Aluminium industry: a Heritage for Europe

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If we consider the discovery of the first production process, that of Henri Sainte-Claire Deville in 1854, the appearance of aluminium as a useful metal dates back 151 years. If we consider the distance we've gone since Humphrey Davy in 1807, the knowledge of aluminium goes back 200 years: a child compared to metals known since prehistory. The technical history of the production processes is rather well known, that it is the process of 1854 or that of Paul Héroult (France) and Charles Martin Hall (USA) in 1886.
The aluminium history is based on research and production places, tools, artefacts and people, whom it is advisable to define and to make known. Very recent history, it remains badly highlighted by the museologic point of view. We propose thoughts on the nature of this heritage and its valorisation today.

We shall examine at first "The aluminium history: places and tools", and then how to "Highlight the aluminium industry heritage".

1/ The aluminium history: places and tools

Initially, we will examine the places of research and industrial development.

1.1. The period 1807 to 1885: a secret and rare metal

1.1.1. The European science in work 1807-1854

Everywhere in nature, aluminium constitutes around eight percent of the element of the Earth's crust. But aluminium is strongly drawn to oxygen to which it binds itself tightly in chemical combinations that are extremely difficult to break down.
So, the aluminium birth is at first connected to the chemistry's history.
The invention of a production process put in evidence the ascendancy of the scientific method and the strong relationships between European scientists in the XIXth century:
- From the Lavoisier (1743-1794) theory,
- The British chemist Humphrey Davy (1778-1829) failed in his attempt to break down alumina's metal, he called "alumium".
- The Dane Christian Oersted (1777-1851) tried with chemical reaction but also failed.
- The German Friedrich Wöhler (1800-1882) had partial success: Wöhler obtained an aluminium powder but with too many impurities. He asserted that aluminium decomposed in water at 100° C.
- The French Henri Sainte-Claire Deville, in his Paris' laboratory, modified the conditions of the Wöhler experiment and was successful in 1854: he replaced potassium with sodium and obtained "more or less large globules of perfectly pure aluminium".

1.1.2. The industrial development

One of the first ones to support financially the French scientist was the Emperor Napoleon III. Thanks to him, HSCD carried on its work to produce industrially what was still only a laboratory's product. Many attempts were successively realized on several sites of the Paris area (La Glacière, Nanterre, Rouen-Anfreville), then the production settled down durably in 1860 in the south of France, at Salindres, in the Pechiney factory, near the raw material. Especially, bauxite, which contains alumina, was extracted near Baux-de-Provence village. In 1890, the production in Salindres was about three tons of aluminium per year.

During the same period, it seems they were some aluminium factories outside France, but which didn't work as long as Salindres[1]. Some of them used different patents, finalized for the greater part in the 1880s. But all of them had to abandon their realization because of the superiority of Hall-Héroult patents.

In England, we found six factories :
- in Battersea, near London, from 1859 to 1863, (C. H. Gerhardt, with Sainte Claire Deville patent)
- in Washington, near Newcastle-on-Tyne, from 1860 to 1867 or 1874, it depends on the author (Bell Brothers, with Sainte Claire Deville patent)
- in Hollywood, near Birmingham, in 1882 (Aluminium Crown Metal Cy, Sainte Claire Deville patent),
- in Hollywood, near Birmingham, in 1882 (Aluminium Company Ltd, with with Sainte Claire Deville–Castner patent
- in London, King's Head Yard, in 1888 (Alliance Aluminium company), and
in Wallsend-on-Tyne from 1889 to 1893 (C. Netto patent)

In Germany
- in Heimeligen, from 1885 to 1890, (Aluminium und Magnesiumfabrik, Grätzel patent
- in Essen, (ateliers Krupp, C. Netto patent, in Bessemer converters), in 1887
- in Trotha, about 1887, (Grabau Aluminium Werke, Grabau patent)

and in the United States,
- Frishmuth's Foundry in Philadelphia, from 1884 to the end of the 1880's (colonel W. Frismuth, and Cowles Brothers).

1.2 From 1886, towards a progressive everyday acceptance

1.2.1 CM. Hall and P. Héroult

Two young men took a second essential step in 1886: Paul Héroult in France (Gentilly, near Paris, rue de la Chamoiserie), and Charles-Martin Hall in the United States (Thompson, Ohio). Both of them, without knowing, succeeded in developing a new process by electrolysis.

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[1] Cf. Louis Ferrand, *Histoire de la science et des techniques de l'aluminium et ses développements industriels*, 2 tomes, Imprimerie Humbert & fils, édité par l'auteur, 1960 et 1961

In France, Paul Héroult initially started to produce aluminium in Switzerland, in Neuhausen, and one year later in France in the Froges factory. Héroult contributed to create the Société électrométallurgique française (SEMF), which built in 1893 a new factory at La Praz, in the Maurienne valley in Savoy. The factory was an industrial and scientific curiosity, and many scientist's and industrialist visited it, including the Americans.

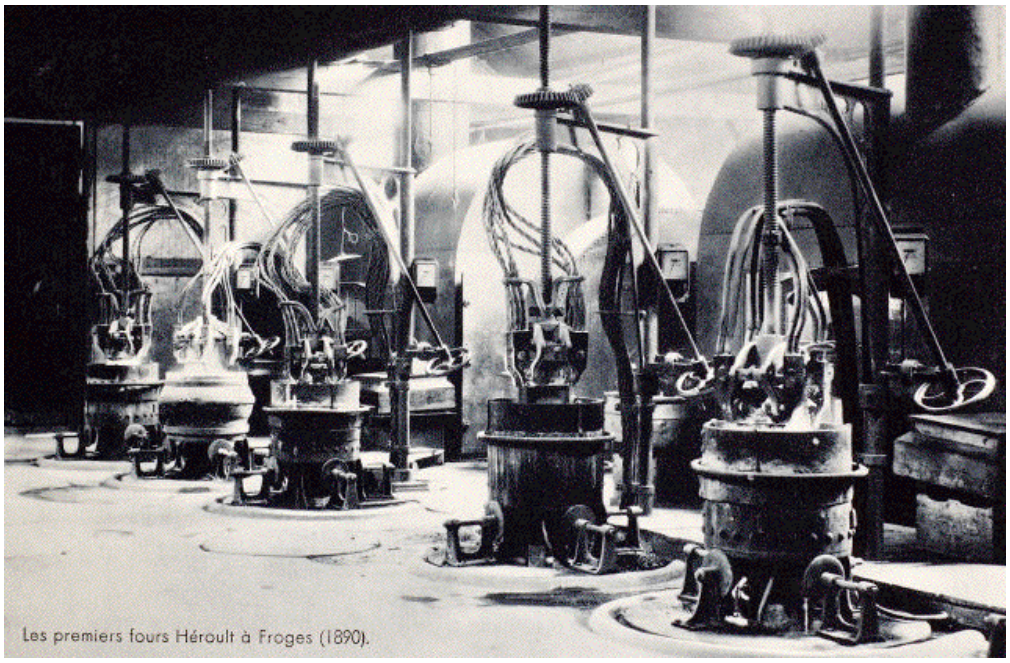


Figure 1 - Froges, 1890, © D. Varaschin.

C.M. Hall obtained at first the support of the Cowles Electric Smelting and Aluminium Cy, from July, 1887 till April, 1888. Then, Alfred Hunt, of Pittsburgh Testing Laboratory, hired him, and created on September 19th, 1888, the Pittsburgh Reduction Company. Two workshops started in Pittsburgh, situated on Smallman Street, and in March 1891, a new factory was built in New Kensington, on Alleghany River, 19 miles from Pittsburgh. A third factory was then started on August 26th, 1895, on the Niagara Falls.

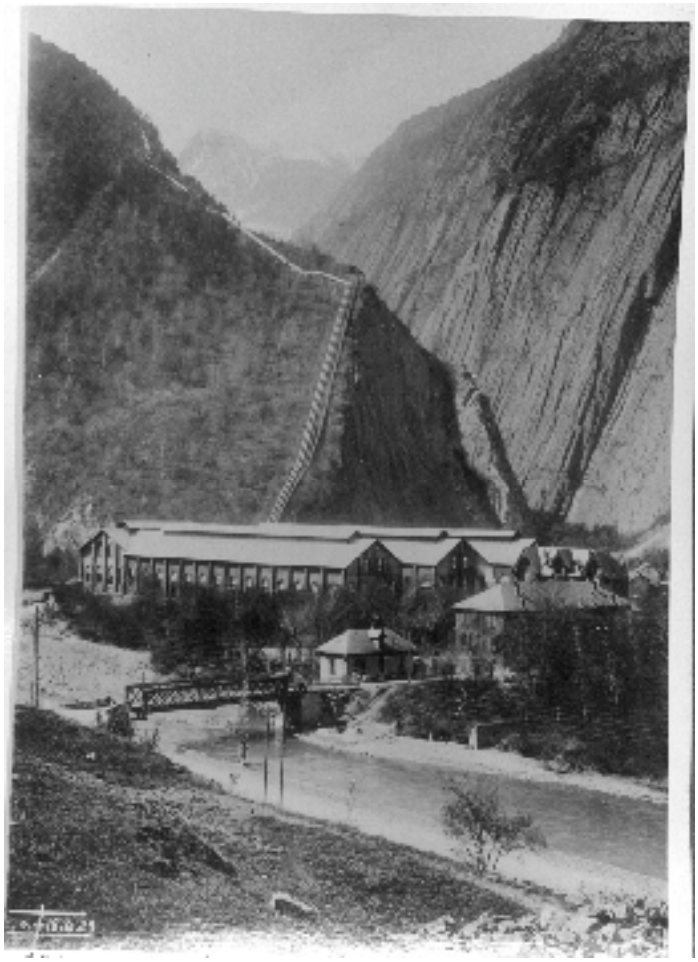
Because of the lower price of metal, many new uses were now made possible, for example planes, packaging, camping or saucepans. The pure metal is soft and ductile, but when combined with other metals, it forms strong alloys. This, together with its lightness, resistance to corrosion and electrical conductivity, makes aluminium suitable for a wide range of uses, from aircraft and vehicle construction, to window frames, overhead power cables and food packaging.

1.2.2 Other vain attempts

During the 1880's, other researchers deposited patents to protect new processes of production of aluminium by electrolysis, among which some knew an industrial development:

- Minet (1854-1914) in France, collaborated at first with the brothers Bernard in their factory of Creil (Lontin process), then was at the head of their Calypso factory (Savoy, Maurienne's valley) from 1891 till 1895

- Cowles in the United Kingdom (Cowles Syndicate Cy, Milton on Trent), and then in the United States, about 1887.
- C. Bradley in the United States gave up his patents in Grovenor P. Lowrey, who exploited them at the Booton pilot plant, in New Jersey, under the name of US Aluminium Metals Company, about 1885.
- M. Kiliani, in Germany, led its first work on the aluminium within the *Allgemeine Elektrizität Gesellschaft* (AEG), then the *Aluminium Industrie A. G.* (AIAG), about 1888, to the Neuhausen factory, where he pursued the work of Héroult. He finalized in particular the oven with tournante anode. Kiliani, in association with Héroult, managed to produce, in July, 1889, pure aluminium, and neither bronze of aluminium.

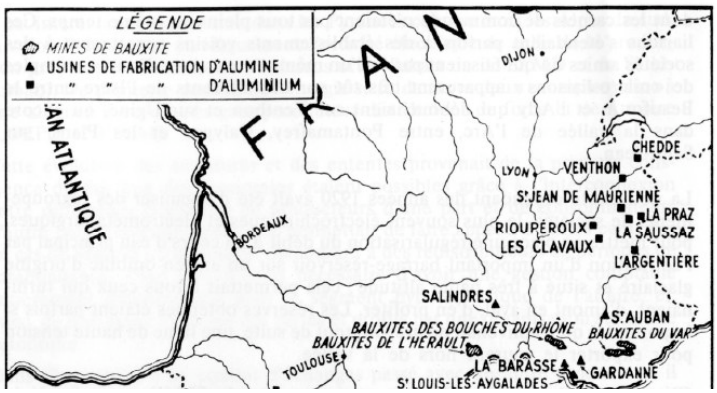


It is also necessary to note a vain attempt of production realized in France, by manufacturing, brothers Bernard: they made their first attempts in Paris, in a factory situated in the impasse of the Moulin Joli, from March, 1887 till March, 1888, with the process Lontin, then in a factory in Creil from April, 1888 till October, 1891 and finally to Calypso, in Savoy, from 1891 till February, 1895, with the process Minet. Calypso was the first factory built in the Maurienne valley.

Figure 2 - Calypso Factory, Maurienne Valley, © Institut pour l'histoire de l'aluminium

1.2.3. A new industry was born

Stimulated by the Héroult success, some French competitors appeared, with new factories in the Alps and Pyrenees. 16 aluminium factories, or smelters, were built in France between 1893 and 1939, but only two remain in 2006.



In the world, five major producers appeared between 1886 and 1901: three in Europe (France, Switzerland and Great Britain) and one in the United States. World War 1, then World war Two, provoked the appearance of

new producers: Germany, Italy, Spain, Canada, USSR and Norway in particular.

Figure 3 - Aluminium and bauxite in France. © Institut pour l'histoire de l'aluminium

The aluminium industry required an important capital investment to build a smelter: the manufacturers mostly had to buy rights on waterfalls and equip them with power plants to produce electricity. The impossibility to transport electricity long distances favoured the location of the smelters near sources of energy, the Alps in particular.
Upstream, most of the producers bought bauxite's mines and built their alumina factories, to secure their requirement in raw material. The mines of the South of France were the only European deposit known before 1914.

Strongly capital-intensive, the aluminium industry is also characterized, during a century, by a monopolistic situation: just one producer by country is a frequent situation, and few producers in the world, were gathered until 1953 within a powerful cartel. Unlike other materials as iron or steel, few smelters were built in Europe. This situation is explained by the slow evolution of the market until World War 2, the high construction cost and the difficulties to use the electrolysis technology.

2/ Highlight the aluminium industry heritage

This long statement on the aluminium industrial history tries to show that it is today possible to emphasize places and symbolic objects, and to do it at the European level. The patrimony of aluminium is at present highlighted in some places.

2.1. The French case

France seems to be the most active country in this domain. More particularly, we note the creation, in 1986, of the Institute for the aluminium history (IHA), the mission of which is to develop the metal knowledge.

2.1.1 L'Institut pour l'histoire de l'aluminium

For twenty years, the Institute has been helping the research and accompanies the realization of numerous research works in economic history, art history, architecture, etc. This corpus of knowledge is essential to work out solid scientific texts and put places, techniques and artefacts in an historical context. Supported by Pechiney and today by Alcan, the Institute facilitates the access of the researchers to archives and to industrial sites.
Another essential aspect of the institute achievement is its work around the collection Jean Plateau/IHA. J. Plateau, the former director of the Pechiney's research centre at Voreppe has more than 20 000 (twenty thousand) aluminium artefacts, he has been collecting for almost 20 years. The collection has got a huge value for aluminium history, with ordinary and unusual artefacts.
This aluminium collector gathered peculiarly some period saint-Claire Deville artefacts. Inaccessible to the public, the collection is highlighted by means of participations in national and international exhibitions.

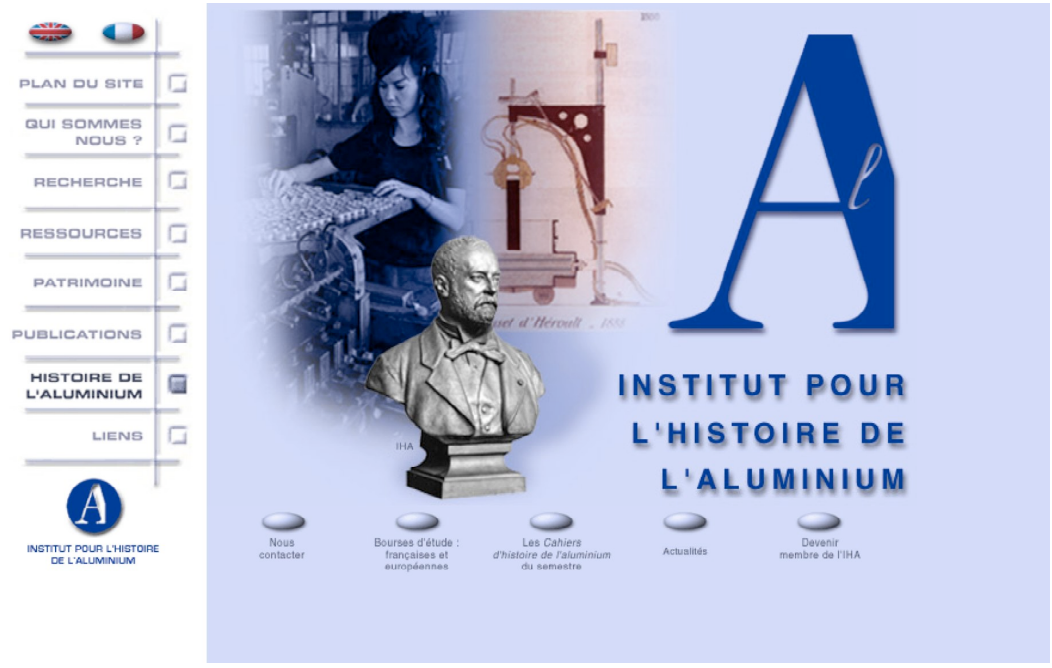


Figure 4 - Institut pour l'histoire de l'aluminium website, www.histalu.org

2.1.2. The partnerships with museum

Aluminium was also made the object of an exemplary partnership between the **musée des Art et Métiers** (Paris) and the Pechiney, and now Alcan company. The animation of this partnership was entrusted to the IHA. The company financed the realization of a cell model and mediation supports (video, CD-ROM). It also enriched the museum collection by a donation, with representative artefacts of the aluminium technology (production and transformation) in the year 2000 (two thousand).

In the museum collection, the Institute made the aluminium artefact inventory, putting in evidence the presence of one of the most ancient aluminium artefact: a weighing machine beam (le fléau d'une balance), dated at 1855.

Another successful example is: the collaboration with Carnegie Museum of Art (Pittsburgh-USA) during the conception of the ***Aluminum by Design*** exhibition (2000). The Institute brought to the curator scientific help, and lent about thirty unpublished objects. More details of these actions are available on the website of the institute: www.histalu.org. The exhibition was presented at the Cité des sciences et de l'industrie, in Paris.

Figure 5 - Exhibition poster, L'âge de l'aluminium

2.1.3. Other French initiatives

Inside the numerous initiatives in France, it is necessary to mention particulary the **Museum of aluminium**, called "EspaceAlu", to Saint-Michel-de-Maurienne, in Savoy (www.saint-michel-de-maurienne.com/culture_alu.htm). The Maurienne valley presents the peculiarity to have collected most of the French smelters (7 on 16), since 1891. One of them still works today, that of Saint-Jean-de-Maurienne. The people history and the landscape were considerably marked by more than a century of

industrial presence. But all the factories were immediately demolished after their lock out.
Some outbuildings, hydroelectric equipment, staff houses and other buildings with social vocation are still visible, but no inventory was realized.

The awareness of this patrimony was valued late: the creation of an association for an aluminium museum in Maurienne (AMMA) dates 1991. This formation was an opposition to a Pechiney museum project, near its new Dunkerque smelter, in the North of France.
The Espace Alu purpose is ambitious:
- Redraw the economic, technical and human history of this industry, in the valley but also in a European and international perspective.
- Explain the aluminium artefacts history.

Figure 6 – EspaceAlu, Architectural plan.

Figure 7 EspaceAlu, design plan.

The mayor constituted three committees, including a scientific one. They gather university researchers, curators, industrial, politicians and members of associations. A scenographer and a scientific mediator complete the plan. The opening is envisaged in October 2007.
It is also important to emphasise that a significant number of local initiatives have emerged in the last ten years, in order to preserve and develop the memory of this industry.

Here are some cases:
- the Salindres factory, which commemorated its 150e (hundred and fiftieth) birthday in 2005 with many shows;
- L'Argentière-La-Bessée, in the Haute Provence Alps, with an industrial course, and exposures realized by the Scientific centre (CCSTI).
- Rioupéroux, with a presentation of the industrial history in the municipal museum;
- Auzat, where the factory closed very recently. The former employees take sudden account of the value of their industrial heritage.
- Tourves, (Gard, south of France) has got the "musée des gueules rouges" a bauxite museum. Limited to only one room, the museum is the subject of a more ambitious project.
- Issoire, where the largest European aeronautical factory was built in 1946 by the brothers Pereire; a think tank is held by the municipality, within the project "POMA", in order to develop the patrimonial richness of the city.

Figure 8 - Pechiney house in Salindres, 1892. © Institut pour l'histoire de l'aluminium

Figure 9 - Pechiney house, 2000. © F. Hachez-Leroy

2.2 Outside of France

One finds, in an unequal way, some achievements in other countries:

2.2.1 In Europe

Especially, in the United Kingdom, "The Aluminium Story Visitor Centers", in Kinlochleven (Lochaber), recalls the industrial history of the site. This small museum was carried out in the smelter outbuildings, thanks to an Alcan group's funding. A DVD-Rom recalls this adventure. (Based on audio visual displays describing the

aluminium production seedling established in 1908, and the effect on the local community. There is also a small library.)
We do not forget, of course, the Science Museum of London, which has in its collections a certain number of very interesting objects relating to the history of aluminium
For example,
- this bar made in 1855 with aluminium and sent to Faraday,
- a pair of binoculars realized in 1895 (Army exit folding camera binoculars, C 1895),
- or this aluminium postcard of 1900.

2.2.2 In North America

The United States seems to have emphasized best the sites relating to the aluminium history. A certain number of places were the subject of a classification like "historical landmark": the cabinet Hall in Oberlin College (Ohio), or the Frismuth foundry, in Philadelphia, for example.
In 1986 Frishmuth Foundry at Rush and Amber Streets in Philadelphia (still produces commercial castings) was declared a historical landmark by ASM International. A cast aluminum plaque affixed to the building bears the citation "Colonel Frishmuth's Foundry has been designated an Historical Landmark.... The site of the first commercial aluminum reduction facility in the United States of America and the only producer of aluminum from its ore until the late 1880s"[2].

In Canada, within the City of energy, in Shawinigan, a part of the permanent exhibition is devoted to aluminium. The Alcan industrialist also gave a donation besides, in 2001, of the first electrolysis workshop installed in Canada in 1901, and appearing in the perimeter of the park. If the building were saved, it was unfortunately emptied of its industrial tools, in order to install an art gallery. It is particularly regrettable, because the City presents somewhere else one of the first cells built by CM Hall.

Conclusion

One of the aluminium history peculiarities is their profound European roots. The patrimony of this industry is protected today very unevenly, in spite of the sites importance, and the value of artefacts.
The French example, for 20 years, is a particular case, where the individual and collective awareness allowed the success of some projects. To make the inventory of the aluminium's European patrimony would be a first step towards a work in common.
The size of factories and their cost of maintenance stand in the way of their conservation. No factory of electrolysis was the object, up to now, of a real highlight work.
Now, it is urgent, because of the smelters and industrial tools destructions, to think about concrete solutions. One of them is maybe to work on the analysis and the protection of at least one site of electrolysis in Europe. A potential exists in Europe, in France and in Switzerland notably.

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