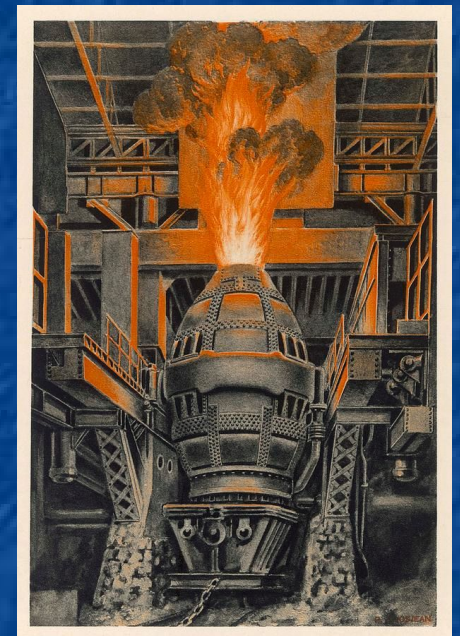
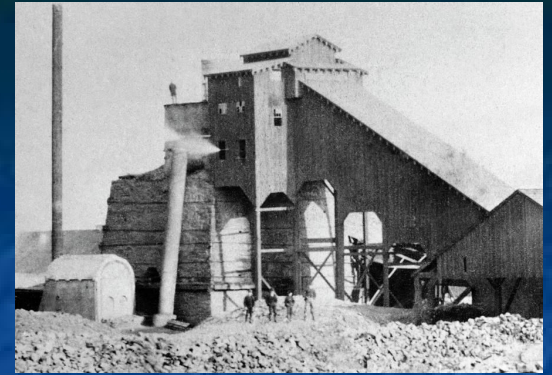


Iron & Steel: the History

by Doug Geiger, MMR



Disclaimer

- **I am not an expert and never worked in the industry, but I am just fascinated with this topic.**
- **Lots of facts, figures and dates, so try to concentrate on the “big picture”.**
- **many thanks to all the sources, both online and off.**
- **please do not make videos/stills of this presentation because of copyrights.**

ancient production

- first iron – meteorites
- 13th century BC in Turkey
- steel for weapons
 - Damascus steel blades
 - Sheffield steel in 1740
 - Wilkinson Sword in 1772
- blister steel in Germany in 17th century (cementation)



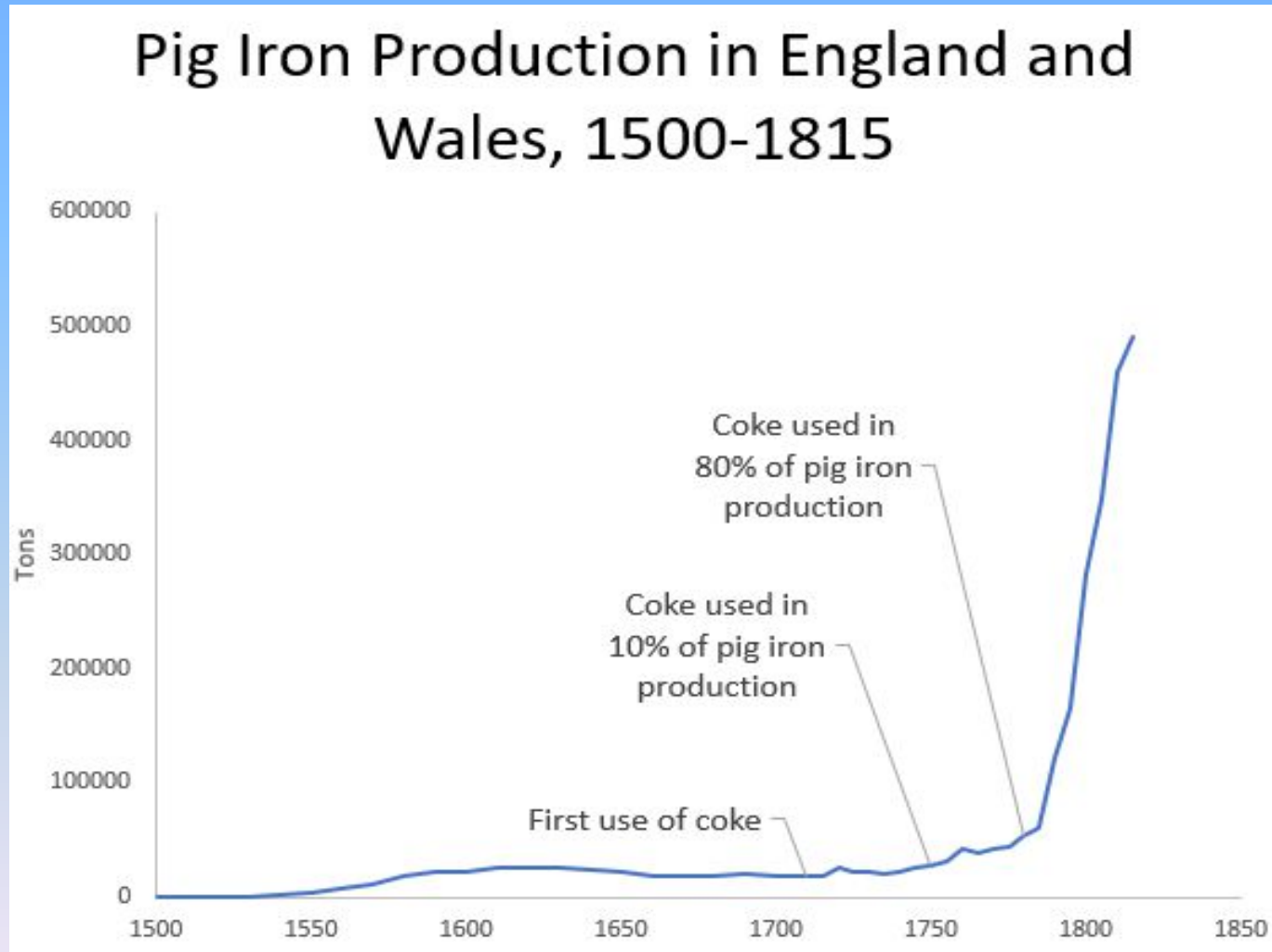
pre-1900

- England in 1700s
- very bad working conditions (carbon monoxide)
- lots of nationalities as labor
- iron rail - the prime commodity
- steel was very costly

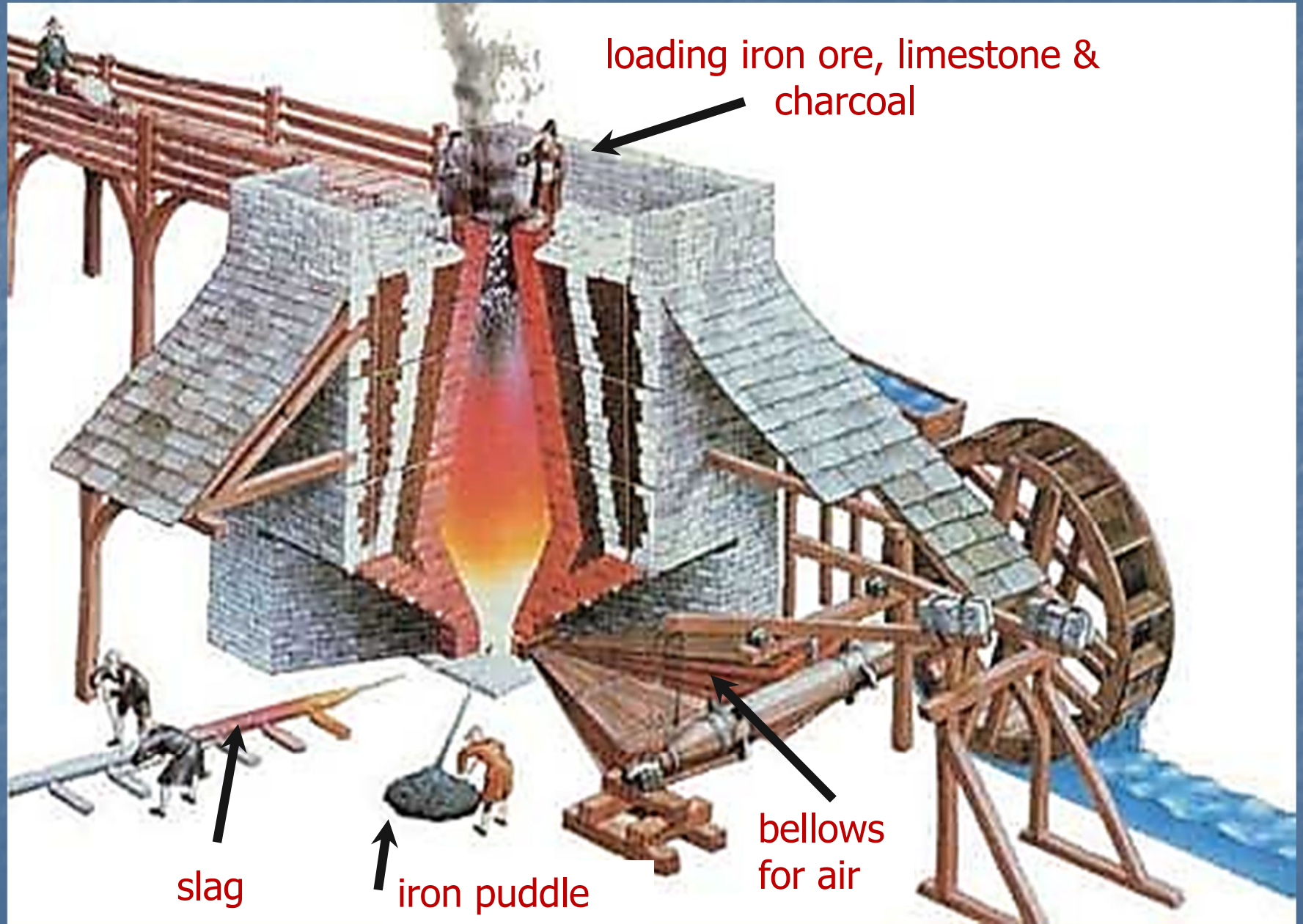


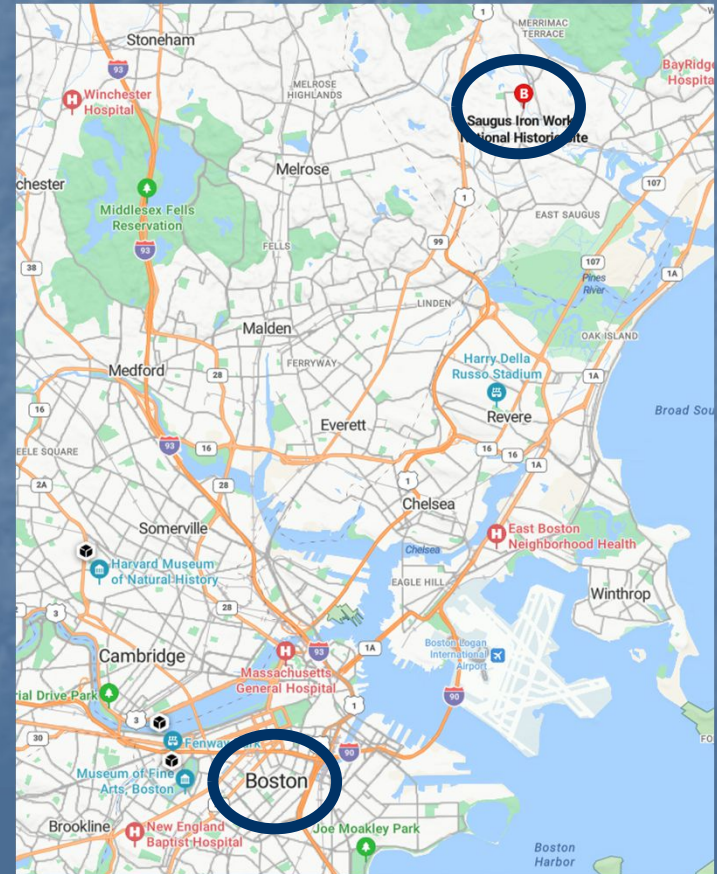
pre-1900

- charcoal for fuel, later coal, then coke



pre-1900





pre-1800

- early blast furnaces

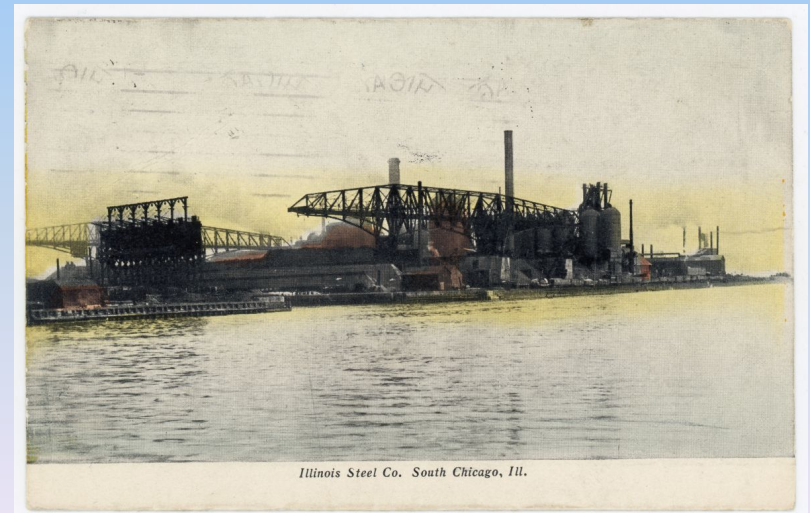




pre-1900



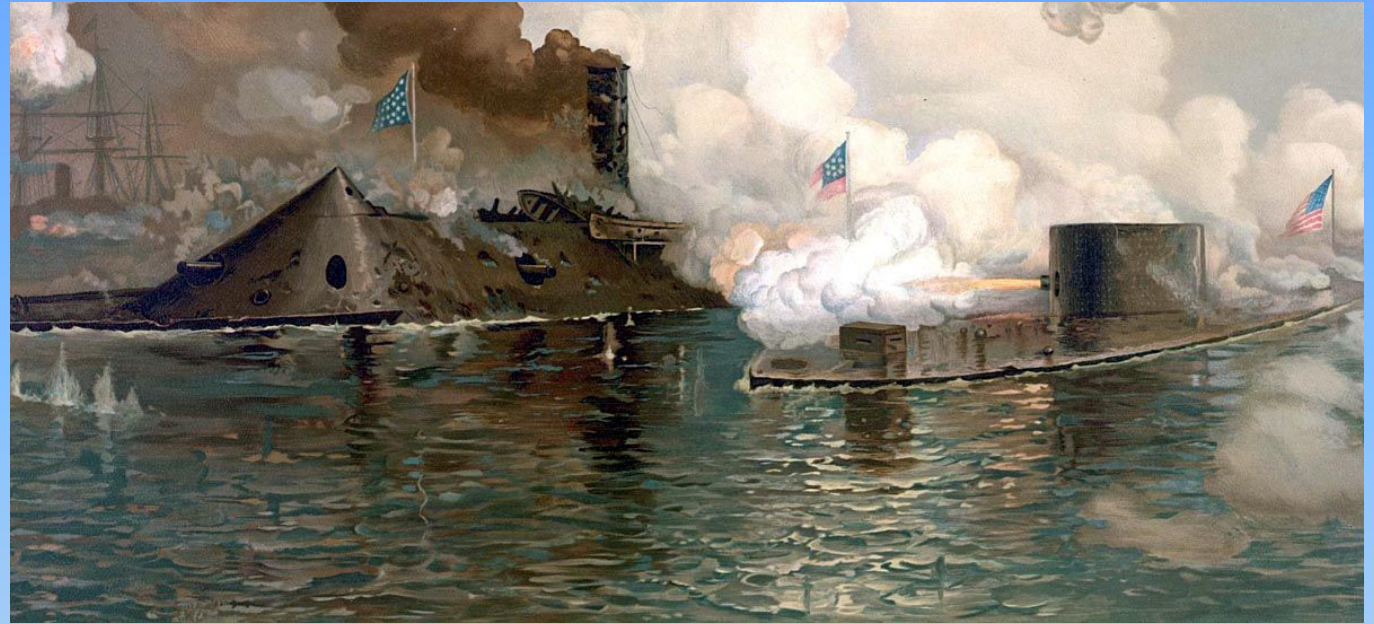
- **Bethlehem Steel formed - 1857**
- **1860 – Tennessee Coal and Iron (TC&I) in Birmingham, AL**
- **1865 – Carnegie had one of 7 blast furnaces in Pittsburgh, PA**
- **Chicago area – Illinois Steel Company in 1889**



■ Civil War 1861-1865

pre-1900

the Monitor
verses the
Merrimac



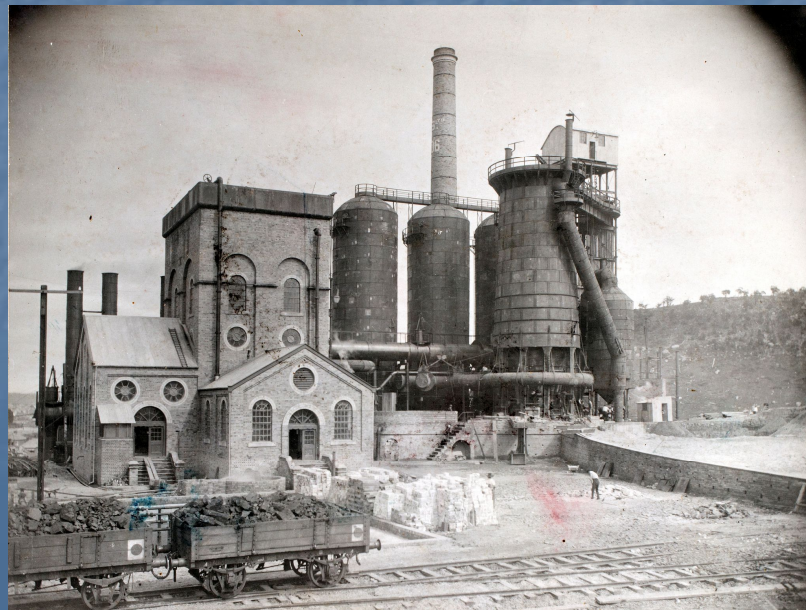
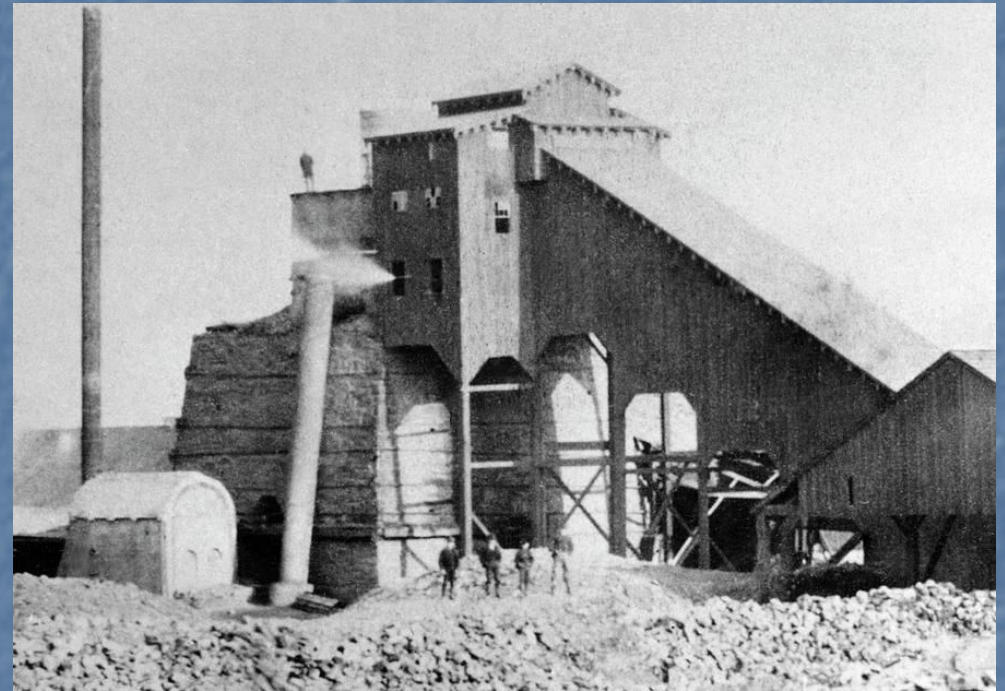
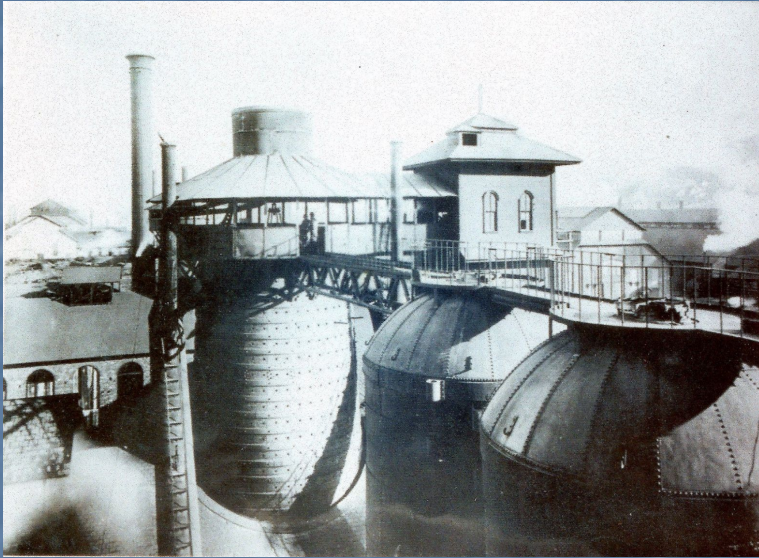
Tredegar Iron Works (Confederate)



■ early blast furnaces

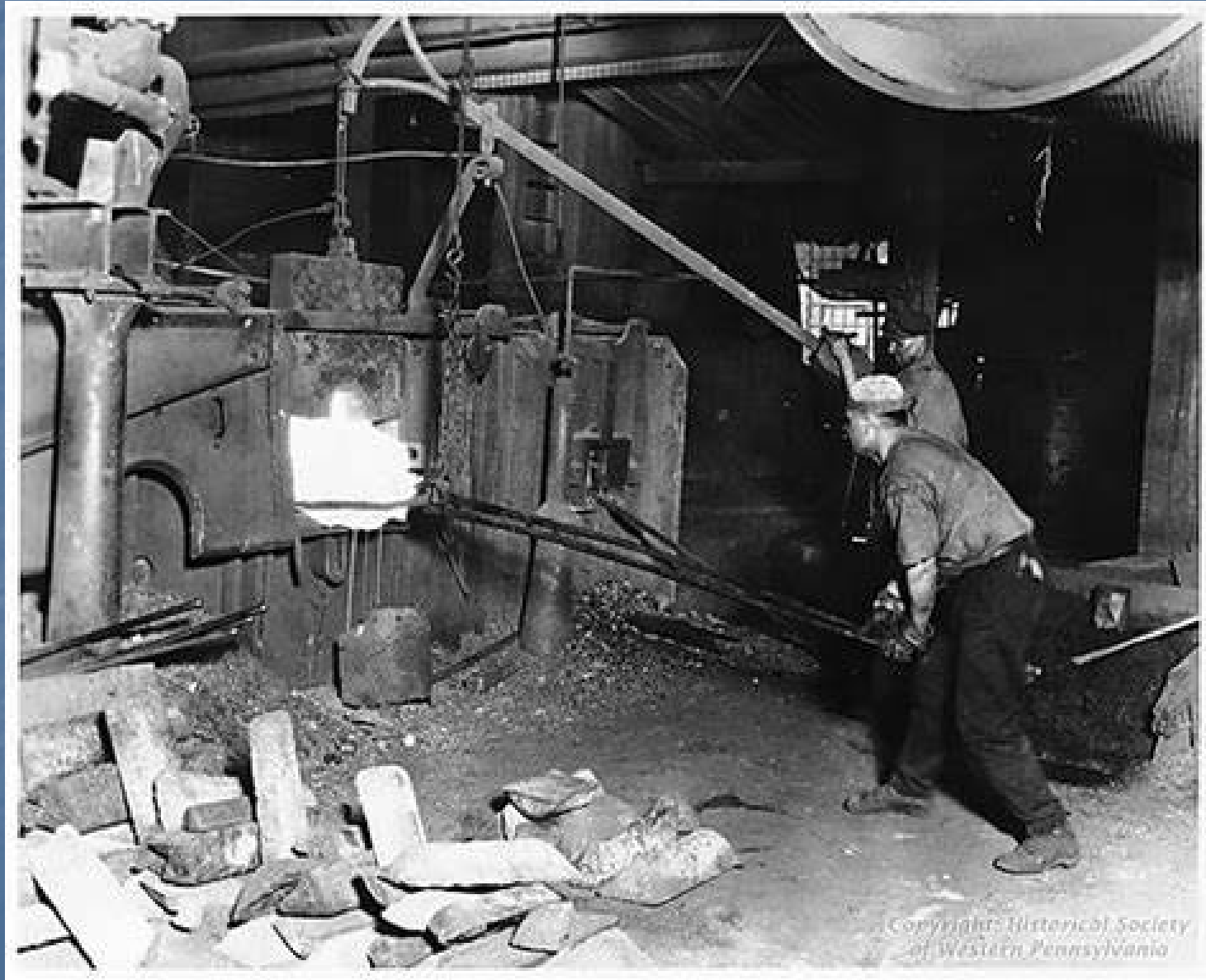
pre-1900

Bethlehem furnace and hoist house



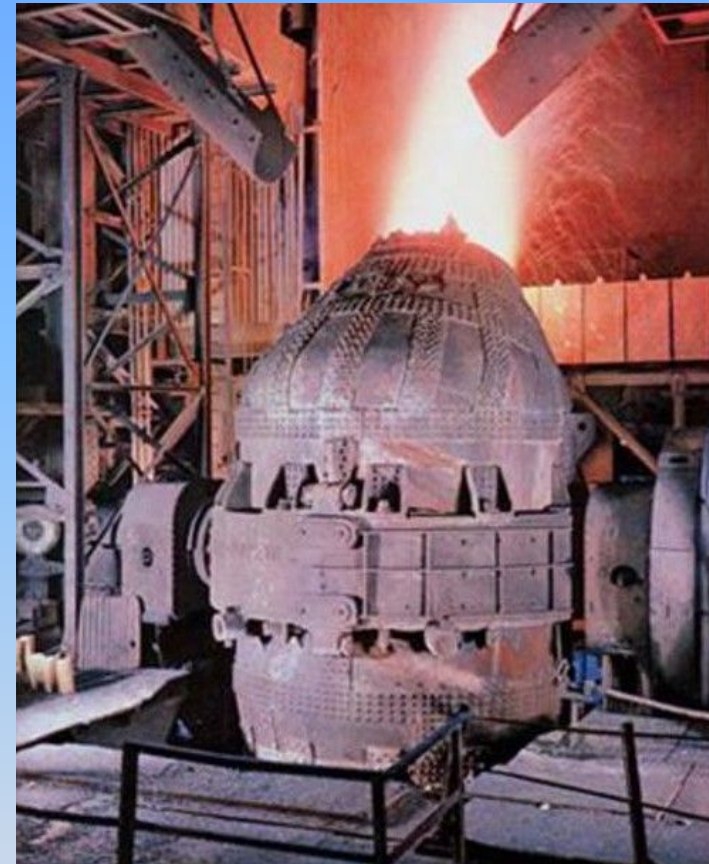
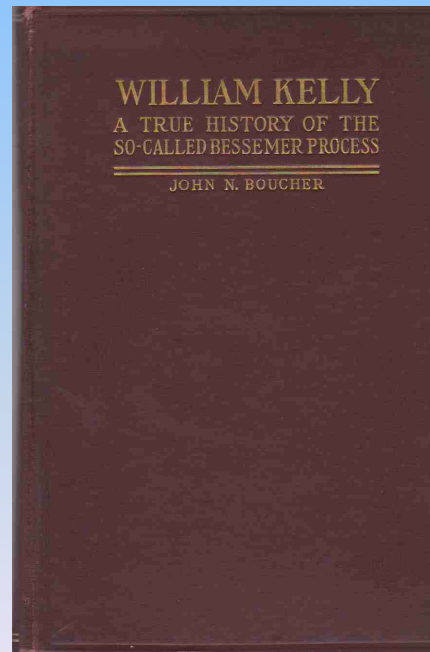
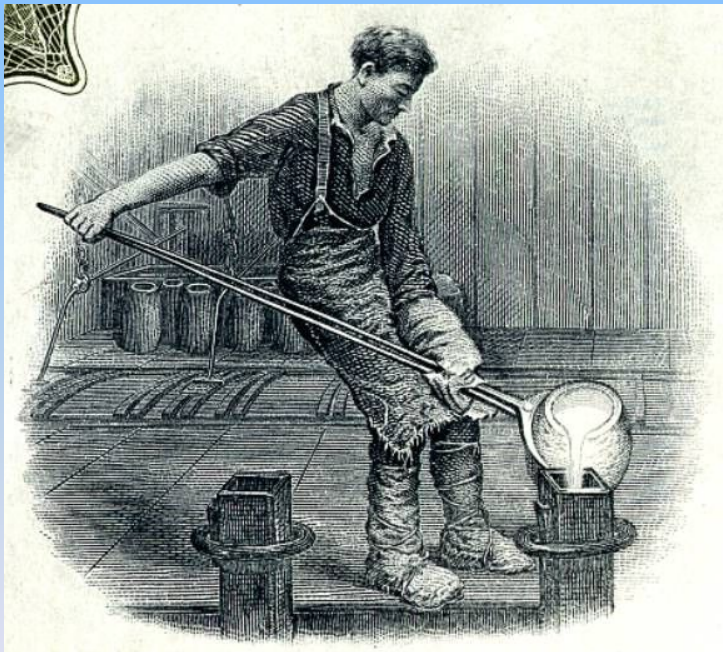
pre-1900

- puddling



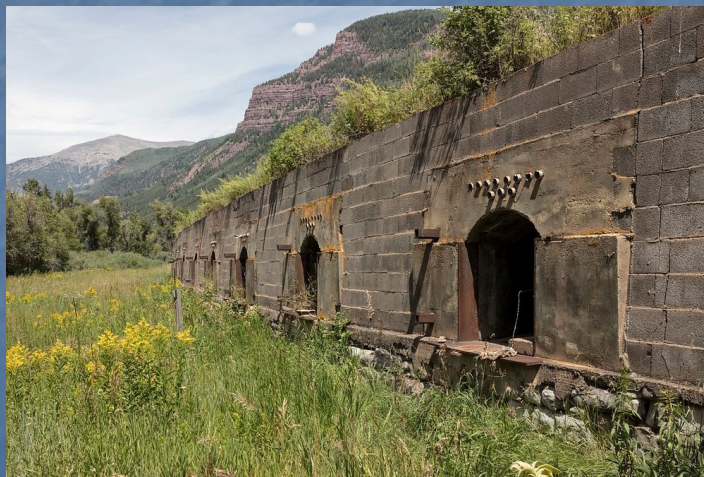
pre-1900

- crucible steel
- Bessemer (or Kelly) process
 - 1851 - developed
 - 1855 - 1st plant in Britain
 - 1872 - 1st plant in America

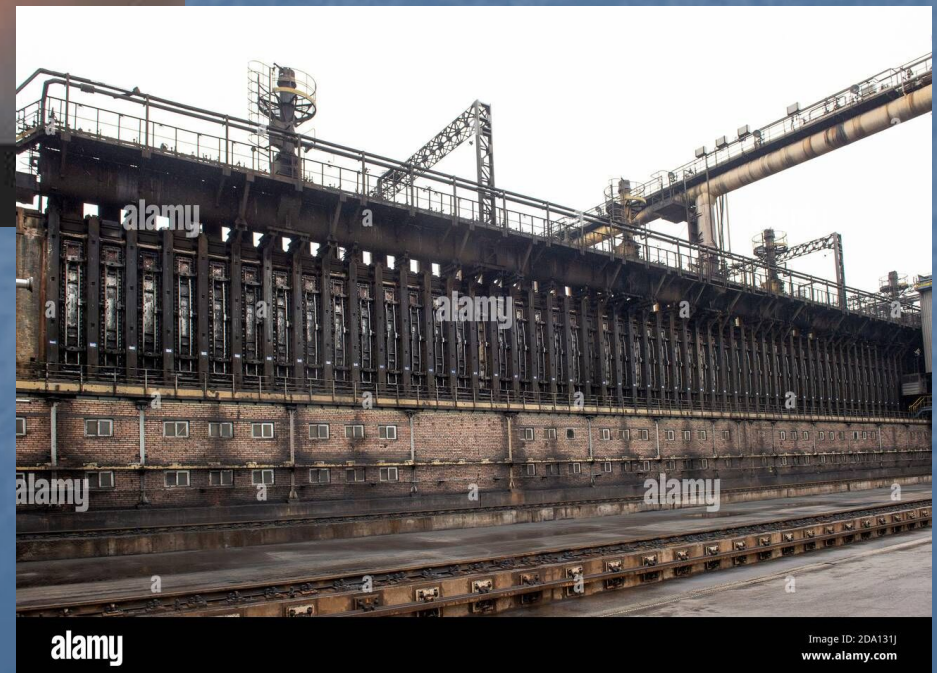


pre-1900

■ beehive coke ovens



■ modern coke oven battery



CARNEGIE

= STEEL CO =

pre-1900

1892

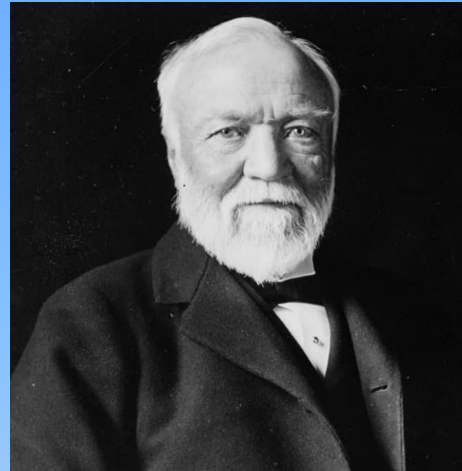
■ Key players

- Andrew Carnegie
- Henry Clay Frick
- Charles Schwab

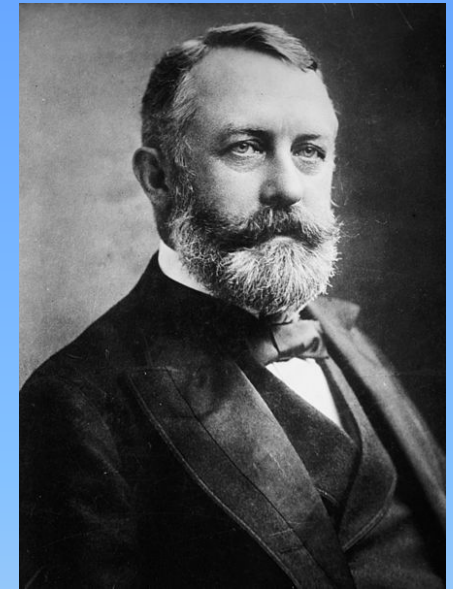
■ Key plants

- in the Monongahela (Mon) Valley
 - Homestead - 1888
 - Edgar Thomson – 1890
- in the US
 - Bethlehem Steel – 1899
 - Inland Steel – 1898

Andrew Carnegie



Henry Clay Frick

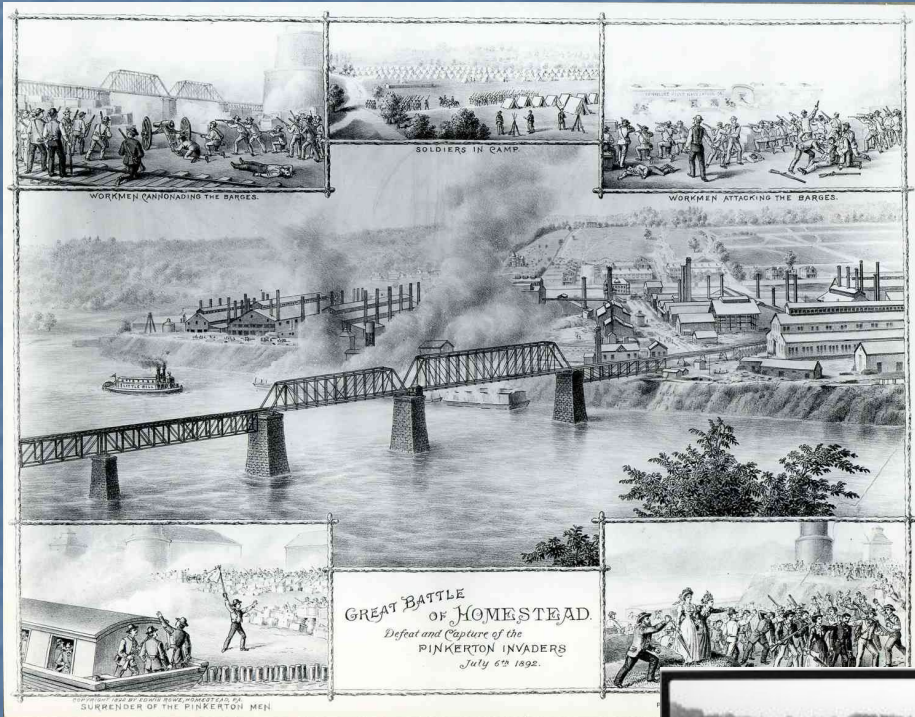


Charles Schwab



1892

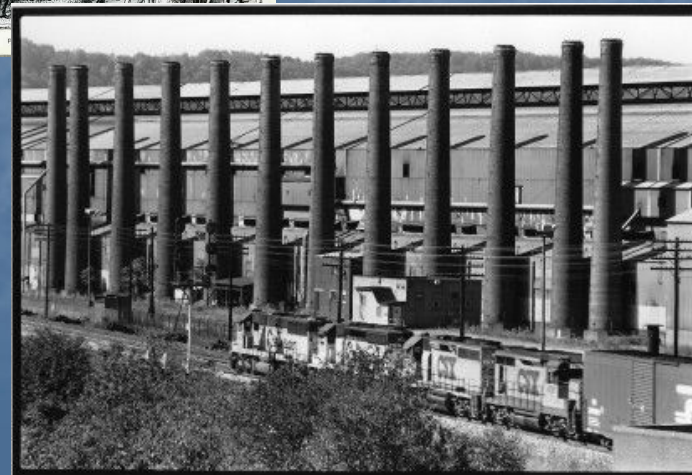
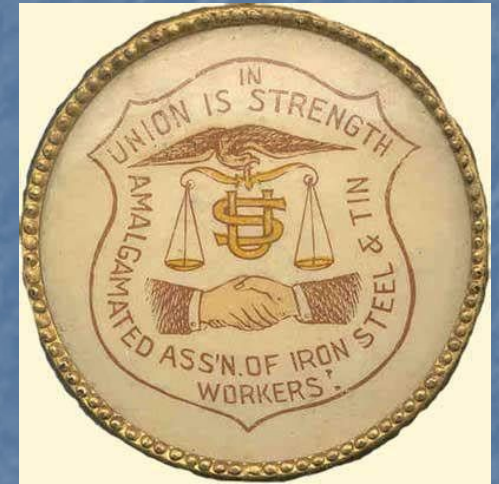
■ The Great Homestead Strike in July



The Battle for
HOMESTEAD
1880-1892

Politics, Culture, and Steel

PAUL KRAUSE

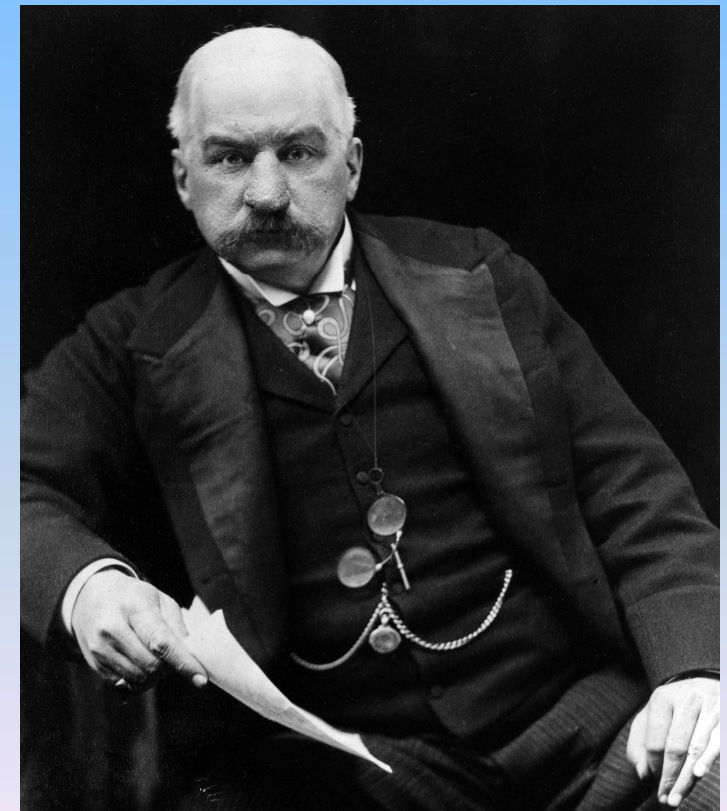


1901

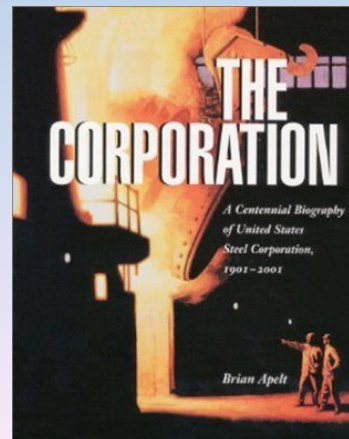


- **US Steel formed – “The Corporation”**
 - 149 steel plants across America
 - 65% of US steel industry, 168,000 workers
 - 84 blast furnaces
 - 112 ships
 - 1000 miles of railroads
 - 29 Carnegie Steel companies
 - paid \$480,000,000
 - largest corporation in the world (1% of global wealth)

J.P. Morgan



Albert Gary



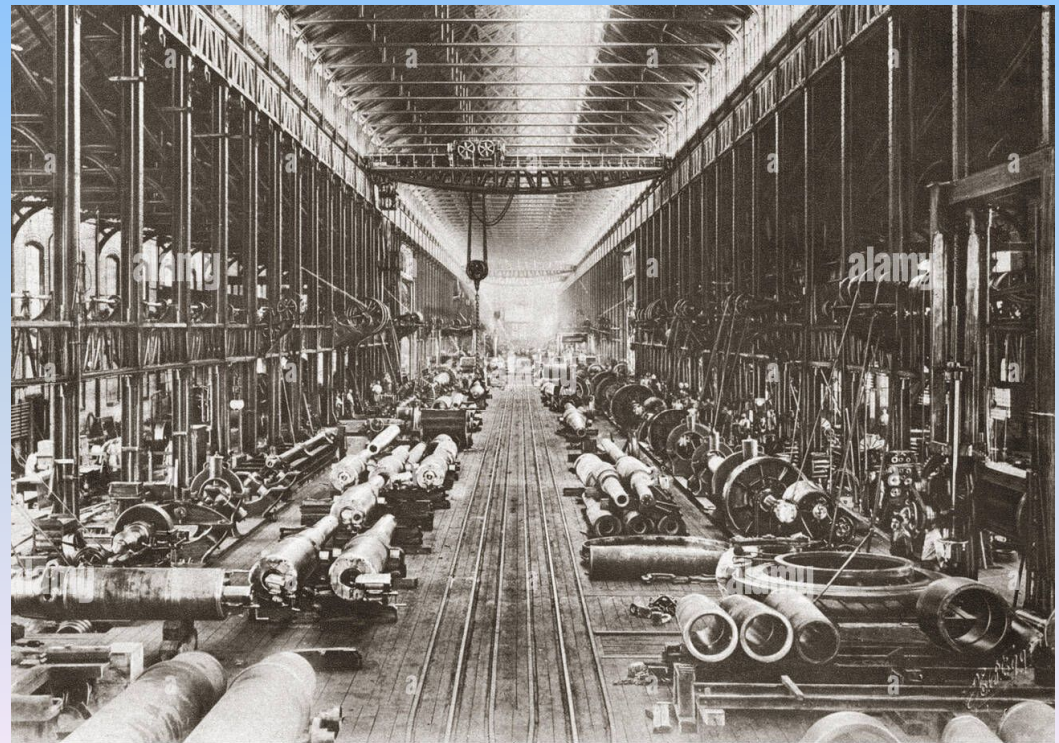
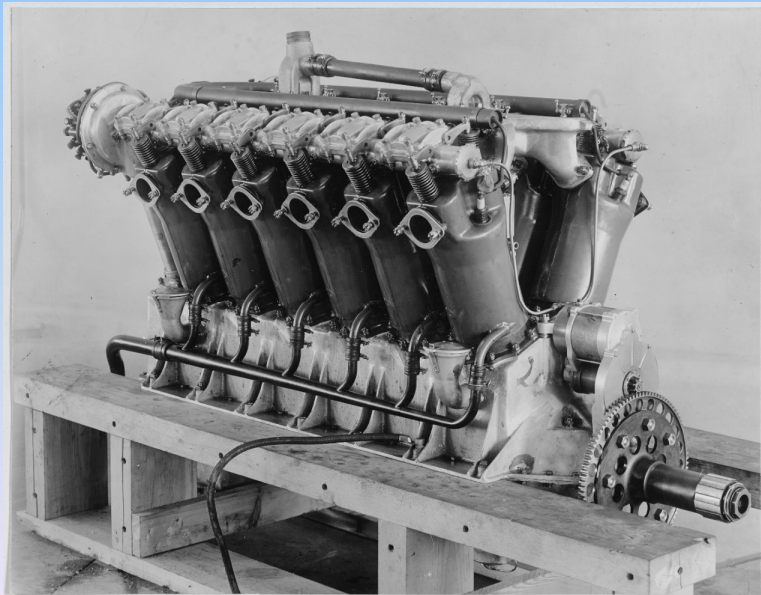
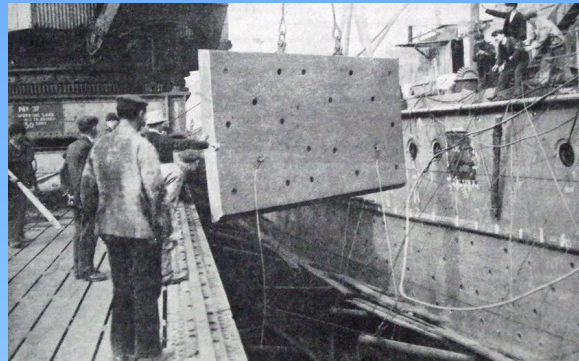
1900-1910

- **Bethlehem Steel**
 - wide flange structural beam
 - Empire State Building
 - Golden Gate bridge
 - Madison Square Garden



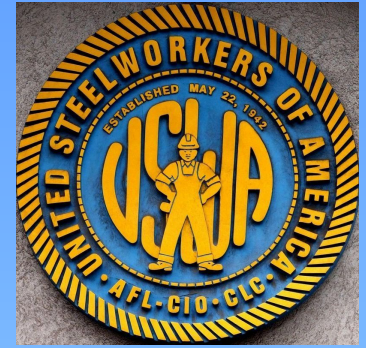
1914-1918: WWI

- aircraft engines
- helmets
- heavy artillery guns
- armor plate



1900-1930's

1942

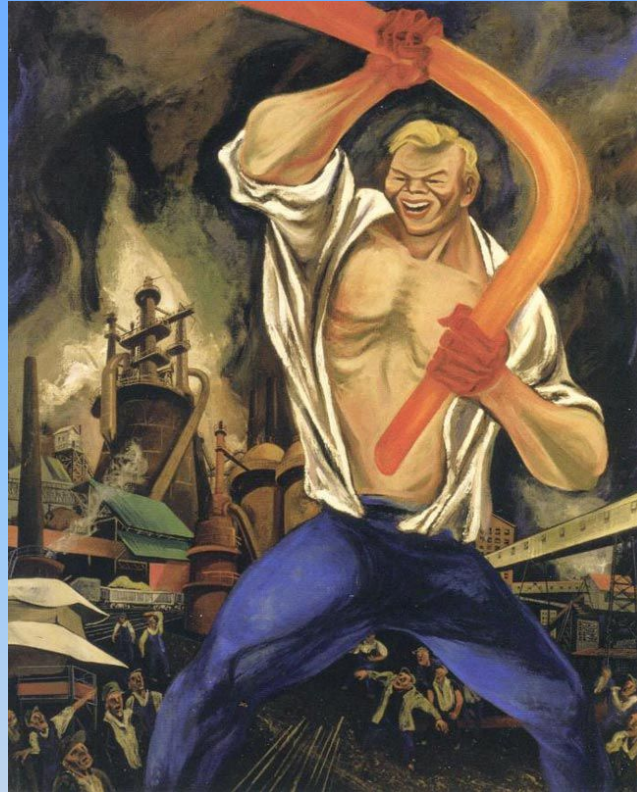


- post WWI – auto industry and sheet steel
- beginnings of the integrated steel mill
- unions have a voice finally by 1935 (the Wagner Act)



1900-1930's

■ Joe Magarac



THE SATURDAY EVENING POST

U. S. STEEL CORPORATION uses a product of Shell Research to save money without sacrifice. The more guests, the better, and, important! all of its products.



Joe Magarac plays "pat-a-cake" — with white hot steel!

Joe Magarac, "Pat-a-cake" of the steel industry, is mighty like a U. S. Steel steelman. And as a working partner, petroleum research is helping him keep the magnets rolling — hot as hell.

At one plant, a giant 600-ton steel hot metal block and bath — collecting them to plants and sheds. Heat is high. Chilled temperatures lower and fast. To offset this, U. S. Steel installed a new, white product of Shell Research, Shell Steam Gasoline. Shell's better heating action at once. Besides other the original installation, others were removed and an excellent line of green was still present.

All the other extreme, new weather control gases to an automatic kiln-casting system for high. Shell Steam Gasoline was used and it began promptly shipped. This made progress green is now used extensively in low temperature operations of U. S. Steel's steel plant.

Development of new research progress is another achievement through which Shell demonstrates leadership in the petroleum industry. The work of Shell Research is

Settle quality — more for your money — when you buy products bearing the Shell name and trademark.

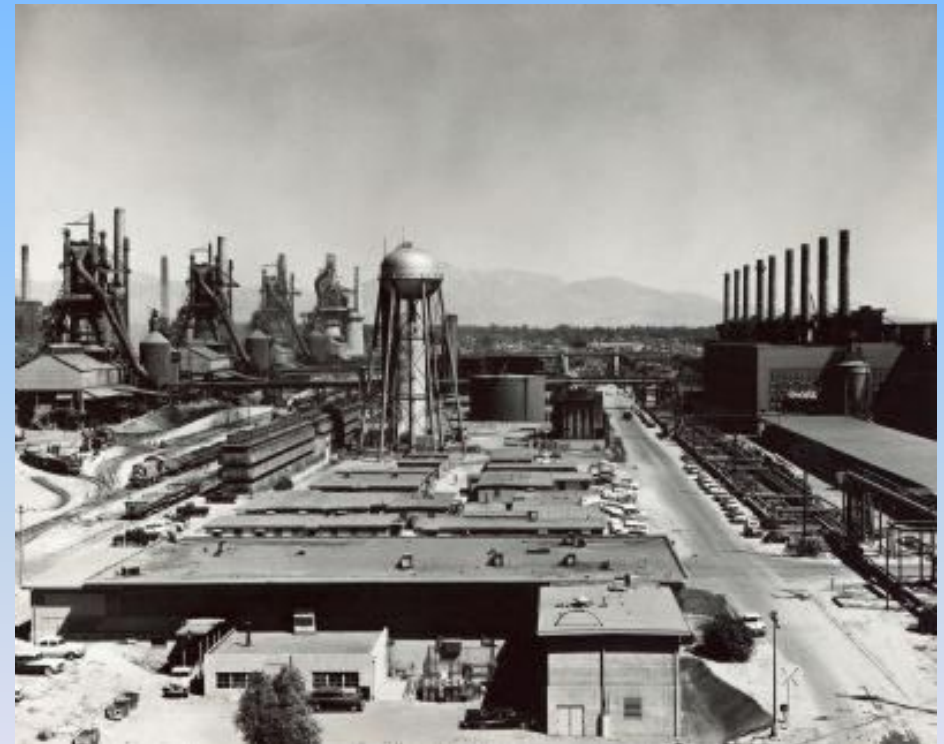


Shell Research leads to finer Products — more for your money.

© 1964, Shell Oil Company

1941-1945: WWII

- War Production Board – January 1942
- New plants built by the Defense Plant Corporation
 - Geneva Steel in Utah
 - Kaiser Steel in California

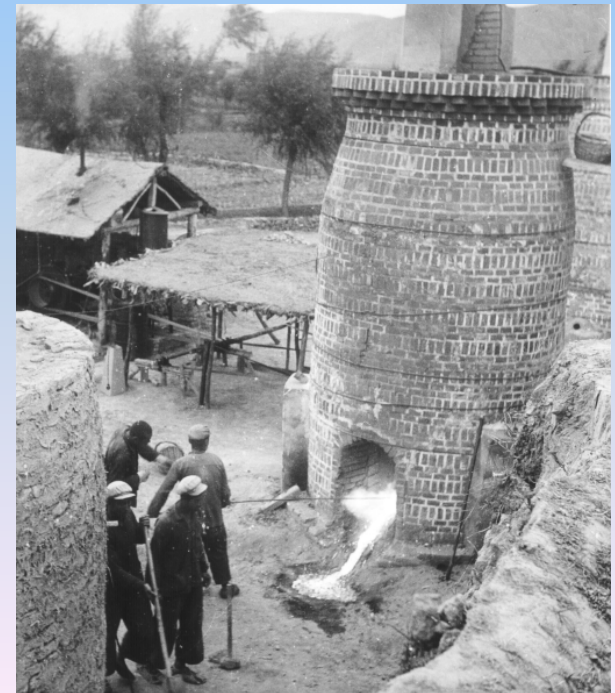


The Peak of Production 1940's-1970's

- 1953 – 73 blast furnaces in Pennsylvania, 49 in Ohio
- record productions of steel
 - 1950 – 100 million tons (half of the world's total)
 - 1980 – 121 million tons
 - 1982 – 73 million tons



China – 1959 >
< US – 1959



The Peak of Production 1940's-1970's

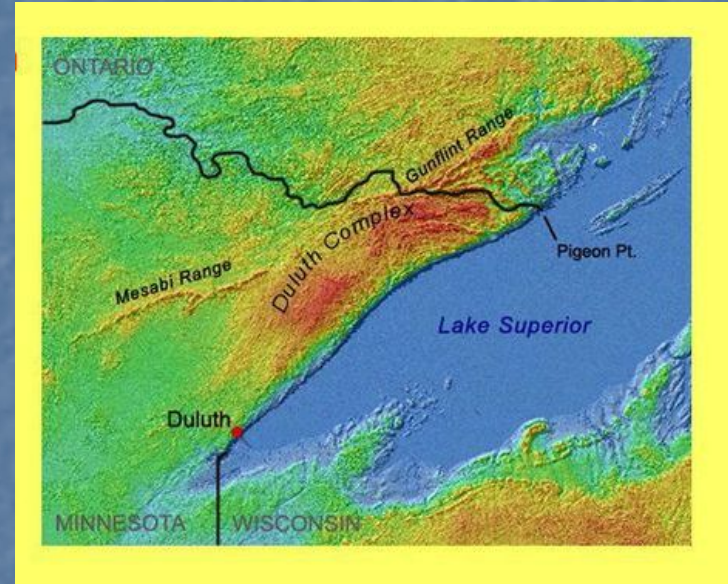
- where located in the US
 - Pittsburgh, PA
 - Baltimore, MA
 - Youngstown, OH
 - Cleveland, OH
 - Buffalo, NY
 - Weirton, WV
 - Dearborn, MI
 - Chicago, IL
 - Gary, IN
 - Ashland, KY
 - Birmingham, AL
 - Provo, UT
 - Pueblo, CO
 - Fontana, CA
 - Hamilton, ON (Canada)



The Peak of Production 1940's-1970's

- iron ore in the US

Hull-Rust



The Peak of Production 1940's-1970's

- strikes



The Peak of Production 1940's-1970's

Homer Labs, Bethlehem Steel



The Peak of Production 1940's-1970's

- US STEEL – Gary, Indiana (1973)



The Beginning of the Decline of American Steel

- 1959 – imports exceed exports of steel
- quality of foreign steel is good
- 1960's – air/water quality begin, will cost \$\$\$ in the 1970's
- over capacity (future growth not realized)



 **NIPPON STEEL**



The Decline of American Steel – 1980's

- labor wages \$\$
- executive wages \$\$\$
- union strength grew
- one by one, the plants close



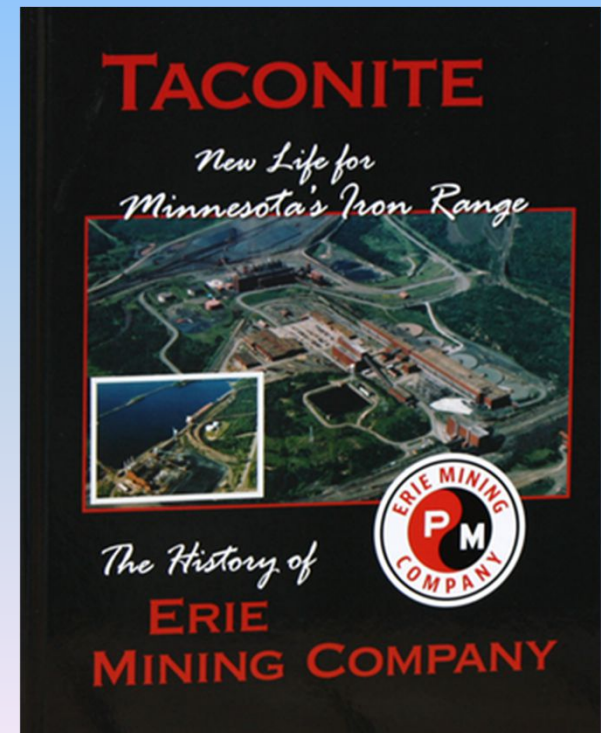
The Decline of American Steel – 1980's

- new technologies cost \$\$, lowers profits
- loss of research for new technologies
- aluminum (cans)
- plastic (cars)



The Decline of American Steel – 1980's

- benefaction of low-grade ore (taconite) because US iron ore deposits dwindle



- Bethlehem Steel's Sparrows Point, blast furnace L



■ Bethlehem Steel's Sparrows Point complex



■ Bethlehem Steel's main plant



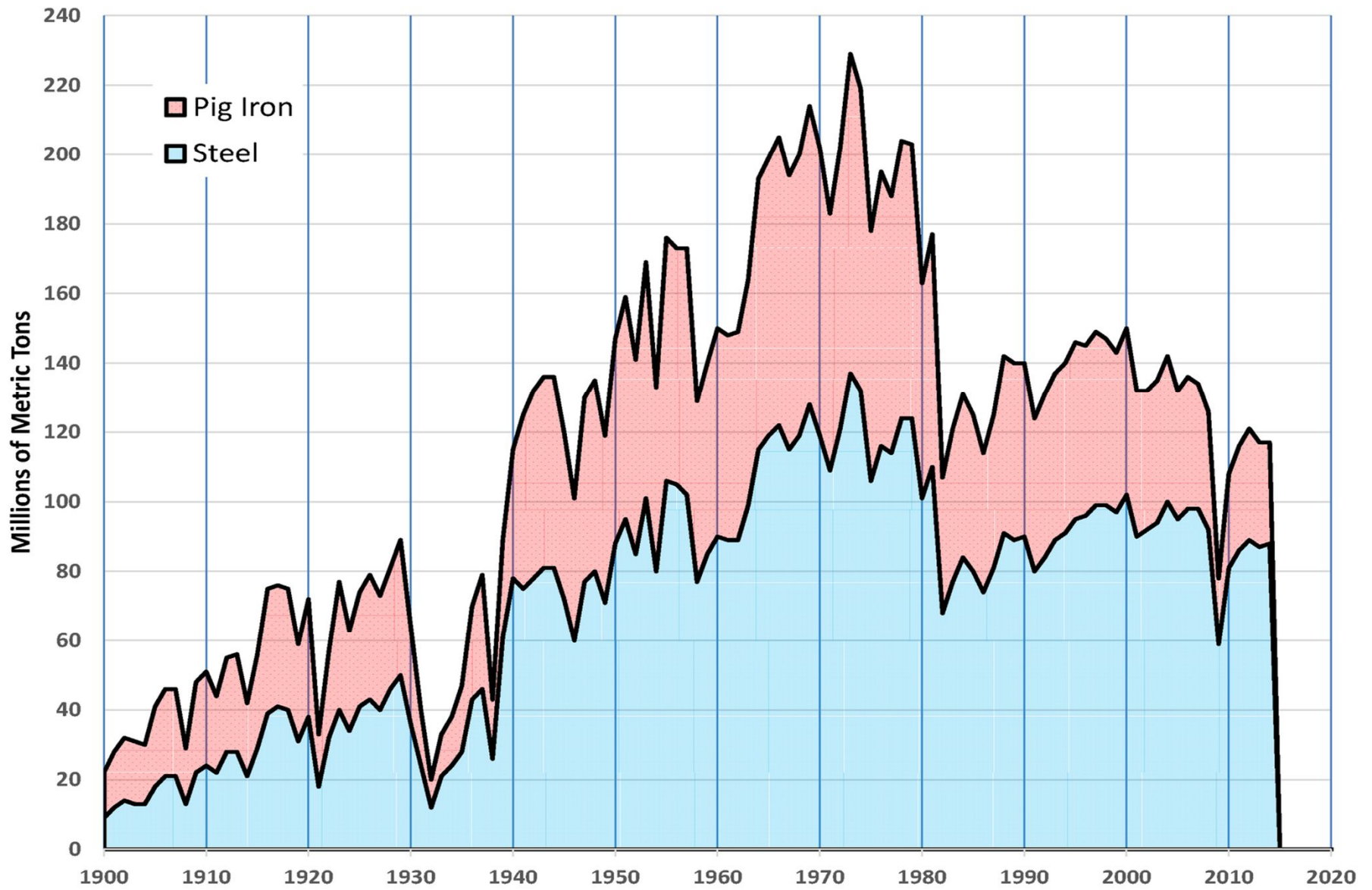
Gerald Finster

■ Bethlehem Steel's Martin Tower



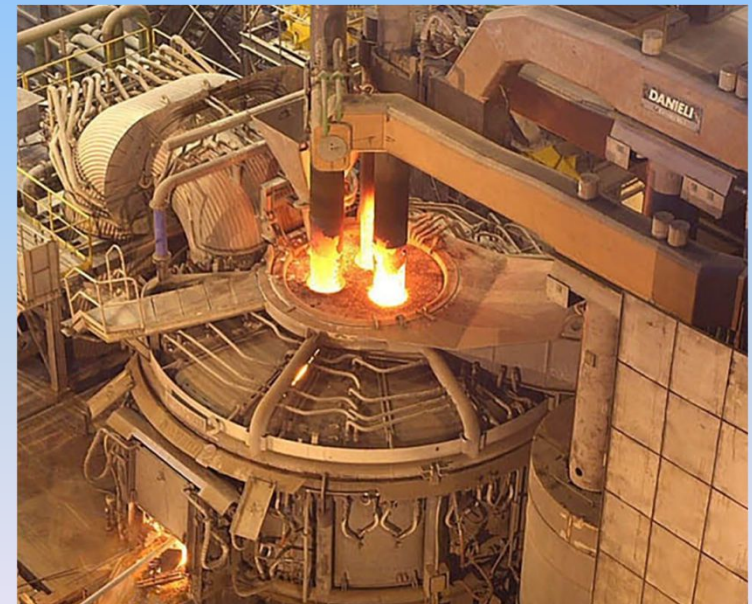
May 2019





The Rebirth of American Steel

- **mini-mills**
 - not an integrated industry
 - mostly melting scrap





Current



- **China & Japan have most of the world's blast furnaces and make the most steel**
- **In America: mostly melt scrap**
- **specialty steels and applications now very common (rail, rebar, sheet)**
- **tariffs since 1840 (10-45%)**
- **current US owners**



Current

- **active blast furnaces in the US in 2025**
 - **Burns Harbor (2) - Indiana**
 - **Cleveland - Ohio**
 - **Dearborn (River Rouge) - Michigan**
 - **Indiana Harbor - Indiana**
 - **Middletown - Ohio**
 - **Gary Works (4) - Indiana**
 - **Edgar Thomson (2) - Pennsylvania**

■ Clairton, PA – USS Coke Works



■ Edgar Thomson – US Steel (PA)



■ ArcelorMittal – Indiana Harbor, Indiana



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■ Cleveland-Cliffs– Dearborn, Michigan



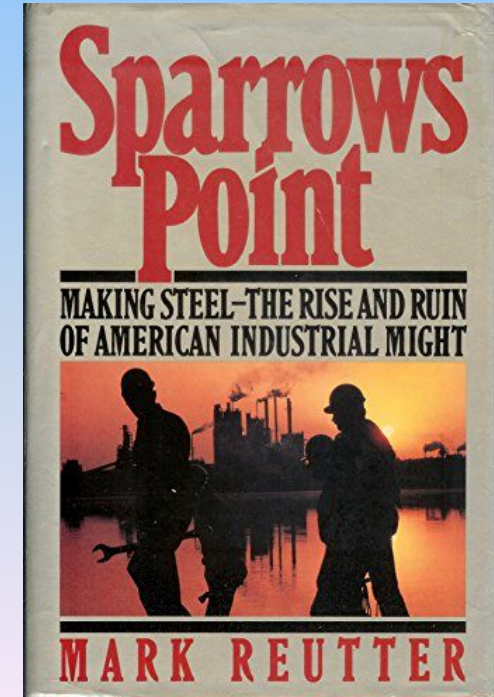
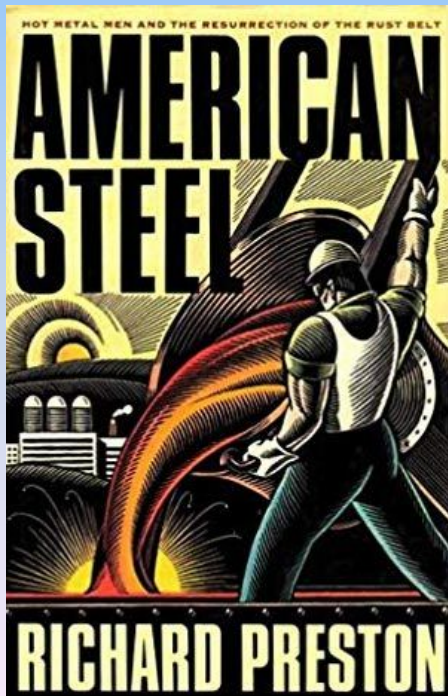
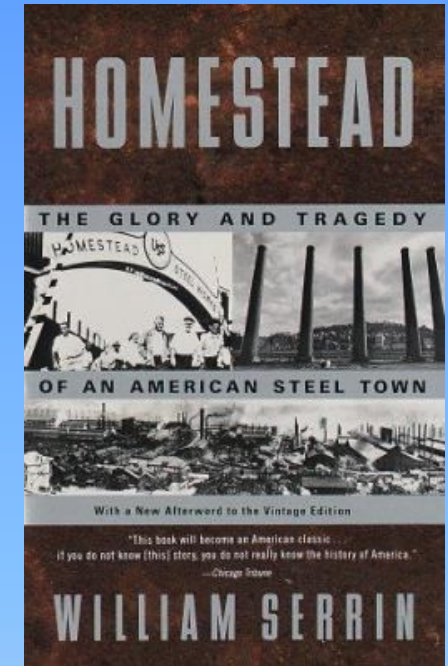
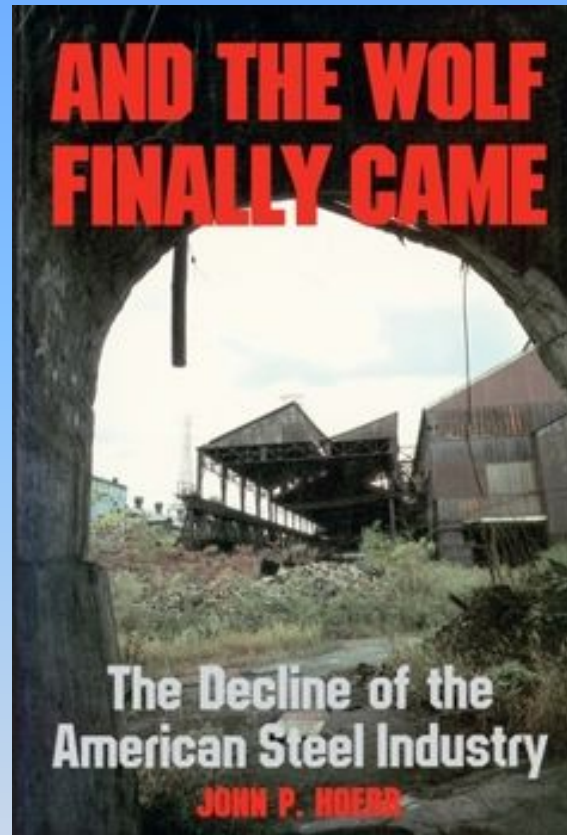
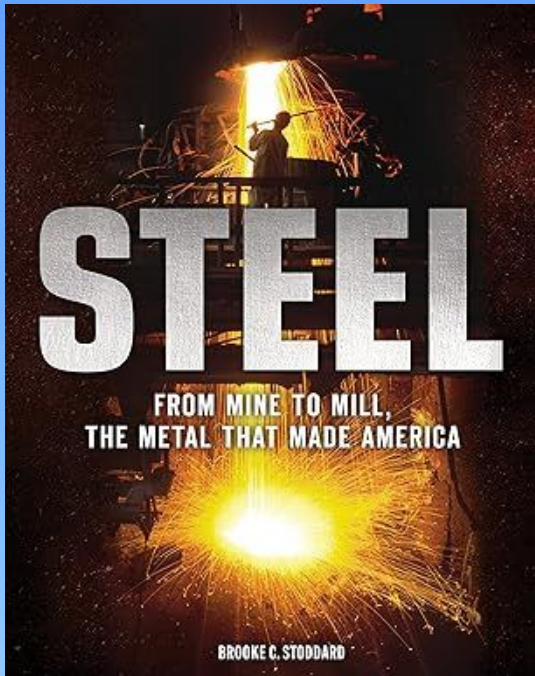
■ Evraz – Pueblo, Colorado



Technological History

- **How we made/make steel**
 - **Puddling = ? – 1870s**
 - **Bessemer = 1870s – 1940s**
 - **Open hearth = 1880s – 1970s**
 - **Basic oxygen furnace (BOF) = 1960's to today**
 - **Electric arc (melting scrap) = 1950s to today**

Books





Iron & Steel: the History



The End

