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May, 2006

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Available at: https://works.bepress.com/fathi_habashi/43/

De Re Metallica, 5, 2006 pp.
©Sociedad Española para la Defensa del Patrimonio Geológico y Minero
ISSN: 1577-9033

THE BEGINNINGS OF CHEMICAL AND METALLURGICAL INDUSTRIES IN CANADA

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INTRODUCTION

The period in the history of Canada known as New France was about 200 years, full of wars and revolutions but also was associated with intellectual activity and social change. It has its origin when Jacques Cartier (Figure 1) landed in 1534 for the first time in Gaspé in what is known today as the Province of Quebec, to take possession of the land in the name of the King of France François I. It was, however, Samuel de Champlain (Figure 2) who in 1608 founded the city of Québec and established the first French permanent settlement on this continent which extended gradually to Gulf of Mexico and became known as New France (Figure 3). This new empire ended in 1760 when the British defeated the French and took over the colony. Very shortly afterwards, the British had a revolution in their North American colonies in 1775 and the French had it in their own country in 1789.

Figure 1- Jacques Cartier (1491-1557) discoverer of Quebec

The Province of Québec is considered to be also the birthplace of chemical education and metallurgy in Canada. Two institutions contributed mainly to this reputation: Le Collège de Jésuites founded in 1635 and

Figure 2- Samuel de Champlain (1567-1635) founder of Quebec City

La Société des Missions Étrangères, known as Le Séminaire de Québec founded in 1663. Le Collège was closed permanently in 1776 and its library which contained old and valuable books was partly donated to the library of "Le Séminaire" and to other institutions. On the other hand Le Séminaire flourished under its founder François de Montmorency Laval the first Bishop of New France during the reign of King Louis XIV. It was transformed in 1852 by Queen Victoria into a university and was named Laval University in honor of its founder.

THE FIRST CHEMICAL INDUSTRY

The first chemical industry introduced in New France was brewing, lime production, pine-tar distillation, sugar and syrup from maple trees, leather tannery, and the production of potash for export to France to satisfy the needs of the soap and glass industries. Wood ash was collected from domestic stoves and fireplaces, and from lime kilns, then agitated with water, filtered to remove the unburned portions of the wood, then the solution

evaporated to dryness in iron pots and heated to red heat to burn off as much as possible of the organic matter to yield potash (Figure 4).

Figure 3- New France

THE FIRST METALLURGICAL INDUSTRY

The only metallurgical operation in New France and the first in Canada was the Forges du Saint-Maurice situated on the bank of Saint Maurice River near Trois-Rivières which is located half way between Québec City and Montréal (Figure 5). Saint-Maurice River is one of the largest tributaries of Saint-Lawrence River

The story of the Forges dates back to 1667 when iron ore was discovered in the neighbourhood of Trois Rivières. It was investigated by an engineer named Monsieur de la Pontardière at the request of the Indendant Jean Talon. Although he reported favourably, nothing was done because at that time the colony was under control of the "West India Company" which was mainly interested in the fur trade. In 1675 the charter of the West India Company was surrendered and in 1730 the French Canadian army doctor Michel Sarrazin examined the deposits.

The first attempt of iron production in Saint Maurice was in 1733 by François Poulin de Francheville (1692-1733), a rich French merchant from Montreal who sent three smiths to New England to collect information for building a forge. Because of the limited funds available to him he was forced to build a short furnace fueled by charcoal to which air was blown by small bellows. The temperature of combustion was

Figure 4- Production of potash in New France

not enough to melt the iron produced. Thus, a product called "bloom", which was wrought iron mixed with slag, was obtained. This was removed from the furnace, then hammered while hot to squeeze away the slag and obtain a nearly carbon-free iron. This wrought iron was malleable and could be shaped into different forms. The operation was suspended, however, when the owner of the Forges died suddenly at the end of the same year the furnace started operation and the iron bars produced were of low quality. His widow hired in 1735 Pierre-François Olivier de Vézin, an iron master from France to operate the Forges.

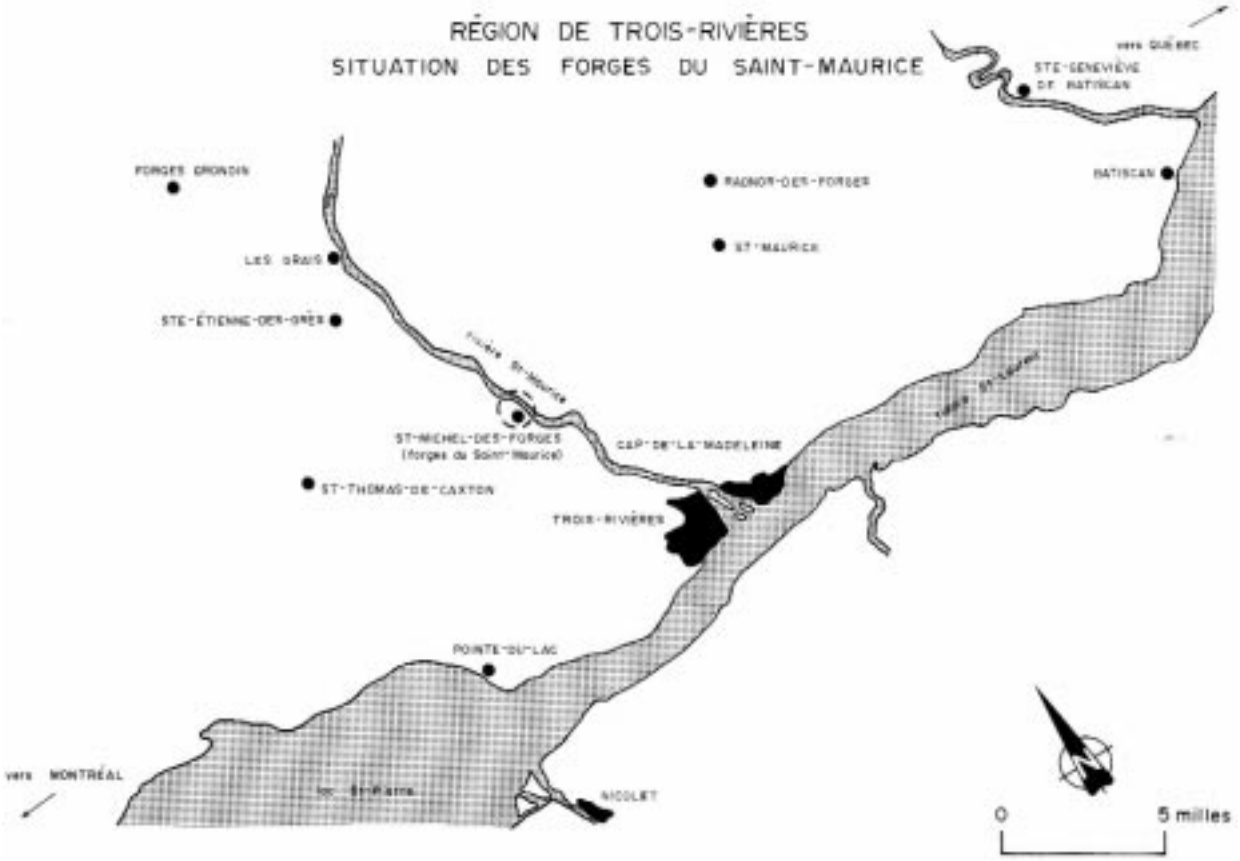

Figure 5- Location map of the Foreges Saint Maurice

Figure 6- A view of the Forges in 1970s

Figure 7- A commemerative dollar 1988

Figure 8- A stamp issued on the occasion of 250th anniverary of the Forges

SUCCESSFUL IRON PRODUCTION

When the new company was organized in 1736, more funds were made available by the French monarch as a subsidy and a modern process was used. A taller furnace was constructed and larger bellows were used so that the temperature in the furnace was enough to obtain a molten product. The furnace was 9.1 meters high and the internal diameter at the hearth was 0.76 meters and at the boshes 2.1 meters and at the throat 1 meter. The air blast was supplied by two tuyeres. The flow of water was used to drive a water wheel which operated bellows for blasting air in the furnace. The charge consisted of 270 kg ore, 20 kg limestone, 16 French bushels charcoal (the French bushel weighed 1 kg more than the English). About 3 tonnes of ore and 1 tonne of charcoal were required to make one tonne of iron.

The iron ore in the Three Rivers District was a sedimentary deposit known as "bog ore", a hydrated iron oxide or more exactly an oxyhydroxide FeOOH (a limonite). It was a yellow porous material that analyzed about 70% Fe_2O_3, 4% SiO_2, 2% Al_2O_3, 1.8% P_2O_5, and 20% loss on ignition. Due to the high temperature, carbon dissolved in the iron and a product known as cast iron was obtained. This product could be easily cast but was brittle. A sample of the iron produced was analysed later by Thomas Sterry Hunt (1826-1892), a former professor of chemistry and geology at Laval University and twice president of the American Chemical Society (1879 and 1888), showed about 0.03%, 0.5% P_2O_5, 0.9% SiO_2, 1.2% Mn, and about 3% total C. To obtain a malleable product, the cast iron must be melted again in an air stream in a small furnace called "finery" to oxidize its carbon content. Most of the product, however, was used as cast iron. Daily production averaged 4 tonnes.

In 1741, the company went bankrupt and as the King of France was the only financial backer, the Forges became the property of the crown. Despite the bankruptcy, the company continued to produce. War with England was a constant threat and so, for the next twenty years, production was concentrated on military equipment such as cannon and cannon balls.

In 1743, the Forges passed to the Royal domain and were carried on for several years in the name of the King Louis XV. Besides other extensive repairs, a Walloon hearth was built, and over 180 men were employed at that time, the number increased to 300 in 1815. The Forges played an important role in supplying military material such as cannons and cannon balls for the King's army, as well as for manufacturing large kettles for the potash industry, kettles for evaporating the maple tree syrup mentioned early, stoves, and in later years railway car wheels.

At the conquest of New France in 1760, the Forge passed with other Royal properties to the British Government and were operated under military authorities. In 1767, it passed into the hands of private company until in 1845, owing to the dissatisfaction of settlers in the neighbourhood, the Forges was sold at public auction. In 1883, operations ceased since other furnaces had been erected in 1860 at Radnor, not far from the St. Maurice Forge, where ore and fuel could be more easily obtained. As a matter of historical interest, the Forges cast shot and shell for the Americans during their the siege of Québec in 1775.

THE FORGES AS A NATIONAL MONUMENT

The Forges operated for about a century and half. In 1973 the Government of Québec transferred administration of the site (Figure 6) to the Federal Government so that it could be developed as a national historic park for Canada's first metallurgical operation. . Immediately thereafter, archeologists excavated the deserted region. The artifacts they unearthed were cleaned and prepared for use in interpreting the history of the Forges. A blast furnace model (complete with water wheel and air bellows operated by a water current) has been constructed to explain to visitors how iron was produced two hundred years ago.

It is now a remarkable touristic attraction. The park Forges du Saint-Maurice is an intriguing spot for visits by laymen and professionals alike. On the occasion of its 250th the Royal Mint in Ottawa issued a silver dollar in summer 1988 (Figure 7) and Post Canada issed a commemorative a stamp (Figure 8). In 1998 a comprehensive fully illustrated volume was published by Laval University Press. Today, a modern blast furnace produces 10 000 tons/day iron. If we compare this with the blast furnace of New France we see how metallurgy made progress in the past years.

SUGGESTED READINGS

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