# WISCONSIN'S MINING INDUSTRY; PAST, PRESENT, AND FUTURE

*Bruce A. Brown P.G.*
*Senior geologist,*
*Wisconsin Geological and Natural History Survey*
*3817 Mineral Point Rd. Madison, WI*

Most Wisconsinites would not immediately think of their state as an important mining state. However, the mineral production statistics kept by the U.S. Geological Survey consistently rank Wisconsin in the top three states in dimension limestone production, passing Indiana for top position in 2006. Preliminary figures for 2009 rank Wisconsin second to Illinois in production of industrial sand, due primarily to the explosive growth in demand for hydrofrac sand for the oil and gas industry. Prior to the recent economic downturn, Wisconsin produced nearly $400M worth of construction aggregates. Increasing metal prices have revived interest in base metals, precious metals, and most recently iron. Wisconsin also has a long history as a manufacturer of heavy equipment for the mining industry. Minerals and mining have always played a significant role in the history and economy of Wisconsin, and all indications are that they will continue to do so into the future.

The early history of Wisconsin is closely tied to mining. As early as 1690 the French were trading for lead with the local Native Americans. The French were actively mining lead in the early 1700s, and mining activity continued on a small scale through British rule until the region that would become Wisconsin became part of the United states in 1783. The U.S government began officially leasing lands for lead mining in 1822, and soon after, the first permanent mining settlements at Hazel Green and New Diggings were founded. By 1829 more than fifty small smelters were active, producing nearly 13.5 million pounds of lead. Lead mining expanded after the Blackhawk War of 1832. The Territory of Wisconsin was organized in 1836, followed by statehood in 1848. The incorporation of a lead miner and lead ingots on the state seal are evidence of the importance of lead mining in the early history of the state.

By the time of the civil war, southwest Wisconsin was the most important lead producing district in the country. In the latter half of the 19$^{th}$ Century lead production began to fall off as zinc production increased. From 1900 on until the last active mine, at Shullsburg in Lafayette County, closed in 1978, Wisconsin produced predominantly zinc. Wisconsin's mineral industry expanded rapidly in the latter half of the 19$^{th}$ century. As lead-zinc mining continued in the southwest, iron was discovered in northern Wisconsin. Iron mining began in Florence County in 1881, followed by the first shipments of iron ore from the Germania Mine at Hurley in 1885. In 1893 the Ordovician oolitic iron ores of the Neda formation were first mined near Mayville, in Dodge County. Iron was mined in the Baraboo region from 1904 until the early 1920s.

In this same time period, Wisconsin's nonmetallic mining industry expanded rapidly. Local stone had been used as a building material since the first settlers arrived. As Wisconsin's population grew in the late 19$^{th}$ century, an extensive quarrying industry provided building material for the Milwaukee, Madison, Fox Valley, and Green bay metropolitan areas. In 1900 Wisconsin had more than twenty hard rock quarries producing granite for building and monument stone, and rhyolite and granite for paving blocks. At this time, quarrying of Lake Superior red sandstone reached its peak. This distinctive red-brown sandstone was quarried along the shore in Bayfield County and the Apostle Islands, and was shipped by boat to lower great lakes ports, from which it was widely distributed throughout the upper Midwest by rail.

Wisconsin has almost no high-calcium limestone to support a portland cement industry, but the need for mortar lime resulted in a large number of lime kilns being built in the 19$^{th}$ and early 20$^{th}$ centuries to produce dolomitic lime, primarily from Silurian rocks in eastern Wisconsin. In the early 20$^{th}$ Century,

Wisconsin had an extensive brick industry that utilized glacial lake clays, residual clays from weathering of granites, and the Maquoketa Shale. Lime production continues on a reduced scale today, but the brick industry died out because clay deposits were limited and Wisconsin lacks energy resources such as coal and natural gas needed to fire the kilns. The growth of the foundry and heavy manufacturing industries after the Civil War created a demand for molding and core sand used in metal casting. The St. Peter sandstone, and some outwash sands remain an important source of foundry sand today.

In the years following World War II, Wisconsin's mining industry was undergoing some major changes. Lead-zinc production was declining. Although reserve estimates predicted significant amounts of ore remaining in southwest Wisconsin, the small size of individual ore bodies, and the need to operate many headings to produce an adequate ore supply for the mills, and new environmental regulations made mining uneconomic. The last zinc mine, located south of Shullsburg in Lafayette County, closed in 1978. By the 1950s reserves of high-grade hematite known as "direct shipping ore" were declining and the taconite process had been developed for beneficiating low-grade silicious ores. The change to taconite by the steel industry and the high cost of underground mining closed the Montreal and Cary mines at Hurley in 1965, temporarily ending iron mining in Wisconsin. A small taconite mine opened in 1969 at Black River Falls in Jackson County, and operated until economic conditions closed it in 1983.

The discovery of the Flambeau volcanogenic massive sulfide (VMS) copper–zinc deposit near Ladysmith in Rusk County in 1968 would prove to be a milestone in the history of metal mining and mining regulation in Wisconsin. Flambeau set off a period of intense exploration that resulted in the discovery of 15 VMS deposits in the region, including the Crandon deposit in 1976. The VMS discoveries prompted Wisconsin to complete geologic mapping of the Precambrian rocks in the north, and brought about significant changes to the state's metallic mining and reclamation laws. The permitting process requires a thorough review of a project, with the goal of providing maximum protection for the environment. Flambeau, the first deposit discovered, is the only one to have been permitted, mined, and reclaimed- a process that stretched over 32 years. The larger Crandon deposit was nearly permitted by several owners but finally abandoned in 2003.

Where is Wisconsin's mining industry headed in the 21$^{st}$ Century? Nonmetallic and industrial minerals dominate the industry today, and will probably continue to do so. Although dimension granite can no longer compete in the international market, dimension limestone in the form of facing stone and flagstone should remain strong and grow if the housing market recovers. The aggregate industry experienced a slight decline with the recent recession and resulting slowdown in residential and commercial construction, but the demand for highway and infrastructure construction and maintenance has not decreased significantly. The bright star among the industrial minerals is hydrofrac sand. In recent years the demand for frac sand for development of tight-shale gas and oil has resulted in the opening of more than ten new mines, and exploration and permitting activity is continuing at a rapid pace.

On the metallic side, the recent rise in base metal prices has prompted interest in the Lynne deposit, one of the mid-sized VMS zinc deposits in Oneida County. High gold prices have resulted in a company applying to the DNR for permits to further explore the Reef deposit, a gold property in eastern Marathon County. Perhaps the most newsworthy development in metallic mining is the proposal for a new iron mine on the western Gogebic Range in Iron and Ashland Counties. This mine would be an open pit operation that would mine magnetic taconite ore. The proposed mine and mill would eventually employ 700 people and produce 8 million tons of taconite pellets annually. The proposal has generated considerable interest in an area of the state where jobs are badly needed.

In summary, Wisconsin is a state with a long history of mining, and where mining is likely to remain a significant contributor to the economy for years to come. Today, our mineral economy is based on

nonmetals and will likely remain there.  We will probably never see a renewed interest in lead-zinc mining in the southwest, but the known resources of copper, zinc and precious metals in the VMS deposits, and the extensive iron resources of northern Wisconsin will continue to attract the attention of the mining industry in times of high metal prices