A Tale of Two Companies: The Cleveland Iron Mining Company and the Iron Cliffs Company, 1850-1891

By Terry S. Reynolds

During the late nineteenth century, the locales from which the American iron and steel industry secured ore shifted radically. Before 1850, iron and steel mills and furnaces typically used low-grade local ores. In the mid-1840s, surveyors and prospectors, initially looking for copper, discovered very large deposits of high-grade iron ore near the southern shore of Lake Superior on Michigan's Upper Peninsula, about a dozen miles inland from the present port of Marquette. Land and water transportation systems developed in the 1850s to bring Marquette Range ore economically to the lower Great Lakes. Whereupon the American iron and steel industry—especially that part of it west of the Alleghenies—began a steady shift away from using local deposits to depending on Lake Superior iron ores transported hundreds of miles and eventually drawn from six different iron ranges.

Cleveland Iron Mining Company, organized in 1850, and the Iron Cliffs Company, organized in 1864, became two of the major players on the Marquette Range, the first of the Lake Superior iron-ore ranges discovered and, prior to the 1890s, arguably the most important. In 1891 Cleveland Iron and Iron Cliffs combined to form the Cleveland–Cliffs Iron Company, today the leading American producer of iron ore.[1]

Although frequently pictured as a "merger" or "consolidation," in reality Cleveland Iron Mining Company absorbed the Iron Cliffs Company through indirect purchase, initially creating a holding company (Cleveland–Cliffs) due to property holding limits in Michigan mining law.[2] The officers of all of the related companies after 1891—Cleveland Iron, Iron Cliffs, and the holding company, Cleveland–Cliffs—came from Cleveland Iron Mining Company; no major official from Iron Cliffs remained.

Given the comparative land holdings and initial stockholders of the two companies, however, one would have expected Iron Cliffs to absorb Cleveland Iron, not the reverse. (See Table 1.) While Cleveland Iron, founded in 1850 and commencing operations in 1853, was one of the first three companies to mine iron ore on the Marquette Range. In 1890 it owned only around two thousand acres of mineral land. In its early years it was chronically short of capital, for its founders and officers were, at least initially, men of modest means: Samuel L. Mather, a Cleveland lawyer and land manager; William Gordon, a wholesale grocer; Morgan Hewitt, a physician; and John Outhwaite, a chemist recently arrived from Britain.

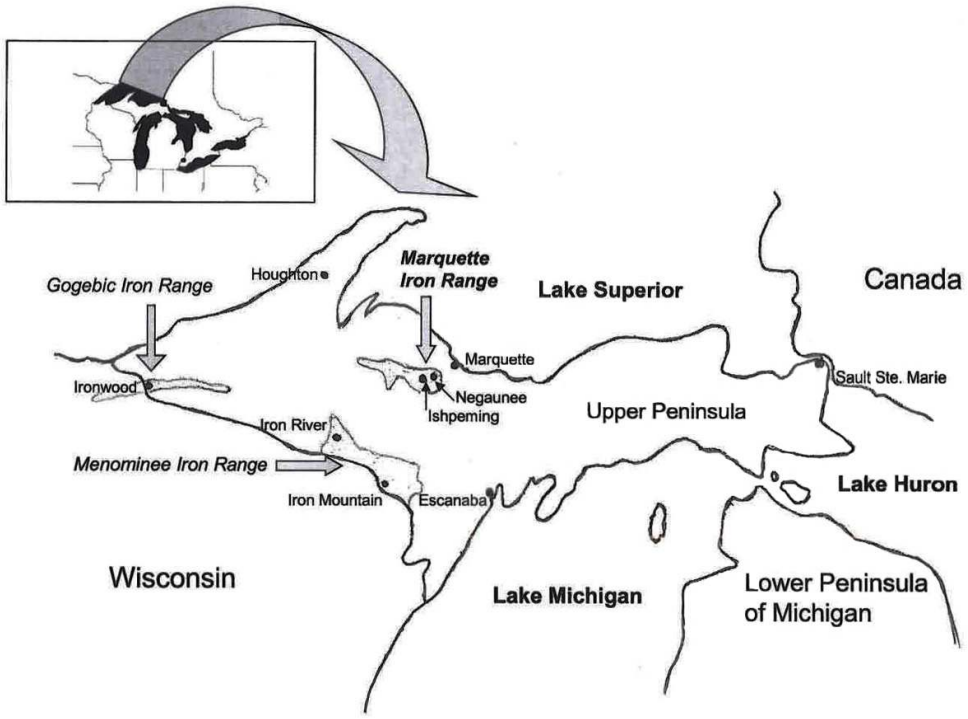
With their limited capital they not only had to open an iron mine, but invest in preparing the transportation infrastructure to make the venture profitable, for iron ore—unlike gold, silver, or even copper—is a bulk commodity, sold by the ton, not by the gram, ounce, or pound. Moreover, early iron-ore producers in the Lake Superior district had to develop customers in the face of skepticism over whether the ores of the new district could really produce quality pig iron. They also had to contend with blast furnace operators on the lower Great Lakes preferring local iron-ore deposits to dependence on distant suppliers. Making matters worse, none of the early leaders of Cleveland Iron had any experience in the iron industry. In fact, they initially had hoped to find copper deposits rather than iron; their diversion into iron was serendipitous.[3]

In contrast, the Iron Cliffs Company seemed to have all the advantages. It was founded in 1864 by wealthy men with experience in the iron industry. Among them were William B. Ogden, first mayor of Chicago, first president of the Union Pacific Railroad, and a leading investor in what would become the Chicago and Northwestern Railroad. He was joined by Samuel J. Tilden, a wealthy New York lawyer who later became governor of New York and the Democratic Party's presidential candidate in 1876. Tilden had a long association with Iron Cliffs' founder Peter Cooper, the prominent operator of a New York City iron works. William Barnum, another key figure in the company, was heir to important iron mining and smelting interests in northwest Connecticut. Besides running his family's business, Barnum would head the Democratic National Committee during Tilden's presidential run and serve in both the U.S. House and Senate.

Capital provided by these and other wealthy backers, mostly New Yorkers, enabled Iron Cliffs to immediately purchase all of St. Mary's Mineral Land Company's mineral and timber lands in Marquette County, Michigan—over thirty-eight

	Cleveland Iron Mining Co.	Iron Cliffs
Approximate Land Holdings c. 1880	2000 acres	Over 50,000 acres
Wealth of Company Founders (capitalization abilities)	Founders men of modest means	Founders both wealthy and politically prominent
Transportation Issues	No infrastructure in place at founding (1850); required to expend funds on development	Infrastructure already in place at founding (1864)
Experience in the Iron Industry	No officers with significant prior experience in the iron industry	Several officers and directors with extensive experience in the iron industry

Table 1. Cleveland Iron–Iron Cliffs Comparison



Michigan's Upper Peninsula, with the locations of its leading cities and important iron ore ranges. (By the author.)

thousand acres.[4] And Iron Cliffs had sufficient capital to add over twelve thousand additional acres to its "estate" over the next quarter century. The company owned well over fifty thousand acres by 1890, compared to Cleveland Iron Company's holdings of approximately two thousand acres.

By the time Iron Cliffs entered the Lake Superior iron mining district in 1864, Lake Superior iron ore had already established itself as a very desirable commodity and the infrastructure to ship it to blast furnaces on the lower Great Lakes was falling into place. By 1865 two railroads linked the Marquette Range to Marquette and Escanaba, where docks for loading ore and a network of ore carriers were already operational. So Iron Cliffs did not have to worry about developing infrastructure or markets.

Thus Iron Cliffs seemed to have all the advantages over Cleveland Iron: greater mineral land ownership, wealthier backers more experienced in the iron industry, and lesser capital needs. Yet Cleveland Iron absorbed Iron Cliffs. Why? The answer lies in four critical areas where Cleveland Iron had the advantage: better strategic choices, better relations between local and national management, a greater commitment by national management to iron mining, and the more aggressive adoption of new technologies. These four factors enabled Cleveland Iron to overcome its apparent disadvantages in land holdings, capitalization, and experience to absorb its rival.

Cleveland Iron Mining Company made several early strategic decisions that gave it an advantage over Iron Cliffs, the most critical being to mine and ship ore rather than reduce ore locally and ship pig iron. This issue had originated in the mid-1840s with the discovery of large outcrops of iron ore, sometimes called "mountains of iron," about fifteen miles inland from the southern shore of Lake Superior on Michigan's Upper Peninsula.

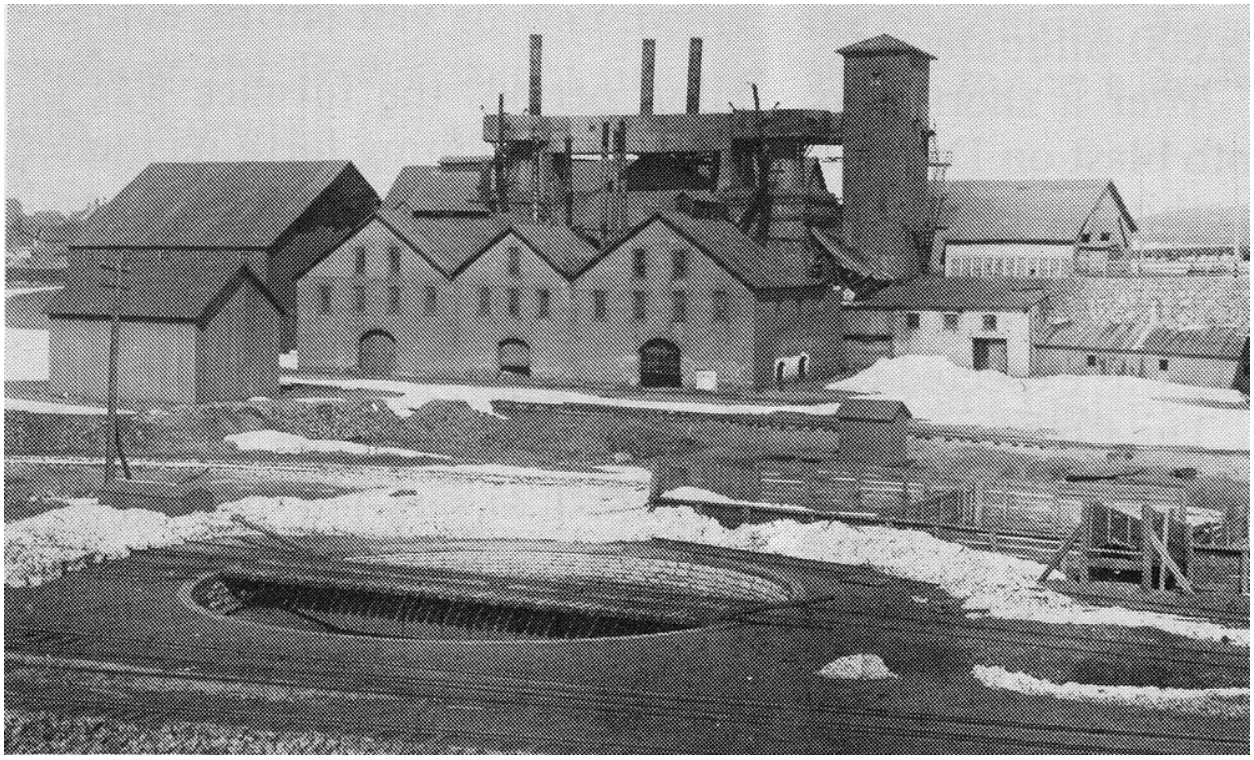
It was unclear whether it would be better to use the region's abundant forests to produce charcoal to process ore into cast or wrought iron locally, or to ship raw ore directly to blast furnaces on

the lower Great Lakes. Partly because the rapids at Sault Ste. Marie effectively barred water-borne bulk transportation of iron ore before 1855, the first two companies to mine in the Lake Superior region—Jackson Iron Company and Marquette Iron Company—attempted to forge iron locally.[5]

After buying out the Marquette Iron Company, Cleveland Iron reversed course in 1854 after its new forge burned down, electing to ship its iron ore more than five hundred miles to blast furnaces on or near Lake Erie for processing. Cleveland Iron's first president, Morgan Hewitt, undoubtedly played a key role in this decision after visiting the region in the summer of 1853. He concluded that the mine's isolation and high cost of provision on the remote Upper Peninsula, the lack of a regional coal supply and difficulties of securing the alternative charcoal, and the required heavy outlay of capital, all argued for producing ore but shipping it to furnace operators elsewhere.[6]

Reflecting this decision, Cleveland Iron abandoned its burned-out forge site on Lake Superior and shifted its attention to developing its mine near present-day Ishpeming. The company constructed an inexpensive, horse-drawn railroad from the mine to the new port of Marquette, some fifteen miles away, but abandoned the line a few years later after outside entrepreneurs built a steam-powered railroad.

These strategic decisions produced several advantages, the chief being to reduce the capital required from Cleveland Iron's investors, mostly men of modest means at the time. All the Cleveland Iron Company needed, at least initially, was sufficient capital to run an iron mine that operated much like a quarry, since the ore outcropped above the surface. Others would supply the capital necessary to build the railroads and vessels



The Pioneer Furnace of the Iron Cliffs Company, Negaunee, Michigan, as it appeared in the 1880s. Built in 1859 and purchased in 1867, this furnace became the heart of the company's operations and the primary consumer of its ores. (Courtesy of Cliffs Natural Resources.)

needed to ship the ore, and to build the blast furnaces, forges, and rolling mills required to smelt and process it into semi-finished or finished products.

The Iron Cliffs Company took the opposite path. Founded late in the Civil War, when pig iron prices were hitting an all-time peak, Iron Cliffs soon abandoned its original intention to mine and ship ore. In 1866 the company declared that instead it would focus "chiefly [on] making pig iron, instead of selling ore."[7]

Pursuing this objective, Iron Cliffs purchased the Pioneer Iron Company, which had built the region's first charcoal-fueled blast furnace in Negaunee, Michigan, in 1859. Iron Cliffs also erected a new set of charcoal-fueled blast furnaces south of Negaunee near its Foster mine. The primary function of Iron Cliffs' mines would be to supply its own furnaces; only secondarily would the firm produce iron ore for sale.[8]

This was a critical strategic decision from which turning back was difficult. Companies, like Cleveland Iron, which focused on shipping ore, concentrated on identifying and exploiting deposits of high-grade, direct-shipping ores with 60 percent or more iron content. The richness of such ores compensated for the cost of transporting them to the lower Great Lakes, and they could almost always find a market. Companies which smelted locally, like Iron Cliffs, recognized that they could charge their furnaces with lower-quality ores, given their minimal shipping costs. These ores, of 45 to 55 percent iron, only found an outside market in periods of peak demand.

Thus Iron Cliffs, which intended its mines primarily to serve its own furnaces, opened low-grade iron mines instead of identifying and exploiting deposits of high-grade shipping ores. The company's first two operations, the Tilden and Ogden mines, required substantial investment, yet produced ores a local newspaper described as, "hardly up to shipping standards."[9] While they did not have to be if intended for local processing, Iron Cliffs' dependence on low-grade ores meant that if the charcoal pig iron market collapsed, its mines were almost useless. This made it difficult for Iron Cliffs to reverse its initial decision to focus on iron processing, rather than on mining and shipping ores to outside processors, when conditions did change.

This strategy, however, initially appeared sound. In 1866, Iron Cliffs' profits from making charcoal iron were almost three times higher than those from ore sales. But by the 1870s coal-fired blast furnaces in Pennsylvania, Ohio, and New York had largely superseded charcoal-fueled blast furnaces like those being operated by Iron Cliffs. Coal's accessibility and abundance meant coal-fired blast furnaces could produce iron more cheaply than charcoal furnaces. By 1890 the superior qualities of charcoal iron were more than offset by its much higher production costs. Moreover, the increased production possible using coal steadily decreased the price of pig iron, squeezing Iron Cliffs' profits. Between 1864 and 1890 the price of pig iron, Iron Cliffs' specialty, dropped 70 per cent; while the price of iron ore, Cleveland Iron's specialty fell only 34 percent.[10]

A second strategy that contributed to Cleveland Iron's ultimate triumph was to avoid entrepreneurial distractions from iron mining. While the essence of this decision was to focus on mining and not undertake ore processing, it involved broader issues. In its early years Cleveland Iron flirted with iron forging and operating a horse-drawn railroad and a store. In the early 1870s it briefly operated its own line of ore vessels.[11] But when faced with economic pressures, it regularly turned away from diversification to refocus its capital and entrepreneurial energies on mining iron ore.

For its part, Iron Cliffs diversified early and remained so. In addition to its mines and blast furnaces, the company established the charcoal kilns necessary to process fuel, as well as a sawmill, a brickyard, a store, and a farm. Iron Cliffs management also erected a foundry.[12]

At first, Iron Cliffs' decision to carry out diver-

sified operations, like its decision to smelt iron locally, appeared to be wise. The store, for instance, did well, sales hitting $200,000 in 1870, generating $20,000 in profits.[13] Moreover, the company's employees often had to trade with the company store in lieu of pay during the winter months when Iron Cliffs, like most regional companies, was cut off from cash by the frozen lakes.[14] Thus Iron Cliffs faced less pressure to come up with currency than Cleveland Iron, which had no company store. While Iron Cliffs' farm supplied fodder for the horses used in its charcoal-making and mining operations, Cleveland Iron had to import fodder, an often troublesome process—as when one vessel dumped hay bound for the company's stables upon encountering rough weather.[15]

However, as with its choice to both mine and smelt iron locally, rather than simply ship it to distant processors, Iron Cliffs' determination to diversify proved burdensome in the long run. Iron Cliffs' large fixed-capital investments in land, a saw mill, a brickyard, a store, mines, blast furnaces, and charcoal kilns meant its local officials had to manage "over a hundred structures from a log house to a furnace scattered over fifty square miles," instead of focusing only on iron mining.[16]

This large number of enterprises, moreover, meant that the company was undercapitalized, despite the wealth of its leading stockholders. Iron Cliffs' secretary-treasurer Charles Canda commented in the fall of 1867 that the company's working capital was "much too small even in prosperous times" when pig iron sold well. When the market for pig iron declined, problems ensued. In 1867, local agent Thomas B. Brooks was instructed to sell off the company's bricks and lumber and give his "entire attention and energy to making cheap pig iron of the best quality." To salvage matters, Canda had to do everything in his power "to prevent our spending <u>one dollar</u> except for making iron and <u>perhaps</u> running our store."[17]

By the 1880s the emergence of independent merchants in the Marquette iron district made the company store, once so successful, both unprofitable and a source of increasing conflict between the company and its employees.[18] In 1887 Iron Cliffs belatedly abandoned its store, but in the meantime the company's multiple activities had undercut its mining operations.

The problems engendered by Iron Cliffs' strategic decisions to smelt iron locally and operate multiple enterprises were compounded by endemic problems between corporate headquarters and the company's local agents. Both Cleveland Iron's and Iron Cliffs' headquarters lay a considerable distance from the ore fields: Cleveland Iron's in Cleveland, and Iron Cliffs' in New York. Thus, hiring the right local personnel and establishing good working relationships between corporate officers and local agents were critical. Both companies initially struggled with this, but Cleveland Iron solved the problem; Iron Cliffs did not.

Cleveland Iron Mining Company's directors first tried to closely manage their agents on the Marquette Range, insisting that they "communicate by <u>every mail</u> & other opportunity <u>direct</u> to the office here . . . at length & give full particulars of everything going on, that can, in any way, interest our company." Corporate headquarters sometimes issued very specific instructions, including the exact grade for a plank road and the number of rooms in a house to be erected at the mine.[19] Little was left to the local agent's discretion.

Several indicators suggest that Cleveland Iron's oversight of its Michigan properties did not go well at first, perhaps because of this micromanagement. Four of the first five agents lasted only about a year. In 1858 a company director, H. B. Tuttle, noted: "We have lost large amounts . . . by the remissness of previous agents."[20]

Cleveland Iron adapted to this situation in several ways. First, in 1857, a Cleveland member of its board moved permanently to Marquette, the range's shipping port, giving the board a regular point of contact and a local observer. Second, the company's directors initiated a practice of making regular summer visits to the company's holdings on the Upper Peninsula. Third, the company had

one of its directors serve as local agent in Marquette for several years in the late 1850s to bring operations under control. Finally, and most significantly, the company became more careful in selecting its local mining superintendents and general managers, gave considerable autonomy to the good ones, and made every effort to keep them.[21]

In 1867, for example, company officials appointed a clerk to assist mine superintendent Frank Mills, permitting Mills, who hated accounting paper work, to focus on mining alone. Mills long lived in a house so close to one of the pits that when the company blasted, four times each day, his wife and children had to descend to the basement for safety. In 1871 the company built Mills a new house farther from the pits. Cleveland Iron's president, Samuel L. Mather, instructed Jay Morse, the company's local shipping agent in Marquette, to make the dwelling "convenient & comfortable for Mr. Mills & his family in every respect." Mills, an outstanding mining superintendent, stayed with the company until he retired in the 1880s.[22]

Cleveland Iron's directors also seem to have learned from their early attempts to micro-manage from Cleveland, and began to grant their local agents considerable discretion. The company faced the first strike at its Michigan mines in 1856. Its local agent, William Ferguson, settled the strike, apparently on his own authority, by making partial concessions to the strikers and discharging those who would not agree to the compromise. Company president W. J. Gordon wrote to Ferguson that he "fully indorse[d] the course you adopted let the consequence be what it may."[23]

The instructions the company sent to H. B. Tuttle, on his appointment as agent at Marquette in early 1857, were much less specific than those given to J. J. St. Claire three years earlier. These left Tuttle with considerable autonomy, perhaps because he was from Cleveland, had been made a director of the company, and was well known to the other directors. By 1859, the expression "you . . . can judge best" became increasingly frequent in correspondence from headquarters to its ever-more-competent agents at Marquette and the company's mines.[24]

At times Cleveland headquarters clearly wanted to get involved. Struggling to keep the company afloat in the depression of 1873 and frustrated by a strike at the mines, President Mather told his agent to "pay them off and discharge the whole set." But then, recognizing that the local agent probably knew better how to handle the situation, he backed away: "I won't advise you what to do. . . . Be governed by circumstances and whatever you do, we will back you in it."[25]

As mining became more technologically sophisticated, management in Cleveland conceded more and more autonomy and authority to its Upper Peninsula operatives. In 1876 Mather wrote to Marquette agent Morse that he would leave the matter of testing and purchasing mechanized drills "entirely" up to him: "Whenever you are satisfied, & wish to use them in our mines, you have full authority to buy such & as many as can be used to advantage." A few years later Mather wrote to Morse regarding lubricants: "You know better than I do what we need & I wish you to judge for yourself & I shall be satisfied." And again, regarding labor, Mather informed Morse in 1881: "You can . . . judge better than I, what to do with <u>our</u> men."[26]

By 1860, Cleveland Iron realized the importance of its local agents and willingly granted them more authority. In return, the company won the loyalty of a series of very good, long-serving mine superintendents and general agents at its Upper Peninsula mines in the succeeding years.

Like Cleveland Iron, the Iron Cliffs board initially had problems adjusting to distance management, tending to override the judgment of its local agents. Unlike Cleveland Iron, it never fully resolved those issues. Early in Iron Cliffs' history, one agent suggested using a partnership to ease the capital and managerial burden of opening

and operating a company store. Iron Cliffs' board rejected the advice, stating that its policy was "to have no partnerships in any department of their business."[27]

In another expensive example, the company acquired the Pioneer blast furnaces in early 1867, apparently without close inspection or input by experts or its own local manager. On taking control that local manager found them in worse condition than expected, and, he reported, "not one man in the companies [*sic*] employ [locally] knew anything about iron making."

As a result of this ignorance, the company's charcoal supply was left out of doors during the winter months in an area where annual seasonal snowfall often hits two hundred inches and temperatures plunge as low as minus twenty degrees Fahrenheit. By March of 1867 the charcoal piles were inaccessible frozen masses, useless for firing the smelters. Thomas B. Brooks, the company's local agent at the time Iron Cliffs purchased the Pioneer Furnace, was widely respected in the Marquette iron district for his knowledge of mining, but he knew little about smelting. He commented in a report to his board after the charcoal catastrophe that he realized later that he should have built a coal shed "at any cost, but I did not know it then."[28]

Iron Cliffs' inability to produce charcoal iron cheaply enough to compete with coke iron—and sometimes even with other charcoal furnaces—soon led to more feuding between Brooks and the company's New York headquarters. After suggesting in several letters in early 1868 that the company's directors lacked sufficient knowledge of conditions in upper Michigan, Brooks exploded in a long letter dated 4 July. He told the company's secretary-treasurer, Canda, that Iron Cliffs made less pig iron than other companies because of "the spirit of the instructions" issued to him "from the New York office," which compelled him to contract for 50 percent more charcoal than required. These instructions, he asserted, "had their origin in an entire misconception of the then future of the iron market . . . and . . . a total misunderstanding of the nature of coal [i.e. charcoal] making here."[29]

In 1868 Brooks attempted to open a new mine, the Gilmore. This venture did not succeed, leading to further sniping between Brooks and his New York managers. Company secretary Canda later commented to Brooks' successor, E. B. Isham, that the company's working capital was insufficient to run two furnaces, a store, a mine, and sundry other businesses "besides developing a Gilmore Mine." He added that he was sorry that anyone had though it necessary to build roads to the Gilmore and houses at the site, when test pits and cuts alone should have determined the site's viability.[30]

Conflicts between Iron Cliffs' field agents and New York continued. In 1869 new company president William H. Barnum castigated the replacement agent, Isham, for not providing reports with sufficient frequency or detail.[31] In 1875, Barnum, concerned about reducing phosphorus in the Pioneer furnace's pig iron to Bessemer-grade levels, interfered with yet another company agent, T. J. Houston.

Houston had tried to reduce costs by using cheaper, soft-hematite ores in the company's blast furnace feed, a practice that he had found prolonged the life of furnace linings. Barnum, unfamiliar with the soft hematite ores of the Lake Superior ore ranges, ordered Houston to use strictly hard ores and no hematites. In 1878 this dispute over using local hematites flared up again. Both Houston and the company's local furnace manager complained, as had their predecessors, that the company's eastern management did not understand the problems specific to operating furnaces in the Lake Superior region.[32]

In April 1877, Canda apparently suggested that some of Houston's accounting practices were fraudulent or deceitful, setting off yet another dispute between the company's New York headquarters and its agent in Negaunee. In September another spat arose over office expenses, late reports,

and the role of the assistant superintendent.[33]

Disputes like these were apparently endemic within Iron Cliffs. The local view was that Iron Cliffs' agents, such as Brooks and Houston, were generally top quality, but "continually hampered by the action of the head officers" and not permitted to "exercise their judgment in the management of affairs."[34]

Iron Cliffs' management woes were due to more than disputes between its field agents and corporate headquarters and to poor strategic decisions. They were compounded by upper management's failure, because of outside commitments, to devote sufficient time and attention to understanding the problems encountered at their Michigan operations. Perhaps the leading figure at Iron Cliffs was William Barnum, a prominent charcoal-iron manufacturer from western Connecticut, who also spent extended periods absorbed in national politics.[35]

His experience in charcoal-iron production may have been the critical factor in Iron Cliffs' turn from mining shipping ore to producing charcoal iron locally. It was to the experienced Barnum that Canda and the other directors generally turned for guidance, but Barnum was so deeply involved in politics the he was often unavailable. In late 1868, Canda commented to Isham, that he hoped Barnum would become Iron Cliffs' president, so that when advice was needed "we will have the right to call for it and not wait upon it till all political meetings and conventions are over."[36]

Unfortunately, Canda got his wish. In 1869 Barnum replaced Tilden, by then also deeply involved in Democratic politics, as president of Iron Cliffs. Barnum directed the company until 1886, and enjoyed success in his first few years, partly due to a rising demand for pig iron.[37] The Panic of 1873, however, hit mining companies that smelted, like Iron Cliffs, harder than those focused only on ore production. The price of pig iron dropped 64 percent between 1872 and 1878, while the price of iron ore dropped only 39 percent.[38] By 1880 iron ore prices rebounded to 1872 levels, but pig iron never approached its 1872 price for the remainder of the century.

Responding to depressed conditions, Iron Cliffs had begun to shut down operations by 1876. It blew out one of its two Pioneer Furnace stacks, seriously considered allowing one of its mines to flood, and reduced its mangers' salaries. Iron Cliffs had been on the verge of paying its first dividend by 1873, but, due to the depression, stockholders did not see their first dividend, of only 2 percent, until early 1879.[39]

In some ways, Barnum's knowledge of charcoal iron making under eastern conditions may have hurt rather than helped the company after he assumed the helm. As we have seen, Barnum insisted that his Upper Peninsula agents do things his way. Other directors deferred to his judgment because of his background in the iron industry, even when his political activities made it advisable to find someone with more time to devote to Iron Cliffs' operations. Making matters worse, Barnum's experience probably kept him tied to furnace operations even after charcoal pig iron went into sharp decline, which made a shift to mining ore for shipment elsewhere advisable.

Charles Canda, the company's long-time secretary and the man who handled its daily business, seems to have changed his mind about Barnum's presidency by the 1880s, becoming steadily more critical. Surviving correspondence indicates that he had become skeptical of the company's focus on charcoal iron, that he disliked Barnum's "long-winded" sales pitch, and that he considered Barnum careless in securing the board's passage of resolutions because he was so busy with his other affairs.[40]

The accumulating discontent led to Barnum being eased out as president in 1886, although he remained a major shareholder and important figure in the company's operations. When Cleveland Iron absorbed Iron Cliffs, a local newspaper commented: "It has long been known that the [latter] concern has been badly handled from the main office."[41] This was because neither Tilden

nor Barnum made Iron Cliffs' mining operations the center of their lives; politics was more important.

Contrast the leadership of Iron Cliffs—Tilden and Barnum, with their constant political absorptions—to that of the leading figure in Cleveland Iron Mining Company. Samuel L. Mather invested in and became a member of the board of Cleveland Iron in the early 1850s. He first came to then-small-town Cleveland in 1843 to handle real estate matters for his father, who owned land in the area. The younger Mather later studied law, became secretary-treasurer of the company in 1853, and its president in 1869.

Cleveland Iron quickly became the focus of Mather's life. Although he occasionally invested in and served on the boards of other iron-related businesses, he dropped his real estate and legal practices. He devoted himself instead primarily to selling Cleveland Iron's ores, contracting for their transportation to Cleveland, and generally overseeing the company's operations. While Iron Cliffs' chief operating and executive officers were constantly distracted by their political careers, Mather was not. He corresponded almost daily with Cleveland Iron's agents on the Upper Peninsula, producing thousands of letters. He not only devoted his life to Cleveland Iron, but trained his two sons to succeed him in the iron trade.[42]

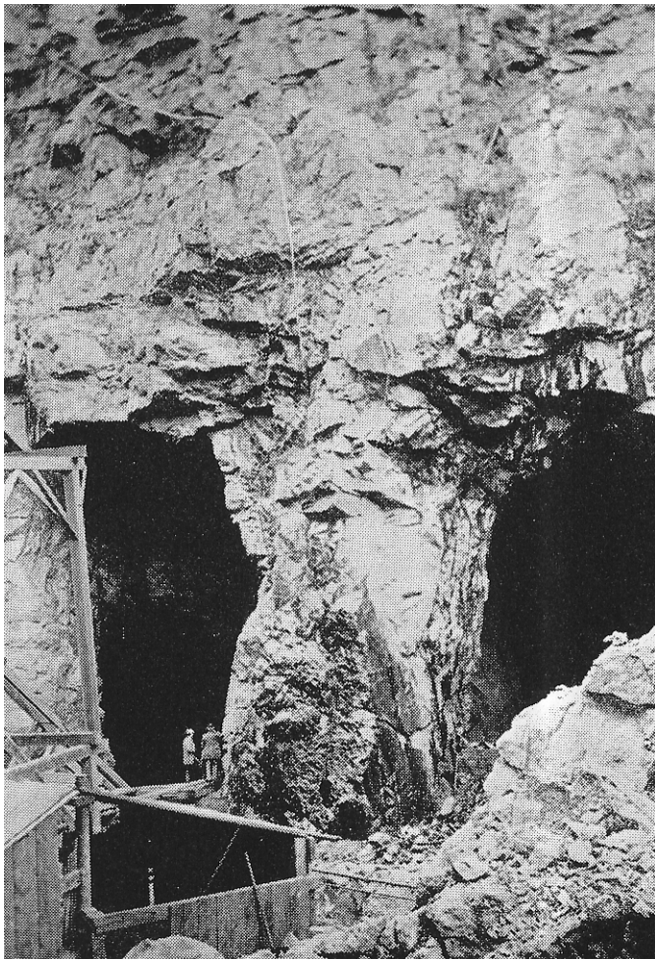
A final factor accounting for Iron Cliffs' absorption by Cleveland Iron was the former's slower adoption of new mining technologies. Iron Cliffs had a mixed record in adopting new technologies. On the positive side, in 1870 it became one of the earliest companies to replace black powder with nitroglycerine. Iron Cliffs also early acquired a diamond drill, one of the key new tools for mining exploration, which it purchased in 1877 and ran "night and day."[43]

In many other respects, however, Iron Cliffs lagged. The firm did not begin using compressed-air drills until 1880, several years after other regional iron mines had begun to do so.[44] Iron Cliffs only slowly made the transition from open pit to underground mining. After a major rock fall in 1880, the company's new agent, Alexander Maitland, warned that "the present style of working the mine," which involved following deposits underground from the open pit at an angle, leaving pillars to support the overhang, "must be abandoned . . . and the systems of underground [shaft] mining must soon be commenced."[45] Iron Cliffs' management, however, delayed that transition.[46]

Then, instead of gradually easing into underground mining, Iron Cliffs' undertook a first project of considerable magnitude and difficulty. In 1879 crews working with the diamond drill discovered a large deposit of very high-grade iron ore at a depth of six hundred feet.[47] The company began sinking two shafts the following year. Officials projected that the venture would cost $125,000 and be completed by spring of 1881, but the Cliffs Shaft Mine project was not completed until April 1884, three years behind schedule and at almost two and a half times its initial estimated cost.[48]

Even after completion, the new mine did not operate economically. In 1883 Iron Cliffs' secretary indicated to the Negaunee agent that he did not want stockholders to know about the mine's high operating costs. This expense led the company to suspend operations briefly at the Cliffs Shaft Mine a little more than a year after extraction began. In 1890 Michigan's commissioner of mineral statistics reported Cliffs Shaft's hoisting machinery "inferior to the necessitys [*sic*] of the mine."[49]

In contrast, while Cleveland Iron adopted new technologies more aggressively and successfully than Iron Cliffs, it also approached them more cautiously and systematically. Cleveland Iron began underground mining in 1866, fourteen years before Iron Cliffs undertook its difficult Cliffs Shaft project. By 1876 at least one Cleveland Iron mine, the School House, was an underground, shaft operation. Others, like the Incline, were in transitional, not shaft mines, but operating underground in continuation of open pit operations. In 1876, Jay Morse, Cleveland Iron's Marquette



The Cleveland Iron Mining Company's Incline Mine, c. 1875. Note the size of the pillars left standing to support the overhang compared to the men standing at the left. The company had not yet adopted shaft mining and simply followed its ore deposit into the adjacent "mountain." (Cleveland–Cliffs Iron Company, The Cleveland–Cliffs Iron Company: An Historical Review of This Company's Development and Resources Issued in Commemoration of Its Seventieth Anniversary, 1850-1920 *(Cleveland: Cleveland-Cliffs Iron Company, 1920), p. 11)*

agent, reported that the company's transition from open-pit to underground shaft mining had enjoyed "a much greater degree of success than we had expected . . . due to the fact that we were perfectly well aware that we knew nothing of that method of mining, and consequently went to work with great caution and care."[50]

Not only was Cleveland Iron one of the first companies to go underground on the Marquette Range, it also aggressively pursued new underground techniques. Marquette Range iron ore tended to come in the form of large, vertically-situated, lens-shaped deposits, rather than the extended veins more common in precious metal mining. Around 1880 Cleveland Iron introduced into its soft-ore mine a new, cost-saving technique called sub-level caving.

In sub-level caving miners removed ore from the top of the ore-bearing lens instead of from the bottom, the more usual practice. They deliberately allowed the overburden of soil and rock to cave in a controlled manner as they mined each successive level and operations went deeper. This left a depression on the surface, of course, but that was not then considered a problem in the sparsely populated region. Sub-level caving sharply reduced the need for complex, costly timbering, and the technique spread from Cleveland Hematite Mine to other soft-ore mines in the district.[51]

Cleveland Iron began diamond drill-exploration at least as early as Iron Cliffs, and perhaps earlier. Cleveland Iron's 1869 annual report suggests that it was awaiting delivery of a diamond drill eight years before Iron Cliffs purchased its first in 1877. Cleveland Iron certainly began to contract extensively for diamond drill work in 1877, and purchased a drill of its own in 1878.[52]

Both companies adopted nitroglycerine around 1870. Frank Mills, Cleveland Iron's mining superintendent, resisted at first, probably due to an accident that killed the "nitro-glycerine man" at the nearby Jackson Mine, as well as miners' opposition because of the bad reputation the explosive developed in its early liquid form. In 1870 or 1871, however, Mills converted. He began using nitroglycerine extensively, declaring that "he would not like to be compelled to work

. . . without it."[53]

Cleveland Iron's superintendents began to investigate mechanized rock drills in 1875 or 1876, four or five years earlier than Iron Cliffs. Though initially disappointed, probably because of frequent mechanical failures in the Cleveland Mine's very hard rock, Cleveland Iron's local superintendent remained convinced that mechanized drilling was essential to reducing costs. He continued to test machine drills, working with drill manufacturers and eventually finding one that worked. In 1879 Cleveland Iron regularly began to use Rand compressed-air drills. By 1880 the company used five at its Incline Mine alone, and did little if any hand drilling there. That same year Iron Cliffs first began to use mechanized rock drills.[54]

Cleveland Iron Mining Company's mines may have been the first iron mines anywhere to use electric lighting. Charles Brush, a Clevelander, introduced one of the first commercially successful electric arc lighting systems in the United States in 1878, intended for street lighting. Hoping to find a broader market for his system, Brush's company approached three of the leading ore companies on the Marquette Range the following year, including Cleveland Iron, about giving the Brush arc light a trial under conditions as "dark & black as possible."[55]

The Cleveland Mine was selected for the trial, and in 1880 the Brush Company installed there perhaps the first electric lighting plant located at any mine in the country. The system used sixteen arc lights to illuminate several open-pit workings. By 1890 the Cleveland Mine's electric lighting system was regarded locally as "perhaps the most complete" of any among the companies using electric lights on the Marquette Range. By then it consisted of twenty-four arc and fifty-six incandescent lights illuminating the company's shops, offices, shaft houses, and ore pockets. Iron Cliffs turned to electric lighting around 1889, almost a decade behind Cleveland Iron.[56]

As a final example of Cleveland Iron's rapid adoption of new technologies, in the winter of 1886–87 a company diamond-drill, operating on the ice, discovered a rich deposit of non-Bessemer ore beneath Lake Angeline, just south of Ishpeming. Cleveland Iron, working with two other companies, decided to drain the lake to exploit the deposit. The project was planned before Cleveland Iron's absorption of Iron Cliffs in 1891, and was carried out by Cleveland Iron personnel after the formation of Cleveland–Cliffs Iron Company.

The size of the ore body, as well as the long distance from where the ore would be extracted under the lake bed to the hoisting shaft near the old shore line, offered a particularly good opportunity for mechanical haulage. To do this, Cleveland Iron's engineers installed the first underground electric tramway in the district. Electric locomotives reduced the cost of moving ore within the mine from twenty-nine cents to less than four cents per ton. The company's general superintendent noted in late 1894 that electric haulage was "certainly a great success," and that the company could not have made a profit using hand tramming in that mine.[57]

Charles Lawton, Michigan's commissioner of mineral statistics, commented in his annual report for 1882 that Cleveland Iron Mining Company had "always been consistently and ably managed." In his 1887 report he observed that the company had "something new in the way of improvement every year," and noted the following year that no other iron mining company "more completely systematized" details or kept its mine "neater and in better trim than the Cleveland."[58]

Lawton's descriptions of Iron Cliffs' operations contained no comparable accolades. Indeed, scattered surviving correspondence suggests that by the mid-1880s Iron Cliffs was having problems maintaining the quality of both its Pioneer Furnace pig iron and of the limited volume of ore it was shipping to furnaces on the lower Great Lakes.[59]

Because Cleveland Iron Mining Company had made superior strategic choices, remained more focused on its core business of iron ore

mining, developed better relationships between distant corporate officers and local agents, and innovated more technologically, it was poised to absorb its more heavily capitalized and seemingly stronger rival by the mid-1880s. The opportunity to do so came soon thereafter.

William Barnum relinquished the presidency of Iron Cliffs in 1886, around the same time that the generation of principal shareholders who had founded and directed Iron Cliffs began to pass on. Samuel Tilden died in 1886, and Edmund Miller, another significant stockholder and prominent director, a year later. Charles A. Rapallo, a leading shareholder, died shortly after that.

Their replacements were less committed to the company's traditional ways. In 1887 Iron Cliffs' board closed the twenty-year-old company store, declaring that it was no longer necessary and invited problems. When reports suggested some of the company's mines were approaching exhaustion and explorations to find cheaper, readily accessible ore deposits failed, the board abandoned Iron Cliffs' long-standing policy of not leasing its properties to others.

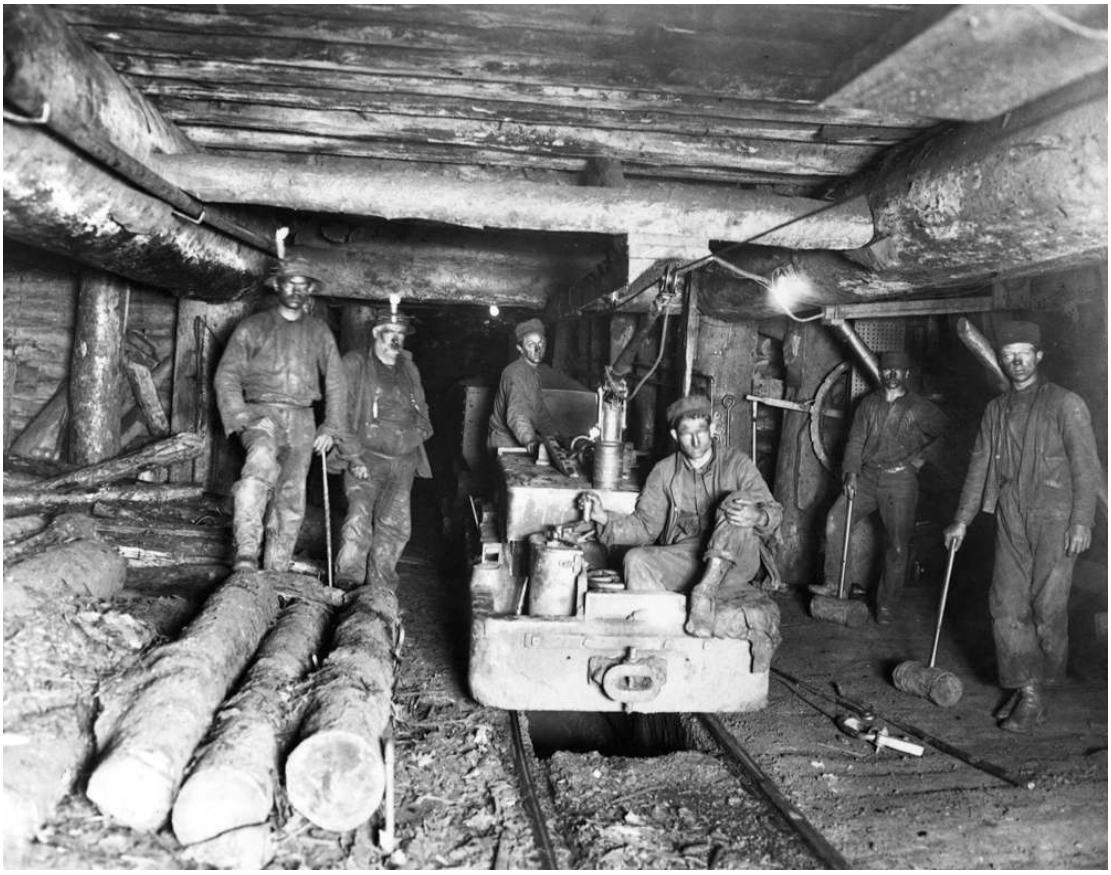
In 1887 the board opened the company estate of over fifty thousand acres to exploration, hoping to shift the costs of prospecting and development to others, securing income from leases instead of operations. This initiative was not well handled. A local mining observer called the terms "illiberal" and ill conceived. The initiative failed, and in April 1889 Iron Cliffs' board of directors appointed a committee to consider the company's condition and "the possibilities of selling [its] shares." Cleveland Iron Mining Company jumped at this opportunity.[60]

Several factors contributed to Cleveland Iron's interest in acquiring Iron Cliffs. Fear of the exhaustion of ores on its own limited holdings was certainly a factor. Cleveland Iron only owned about two thousand acres in the Marquette Range mineral district. In the early 1880s correspondence between Samuel Mather and his Upper Peninsula agent, Don H. Bacon, suggests growing concern about exhaustion. In March 1882, as output from the company's No. 3 Mine declined, Mather wrote: "Is it possible . . . that that mine is going to play out entirely! Why, it would be dreadful, & makes me sweat even to think of it." He told Bacon to keep the company's diamond drill going to discover new mining territory: "We must not holdup [sic] in any direction. Can't afford to."[61]

By 1886 Mather was particularly concerned about having insufficient low-phosphorus, soft-hematite ores, commenting to Bacon that "Bessemer ores are all the rage. . . . My great anxiety is about our Hematite." He instructed Bacon to push exploration for hematites at all cost, even if it meant the company would pay no dividends to its stockholders. In 1889 he commented to fellow board member Morgan L. Hewitt: "Our ore is becoming more of a second class ore & sells slowly & at a lower price." [62]

In 1886, in the midst of his anxiety over his company's ore reserves, Mather asked Bacon to keep an eye out for properties to buy or lease, prophetically adding that "the time may come when we may be able to pick up some good ore property at little cash."[63] Among the properties Mather had in mind were certainly those of Iron Cliffs. In light of these fears about exhaustion, Cleveland Iron's acquisition of Iron Cliffs was a natural. Iron Cliffs had mines near Cleveland Iron's properties in Ishpeming, Michigan, proven ore underneath its "A" and "B" shafts, and controlled over fifty thousand acres, much of it in the Marquette Range mineral belt. Its acquisition would relieve Cleveland Iron's fears of exhaustion.

When Samuel Tilden, Iron Cliffs' founder, died in August 1886 after a long illness, Mather began to investigate acquiring the company. In October he wrote to Bacon: "I wish we could control . . . Iron Cliffs, we are pegging away on it but don't meet with any success so far." In November 1886 Mather traveled to New York to visit the executors of the Tilden and Ogden estates to explore purchase. He had no luck. The executors re-



Electric tramming at the Cleveland Iron Mining Company's Lake Mine, c. 1900. This mine, which penetrated under the bed of the drained Lake Angeline south of Ishpeming, was the earliest mine in the Lake Superior district to replace hand and animal tramming with electric locomotives, thereby drastically reducing the cost of moving ore. The electric tramming system, planned before the merger with Iron Cliffs in 1890 and operative by 1893, illustrates Cleveland Iron's receptivity to new mining technologies. (Courtesy of the collections of Superior View, Marquette, Michigan.)

lied on William Barnum for direction. Barnum, though no longer president of Iron Cliffs, still exerted considerable influence. "He is the Law & Gospel to them on all Mining matters," Mather complained, "& they will do nothing without consulting him." Barnum apparently opposed any sale of Iron Cliffs.[64]

Iron Cliffs' board's decision, on 15 April 1889, to investigate possible sale of the company, coupled with Barnum's death two weeks later, set the stage for the creation of a syndicate of Cleveland investors. Their goal was to secure controlling interest in Iron Cliffs, apparently, and secretly, for Cleveland Iron. Jeptha Wade, a longtime director of Cleveland Iron who had made his fortune building the Western Union Telegraph Company, led the group, which included Samuel L. Mather, his son William G. Mather, Selah Chamberlain, and others associated with Cleveland Iron.

By February 1890 the syndicate had secured over fourteen thousand of Iron Cliffs' twenty thousand outstanding shares, and at Iron Cliffs' April 1890 meeting the syndicate took control of the company, placing Cleveland Iron officers in charge. In May 1891 Ward, Mather, and other directors of Cleveland Iron formed the Cleve-

land–Cliffs Iron Mining Company as a holding company to control the majority of stock in both Cleveland Iron and Iron Cliffs. They adopted this form of organization because of restrictions on property ownership and capitalization under existing Michigan mining law. Only in the 1910s would Cleveland Iron Company and Iron Cliffs pass out of paper existence.[65]

Cleveland Iron Mining Company's acquisition of Iron Cliffs clearly demonstrates that superior mineral holdings, superior capital, and even superior experience alone are insufficient to insure survival in the highly competitive mining industry. In the case we have reviewed, the company that prevailed was the one with the smaller mineral holdings, and, at least initially, smaller capital resources and less experience in the industry. That company's strategic choices, its development of local managers and willingness to give the talented ones considerable autonomy, the greater devotion of its upper management to the enterprise, and its greater receptivity to new mining technologies overcome its deficiencies.

Its acquisition of Iron Cliffs and the subsequent formation of Cleveland–Cliffs put the reorganized Cleveland Iron Mining Company in a solid position. It immediately became the dominant company and largest holder of ore reserves on the Marquette Range. Because Cleveland Iron and Iron Cliffs' properties were contiguous, the same management team could operate both, saving administrative costs. As a larger organization, Cleveland–Cliffs could undertake more capital-intensive mining and negotiate lower prices for transportation and supplies.[66]

The timing of the acquisition was fortunate. Cleveland–Cliffs was formed just as large volumes of low-cost Minnesota Mesabi Range iron ores began to hit the market and just two years before the Depression of 1893, the worst economic downturn in American history to that date. The Mesabi ores and the economic depression, as well as the emergence of captive iron-ore companies vertically integrated into iron- and steel-making companies, depressed iron ore prices. That meant that only the largest, wealthiest, and best-managed independent iron-ore mining firms could employ economies of scale to survive the rising competition and precipitous drop in prices in iron mining.

In the short space of six years, between 1895 and 1901, most independent iron-mining companies vanished, either wiped out by falling ore prices or absorbed by steel firms committed to vertical integration in the 1890s. Cleveland–Cliffs—which produced 7 to 8 percent of American iron ore by 1900—was the nation's largest surviving independent iron-mining firm. It not only survived but maintained its established reputation as one of the best-managed, most-innovative iron mining firms in the United States.[67]

From the 1980s into the early twenty-first century the woes of the American steel industry reversed the pattern of the early twentieth century. Steel companies, desperately trying to stay alive, divested themselves of iron properties. Cleveland–Cliffs has taken advantage of these bargain-basement sales to become the largest iron-mining company of any type—subsidiary or independent—in the United States.

Terry S. Reynolds is a professor of history at Michigan Tech. He has published several books and numerous articles on various aspects of the history of technology. His research interests currently focus on iron mining in the Great Lakes region. He co-authored a recently completed book manuscript on the history of the Cleveland–Cliffs Iron Mining Company.

Notes

1. Cleveland–Cliffs Iron Company recently changed its name to Cliffs Natural Resources.
2. Harlan Hatcher (*A Century of Iron and Men* (Indianapolis and New York: Bobbs-Merrill Co., Inc., 1950), 174) uses the term merger, as does H. Stuart Harrison in *The Cleveland–Cliffs Iron Company* (New York: Newcomen Society in North America, 1974), 188. It also appears in "Cleveland–Cliffs Inc.," in *Encyclopedia of Cleveland History*; "Semi-Centennial of the Cleveland Iron Mining Co.," *Iron Trade Review* (19 July 1900): 18; and "A Bond of Interest," *Harlow's Wooden Man* 13, no. 5 (Fall 1978): 8. The term "consolidation" is used by S. R. Elliott in "The Cleveland–Cliffs Iron Company: History and Organization," in *The Cleveland–Cliffs Iron Company and Its Extensive Operations in the Lake Superior District* (Cleveland: Cleveland–Cliffs Iron Co., 1929), 6.
3. One account of the opening of the Marquette Range is: Philo M. Everett, "Recollections of the Early Explorations and Discovery of Iron Ore on Lake Superior," *Michigan Pioneer Historical Collections* 11 (1887): 161-74.
4. This land had been given to the St. Mary's Canal Mineral Land Company by the State of Michigan in exchange for excavating the canal around the rapids at Sault Ste. Marie, opened in 1855, that permitted uninterrupted water transportation from Lake Superior to the lower Great Lakes. St. Mary's Canal Mineral Land Company, *Reports upon the Value of the Company's Lands located in the Iron Region of Lake Superior, County of Marquette, State of Michigan* (Boston: Wright & Potter, 1864), 5, says that of the thirty-three thousand acres in the Marquette area (around five thousand lying outside of the iron-bearing area), eighteen thousand were mineral lands and fifteen thousand "agricultural," meaning forested, lands.
5. See, for instance, D. Landon, et al., "'A Monument to Misguided Enterprise': The Carp River Bloomery Iron Forge," *IA: Journal of the Society for Industrial Archeology* 27, no. 2 (2001): 5-22.
6. Burton H. Boyum, "Cliffs Illustrated History" (unpublished manuscript, copy at the Michigan Iron Industry Museum, Negaunee, Michigan), ch. 3, 19. Boyum quotes the document, but does not indicate its location. Since he served as head of Cleveland–Cliffs' public relations department and collected historical materials, one can assume that he probably saw the original document.
7. *Minute Book*, Iron Cliffs Company, 1864-1880, 1 Mar. 1866, Cleveland–Cliffs Iron Company historical records, Cleveland, OH (hereafter CCI-Cleveland).
8. Thomas B. Brooks, et al., *Geological Survey of Michigan. Upper Peninsula 1869-1873*, v. 1 (New York: Julius Bien, 1873), 31-2; Kenneth D. LaFayette, *Flaming Brands: Fifty Years of Iron Making in the Upper Peninsula of Michigan 1848-1898* (Marquette: Northern Michigan University Press, 1990), 13, 14-5. Iron Cliffs initially sought to lease the furnaces it purchased. For the leasing negotiations see *Minute Book*, 8 Mar. 1866, CCI-Cleveland. *Minute Book,* 28 Sep. 1866, 24 Jan. 1867, CCI-Cleveland (furnace construction). By early 1867 Iron Cliffs was planning to operate four blast furnaces in the region, see Kirk Talcott to ? Jackson, 1 Feb. 1867, Iron Cliffs Letter Book, Folder 1, Box 1, RG 81-29, Department of State, Archives of Michigan, Lansing, MI.
9. *Mining News* (Negaunee, MI), 26 Mar. 1868. Michigan's Commissioner of Mineral Statistics (*Mines and Mineral Statistics, 1889* (Lansing, MI: Robert Smith & Co., 1890), 128) commented that "the company does not seem to have been able or to have cared to sell much ore and so the minng work has not been pushed." He was speaking of the company's relatively new Cliffs Shaft Mine, but his comment could be applied more generally to the company's operations.
10. "Financial Statement to Dec. 31, 1866 [Iron Cliffs]," Folder 1, Box 19, Iron Cliffs Company Papers, RG 68-102, Cleveland–Cliffs Collections, Archives of Michigan, Northern Michigan University Repository, Marquette, MI (hereafter IC Papers-A). Lowthian Bell, "On the American Iron Trade and Its Progress during Sixteen Years," in Iron and Steel Institute (London), *The Iron and Steel Institute in America in 1890* (London: E. & F. N. Spon, 1890), 132 (higher cost of charcoal iron). Peter Temin, *Iron and Steel in Nineteenth-Century American: An Economic Inquiry* (Cambridge, MA: MIT Press, 1964), 283-4 (price of No. 1 foundry pig at Philadelphia); Rukard Hurd, *Hurd's Iron Ore Manual* (Cleveland: Penton Press, 7th ed., 1930), 85 (price of Old Range Bessemer).
11. Terry S. Reynolds, "Flirting with Vertical Integration: The Cleveland Iron Mining Company and Great Lakes Shipping, 1855-1880," *Inland Seas* 63, no. 1 (Spr. 2007): 22-35.
12. For the foundry see Edward Kirk-Talcott to Messrs. Platt & Thom, 21 Sep. 1866, and T. B. Brooks to W. N. Moon, 27 Sep. 1866, Iron Cliffs Letter Book, Folder 1, Box 1, RG 81-29, Archives of Michigan, Lansing, MI.
13. E. S. Green to H. Benedict, Milwaukee, 16 Jan. 1871, Folder 3, Box 39, IC Papers-A.
14. T. B. Brooks to Edmund H. Miller, 6 Dec. 1867, Folder

11, Box 4, Iron Cliffs Company Papers, RG 65-37, Cleveland Cliffs Collections, Archives of Michigan, Northern Michigan University Repository, Marquette, MI (hereafter IC Papers-B).

15. "Instructions for Cleveland Iron Mining Co's Agent at Marquette, April 30, 1857," Cleveland Iron Mining Company, Correspondence, 1849-1857, file M, item 2768, MS 86-100, Cleveland Iron Mining Company and Cleveland–Cliffs Iron Company Papers, Cleveland–Cliffs Collections, Archives of Michigan, Northern Michigan University Repository, Marquette, MI (hereafter CIMC-CCI Papers).
16. T. B. Brooks to Edmund H. Miller, 24 Jan. 1868, Folder 11, Box 4, IC Papers-B.
17. Charles J. Canda to T. B. Brooks, 9 Aug. and 12 Sep. 1867, Folder 1, Box 29, IC Papers-A (emphasis original). See also Canda to Brooks, 16 Sep. 1867, and Edmund H. Miller to Brooks, 23 Sep. 1867, ibid.
18. Iron Cliffs Company, "Annual Statement of the Iron Cliffs Company for the year ending November 30, 1887," CCI-Cleveland.
19. Samuel L. Mather to J. J. St. Claire, 27 Feb. 1854, File G, Item 2768, CIMC-CCI Papers (emphasis original). See also 20 Mar. 1854, ibid.
20. In 1859 Mather referred to J. J. St. Clair, the company's second agent from 1853 to 1856, as a "bitter enemy" of the company. Samuel L. Mather to H. B. Tuttle, 19 Feb. 1859, File B, Item 2769, CIMC-CCI Papers. H. B. Tuttle to A. Kent, 18 Jan., 3 Feb., and 23 Feb. 1858, File A, Item 2769, CIMC-CCI Papers. See also Samuel Mather to H. B. Tuttle, 18 Mar. 1859, File B, Item 2769, ibid.
21. The board member was Morgan L. Hewitt, who also moved to Marquette because of his wife's health. For evidence of Hewitt's reports to Cleveland see: Samuel L. Mather to Morgan L. Hewitt, 18 Jan. 1866 (letter no. 8) and 19 Aug. 1873 (letter no. 11), Morgan L. Hewitt Letters, Marquette County Historical Society, Marquette, MI (hereafter Hewitt Letters). For an example of a summer visit see Samuel L. Mather to Sam Mather (his son), 7? Aug. 1870, Folder 1, Container 1, MS 3735, Samuel Mather Family Papers, Western Reserve Historical Society, Cleveland, Ohio (hereafter SMF Papers), which refers to a visit by board member John Outhwaite. See also Samuel L. Mather to Sam Mather, 16 July 1872, ibid. (a visit by Samuel L. Mather and the board), and 11 and 21 June 1873, Folder 2, ibid. (Mather and other board members). Not all visits occurred in summer. John Outhwaite apparently visited the mines in Feb. 1867, see Samuel L. Mater to Morgan L. Hewitt, 22 Feb. 1867, (letter no. 9), Hewitt Letters.
22. Jay C. Malone to Samuel L. Mather, undated, probably c. 26 Mar. 1867, Item 2434, CIMC-CCI Papers (Mills' clerk). Cleveland Iron Mining Company, *Annual Report . . . for the Year ending May 17, 1871* (Cleveland: Sanford & Hayward, 1873), 8; Samuel L. Mather to Jay Morse, 31 Aug. and 13 Sep. 1871, Item 2771, CIMC-CCI Papers (Mills' dwelling). Morgan L. Hewitt wrote to Mather on 6 Nov. 1873 that Mills was "the best man that we have." See File G-L, Item 2724, CIMC-CCI Papers. For attempts to retain another important manager, Joseph Sellwood, see Mather to D. H. Bacon, 7 and 8 Nov. 1881, Item 2789, CIMC-CCI Papers.
23. W. J. Gordon to Wm. Ferguson, 3 July 1856, File K-L, Item 2768, CIMC-CCI Papers.
24. "Instructions for Cleveland Iron Mining Co's Agent at Marquette, April 30, 1857," File M, Item 2768, CIMC-CCI Papers. For an example of the expression see Samuel Mather to H. B. Tuttle, 25 Mar. 1859, File B, Item 2769, CIMC-CCI Papers.
25. Samuel L. Mather to Jay C. Morse, 29 and 30 July 1874, Item 2776, CIMC-CCI Papers.
26. Samuel L. Mather to Jay C. Morse, 16 Mar. 1876, Item 2779, CIMC-CCI Papers (drills); Mather to Morse, 2 Aug. 1880, Item 2787, ibid. (lubricants); Mather to Morse, 26 July 1881, Item 2789, ibid. (labor; emphasis original).
27. *Minute Book,* 5 Mar. 1867, CCI-Cleveland.
28. T. B. Brooks to Executive Committee, 19 Mar. 1867, Folder 11, Box 4, IC Papers-B.
29. T. B. Brooks to Edmund H. Miller, 4 July 1868, Folder 11, Box 4, IC Papers-B; Brooks to Charles J. Canda, 24 June 1868, ibid.; Brooks to Canda, 4 July 1868, ibid.
30. Charles J. Canda to E. B. Isham, 21 Sep. and 12 Oct 1868, Folder 5, Box 21, IC Papers-A.
31. W. H. Barnum to E. B. Isham, 15 Dec. 1869, "Historical Letter Box," historical records at the Empire Mine, Cleveland–Cliffs, Palmer, MI (hereafter EM Records).
32. For the mix Houston was using, see T. J. Houston to Charles J. Canda, 4 Dec. 1875, Folder 2, Box 9, IC Papers-B. For Barnum's order to use only hard ores, see Houston to Canda, 6 Mar. 1876, Folder 6, Box 9, IC Papers-B, and Canda to Houston, 8 Mar. 1876, Folder 2, Box 29, IC Papers-A. T. J. Houston to Charles J. Canda, 25 and 27 March and 19 and 29 April 1878, Folder 1, Box 11, IC Papers-B (renewed dispute). T. J. Houston to William Barnum, 13 Apr. 1876, Folder 1, Box 10, IC Papers-B; James A. Root to Wm. Barnum, 3 Mar. 1876, Folder 1, Box 2, ibid. In 1868 Brooks insinuated that that the company's New York management did not understand labor issues in Upper Michigan; see Brooks to Charles J.

Canda, 24 June 1868, Folder 11, Box 4, IC Papers-B.

33. T. J. Houston to Charles J. Canda, 6 Mar. 1877, and T. B. Brooks to Edmund H. Miller, 30 Sep. 1877, "Historical Letter Box," EM records.
34. *Iron Ore* (Ishpeming, MI), 15 Feb. 1890.
35. Robert B. Gordon, *A Landscape Transformed: The Iron-making District of Salisbury, Connecticut* (Oxford: University Press, 2001), 63, 66, 83.
36. Charles J. Canda to E. B. Isham, 1 Dec. 1868, Folder 5, Box 21, IC Papers-A (emphasis original).
37. *Minute Book,* 28 July 1870 and 13 Aug. 1873, CCI-Cleveland.
38. Rukard Hurd, *Hurd's Iron Ore Manual* (St. Paul, Minn.: F. M. Catlin, 1911), 52.
39. *Minute Book,* 31 Aug. and 24 Oct. 1876, 25 Jan. 1879, CCI-Cleveland.
40. For examples, see Charles J. Canda to Alex. Maitland, 4 Nov. 1882, vol. 20, Iron Cliffs Company Papers, RG 66-36, Cleveland–Cliffs Collections, Archives of Michigan, Northern Michigan University Repository, Marquette, MI (hereafter IC Papers-C), (switch to shipping ore); Canda to James Rood, 14 Apr. 1882, ibid. (long-winded); Canda to Maitland, 4 June 1882, ibid. (careless and busy).
41. Iron Ore, 15 Feb. 1890.
42. The Cleveland–Cliffs papers presently housed in the Archives of Michigan at Northern Michigan University have several thousand letters from Samuel L. Mather relating to Cleveland Iron Mining Company business, attesting to his close daily devotion to company affairs. Mather's oldest son, Samuel Mather, would become a principal of the prominent iron merchant firm Pickands Mather. William G. Mather, his other son by a second wife, would succeed him as president of Cleveland Iron Mining Company and its successor Cleveland–Cliffs.
43. T. J. Houston to Wm. Barnum, 25 Aug. 1877, Folder 4, Box 10, IC Papers-B (purchase); "Annual Statement of the Iron Cliffs Company for the year ending November 30, 1878," CCI-Cleveland (night and day, purchase of second diamond drill).
44. Alex. Maitland to Wm. Barnum, 9 Feb. 1880, Folder 1, Box 43, IC Papers-A. Despite the skepticism Maitland expressed in this letter, he found that they worked satisfactorily after they arrived: T. J. Houston to Maitland, 26 June 1880, Folder 7, Box 3, IC Papers-B.
45. Alex. Maitland to James Rood, 22 June 1880, Folder 4, Box 43, IC Papers-C.
46. A. P. Swineford (*Annual Review of the Iron Mining and Other Industries of the Upper Peninsula for the Year Ending Dec., 1882* (Marquette, MI: *Mining Journal*, 1883), 48), chided the owners of the Winthrop Mine following a major cave in at their open pit, commenting that "open pits are mistakes, and where commenced they cannot be abandoned a day too soon."
47. *Minute Book* 7 Nov. 1879, CCI-Cleveland; "Annual Statement of the Iron Cliffs Company for the year ending November 30, 1879," ibid.
48. "Annual Statement of the Iron Cliffs Company... 1879," CCI-Cleveland. Cost estimates based on figures provided in the company's "Annual Statement" between 1880 and 1884. The 1882 statement does not indicate expenditures on the project, perhaps because work on "B" shaft had been temporarily abandoned. For additional information on the company's problems in "B" shaft see various letters from T. J. Houston to Alex. Maitland, Folder 8, Box 3, IC Papers-A. Michigan, Office of the Commissioner of Mineral Statistics, *Annual Report of the Commissioner of Mineral Statistics of the State of Michigan for 1882* (Lansing: W. G. George & Co., 1883), 218-9. One cause of the delay was that one of the two shaft excavations encountered quicksand, forcing shaft sinking to begin anew.
49. Charles J. Canda (to Alex. Maitland, 22 Jan. 1883, Folder 9, Box 21, IC Papers-A) stated that he didn't want to tell stockholders that it cost $4.64 to raise ore from "A" shaft of the Cliffs Shaft Mine. *Minute Book,* Iron Cliffs Company, 1880-1889, 17 June 1885, CCI-Cleveland. Michigan, Office of the Commissioner of Mineral Statistics, *Mines and Mineral Statistics* (title of the commissioner's annual report after 1884), 1889, 128.
50. Boyum, "Cliffs Illustrated History," 5-17, citing a letter from mine superintendent Fred Mills (for the 1866 attempt); Alfred P. Swineford, *History and Review of the Copper, Iron, Silver, Slate and other Mineral Interests of the South Shore of Lake Superior* (Marquette, MI: *Mining Journal*, 1876), 156 (for the 1876 mine). Cleveland Iron Mining Co., *Annual Report of the Directors to Stockholders . . . for the year ending May 17, 1876* (Cleveland: Sanford & Hayward, 1876), esp. pp. 7 (transition to underground) and 11.
51. Charles D. Lawton, "The Cleveland Cliffs Iron Company and Its Mine," *The Michigan Mine* 2, no. 11 (1 Oct. 1900): 11.
52. Cleveland Iron Mining Company, *Annual Report for 1869*, 10. Samuel L. Mather to J. C. Morse, 8 Dec. 1877, Item 2780, CIMC-CCI Papers (on the attention being paid by the board of directors to the company's probably-contracted diamond drill work); Samuel L. Mather to Jay C. Morse, 15 July 1878, Item 2783, CIMC-CCI (papers on the purchase of a diamond drill).

53. Alfred P. Swineford, *Swineford's History of the Lake Superior Iron District* (Marquette: *Mining Journal* 2nd ed., 1871), 27. The accident at the Jackson mine is mentioned in Thomas Dunlap, *Wiley's American Iron Trade Manual. . . .* (New York: John Wiley & Son, 1874), 467.
54. Cleveland Iron Mining Co., *Annual Report for 1876*, 11. See also G. N. McKibbin, National Drill & Compressor Co., to Jay C. Morse, 11 Sep. 1877, File A, Item 2781, CIMC-CCI Papers (on compressed air drills reducing the cost from hand drilling and on possible resistance by hand drillers). N. W. Horton to Jay C. Morse, 25 July, and 13 and 26 Aug. 1879, Item 2785, CIMC-CCI Papers (using Rand drills).
55. M. C. Bullock to Jay C. Morse, 15 Apr., 12 May, and 27 Oct. 1879, Item 2785, CIMC-CCI Papers (emphasis original).
56. Frank P. Mills to M. C. Bullock, 9 Mar. 1880, Item 2450, CIMC-CCI Papers; *Iron Agitator* (Ishpeming, MI), 22 May and 5 June 1880; Samuel L. Mather to Jay C. Morse, 24 May 1880, Item 2787, CIMC-CCI Papers; Stanford, "Electrification of the Mines," 189. *Mining Journal* (Marquette, MI), 5 Apr. 1890. *Iron Ore* (Ishpeming, MI), 12 Oct. 1889.
57. For the discovery of the deposit see Michigan, Office of the Commissioner of Mineral Statistics (by Chas. D. Lawton), *Mines and Mineral Statistics*, 1887 (Lansing: Thorp & Godfrey, 1888), 27. For accounts of how the deposit was exploited see Cleveland–Cliffs Iron Company, *Agents' Annual Reports and Statistics*, 1892, Section 1, n. p. (letter F. P. Mills to W. G. Mather, 16 Jan. 1893), and Section 2, p. 3, Item 2058, CIMC-CCI Papers; F. C. Stanford, "The Electrification of the Mines of the Cleveland–Cliffs Iron Company," *Proceedings of the Lake Superior Mining Institute* 19 (1914): 189; and *Iron Ore*, 12 Sep. 1891. Cleveland–Cliffs Iron Company, *Agents' Annual Reports and Statistics*, 1894, 15-6, 19, Item 2060, CIMC-CCI Papers.
58. Michigan, Office of the Commissioner of Mineral Statistics, *Annual Report for 1882*, 211. Michigan, Office of the Commissioner of Mineral Statistics, *Mines and Mineral Statistics*, 1887, 25, 29; ibid., 1888, 139-40.
59. For problems with the quality of its pig iron see M. A. Hanna & Co. to James Rood, 26 May and 11 June 1887, in Alexander Maitland Correspondence with James Rood papers, Longyear Research Library, Marquette, MI. For ore quality problems see, for example, M.A. Hanna & Co. to James Rood, 5 and 15 June 1885; M. A. Hanna & Co. to Alexander Maitland, 22 Dec. 1885; Jay C. Morris, Union Steel Company, to James Rood, 19 Sep. 1887, and M. A. Hanna & Co. to James Rood, 21 and 22 Sep. 1887, ibid.
60. Michigan, Office of the Commissioner of Mineral Statistics, *Mines and Mineral Statistics*, 1889, 127-8 ("illiberal"). For the decision to close the company store, poor returns from exploration work, the Barnum Mine's exhaustion, and the changed policy on leases see "Annual Statement of the Iron Cliffs Company for the year ending November 30, 1887," with follow-on information in the 1888 and 1889 statements, CCI-Cleveland. For the appointment of the committee to consider the condition of Iron Cliffs and its possible sale see Minute Book, Iron Cliffs Company, 15 Apr. 1889, CCI-Cleveland.
61. Samuel L. Mather to D. H. Bacon, 6 Mar. 1882 (makes me sweat), and 1 Mar. 1882 (must not holdup), Item 2790, CIMC-CCI Papers.
62. Samuel L. Mather to D. H. Bacon, 7 and 14 June 1886, Folder 7, Container 1, Cleveland Iron Mining Company Correspondence, MS 3136, Western Reserve Historical Society, Cleveland, OH (hereafter CIMC-WRHS). Samuel L. Mater to Morgan L. Hewitt, 12 Jan. 1889, letter no. 16, Hewitt Letters.
63. Samuel L. Mather to D. H. Bacon, 14 June 1886, Folder 7, Container 1, CIMC-WRHS.
64. Samuel L. Mather to D. H. Bacon, 13 Oct. 1886, Folder 2, Container 2, CIMC-WRHS (wish we could control); Mather to Bacon, 13 and 17 Nov. and 1 Dec. 1886, Folder 3, ibid. (visit to New York); Mather to Bacon, 4 Dec. 1886, Folder 3, ibid. (dependence on Barnum).
65. *Iron Ore*, 15 and 22 Feb. 1890; *Mining Journal*, 8 Feb. 1890. Some miscellaneous documents relating to the acquisition of Iron Cliffs stock are in Item 2756 (Miscellaneous Papers), CIMC-CCI Papers. Michigan's Commissioner of Mineral Statistics commented (*Mines and Mineral Statistics*, 1889 (Lansing, Mich.: Robert Smith & Co., 1890), 127) that the take over was "a surprise" and that "people think that the price paid is a very low one." *Minute Book*, 1891-1906, Cleveland–Cliffs Iron Mining Co., 16 May, 10 and 11 July 1891, CCI-Cleveland.
66. Henry R. Mussey (*Combination in the Mining Industry: A Study of Concentration in Lake Superior Iron Ore Production* (NY: Columbia University Press, 1905), 98-9) quotes a circular to stockholders outlining the expected advantages from the merger. See also Michigan, Office of the Commissioner of Mineral Statistics, *Annual Report of the Commissioner of Mineral Statistics*, 1891 (Lansing: Thorp & Godfrey, 1892), 71-2.
67. The best account of the consolidation of mine ownership in the Lake Superior iron district and the vertical integration of iron mines into steel companies is still Mussey's, *Combination in the Mining Industry*, published in 1905.