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解　説

Chemical Heritage Japan Program : Introduction to the History of Chemistry in Japan

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注　本稿は2020年度化学史研修講演会での講演内容[1]を英訳したものである.「日本化学会の化学遺産」についての英語紹介がこれまで殆どなかったとのご指摘を受けて投稿した. なお本英訳に当たって, 最新の2020年度認定までの総数57件に対する議論とし, また認定対象物の種類・技術分野・所在地（所蔵地）の細かい議論を省略するなど一部見直ししている.

なお, 化学遺産の表記について,「認定の順にしたがって, 日本化学会認定化学遺産第何号, Chemical Heritage No. ○○○○ authorized by the Chemical Society of Japan と表記する.」と規則で定められているが, 本稿では趣旨を損なわない範囲で簡略表現を用いた.

1. Introduction

The Chemical Heritage Japan (hereinafter CHJ) Program of the Chemical Society of Japan (hereinafter CSJ)[2] has entered its 13th year. I have analyzed the 57 certified CHJs as of 2020 by grouping them into academic or technical (chemical technology, manufacturing chemistry) and people-centered or things-centered, by active periods, and so on. In this work, I would like to explore the history of chemistry in Japan derived from CHJs and discuss the source of the people's will to save something precious and/or memorable.

2. About the Chemical Heritage Japan Program

The Chemical Heritage Committee (CHC) of CSJ, established in March 2008, began recognizing world-class chemistry-related cultural heritage in Japan from 2009 and disseminating information about its history. The committee's accreditation work can be termed a chemical heritage certification activity and CHJ Program. The annual flow of the CHJ Program is shown in Fig. 1.

The CHC, the parent committee, restarts the program each April. Following the parent committee's instructions, the investigation subcommittee reviews the investigations of the recommended candidates, prioritizing them and then reporting back to the parent committee. Next, the third-party certification subcommittee, comprising authorities from industry and academia, discusses and authorizes the report. Finally, the report is submitted to the Board of Directors of CSJ for approval.

This process, which has been officially decided through many procedures, is almost the same as other heritage-recognition processes. In the CHJ Program, the report is officially certified after

2021年4月15日受付

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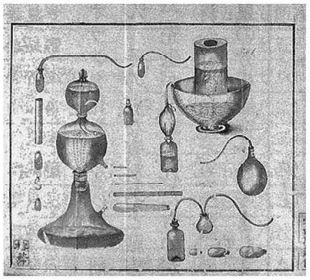
Annual Flow of Chemical Heritage Japan(CHJ) Program

Subject	Action time (about)
① Chemical Heritage Committee of CSJ	
Starting	April
② Investigation Subcommittee	All year round
Shared investigation of recommended candidates Discussion and Prioritization and Report to the parent committee	(Especially April—October)
③ Certification Subcommittee	
Discussions and authorization by the third-party	November
④ Chemical Heritage Committee of CSJ	
1. Report submitted to CSJ's Board of Directors	December
2. "Confirmation of the consent of the owner/organization" of the unofficial CHJ	December
3. Official decision	
4. Press release	Early in next March
5. The certificate awarded by CSJ	Next March
6. Introduced in a public lecture	Next March

Fig. 1

Typical academic Chemical Heritage Japan(CHJ)

No. 001 Kyo-U Sho-Oku collection:
Youan Udagawa's (1798-1846) chemistry-related materials including *Seimi Kaisou*

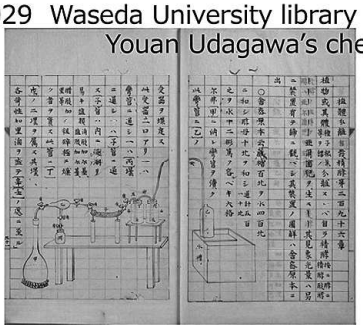


Ex.『舎密器械図彙 (*Seimi-Kikai-ZuI*)』
杏雨書屋 蔵 (Kyo-U Sho-Oku Collection)

Carbonated water production equipment ~~Kipp's apparatus~~[1] and so on, presumed to have been drawn by Youan himself

Ref. Commentary article: Tetsuo Shiba, *Chemistry and Industry* (July 2010)

No. 029 Waseda University library collection:
Youan Udagawa's chemistry-related materials including *Seimi Kaisou*



Ex.『舎密開宗 内篇 (*Seimi Kaisou, Nai Hen*) 』
(Waseda University library collection)

A manuscript containing Lavoisier's experimental equipment

Ref. Commentary article: Toru Azuma, *Chemistry and Industry* (July 2015)

Fig. 2

"confirmation of the consent of the owner/organization" (④-2 of Fig. 1) at the unofficial stage. Once certified, the certificate is awarded by the CSJ president at the annual awards ceremony each year. Currently, the total number of CHJs is 57.

At the beginning of the program, we created detailed CHJ certification criteria.[3] Simply put, CHJ has been associated with pivotal events in the history of chemistry in Japan since the end of the Edo era. Candidates for CHJ are investigated,

1 Shiba (2010) called this a "Kipp's apparatus," but this is a "Carbonated water production equipment."

recommended, and prioritized according to these criteria. We also investigate the recommendations by an open call for CHJs. Based on the results of the investigations, we discuss the revision of the recommendation title and the reason for recommendation.

Some of the common questions about the program include these: Is there any financial assistance for preservation for those certified? Are there any restrictions (permissions for publishing, visiting, selling, etc.) applied after certification? The CHJ Program does not provide assistance of any kind, nor does it impose restrictions.

3. Analysis of 57 certified CHJs

See Tables 1-1, 1-2, 2-1, and 2-2. Table 1 is a list of CHJs of CSJ as of March 2021, and Table 2 is a list of the subjects analyzed in each CHJ. The results of the completed analysis are shown at the bottom of the Table 2-2 (and Table 5).

4. Results and Discussion

a. The numbers of academic and technical CHJs are almost the same.

Table 2-2 shows 28 academic CHJs, and the ratio is about 50 % (28/57) . There were 35 technical CHJs, for a ratio of about 60% (35/57). There were a few more technical CHJs, but the numbers were almost the same. I explain this in detail below.

Typical academic examples of CHJs taken from Fig. 2 are CHJ No. 001, "Kyo-U Sho-Oku collection,"[4] and CHJ No. 029, "Waseda University library collection,"[5] which are both unique collections of Youan Udagawa's (1798-1846) chemistry-related materials, including his manuscript of Seimi Kaiso, Japan's first systematic chemistry book written in Japanese.

In Fig. 3, CHJ No. 004, "Remains of granite towers for absorbing hydrogen chloride gas,"[6] is a typical technical CHJ. Only one part of the equipment remains from Japan's first privately owned chemical fertilizer company, which used the Leblanc process to produce sodium carbonate. Amazingly, the stone towers, about 10 m tall, have remained standing for 130 years.

Many cases were difficult to classify. For example, in Fig. 4, CHJ No. 002, "Keizo Uenaka's (1876-1960) notebook, Memorandum on Adrenalin,"[7] was originally a laboratory memorandum recording the successful crystallization of adrenalin in Takamine Laboratory. The handling volume was gradually increased until finally the adrenaline could be put to practical use as a high-potency drug. Since the notebook was a famous "laboratory memorandum" in Japan,[8] I classified it as an academic CHJ. Another difficult case to classify was CHJ No. 003, "A sample of glutamic acid by Kikunae Ikeda (1864-1936)."[9] The sodium salt of glutamic acid is the famous food additive, ajinomoto (monosodium glutamate). I classified this sample as an academic CHJ since it was the first sample remained at Kikunae's laboratory in the University of Tokyo. However, it could be also classified as a technical CHJ.

Other examples that were difficult to classify as academic or technical were the people-centered CHJs, such as CHJ No.026, "Materials of Saburo Utsunomiya (1834-1902), pioneer chemical engineer of Japan."[10] (See Fig. 5) Around 1860, Utsunomiya was an assistant at Yousho Shirabesho (later Kaisei-jo, one of the forerunners of the University of Tokyo), an educational and research institution at the end of the Edo era. In 1863, Utsunomiya successfully proposed renaming Kaisei-jo's Refining Department as the Chemistry Department. He invited Dutch chemist Koenraad Wolter Gratama (1831-1888) to be a professor

Table 1-1 Chemical Heritage Japan (57 cases in 12 years)

Chemical Heritage Committee of Chemical Society of Japan

No.	Title
①	
No. 001	Kyo-U Sho-Oku collection : Youan Udagawa's (1798-1846) chemistry-related materials including *Seimi Kaiso*
No. 002	Keizo Uenaka's (1876-1960) notebook "*Memorandum on Adrenalin*" in 1900 at the Takamine Laboratory in New York
No. 003	A sample of glutamic acid extracted from Laminaria japonica by Kikunae Ikeda (1864-1936) in 1908
No. 004	Remains of granite towers for absorbing hydrogen chloride gas, by-product of Leblanc soda process, built in 1891 at Nihon Seimi Seizo Co. Ltd.
No. 005	Materials (yarns and a model of spinning machine) showing the origin of the viscose rayon industry around 1916 in Yonezawa
No. 006	A part of the plant and related materials for ammonia production by Luigi Casale process, built in 1923 at Nihon Chisso Hiryo Co. Ltd.
②	
No. 007	Transcripts of lectures on chemistry delivered by Pompe van Meerdervoort in 1859 at Nagasaki (*Pompe Seimisho*)
No. 008	Japan Academy collection : Komin Kawamoto's (1810-1871) chemistry-related materials including *Kagaku Shinsyo*
No. 009	Remains (buildings and materials) to show the establishment and development of celluloid industry in Japan from 1908 at Daicel Chem. Ind. Ltd.
No. 010	Materials including cylindrical glasses to show the origin of flat glass plate industry in Japan around 1910 at Asahi Glass Co. Ltd.
③	
No. 011	Riko Majima's (1874-1962) Urushiol Research-related materials including ozone generator in Tohoku University and Osaka University
No. 012	Setsuro Tamaru's (1879-1944) materials (photographs and letters) stored in the Tamaru family
No. 013	Umetaro Suzuki's (1874-1943) Vitamin B1 discovery in 1910 and related materials, the first discovery in the world
No. 014	Benzene purification equipment, designed in-house in 1914 and domestically made, related to the origin of the Japanese synthetic dye industry
No. 015	Hard (for pipes) and soft (for wire coating) vinyl chloride resin molded early products in Japan
No. 016	Materials including vinylon tow in 1950, showing the origin of Japanese vinylon industry around 1940-1950
No. 017	Materials showing the origin of the Japanese cement industry both government-owned and private-owned
④	
No. 018	Masataka Ogawa's (1865-1930) Nipponium Research, discovery research of new element, related materials
No. 019	Chika Kuroda (the pioneer female chemist)'s (1884-1968) natural pigment research-related materials
No. 020	Materials related to manufacture of artificial oil by the Fischer-Tropsch Synthese in Japan around 1938-1940
No. 021	Materials on the development and commercialization of ammonia synthesis using the Tokyo Industrial Research Institute method
No. 022	Remains (buildings and materials) showing the origin of the potassium chlorate by electrolysis industry of Japan in 1910
⑤	
No. 023	Materials about Joji Sakurai (1858-1939) who laid the foundation for modern Japanese chemistry
No. 024	Materials related to Nagayoshi Nagai (1845-1929) who contributed to the discovery of ephedrine and to girls' education
No. 025	Chem lab of Former Fifth High School and Physics and Chemistry Classrooms of Former Fourth High School, built in 1889 and 1890, respectively
No. 026	Materials including the bundle of the resignations and orders to Saburo Utsunomiya (1834-1902), the pioneer of chemical engineers in Japan
No. 027	Isoma injection molding machine and dies those were imported from Germany in 1943 and supported the development of plastic industry in Japan
No. 028	Materials related to Japan's first industrialization of aluminum production in 1934 at Omachi, Nagano Prefecture

Table 1-2 Chemical Heritage Japan (57 cases in 12 years)

Chemical Heritage Committee of Chemical Society of Japan

No.	Title
⑥	
No. 029	Waseda University library collection: Youan Udagawa's (1798-1846) chemistry-related materials including *Seimi Kaiso*
No. 030	Industrial high-pressure oil/fat decomposer (autoclave) imported in 1910 and supported the development of the Japanese oleochemical industry
No. 031	Remains (Moromi tower and distillation tower shelf) showing the origin of Japanese industrial alcohol industry in around 1938-1939
No. 032	Nippon Paint HD collection: Materials showing the origin of the Japanese paint industry from 1881 at Komyo-Sya Co.
No. 033	Materials showing the origin of the Japanese nylon industry around 1942-1957 at Toyo Rayon Co., Ltd. (later Toray Industries, Inc.)
⑦	
No. 034	Materials related to Hikoma Ueno (1838-1904), the founder of Japanese photographic chemistry
No. 035	Materials related to Mitsuru Kuhara (1855-1919), the pioneer of Japanese chemistry in Meiji era and the first president of Chem Soc of Japan
No. 036	Tetsuo Nozoe's (1902-1996) chemical heritage: Non-benzene aromatic compounds samples and world famous chemist signature book
No. 037	Materials showing the origin of Japanese high-pressure polyethylene industry, research at Kyoto University and industiallization
No. 038	Materials related to G. Wagner (1831-1892) who contributed to the development of Japan's modern ceramics industry
⑧	
No. 039	Materials related to Mitsumaru Tsujimoto (1877-1940), the creator of Japanese Oleochemistry
No. 040	Materials including early equipments of oxygen gas separation, showing the origin and development of oxygen industry in Japan
No. 041	Dainihon Jochugiku Co., Ltd. collection: Materials showing the origin of the pesticide industry in Japan
No. 042	Materials including the prescriptions and the containers, showing the origin of the modern cosmetics industry
No. 043	Remains (production equipment and wooden container) of iodine made from natural gas brackish water
⑨	
No. 044	Transcripts of lectures on chemistry: Griffith "*Kagaku Hikki* (*Chemical Writings*)" and Sluis "*Seimi Gaku* (*Chemistry*)" both written in 1871
No. 045	Synthetic rubber samples by monovinyl acetylene method of J. Furukawa of Kyoto University
No. 046	Materials related to Jokichi Takamine (1854-1922), the pioneer of chemical entrepreneurs looking at the world from Japan
⑩	
No. 047	Fume hood of Gakushuin University, south building No. 1, built in 1927
No. 048	Remain of Japan's first electromagnet for NMR spectrometer, stored in the University of Electro-Communications
No. 049	Remains (the early building and the sellected materials related physics and chemistry) in Shimadzu Foundation Memorial Hall
No. 050	Copper ammonium rayon manufacturing equipment "Hank spinning machine", and related materials
⑪	
No. 051	Third-order structural models of protein (cytochrome c, takaamylase A), stored in Osaka University
No. 052	Blueprint of the Seimi-Kyoku that laid the foundation for modern chemistry education in Japan around 1869-1872 (*Osaka Kaiseijo-Zenzu*)
No. 053	Remains of the first domestic metal magnesium ingots manufactured in Japan in 1935
No. 054	Three containers at the time of the launch (in 1885) of Japan's first Western medical prescription cosmetics, Bi-gan-sui (Beauty Water)
⑫	
No. 055	Materials (including parts of naphtha steam cracker and a polyethylene reactor) around the time of birth of the Japanese petrochemical complex
No. 056	Remains (stoned distillation tower and bamboo filler) of bromine production equipment made from bittern and seawater, and porcelain containers
No. 057	Remain of a part of regenerated camphor distillation column, built in 1920, kept in Kobe, Hyogo Prefecture

Table 2-1 Analyzed Characters of each CHJ

No. Title						
①	Academic	Technical	people	things	Period	Remarks
No. 001 Kyo-U Sho-Oku collection: Youan Udagawa's (1798-18	○		○	○	1	Related to No.029
No. 002 Keizo Uenaka's (1876-1960) notebook "*Memorandum*	○	○	○	○	3	Related to No.046
No. 003 A sample of glutamic acid extracted from Laminaria jap	○	○	○	○	3	
No. 004 Remains of granite towers for absorbing hydrogen chlo		○		○	2	
No. 005 Materials (yarns and a model of spinning machine) sho		○		○	4	
No. 006 A part of the plant and related materials for ammonia p		○		○	4	
②						
No. 007 Transcripts of lectures on chemistry delivered by Pomp	○		○	○	1	
No. 008 Japan Academy Collection : Komin Kawamoto's (1810-	○		○	○	1	
No. 009 Remains (buildings and materials) to show the establisl		○		○	4	
No. 010 Materials including cylindrical glasses to show the origi		○		○	3	
③						
No. 011 Riko Majima's (1874-1962) Urushiol Research-related r	○		○	○	4	
No. 012 Setsuro Tamaru's (1879-1944) materials (photographs	○		○	○	4	
No. 013 Umetaro Suzuki's (1874-1943) Vitamin B1 discovery in	○		○	○	4	
No. 014 Benzene purification equipment, designed in-house in		○		○	3	
No. 015 Hard (for pipes) and soft (for wire coating) vinyl chlorid		○		○	6	
No. 016 Materials including vinylon tow in 1950, showing the or		○		○	6	
No. 017 Materials showing the origin of the Japanese cement in		○		○	2	
④						
No. 018 Masataka Ogawa's (1865-1930) Nipponium Research,	○		○	○	3	
No. 019 Chika Kuroda (the pioneer female chemist)'s (1884-19	○		○	○	4	
No. 020 Materials related to manufacture of artificial oil by the F		○		○	5	
No. 021 Materials on the development and commercialization of		○		○	4	
No. 022 Remains (buildings and materials) showing the origin o		○		○	4	
⑤	Academic	Technical	people	things	Period	Remarks
No. 023 Materials about Joji Sakurai (1858-1939) who laid the f	○		○	○	3	
No. 024 Materials related to Nagayoshi Nagai (1845-1929) who	○		○	○	3	
No. 025 Chem lab of Former Fifth High School and Physics and	○			○	2	Related to No.047
No. 026 Materials including the bundle of the resignations and c	○	○	○	○	1、2	
No. 027 Isoma injection molding machine and dies those were i		○		○	4	
No. 028 Materials related to Japan's first industrialization of alur		○		○	4	
⑥						
No. 029 Waseda University library collection: Youan Udagawa's	○		○	○	1	Related to No.001
No. 030 Industrial high-pressure oil/fat decomposer (autoclave)		○		○	3	
No. 031 Remains (Moromi tower and distillation tower shelf) sh		○		○	5	
No. 032 Nippon Paint HD collection: Materials showing the origi		○		○	2	
No. 033 Materials showing the origin of the Japanese nylon indu		○		○	6	
⑦						
No. 034 Materials related to Hikoma Ueno (1838-1904), the fou	○		○	○	1	
No. 035 Materials related to Mitsuru Kuhara (1855-1919), the p	○		○	○	2	
No. 036 Tetsuo Nozoe's (1902-1996) chemical heritage: Non-b	○		○	○	6	
No. 037 Materials showing the origin of Japanese high-pressure		○		○	6	
No. 038 Materials related to G. Wagner (1831-1892) who contr	○	○	○	○	2	

＊ left a part of the title for convenience

Table 2-2 Analyzed Characters of each CHJ

No. Title						
⑧	Academic	Technical	people	things	Period	Remarks
No. 039 Materials related to Mitsumaru Tsujimoto (1877-1940),	○		○	○	4	
No. 040 Materials including early equipments of oxygen gas sep		○		○	4-7	
No. 041 Dainihon Jochugiku Co., Ltd collection: Materials showi	○	○	○	○	2-6	
No. 042 Materials including the prescriptions and the containers		○		○	2	Related to No.054
No. 043 Remains (production equipment and wooden container		○		○	5	
⑨						
No. 044 Transcripts of lectures on chemistry: Griffith "*Kagaku H*	○		○	○	1	
No. 045 Synthetic rubber samples by monovinyl acetylene meth		○	○	○	5	
No. 046 Materials related to Jokichi Takamine (1854-1922), the	○	○	○	○	3	Related to No.002
⑩						
No. 047 Fume hood of Gakushuin University, south building No	○			○	5	Related to No. 0 25
No. 048 Remain of Japan's first electromagnet for NMR spectror	○			○	6	
No. 049 Remains (the early building and the sellected materials	○		○	○	2-6	
No. 050 Copper ammonium rayon manufacturing equipment "H		○		○	5-7	
⑪						
No. 051 Third-order structural models of protein (cytochrome c	○			○	7	
No. 052 Blueprint of the Seimi-Kyoku that laid the foundation fo	○		○	○	1	
No. 053 Remains of the first domestic "Metal Magnesium Ingot"		○		○	5	
No. 054 Three containers at the time of the launch (in 1885) of		○	○	○	2	Related to No.042
⑫						
No. 055 Materials (including parts of naphtha steam cracker and		○		○	6	
No. 056 Remains (stone distillation tower and bamboo filler) of		○		○	6	
No. 057 Remain of a part of regenerated camphor distillation co		○		○	4	
total	28	35	26	57		
ratio	49%	61%	46%	100%		

＊ left a part of the title for convenience

Typical technical Chemical Heritage Japan(CHJ)

No. 004 Remains of granite towers for absorbing hydrogen chloride gas,
by-product of Leblanc soda process, built in 1891 at Nihon Seimi Seizo Co. Ltd.
(later Nissan Chem Co. Ltd.)

Height 10 m, towers area 11 x 10.5 m
(Nissan Chemical Co. Ltd., Sanyo-Onoda City, Yamaguchi Pref.)

The certificate
(Height about 20 cm,
framed and with glass lid)

Ref. Commentary article: A. Kitajima and K. Arai, *Chemistry and Industry* (July 2010)

Fig. 3

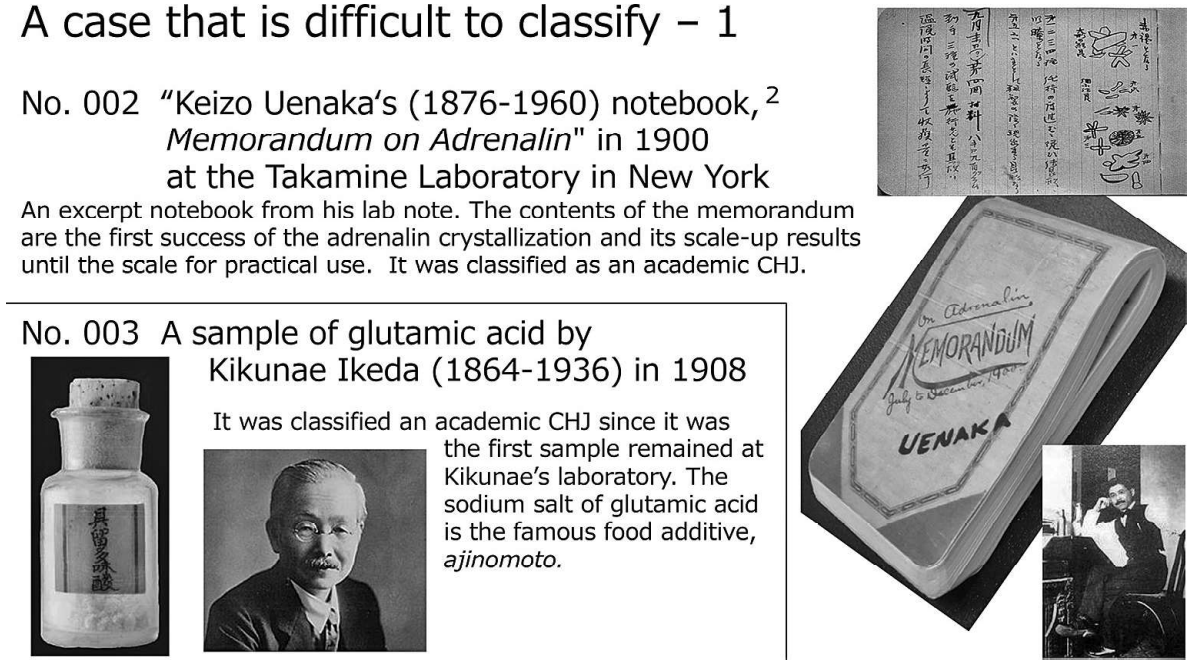


Fig. 4

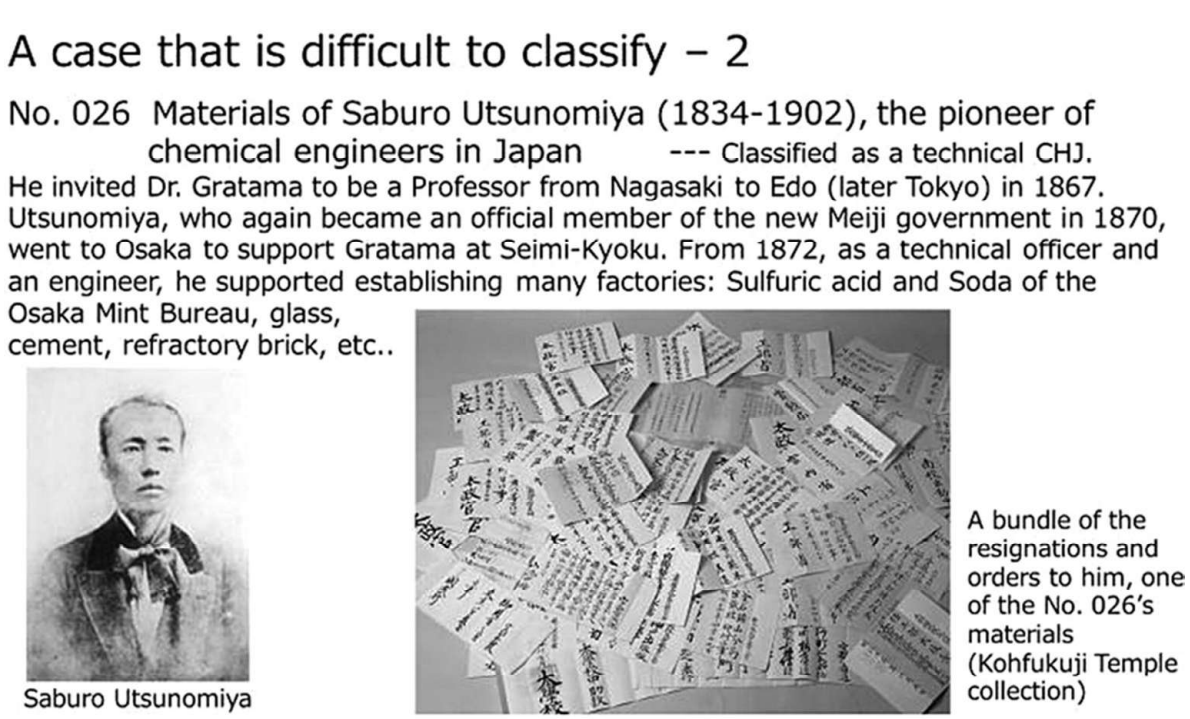


Fig. 5

from Nagasaki to Edo (later Tokyo) in 1867 and helped popularize modern Western chemistry in Japan. When Japan's Meiji Restoration began in 1868, under the new Meiji government, Gratama set up a Seimi-Kyoku (school of modern physics and chemistry) in Osaka. Utsunomiya, who again became an official member of the Ministry of Education of the new Meiji government in 1870, went

2 Yamashita (1966) called this a "Lab Notebook" in Japanese, but it was a "memorandum on adrenalin" excerpted from Uenaka's lab notebooks. Yamashita (2002) renamed this a "Research Note" in English. See reference 8-a and 8-b.

to Osaka to support Gratama. He consistently undertook efforts to popularize modern Western chemistry in Japan. Hence, CHJ No. 026 was best classified under academic efforts.

From 1872, as a technical officer of the Ministry of Industry of the new Meiji government, Utsunomiya supported establishing sulfuric acid and soda factories of the Osaka Mint Bureau. As an engineer, he also accomplished the start-up of numerous government-owned factories, such as glass, cement, refractory brick, and so on. After retiring in 1884, he continued to help modernize attempts such as the Japanese brewing industry. Utsunomiya, the pioneer of chemical engineers in Japan, responded actively to the demands of the times, as evidenced by the bundle of the resignations and orders to him, shown in Fig. 5. I classified No. 026 as a technical CHJ.

The classification was especially difficult in the academic materials. Tables 2-1 and 2-2 show the academic CHJs with technical aspects marked ○ near the technical column, and the technical CHJs with academic aspects were also marked ○ (double marked). There were 28 academic CHJs, about 50% of the total, and 35 technical CHJs, about 60%. There were a few more technical CHJs, but the numbers were almost the same, suggesting that the CHC wanted to balance the academic and technical fields.

b. People-centered or things-centered?

b-1. About the people-centered CHJs

Many people's names were included in the titles of the CHJs, and names and portraits frequently appeared in the CHJ leaflets issued every year by the CHC. However, all the chemical heritage items could be called "things," is the question useless? I did not think so. To me, the critical classification distinction was whether the material was aligned with a specific person. When a specific person's name was included in the title or the description in the CHJ leaflets, I classified that CHJs as a people-centered CHJ and added the ○ mark to the people column.

Table 3 The list of CHJ involving a specific person

No.	Person	Year of birth & death
No. 001	Yoh-an Udagawa	1798-1846
No. 002	Keizo Uenaka	1876-1960
No. 003	Kikunae Ikeda	1864-1936
No. 007	Pompe v. Meerdervoort	1829-1908
No. 008	Komin Kawamoto	1809-1871
No. 011	Riko Majima	1874-1962
No. 012	Setsuro Tamaru	1879-1944
No. 013	Umetaro Suzuki	1874-1943
No. 017	(Soichiro Asano)	
No. 018	Masataka Ogawa	1865-1930
No. 019	Chika Kuroda	1884-1968
No. 023	Joji Sakurai	1858-1939
No. 024	Nagayoshi Nagai	1845-1929
No. 026	Saburo Utsunomiya	1834-1902
No. 029	Yoh-an Udagawa	1798-1846
No. 034	Hikoma Ueno	1838-1904
No. 035	Mitsuru Kuhara	1855-1919
No. 036	Tetsuo Nozoe	1902-1996
No. 038	G. Wagner	1831-1892
No. 039	Mitsumaru Tsujimoto	1877-1940
No. 041	Ei-ichiro Ueyama	1862-1943
No. 044	(Griffith, Sluis)	
No. 045	Junji Frukawa	1913-2009
No. 046	Jokichi Takamine	1854-1922
No. 049	Genzo Shimazu	1839-1894
No. 052	Koenraad W. Gratama	1831-1888
No. 054	Seijiro Momotani	1863-1930

There were 26 "people-centered" CHJs, about 45% of the total (See Tables 2-1 and Table 2-2). Among these 26 CHJs, in CHJ No. 017 one person's name was mentioned but multiple people were really associated with the CHJ materials. Two person's names were mentioned in CHJ No.044. I excluded these two from the following

No.	Person	Year of birth & death
No.001	Yoh-an Udagawa	1798-1846
No.029	Yoh-an Udagawa	1798-1846
No.008	Komin Kawamoto	1809-1871
No.007	Pompe v. Meerdervoor	1829-1908
No.038	G. Wagner	1831-1892
No.052	Koenraad W. Gratama	1831-1888
No.026	Saburo Utsunomiya	1834-1902
No.034	Hikoma Ueno	1838-1904
No.049	Genzo Shimazu	1839-1894
No.024	Nagayoshi Nagai	1845-1929
No.046	Jokichi Takamine	1854-1922
No.035	Mitsuru Kuhara	1855-1919
No.023	Joji Sakurai	1858-1939
No.041	Ei-ichiro Ueyama	1862-1943
No.054	Seijiro Momotani	1863-1930
No.003	Kikunae Ikeda	1864-1936
No.018	Masataka Ogawa	1865-1930
No.011	Riko Majima	1874-1962
No.013	Umetaro Suzuki	1874-1943
No.002	Keizo Uenaka	1876-1960
No.039	Mitsumaru Tsujimoto	1877-1940
No.012	Setsuro Tamaru	1879-1944
No.019	Chika Kuroda	1884-1968
No.036	Tetsuo Nozoe	1902-1996
No.045	Junji Frukawa	1913-2009
No.044	(Griffith, Sluis)	
No.017	(Soichiro Asano)	

People-centered CHJs (26/57 from Table 3)

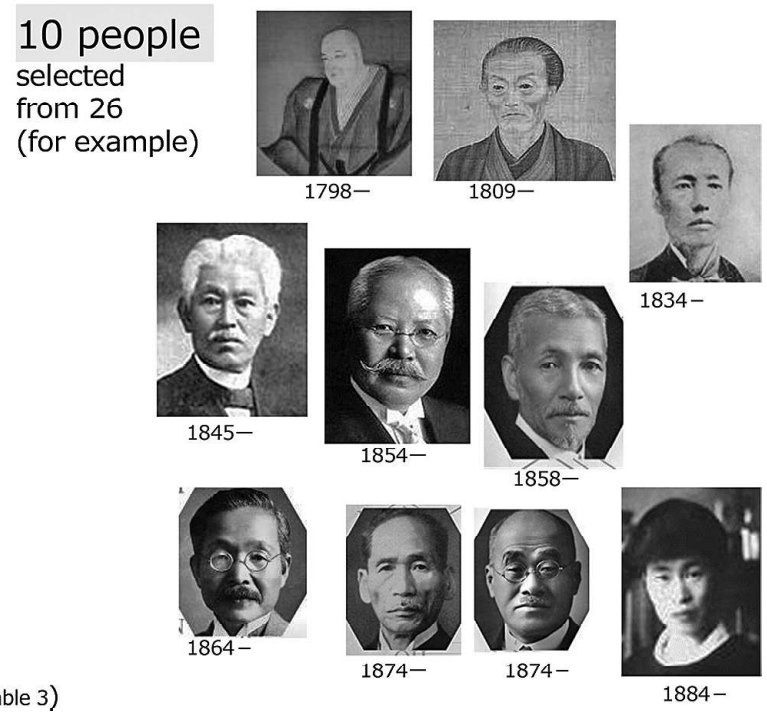


Fig. 6 Biographical timeline of the history of chemistry in Japan.

discussion. It is interesting to see the history of chemistry in Japan spelled out by people. I extracted 26 CHJs (see Table 3), rearranging them from oldest to the most recent by birth year (see Fig. 6, left) and choosing 10 people whose portraits appeared on the Chemical Heritage website[2]. In this way, I constructed a biographical timeline of the history of chemistry in Japan (see Fig. 6, right). This seemed to be an effective methodology. Overall, there were more than 50 CHJs, with no major omissions.

b-2. About the things-centered CHJs

When there was a single object, it was relatively easy to sort the CHJs by the type of thing. However, when there were many related things of value, the sorting task became more difficult. For example, CHJ No.009, "Remains (buildings and materials) to show the establishment and development of celluloid industry in Japan,"[11] included a red brick factory, a western-style dormitory for invited foreign engineers, an experimental squeezer, and many initial products (including a black celluloid doll). (See Fig. 7)

I will not provide an overly detailed discussion about the sorting in this section. Suffice to say that in general, people and companies often cherish things that they find meaningful for a long time. If such things were related to chemicals in Japan, they were likely to be recognized as CHJs. For example, I classified CHJ No. 019, "The pioneer female chemist in Japan, Chika Kuroda's (1884-1968) natural pigment research-related materials"[12] as people-centered. The four specimen boxes she left behind are excellent examples of cherished things. They may have been the important evidences of her research as her livelihood and the meaningful thing. She handwrote the specimen descriptions. (See Fig. 8) Many things classified as people-centered CHJs look like the same. The large number of patent manuscripts of CHJ No. 046, signatured by Jokichi Takamine (1854-1922) in many places, would be another example.

CHJ No. 040, "The Origin and Development of

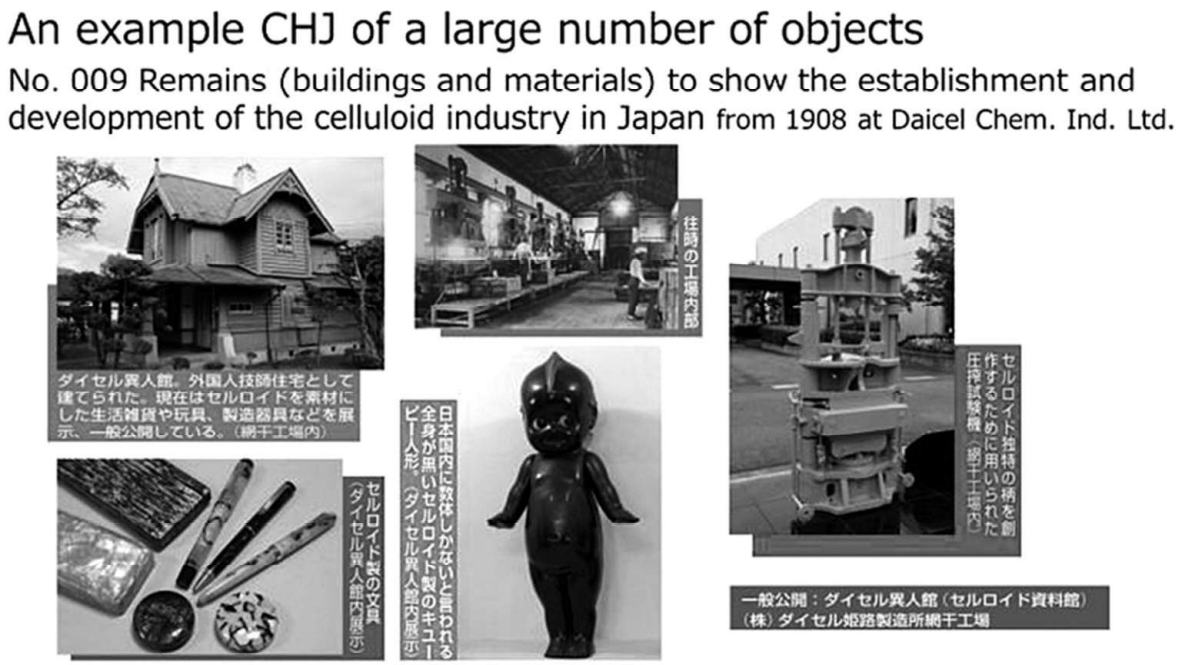


Fig. 7

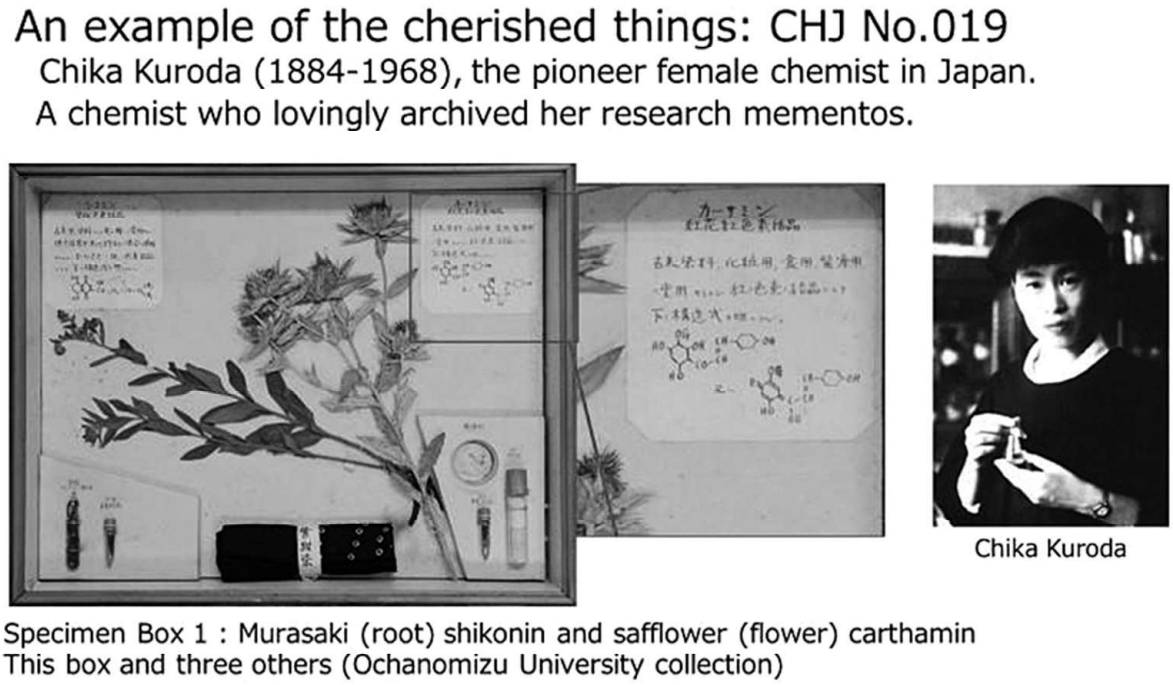


Fig. 8

the Oxygen Industry in Japan"[13] is one of the things-centered CHJs. The historical factory buildings have housed much of the historical equipment as the memorial halls. The website of Hakodate Oxygen Company shows the air expander that had been in operation for 47 years total in three different factories (Kawasaki, Sendai, and Hakodate), kept operational by many maintenance staff in charge of the first domestically manufactured equipment in Japan.[14] (See Fig. 9, bottom left) These buildings and the equipment reminded me that Japanese culture values history.

I analyzed things of CHJs about the types of technical processes and the locations: the place of

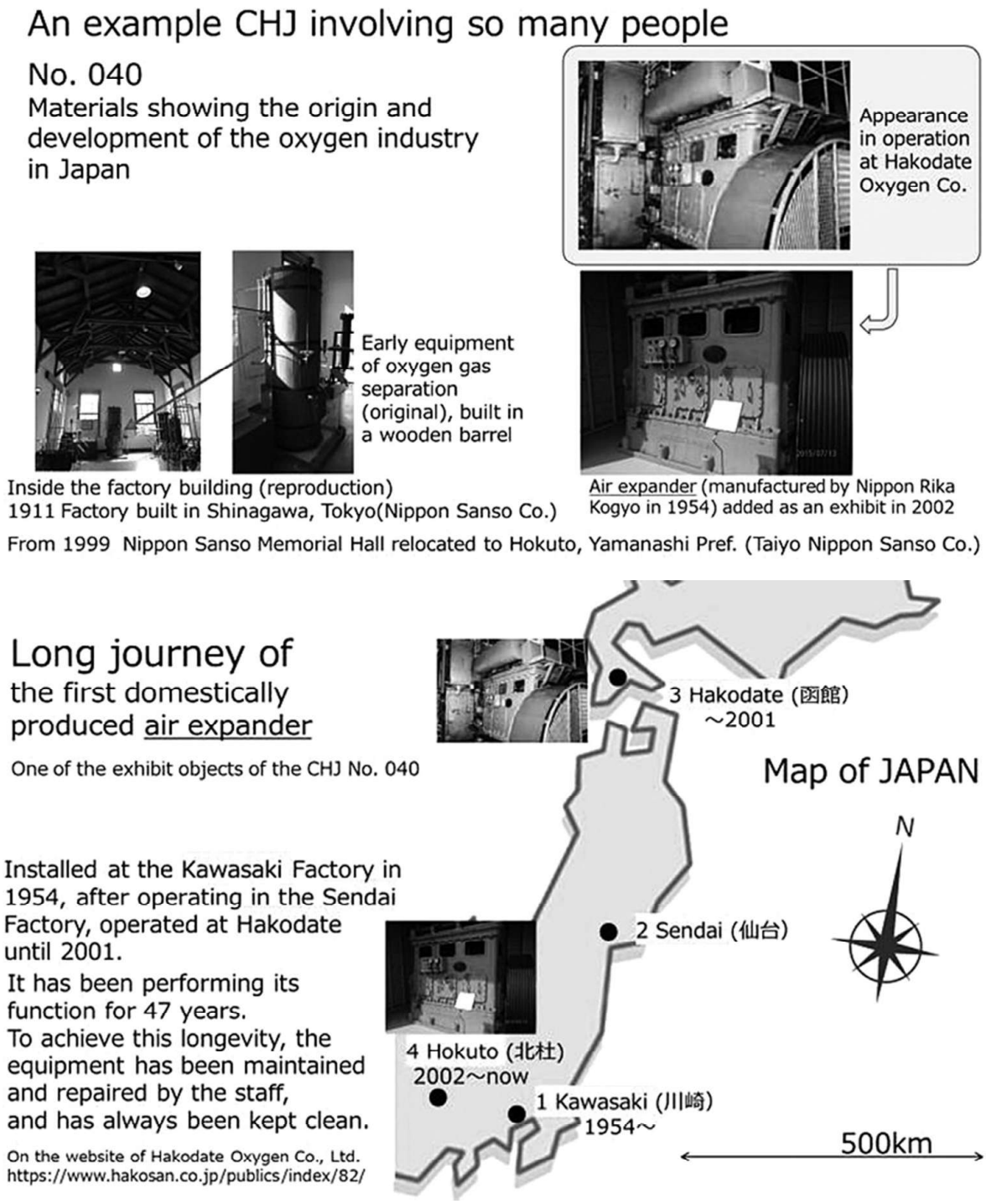


Fig. 9

activity, the present location of the collections, but I would like to avoid too detailed discussions here.

c. What is the timeline?

I color-coded the CHJs into seven periods :

Period 1. End of the Edo era to the beginning of the Meiji era (1830-1875)

Period 2. Early and middle Meiji era (1875-1890)

Period 3. Late Meiji era and to the early Taisho era (1890-1915)

Period 4. Late Taisho era to the early Showa era (1910-1930)

Period 5. Before and during World War II

(1930-1945)

Period 6. Later part of World War II and post-war (1940-1960)

Period 7. Decades of high economic growth (1960-present).

Table 4 shows each period's position in Japanese history. I sorted the CHJs according to these positions after carefully considering whether they

Table 4 7 periods in the history of Japan

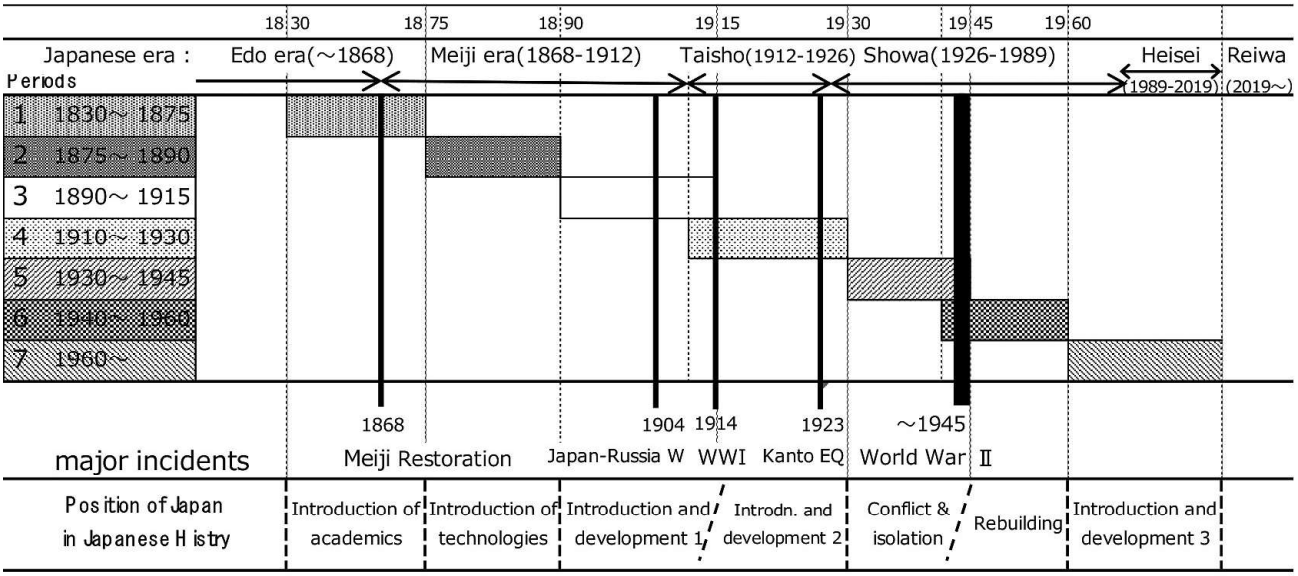
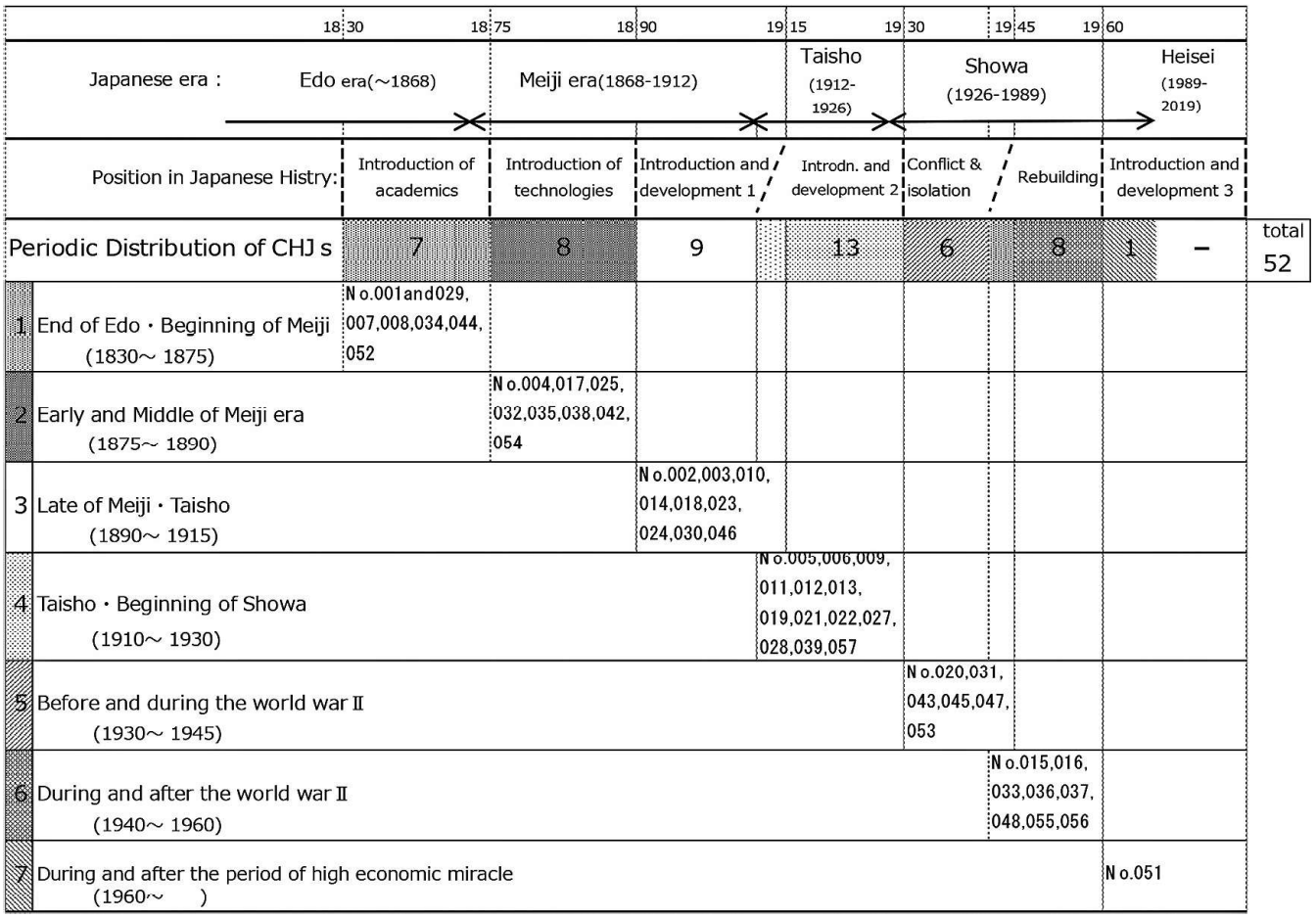


Table 5 Periodic Distribution of CHJs



should be placed before, during, or after either of the two World Wars. Therefore, the starting and ending years overlap slightly. The World Wars had a massive impact on both academia and the rise and fall of industries in Japan. Table 4 also shows the major historical incidents in Japan. The results of sorting the CHJs are shown in Tables 2-1 and 2-2. Some CHJs straddled the periods-for example, CHJ Nos. 026, 040, 041, 049, and 050-but their numbers were small, so I excluded them. Table 5 shows the periodic distribution of the CHJs.

Many of the pivotal events in modern chemistry in Japan happened in the early days, so about five years after the CHJ Program started, there were many certifications for the older periods. (See Tables 2 and 5) However, since the investigation subcommittee of the CHC must conduct field surveys by hand, the investigations take time. Moreover, after an investigation is completed, all committee members must agree before they reach an official conclusion (Fig. 1). Now that the CHJ Program has run for more than ten years, they have achieved a balanced distribution across the periods (Table 5). There are 13 CHJs in Period 4, which is notably higher than the others, likely because the academic and technical seeds planted in Periods 1-3 blossomed in Period 4. One of the reasons why there are many CHJs in Period 4, may be that many meaningful objects have been carefully stored for about 100 years, and have become considered as CHJ candidates.

5. Conclusion

I scrutinized 57 CHJs and analyzed them to explain the history of chemistry in Japan from various perspectives. The CHJs of the CSJ are good teaching materials for explaining this history.

The CHJ program is in its 13th year, and the CHC's slogan is that do not lower the level of CHJ. We will continue to honor the certification criteria and end the program only when there are no more candidates - a time that is unlikely to come, since new milestones are achieved each year. We need to investigate the preservation status of some of the CHJs, recognized in past years but not yet realized. There are also issues to be resolved, such as how to acknowledge the negative elements in Japan's chemical heritage, such as the remains of poison gas manufacturing plants, records of chemical weapons research, and the manifestations of environmental pollution. We also need to focus on the relatively new but important chemical heritage certification of Periods 57. We would be grateful if you, our readers, would continue your warm and generous support in these efforts.

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Chemical Heritage Japan Program : Introduction to the History of Chemistry in Japan

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This paper introduces the Chemical Heritage Japan (hereinafter CHJ) Program of Chemical Society of Japan (hereinafter CSJ), which was established in March 2008 and has entered its 13th year. As far as I know, this is the first detailed introduction of the program in English.

Firstly I introduce the goals, the organization and the annual flow of the CSJ Program. Table 1 shows a list of 57 certified CHJs up to March of 2021. The 57 certified CHJs will be analyzed by grouping them into academic or technical (chemical technology, manufacturing chemistry), people-centered or things-centered, by active periods, and so on.

Some of the results are as follows. The numbers of academic and technical CHJ are almost the same, though there are many cases where it is difficult to classify. The numbers of people-centered CHJ is almost the half of the numbers of all CHJ. It is interesting to see the history of chemistry in Japan spelled out by people, Fig. 6 for example. Periodic distribution of CHJs was shown in Table 5.

In this work, I have attempted to explain the history of chemistry in Japan from various perspectives. In other words, it can be said that the CHJs of CSJ are good teaching materials for intxoducing the history of chemistry in Japan.