A Unique Canadian Presentation Ingot

by Bill Collins

This unique ingot was presented to Andrew Trew Wood, Member of Parliament, an Ontario businessman, banker, and millionaire, for his efforts to spur the growth of the steel, nickel and copper industry in Canada. It is a representation of extreme optimism in the field of electrolytic metallurgy and the desire to develop the vast nickel deposits in the Province of Ontario. For some forever unknown reason the date of the award was not recorded on the ingot.

The ingot is pure copper, electrolytically refined from a nickel copper ore of an undefined mineralogical composition. The ingot is 37 mm x 35 mm at the top, 41 mm x 40 mm at the base and 15 mm thick forming an irregular, truncated pyramid. The ingot weighs 7.35 avoirdupois ounces. The inscription has been entirely

engraved rather than gang stamped like the Pittsmont blister copper presentation ingots produced by the "Baggaley Process" that were made in 1904 in Butte, Montana. For more information on the "Baggaley Process" ingots the reader is referred to an article by Dave Johnson in the Summer 2001 issue of *Eureka!* Issue 37, pp 28-29.

Evidence Leading to Determination of the Award Date

1897: House of Commons Member of Parliament A. T. Wood introduced a bill to incorporate three nickel refining companies: the Nickel Steel Company of Canada, the Hoepfner Refining Company and the Nickel Copper Company of Ontario. His partners in these ill-fated and controversial ventures were fellow industrialists, John Patterson, John R. Moodie, Sr., Samuel J. Richie (the disgruntled founder, collateralized shareholder, and fired president, he had held the job from 1886 until 1891, of the Canadian Copper Company) and Sir John Morrison Gibson (politician and president of the Cataract Power Company of Hamilton).

1898: The Nickel Steel Company of Canada was incorporated. This venture would collapse sometime in 1900 due to failure of the provincial government to implement tariffs on exported nickel matte. The hopes of the Canadians to keep the treatment of the nickel mattes, and the profits to be made, were doubly confounded by the unwillingness of the U.S. government to implement a tariff on the imported nickel matte. This meant that nickel-copper mattes could be shipped, financially unimpeded, to the United States for refinement at the Orford Refining Company in New Jersey. Orford was a major partner of the Canadian Copper Company.

1899: The Nickel Copper Company of Ontario and the Hoepfner Refining Company were incorporated in the latter part of the year. The Hoepfner Company, with CN$10,000,000 capitalization, was created to mine, and refine zinc, lead, silver, nickel and copper ores. The ores were shipped to the Nickel Copper Company for the production of nickel-copper mattes. Hoepfner built their electrolytic refining plant near the Cataract Power Company generation plant for the needed electrical power for Dr. Carl Hoepfner's Process for the production of metals; Patent No. 507130 (dated October 23, 1893) but found it was unable to refine the nickel-copper matte provided to them by the Nickel Copper Company on an economic large scale. The Hoepfner process was designed to separate the copper and silver from the ore but never designed to handle nickel. The extreme levels of nickel sulphide material mined in the same copper bearing orebody ruined the planned process. The copper was intended to be recovered as a copper chloride solution, the silver as a silver chloride solution with the sulfur as a light weight slag. Electrolysis would then deposit the copper and silver at different cathodes. Nickel bearing ores required the nickel to be dissolved in a different electrolyte for deposition on the cathode. Refining problems were not limited to the Nickel Copper Company:

- The Canadian Copper Company located a desirable copper sulfide deposit and tried to recover the sulfur (as sulfur dioxide) from the ore but found it not to be economical with their process. At the same time they found that there was too much nickel in the ore to provide for an effective recovery of the copper. They were eventually able to overcome the metals recovery problem.

- The Lake Superior Power Company located a desirable nickel sulfide ore body, tried to recover the nickel and found they had too much copper. Titus Ulke apparently developed a process to alleviate this problem although its success is not recorded. During this time, William Koehler, a competing, combative metallurgist, provided nothing but professional interference to Mr. Ulke. The battle between these two metallurgists continued for years.

By this time John Gibson had become president of the Hoepfner Refining Company. Considering the unspecified cost expended in building the plant and rather than abandon it, several shareholders decided to lease

it and have additional pilot testing done on processing the mattes. They then enlisted the assistance Mr. Hans A. Frasch in this operation.

1900: Mr. Frasch (a U.S. citizen) demonstrated a small scale application of his yet unpatented electrolytic process for separating metals at a public exhibition on September 3, 1900, and applied for a patent for his process on September 14,1900 (accepted September 15, 1900). The process worked satisfactorily on a laboratory or small scale basis.

1900: A.T. Wood fails to be re-elected to the Ontario House of Commons in November.

1901: On January 1, Mr. A.T. Wood was appointed to the Canadian Senate to represent the senatorial division of Hamilton, Ontario in Parliament.

1901: Mr. Hans A. Frasch was granted a patent (Patent No. 669,442) for his **Process of Recovering and Separating Metals by Electrolysis** on March 5; this is better known as the "Frasch Process" and the subject of this ingot. Nickel sulfide ores required outdoor heap roasting with coke to drive off the sulfur and allow for electrolytic removal of the copper first using a different dissolving agent than the Hoepfner process. Once the copper has been plated out, any iron could be removed chemically and the nickel could be electrolytically removed from the solution for refinement. [Frasch was also granted a patent (Patent No. 689,391 for producing nickel through chemical means on December 24, 1901, which was much too late to save the company.]

1901: A miniaturized display of the "Frasch Process" to separate nickel from copper (and other metals bearing) ore was provided for public viewing in the Ontario Building at the Pan-American Exposition at Buffalo, New York. For all practical purposes the display was "prettily shown" according to Harriet Brown.

1901: An experimental industrial plant was erected at Worthington Station, Hamilton, Ontario for the purpose of conducting a practical trial for processing the nickel-copper matte using the newly patented "Frasch Process" which was now under the control of The Nickel Copper Company.

The primary metal of interest to the Nickel Copper Company of Ontario was nickel. Production of nickel required the copper in the ores to be removed first. The complex nickel-copper ores in the Sudbury District contained varying amounts of iron, cobalt, gold, silver, platinum, palladium, and occasionally arsenic and antimony as potential contaminants. Some Sudbury ores also contained minute percentages of tin, titanium and tellurium. The source of the ore was not identified but it did come from a company mine. John Kershaw expressed concern about the presence "of even small amounts of impurity" in the nickel-copper mattes and their deleterious effects upon the metal produced at the cathode even before experimental operations started. Because of this potential problem it was feared that the "Frasch Process" would be a failure. Frasch's patent indicted that impurities of cobalt and iron would present no problem. Roasting the ores to produce mattes apparently eliminated some contaminants.

In the end the "Frasch Process" failed to be capable of large scale production. No definitive reason was given for failure. Several others electrolytic refining processes, possibly more than dozen, were being used or potentially available at the time for treating nickel-copper; four examples were:

- The Balbach-Thum process. The Balbach Smelting and Refining Company in Newark, New Jersey used this method until 1900 to separate silver from the copper when operations ceased.

- The Orford process. This was used at the Orford Copper Company at Bayonne, New Jersey. At this time Orford was processing Canadian Copper Company mattes; this most likely made the process unavailable for trials.

- The Browne process. Browne's process was being reviewed for patent at the U.S. Patent Office (1899-1902) but Browne had assigned the patent to the Canadian Copper Company.

- Ulke's process. His early process was controlled by the Copper Refining Department of the Lake Superior Power Company.

Both the Nickel Copper Company and the Hoepfner Refining Company operations came to an end in 1901; the former because of the failed "Frasch Process" and the latter because of the complete failure of a new self-roasting plant erected near Worthington Station to produce suitable nickel-copper matte from the available ore. The insignificance of the Hoepfner Refining Company and the Nickel Copper Company of Ontario in the development of the Sudbury Mining District was documented by their very brief mention in both volumes prepared by Alfred Ernest Barlow for the Canadian government. "Although these ventures ultimately failed, from 1897 to 1901 Ritchie and his associates were publically able to maintain the façade of their competitive viability and thereby keep pressure on the Canadian Copper Company" [Bray, page 4].
1901: This the most probable date for the creation of this ingot. Mr. A.T. Wood, the chief promoter of the Nickel Copper Company of Ontario was still an M.P. (Member of Parliament). Mr. Frasch had recently received his patent. And more importantly the copper used in the creation of this ingot most likely was derived from the mattes used in the development of the patent process.
Soon after the production of this ingot and any other presentation ingots it most likely became evident to this small group of investors that the collapse of the matte production facility and the failure of the Frasch Process to work on a larger scale was inevitably an ineffective combination for the production of nickel. To cap it all off the group was at least CN$10,000,000 poorer with nothing to show for their efforts. They were essentially broke.
It is likely that no more than a total of six personalized ingots were produced and presented to the process inventor and the principle officers and owners of the company assuming that John Moodie was still alive in 1901:

- Hans A. Frasch, Inventor and chief engineer, c. 1856-? No exact dates are available but he was still at work on nickel recovery patents in 1905 and later on other patents regarding distillation and dye manufacturing until at least 1919.

- John R. Moodie, Sr., Hamilton businessman, 1841-?

- Sir John Morison Gibson, President, Hoepfner Refining Company, 1842-1929

- John Patterson, Hamilton businessman and a director of Cataract Power Co., 1857-1913

- Samuel J. Ritchie, Hamilton businessman, 1838-1908

- Andrew T. Wood, M.P. and Hamilton businessman, 1826-1903

Herman Frasch, 1851-1914, was <u>not</u> part of this process but rather a producer and refiner of oil, alkali soda and sulfur. He was the inventor of the "Frasch Process" for mining sulfur. Hans and Herman were brothers and both had received training as pharmacists in Germany.

<u>Acknowledgment</u>

I want to thank Tony Moon for taking the time to review and discuss, by email and phone calls, two drafts of this article both in general for its readability and primarily for his assistance in getting the metallurgy correct.

He also provided me with copies of several Frasch patents, the Hoepfner and Browne patents, and several of the more obscure technical papers. For a retired geologist this was an enjoyable exercise in metallurgy and history. Little treasures turn up in strange places; I found this ingot at an Orlando coin show within 10 minutes of walking in the door. Keep your eyes peeled, there may be another five out there and they will all be unique.

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