Fathi Habashi

My Trips in the Far East

2015

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Volume derived from

Fathi Habashi

Department of Mining, Metallurgy, and Materials Engineering
Laval University, Quebec City, Canada

2015

The Book

The present volume is derived from *De Re Metallica. A Metallurgist on the Move*, which is a diary of the trips the author has undertaken during his professional career. He visited many industries, universities, research centres, and museums and participated in many conferences. The book therefore reflects the state of extractive metallurgy since he left his home country Egypt and went to study in Vienna. *De Re Metallica* is in seven volumes fully illustrated mainly by coloured photographs. It includes a short history of the place visited and its main sightseeing sites. Volume 1 Egypt, Volume 2 Canada, Volume 3 United States, Volume 4 Latin America, Volume 5 Asia [in two parts], Volume 6 Europe [in two parts], and Volume 7 Russia & other countries. Total number of pages was 5500.

Since these volumes could not be separated and therefore they will not be available to many readers, I decided to split the book into selected 29 small units, each representing one country or a group of countries closely related geographically. The present volume is one of these volumes.

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Fathi Habashi, Professor Emeritus at Laval University in Quebec City. He holds a B.Sc. degree in Chemical Engineering from the University of Cairo, Dr. techn. degree in Inorganic Chemical Technology from the University of Technology in Vienna, Dr. Sc. *honoris causa* from the Saint Petersburg Mining Institute, Dr. *h.c.* from National Technical University in Lima, and Dr. *h.c.* from San Marcos University also in Lima. He held the Canadian Government scholarship at the Mines Branch in Ottawa, taught at Montana College of Mineral Science & Technology, then worked at the Extractive Metallurgical Research Division of Anaconda Company in Tucson, Arizona, before joining Laval in 1970. His research was mainly directed towards organizing the unit operations in extractive metallurgy and putting them into a historical perspective.

Published by:

Métallurgie Extractive Québec
800 Alain, #504, Québec City, Québec, Canada G1X 4E7
Tel.: (418) 651-5774. E-mail: Fathi.Habashi@arul.ulaval.ca
http://pages.infinit.net/habashi
http://works.bepress.com/fathi_habashi/

Distributed by:

Laval University Bookstore Zone
Pavillon Maurice-Pollack, Cité Universitaire, Québec City, Canada G1V 0B4
Tel.: (418) 656-2600, Fax: (418) 656-2665
E-mail: conseiller@zone.ul.ca

Dépôt légal 2015

- Bibliothèque nationale du Québec, Montréal
- National Library of Canada, Ottawa

ISBN 978-2-922686-39-5

Fathi Habashi, *My Trips in the Far East.*

Page set up in Québec City by **Jean-François Morin**.

Printed in Québec City by **Les Copies de la Capitale, Inc.**

Métallurgie Extractive Québec is a non-profit publisher registered in Québec City #2240676462 devoted to diffusion of extractive metallurgy literature.

To Nadia,
Hani, and Hatem
with love

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Published by Métallurgie Extractive Québec, Québec City and distributed by Laval University Bookstore except otherwise stated.

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Preface

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1	Arab Countries	Jordan, Kuwait, Morocco, Syria, Tunis
2	Austria	
3	Australia & Southeast Asia	Australia, Cambodia, Indonesia, Malaysia, Philippines, Thailand, Vietnam
4	Balkans	Albania, Bosnia, Bulgaria, Croatia, Greece, Romania, Serbia, Slovenia
5	Baltic Countries	Latvia, Lithuania, Poland
6	Brazil	
7	Canada	
8	Caribbean	Cuba, Puerto Rico, Venezuela
9	Caucasus	Armenia, Azerbaijan, Georgia
10	Central Asia	Afghanistan, Kazakhstan, Mongolia, Uzbekistan
11	Central Europe	Czech Republic, Slovakia, Hungary, Switzerland
12	Chile and Argentina	
13	China	
14	Egypt	
15	England and France	
16	Germany	
17	Iberian Peninsula	
18	India	
19	Italy and Vatican	
20	Japan and Korea	
21	Low Countries	

22	Mexico	
23	Middle East	Iran, Turkey
24	Peru and Bolivia	
25	Russia	
26	Scandinavia	
27	South Africa	
28	USA	

I hope in this way the book will available to a large number of readers.

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Japan

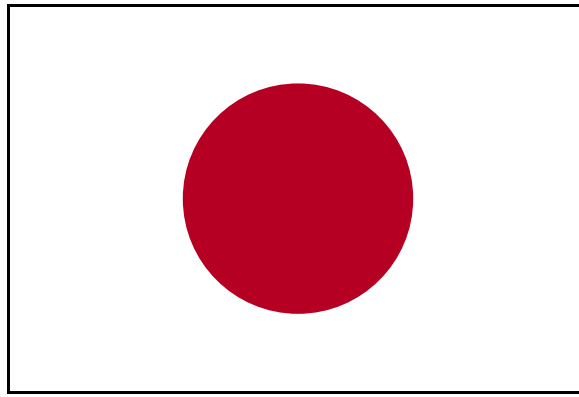

Figure 1.1: Flag of Japan.

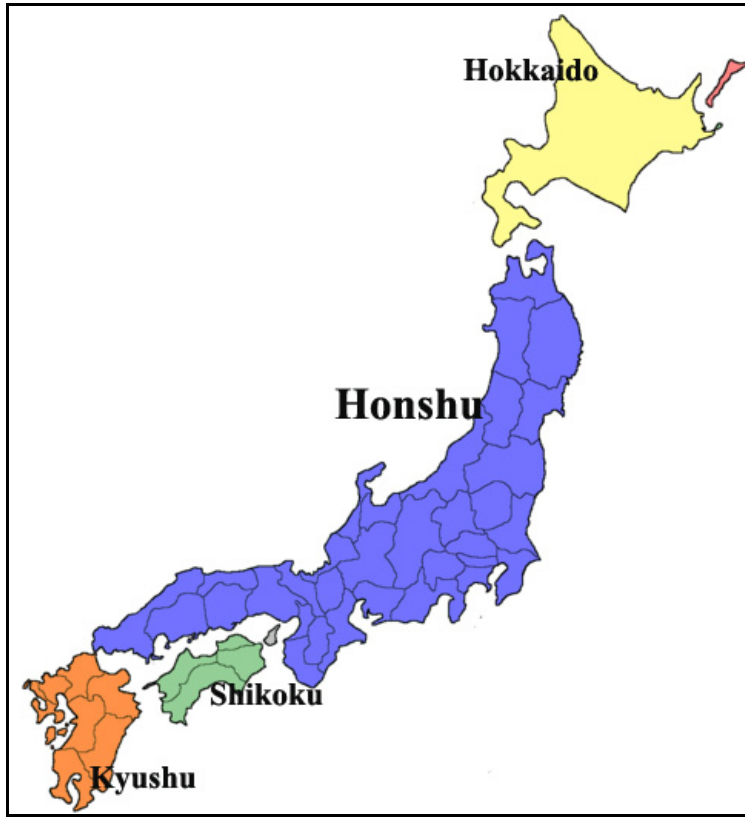

Figure 1.2: Main Japanese islands.

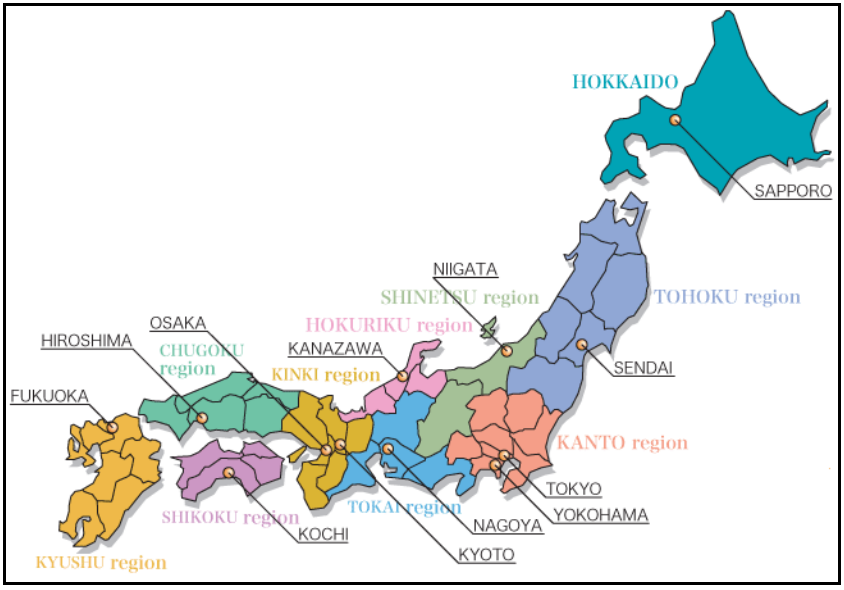

Figure 1.3: Japan main cities.

INTRODUCTION

Population in Japan is around 130 million living in on the main four islands: Hokkaidō, Honshū, Shikoku, and Kyūshū (Figure 1.2). All the islands are connected either by bridges or tunnels. The major cities are shown in Figure 1.3.

History

The word "Japan," like so many things Japanese, comes from China. Literally, the Chinese ideograph for Japan (日本) means "Sun-origin." The Chinese pronounce the words as Jihpen, the Japanese as Nihon, from which comes Nippon. In ancient times China was the dominating power in Asia and was a model for other neighbouring countries especially Japan. The Japanese adopted similar hieroglyphs like in China and many other customs. Although the ancient Chinese have mastered casting of bronze, produced metallic zinc and white copper (a copper–nickel alloy) before the Europeans, and Marco Polo had reported on the splendour of Chinese court in the thirteenth century, mining and metallurgy were taught in China only towards the end of the nineteenth century. A similar situation existed in Japan, and both countries were closed societies that were opened only by Christian missions and foreign traders supported by gunboat diplomacy. Trade with China was already in the hands of the Arabs, Persians, and

Turks for many centuries but opening these societies to the West was considered essential after the Industrial Revolution in England to keep its textile mills and blast furnaces in operation.

Feudalism in Japan

Before the mid nineteenth century, Japan was not interested to have commercial or cultural relations with the rest of the world. The Japanese emperor was a ceremonial figure, living powerless in the ancient capital Kyōto. For centuries the power had rested in the hands of a military leader called the shōgun (Figure 1.4) who ruled from Edo (the present Tōkyō). He was helped by feudal lords, called daimyō, who dominated the provinces. The daimyō (Figure 1.5) lived in fortified castles (Figure 1.6), controlled vast territories and had an army of warriors called samurai (Figures 1.7–1.8) who defended their estates in the provinces, and prized obedience and loyalty to their lords. The samurai fought with bows and arrows and with swords. They were like the European knights of the Middle Ages except that in Europe the knights disappeared already many centuries earlier.

Figure 1.4: A shōgun.

A closed society

In the early seventeenth century, alarmed by the behaviour of European traders and missionaries, the Japanese government expelled all foreigners and forbade Japanese to travel abroad. The islands were cut off from the outside world except some Dutch merchants who were allowed, under strict regulations, to have a trading post on an Island in Nagasaki Bay. There were some Japanese scholars, however, who read books imported by the Dutch

and understood that knowledge was increasing among the Europeans and argued that it was time for Japan to open its gates and admit new ideas. But such voices were ignored or suppressed by the government. For example, the German physician on the island in Nagasaki Bay Philipp Franz von Siebold (1796–1866) (Figure 1.9) was expelled from Japan in 1828 and his Japanese interpreter was put to death when it was learned that he was collecting information about Japan. Von Siebold wrote numerous books about Japan, its fauna and flora between 1832 to 1853 and was a major contributor about Japanese civilization to the Western world.

Figure 1.5: A Japanese daimyō.

Figure 1.6: A typical Japanese medieval castle.

Figure 1.7: Samurai archer.

Figure 1.8: Samurai with sword.

Figure 1.9: Philipp Franz von Siebold (1796–1866).

JAPAN OPENS TO THE WEST

Gunboat diplomacy

When US Commodore Matthew C. Perry (1794 –1858) (Figure 1.10) arrived at Uraga Harbour in July 1853 he was told that he would have to leave and sail to Nagasaki, the only Japanese port open to foreigners. He refused and ordered a limited bombardment to demonstrate US naval power. Forced to allow Perry ashore, delegates of the Japanese emperor were presented a letter by Perry asking to supply US ships with food and water and for agreements to trade. He then departed and promised to return for the reply. In February 1854, Perry returned with more ships. He found a treaty waiting for his signature that complied to all of the demands by the US Government.

The treaty has been described as one of the major American diplomatic successes of the 19th century. The shōgun and his advisers were impressed by the ships and guns and decided to agree. When he returned to the United States, Commodore Perry was awarded by Congress for his service. He edited the three volume set entitled, "Narrative of the Expedition of an American Squadron to the China Seas and Japan," published in 1852–1854. As soon as the USA was allowed to trade, other Western nations demanded and had to be given the same rights. Perry is honoured in his home town (Figure 1.11) and also on US and Japanese postage stamps (Figure 1.12).

Figure 1.10: US Commodore Mathew C. Perry (1794–1858).

Figure 1.11: Monument to US Commodore Mathew C. Perry in Touro Park, Newport, Rhode Island.

Figure 1.12: Commodore Mathew C. Perry on postage stamps.

The Meiji reign

Many Japanese were furious at the Perry agreement, especially the samurai. Some of them attacked foreigners, but this only made matters worse, as the shōguns then had to pay compensation. The situation, however, changed in 1868 when Emperor Mutsuhito (Figure 1.13) came to power and ensured the supremacy of the imperial government. He adopted the name *Meiji* for his reign and moved the imperial court to Edo, which was re-named 'the eastern capital' or Tōkyō. The *daimyō* were reduced from being lords of their provinces to being simply governors representing the emperor; the country was divided into prefectures with prefects taking orders from the emperor's ministers. The army and the navy were reorganized copying the most successful European models, a ministry of education was founded, the first newspapers appeared, the European (Gregorian) calendar was adopted, and freedom of worship to all religions was allowed.

The government did its best to encourage trade and industry in the Western style. The first railway, between Tōkyō and the port of Kanagawa (now known as Yokohama), was opened in 1872, and by the end of the century Japan had over 6 000 kilometres of railway and by 1900 she was able to make for herself whatever she needed, including heavy steel goods. All this was supported by a banking service copied from the USA. Postal service, telegraphic service, customs service, meteorological observation, a science museum, and light houses were also started during this period. The years following the Meiji Restoration of 1868 and the fall of the Shōgunate trans-

formed Japan from a feudal and backward society to a modern industrial state.

Figure 1.13: Japanese Emperor Mutsuhito (1852–1912), whose reign was known as Meiji. He overthrew feudalism and led reform towards Westernization.

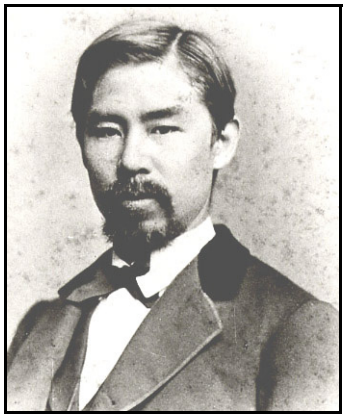

Figure 1.14: Joseph Hardy Neesima (1843–1890).

Renaissance

In 1875, Joseph Hardy Neesima (1843–1890) (Figure 1.14), a Japanese convert to Christianity and the first Japanese to study in USA, founded the Dōshisha College in Kyōto, a Christian establishment which literary means "One-Purpose Institution," to become over the years Dōshisha University

(Figure 1.15), one of the most important in Japan today. The Academy of Foreign Languages was evolved in 1877 into the University of Tōkyō.

Figure 1.15: Dōshisha University.

The Japanese sent delegations and students around the world to learn western arts and sciences to enable Japan to compete with the Western powers. British advisors were sent to Japan to train, advise and educate the naval establishment, while students were in turn sent to Great Britain in order to study and observe the Royal Navy. Many of Japan's warships were built in British and French shipyards. Nationwide conscription was enforced in 1873, military schools and arsenals were built and Japan turned towards the Prussian Army as the basis for its army.

Industrialization

Problems however resulted from hiring foreign specialists. In 1877, a *samurai* revolt broke out led by a man who thought that change had gone too far. In fierce fighting the revolt was crushed, but the changes were not all gain for the common people; many of them suffered those same evils that had happened to many European workers when their countries went through an industrial revolution.

Industrialization of the mining sector in Japan had also its problems because the engineers did not consider proper waste disposal. In the 1890s the Ashio Copper Mine was responsible for the destruction of large portions of the Kanto Plain through SO_2 emission and other effluents released into the Watarase and Tone rivers. With the livelihoods and health of thousands of farmers at stake, the Ashio Pollution case quickly became a problem for Meiji social reformers. In 1907, Ashio's miners erupted in a three day outburst of violence unprecedented in Japanese labour history. Using dynamite and arson Ashio's angry miners destroyed a large part of Japan's most modern mining complex. In the end it took a declaration of martial law, the use of government troops, and a heavily augmented police force to suppress the riot. By 1910 the Furukawa Company's Ashio Copper Mine stood not only for environmental degradation, but symbolized the darker and more violent side of Japan's transformation into a modern industrial state and economy.

Sending students abroad

Students were sent abroad to get Western education. For example, the Freiberg Mining Academy received 45 Japanese students from 1765 to 1939 to study geology, mining, and metallurgy (Figure 1.16) but this number was very small as compared with the 801 Russian students and 324 US students.

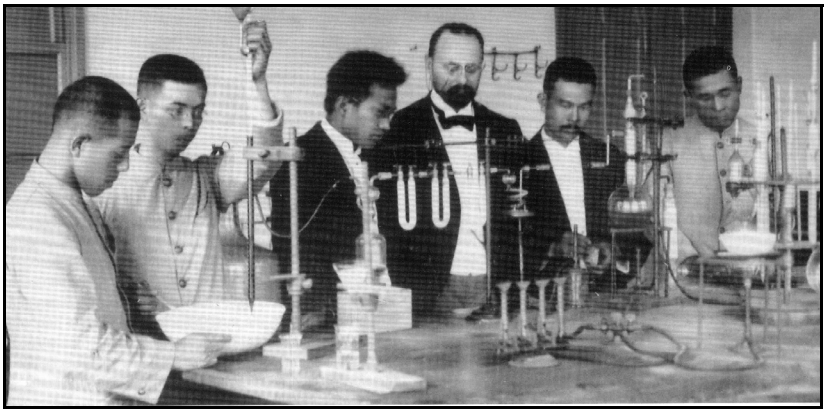

Figure 1.16: Professor Emil Bahlsen at the Freiberg Mining Academy with his Japanese students [Bergakademie Freiberg].

Hiring foreign specialists

Another way to accelerate westernization of the country was hiring foreign specialists. Japan actively hired experts from Europe and USA to help her developing science and technology. It is estimated that more than 3 000 were hired by the Government and thousands more in the private sector. They were highly paid; in 1874, they numbered 520 men, during which time their salaries represented 33.7% of the annual budget. They were usually contracted for three years after which Japanese replacements took over their places. The system was officially terminated in 1899. Nevertheless similar employment of foreigners persists in Japan, particularly within the national education system and professional sports. Until 1899, more than 800 hired foreign experts continued to be employed by the government, and many others were employed privately. Also many German medical doctors were hired to teach medicine at the University of Tōkyō. Some of the prominent foreign engineers who worked in Japan were:

- William P. Blake (1826–1910) (Figure 1.17) was born in New York City, graduated in 1852 from Yale University, worked as a chemist in New Jersey Zinc in Baltimore (1852–1854), appointed geologist for Pacific Railroad (1854–1856), went to Japan to organize the first School of Mines (1861–

1863). When back home he was appointed professor of geology and mining, then director School of Mines, University of Arizona (1895–1905).

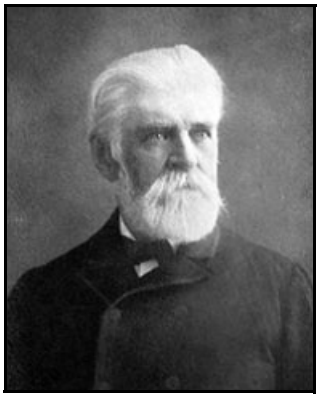

Figure 1.17: William P. Blake (1826–1910).

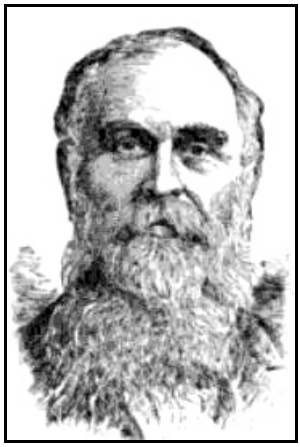

Figure 1.18: Benjamin S. Lyman (1835–1920).

- Benjamin Smith Lyman (1835–1920) (Figure 1.18) was born in Northampton, Massachusetts. He graduated from Harvard University in 1855. After working briefly as a school teacher, he went to study at the École Impériale des Mines in Paris (1859–1860) and at the Freiberg Mining Academy in Saxony (1861–1862). Upon returning to the United States, he opened a consulting mining engineering office in Philadelphia. In 1870, Lyman surveyed oil fields in the Punjab for the Public Works Department of the government of British India.

In 1872, he was hired by the Japanese government to survey the coal and oil deposits of Hokkaidō and along the Sea of Japan coastline of Honshū. His survey identified the most promising coal fields for Hokkaidō's eventually successful coal industry. He stayed in Japan from 1873–1879 as chief geologist and mining engineer to the Meiji government (Figure 1.19). He published the first geological map of Hokkaidō in 1876. Before leaving Japan, he encouraged his assistants to form the Geological Society of Japan and to publish a journal. He donated his house to the new society for use as its headquarters. Lyman returned to Northampton, and spent the next several years working on his reports.

- John Milne (1850–1913) (Figure 1.20), a British geologist from Liverpool, studied at King's College, Royal School of Mines, and Freiberg Mining Academy. He obtained doctorate from Oxford University then worked in Cornwall, Central Europe, Newfoundland, and Labrador (1872–1874). He taught geology and mining at Tōkyō Imperial College of Engineering, now the University of Tōkyō (1875–1895). He invented the seismograph in 1880

and was co-founder of the Japanese Earthquake Society. He returned to England with his Japanese wife in 1895 and authored: *Earthquakes*, 1883, *Seismology*, 1888, and *Miner's Handbook*, 1894.

Figure 1.19: Lyman and his students in Tōkyō.

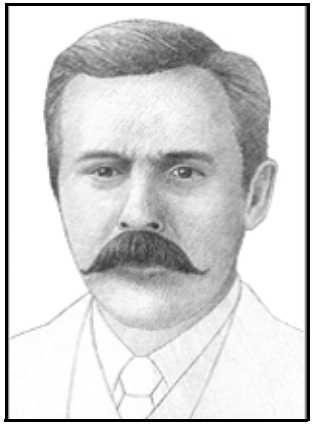

Figure 1.20: John Milne (1850–1913).

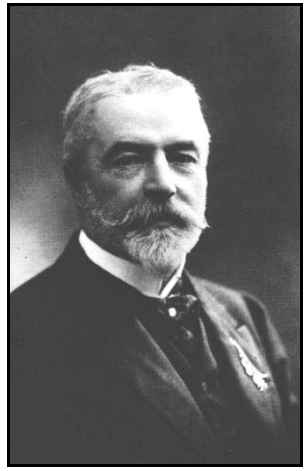

Figure 1.21: Curt A. Netto (1847–1909).

- Curt Adolf Netto (1847–1909) (Figure 1.21) was born in Freiberg, Saxony. His father was a mine inspector. After graduation from the Freiberg Mining Academy he volunteered in the German Army, was wounded in the French–Prussia War of 1870–1871, and was awarded the Iron Cross. In 1873 he went to Japan to work in a silver refinery in Kosaka, Akita Prefecture. In 1877 he joined the Imperial College of Engineering to teach mining and metallurgy. His metallurgy lectures were translated in Japanese by his students in 1887 and it remained for a long time as a useful book. Before

leaving Japan in 1886 he was received by the emperor who decorated him with the Order of the Rising Sun. When back in Germany, Netto continued his metallurgical researches.

In 1947, a group of engineers at Japan Iron and Steel Institute celebrated Netto's hundredth birthday anniversary in recognition for his service to the Japanese mining and metallurgical industries.

JAPANESE IMPERALISM

Annexation of Korea

As a newly emergent country, Japan turned its attention towards Korea's coal and iron ore deposits. Korea was under Chinese influence and opinion was split: conservatives wanted to retain the traditional relationship with China, while reformists wanted to establish closer ties with Japan and western countries. China had two Opium Wars [1839–1842 and 1856–1860] with England and a war with France when France in 1884 wanted to control the Red River, which linked Hanoi to Yunnan province in China. This rendered China weak and was unable to resist western intervention. After some confrontation incidents with China, Japan in 1876 sent a military force that seized the Korean emperor, occupied the Royal Palace in Seoul, and replaced the existing government with members pro-Japanese (Figure 1.22).

Figure 1.22: Annexation of Korea, 1876.

Annexation of Port Arthur and Taiwan

The First Sino-Japanese War then took place between August 1, 1894 and April 17, 1895. The Japanese eventually defeated the Chinese and entered Pyongyang then took Lü-shun (Port Arthur) (Figure 1.23). Another Japanese force landed in Taiwan (Figure 1.24). This ended Chinese influence in Korea and established Japan as the dominant power in Asia.

Figure 1.23: Annexation of Port Arthur [Lü-shun] on the southern tip of Liandong Peninsula [see previous map].

Annexation of Sakhalin

Russia then persuaded Germany and France to join her in applying diplomatic pressure on Japan. This resulted in 1898 Russia signing a 25-year lease on Liaodong Peninsula and proceeded to set up a naval station at Port Arthur which infuriated the Japanese. Tensions between Russia and Japan increased. During the Boxer Rebellion in China, Russia sent troops into Manchuria to suppress the uprising. On the night of February 8, 1904, the Japanese fleet attacked Russian ships at Port Arthur and on 27 May 28, 1905 and the Japanese occupied the Sakhalin Island (Figure 1.25).

Figure 1.24: Annexation of Taiwan in 1895.

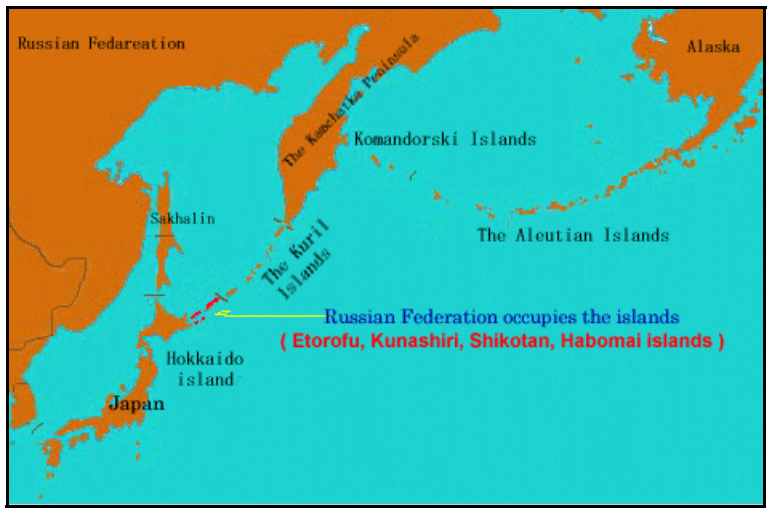

Figure 1.25: Annexation of Sakhalin, 1905.

Intervention in China

Following World War I, Japan saw Manchuria as a supply of raw materials. After Chiang Kai-Shek succeeded in unifying China in 1928 civil wars broke out between different factions. In addition, the Chinese Communists revolted against the central government. This situation provided an opportunity for Japan to further its goals. After five months of fighting the puppet state Manchukuo [Manchuria] was established in 1932 with the last

emperor of China installed as its head of state (Figure 1.26) The Japanese then formed a Mongol Military Government in 1936.

Figure 1.26: Japanese intervention in China.

In the early 1937 the Japanese occupied Shanghai and took Nanking then capital of the Republic of China. The Nanking massacre was an infamous genocidal war crime committed by the Japanese military on December 13, 1937. A large museum in Nanking [now Nanjing] commemorates the massacre of 300 000 victims (Figure 1.27).

Figure 1.27: Entrance to Nanking Museum.

Attack of Pearl Harbor

On December 7, 1941, the Japanese attacked Pearl Harbor in Hawaii (Figure 1.28), which brought the United States into the war. During World War II, Japan invaded Vietnam, Indonesia, and the Philippines (Figure 1.29).

Figure 1.28: Japan attacks Pearl Harbor.

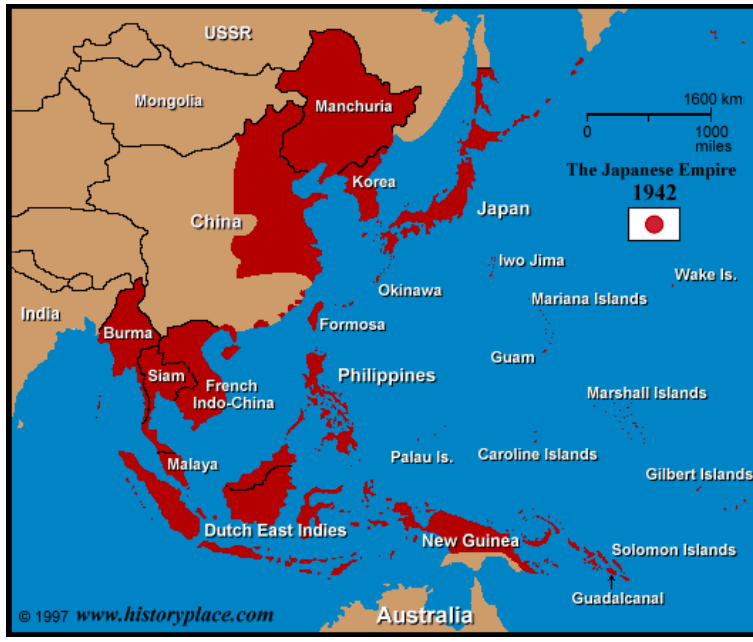

Figure 1.29: The Japanese Empire at its zenith in 1942.

Fall of the empire

The dropping of the atomic bombs (Figures 1.30–1.32) and the Soviet entry into the war against Japan ended the Empire. Emperor Hirohito (1901–1989) officially capitulated to the Allies on August 15, 1945 (Figure 1.33), and the official surrender was signed aboard the battleship USS Missouri on September 2, 1945 giving back Manchuria, Taiwan, and the Pescadores Islands to China.

Figure 1.30: Hiroshima bomb on August 6, 1945 and Nagasaki bomb on August 9, 1945.

The Japanese war criminals were judged at the International Tribunal of the Far East held in Tōkyō. Prime Minister Tojo (1884–1944) (Figure 1.34) and five generals were hanged, sixteen others were sentenced to life imprisonment, six of whom died in prison. In other trials outside Tōkyō (2 200 in all) conducted by the major Allies, more than 4 300 individuals were convicted of whom 984 received the death sentence and 475 to life imprisonment. Emperor Hirohito was granted immunity from prosecution, although all the evidence points to his implication in the planning of aggressive war. He was forced to renounce his divine status.

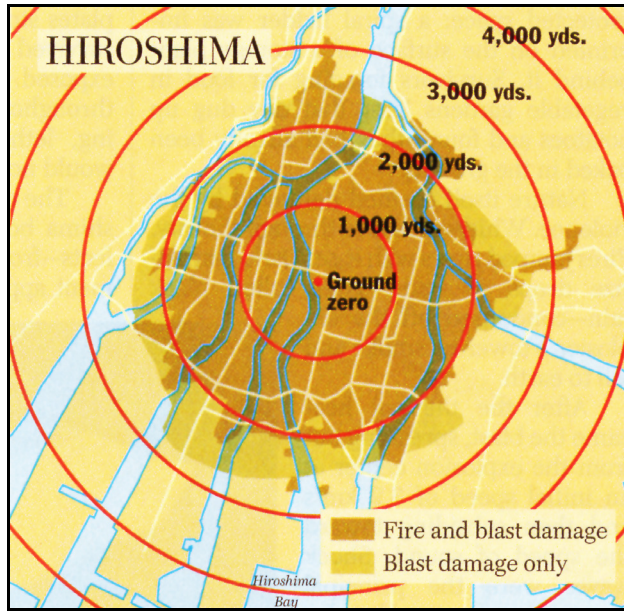

Figure 1.31: Damage done to Hiroshima by the first atomic bomb.

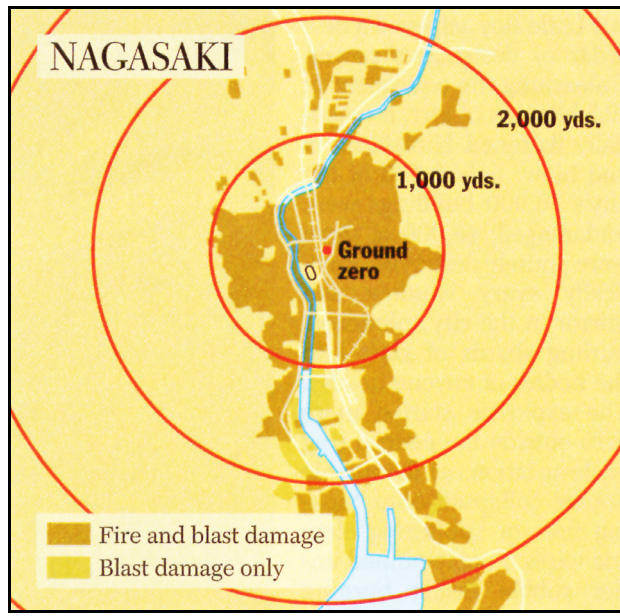

Figure 1.32: Damage done to Nagasaki by the second atomic bomb.

Figure 1.33: Emperor Hirohito recording the surrender speech on August 14, 1945.

Figure 1.34: Prime Minister Tojo (1884–1944).

MODERN JAPAN

Figure 1.35 shows Japanese universities.

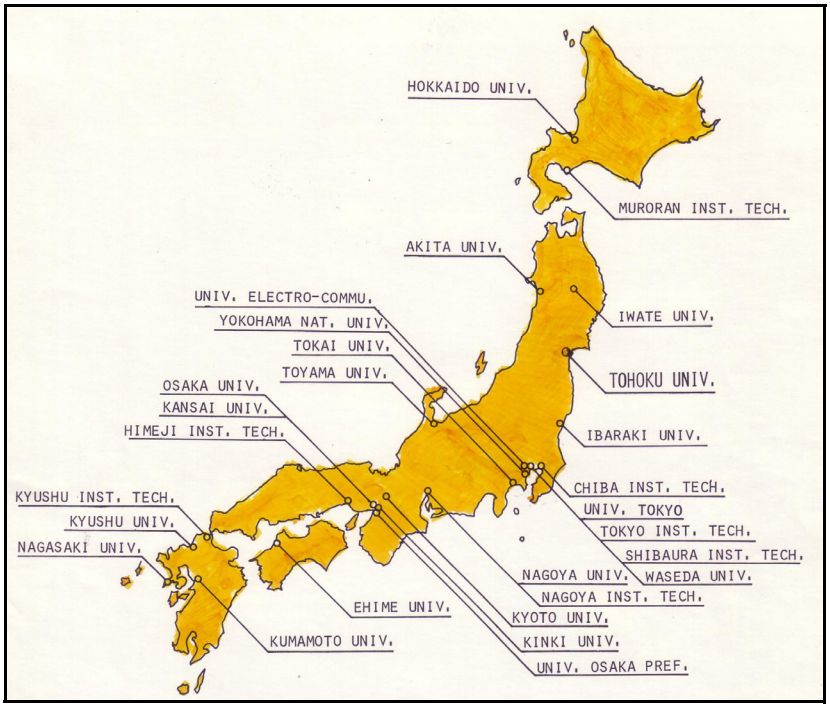

Figure 1.35: Some Japanese universities in 1990.

Japanese visitors

The first Japanese professors to visit Department of Mining & Metallurgy at Laval University was Tadai Nagai (Figure 1.36) from Hokkaidō University, Sapporo in northern Japan who came to Quebec City in March 1973 after attending the AIME conference in USA. He was interested in pressure hydrometallurgy and published work on the aqueous oxidation of pyrite and the precipitation of nickel by hydrogen at high temperature and pressure.

He was followed in October 1989 by Takashi Sakaguchi (Figure 1.37) from Department of Chemistry, Miyazaki Medical College on Kyūshū Island in south of Japan (Figure 1.38). He was interested in adsorbing uranium from sea water on biomass produced from certain sea weeds.

Figure 1.36: Tadai Nagai.

Figure 1.37: Takashi Sakaguchi.

A few days later came Nakamichi Yamasaki (Figure 1.39) from Kōchi University on Shikoku Island also in southern Japan. He was a specialist in hydrothermal reactions. He constructed a number of autoclaves of different sizes in his Research Laboratory of Hydrothermal Chemistry. Later he became interested in asbestos and came in October 2006 with his student Yoshihiko Oke to visit the asbestos plant in Asbestos, Quebec.

Professor Satoru Asai (Figure 1.40) from Chemical Engineering Department in Ōsaka came in October 1995. Professor Toshihiro Tanaka (Figure 1.41) from Ōsaka University came in October 2008.

Figure 1.38: Location of Miyazaki.

Figure 1.39: Nakamichi Yamasaki.

Figure 1.40: Satoru Asai.

Figure 1.41: Toshihiro Tanaka.

Japanese co-workers

- Tadaaki Mizoguchi (Figure 1.42) from Tōhoku University came as a Post-doctoral Fellow to work on the pressure leaching of complex sulfides.

- Kunishige Naito (Figure 1.43) from Ibaraki University who came also as a Post-doctoral Fellow to work on pressure leaching of lead sulfide concentrates.

Figure 1.42: Tadaaki Mizoguchi.

Figure 1.43: Kunishige Naito.

VISITS TO JAPAN IN CHRONOLOGICAL ORDER

Table 1.1: Visits to Japan in chronological order.

Dates	Places visited	Purpose of visit
November 8–18, 1990	Tōkyō	Cultural visit
	Kitakyūshū	International Symposium on Processing of Rare Metals
November 30–December 11, 1994	Takamatsu	First International Conferences on Solvo-thermal Reactions
	Kōchi	University of Kōchi
	Tōkyō	Mitsubishi Materials Research Center
December 15–20,1996	Takamatsu	Second International Conferences on Solvo-thermal Reactions
August 26–September 4, 1997	Takamatsu	Third International Conferences on Solvo-thermal Reactions
	Kyōto	
October 11–13, 2001	Akita	Fourth International Conference on Materials Engineering
November 12–December 1, 2007	Tōkyō	University of Tōkyō
	Sendai	Tōhoku University
	Ōsaka	Ōsaka Prefecture University
		Ōsaka University
	Nara	Cultural visit
	Sakawa	International Symposium on Aqua Science, Water Resource, and Innovation Development of Countryside

CONFERENCES IN JAPAN

Japanese researchers organized many conferences to which I was invited. Such conferences were generously subsidized and all expenses were paid by the Organizing Committees.

Rare Metals

The International Symposium on Processing of Rare Metals was held at Kokura, Kitakyūshū, Kyūshū Island (Figure 1.44) in 1990 by Z. Kouzuka, T. Oki, K. Morinaga, and Y. Ueda. My presentation was entitled "Rare Earth Metals and Their Position in the Periodic Table," published in the proceedings volume on pages 47–52.

Figure 1.44: Location of Kitakyūshū.

Figure 1.45: Akira Yasawa. Photo by Nadia Habashi, 1990.

It was there at the conference that I met Professor Akira Yasawa, formerly at Tōhoku University and at that time President of Miyagi National College of Technology (Figure 1.45).

Figure 1.46: With Professor Tadai Nagai [second from right] in the Aquarium.

Solvo-thermal Reactions

The First International Conferences on Solvo-thermal Reactions was held in 1994, the Second in 1996, and the Third in 1997, all in Takamatsu on Shikoku Island (Figure 1.47). The Third Conference was organized jointly with the International Conference on High Pressure Science and Technology that was held at Dōshisha University in Kyōto.

Figure 1.47: Location of Takamatsu.

Figure 1.48: Japanese dinner at the First International Conferences on Solvo-thermal Reactions held at Takamatsu in 1994.

Figure 1.49: Group photo of some participants at the Third International Conferences on Solvo-thermal Reactions held at Takamatsu in 1997.

Materials Engineering

The 4th International Conference on Materials Engineering was held in Akita under the auspices of Akita University on October 11–13, 2001 (Figure 1.50).

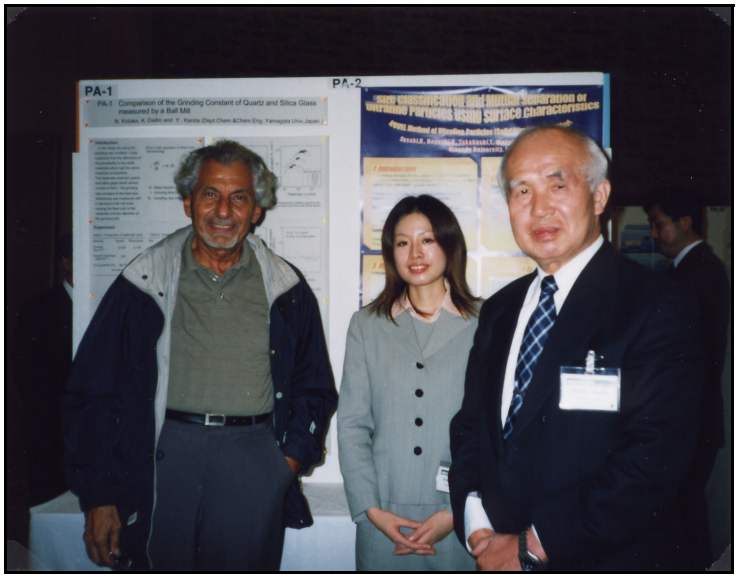

Figure 1.50: With Prof. Hiroshi Sasaki (Waseda University in Tōkyō) and his graduate student Sonoko Sokiya at the conference in Akita in 2001.

Aqua Science

This conference was organized by Sakawa Town Municipality Government in Kōchi Prefecture, and the Research Institute on Aqua Science and Technology in November 26–30, 2007. It was supported by the Iron & Steel Institute of Japan, the International Solvothermal & Hydrothermal Association, and Shikoku Electric Power Company in Kōchi & Nakamura Branch. It was held at Sakuraza Building in Sakawa. The town of Sakawa is located 28 km west from Kōchi Railway Station (Figures 1.51–1.52). Conference Chairman was Professor Emeritus Nakamichi Yamasaki formerly of Kōchi University and presently associated with Ōsaka University.

Figure 1.51: Main street in Sakawa.

Figure 1.52: With Professor Fangming Jin in front of Sakawa Railway Station. Prof. Jin is Director, Institute of Carbon Cycle Technology, School of Environmental Science & Engineering at Tongji University in Shanghai, China. She organized the Second Aqua Science Conference in Sanya, China, in 2009.

The conference scope was focussed on the basic science related to aqueous, vapour, and supercritical state of water. Topics such as structure, characteristics, thermodynamics, fluid dynamics, and phase equilibria in aqueous systems. For example, solubility of polar and non-polar materials, interaction of water and mineral formation in nature, sedimentary process of limestone in Sakawa, biomass resource using aqueous and water technology, material formation using hydrothermal process as reaction media, paper industry and water, lime industry and water, recycling and waste treatment, energy and CO_2, CH_4 problems, economy and ecology for establishment of sustainable society, innovation development in countryside using water and solar energy, treatment of asbestos, sludge, and slags, treatment waste containing toxic and hazardous materials such as radioactive waste, heavy metals, and chlorinated organic compounds.

The conference therefore, covered a wide rang of topics related to water, air, and soil. The organizers believed that Earth's future is facing a turning point due to the drastic ecological changes brought by human civilization. They planned to hold this symposium in this little town of Sakawa in Kōchi Prefecture whose population is only 15 000.

It is quite rare to have an international conference in a small municipality like this, but this symposium has been planned not only for scientists but also for public officials of local governments so that they can play an important role in helping put our world on a path towards environmental and ecological sustainability. Participants were about 120 mainly from Japan but also from China, Canada, USA, United Kingdom, Thailand, Indonesia, India, Taiwan, Korea, Finland, Singapore, Colombia, and Uganda.

A welcoming luncheon, a banquet with folk dancing, and a closing ceremony. Participants got a book of the program and Extended Abstracts as well as 450-page Proceedings Volume, very well edited, handsomely produced, and fully indexed.

Figure 1.53: Lunch with Eramoya, Mayor of Sakawa.

Figure 1.54: The opening ceremony.

Figure 1.55: Saki ceremony.

Figure 1.56: Banquet st Sakawa Conference.

Calcium Carbonate plant

A trip was organized to a local limestone quarry (Figure 1.57) and a local chemical plant producing nano-particle size calcium carbonate for the chemical industry. The Shiraishi Kogyo Kaisha Company was founded in 1909 by Tsuneji Shiraishi to manufacture nano-particles of calcium carbonate by calcining limestone, slurrying CaO produced with water, then reacting it with CO_2 (Figure 1.58). Calcium carbonate formed was used for toothpaste manufacture, as extender in pigments, rubber industry, plastics, paper, and other applications.

Figure 1.57: Guides at limestone quarry near Sakawa.

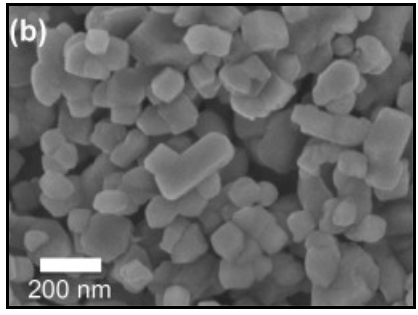

Figure 1.58: Photomicrograph of cubic calcite nano-particles.

Tōkyō

Tōkyō was originally a small fishing village named Edo It was first fortified by the Edo clan, in the late 12th century, and in 1457, a castle was built. In 1590, Tokugawa Ieyasu made Edo his base and when he became shōgun in 1603, the town became the center of his nationwide military government. During the subsequent Edo period, grew into one of the largest cities in the world with a population topping one million by the 18th century. There is a regular bus service between Narita International Airport and Haneda National Airport (Figure 1.59).

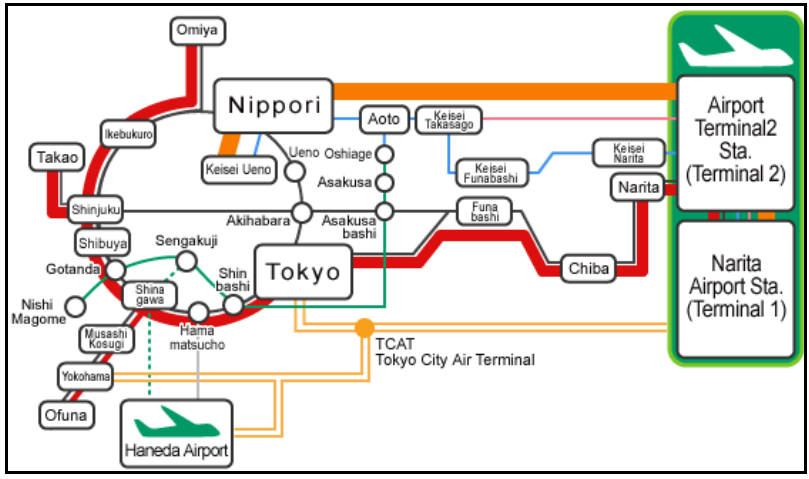

Figure 1.59: Airport transportation.

University of Tōkyō

The first courses on mining and metallurgy in Japan were taught at the newly-founded Imperial College of Engineering in Tōkyō in 1877 by Curt Adolf Netto. The Imperial College became in 1886 Tōkyō Imperial University (re-named University of Tōkyō in 1947). From Tōkyō University graduated the distinguished Japanese metallurgist Kotaro Honda (1870–1954) (Figure 1.60). After studying in Europe from 1907 to 1911, he returned to Japan to become a professor at the Tōhoku Imperial University. He developed the thermal balance and was the first to develop in 1916 the cobalt steel for permanent magnets. He became the president of the Tōhoku Imperial University in 1931. He received many medals and awards.

Figure 1.60: Kotaro Honda (1870–1954).

Figure 1.61: With students at Tōkyō University in 2007. Prof. Toyohisa Fujita [sitting] and Research Associate Dr. Gjergj Dodbiba [in white shirt, standing].

Mitsubishi Materials Research Centre

The Mitsubishi Companies is a multinational was first established two years after the Meiji Restoration as a shipping firm in 1870. The name is translated as "three diamonds" (Figure 1.62). It first entered into coal-mining to gain the coal needed for ships then founded an iron mill to supply iron to the shipbuilding yard. It then started a marine insurance for its shipping business. It expanded further into the manufacture of aircraft, in paper, glass, electrical equipment, oil, and others. It played a central role in the modernization of Japanese industry.

National Museum of Japanese History

The Museum is located in Sakura near Tōkyō, founded in 1872 as the first museum in Japan. New pavilions were added.

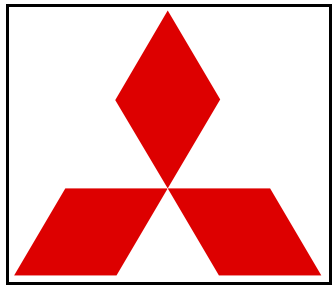

Figure 1.62: Logo of Mitsubishi.

Figure 1.63: Mitsubishi Materials Research Centre in Ōmiya, near Tōkyō.

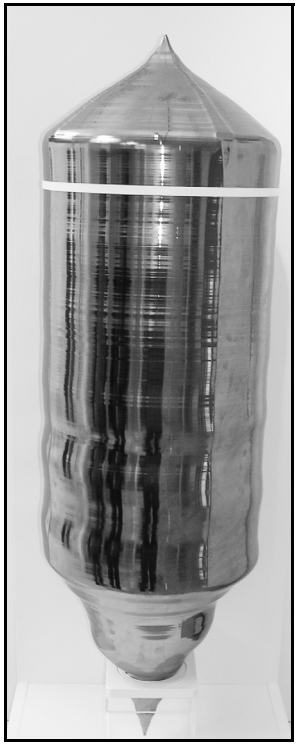

Figure 1.64: Synthetic silicon single crystal.

Figure 1.65: With Dr. Iwao Iwasaki and his assistants in 1994 during his brief stay as Director of Mitsubishi Materials Research Centre in Ōmiya, near Tōkyō.

KYŌTO

Kyōto (Figure 1.66) is in the central part of the island of Honshū, has a population close to 1.5 million. It was formerly the imperial capital until the transfer of the imperial court to Tōkyō in 1869 after the rebellion of 1864 that burnt down most of the city. It has many temples and shrines (Figures 1.67–1.68). The International Conference on High Pressure Science & Technology was held in August 1997 in Dōshisha University in Kyōto (Figures 1.69–1.72). Paper presented: "Hydrothermal Precipitation of Metals". The abstract was published in the Abstract Volume of the conference page 343.

Figure 1.66: General view of Kyōto.

Figure 1.67: One of the temples visited near the Railway Station.

Figure 1.68: One of the temples visited near the Railway Station.

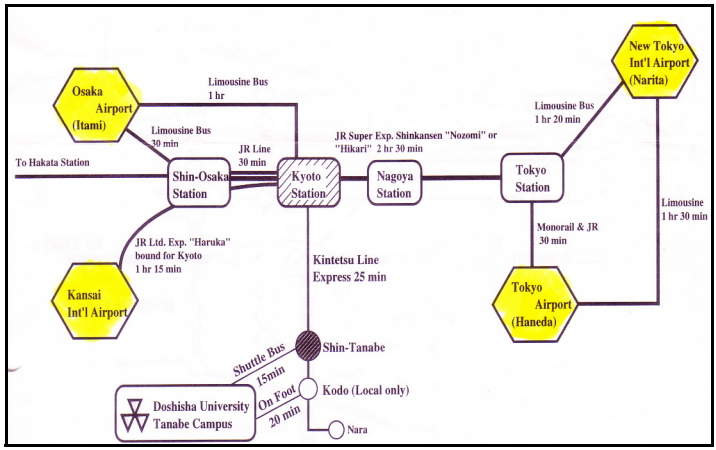

Figure 1.69: Access to Kyōto.

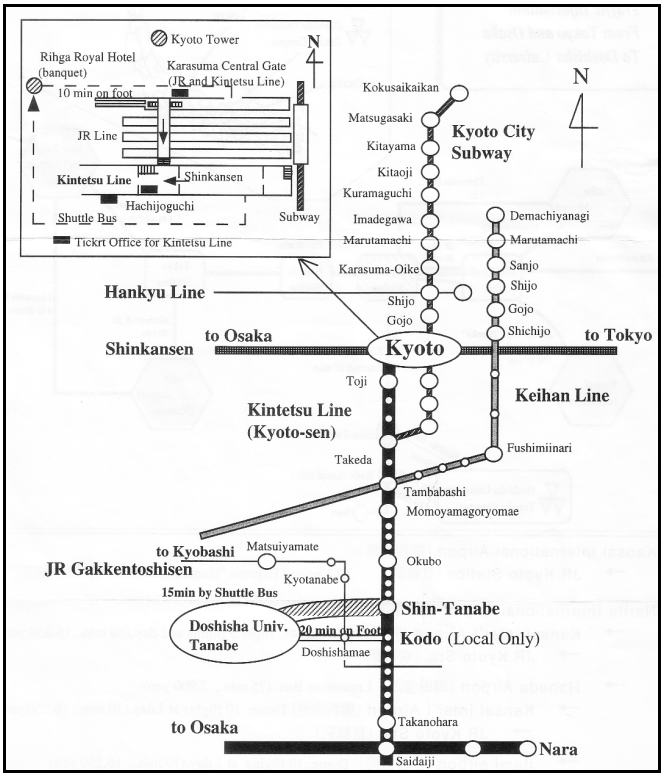

Figure 1.70: Access to Dōshisha University from Kyōto.

Figure 1.71: International Conference on High Pressure Science & Technology, Kyōto 1997.

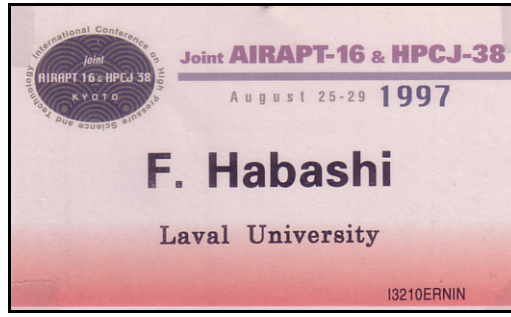

Figure 1.72: Conference badge.

AKITA

Akita (Figure 1.73) remained largely isolated from Japanese society because it was separated from the principal Japanese centres of commerce and politics by the mountain ranges to the east.

Figure 1.73: Location of Akita.

Akita University

Akita Mining College was founded in 1910 in Akita City as the first mining college in Japan. Akita Prefecture has been well known as a rich area in mineral resources for many years and the foundation of a College there was a result of combined effort of the Prefecture Government and the mining companies. The college started with two programs: mining and metallurgy based on the Mining Academy in Freiberg as a model. Over the years, the College expanded and became known as Akita University. In addition, the University has an excellent Mining Museum (Figure 1.74) with a large collection of minerals, fossils, and models of metallurgical plants. Host was Professor Toyohisa Fujita and his Albanian assistant Gjergj Dodbiba. Both moved later to University of Tōkyō.

Akita Zinc

In Akita Zinc (Figure 1.75), the concentrate is roasted, leached, and zinc is recovered by electrowinning. The residue from leaching, mainly zinc ferrite and gangue, is heated at 115 °C in autoclaves in sulfuric acid and SO_2 so that iron will be present in the ferrous state. After filtration to remove the gangue, gallium and indium are recovered then the solution is heated at 200 °C in autoclaves in presence of oxygen to precipitate Fe_2O_3 (Figure 1.76). Zinc is then recovered from solution. This is the only process in the world for iron oxide production from zinc.

Figure 1.74: Mining Museum at Akita University.

Figure 1.75: Akita Zinc.

SENDAI

Sendai is located on the east-north coast of Honshū Island. It was founded in 1600 by daimyō Date Masamune (Figure 1.77).

Tōhoku University

Tōhoku University was founded in 1907 as the third Imperial University of Japan, following Tōkyō Imperial University and Kyōto Imperial University. It has about 20 000 students.

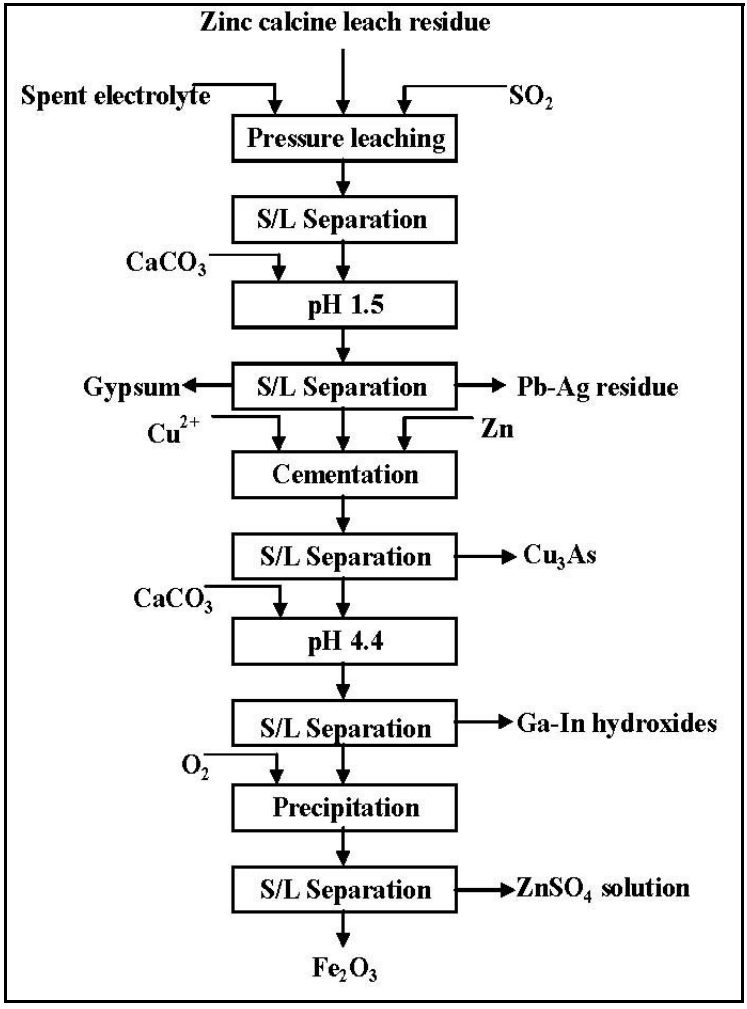

Figure 1.76: Precipitation of Fe_2O_3 in zinc industry in Japan by oxygen in autoclave.

Figure 1.77: Statue of daimyō Date Masamune founder of Sendai.

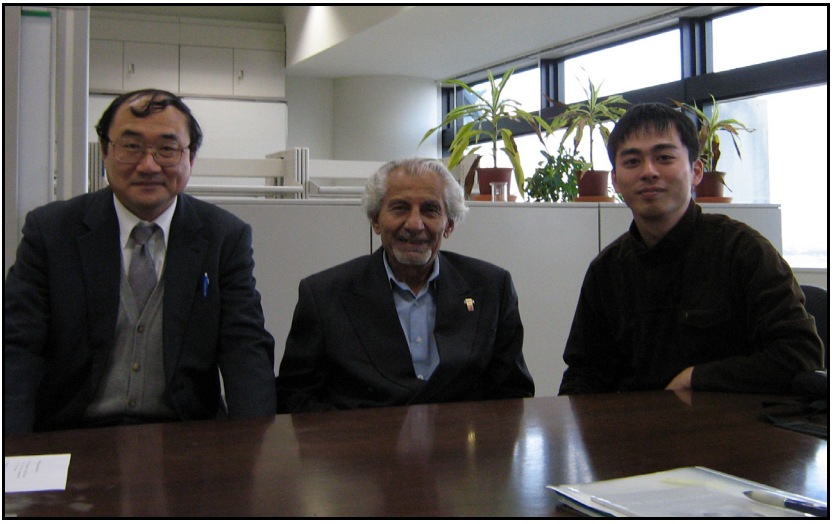

Figure 1.78: With Professor Toshiyuki Hoshida and his student Hiro.

Tōhoku University Museum of Natural History

Figure 1.79: With guide at Tōhoku University Museum of Natural History.

ŌSAKA

Ōsaka is the third largest city by population after Tōkyō and Yokohama (Figure 1.80). It was host to the 1970 World Fair. This was the first World's Fair held in Japan. The terrain is now a large park known as Ōsaka Exhibition Memorial Park. The symbol of the exhibition was the *Tower of the Sun* (Figure 1.81). The park includes an art museum.

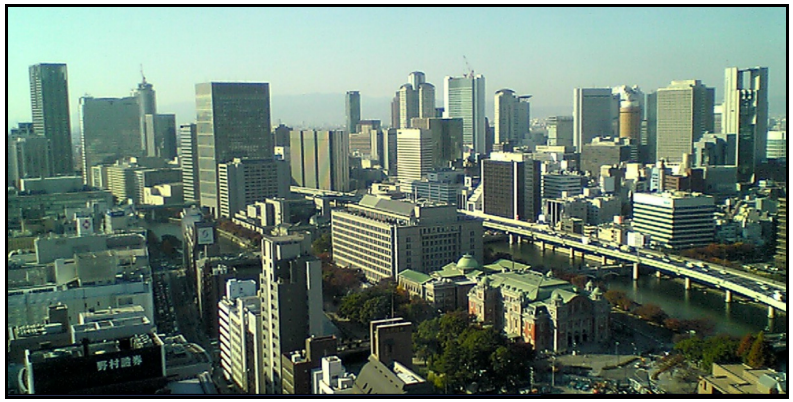

Figure 1.80: A view of Ōsaka.

Figure 1.81: Ōsaka Exhibition Memorial Park. The symbol of the exhibition was the Tower of the Sun.

Ōsaka Prefecture University

Ōsaka Prefecture University has 8000 students. Host: Professor Yasuhiro Konishi at the Department of Chemical Engineering doing extensive work on bacterial leaching (Figure 1.82).

Figure 1.82: With Prof. Yasuhiro Konishi and students of Chemical Engineering at the Ōsaka Prefecture University.

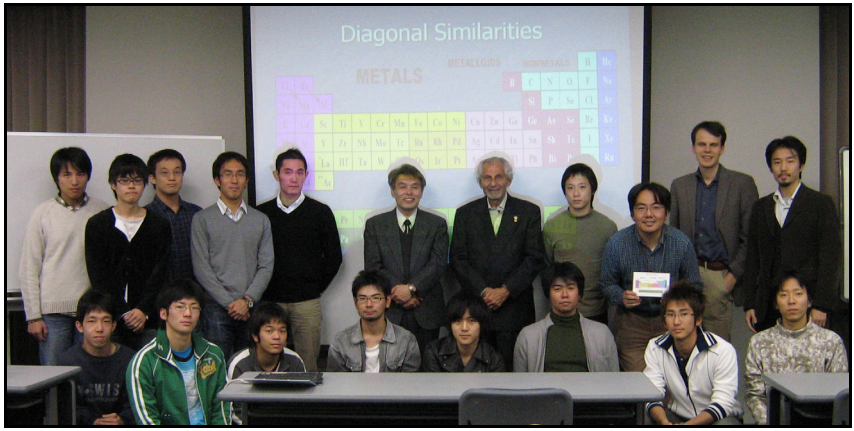

Figure 1.83: With Prof. Toshihiro Tanaka and his students at the University of Ōsaka.

Ōsaka University

Ōsaka University has about 16 000 students. Host: Professor Toshihiro Tanaka of the Department of Metallurgy (Figure 1.83).

The three giant statues of Buddha from old Japan: the Kamakura Daibutsu (11.3 metres) remains in original form, the Nara Daibutsu (15 metres) was recast, while the Kyōto Daibutsu (24 metres) was destroyed in a fire.

Figure 1.84: Location map of Nara.

Figure 1.85: The bronze Big Buddha, Kamakura's leading attraction, constructed in 1252. The statue is about 11.3 m high including the base and weighs about 93 tonnes. The statue is hollow.

KŌCHI

Kōchi University

Kōchi is located on the south of Shikoku Island. Host: Professor Nakamishi Yamasaki, Director of the Laboratory for Hydrothermal Reactions (Figures 1.86–1.87). He was the organizer of the Aqua Science conferences.

Figure 1.86: Research Laboratory for Hydrothermal Reactions, Kōchi University.

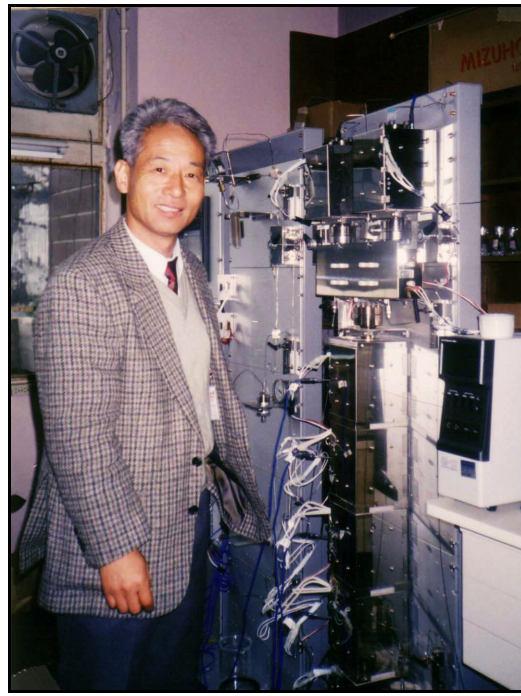

Figure 1.87: Prof. N. Yamasaki in his Research Lab in 1994.

Typical Japanese

Contrary to common belief, Japanese language is unrelated to the Chinese but related to Korean although the Japanese had adopted the written Chinese characters. Buddhism was introduced in Japan in the year 538. Japan is famous of Fujiyama or Mount Fuji which can be seen during a train ride 20 minutes after leaving Tōkyō (Figure 1.88). It dominates the scene for about half an hour. It can also be seen when flying over Tōkyō. She is also famous of the beautiful cherry blossom tree (Figure 1.89). The Japanese are skilled in designing gardens (Figure 1.90).

Figure 1.88: Fujiyama.

Figure 1.89: Cherry blossom tree.

Gambling houses with gambling machines, called Pachinko, are widespread, becoming a very remarkable institution in Japan (Figures 1.91–1.92). It is estimated that around 75% pachinko parlours are run by ethnic Koreans. Another remarkable attraction for a visitor is the plastic Japanese food in restaurant windows (Figure 1.93). The elaborate kimonos are some times seen on the streets (Figure 1.94). A popular sport in Japan is watching heavyweight young wrestlers (Figure 1.95).

Figure 1.90: A Japanese garden.

Figure 1.91: Entrance to a pachinko parlour.

Figure 1.92: Inside a Pachinko parlour young and old are stuck to the machines.

Figure 1.93: Typical plastic Japanese food in restaurant windows.

Figure 1.94: The elaborate kimonos are sometimes seen on the streets.

Figure 1.95: Sumo wrestlers.

JAPANESE ACHIEVEMENTS IN ENGINEERING

Ground transportation

Travellers in Japan will be impressed by railway transportation system which eliminates rush hour problems. The trains are fast and punctual:

- The Bullet Train, known as Shinkansen, connect the major Japanese cities (Figures 1.96–1.97).
- The Monorail, connects large cities with their suburbs (Figure 1.98). The stations are identified by numbers beside the names which simplifies greatly the movement of foreign visitors.
- Regular railway, branches from Shinkansen to small towns
- Subway, underground fast transportation. For example, the Tōkyō subway is the world's most extensive rapid transit system in a single metropolitan area (Figures 1.99–1.101).

Figure 1.96: Bullet train known as Shinkansen.

Figure 1.97: Shinkansen network.

Figure 1.98: Monorail connecting large cities with their suburbs.

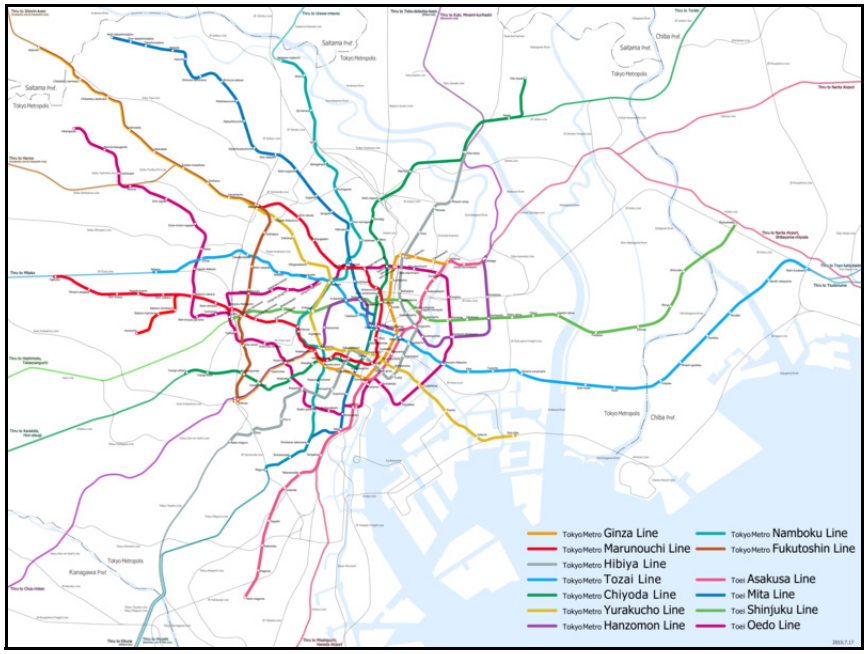

Figure 1.99: Tōkyō subway network.

Figure 1.100: Subway train.

Figure 1.101: Railway train.

The largest blast furnaces

Japan has the largest blast furnaces in the world producing 10 000 tonnes of pig iron per day. It was possible to overcome the material handling problems (Figure 1.102).

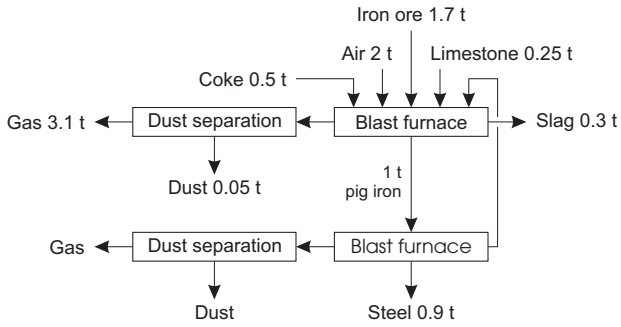

Figure 1.102: Iron and steel production.

The Great Seto-Ohashi Bridge

Visitors will also be impressed by the Great Seto-Ohashi Bridge (Figures 1.103–1.106) which is a series of double deck bridges connecting Honshū and Shikoku islands across a series of five small islands in the Seto Inland Sea, built over the period 1978–88. At 13.1 kilometres it ranks as the world's longest two-tiered bridge system.

Figure 1.103: Location map of the Great Seto-Ohashi Bridge connecting Honshū and Shikoku islands.

Figure 1.104: Details of the Great Seto-Ohashi Bridge.

Figure 1.105: General view of the Great Seto-Ohashi Bridge.

Figure 1.106: Another view of the Great Seto-Ohashi Bridge.

Honshū and Hokkaidō tunnel

Tunnelling is highly advanced in Japan because of the steep mountains that must be crossed by tunnels. Japanese engineers were successful in building a 54-km tunnel connecting Honshū and Hokkaidō islands that was inaugurated in 1988 (Figure 1.107).

Buildings resistant to earthquakes

Japanese Engineers design buildings with new technology that can withstand earthquakes (Figure 1.108).

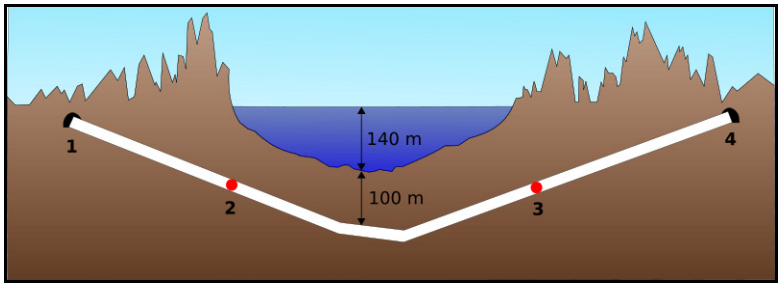

Figure 1.107: The 54-km tunnel connecting Honshū and Hokkaidō islands inaugurated in 1988.

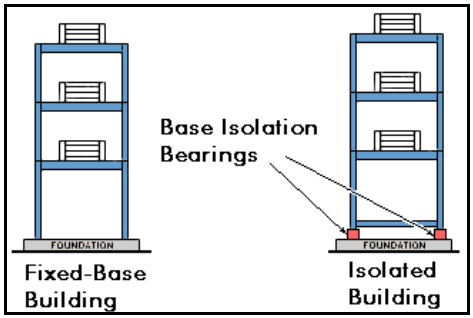

Figure 1.108: Buildings resistant to earthquakes.

Oil tankers

Transportation of crude oil and petroleum by oil tankers is crucial for Japan because the country depends on imports for almost all of its oil energy needs. The first ocean going Japanese oil tanker was constructed in 1931 (Figure 1.109).

Figure 1.109: Japan excelled in building ocean-going oil tankers.

JAPANESE CATASTROPHES

Beside the destruction of Hiroshima and Nagasaki by the atomic bombs in 1945, Japan suffered much destruction by many earthquakes. In addition, there was the Minamata disease and the tsunami.

Minamata

In the 1950s, inhabitants of the industrial town Minamata, on the west coast of Kyūshū island (Figure 1.110), suffered many deaths and disease which was attributed to eating fish contaminated with mercury from the nearby chemical factory (Figure 1.111). This accident alerted public opinion regarding the need to regulate industrial emissions. As a result, the Scandinavian countries were the first to solve the problem of mercury emissions from smelters and processes for mercury removal from zinc plants were installed later world wide.

Figure 1.110: Location map of Minamata on the west coast of Kyūshū Island in the south of Japan.

Tsunami

Japan as well as other Southeast Asian countries are plagued with earthquakes in the Pacific Ocean that result in huge destructive waves known as Tsunami (Figure 1.112). In 2011 Japan suffered greatly from such terrible event.

Figure 1.111: Minamata chemical plant.

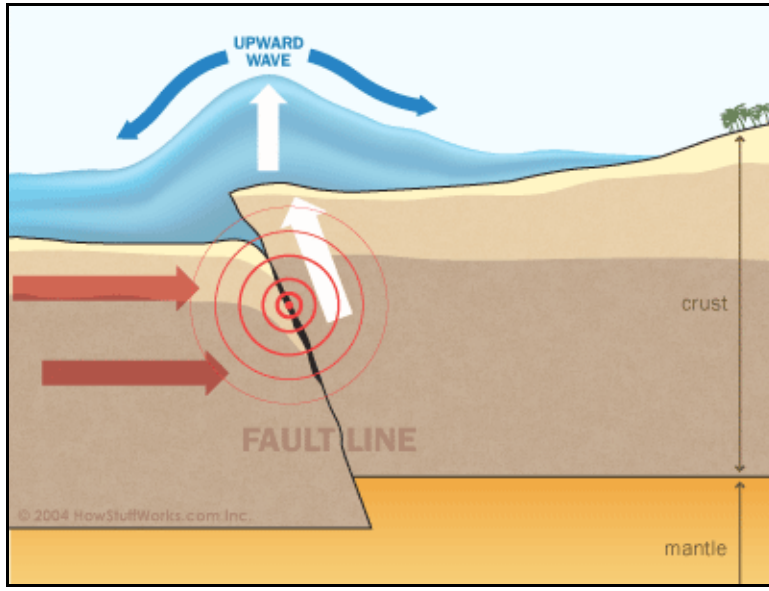

Figure 1.112: Origin of tsunami.

Japanese mining and metallurgical industry

Figures 1.113–1.115 give data on Japanese mining and metallurgical industry.

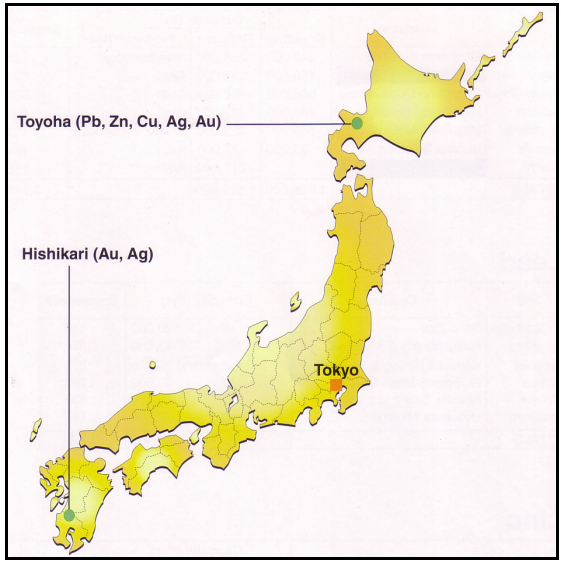

Figure 1.113: Major metal mines.

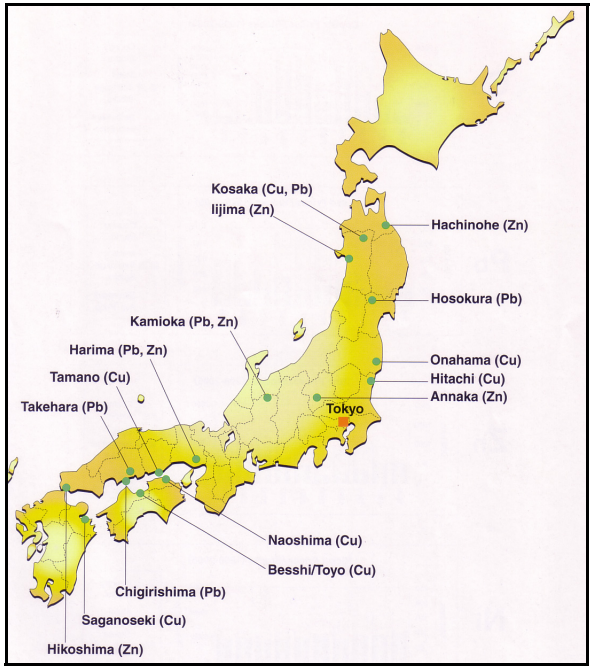

Figure 1.114: Major metal smelters.

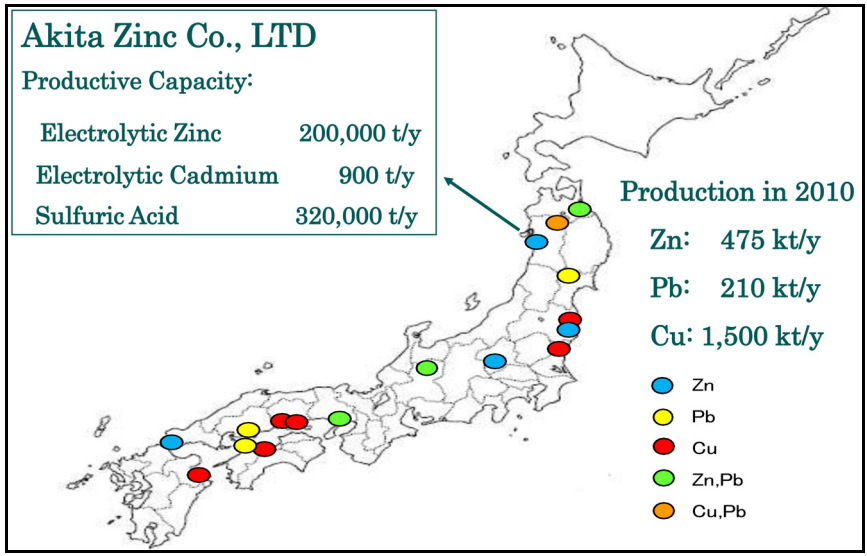

Figure 1.115: Nonferrrous metals production in 2010.

Japanese Art

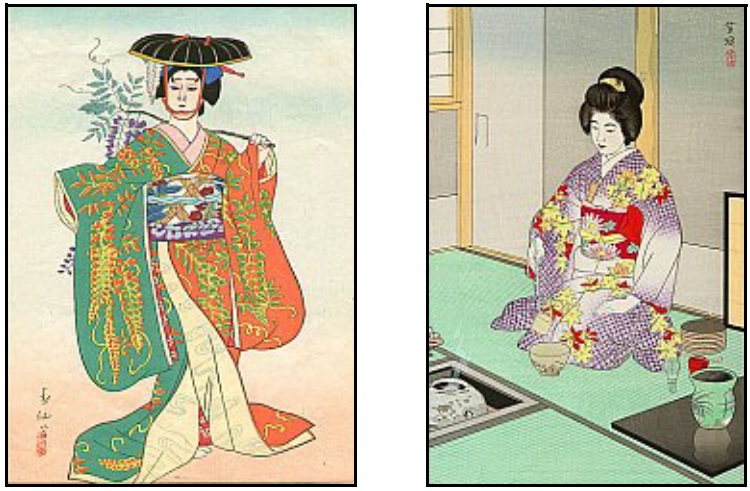

Figure 1.116: Typical Japanese art.

Figure 1.117: Typical Japanese art.

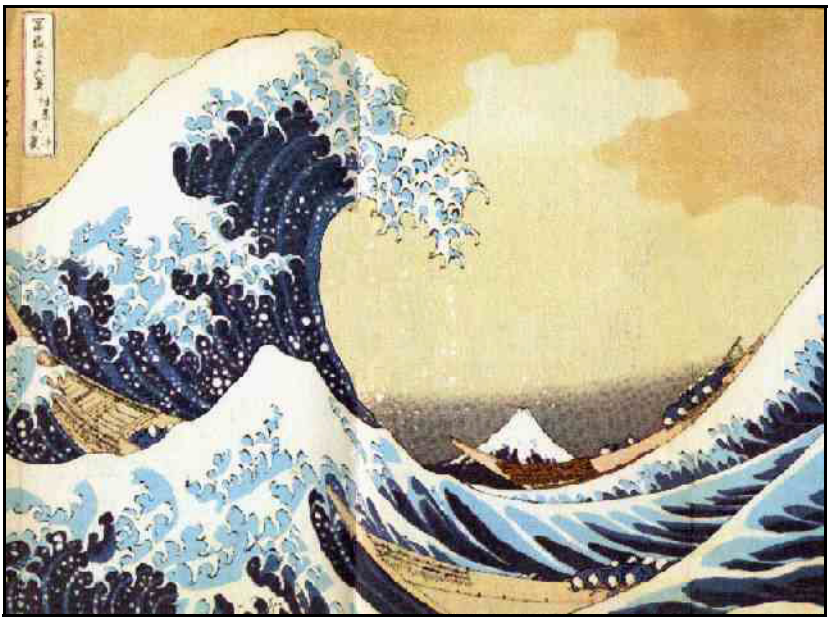

Figure 1.118: Typical Japanese art.

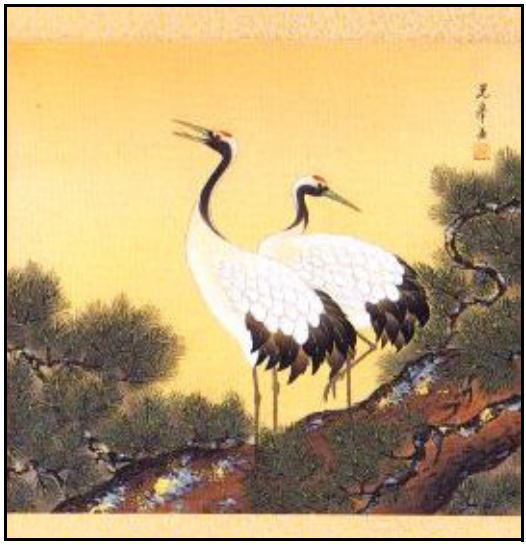

Figure 1.119: Typical Japanese art.

Figure 1.120: Typical Japanese art.

Figure 1.121: Typical Japanese art.

EPILOGUE

Japan was a closed society until 1853 when it was forced to open to the West. Mining, metallurgical, and geological education started there around 1861 when a graduate from Yale University in USA went to Japan to organize the first School of Mines. This was followed by other metallurgists from Great Britain, France, and Germany and thousands from other disciplines. Japan accepted the Western ideas probably after observing the humiliation of China by Western powers in the 1840s. She innovated her army, navy, and industry, while the Chinese rulers resisted every effort to renovate because of widespread corruption in the imperial palace and ignorance and superstition everywhere.

While the Japanese hired many Westerners in various specialities, China was plagued by intruding Westerners who went there to loot the country. The result of this was demonstrated in the victorious Japanese army against China in 1895 and against Russia in 1905, and the occupation of Manchuria and Korea. China no longer became the dominating power in Asia and a model for other neighbouring countries. The situation was reversed: Japanese imperialism became the dominating force in the Far East and the chief training ground for Chinese students. For example, in 1911 there were 800 Chinese students in USA, 400 in Europe, and 15 000 in Japan.

During my last visit to Japan in November 2007, I recalled the lines by the nineteenth-century British poet Rudyard Kipling (1865–1936):

East is East and West is West
And never the twain shall meet

I was wondering if this statement is now valid. True the Japanese still have their special eating habits and from time to time one sees ladies in Kimonos, but in general the appearance of French café houses serving café au lait and European gâteaux as well as restaurants serving hamburgers and Coca Cola, is a proof that the situation is changing (Figure 1.122). Forks and knives are also readily available in restaurants. The magnificent shopping centres decorated with Christmas lights and Christmas trees and playing Christmas music is rather surprising. Japan the once closed society is now adapting to Western way of life (Figures 1.123–1.127).

Figure 1.122: With Prof. Yasuhiro Konishi and the waitress in an Ōsaka Café serving French gâteaux.

Figure 1.123: Christmas in Sendai [Photo by F. Habashi, November 2007].

Figure 1.124: Christmas in Tōkyō.

Figure 1.125: My Japanese friend Professor Akio Fuwa and his family with a Christmas tree at their home, 2010.

Figure 1.126: Traditional wedding.

Figure 1.127: Wedding of my friend's daughter, 2010.

I had a Japanese couple at home in 1989 and my wife prepared a variety of Western dishes. The young lady at that time, however, preferred to eat a can of sardine instead. Last year the same couple visited me again. When I wanted to take them to a sushi restaurant as a surprise for them, I was the one who was surprised — the same lady now wants to go a Western restaurant! I think the changes taking place in Japanese society is due to their extensive travels abroad usually in groups and also as individuals.

SUGGESTED READINGS

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- Japan. A Lecture Tour, November 15–December 2, 2007

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F. Habashi, "Hydrothermal Reactions of Sulfides and Disulfides," pp. 39–49 in *Proceedings Third International Symposium on Solvothermal & Hydrothermal Processes*, Research Institute for Solvothermal Technology, Takamatsu, Kagawa, Japan 1997.

F. Habashi, "The Theory of Four Elements. Water, Air, Earth, and Fire," pp. 15–20 in *Proceedings First International Symposium on Aqua Science, Water Resource, and Innovation Development of Countryside*, Sakuraza, Sakawa, Kōchi Prefecture, Japan, November 26–30, 2007.

F. Habashi, "Can the Toxicity of Asbestos Be Reduced?" pp. 111–114 in *Proceedings First International Symposium on Aqua Science, Water Resource, and Innovation Development of Countryside*, Sakuraze, Sakawa, Kōchi Prefecture, Japan, November 26–30 (2007).

Chapter 2

Korea

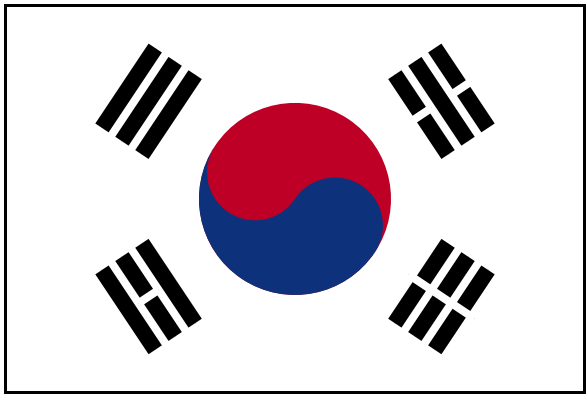

Figure 2.1: Flag of South Korea.

Historical Introduction

Near the end of the 2nd century BC, the Korean peninsula fell to the Chinese Han dynasty. This led to succeeding warring states then in the 1st century, three kingdoms grew to control the land (Figure 2.2) until unified by Silla in 676 AD. The Silla dynasty (57 BC–935 AD) is characterized by its many gold crowns of extreme beauty (Figure 2.3).

Many dynasties followed later until Goryeo period (918–1392) when laws were codified, a civil service system was introduced. The name of the country is derived from this period. During this dynasty the Mongols invaded Korea in 1231 and influenced the country till 1259. King Sejong the Great (1397–1450) (Figure 2.4) then reigned from 1418 until his death, implemented numerous administrative, social, and economical reforms, and promulgated the Korean alphabet and Buddhism culture.

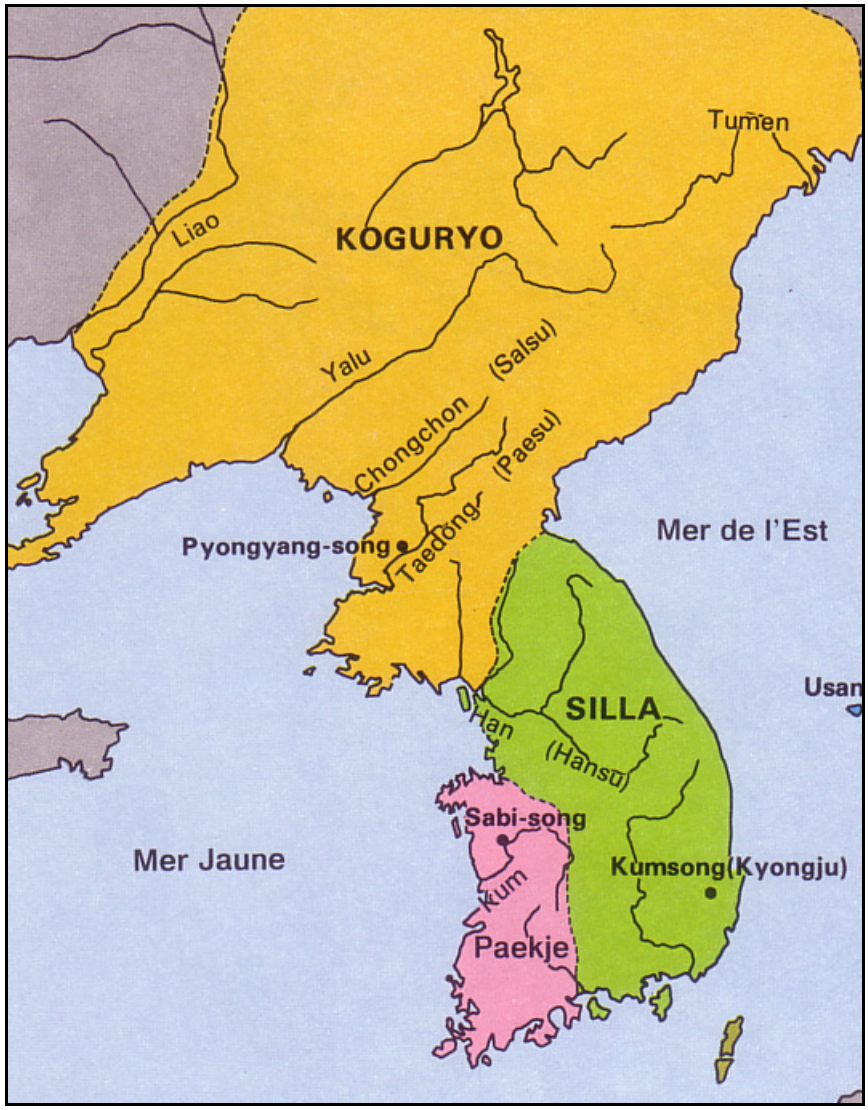

Figure 2.2: The Three Kingdoms of ancient Korea.

Figure 2.3: Gold crowns from Silla dynasty (57 BC–935 AD) at National Historical Museum in Gyeongju.

From the late 16th century, Korea faced foreign invasions, internal power struggle and rebellions, and it declined rapidly. In 1910 it was annexed by Japan and all attempts were made to eradicate Korean culture, language, religion, etc. and make it part of Japan. After World War II when Japan signed the unconditional surrender document Korea was divided into two occupation zones in 1945, with the United States administering the southern half of the peninsula and the Soviet Union taking over the area north of the 38th parallel.

In 1947, with no solution in sight to unify the two Koreas, the United States submitted the Korean question to the UN General Assembly. The politics of the Cold War resulted in the 1948 establishment of two separate nations with opposed political, economic, and social systems (Figure 2.5). In June 25, 1950, the Korean War broke out when North Korea breached the

38th parallel line by invading the South. After the war, the 1954 Geneva conference failed to adopt a solution for a unified Korea. South Korea eventually became a market-oriented democracy in 1987. Due to the Soviet influence, North Korea established a communist government with a hereditary succession of leadership, with ties to China and Russia.

Figure 2.4: Statue of King Sejong the Great (1397–1450) in Seoul.

Figure 2.5: Map of Korea.

Figure 2.6: Location of Gyeongju in South Korea.

Visit to Korea

My visit to Korea took place in April 2002 to attend a conference in Gyeongju (Figure 2.6), the historic cultural centre in the south of the country. A stop was made for few days in Seoul before taking the 6-hour bus trip to Gyeongju. Near Gyeongju is the zinc plant at Onsan, which was visited. The trip to Korea was coupled with another conference in Kunming in China.

Figure 2.7: View of Seoul.

SEOUL

Seoul (Figures 2.7–2.8) is a mega city — almost a quarter of South Koreans live in Seoul. As the headquarters for Samsung, LG, Hyundai, Kia, and SK, Seoul has become a major business centre. It has huge shopping centres and excellent underground transportation system.

Gyeongbokgung (Figures 2.9–2.11) is a royal palace first constructed in 1394 and re-constructed in 1867. Nearly destroyed by the Japanese government in the early 20th century, the walled palace complex is slowly being restored to its original form.

Figure 2.8: Seoul at night.

Figure 2.9: Royal palace gate in Seoul.

Figure 2.10: Royal palace in Seoul.

Figure 2.11: Royal palace in Seoul.

Seoul National University

Seoul National University was founded in 1946 by merging of ten institutions of higher education around the Seoul area.

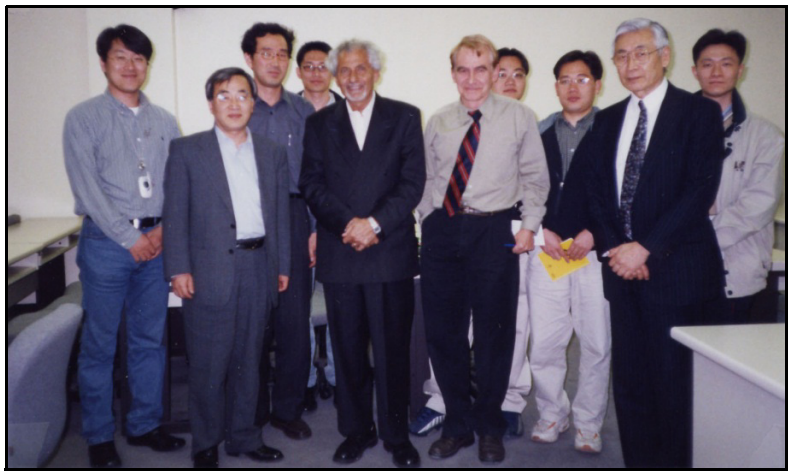

Figure 2.12: Students and faculty members of Seoul National University. Photo by Nadia Habashi, 2002.

GYEONGJU

Gyeongju is in the far southeastern corner of the Korean Peninsula, 370 km southeast of Seoul. It was the capital of the ancient kingdom of Silla. In the 13th century the Mongols and the Japanese destroyed most of it. Under the subsequent dynasties, Gyeongju was no longer of national importance and in 1601 it ceased to be the capital. During the early 20th century, many archaeological excavations were conducted and a number of sites were discovered. In the 1970s, Korea saw substantial industrial development, near Gyeongju. The POSCO steel mill in neighbouring Pohang commenced operations in 1973, and the chemical manufacturing complex in Ulsan emerged in the same year. A zinc production plant is nearby at Onsan.

Bulguksa Temple

Bulguksa Temple was built in 528 during the Silla dynasty. But during the Japanese invasion, 1592–1598 the wooden building was burned. From 1604, during Joseon Dynasty the reconstruction started again and was renovated. The Bulguksa Temple of today has many cultural relics including an 18.9-tonne bronze bell cast in 771 (Figure 2.13).

Figure 2.13: An 18.9-tonne bronze bell in Bulguksa Temple.

The Beginnings of the Use of Metals and Alloys

The conference was conceived and organized in China by Prof. Tsun Ko (Figure 2.14) of Beijing Science and Technology University whom I met in Beijing in 1984. Prof. Robert Maddin of the Pennsylvania State University in USA also collaborated in this effort. The first three conferences were held in Beijing in 1981, 1986 and 1987, the fourth in Matsue in Japan in 1998, and the fifth in Gyeongju in 2002 in Hotel Temf (Figures 2.15–2.16). The conference was organized by the Korean Institute of Metals and Materials and the Division of Materials Education and Research of Seoul National University. Chairman of the Organizing Committee was Dr. Hyung-Yong Ra, professor emeritus of Seoul National University.

Figure 2.14: Prof. Tsun Ko from Beijing.

Figure 2.15: Hotel Temf in Gyeongju.

Figure 2.16: Hotel Temf in Gyeongju.

Figure 2.17: Conference participants, April 2002.

Figure 2.18: Conference participants, April 2002.

ONSAN

Onsan (Figure 2.20) is a port located near Gyeongju–Ulsan and is dealing with crude oil, oil products, non-ferrous metals, and other bulk cargos.

Figure 2.19: Korean dancers in the banquet.

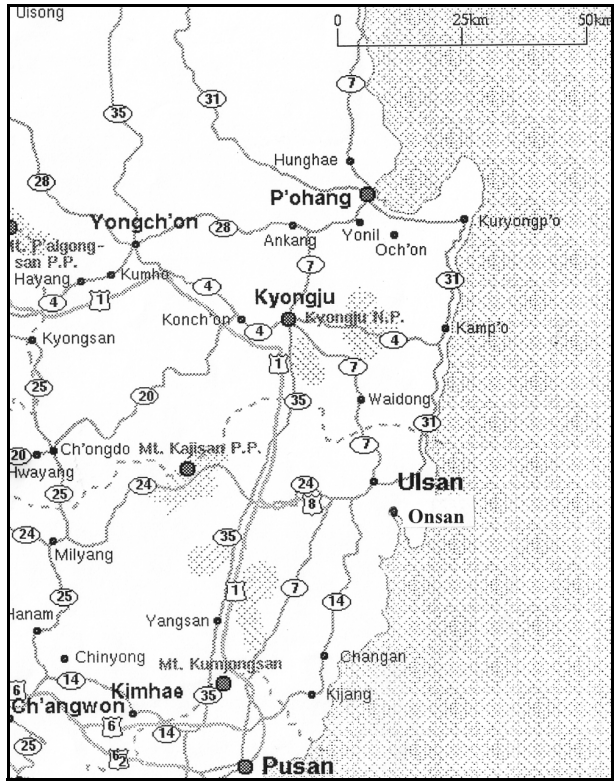

Figure 2.20: Location map of Gyeongju [Kyongju, Kyong Ju], Ulsan, and Onsan.

Korea Zinc

Contact with Korea Zinc was established when my article on the history of zinc was translated into Korean and published on the web site of the company (Figures 2.21–2.24). Korea Zinc was founded in 1974 using roasting, leaching, electrowinning technology for zinc. The company has also the Q-S-L furnace for lead (Figure 2.25).

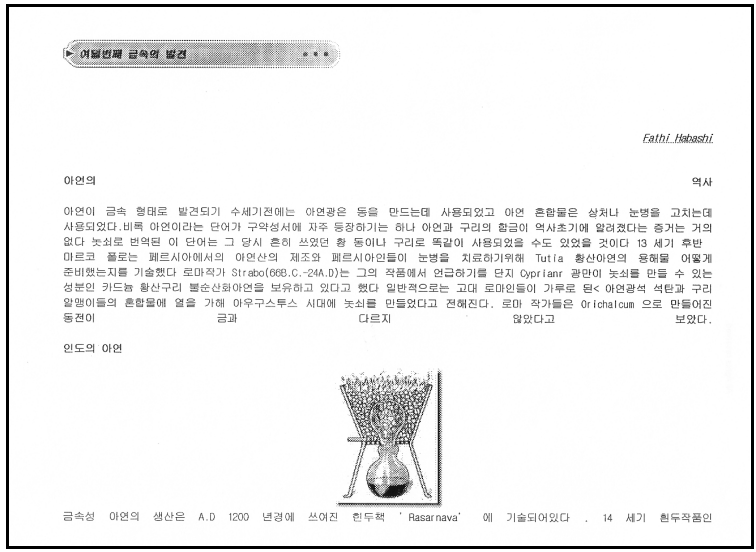

Figure 2.21: Front page of Korea Zinc web site (http://www.koreazinc.co.kr/story/story1/story2.htm).

Figure 2.22: Dr. Young Choi, President of Korea Zinc, Columbia University graduate. Photo by Nadia Habashi.

04-18 16:30 THU FROM: TO:8838197 PAN::01

수신 : 이 성우 교수님.

발신 : 고려아연 기술실 한홍찬

Mr Habashi Professor Time Schedule

* Date : April 23 (TUE)

* Schedule :

10:00 – 11:00	Pick Up (Kyong Ju → Onsan)
11:00 – 13:00	Introduction Korea Zinc Company Plant Tour
13:00 – 14:30	Lunch
14:30 -	Return To Kyong Ju

* Our Company staff will pick up you at Kyong Ju TEMF Hotel.

* Mr Young Min Park will show you Onsan plant

* Young Min Park : Department of Technology Manager

Figure 2.23: Visit schedule to Korea Zinc plant in Onsan.

Figure 2.24: Guide to Korea Zinc plant in Onsan Dr. Ji-Won Chang, University of Minnesota graduate.

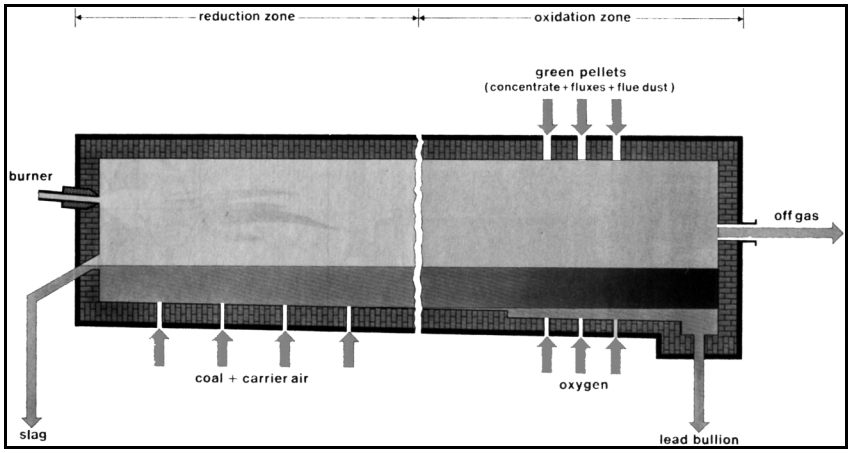

Figure 2.25: Q-S-L furnace for lead.

SEOUL AIRPORT 2012

On a trip to Manila in March 2012, I was in transit at Seoul Airport, where I was invited at the Tourist Office to take a photo souvenir (Figure 2.26).

Figure 2.26: At the Tourist Office, Seoul Airport March 2012.

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