



Hagi: Origin of Japan's Industrial Revolution, a Late 19th Century Miracle of World History

Hagi proto-industrial heritage, part of



United Nations
Educational, Scientific and
Cultural Organization



**Sites of Japan's Meiji Industrial Revolution:
Iron and Steel, Shipbuilding and Coal Mining**
inscribed on the World Heritage List in 2015

Prologue

World Cultural Heritage “Sites of Japan’s Meiji Industrial Revolution”

In July 2015, twenty-three sites across eight prefectures and eleven cities were registered as World Cultural Heritage Sites under the title, "Sites of Japan's Meiji Industrial Revolution: Iron and Steel, Shipbuilding and Coal Mining." These heritage sites comprised the first real serial nomination in Japan. The aim of a serial nomination is that several disparate sites across a wide geographical area may be nominated together as World Heritage Sites, for their shared cultural significance and historical legacy. We can better understand Japan's rapid industrialization in the sphere of heavy industry, a singular historical event, though viewing these sites together as a group. From the mid-19th century to the early 20th century, Japan became the first non-Western nation to achieve industrialization. Through this registration, let us trace the path towards Japan's industrialization.

Distribution of the Component Sites

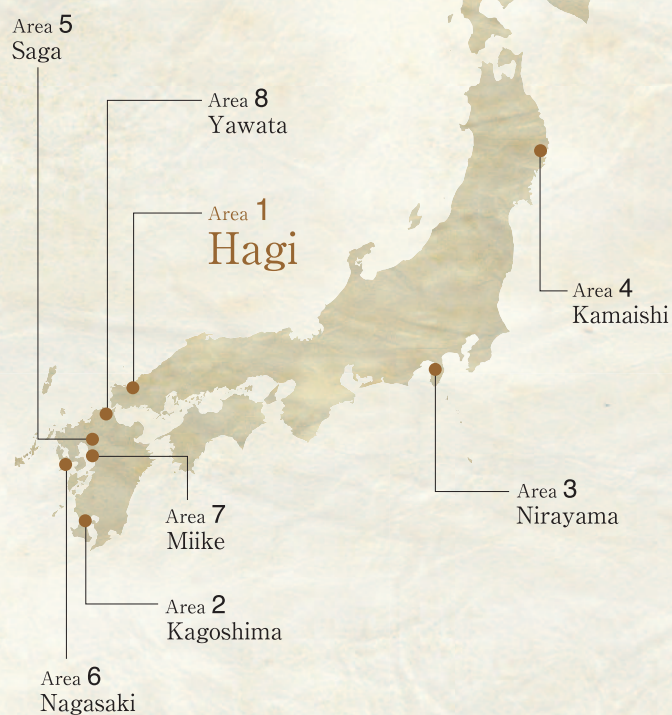


Table of the Component Sites of Japan’s Meiji Industrial Revolution

Area	Site	Number	Component Sites
1 Hagi	Hagi Proto-industrial Heritage	1-1	Hagi Reverberatory Furnace
		1-2	Ebisugahana Shipyard
		1-3	Ohitayama Tataro Iron Works
		1-4	Hagi Castle Town
		1-5	Shokasonjuku Academy
2 Kagoshima	Shuseikan	2-1	Shuseikan
		2-2	Terayama Charcoal Kiln
		2-3	Sekiyoshi Sluice Gate of Yoshino Leat
3 Nirayama	Nirayama Reverberatory Furnaces	3-1	Nirayama Reverberatory Furnaces
4 Kamaishi	Hashino Iron Mining and Smelting Site	4-1	Hashino Iron Mining and Smelting Site
5 Saga	Mietsu Naval Dock	5-1	Mietsu Naval Dock
6 Nagasaki	Nagasaki Shipyard	6-1	Kosuge Slip Dock
		6-2	Mitsubishi No.3 Dry Dock
		6-3	Mitsubishi Giant Cantilever Crane
		6-4	Mitsubishi Former Pattern Shop
		6-5	Mitsubishi Senshokaku Guest House
	Takashima Coal Mine	6-6	Takashima Coal Mine
	Glover House and Office	6-7	Hashima Coal Mine
		6-8	Glover House and Office
7 Miike	Miike Coal Mine and Miike Port	7-1	Miike Coal Mine and Miike Port
	Misumi West Port	7-2	Misumi West Port
8 Yawata	The Imperial Steel Works, Japan	8-1	The Imperial Steel Works, Japan
		8-2	Onga River Pumping Station

Chronological Development Phase of Three Industrial Typologies (1850s to 1910)

From the 1850s to 1910: Taking steps towards heavy industrialization (iron & steel manufacturing, shipbuilding and coal mining)

Phase	1850s	1910	
	Trial and Error Experimentation	Direct Importation of Western Technology	Full-blown Industrialization
Iron&Steel	Kagoshima Shuseikan Terayama Charcoal Kiln Sekiyoshi Sluice Gate of Yoshino Leat		Yawata The Imperial Steel Works, Japan Onga River Pumping Station
	Nirayama Nirayama Reverberatory Furnaces		
	Kamaishi Hashino Iron Mining and Smelting Site		
	Hagi Hagi Reverberatory Furnace Ebisugahana Shipyard Ohitayama Tataro Iron Works Hagi Castle Town Shokasonjuku Academy		
Ship-building	Kagoshima Shuseikan Sekiyoshi Sluice Gate of Yoshino Leat	Nagasaki Kosuge Slip Dock	Nagasaki Mitsubishi No.3 Dry Dock Mitsubishi Giant Cantilever Crane Mitsubishi Former Pattern Shop Mitsubishi Senshokaku Guest House
	Saga Mietsu Naval Dock		
		Nagasaki Glover House and Office	
Coal Mining		Nagasaki Takashima Coal Mine	Nagasaki Hashima Coal Mine
		Miike Misumi West Port	Miike Miike Coal Mine and Miike Port

Chronology of Events Relating to the Sites of Japan's Meiji Industrial Revolution

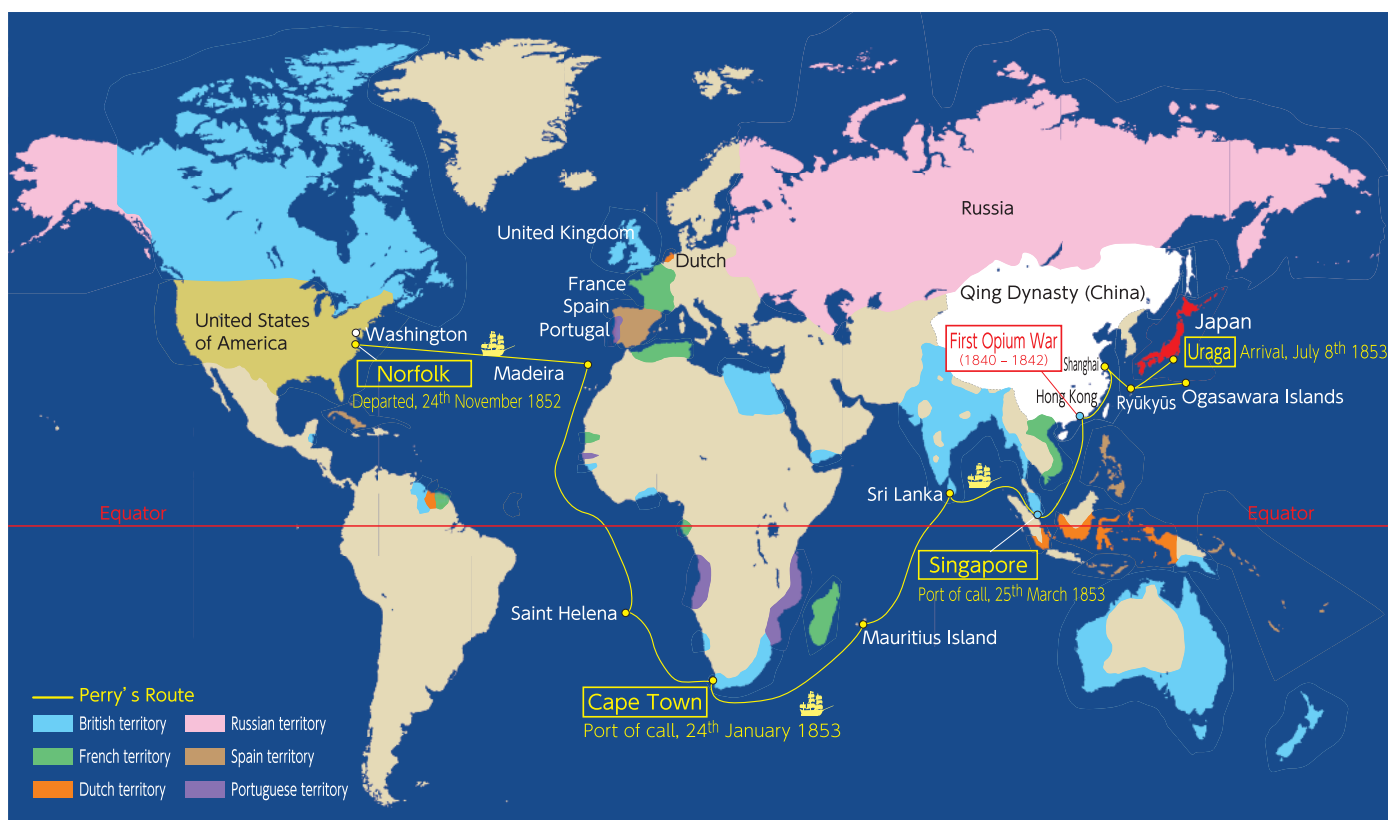
History of the Component Sites of Japan's Meiji Industrial Revolution		Historical Events in Japan and Abroad	
1604	Construction of Hagi Castle begins		
		The First Opium War (1840 – 1842)	1840
		First reverberatory furnace built in Saga domain	1850
1851	The Shuseikan project begins		
		Arrival of Perry's Black Ships	1853
		Ban on building large scale ships lifted	
		Conclusion of Convention of Kanagawa End of the Closed Country Policy	1854
1855	Reopening of Ohitayama Tataru Iron Works (3 rd time)	Establishment of Nagasaki Naval Training Center	1855
1856	Yoshida Shōin gives lectures at the Sugi house (beginnings of the Shokasonjuku Academy) Construction of Hagi Reverberatory Furnace as a trial run Establishment of Ebisugahana Shipyard		
1857	Construction of Shuseikan Reverberatory Furnace No.2 Completion of Nirayama Reverberatory Furnaces Work begins on Imperial Dock at Nagasaki		
1858	Establishment of Mietsu Naval Training Center (beginnings of Mietsu Naval Dock) Hashino Iron Mine successfully operated (Hashino Iron Mining and Smelting Site) Completion of Terayama Charcoal Kiln	Conclusion of Treaty of Amity and Commerce (United States – Japan)	1858
1863	Construction of Glover House and Office in Nagasaki	Bombardment of Kagoshima (Anglo-Satsuma War) The Chōshū Five travel to the United Kingdom in secret	1863
		The Shimonoseki Campaign	1864
1865	Completion of Shuseikan factory floor	Satsuma Students dispatched to the United Kingdom	1865
1867	Completion of Foreign Engineers' Residence at Kagoshima Textiles Mill	Taisei Hōkan (restoration of imperial rule)	1867
		Formation of the Meiji government	1868
1869	Completion of Kosuge Slip Dock Opening of Takashima Coal Mine (also known as Hokkeisei Mine)		
		Founding of the Ministry of Industry	1870
		Abolition of han system and establishment of prefectures	1871
		Establishment of Kōgakuryō (to become the Kōbu Daigakkō [Imperial College of Engineering])	
		Iwakura Mission dispatched to Europe and America	
1887	Opening of Misumi West Port		
		Promulgation of Meiji Constitution (Constitution of the Empire of Japan)	1889
1890	Hashima Coal Mine taken over by Mitsubishi and begins major production		
1891	Private railway opens for exclusive use of Miike Coal Mine (all lines opened 1905)		
		First Sino-Japanese War (1894 – 1895)	1894
		Announcement of construction of an Imperial Ironworks	1896
1898	Completion of Mitsubishi Former Pattern Shop at Nagasaki Shipyard Opening of Miike Miyanojima Mine		
1899	Completion of Imperial Steel Works, Japan site office		
1900	Completion of Imperial Steel Works foundry Completion of Imperial Steel Works repair factory		
1901	Operations begin at Imperial Steel Works		
1902	Opening of Miike Manda Mine		
1904	Completion of Mitsubishi Senshokaku Guest House at Nagasaki Shipyard	Russo-Japanese War (1904 – 1905)	1904
1905	Opening of Mitsubishi No. 3 Dry Dock at Nagasaki Shipyard		
1908	Opening of Miike Port		
1909	Installation of Mitsubishi Giant Cantilever Crane		
1910	Operations begin at Onga River Pumping Station		

Japan and the World in the Mid-19th Century

The Industrial Revolution marked a turning point in the course of human history. Power conversion and the establishment of automated factories were the important features of this age. Formerly, people, animals or natural forces had been used as sources of power. However, through the great power of the steam engine and the installation of complex factory machinery, production rapidly improved. By the mid-18th century, the Industrial Revolution was underway in the United Kingdom and by the early 19th century, the United Kingdom was established as the “World’s Factory.” As the origin of industrialization, the United Kingdom soon cornered the global markets. In reaction, other Western countries achieved industrialization in rapid succession. France and America particularly increased in power. By the mid-19th century, the West was markedly more advanced than the countries of East Asia, and met with opposition over tensions relating to market acquisition and colonization. In 1842, this difference became evident when Qing dynasty China, the most powerful of the Asian countries, lost the First Opium War to the United Kingdom. In 1853, Commodore Matthew Perry of the United States Navy sailed his Black Ships into Tokyo bay and the following year the Convention of Kanagawa was concluded, providing for the opening of Japan to the West. When examined as part of the big picture, these events demonstrate the wave of industrialization that was sweeping the globe.



Map of Japan made in London (1860s)
Empire of Japan (Hagi Museum Collection)



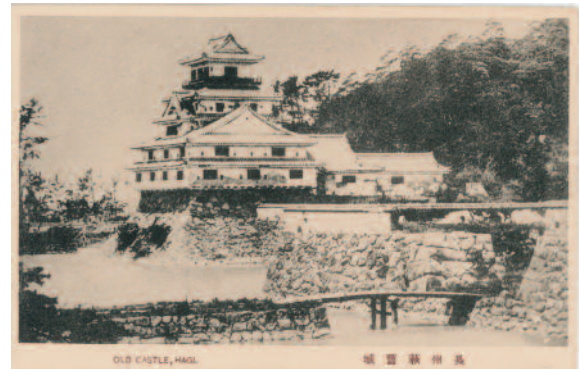
Made with the consultation of Tanaka Akira, *Nihon no Rekishi* ⑮ *Kaikoku to Ishin* (Shūeisha, 1992), *Chūgaku Shakai - Rekishi-teki Bunya* (Ōsaka Shoseki), and other texts

II

Hagi as a base for Industrialization by Trial and Error

The First Opium War (1840-42) caused a sense of impending crisis in Tokugawa Japan, and coastal defense became a priority. The Hagi (Chōshū) domain, with a long coast line and in close proximity to China, took sea defense very seriously. When Commodore Perry brought his Black Ships to Uraga in 1853, the Tokugawa Shogunate realized that Japan was unable to withstand the Western powers without military modernization. After more than 200 years of Tokugawa rule, the military strength of the clans was negligible. However, with change now an objective, the ban on the building of large ships was lifted and the casting of Western-style armaments was encouraged.

The strong clans of the south-west, including the Saga, Satsuma and Hagi clans, experimented with building warships and casting Western-style cannons. Guided by the government, other influential clans such as the Mito and the Fukui clans also committed to Western-style militarization. In this way, the feudal lords of many clans grappled with the process of industrialization from a military standpoint. However, imported Dutch texts were the sole source of reference, and there were many difficulties to overcome. Hagi Castle Town contains many examples of industrialization through “trial and error.”



Picture postcard of majestic Hagi Castle, symbol of the domain
Hagi Castle Picture Postcard (Hagi Museum Collection)



Picture postcard of the Hagi Castle Ruins provides a visual record of change
Hagi Castle Ruins Picture Postcard (Hagi Museum Collection)



Hagi Castle Town was built on a delta facing the Sea of Japan
Hagi Castle Town Illustrated Folding Screen
(Hagi Museum Collection)

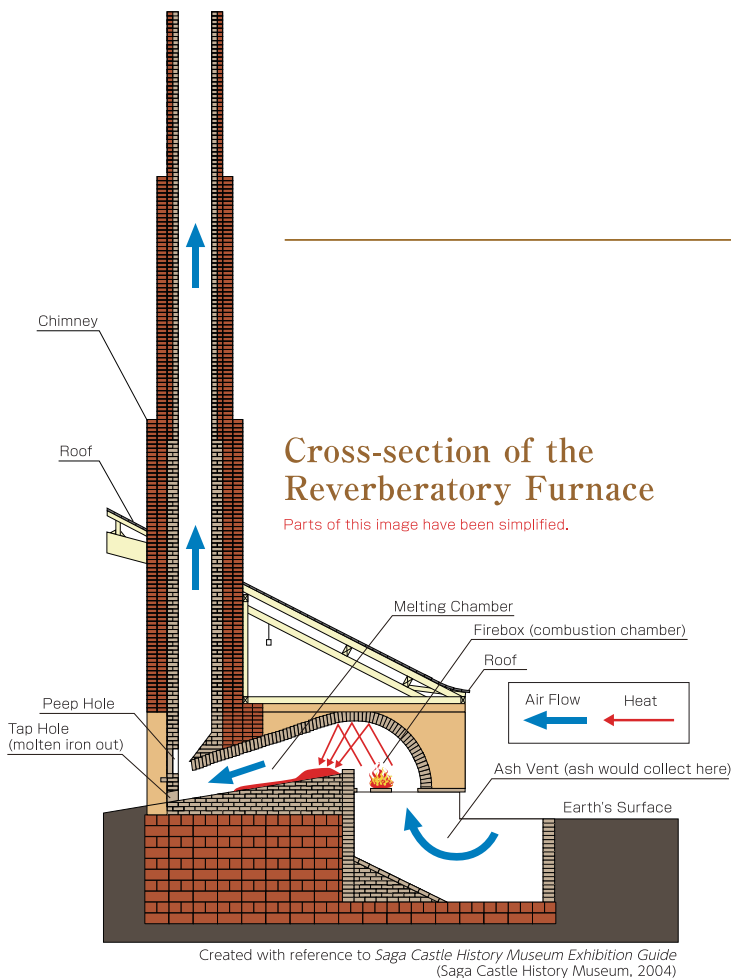
Military modernization of late Tokugawa Japan included the casting of Western-style cannons. Formerly, Japanese cannons were bronze-cast, but according to *The Casting Processes at the National Iron Cannon Foundry in Luik*, by Ulrich Huguenin, the casting of iron cannons was possible by the use of a reverberatory furnace. This Dutch text had been imported to Nagasaki and sparked interest in Japan.

The Saga clan constructed the first reverberatory furnace in Japan. Construction began in 1850 based on a translation of Huguenin's text. The clan successfully cast their first iron cannon in 1852. Government-sponsored reverberatory furnaces were constructed by Satsuma clan, Mito clan and at Nirayama Ward in Izu (present day Izunokuni City, Shizuoka Prefecture). Private furnaces were introduced in Ajimu (present day Oita Prefecture) and Ōdara (Okayama City).

The Hagi clan also constructed a reverberatory furnace as a trial from 1855-56, which was ultimately unsuccessful. However, this challenge represents an example of modernization through "trial and error" in Hagi.



Picture postcard of Hagi Reverberatory Furnace, taken around 1920
Hagi Reverberatory Furnace Picture Postcard (Hagi Museum Collection)



Construction of the Reverberatory Furnace

The reverberatory furnace was invented in Europe as a metallurgical furnace. The main feature of the reverberatory furnace was that foreign substances trapped inside the metal, such as carbon, were removed through the refining process. This produced a smooth metal, able to withstand even the explosive force of cannon fire.

Knowledge of reverberatory furnaces came to Japan through Dutch books. The first successful use of a reverberatory furnace in Japan was by the Saga clan in 1852. To withstand the military might of the Western countries, the Saga clan manufactured iron cannons, which were more powerful than traditional bronze cannons.

Hagi Reverberatory Furnace was based on that of the Saga clan. In this design, the furnace is located away from the chimney. Inside the arched furnace, flames and heat produced from combustion of fuel are reflected off the refractory roof of the firebox, allowing the heat to pass through the melting chamber and dissolve the metal. The 16m chimney of the Saga clan's reverberatory furnace pulled in great quantities of air, allowing the heat to surpass 1200 degrees Celsius.

IV

Shipbuilding and the Challenge of Modernization

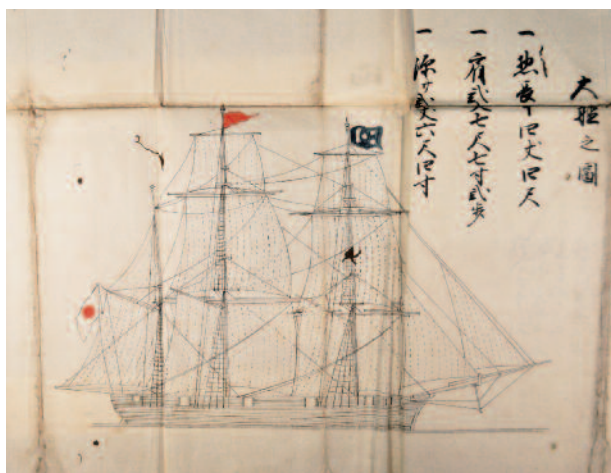
Along with Western-style cannons, warships were also necessary for naval defense. Besides the ships used by the Shogun or feudal lords, the only large ships in the Edo period were the wooden sengoku junks used in trade. Upon seeing Perry's powerful steam fleet, fruit of the industrial revolution, the uneasy Tokugawa Shogunate subsequently lifted the ban on the construction of large ships. As if in competition, the various clans around Japan began to challenge themselves with the construction of Western-style warships.

The Hagi (Chōshū) clan determined to build a warship in 1856, and constructed the "Heishin Maru" based on Russian techniques. In 1860, the second domain warship, the "Kōshin Maru" was constructed using Dutch techniques. Although both ships were Western-style vessels, they were wooden, as the construction of steam-powered ships was not yet possible with the current infrastructure. The remains of Ebisugahana Shipyard represent another site of modernization through trial and error.

The nails, anchors and other iron fittings were supplied by the Ohitayama Tataru Iron Works. As such, the construction of the Hagi domain warships represented a fusion of the modern and the traditional.



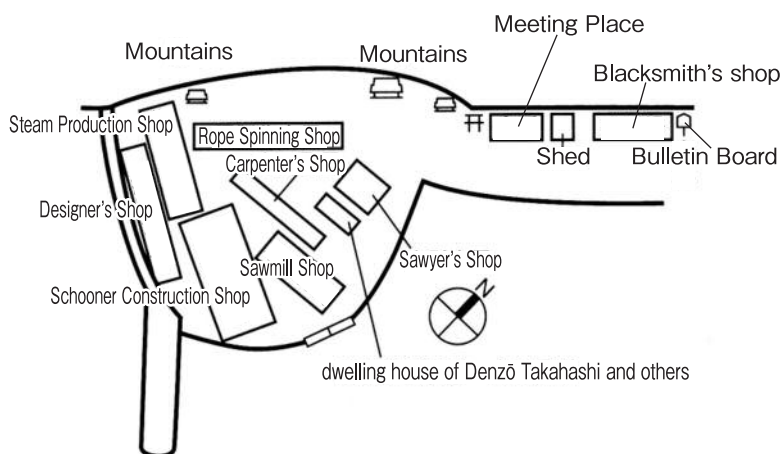
Heishin Maru, first Hagi (Chōshū) domain warship
Historical Documents Concerning the Building of the Heishin Maru
(Yamaguchi Prefectural Archives)



Kōshin Maru, second Hagi (Chōshū) domain warship
Historical Documents Concerning the Building of the Great Ship
(Yamaguchi Prefectural Archives)



Nails discovered at the Ebisugahana Shipyard
Objects excavated at the Ebisugahana Shipyard
(Hagi City Depository)



Layout of the Ebisugahana Shipyard

Commodore Matthew Perry was the herald of modernization in Japan, wrenching open the door to the “closed country.” The military scholar Yoshida Shōin had attempted to crack open this shell of isolation from within when he and his friend Kaneko Shigenosuke sought secret passage to America aboard Perry’s flagship. Perry denied the request, but was surprised at their curiosity, praising them as exemplifying the promise which Japan held, and praying that their lives would be spared.

Yoshida escaped decapitation and supervised the Shokasonjuku Academy, where he lectured his students on foreign affairs, based on the *Kon'yozushiki*, authoritative texts on world history and geography.

Yoshida concluded that the reason for the military might of the Western nations was the emphasis placed on engineering training. In order to strengthen Japan, Yoshida believed that engineering should be taught in schools and that workmen from outside the samurai class should also be accepted. Yoshida advocated engineering in education so fervently that we could even call him a “pioneer”.



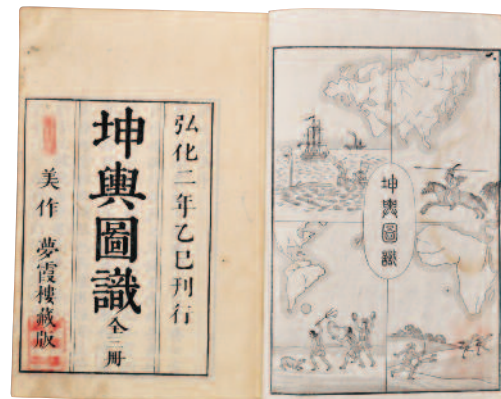
Military philosopher Yoshida Shōin educated his students on a wide variety of topics
Portrait of Yoshida Shōin (Shōin Shrine Archives)

Yoshida Shōin headed the Shokasonjuku Academy for 2 years, 10 months, from April 1856 – January 1859. He taught his students a variety of subjects, including military science, Confucianism, Japanese, history, geography, agriculture, economics.



Yoshida Shōin's epoch-making treatise on the necessity of engineering education
Bogo Yūshitsu Bunkō (Shōin Shrine Archives)

Around July and August 1858, Yoshida wrote a treatise titled “*On a School with an Attached Workshop*.” In the treatise, he insisted that the enhancement of national power should be based on human resources development, so talented people, regardless of status or educational background, should be offered an equal opportunity to receive practical education. This treatise was pioneering in advocating the necessity of engineering education. The manuscript exhibited here was not written by Yoshida Shōin himself. The original no longer exists.



Shokasonjuku Academy text on world geography and history
Kon'yozushiki (Hagi Museum Collection)



A geography and history of China read by Yoshida Shōin
Kaikokuzushi (Hagi Municipal Library Collection)

After 1860, the Tokugawa Shogunate dispatched delegations to the West for study. A group of five young students travelled from Hagi (Chōshū) to the United Kingdom in 1863. The group included Itō Hirobumi, pupil at Shokasonjuku Academy of Yoshida Shōin and his close friends Inoue Kaoru and Yamao Yōzō. Understanding the need for modernization in their native Japan, the Chōshū Five went to the United Kingdom to study industrialization for themselves, travelling in contravention of Japan's isolationist policy. These five young men had the rare chance to experience life in an industrialized nation.

Following the Meiji restoration, Itō and Yamao formed the Ministry of Industry, which unified the mining, iron manufacturing, lighting, railway, telegraph, and other industries necessary for modernization. Yamao also petitioned for an engineering school, and ceaselessly supported the Imperial College of Engineering upon its foundation. This school was the realization of Yoshida Shōin's dream of engineering in education.

The desire to stand on an equal footing with the powerful Western countries propelled Japan's rapid modernization. A miracle of history, Japan became the first non-Western industrialized nation between the late 19th century and the early 20th century.



Endō Kinsuke Itō Hirobumi
Inoue Masaru
Inoue Kaoru Yamao Yōzō

The Chōshū Five - Architects of the Meiji Industrial Revolution
Photograph of the Secret Hagi (Chōshū) Study
Abroad Group (Hagi Museum Collection)

1 Inoue Kaoru - Architect of the Cutting-Edge Japan Mint

Portrait of Inoue Kaoru (Hagi Museum Collection)

Inoue Kaoru oversaw the construction of the Japan Mint in Osaka in 1869. In 1875, Inoue also served as the second Minister of Industry for one year, and held other important public offices throughout his life.

2 Yamao Yōzō - Founder of Engineering Education in Japan

Photo of Yamao Yōzō (Hagi Museum Collection)

Yamao Yōzō helped found the Ministry of Industry, and advanced both engineering education and education for the blind in Japan. Serving as Assistant to the Minister of Industry in 1872, he went on to serve as the fourth Minister of Industry in 1880.

3 Endō Kinsuke - Mechanization of Minting at the Japan Mint

Photo of Endō Kinsuke (Mint Museum Collection)

Endō Kinsuke became Director of the Japan Mint in 1881. He established his own method for casting copper coins, without relying on the help of foreign advisors.

4 Inoue Masaru - Railway Construction and Technological Development

Photo of Inoue Masaru

As Director of Railways, Inoue Masaru was in charge of establishing the first railways in Japan, beginning with the opening of a line between Shinbashi and Yokohama in 1872. He also worked hard to train Japanese engineers.



1



2



Itō Hirobumi - Minister of Industry who Laid the Foundations for Industrialization
Portrait of Itō Hirobumi (Hagi Museum Collection)

Itō Hirobumi was the only one of the Chōshū Five to have attended the Shokasonjuku Academy. In 1871, Itō became Vice-Minister, and then in 1873, the first Minister of Industry. He also became the first Prime Minister of Japan in 1885.



3



4

The Chōshū Five and The Imperial College of Engineering

In 1871, Itō Hirobumi and Yamao Yōzō established the Kōgakuryō (Engineering School) in response to support for the introduction of engineering in education. In 1873, the Scottish engineer Henry Dyer was invited to Japan and participated in the conception and planning of the school. In 1877, the Kōgakuryō was renamed the Kōbu Daigakkō (Imperial College of Engineering). Dyer took up the post of President and Professor of Civil and Mechanical Engineering. Until 1882, when he returned to the United Kingdom, Dyer committed himself to the training of Japanese engineers. Today, the Imperial College of Engineering has become the Faculty of Engineering of the University of Tokyo.



Successive Chōshū Five Members Acted as Minister of Industry

Photo of the Ministry of Industry Main Entrance

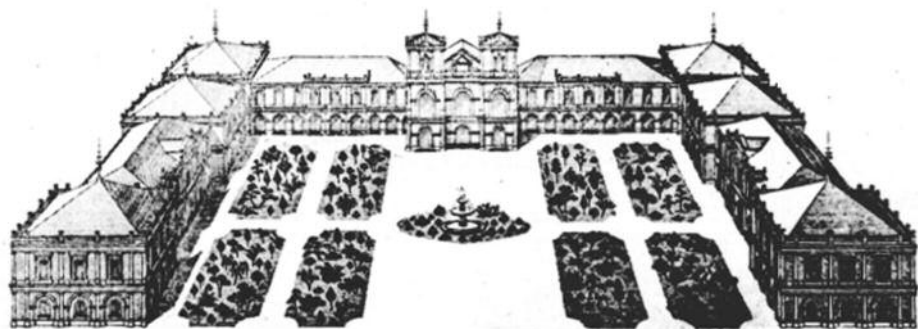
The Ministry of Industry was established in 1870 and was the heart of government-managed industry in Japan for the next fifteen years until 1885. Out of the Chōshū Five, Itō Hirobumi was the first Minister of Industry, Inoue Kaoru the second and Yamao Yōzō the fourth. The position of Vice-Minister of Industry was also held by Inoue Masaru. Furthermore, the third Minister of Industry was another Shokasonjuku Academy alumni, Yamada Akiyoshi.



Yamao Yōzō - Champion of Engineering in Education and the Imperial College of Engineering

Photo of the Imperial College of Engineering (Hagi Museum Collection)

Yamao Yōzō petitioned the government to train engineers for Japan's advancement. Acknowledging this need, the Ministry of Industry founded the Institute of Engineering at Toranomon, on the site of the former Nobeoka residence, in 1873.



Layout of the Imperial College of Engineering

Image courtesy of the National Diet Library Archives

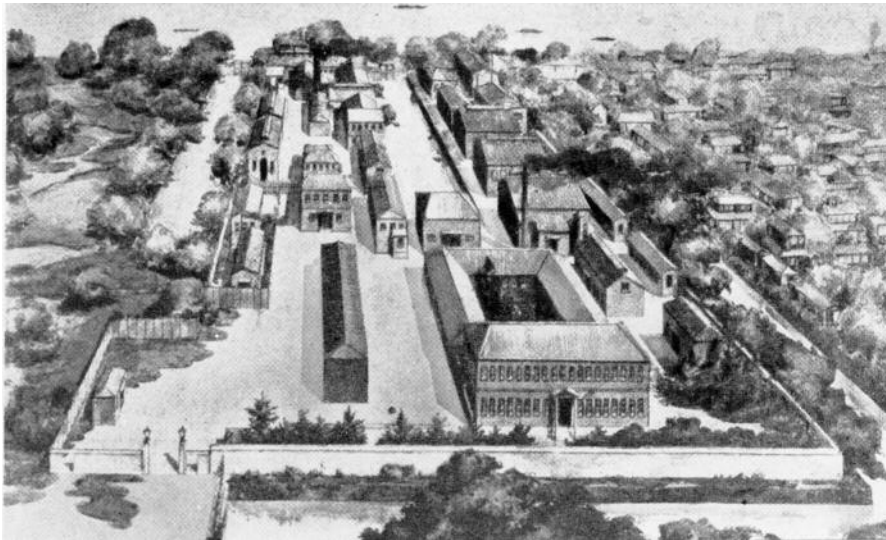
Contribution to the Industrialization of Japan Made by Students of the Shokasonjuku Academy

The Shokasonjuku Academy has long been known for training many of the talented people who would push forward Japan's modernization during the late Tokugawa and early Meiji period. However, until recently it was not widely acknowledged that many of its students went on to enter the field of industrial technology. Some examples are Masaki Taizō, first president of the Tokyo Vocational School (now the Tokyo Institute of Technology), Watanabe Kōzō, Director of Nagasaki Shipyard and Iida Toshinori, a rail engineer.

First President of the Tokyo Vocational School, Masaki Taizō

Image courtesy of Tokyo Institute of Technology

Masaki Taizō was a student of the Shokasonjuku Academy who studied in the United Kingdom in 1871. Masaki made efforts to invite British teachers of the natural sciences back to Japan, and upon returning home, became president of the Tokyo Vocational School (now the Tokyo Institute of Technology).



Full view of the Tokyo Vocational School, around 1890

Image courtesy of Tokyo Tech Museum and Archives

1 Watanabe Kōzō, who Modernized Shipbuilding at Nagasaki Photo of Watanabe Kōzō (Hagi Museum Collection)

Watanabe Kōzō studied abroad in the United Kingdom. He returned to Japan in 1873 after six years of study. He oversaw the work of the Ministry of Industry Imperial Shipyard at Nagasaki, working continually to modernize shipbuilding in Japan. With the founding of Nagasaki Shipyard Bureau in 1883, he was inaugurated as Shipyard Director.



1

2 Iida Toshinori and the Advancement of the Kansai Area Rail Network Photo of Iida Toshinori (Shōin Shrine Collection)

Iida Toshinori was a student of the Shokasonjuku Academy who studied abroad in the Netherlands. Upon his return, he entered the Ministry of Industry and served as Assistant-Commissioner of Railways, in charge of rail construction in the Kansai area. Iida made great efforts in the training of Japanese engineers.



2

Map of Hagi



Hagi Meiringakusha Visitor Center

602 Ban-chi, Emukai, Hagi

■ Opening Times 09:00-17:00

■ Entrance Fee Main Building/Free
Building No.2/Adult: 300 yen, High School Student: 200 yen,
Elementary or Middle School Student: 100 yen (20% discount for groups)

■Parking Standard-sized car:~180 spaces (310 yen/car)
Large Bus/Coach: 10 spaces (1,030 yen/coach)

Large Bus/Coach: 10 spaces (1,030 yen/coach)
 ■Enquiries Hagi Meiringakusha Visitor Center TEL 0838-21-0304

World Heritage Visitor Center (Hagi Meiringakusha Visitor Center Building No.2)

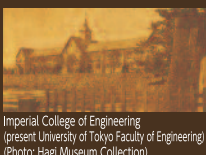
Of all the sites registered as World Heritage under Sites of Japan's Meiji Industrial Revolution, it was from Hagi's sites that Japan's modernization began. Come and learn about the important role that Hagi's 5 World Heritage Sites played in kick-starting Japan's modernization, and the impact that Yoshida Shōin had on engineering education in Japan. Information is presented enjoyably through easy-to-understand pictures, panels and animations.



Shokazonjaka Academy, classroom 100100



try pumping Shimayama Tataru iron works bellows



(photo: Field Museum collection)



Tourist Information Centers:

Hagi City Tourism Dept. TEL 0838-25-3139 (weekdays only)

Hagi Tourism Association TEL 0838-25-1750

NPO Hagi Sightseeing Guide Association TEL 0838-25-3527

Hagi Hotel Cooperative Association TEL 0838-25-7599

Publisher

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