A History of the Phosphate Mining Industry in the South Carolina Lowcountry

By

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Introduction

In the 1870s, technological advancements coupled with the discovery of unique geological strata in the Coastal Plain ushered industry into the Lowcountry of South Carolina. The manufacture of inexpensive plant fertilizers that could be sold to both domestic and foreign markets presented new economic potential for the region, offering jobs and an important commodity for farmers. Newly freed African Americans who were seeking employment as wage laborers found work in the mines and in the fertilizer production facilities. The demand for low skilled laborers skyrocketed as the new industry grew. Some Charlestonians were hopeful that a new industry meant that Charleston would flourish once again, but most Charlestonians were skeptical and suspicious, and less than eager to support the change. It was only as a result of northern backing pushed through by carpet-baggers that started industrialization in Charleston. As the profit margin for the new industry quickly grew, local entrepreneurs cautiously began to follow suit and invest.

Quickly, industrialization in the region began to take its toll, and many of the fears of local Charlestonians became realized. Industrialists ravaged the once winsome local landscape of the Holy City. Where beautiful antebellum plantation homes had dotted the banks of local rivers such as the Ashley and Cooper Rivers, the late nineteenth century mining industry ushered in the obtrusive sight of industrial barges, wharves, fertilizer mills, phosphate drying sheds, and smoke stacks. The riverbanks of the Lowcountry literally were gutted and carted off piecemeal as companies dug ruthlessly for their precious crude phosphates to sell.

Despite the economic promise that phosphate mining may have held for the Lowcountry and even the state of South Carolina, the fertilizer industry soon collapsed. Soon after its inception, the mining and production of superphosphates in South Carolina came to a standstill, and the industry declined steadily after 20 meager years. The importance of this period in Charleston's history is readily apparent today in the form of large phosphate pits, some as large as 10 feet deep, along with mottled local soils, and disturbed archaeological and historic sites. Street names like Ashley Phosphate Road within Charleston County hint at an important history that has not truly been told.

Schick and Doyle (1985), in one of the few articles addressing this industry in the Lowcountry, refer to the mining and manufacturing of high quality phosphate fertilizers during the late nineteenth century as the "Stillbirth of the New South." Their metaphor suggests promise and unfulfilled potential, but it also suggests that it held potential for the entire state of South Carolina and the even for the entire southern United States.

How did the phosphate industry in South Carolina compare with the state or national trend towards industrialization? Was the phosphate industry a reflection of a stagnating New South or did it mark the beginning of a continuous if not steady path toward industrialization or the region? Did the industry have any impact on social relations in the South, especially racial relations, and if so, was this impact positive or negative? Did the industry drive technological advancements or borrow from common industrial practices? These and many other questions remain unanswered by the limited current literature.

A wealth of historical data are peppered throughout innumerable personal letters, diaries, and ledgers of the individuals who owned and operated mining and fertilizer companies. In conjunction with archaeological data from phosphate mills, these historical sources can provide invaluable evidence on industrialization and economic history in the late nineteenth century South.

A Market for Fertilizer. Viable and abundant land, along with labor and capital, all became increasingly scarce in the post-war South of the late nineteenth century, requiring farmers to maximize their yield-per-acre. As a result, sharecropping became a way of life for many southern families, white and black alike. Unlike the large plantation systems of the years before, these small-scale farmers were forced to use every bit of available lands for production, increasing the need for rich fertilizers that could replenish the drained soils.

The broad application of commercial fertilizers to the soil was rarely practiced in the antebellum South. There was no need. Planters had abundant lands to farm and a huge labor force to work the grounds. Furthermore, antebellum plantation owners had little or no liquid capital to invest in costly fertilizers, since most resources were tied up in the slaves and in the land. The use of slave labor further prohibited planters from purchasing fertilizers for their crops. Planters presumed that enslaved laborers could not be trusted to till expensive fertilizers deeply into the soils, and it was known commonly that fertilizers such as guano, if not applied to the soil appropriately, could permanently damage the fields (Genovese 1965).

The practice of monocropping, according to Genovese (1965), was common on large cotton plantations in Mississippi and Louisiana, where the overplanting of single crops such as cotton or corn exhausted the vital nutrients from the soils. In the Coastal Plain of South Carolina, however, monocropping was practiced less frequently. The parcels of land were smaller, as they were broken up by large bodies of water, and planters learned quickly of the need to rotate crops and to practice methods that could prevent soil exhaustion. Where monocropping was practiced along the coast, copious amounts of land and cheap labor allowed planters to temporarily fallow selected parcels or fields of land within a plantation, replenishing some of the lost nutrients. Planters, therefore, devised a variety of techniques to revitalize their precious soils. Rosengarten (1986:70) writes in a biography of Thomas Chaplain, a Sea Island Cotton planter from St. Helena Island, South Carolina,

> The production of a crop took eighteen months, from the first manuring through the final baling and shipping, so work on one year's crop overlapped with work on the next. Soon after the last picking of cotton, the vegetation in the fields was hoed under. This was called *listing*. *Tracking* the land came next – laying out the beds so that water would flow into the ditches that interlaced the fields. Some planters used the same beds year after year, but Chaplain rotated his.

Such practices as the one described above ameliorated the land well enough when land and workers were plentiful during the antebellum period; however, after emancipation fields became severely depleted as there were not enough workers to help plant, harvest and tend the precious soils. The sale of lands also limited the ability of planters to fallow and plant simultaneously. This was compounded by a paucity of natural fertilizers such as manures from barnyard animals, their difficult application to the fields, and a dearth of laborers with the knowledge to apply the fertilizers.

Various natural fertilizers (including decomposed vegetation, shell, and crushed limestone) were used historically to replenish soil nutrients. A rich fertilizer was found in the ash of ground animal bones, from which emerged the term "bonfire." Cottonseed commonly was used by planters in the corn fields, while barnyard manures were applied to cotton crops (Genovese 1965). Such methods were employed more frequently in the northern part of America, with smaller agricultural plots. In the antebellum South natural manures were not abundant enough to fertilize the large plots of land, some of which spanned hundreds of acres.

The mass production of fertilizers did not occur in the United States until the mid-nineteenth century. It was in 1830 that the first bone mills were established in this country. Animals such as large bison were killed in drives on the western plains and were processed in bone mills, creating plant food for use on domestic crops. About the same time, the German explorer Humboldt introduced phosphoratic Peruvian guano to Europe after a mapping expedition in South America. Guano was introduced to America in 1832, and by the 1840s to1850s, guano became a highly profitable import from Peru. Guano's use as a plant fertilizer had been known for centuries. Inca populations (ca. 2000 BC to 1300 AD) of South America had exploited the phosphate-rich guano from the Chincha islands off the coast of Peru. Guano is a combination of fossilized bones of ancient birds and fish, mixed with bird excrement and formed over millions of years. Guano offers a very rich fertilizer that is high in elements that are essential for proper plant growth such as nitrogen, phosphorous, potassium sulfur, sodium, chloride, magnesium, silicon, iron, and manganese. While it is a powerful fertilizer, Guano unfortunately produces extremely strong odors, limiting its utility for large-scale usage (O'Connor 2000).

Some nineteenth century planters, faced with the challenges of soil exhaustion, began seeking new alternatives. As early as 1832, Edmund Ruffin, who was seeking a means to increase production and fertilize his own plantations in Virginia, advocated marling for agricultural crops including corn, cotton and potatoes. Ruffin contended that the rich carbonate of lime found in marls could be a source of plant fertilizer; phosphates, however, he believed useless for the task. Other planters began experimenting with phosphate fertilizers by the 1840s (Mathew 1992, Stephens 1988).

By the mid-1850s, widely circulated agricultural periodicals and prominent southern planters such as Ruffin were extolling the benefits of fertilizers on crops. Planters began to understand the need for both phosphates and alkali salts for crop growth, and to understand that nitrogen compounds were necessary for healthy nonleguminous crops. As a result, fertilizers such as Peruvian guano seemed like a magic bullet for the barren soils, and the market for these chemical manures grew rapidly. From 1847 to 1848, a modest 1,000 tons of guano were exported into this country from Peru. This figure climbed to 163,000 tons by 1853-1854. American guano was available as a fertilizer, but was by far inferior to the Peruvian import in quality, ultimately costing the planter or farmer more capital as nearly three times the quantity of American to Peruvian guano had to be applied to the fields (Genovese 1965; O'Connor 2000).

Guano was an excellent fertilizer for crops such as wheat, and was well used in Virginia, Delaware, and Maryland with their relatively small crop lands. Not all plants reacted equally, however. Tobacco plants responded poorly to guano, since the fertilizer toughened the leaves of this plant. The adoption of guano was apparently not widespread in the lower southeast, according to Genovese (1965). When used, it was more often applied by planters in the Coastal Plain than those of the inland, and then it was used only on sorely depleted soils. Genovese (1965) further states that this is not surprising given the ample cost of covering large parcels of land on southern plantations with these fertilizers. The following presents the views of one Louisiana agriculturalist regarding the use of natural fertilizers on crops.

> In respect to our worn out lands, it is almost useless for anyone to waste paper and ink to write the Southern planter telling him to manure. It is well enough for Northern farmers to talk; they can well afford to fertilize their little spots of ten or a dozen acres; but a Southern plantation of 500 or 600 acres in cultivation would require all the manure in the parish and all the force to do it justice... Again, we have no time to haul the large quantities of manure to the field, for it generally takes until January to get all our cotton, and we have to rush it then, to get time to make repairs before we go to plowing for our next crop (Peacocke 1846).

Unfortunately for most planters, expensive chemical fertilizers were not a viable option during the antebellum period, as capital was bound in land and slaves. Reliable fertilizers that could be easily used during the antebellum period were very costly and relatively hard to procure. The components to produce inexpensive chemical fertilizers en mass were only just being experimented with during this period. Marl, a mixture of clay containing chalk from the calcified bones of ancient fauna, was discovered in New Jersey in the late eighteenth century. Phosphate (the mineral which contains the element phosphorous) from the calcified bones in these marls had potential as a fertilizer, but it was not until the nineteenth century that the commercial value of marling (mining of marl beds for phosphate) for fertilizer was fully appreciated. Marl can be mined for mineral phosphate, which in turn can be pulverized and added to agricultural crops, providing rich nutrients for the root system of many domesticates. Nineteenth-century scientists realized that although phosphate is necessary for plant growth, the crude phosphate is less a effective plant fertilizer as an insoluble raw mineral.

Technological innovations during the mid-nineteenth century, however, would change the way that farmers could use the phosphates for their crops. European scientists began to experiment with crude phosphate in the 1830s, and Justus Von Liebig in 1840 "recommended the use of sulphuric acid as a solvent for the phosphate of lime in bones, to render it available for plant food" (Chazal 1904:34). A technique for adding vitriol (sulfuric acid) to crude phosphate was employed to produce "super phosphate of lime", and the procedure was patented in 1842 by John Bennet Lawes. This superphosphate, unlike raw phosphate, was water soluble and could be produced in a fine, dry powder state, rendering it a more efficacious fertilizer that could be easily transported domestically or to a foreign market. It also meant easier application of the fertilizer to the fields. With this technological achievement, the stage was set for a brand new industry.

The Dawn of a New Industry. It was during the latter part of the nineteenth century that the port city of Charleston, South Carolina became the center of a short-lived boom in the production of phosphate fertilizers. Geological surveys of the state showed an abundance of phosphate-rich marl lying in Charleston river beds and underground. As early as 1795, the fossilized bones and teeth of prehistoric fauna had been recovered from Oligocene marls within Biggin Swamp in the Cooper River. Early writers, such as Dr. David Ramsey in 1797, referred to the phosphate beds of South Carolina, but the first scientific studies of these marls was not until 1837. Initial research on the marls was conducted by Francis S. Holmes. Figure 1 presents a photo of Holmes taken in his plantation near Goose Creek, South Carolina in 1875.

In 1843, shortly after Holmes' discovery, Edmund Ruffin first published on the location of the Charleston phosphate deposits. Ruffin, who had been commissioned by the state of South Carolina to conduct an agricultural survey, focused primarily on the marl beds and phosphate deposits (Mathew 1992). Upon Ruffin's retirement from this position, Professor M. Toumey took over the agricultural survey in 1846, and continued to map the state's phosphates deposits (Chazal 1904). This calcareous stratum of the Charleston Basin became so well known to scientists, that it was labeled the "Fish Bed of the Charleston Basin" by the renowned Swiss-born American geologist Professor J. Louis Agassiz. Figure 2 presents a map of the geological strata and phosphate deposits for the Charleston Basin.

The full boundaries of the Charleston deposits were not mapped until 1870-1872, when N. S. Shaler of the US Coast Survey charted the extent of the phosphate deposits in the rivers of South Carolina (Chazal 1904). Phosphate deposits in South Carolina run parallel to the coast for approximately 70 miles. The beds extend south from the Wando River near Charleston to the

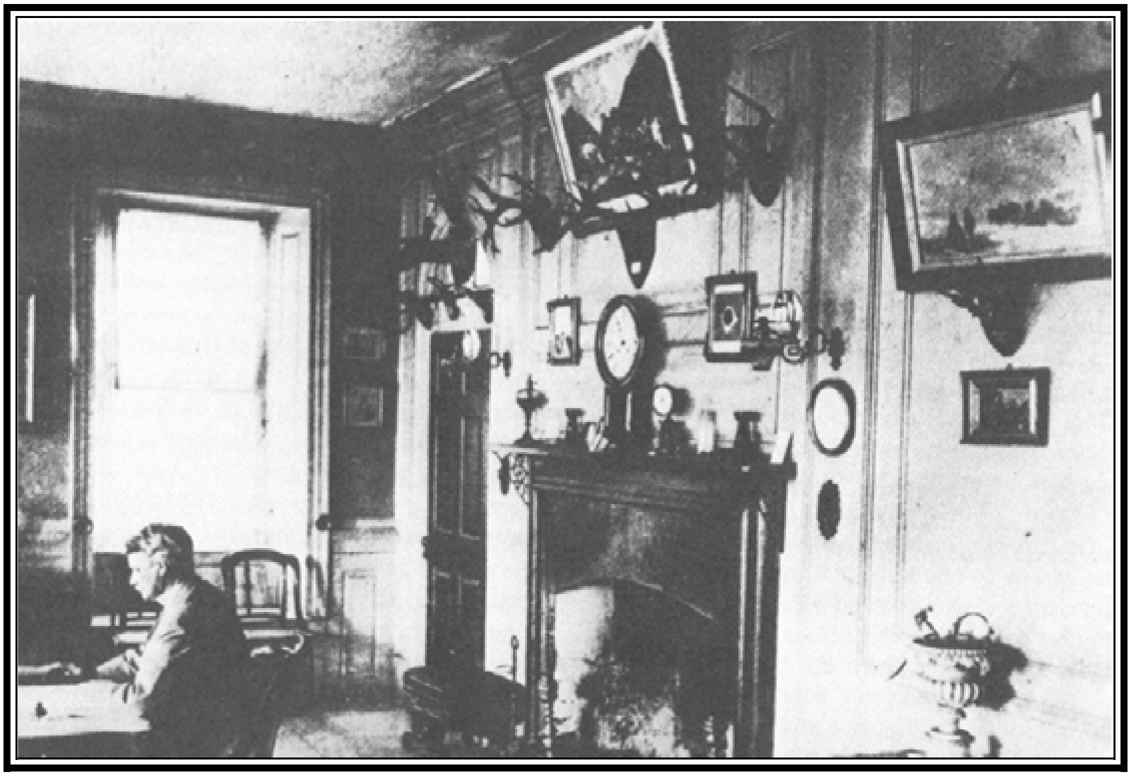


Figure 1. Professor Francis S. Holmes in 1875 at Ingelside Plantation (Courtesy of the Charleston Museum).

BroadRiver, and continue inland from the coast for approximately 30 miles. The phosphate beds within the Ashley River extend north of Bee's Ferry in Charleston for approximately 10 miles.

Phosphate within the Charleston Basin outcrops on the banks of the Cooper, Ashley, Stono, Edisto, Coosaw and Combahee Rivers, as well as along the tributaries of each of these rivers. According to a geological survey of the Charleston area phosphates by Malde (1959), the South Carolina marine deposits range from the Oligocene to the Pleistocene epochs in age. The oldest formation that is exposed through river outcrops in the Charleston Basin is an Oligocene period formation known as the Cooper marl. The Cooper marl contains approximately equal amounts phosphate and calcium carbonate (limestone). Malde (1959) describes the Copper marl formation, stating that it "dips southward from 8 to 14 feet per mile and overlies beds of Eocene age upturned on the north. From a thickness of 200 feet near Charleston the Cooper marl thins and pinches out 20 miles north. It thickens southwestward to at least 280 feet" (Malde 1959).

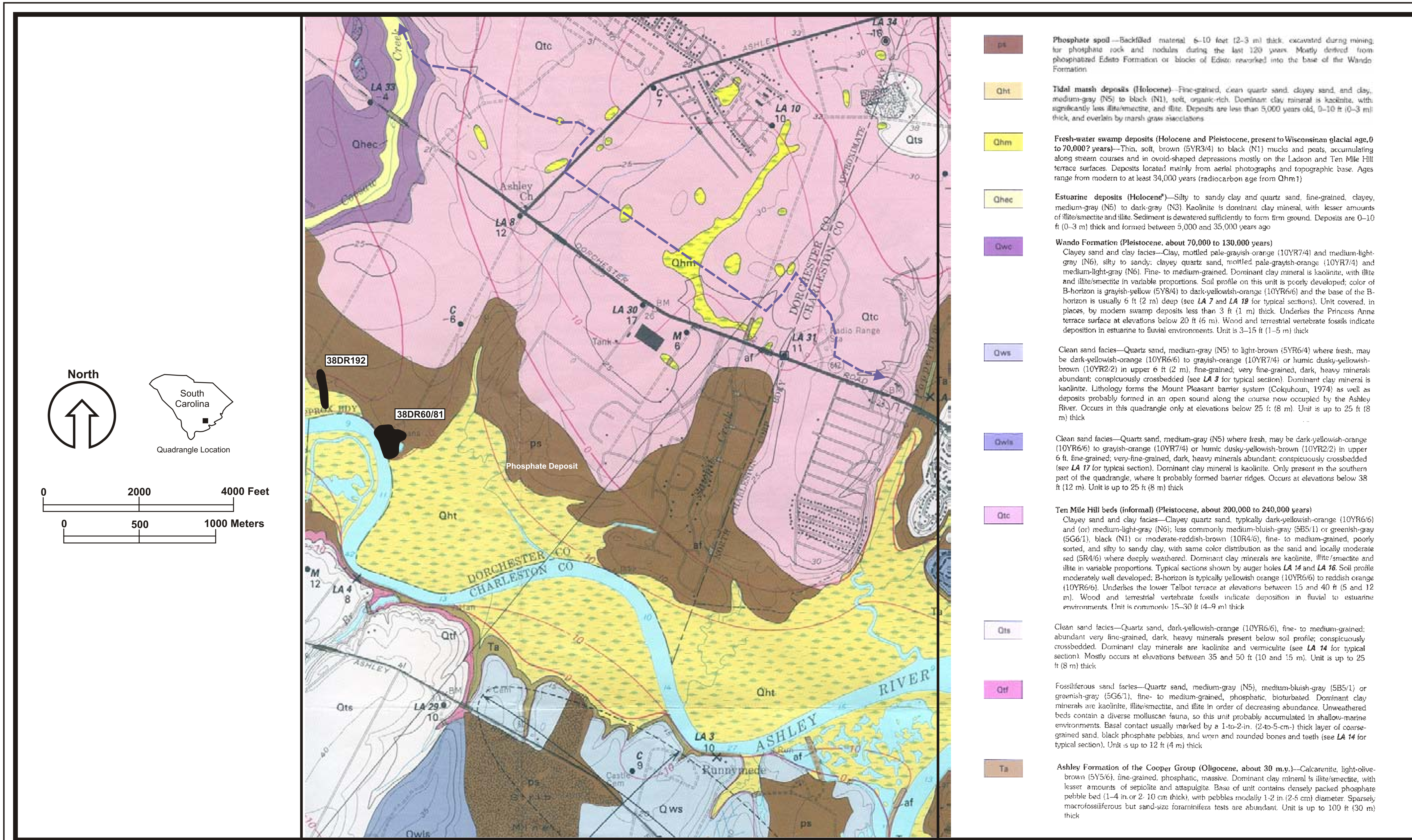


Figure 2. A map showing the location of 38DR60/81 and 38DR192 and phosphatic deposits (Courtesy of the Charleston Museum).

The four youngest Pleistocene formations containing phosphatic rich soils in the Charleston area, in ascending order are: the Ladson formation (ca. 450,00-400,00 years before present [ybp]), Ten Mile Beds (ca. 240,00 - 200,000 ybp), Wando Formation (ca. 130,000 - 70,000 ybp), and Socastee Formation (ca. 120,000 ybp). The Ladson Formation, approximately 35-40 feet thick, is characterized by phosphate at the bottom stratum, topped by layers of fine sand, and medium grained sand, with coarse sand at the top. The Ten Mile Beds, approximately 45-50 feet thick, consists of a clayey sand and clay facies, underlain by a clean sand facies, underlain by a fossiliferous sand facies. The Wando Formation, approximately 85 feet thick, is characterized by a clayey sand and clay facies, clean sand facies, and shelly sand facies. The basal contact is usually marked by a thick layer of coarse-grained sand, black phosphate pebbles, and worn and rounded bones and teeth. This basal layer is ambiguously mentioned in the literature as the "Ashley River phosphate beds." The Socastee Formation is comprised of non-marine sediments overlain by marine sediments and extends to Winyah bay (Sanders 2002).

Most of the exploited phosphates in the Charleston area came from younger, Pleistocene age deposits, generally close to the surface. A large portion of these outcrops were destroyed by the phosphate mining industry of the early twentieth century, limiting complete study to hand coring and loose interpretation. These outcrops were originally though to be the lower facies in the Ladson Formation which is reworked Cooper Marl (Malde 1959). While excavating a giant ground sloth fossil, a few miles northeast of Charleston on SC Route 642, an intact phosphate bed was located. This created the first opportunity in recent times to record the stratum in situ and determine its formation of origin. The upper portion of the excavated section consists of a 32 inch thick deposit of the Wando Formation, with the bottom 8 inches consisting of lag deposits of large phosphate rocks and reworked bone. The site area is located within the heart of the old phosphate mining region, thus lending credit to the theory that the majority of the phosphatic outcroppings in this area are from the lower Wando Formation (Sanders 2002).

Geologically, the mineral phosphate is taken up over thousands of years in sedimentary rocks, shell, bones, teeth, and coprolites. Phosphate nodules occur in a variety of shapes and sizes, ranging from less than a single ounce to hundreds of pounds (Figure 3). The smell of the mineral is unique and phosphate nodules omit a "peculiar odor bearing a slight resemblance to burning horn" when rocks were rubbed together (Chazal 1904:10). Mineralogically, the phosphate rock that found within the Charleston Basin is comprised of carbonate-fluorapatite which is an combination of phosphate radical PO_4 with water, calcium, and the trace elements fluoride and uranium, expressed chemically as Ca_{10} PO_4 CO_3 $F_{2\text{-}3}$.

Phosphate nodules outcrop in both land and river deposits in the Charleston area, and average approximately 28 percent P_2O_5, which calculates to 61 percent phosphate of lime (Malde 1959). This average far exceeded those of the coprolite deposits of the London Basin in England, increasing the marketability of American phosphates abroad (O'Connor 2000). The external appearances of the Charleston river and land mineral differ substantially due to variance in the chemical composition of each. River phosphates appear darker in color, almost black, compared with the tan-colored land deposits, and are much softer in texture than the land phosphates as well. The land rock contains higher amounts of phosphate of lime, making it soft (O'Connor 2000).

New technologies were developed in the northern United States during the mid-nineteenth century that utilized sulfuric acid to convert crude phosphate into fertilizer that could be readily absorbed by plants. By 1867, the marl beds of the Cooper River in Charleston were being exploited for crude phosphate, a mineral that was already known to replenish nutrient poor soils, but had not been used commercially as it was not readily absorbed by plants in its crude form.

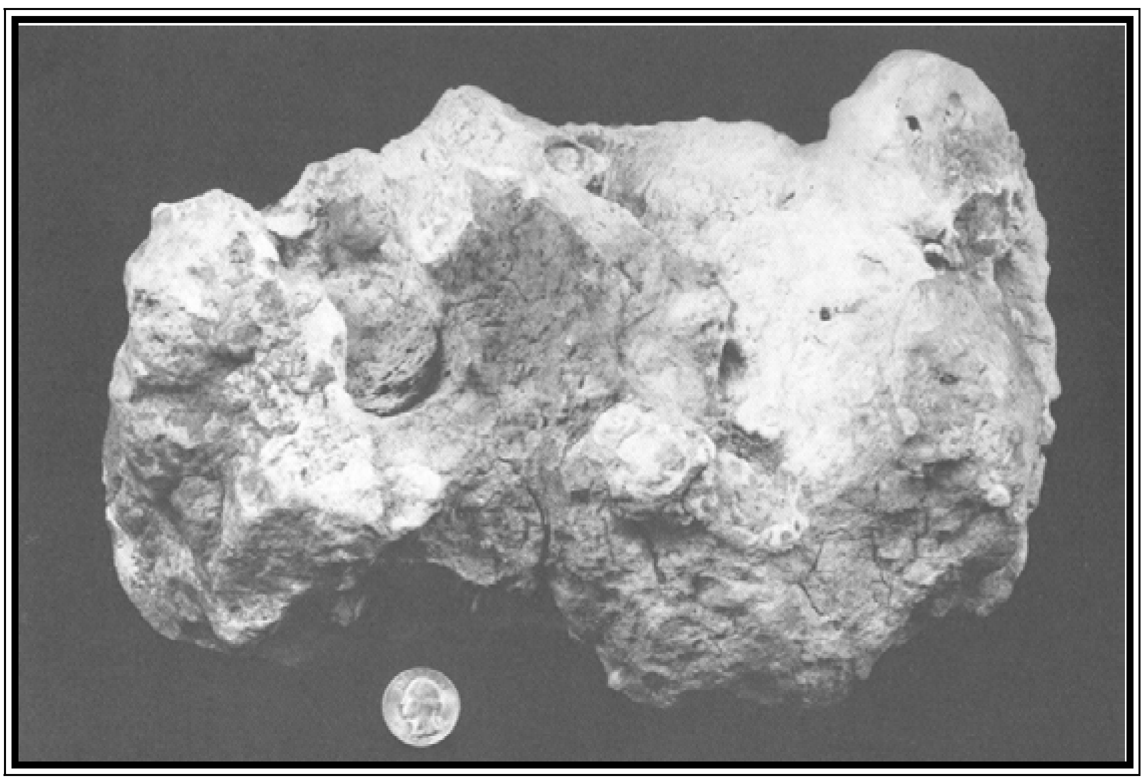


Figure 3. A view of a typical phosphate nodule (Stephens 1988:42).

The presence of phosphate-rich marl beds had been discovered as early as 1837 by naturalist Francis Holmes in Charleston. While collecting ancient bones and teeth from the marl beds of the Ashley river, he noted that the marl, especially the bones, was rich in the mineral phosphate. Holmes was a successful planter in the community, but had little formal education, having withdrawn from school at the young age of 14. He nonetheless made a name for himself by publishing on various topics in agriculture, including the use of marls for fertilization. Holmes experimented with various techniques in marling his own crops to increase production (Stephens 1988).

During the 1840s, Holmes became a well-respected naturalist and an authority in geology, as he began to amass and display an impressive collection of fossils, and to publish scientific papers in widely circulated journals. His work gained the recognition by such prominent scientists as paleontologist Louis Agassiz, and anthropologist Samuel Morton. In 1850, the College of Charleston constructed a new museum, and with encouragement from Agassiz, the board of trustees elected Holmes as its curator. Soon thereafter, Holmes was appointed to a position of Professor of Geology and Paleontology at the College of Charleston. Much of Holmes' geological knowledge was acquired as Michael Tuomey's assistant and through readings. Eventually, Holmes was awarded an honorary Masters degree from the University of Alabama, and an honorary doctorate; however, he remained self-educated throughout his life. His lack of formal education may have been a source of insecurity for Holmes, since it caused some strife in his career with some members of the academic community that refused to acknowledge him professionally (Stephens 1988). Holmes eventually was dismissed from his position as Professor of Geology during economic cutbacks, but he appealed to the Charleston Museum's board of trustees to allow him to retain his position as Curator. Although he stayed on with the Museum, it was with a reduction in his salary by more than half. In January 1869, Holmes ultimately decided to resign from the museum, and to open the door to new ventures such as the phosphate industry (Stephens 1988).

There is some discrepancy in the literature over whether it was Professor Holmes or Dr. St. Julien Ravenel of Charleston who first saw the phosphatic marl beds of South Carolina as marketable for use as a fertilizer; nonetheless, it is amply clear that Professor Holmes, along with Dr. N. A. Pratt of Georgia, founded the first phosphate mining company in the state. Dr. Pratt (formerly a chemist with the Nitre and Mining Bureau) met Holmes during the war while inspecting the Ashley River beds for saltpetre (Stephens 1988:44).

With a knowledge of how to produce their new plant fertilizer from phosphate, Pratt and Holmes were faced with the problem of convincing local businessmen of Charleston to invest in such a potentially high-risk endeavor during the economically troubled times of Reconstruction. Furthermore, many southerners resisted change, and clung tightly to tradition and to the notion of the Old South. This meant that even though agriculture was not especially lucrative during the Reconstruction period, it was a tradition, and as a result it held a far superior status to most Southern gentlemen than did industry.

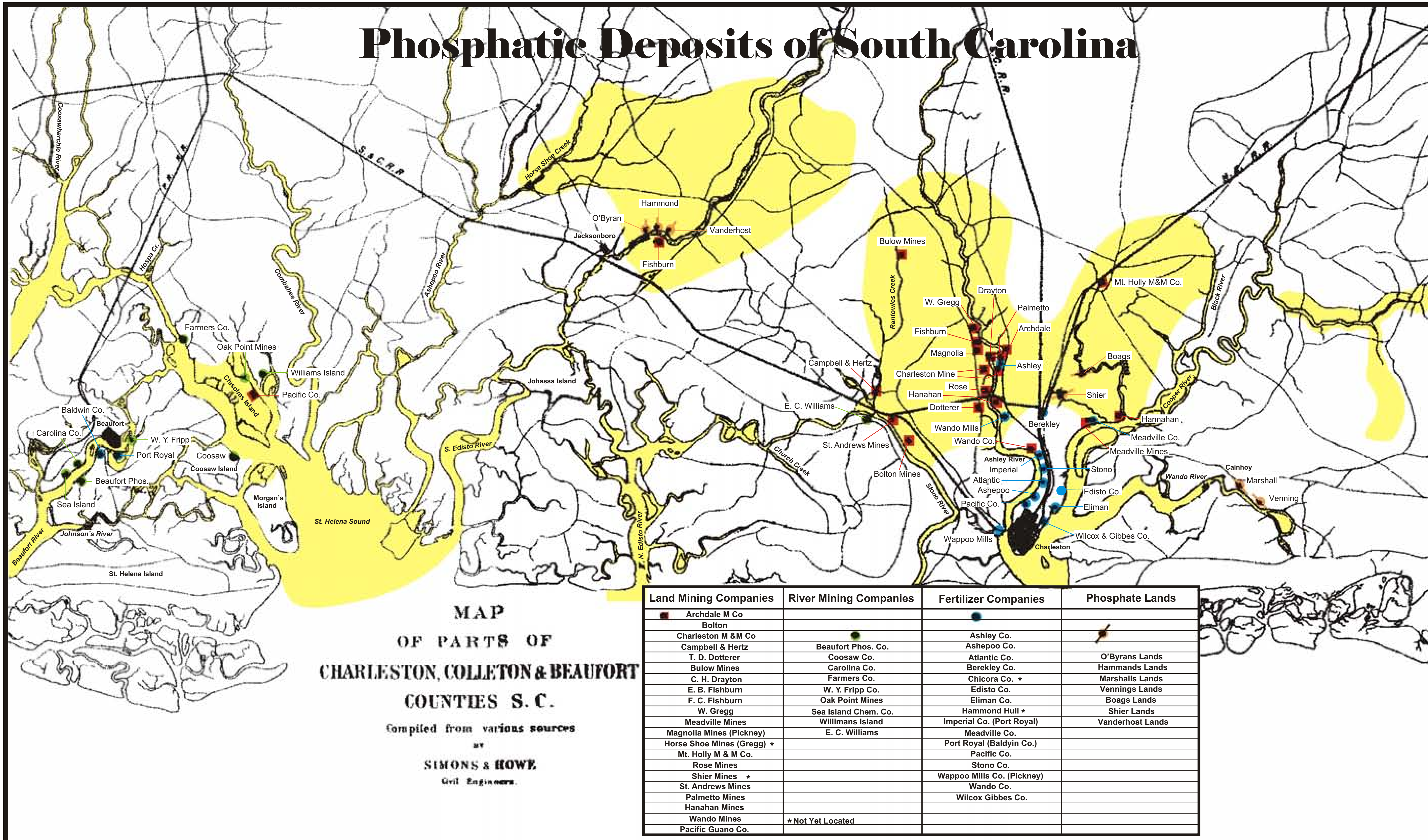
In 1868, however, Pratt and Holmes were able to persuade northern entrepreneurs from Philadelphia to provide them with a backing of one million dollars in capital. This investment was used to establish the first phosphate mining operation in South Carolina, and the Charleston Mining and Manufacturing Company began its operation along the Ashley River (Stephens 1988:44). Dr. Pratt served as the company chemist, and Professor Holmes served as the company president (Sanders and Anderson 1999, Shick and Doyle 1986).

The Charleston Mining and Manufacturing Company quickly purchased most of the available land deposits of phosphate near the Cooper and Ashley Rivers in Charleston. The company leased as much as 10,000 acres along the Ashley River by 1868. Rice production along the Ashley River had been in steady decline since the Revolutionary War, and by the end of the Civil War planters found themselves heavily in debt with no available capital. Phosphate deposits were easily obtained from the former rice planters who quickly sold or rented their lands to the new industrialists to alleviate their economic woes. In this manner, Charleston Mining and Manufacturing quickly accumulated over 10,000 acres of leased land by July 1868 (Shick and Doyle 1986).

Between 1867 and 1870, many of the local investors who were originally hesitant to support Pratt and Holmes, realized the fortune that could be made in the phosphate mining industry. Times were economically tough, but many of those who had resisted change made a turn and invested in industry. As early as 1890, approximately $3 million had been invested in the rents paid for phosphate lands and an additional $2.6 million in capital had been invested in the necessary equipment for processing the mineral (Shick and Doyle 1986:8). Numerous phosphate mining companies cropped up along the Ashley River in Charleston during the late nineteenth century. Figure 4 shows a map of the location of land mining companies, river mining companies, fertilizer companies and phosphatic lands in the region during the late nineteenth century.

The numerous land mining companies along the Ashley River included Atlantic Phosphate (later reorganized as the Ashley Phosphate Company), Palmetto Mining and Manufacturing Company, Cherokee Mines, Pickney Mines, Drayton Mines, Gregg Mines, and Millbrook Mines. Mines near Stono River included: Bolton Mines, St. Andrew's Mines, and Bulow Mines. Mines along other navigable rivers in the Charleston area included: Pacific Guano Company on Chisholm Island, Oak Point Mines Company at Kean's Neck, Pon-Pon Mines at Edisto, and Horseshoe Mines near the Ashepoo, among others. Charleston Mining and Manufacturing was by far the largest of the companies. Of all land mining operations started in the state between 1867 and 1891, the capital investment of Charleston Mining and Manufacturing equaled one-third of the total invested in the market (Shick and Doyle 1986:8).

In the beginning, only the land deposits were exploited by the mining companies. River phosphate rock was not mined until 1870, but it quickly became preferred to the land rock as the river phosphate was easier to excavate. Generally, the river beds lay nearer the surface; although, they did vary in depth between 3 to 36 inches. It was more common to find shallow outcroppings, and most of the beds that could be mined averaged approximately 8 or 9 inches below the ground surface. The especially good deposits were encountered at depths of only 12-16 inches below ground surface (Chazal 1904:9). This compared quite favorably to the deposits sometimes in excess of 10 feet or more on land. Furthermore, in order to access the soft phosphate of the land deposits, it was necessary hand excavate or utilize picks and shovels to remove it from the clay marl beds. The clay of the land deposits was more difficult to separate from the phosphate nodules than that of the river deposits, and as such, companies fiercely competed for access to mining the Charleston area rivers (Reid 1876, O'Connor 2000). While land deposits were held as private property, quickly bought up by individual companies, the state of South Carolina owned the mineral rights to the riverine phosphate beds. Originally, access to these river deposits was on a first come first serve basis, but some controls were placed on the riverine phosphates with the Phosphate Act of 1870. This legislation "granted to certain persons and their associates the right to dig and mine in the beds of navigable streams and waters of the State for phosphate rocks and phosphate deposits, for a period of twenty-one years" (Taylor 1999:422). It was first vetoed Governor R.K. Scott, but the act was eventually passed (Snowden 1920). Pressure from lobbyists shortly thereafter lead to the Act of 1876, which overturned the twenty-one year limitation and gave a "practically perpetual charter, conditioned only on the prompt payment of the royalty" (Chazal 1904:56).



Land Mining Companies	River Mining Companies	Fertilizer Companies	Phosphate Lands
Archdale M Co			
Bolton			
Charleston M &M Co		Ashley Co.	
Campbell & Hertz	Beaufort Phos. Co.	Ashepoo Co.	
T. D. Dotterer	Coosaw Co.	Atlantic Co.	O'Byrans Lands
Bulow Mines	Carolina Co.	Berekley Co.	Hammands Lands
C. H. Drayton	Farmers Co.	Chicora Co. *	Marshalls Lands
E. B. Fishburn	W. Y. Fripp Co.	Edisto Co.	Vennings Lands
F. C. Fishburn	Oak Point Mines	Eliman Co.	Boags Lands
W. Gregg	Sea Island Chem. Co.	Hammond Hull *	Shier Lands
Meadville Mines	Willimans Island	Imperial Co. (Port Royal)	Vanderhost Lands
Magnolia Mines (Pickney)	E. C. Williams	Meadville Co.	
Horse Shoe Mines (Gregg) *		Port Royal (Baldyin Co.)	
Mt. Holly M & M Co.		Pacific Co.	
Rose Mines		Stono Co.	
Shier Mines *		Wappoo Mills Co. (Pickney)	
St. Andrews Mines		Wando Co.	
Palmetto Mines		Wilcox Gibbes Co.	
Hanahan Mines			
Wando Mines	* Not Yet Located		
Pacific Guano Co.			

Figure 4. A map showing the location of phosphate mining and fertilizer production companies in the region (Courtesy of the Charleston Museum).

River mining companies began to spring up around Charleston in the 1870s. Companies included the Marine and River Company (which collapsed in 1882), and the Coosaw Company (which mined the Coosaw River from 1870 to 1894). According to Chazal (1904), other river companies included Palmetto Phosphate Company (Ashley and Wando Rivers), Farmer's Phosphate Company (Bull and Coosaw Rivers), Sea Island Chemical Company (Johnson and Beaufort Rivers), and the Carolina Mining Company (Broad, Johnson, Morgan, Bull and Coosaw Rivers). Companies, such as the Coosaw Mining Company, paid the state for exclusive river mining rights, and in return, river mining became a very lucrative business for these companies. Phosphate mining brought between $300,000 to $400,000 annually into South Carolina by the early 1880s, and State of South Carolina was receiving revenues of $1 per ton for all phosphate rock mined out of the river beds (Snowden 1920). By 1890, these state revenues came to over $250,000 per year (Moore 1978:371).

In the 1890s, however, Governor Benjamin Tillman argued that since such large profits were being generating from the sale of phosphates, the royalties paid to the state should legitimately be increased from $1 to $2 per ton of rock. Tillman's distaste for the Lowcountry, especially Charleston, was thinly veiled as an attempt by the Governor to "lessen the burden of the tax payers and elevate the financial credit of the State" (Snowden 1920:1,008). Furthermore, in 1891 Tillman argued that the State had already lost in excess of $132,000 dollars in royalties, since the mining companies (specifically Coosaw River Mining) were "not making due allowance for the moisture expelled in drying the rock" (Snowden 1920:1008). The case went to the United States federal courts in the 1890s, which slowed production for these river mining companies. Several companies went under around this same time. Eventually, the State of South Carolina won its case, but was only allowed to collect the royalties lost during the fiscal year of 1891 (Snowden 1920).

The Production of Superphosphates. The mining of crude phosphates was just one stage in the production of soluble phosphoric acid (superphosphate) fertilizers. Although some of the pulverized raw mineral was sold directly for use on fields, the majority of phosphate was chemically altered by fertilizer companies. There was variation among the setup of these production facilities, but the primary process remained the same. Typical components of the plant included: washing and drying houses, boiler houses, a mill building, storage houses, acid chambers, wharves, and rail spurs. Figure 5 is a plan of a typical fertilizer operation on the Ashley River.

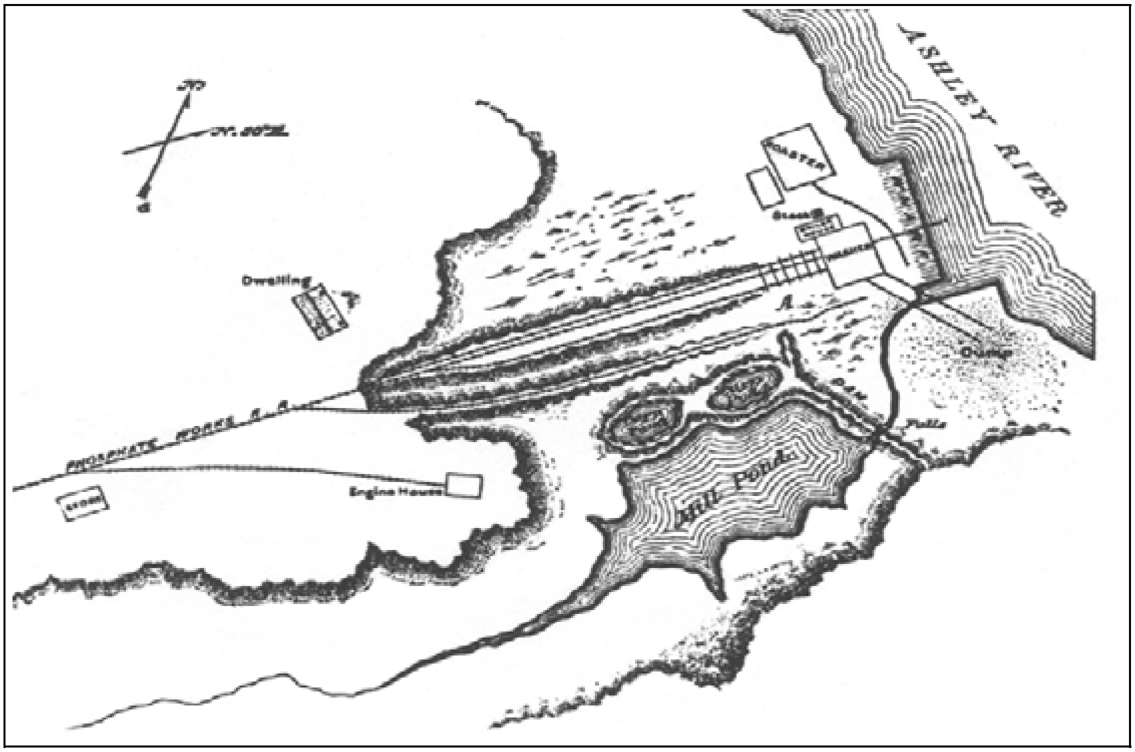


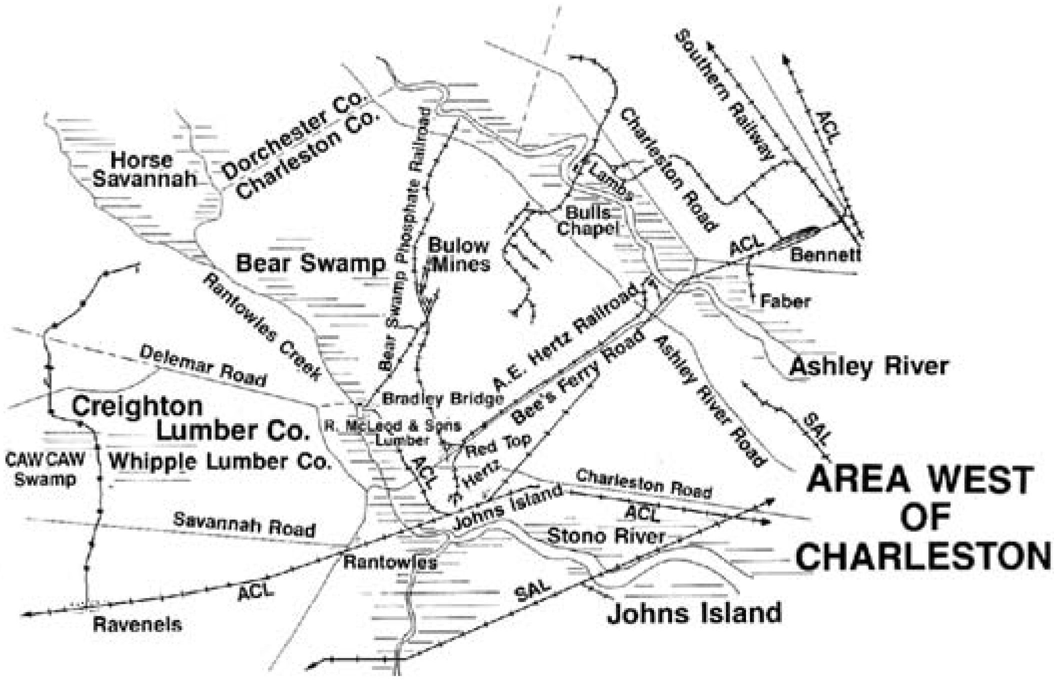
Figure 5. Plan view of a typical fertilizer operation, showing the location of rail lines, washer, housing, and general store (SCHS misc. vertical file).

By the 1880s, worker villages, including housing, general stores and medical facilities, were located near the mines (Schick and Doyle 1985:17). While many companies housed all of their facilities near the wharves, some fertilizer companies maintained offices in downtown Charleston. For example, Ashley Phosphate Company had two offices on East Bay Street.

The crude phosphate was transported out, generally by rail or by river barge, from the mines to the fertilizer production facilities. Rail lines were dominated by the lumber industry in the state. Rail lines were owned by Julian Ravenel of Wando Phosphate Company, and R.L. McLeod and Sons who purchased the Bulow Mines (Fetter 1990:43). Figure 6 (top) shows a map of the rail network west of the Ashley River in the early twentieth century. Figure 6 (bottom) shows a picture of a rail spur leading to a fertilizer plant. Figure 7 (top) is a drawing of a typical wharf at a fertilizer plant.

The crude phosphate was transported by conveyor or wheelbarrow to a steam-powered washing room where the rock was cleaned of dirt and debris. Figure 7 (bottom) is a drawing a phosphate washing facility. Figure 8 is detailed drawing of a washing facility showing the workers engaged in various tasks around the building. The cleaned phosphate nodules were transferred to large drying rooms. In the drying house, furnaces heated the air and thoroughly dried the phosphate rock. The heated air was supplied from the adjacent Boiler and Engine house. Boiler engines were powered by wood, coal or a combination both. The product was then transported to the mill building where it was ground in crushers to a fine powder. The phosphate was then stored temporarily in on-site storage houses, or immediately moved to a mixing house where was is mixed with sulfuric acid (also called vitriol). Figure 9 (top) is a view of a typical fertilizer storage/mixing facility.

The addition of sulfuric acid to crude phosphate was necessary to produce phosphoric acid. The first sulfuric acid to be manufactured in South Carolina (or anywhere south of Baltimore, Maryland) was by the Sulfuric Acid and Superphosphate Company in Charleston in December of 1868 (*Rural Carolinian* 1873). Production of sulfuric acid began with raw sulfur in the form of brimstone or pyrite. The sulfuric acid was produced within facilities known as acid chambers (shown in Figure 9, bottom), which were constructed of lead to contain the lethal gases and liquids that were released. In these chambers, the pyrite ore was burned and allowed to combine with atmospheric oxygen. This in turn created sulphurous acid which possessed only two-thirds of the necessary oxygen for sulfuric acid. The final one-third of the oxygen that was required to make sulfuric acid could not be taken up naturally from the available atmospheric oxygen and had to be forced chemically. To complete the process, nitric acid vapor (from nitrate of soda) was released into the chamber. Oxygen molecules from the nitric acid vapor combine with the sulfurous acid to create sulfuric acid (SO_3), a chemical solid that fell to the floor of the acid chamber. The nitric acid then borrowed oxygen molecules from the atmosphere and was again ready to complete the process of converting sulfurous acid.



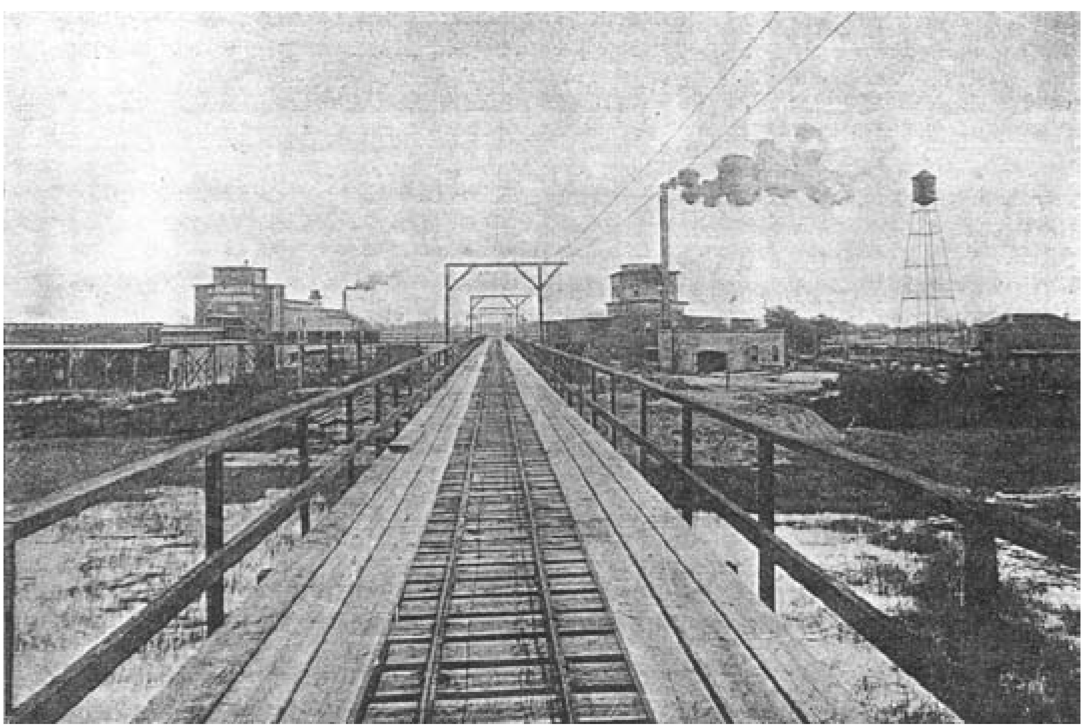


Figure 6. A plan of the railroad network west of the Ashley River (top) [Fetters 1990:43] and a view of a rail spur leading to a fertilizer plant (bottom)[SCHS misc. vertical file].

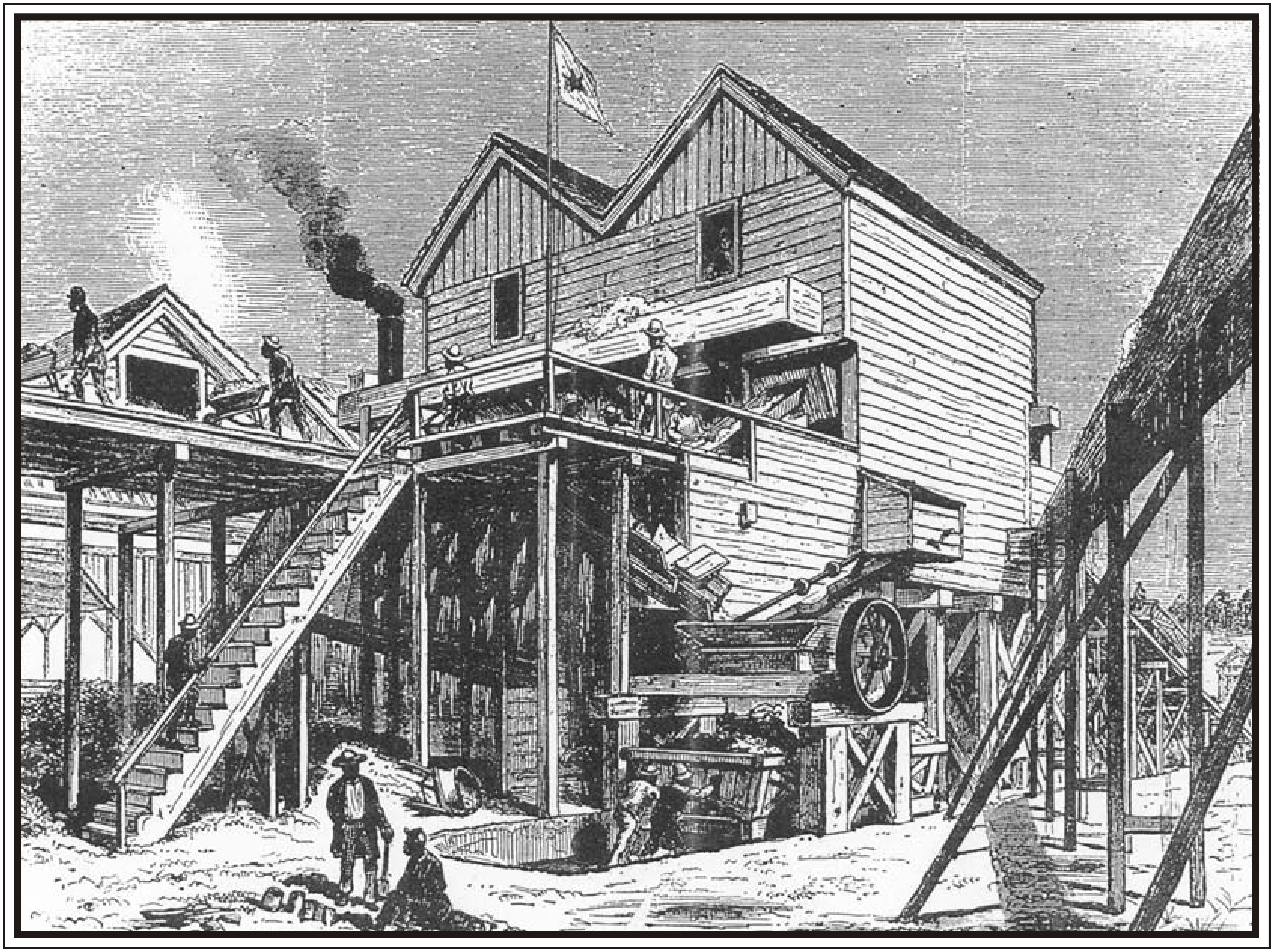
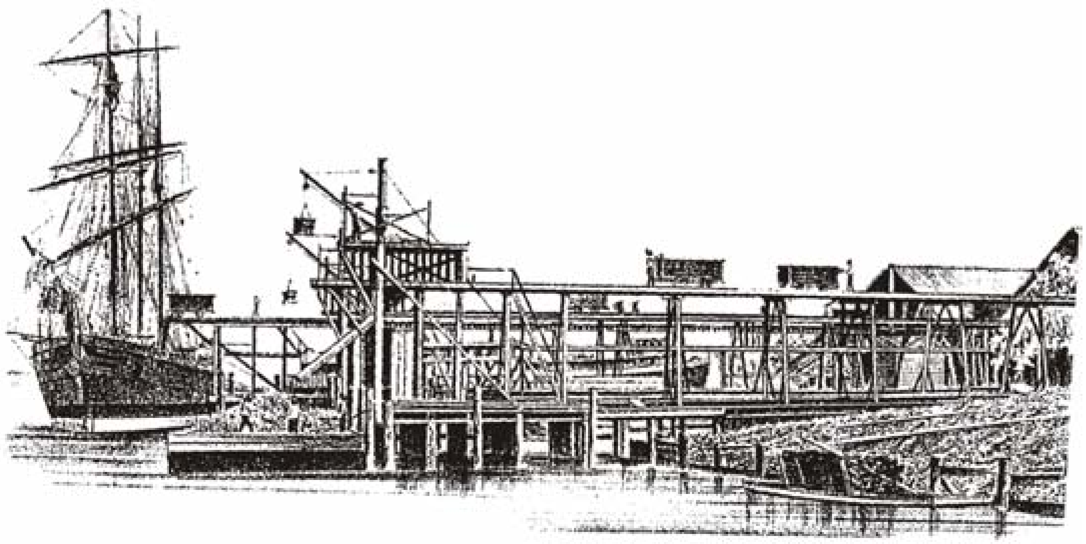
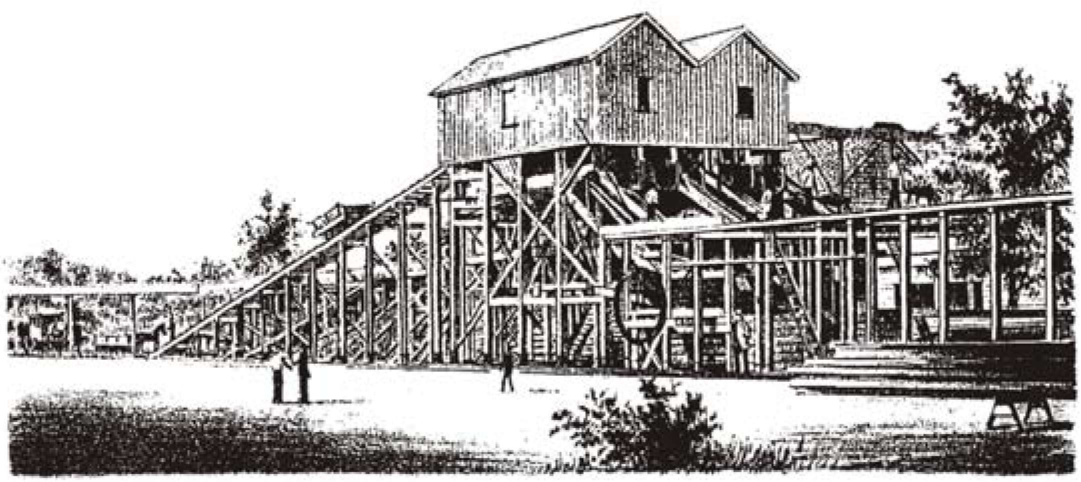


Figure 7. A depiction of a typical phosphate washer from the 1890's (Haskell nd).



WHARVES OF THE COOSAW MINING CO.
COOSAW RIVER, SO. CA



PHOSPHATE WASHERS OF THE CHARLESTON MINING CO.
AT LAMB'S, ASHLEY RIVER.

Figure 8. A drawing of a typical wharf setting at a fertilizer plant (top) and a phosphate washing facility (bottom) [SCHS misc. vertical file].

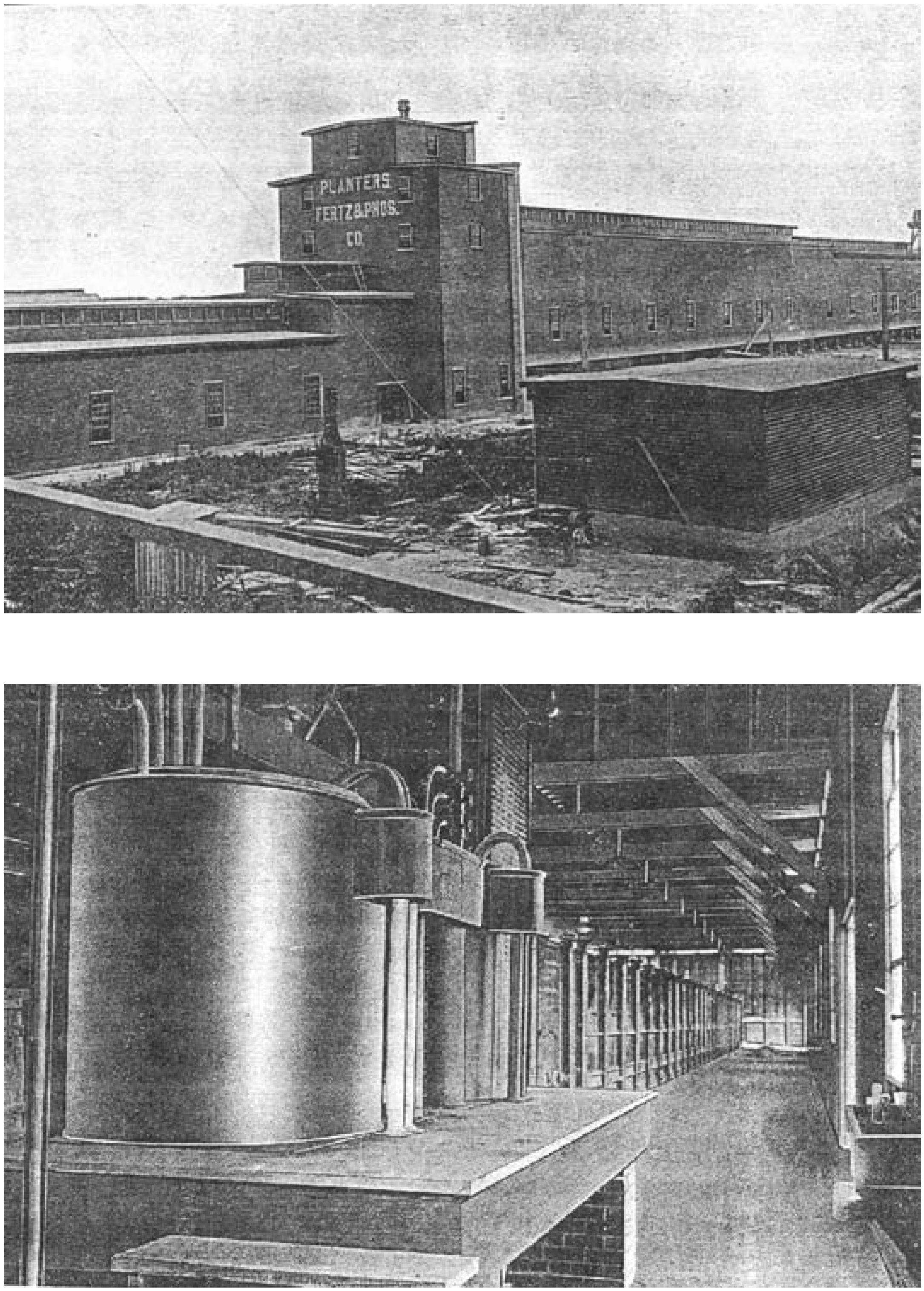
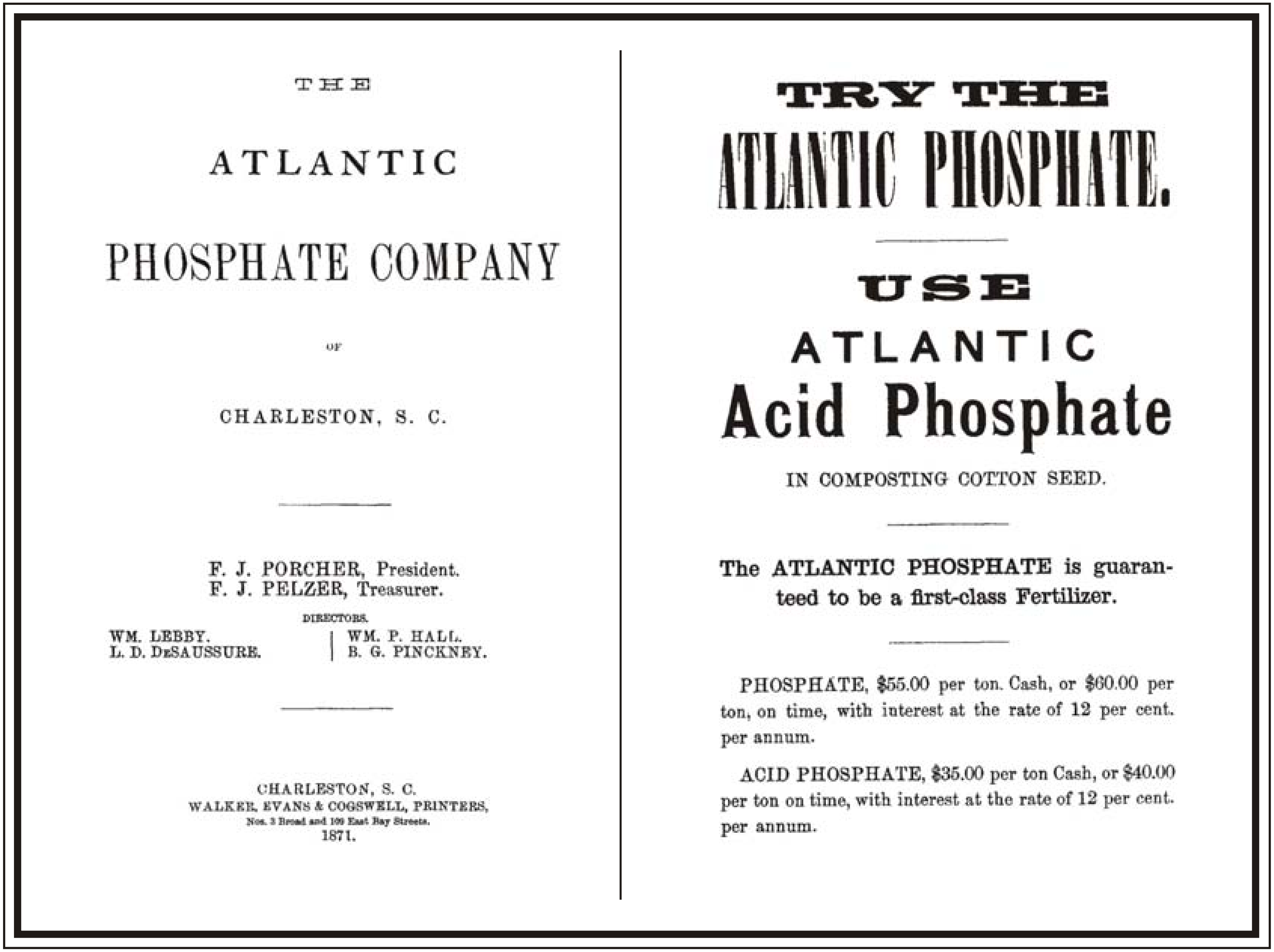


Figure 9. A view of a fertilizer storage and mixing facility (top) and the acid chambers (bottom) [SCHS misc. vertical file].

Within the mixing houses, fixed amounts of cleaned and ground phosphate and sulfuric acid were combined in large iron tubs. After mixing, the phosphoric acid required several weeks to a month to dry. The amount of drying time for the product was relative to the amount of sulfuric acid added, which controlled the degree of solubility of the superphosphate. Once dry, the product was disintegrated and screened and ready for packaging to be sold. The following excerpt from the *Rural Carolinian* in 1873 details the process of altering raw phosphates at the Sulfuric Acid and Superphosphate Company in Charleston:

> The rock...is transported to the wharf of the Company, where it is discharged by a derrick, which is driven by a wire rope 320 feet from the engines. A shed 200 feet long, paved with brick and supported by iron pillars, extends backwards from the wharf. On this brick pavement is laid two rows of pine wood; overhead is a railroad, on which run the cars into which the rock is discharged, and from which it is dumped upon the wood beneath. When the cargo has been thus discharged, the wood is set fire to and the "kiln" burns and is dried; by the well considered arrangements of this Company, the consumption of wood is reduced to one cord or of wood to forty tons of rock, thus obviating some of the damage done by too much heat, while the rock is still thoroughly dried.
>
> The dried rock is loaded into cars, which are then hoisted up an inclined plane into the mill, and dumped into crushers. ...Mill-stones are...four feet in diameter and make 170 revolutions per minute. The amount ground depends entirely upon the degree of fineness to which it is ground; in this mill the rock is ground so that it will pass through a screen of 80 wires to the inch, and the product is about 3 tons per pair of stones per day of 10 hours.
>
> The mixing is done in a tub of cast iron 8 feet in diameter, which revolves 20 times per minute, and in which are small ploughs which revolve 160 times per minute. Into this tub a weighed quantity of the powdered rock is thrown... a known weight of acid is now run in and the revolving ploughs thoroughly incorporate the phosphate and the acid... Up to 5 per cent of Soluable Phosphoric Acid the mass comes from the mixing tub dry, and can be screened at once and packed in sacks; but when enough acid is added to render 11, 12 and 13 per cent soluble, then the mass comes from the mixing tub a semi-fluid and will flow like mud 30 or 40 feet, and must be left for a time varying from two weeks to two months to harden...



THE

ATLANTIC

PHOSPHATE COMPANY

OF

CHARLESTON, S. C.

F. J. PORCHER, President.
F. J. PELZER, Treasurer.

DIRECTORS.

WM. LEBBY. | WM. P. HALL.
L. D. DESAUSSURE. | B. G. PINCKNEY.

CHARLESTON, S. C.
WALKER, EVANS & COGSWELL, PRINTERS,
Nos. 3 Broad and 109 East Bay Streets.
1871.

TRY THE

ATLANTIC PHOSPHATE.

USE

ATLANTIC

Acid Phosphate

IN COMPOSTING COTTON SEED.

The ATLANTIC PHOSPHATE is guaranteed to be a first-class Fertilizer.

PHOSPHATE, $55.00 per ton. Cash, or $60.00 per ton, on time, with interest at the rate of 12 per cent. per annum.

ACID PHOSPHATE, $35.00 per ton Cash, or $40.00 per ton on time, with interest at the rate of 12 per cent. per annum.

Figure 10. An Ashley Phosphate Company advertisement for the fertilizer produced at 38DR60/81 (SCHS misc.vertical file).

> Disintegrating and screening is the last process in the manufacture; the mass from the mixing tub, after standing for a time is mined out and loaded in cars, which are elevated to a machine called an integrator...The stuff is fed in at the centre, dashed to pieces by the bars at the periphery, and falling through these is received in a revolving screen, after passing through which it is ready for market (*Rural Carolinian* 1873:203-204).

One of the first challenges facing the fertilizer production companies was how to market their product to the average consumer. Farmers across the South faced low crop yields during the Reconstruction period due to nutrient exhausted soils during the Post-War years. While the farmers knew that something needed to be done to help their crops, most mid-nineteenth century farmers knew little, if anything, about new chemical fertilizers. It was, therefore, the job of the new fertilizer producers to teach as well as to advertise their products to the consumer. Several examples of late nineteenth century phosphate advertisements from the Charleston area are shown in Figures 10 and 11. In addition to advertisements to market fertilizers, some companies printed "primers" to teach the farmers about the purpose and usage of fertilizer products. Examples from the Ashley Phosphate Company primer are shown in Figures 12 and 13.

Consumption of phosphate fertilizers steadily grew throughout the 1870s and 1880s, and so did the number of companies producing fertilizer. Numerous production companies sprang up in the state during the late nineteenth century to manufacture crude phosphates into fertilizers. The first was the Wando Phosphate Company, established in 1867 with a capital investment of $300,000 by Dr. St. Julien Ravenel, a former professor of chemistry at the Medical College of Charleston. Dr. Ravenel was also the chemist and scientific advisor for the Pacific Guano Company that was established in September of 1869 with one million dollars in capital. Pacific Guano owned its own mines on Chisholm's Island, as well as temporarily owning mines in the Edisto region (Chazal 1904).

By 1870, both the Atlantic and Stono Phosphate Companies had moved into the Charleston area to produce fertilizers. Earlier involvement of some of the managers from these companies in the Peruvian guano trade gave them experience in application and marketing of phosphate fertilizers (O'Connor 2000). The Stono Phosphate Company was established with $350,000 capital and was owned primarily by planters and merchants from the Piedmont of South Carolina as well as investors from North Carolina and Georgia. Professor Lewis R. Gibbes was the chemist of Stono Phosphate Company, and J. D. Aiken & Company were the business managers (Holmes 1870).

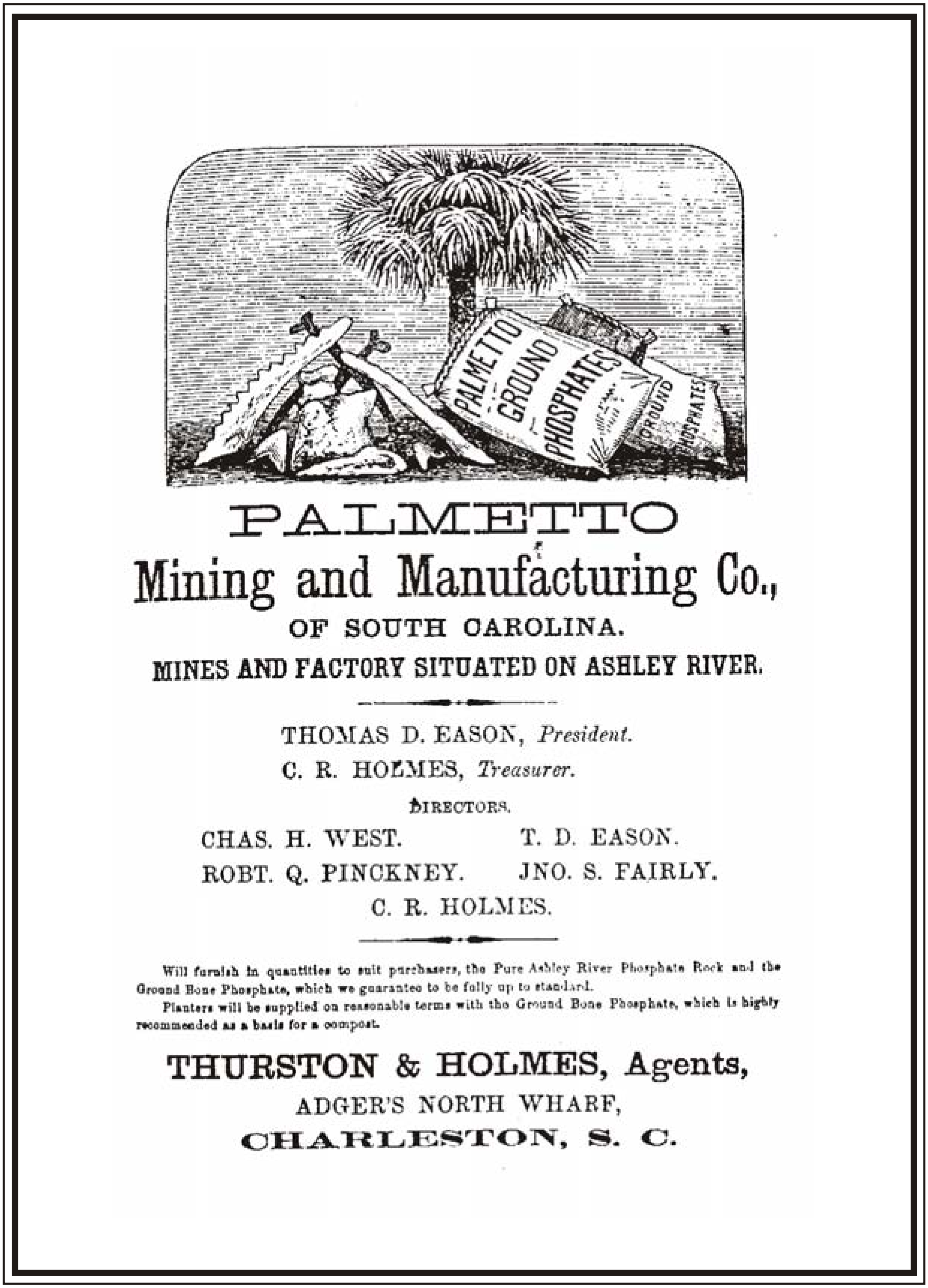


Figure 11. An advertisement for the Palmetto Mining and Manufacturing Company on the Ashley River (Shick and Doyle 1985:13).

THE

Ashley Phosphate Co.

CHARLESTON, S. C.

SOLUBLE GUANO, highly ammoniated;
DISSOLVED BONE, highest grade;
ACID PHOSPHATE, for composting;
ASH ELEMENT, made of Floats,
for Cotton, Grain and Peas;
GENUINE LEOPOLDSHALL KAINIT,
Imported direct from the Mines in
Germany, and warranted pure;
GENUINE FLOATS, of highest grade,
Product of the Duc Atomizer;
SMALL GRAIN SPECIFIC;
COTTON AND CORN COMPOUND;
GROUND DRIED FISH AND BLOOD;
GROUND RAW BONE;
N. S. LAND PLASTER;
COTTON SEED MEAL;
PERUVIAN GUANO; S. C. MARL.

Special formulas made carefully to order, of best material.

Special inducements for cash orders.

For terms, Illustrated Almanacs and Colored Humorous and Analytical Cards address the Co.

THE

ASHLEY PRIMER.

FOR GOOD BOYS ONLY.

Delightful task! to rear the tender thought,
To teach the young idea how to shoot
To pour the fresh instruction o'er the mind,
To breathe th' enlivening spirit, and to fix
The generous purpose in the glowing breast.—*Thomson.*

Copyrighted 1881, by Ashley Phosphate Company.

PUBLISHED BY
ASHLEY PHOSPHATE COMPANY,
CHARLESTON, S. C.

Figure 12. An excerpt from the Ashley Phosphate Company's "Ashley Primer" (SCHS misc. vertical file).

B BUG.

See the bug. No! this is not a bug. It is a worm now. It will be a bug one day. He has come to eat the planter's cotton. He has come too late. This wise Planter put Ashley Fertilizer on his crop. His crop grew before the worm grew. The largest bug is the hum-bug. There are none of these bugs among Fertilizer companies. Oh! no.

C CUSS.

The bad boy uses cuss words. Does his Pa ever catch him? Yes, sometimes. What does he give him? He gives him a licking. When that boy grows up, he will be too big to lick. Then he can cuss. What makes good farmers cuss? For a mean man to sell him bad fertilizer. Is Ashley a bad fertilizer? O No, it is a good one. Only good men sell it.

Figure 13. An excerpt from the Ashley Phosphate Company's "Ashley Primer" (SCHS misc. vertical file).

Located on the banks of the Ashley River at Brown's Wharf, about a mile north of the Charleston city limits, the Atlantic Phosphate Company was organized with $200,000 capital in the year 1870. The company was managed with Mr. Francis J. Pelzer as president and Mr. F. S. Rogers as the treasurer. Total lands encompassed by these works was 90 acres, which was large compared to many of the other fertilizer production plants. Atlantic Phosphate included two mills (one three story and one four story), a storehouse, and four acid chambers divided into two buildings. Twelve additional buildings stood on the property. Within the mill house lay twelve enormous sets of buhrstones [limestone grinding stones] and other equipment; the drying house at the site was powered by two steam engines. The Atlantic Phosphates did as much as $400,000 in transactions annually. It was reorganized under the name of the Ashley Phosphate Company in 1881.

The Ashley Phosphate Company was managed by two gentlemen previously employed as the Secretary-Treasurer and the book-keeper of the Stono Company, Dr. F. L. Frost and Mr. J. P. DeSaussure, respectively. The new managers apparently expanded the facility. Frost placed an advertisement in the 1883 phosphate almanac and handbook in which he proclaimed, "With greatly extended facilities for business, and with greater experience, and much enlarged range of operations, we are in better condition to serve. . . As in the past, so in the future, our labors shall be 'Pro Bono Publico' and our motto "Excelsior"" (Phosphate Pamphlets 1880-1882, Willis n.d.). Despite these improvements, annual trade from the Ashley Phosphate Company was more modest, and only reached between $200,000 to $250,000. Chazal (1904) describes the Ashley Phosphate Company in the following excerpt.

> [T]his (phosphate) deposit lies on both sides of the Ashley River. East of the river it began at a point about a mile below Bee's Ferry... and extended to a point just above the present Ashley Works, a distance of some 10 miles. The upper portion of the deposit has not proven of much value, on account of insufficient quantity or too great depth below the surface, and comparatively little rock has been taken therefrom (Chazal 1904:3-4).

Despite the reduced income realized by the newly reorganized Ashley Phosphate Company, entrepreneurs continued to invest in the industry and numerous fertilizer and start up new companies. In 1880, South Carolina ranked second with $3,993,300 in aggregate capital invested behind Maryland which had only slightly more with $4,271,870 in invested capital. New York stood a distant third with a mere $1,000,000 invested in the phosphate industry (Willis n.d.). That year, 190,000 tons of phosphate rock were mined in South Carolina. By 1884, there were 14 land mining companies, 11 river mining companies, and 11 fertilizer manufacturing companies mining and processing 409,000 tons of the rock a year (Willis n.d.). A few of the fertilizer production companies in the Charleston area included the Sulfuric Acid and Superphosphate Company, Pacific Guano Company, Ashepoo Phosphate Company, Edisto Phosphate Company, Etiwan Works, and Wappoo Mills. In addition to its mining operations, Charleston Mining and Manufacturing Company opened a fertilizer production plant in 1890. It was the first fertilizer plant in the United States to produce "triple-super phosphate" (Johnson 1983). Some of the fertilizer production plants in other areas of the state included: Columbia Phosphate Company (Columbia), Globe Phosphate Company (Columbia), Royster Guano Company (Columbia), Darlington Fertilizer Company (Darlington), Anderson Oil and Fertilizer Company (Anderson), Greenville Fertilizer Company (Greenville), and Blacksburg Company (Blacksburg). By the 1880s, numerous companies were mining and producing both river and land-derived phosphate fertilizers in the Lowcountry.

Industry and the New Labor Force. During the antebellum years, enslaved African Americans served as the primary labor force for agriculture. In the years following the Civil War, however, sharecropping and tenancy by white and black families alike, emerged across the South in response to the labor shortage in agriculture. In sharecropping, the landowner provided all of the supplies and seed for farming, while the agricultural laborers provided their labor; the landowner therefore owned the crop, and the laborer received a share of the crop in pay. Under tenancy, the laborer supplied the supplies, tools, stock, seed, and provisions, while the landowner provided only the land. The tenant controlled the crop, and would give between one-quarter and one-third of the crop to the landowner as rent.

With the increased demand for fertilizer and the rapid growth of the industry, there was an increasing demand for laborers in the region. As a result, many men in the Lowcountry found employment in the new industry. During the 1880s and 1890s, many African Americans found employment in the phosphate mines and the fertilizer production facilities.

Initially, phosphate mining was done using only the most basic means. Phosphate deposits extensive enough to mine were found using a pointed steel rod. Soundings were taken every 100 feet and a map showing the results was made. Test pits then were dug to determined the depth and quality of the deposit. If a deposit was at least 12 inches thick it was profitable to dig up to seven feet down to get it. If the deposit was only six inches thick it would have to be very shallow to be worth mining. Land mines were lain out in fields 600 by 800 feet. A platform was constructed in the center of the field. A tram line was constructed through the field and beside the platform where the rock was piled. Workers began digging a trench along the side of the area to be mined. Then, working away from the trench, the overburden was removed with picks and shovels and placed behind them exposing the phosphate deposit in front. The workers placed the rock into tram cars which were hauled by mules. Figure 14 is a picture of workers loading rail cars with phosphate rock.

The rock was then washed by hand using stiff straw brooms. Innovation came in the form of the steam engine. The engines were used to pump the water out of the mines, to operate river mining dredgers, and to operate mechanical washers. As phosphate rocks were removed from the land, men deposited them into wheelbarrows, and dumped the nodules into steam-powered machines where the rocks were cleaned. The washers were wood or iron. A shaft with steel teeth rotated slowly, moving the rock up an inclined trough and against a falling stream of water. Another improvement to the trough washer was the introduction of a cylindrical washer with spiral iron flanges. The large cylinder rotated around a perforated iron pipe that distributed powerful jets of water (Shepard n.d.)..

Figure 14. A view of miners loading phosphate rock into rail cars.

Once the phosphate rocks were clean, they were either dried and ground on site or shipped by barges along the river to fertilizer companies where this process, along with other chemical processes, would be conducted. Grinding the rock was initially done by turning huge grinding stones, or buhrstones. The invention of a machine that ground the rock using centripetal force eliminated the need for the cumbersome stone grinding. Even with the use of machines at the mines, the unskilled manual laborers provided the primary labor behind the mining of the phosphate rocks. Figures 15 and 16 present line drawings of laborers digging up and washing the phosphate rocks.

Phosphate mining posed numerous health hazards to workers. The brutal summer climate compounded the already strenuous working conditions for the men. The physical demands were not so far removed from the days of slavery for many of the newly freed African Americans employed by the mines; however, for northerners, the work often was overly demanding, and the subtropical climate unforgiving to the unseasoned laborers. Other industrial health hazards included exposure to low levels of radioactivity, emitted as trace elements of uranium along with phosphates in the marl. Uranium is highly carcinogenic with long term exposure. Inhalation posed additional dangers and health effects to the laborers.

Mining was treacherous work, especially in the river beds. Manual laborers, with little more than a rope tied around the mid-section, dove from the sides of boats to extract the precious nodules from the river beds.

> Laborers dug rock from creeks and streams at low tide or dove to the river bottoms to dislodge deposits; 'negroes stripped to the waist, descended to the river bottom with grappling hooks and iron baskets. They filled the baskets, surfaced, and dived again.' Even where steam dredges were used by the large companies, much of the rock broken up by the mechanical 'dipper' had to be pulled from the water by men.

Figure 15. A depiction of phosphate miners near the City of Charleston (Courtesy of the Charleston Museum).

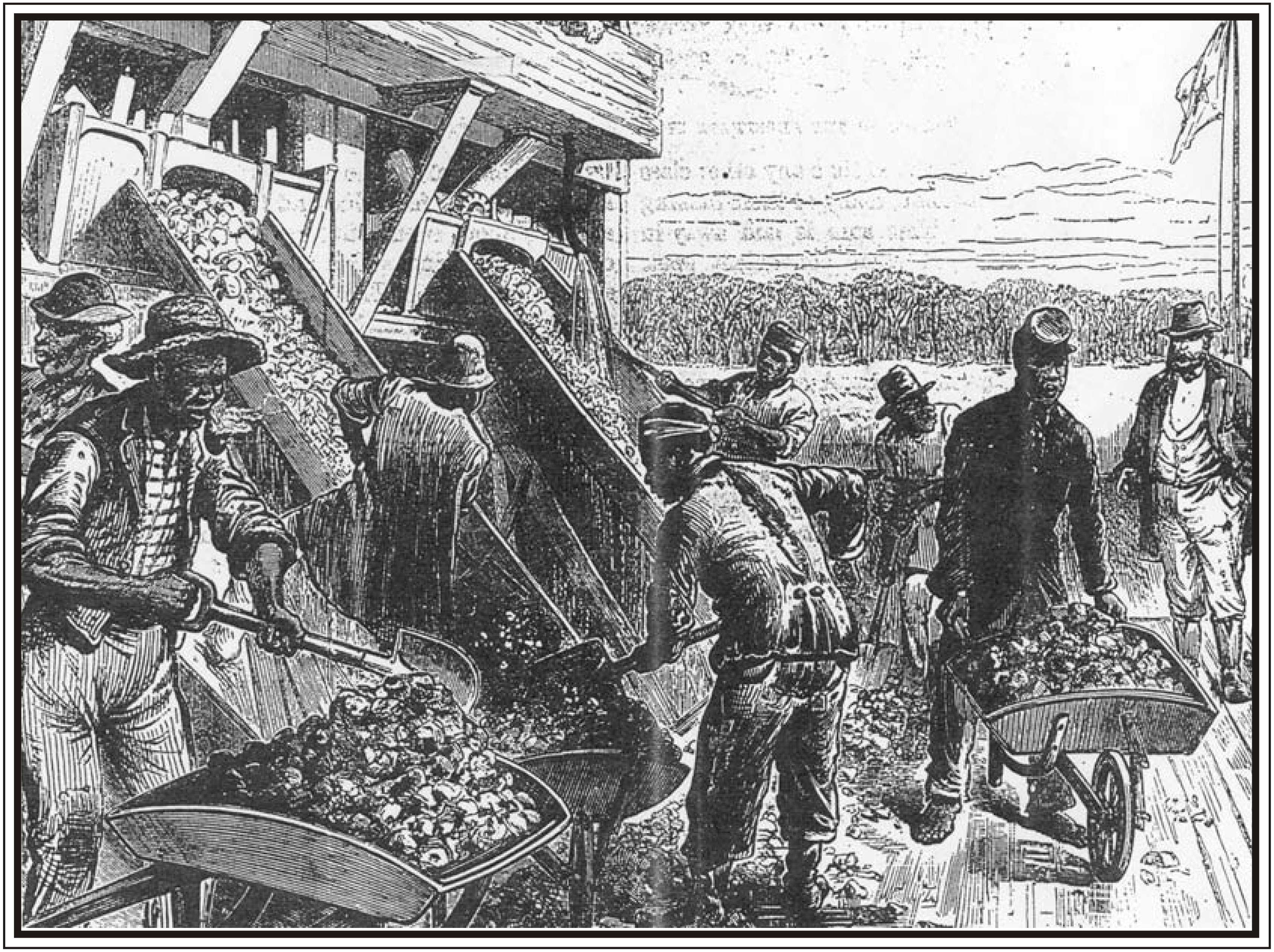


Figure 16. Laborers washing the phosphate rocks (Courtesy of the Charleston Museum).

> with tongs in small boats that followed behind the dredge. The rock collected in this manner was loaded on barges (known as lighters) where other workers methodically removed marl, sandstone, oyster shells, and the like (Shick and Doyle 1986:12).

The river phosphates were then transported to plants owned by the river mining companies, and phosphates were subjected to the steam powered washing and crushing machines.

For river and land miners alike, intense heat and vector-borne illnesses such as yellow fever and malaria took a toll. Local freedmen of African descent had advantages over the imported white laborers from the north. Not only were they acclimatized to the southern heat and humidity, but many of the freedmen whose ancestors originated in West Africa, possessed a genetic advantage in endemic malarial, and possibly yellow fever, environments such as that of coastal Carolina. As a result, African Americans typically were affected less often by such illness. When they were affected, the laborers of African descent faired better at withstanding the active summer months of the mining industry (Kiple 1984; Pollitzer 1999).

Exact labor figures have not been calculated for the state's phosphate industry. Freedmen were attractive to mining companies as a relatively inexpensive labor force that was already present locally in large numbers. Many former slaves who left the large plantations of South Carolina were often taken on as wage laborers in the growing textile industry of the Piedmont. For the freedmen who remained in the Lowcountry, the burgeoning phosphate industry meant jobs.

> The phosphate mining industry obtained the majority of its laborers from the Negroes who lived in the surrounding neighborhoods. Many of the Negro farmers in the coast region commended the farm work to their families and obtained employment at the phosphate works as a means of increasing the family income (Wright, The phosphate industry of the US, 83 in A. A. Taylor 1924 Journal of Negro History Vol 9 Issue 3, p. 312).

In the phosphate mines, the freedmen preferred a labor system similar to that of the antebellum period. Rather than being paid for the amount of phosphate that was produced, workers were paid by the completed task rather than by the amount of time that was worked. Each task, such as digging out a phosphate stratum or wheeling the phosphate nodules over to the cleaners, was paid various wages. For example, digging a pit or ditch 15 feet long by six feet wide would earn a workers approximately 25-30 cents per vertical foot dug. Ditches were often dug four to seven feet deep, as soils were removed to expose the phosphate rock that lay beneath. Rock was then shoveled out by hand into wheel barrows and carried over to mechanical washers. Finally, the rock was stored in drying sheds or loaded onto barges or rail cars for shipment. Some facilities were equipped with wood-burning furnaces to speed up the drying process. The work was hard, conditions were poor, and the pay was low, but through the task system, workers retained "some control over the pace of work and daily wages paid"(Shick and Doyle 1986:12).

Turbulent labor relations drove owners to search for alternate labor sources in South Carolina's phosphate mines. Several of the mining operations in the Charleston area employed convicted criminals as part of their labor force. As early as 1881, Gregg Mines (see Figure 10), which was located on the west bank of the Ashley River, began replacing free African wage laborers with men from the local Penitentiary. Colonel Gregg, the proprietor, firmly believed that the freedmen laborers were "untrustworthy" (*Charleston News and Courier* 1884). There was enormous competition for acquiring workers due to the harsh work conditions, and the convicts were available. According to Mr. Robert S. Pringle of Gregg Mines, this was not an economic decision since the cost of convict labor was greater than that of free wage laborers. Rather, the primary advantage was that convict laborers were easily supplied. Drayton Hall employed in excess of 100 convicts simultaneously in its mining operation, but most companies employed far fewer (*Charleston News and Courier* 1884).

Special precautions were taken with the convict laborers. Unlike the African American workers whose work week ended at noon on Saturday and began on Monday, convicted laborers got only Sundays, July 14th, and Christmas Day off. The convicts worked in separate fields and under harsher supervision by armed men (Willis n.d.). Skilled laborers including carpenters and blacksmiths were employed at the washers. Secure stockades were constructed around these mining operations, and the convicts worked in chains, under close supervision. At night, the convicts employed by Drayton Hall were chained together along a single chain running through the sleeping areas for additional security. According to the *Charleston News and Courier* in 1884, the convicts reported being well-treated, well-fed and, securely housed. Local physicians who visited the mines and cared for the sick, however, attested that the harsh work in the phosphate pits often took its toll on the men *(Charleston News and Courier* 1884).

In addition to freedmen and convict laborers who worked the mines, a few companies experimented with hiring Irish, Italian, and Polish immigrants from the northeastern United States. Such labor practices were short-lived, generally before the 1880s, and were attempted by mining operations with financial backing in the north, such as the Charleston Mining and Manufacturing Company. The northern immigrant laborers typically were unaccustomed to extreme work conditions and the summer climate of the Lowcountry, and as a result they did not fare well in the mining industry. African Americans continued to predominate the labor force as northern laborers were quick to leave the mines and the South (Shick and Doyle 1986:15).

Problems with labor relations notwithstanding, there were advantages to employing a predominantly African American labor force. Most of the freedmen workers were locals who were already acclimatized to the harsh seasonal heat and humidity of the southern Coastal Plain, making it somewhat easier for them to withstand the stresses of work along the coast in the summer. Haskell (n.d.) visited the phosphate mines in the 1890s and wrote the following description:

> Little do they care those dusky laborers, for the beating of the tropic sun! Well seasoned are they to all intensities of heat, and even now and here they must have their dearly-loved fire, where they cook their midday meal of hoecake and bacon, and around which they gather after sunset, when the gnats become troublesome, and exchange their rough and witty sayings, their novel views of men and things (Haskell n.d.).

The labor problems of river mining were somewhat different than those of the land mining operations. River mining companies frequently had to employ local workers from the Sea Islands off of the coast of South Carolina. Most of these men worked in agriculture as well as in the mining industry, which in turn necessitated more flexible seasonal work schedules, including free weekends and more time off during summer months to work the crops. Agricultural production in the state created heavy seasonal fluctuations in the labor force not only for the river operations but also for land mining companies, since the summer months were often the most valuable times in the fields (Shick and Doyle 1986).

Some labor problems for land mining operations were partly solved in the mid-1880s when companies established villages for the workers. These villages were permanent, year-around settlements in which the workers paid to live. Villages were located near the mines and provided access to everything the laborers could need, including housing and medical care. Commissaries were open for the men to purchase desired goods. Some of the stores were operated by the mine itself and some by private merchants. The credit that was extended to the mine workers for everything from rent to medical care to provisions in the stores generally created a system of indebtedness that tied the men to the mines for long periods of time. Haskell (n.d.) stated that the freedmen workers in the phosphate mines were the highest paid laborers in the state of South Carolina during Reconstruction, making as much as $2 per day. Other sources suggest more modest incomes were actually paid to phosphate miners since they worked by tasks, with paid wages widely ranging between \$3.50 to \$7.50 per month. As workers often charged their rents and provisioning during the month, little of this meager income generally remained after the monthly accounts were settled, and as a result, many of the men were trapped into a vicious cycle of work and debt (Shick and Doyle 1986). The newly acquired social freedom of the many African American men who worked in the industry was limited substantially by new economic chains that bound them to the mines.

Contradictory to the mining operations, the most active time of the year for fertilizer production facilities was in the winter months. While unskilled labor predominated the labor in the mines, production at the plants required both skilled engineers and chemists as well as unskilled workmen. Little information has been compiled on the level of skill for the labor force, the treatment of workers, or the wages paid in the production of superphosphate fertilizers. As with the mines, there were numerous potential health dangers to the men who worked at the fertilizer production plants. Everything from unloading the phosphate at the wharf to working around enormous milling stones presented ongoing dangers. Sulfuric acid manufacture was probably the most dangerous of all aspects of production. Chambers that were not well-maintained posed threats not only to the men through chemical burns and inhalation of highly poisonous gases, but leaky chambers also affected local crop lands and polluted the environment. As with labor information, information on work hazards and health effects of fertilizer production has yet to be synthesized.

Attitudes of racism and colonialism continued to prevail during the years following the Civil War, especially in the southern United States. As a result, labor relations in the Reconstruction South were highly volatile. Planters and industrialists fought to retain their antebellum "paternalistic control over labor which amounted to an authoritarian system of 'industrialized plantations'" (Shick and Doyle 1986:2). At the same time, some African American laborers, empowered by their freedom, challenged employers and some went far enough to organize labor unions. Nevertheless, labor unions were never very successful in the South, probably resulting from the widespread availability of unemployed workers in the region who were willing to work for low wages and to tolerate harsh work conditions. Discrimination effectively served to limit the degree of organization among African Americans in the region. Fear of unemployment was sometimes secondary to fear of physical harm to self and family, all of which in varying degrees limited African Americans from uniting against their employers. Marxist historians contend that there is evidence to suggest that the class system of the Old South remained firmly in place during Reconstruction, and even through the 1960s. They hold that the class system was necessarily responsible for a declining economy, but nevertheless, it was in place and had a significant effect. Planters and the rising southern middle class, forced control over many freed African Americans through Jim Crow laws as well as more covert means of discrimination as a means to instill fear. Economic historians argue that the poor economy of the late nineteenth century resulted not from labor relations, but rather from supply and demand, placing the blame on the marketplace and consumers (Shick and Doyle 1986:2-3). Although the causation behind the stagnant southern economy remains a hotly debated topic, one thing is certain; labor relations were changing significantly and quickly in the Reconstruction South and in the US as a whole.

The Decline of the Industry. Superphosphate of lime was a valuable fertilizer for a variety of crops such as cotton, tobacco and grains. In southern states, especially those with clayey soils (with the exception of Louisiana, Texas and parts of Florida), these fertilizers were essential to maximize crop yields. The amount of phosphate fertilizer produced in Charleston started at a mere six tons in the year 1867. By 1876, in just 10 years of production, a total of 132,626 tons annually of crude phosphates were coming from the state. This increased to 163,220 tons in 1877, to 210,323 in 1878, and declined slightly to 199,365 tons in 1879. Between 1876-1881, the bulk of phosphates produced in the state were shipped to a foreign market each year. During 1880-1881, the trend reversed and domestic use exceeded foreign shipments (Taylor 1924) During 1881-1882, 117,470 tons were used domestically while only 29,026 tons were exported to foreign ports (Willis n.d.).

Foreign exports started out very strong, growing during the 1860s and 1870s, but declined in the 1880s. In 1868 foreign exports began at a mere 208 tons. By 1875-1879, these figures rose to between 70,546 and 119,566 tons. The export market turned in 1880, and only totaled 61,375 tons. This decline, however, had an inverse correlation with the domestic market, for phosphate consumption which sharply increased in 1880. The following figures by decade show the rapid growth and decline of the South Carolina phosphate industry for the total tons of crude phosphate produced in the state: 1870 – 65,241 tons; 1880 – 190,763 tons; 1890 – 586,758 tons; 1900 – 428,562 tons; 1910 – 179,659 tons; 1920 – 44,141 tons (Taylor 1924; Willis n.d.).

The production of phosphates for fertilizer along the banks of the Ashley River continued to increase until the earthquake of 31 August 1886 (Figure 17). The earthquake caused severe damage to many of the buildings in the area. The significant shift of a large lead shield used in the fertilizer process at the Ashley Phosphate Company's works was noted by Clarence Edward Dutton

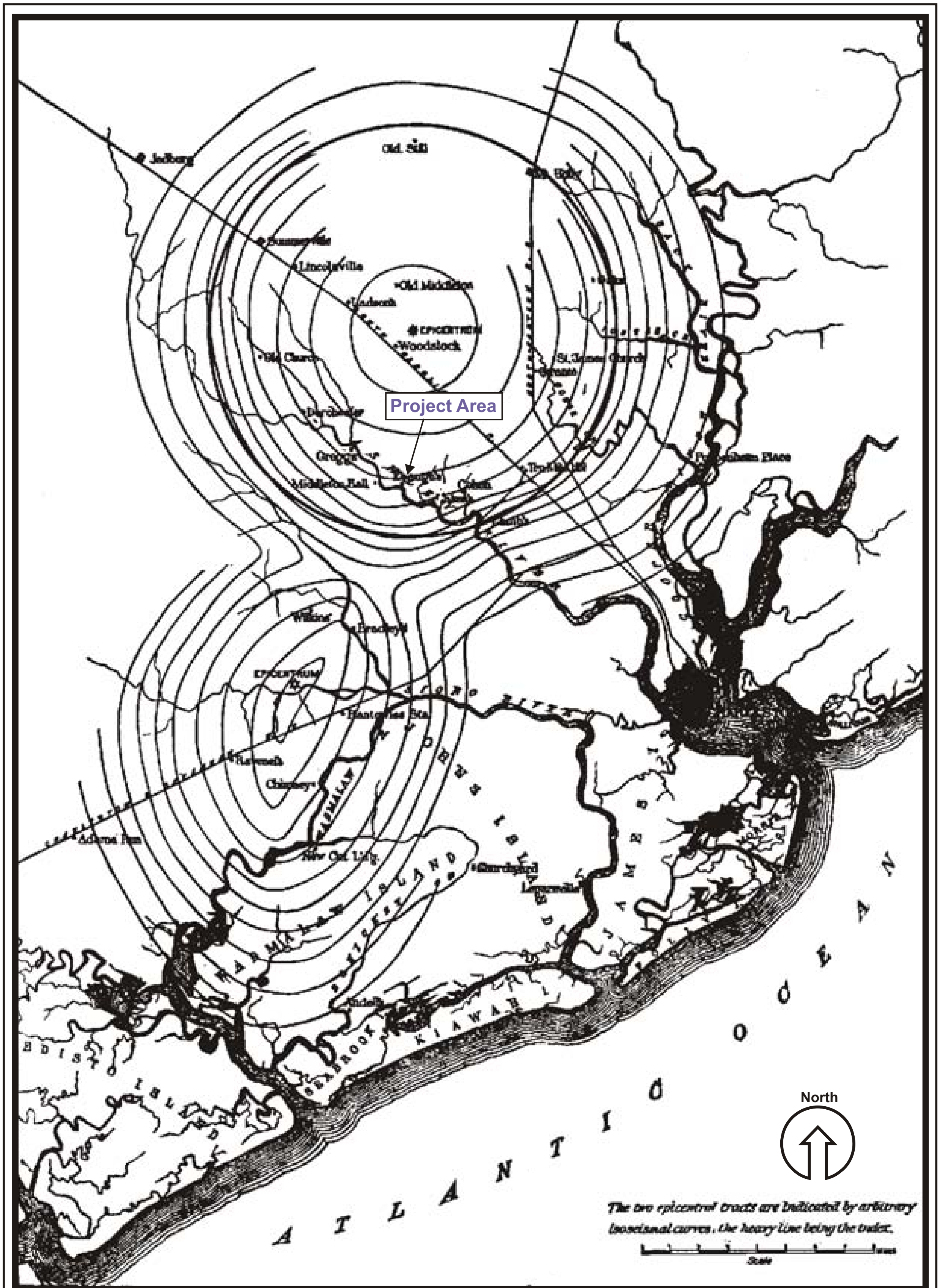


Figure 17. The earthquake map of 1886 (Dutton 1890).

(Dutton 1890). The earthquake of 1886 marked the beginning of the decline in the phosphate industry along the Ashley River.

The late 1870s saw a trend towards consolidation in the South Carolina phosphate industry. An increasingly competitive market created a financial crisis for many of the smaller companies who were forced to sell out during the 1890s. In 1897, Virginia-Carolina Company bought out the largest mining operation in the state, the Charleston Mining and Manufacturing Company. The Virginia-Carolina Company proceeded to take over most of the phosphate companies in the Charleston area. In 1963, the Virginia-Carolina Company was purchased by Mobil Corporation, which continues to be held liable for the environmental hazards at many of these former mining and production sites today. The phosphate industry mirrored, albeit on a much smaller scale, the general trend towards consolidation among other industries of the late nineteenth and early twentieth centuries. For example, the steel industry of the northeastern United States was being taken over by US Steel.

By 1885, the state of South Carolina already was producing one-half of the world's phosphates, with the height of the phosphate boom between 1880-1882. The industry quickly took a turn, and upon discoveries of rich phosphate beds in Florida and Tennessee, the mining and production of phosphates in South Carolina began to decline in the late 1880s. Internal politics in the state exacerbated the rapid decline of the industry. Governor Benjamin Tillman was convinced that the phosphate industry was cheating the state out of revenues, and in 1891, Tillman name a commission to control all river phosphate mining in South Carolina. In 1892, the case made its way to the US Supreme Court, who ruled in favor of the state to suspend Coosaw River bed mining (Stockton 1970). By the late 1890s, these political decisions accompanied by the discovery of phosphates of even higher grade in Florida and Tennessee caused a serious decline in the South Carolina phosphate industry.

The phosphate boom began in 1865, and died out as quickly as it began, rapidly declining in the last decade of the nineteenth century. No phosphate mining has been done in Charleston since 1938, and very little since 1920, although fertilizer production in the state continued on a smaller scale. For the most part, the South Carolina phosphate boom is long forgotten. A statue erected in 1892 in White Point Gardens to celebrate the phosphate industry was replaced by a bandstand at the site in 1906. Hills along the Ashley River, such as those seen on SC Route 61, as well as street names such as the well-known Ashley Phosphate Road remind us of this brief but prosperous period in the South Carolina Lowcountry.

Summary. The Reconstruction period was economically and politically turbulent for the state of South Carolina, and the Lowcountry certainly was no exception. As one of the largest port cities in the southeastern United States, Charleston had thrived during the antebellum period. Sea Island Cotton and rice were produced locally and abundantly, and a class of wealthy elite planters had homes in the city. A vast network of rivers, large and small, tied Charleston to the State's waterways, the Atlantic Ocean, and thus, to the rest of the world. These waterways provided important trade routes for transporting the numerous locally produced goods to both domestic and foreign markets.

Despite the antebellum prosperity of many Charlestonians, the City and her citizens suffered disastrous economic effects during the years succeeding the Civil War. Emancipation of the enormous enslaved African labor force, along with the dissection and redistribution of the majority of the large Sea Island Cotton and rice plantations in the Coastal Plain, were exacerbated by poor leadership in the City of Charleston. All of these factors collided during Reconstruction, ultimately destroying the economic infrastructure of the city. Coastal plantations fell into disrepair during the years of the war, as energy and resources, particularly labor, were diverted to the battle for Southern independence. After the Civil War, planters were left without enough laborers to plant and tend the fields. All aspects of the plantation system such harvesting, processing, and transportation of cash crops to market, became too costly for many southern planters to sustain. Those who owned plantations tried by any means possible to retain their lands. Some rented out parcels to tenant farmers, and then farmed smaller parcels themselves. In the end, however, many planters were forced to abandon the only way of life that their families had known for centuries, and to sell off their plantations as new industry moved into the area and quickly bought up the lands for the minerals that lay beneath the soils.

With an opulence of land and labor, efficiency had not been a primary concern of the antebellum planters. Emancipation, however, brought about enormous changes for the South, as formerly enslaved African laborers eagerly fled the fields and their bonds at the hands of the white planters. Faced with uncertainty about where to go, or what to do, some freedmen remained on plantations as wage laborers, but many freedmen quickly headed out in search of higher wages and a better way of life. Many freed African Americans took jobs in the State's growing textile industry in the Piedmont.

A paucity of jobs, and fierce competition faced the men and women who remained in the Lowcountry working in the fields. The resulting poverty and the depressed southern economy of the postwar years impacted white and black families alike. African American men and women and poor whites often lacked specialized employment skills. It was these men and women who faced the most difficulty in obtaining jobs in the state. Racial issues were heated and many freedmen simply refused to work for white employers out of fear, and sometimes pride. The men and women who found jobs faced open discrimination. Overt racism was compounded through the legalization of Jim Crow laws during the late nineteenth and early twentieth centuries across the South. Although the Emancipation Proclamation had granted freedom under the United States Constitution to enslaved Africans in 1863, the strongly institutionalized class system of the Old South retained its paternalistic hold on African Americans as late as the 1960s, as the South clung fast to its traditions. Many southerners fought change, all change, with a vengeance.

The labor shortage and disruption of the plantation system was only the tip of the iceberg facing southern planters during Reconstruction. Overuse of soils had rendered the agricultural fields practically useless for large scale cultivation. Fields were exhausted of their vital nutrients, and without adequate labor and arable land there seemed little economic hope for a return of the Old South during the late nineteenth century. The industrialism that was growing fast in the north was not present in the coastal southeast prior to the Civil War, nor was it desirable to most southerners even after the War. Many late nineteenth century southerners longed for a return of the Old South's traditions and social system. Eventually, however, some South Carolinians saw industrialism as a way out of the economic problems of the South. Slowly, some came to support the ideal of a New South, and became committed to business ventures outside of agriculture, such as the phosphate industry (Cobb 1988).

Shick and Doyle (1986) refer to the South Carolina phosphate industry as the "stillbirth of the New South." The metaphor of a stillbirth aptly suggests a tragic ending to a promising beginning for the industry. The "New South" is a concept that originated with editor of the *Atlanta Constitution* editor Henry W. Grady, in 1886. Political proponents of the New South welcomed growth, change, and bourgeois industrialism, and some may argue, at any cost. By contrast, supporters of the Old South longed for antebellum days past. Aristocratic elitism, with a firm class system, and an economy anchored in agriculturalism, the Old South and its supporters valued tradition above all else (Cobb 1988). Editor Francis Dawson of Charleston's *News and Courier* was an avid supporter of the New South, but most Charlestonians were little interested in anything short of reviving the Old South. Historian Walter Edgar states that "if ever there was a place that rejected the New South, it was the port city"(Edgar 1998:425).

There have been varying views among historians regarding the politics surrounding industrialism and the New South. Historian Eugene Genovese (1965) portrays the southern agriculturalists of the Reconstruction period as strict opponents of industrialization, but according to Cobb (1988), some recent historical interpretations suggest planters who were simply conservative when it came to investments, preferring to stick with more traditional roles, although with lesser income, rather than venturing into risky unknown business endeavors. Furthermore, the role of southern planter was a more socially desirable role than that of industrialist to many South Carolinians and to Southerners in general (Cobb 1988).

During the late nineteenth century, Charleston, which was formerly the largest city in South Carolina, declined economically and socially. Poor leadership and a city governed by old men with old ideals, along with heavy cutbacks, lead to decline in the infrastructure of the city. This coupled with a fear of change on the part of many Charleston businessmen, limited the potential for growth in the city. Natural disasters, such as the1886 Category 3 hurricane and tidal surge, and the 1886 earthquake, devastated the charleston, caused widespread damage and disease, and only heightened the problems for the already deteriorating city infrastructure (Edgar 1998).

The phosphate industry was just one more symptom of a struggling New South in many ways, especially in Charleston. Although at the state level and on a national level there was a trend towards widespread industrialization (e.g., textiles in the South Carolina Piedmont, and US Steel in the northeastern US), this trend was not reflected in the Lowcountry of South Carolina. Schick and Doyle (1985:2) argue that "this prosperity did not lead to sustained economic development" in the region. A few technological advancements were seen with the phosphate industry, but these remained largely limited to the industry. Phosphate production and development did little to spark technological advancements in other areas either. The technology, such as the use of acid chambers, that was developed for the fertilizer industry was specifically developed for that industry, and had no application outside of that industry. Therefore, while the phosphate fertilizer industry did lead in technological developments for its field, it held little economic potential outside of that arena.

Like technology, social relations in the region were not impacted in a profound way by the short-lived industry. The industry provided jobs to many unemployed and formerly enslaved African American men, but it also served to tie the men to their jobs, creating a vicious cycle of debt and indebtedness by the labor camps that housed the men. Labor relations were changing everywhere in the late nineteenth century United States, but the phosphate boom between 1867 and 1920 did little in fact to affect race and class structure or conservative mores in the New South labor relations in the region (Schick and Doyle 1985:2). Social relations in the South remained firmly entrenched in Old South morals and values, well into the twentieth century.

Economically, the phosphate industry promised hope of a New South to a small number of capitalists in the Lowcountry, but phosphate mining did little overall to stimulate economic development in the region. The mining of phosphates in South Carolina, and the resulting prosperity from the fertilizer industry, lasted for roughly 20 years, after which the state's resources were exhausted and those wanting to mine for phosphates moved to Florida where resources were abundant. Although the late nineteenth century phosphate industry and the resulting economic prosperity was short-lived, it was highly localized in the hands of a few wealthy capitalists.

In the process of industrialization, many rich cultural resources in the Lowcountry also were carted away with the phosphates. Today, over 100 years later, Charleston is left with the environmental aftermath of a short-lived industry. The phosphate industry of the late nineteenth century had a tremendous environmental impact on the landscape along both sides of the Ashley River. The effects are observed today as the EPA has identified many of these former mining sites as hazardous waste sites (April 2002 www.epa.gov). The river, once lined with so many elegant plantation homes with formal gardens and fields a century before, took on a harsh industrial landscape during Reconstruction. Large wharves, tram railroads, mills, storage sheds, and smoke stacks instead dotted the Charleston rivers. The effects to the local culture history and archaeological research has been devastating as well. Numerous archaeological sites such as well as historic cemeteries from earlier periods were affected or destroyed by mining efforts. As a result, studies the of the South Carolina phosphate mining industry tell us much more than just a history of a short-lived industry in the state. Rather, such studies additionally offer an explanation for the state of cultural resources in the region. Future investigations of the industry and of archaeological sites may provide a wealth of information on industry and its economic and environmental impacts.

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