Iron and Steel Production in Birmingham

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In the decades after the Civil War, Alabama became one of the nation's leading iron and steel producers. Although Gadsden and the Florence Sheffield District along the Tennessee River contributed to this rise, the Birmingham District became the largest iron and steel producer in the southern United States. Unique geological conditions provided the district with closely associated and abundant deposits of iron ore, coal, limestone, and dolomite. These were the raw materials essential for making iron and steel, and at some locations within the district, deposits were only a few miles apart. This lucky geological arrangement resulted in the lowest raw-material assembly costs in the United States and allowed the district to grow as rapidly, in the last two decades of the nineteenth century, as Pittsburgh and Chicago.

Within the industry, the most profitable enterprises were those that controlled all the mines, railroads, blast furnaces, and other facilities required to extract and assemble raw materials and to convert these raw materials into iron or steel. The close juxtaposition of their raw materials allowed iron makers in the Birmingham District to create companies that were industry models of what is known as vertical integration. Most of the Woodward Iron Company's holdings, for example, were linked by a remarkably short, 12-mile railroad. The company-owned track extended outward from its blast furnaces and coke ovens, to its limestone and dolomite quarries, to its ore mines on Red Mountain and its coal mines along the edge of the Warrior coal field.

Growth was also spurred by the ability to attract a large labor force of freedmen and poor whites. Impoverished and unemployed after the war, these laborers willingly migrated to the district in search of industrial jobs, which were a more attractive alternative to tenant farming and sharecropping. This work force contrasted starkly with northern industrial centers, which largely employed an immigrant labor force. Southern workers carried over traditional racial attitudes and social structures from antebellum days. Transplanted into new industries, these cultural values led to racially segregated work places that facilitated owners' efforts to control wages, working conditions, and union organizing.

Another factor that allowed Alabama iron manufacturers to dominate labor relations was the convict-lease system, through which companies leased state and county prison inmates for work in their industrial operations. Lasting from shortly after the Civil War until 1928, the convict-lease system provided substantial numbers of workers, largely in the company-owned coal mines. Young black men from rural agricultural areas provided the overwhelming majority of this coerced labor force. Possessing no mining experience, these workers died in numbers that far exceeded the normal mortality rates of the American coal mining industry as a whole. As a result of the political clout held by industrial leaders, Alabama was the last state in the nation to outlaw convict leasing.

Birmingham's promise of abundant raw materials and cheap labor, combined with an increasing national demand for iron and steel in the late-nineteenth and early-twentieth centuries, inspired southern entrepreneurs to join with northern investors to push for industrial development. Pursuing an economic vision dubbed by publicists as the New South Creed, this newly formed coalition launched a major drive to import skilled technicians and the latest technology to the region. They commissioned leading northern engineering firms to build cutting-edge furnace plants and enticed promising young technicians and engineers from northern industrial centers to take charge of mining and iron-making operations. By the turn of the century, the district boasted considerable expertise and the latest technological innovations.

Four iron-making enterprises, each controlling substantial deposits of iron ore, coal, limestone and dolomite, came to dominate the industry. These companies were unique in their use of advanced blast-furnace plants that smelted iron ore into pig iron. Woodward Iron, Sloss Sheffield Steel and Iron Company, and Thomas Works operated blast-furnace plants that produced pig-iron, which was of a lower grade than the iron used in steel-making. These plants were stand-alone facilities, known as merchant furnaces, that sold their product to foundries, where it was refined into cast-iron products. The Tennessee Coal, Iron, and Railroad Company, known locally as TCI, produced high-grade iron and, with it, steel. If managers chose to make iron for conversion into steel, their blasts furnaces were attached to large mills where the pig iron could be transferred, while still molten, directly to steel furnaces.

At the beginning of the twentieth century, there was large-scale consolidation within the American iron and steel industry. In Alabama, Republic Steel purchased Thomas and U.S. Steel acquired TCI. From that point onward, most of the pig iron produced at the Thomas Works was shipped to Republic's Gadsden mill. U.S. Steel enlarged its holdings by erecting the Fairfield Works to complement TCI's
original Ensley operation. Over the next seven decades, Birmingham furnaces produced millions of tons of pig iron, half of which was dedicated to steel production and half of which was sold as foundry iron.

The Sloss and Woodward furnaces continued to operate as merchant iron producers, largely because of the tremendous demand for foundry iron. But this trend also reflected a recognition of the poor quality of the region's iron ore and the difficulties in extracting it presented by the local geology. Resourceful uses of technology and innovative smelting practices could only go so far. These limitations would ultimately dictate not only the grades of pig iron that the district's factories produced but also the mining practices, the processing techniques, and the scale and methods of production at both the merchant blast furnaces and steel mills.

Woodward and Sloss so effectively turned to their advantage the limitations of the district's mineral wealth that they made Birmingham the nation's largest foundry iron producer. Their success was partially a result of relatively high phosphorous content of Red Mountain iron ore. Although the presence of phosphorous is undesirable in steel, it contributes to excellent foundry iron. In addition, foundry iron is best produced in small blast furnaces, which are unsuited for steel manufacture, where the economy of scale is essential. During the early part of the twentieth century, for example, foundry iron consumers preferred pig iron that had been cast in sand. This method was more labor intensive and better suited to small blast-furnace plants. At the same time, both the ore and coal seams in the Birmingham District occurred in geological settings that favored smaller-scale mining practices. Thus smaller mining operations harmonized with the limited output of foundry-iron blast furnaces.

TCI, with its emphasis on steel, had to construct elaborate processing facilities and specially adapted furnaces to work with the high silicon and phosphorous content of Red Mountain iron ore. The company operated four separate mining operations on Red Mountain that combined to form the largest underground iron-mining complex in the United States. Because the silicon content of the ore from each mine varied greatly, the company built a large processing plant at the base of the mountain where ore from several mines could be mixed and subjected to other refining processes in order to average out its silicon content. At their steel mills, TCI installed the nation's first large-scale duplex mill, which employed both Bessemer converters and tilting, open-hearth furnaces. The Bessemer converters were required to rid molten pig iron of its relatively high silicon content, and the molten metal was then transferred to the tilting open-hearth furnaces, where excess phosphorous was removed. Large mixers held reserve supplies of steel from the converters, ensuring an uninterrupted flow to the larger open hearths.

Over time, the district matured into a major regional iron and steel producer. The availability of cheap foundry iron attracted large cast-iron pipe producers, such as Stockham Pipe and Fittings Company and American Cast Iron Pipe Company. By the early-twentieth century, all of the nation's large cast-iron producers had moved substantial portions of their operations to the Birmingham District. Other industries seeking cheap foundry iron followed, along with a diversified mix of related industries. Steel production increased along with the rise of merchant foundry iron plants. By the 1920s, Birmingham produced one fourth of the nation's foundry iron and had grown into the largest steel maker in the Southeast.

In the latter half of the twentieth century, Birmingham's iron and steel industry began a decline that continues today. Increasingly stringent air-quality requirements, foreign competition, and the rise of ductile iron made from scrap forced the shutdown of foundry iron furnaces and their coal and ore mines in the early 1970s, but Birmingham remains an important steel producer.

Additional Resources


