

of the Ukraine. His father was a Leipzig businessman who expected his son to follow in his footsteps. Farber had an intellectual leaning which resulted in early rebellion and his father finally permitted him to attend the University of Leipzig. After completing his doctorate, he worked with Carl Neuberg at the Kaiser Wilhelm Institute in Berlin. Because of weak eyes, he was not obliged to serve in the German army, but was forced to leave the Institute and supervise the conversion of a fermentation plant to production of nitroglycerine. After the war, he became Director of Chemical Research with Holzhydrolyse A.G. in Mannheim. Farber fled Germany in 1938, coming to the U.S., where he served as a chemical consultant and a laboratory director. In 1943, he became director of chemical research for Timber Engineering, a firm



Martin Levey

in Washington, D.C. Farber developed an early interest in history of chemistry and published a German text in the field in 1921. He continued to pursue this avocation throughout the remainder of his life, publishing numerous papers and several books, including a second history of chemistry, this one in English. His principal contribution was the editing of *Great Chemists*, a collection of biographies, partly selected from existing literature and partly written by selected contributors.

Martin Levey (1913-1970), recipient of the 1965 award, was born in Philadelphia and combined the study of chemistry and languages. He served in the Merchant Marine during World War II, then took an industrial position until he entered Dropsie College in 1949 to pursue the study of Semitic languages and the history of ancient and medieval science. Despite a doctorate in history of science, he found great difficulty in finding an academic position which permitted

him to pursue his talents. He ultimately obtained an appointment at SUNY in Albany, with an opportunity to create a department such as he desired. Levey published a treatise on Babylonian chemistry and technology in 1959 and up to the time of his unfortunate death in 1970 published nearly a dozen additional works, most of them translations from Middle Eastern Antiquity and the Middle Ages, dealing with mathematics, book production, perfumery, toxicology, medicine and chemistry. He had a great talent for combining archeology, exotic languages, and science.

The overall statistics for the first decade of the award reflect its diversity, in terms of both the recipients themselves and the nature of their contributions. Of the first ten recipients, five were in their seventies when they received the award, two were in their sixties, and three in their fifties. All but one (Armstrong) were formally trained as chemists at either the undergraduate or graduate level. Four held academic positions in chemistry, two were industrial chemists, two held academic positions in the history of science, one was a librarian, and one was an editor. Their contributions ranged from the writing of general histories of chemistry to the writing of biographies, the founding and editing of journals, and the assembling and maintenance of major library collections in the field.

Part III of the series, dealing with the second decade of the award, will appear in the next issue.

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BONES AND STONES

The 250th Anniversary of the Saint Maurice Ironworks

Fathi Habashi, Laval University

On 20 August 1738, Pierre-Francois Olivier de Vezin, an iron master from France, who had come especially to New France in 1735 to operate the Forges de Saint-Maurice near Trois-Rivieres, Quebec, started the first successful iron making furnace in Canada. This event will be celebrated in Canada by a silver dollar that will be issued by the royal Mint in Ottawa in the summer of 1988.

The design of the dollar (see figure) will show a typical eighteenth century scene depicting two smiths with hammers raised, striking iron on an anvil. The base of the anvil will carry the date 1738 and the anvil itself will be adorned with a "fleur

de lys", the emblem of the Province of Quebec. The name of the factory "Les Forges du Saint-Maurice" will be marked in French and English on one side while the other will carry the effigy of Queen Elizabeth II. The scene is designed by the Canadian artist Robert-Ralph Carmichael of Ontario. The dollar will contain 50% silver, 50% copper, weigh 23.33 grams and measure 36.07 millimeters in diameter. The number of pieces minted will be limited to the orders received before 30 November 1988.

Canada's first ironworks is located half-way between Quebec City and Montreal on the Saint-Maurice River, which is connected to the Saint-Lawrence River at the town of Trois-Rivieres. It operated from 1738 to 1883 and was shut down because it did not adopt the essential technological change of replacing charcoal with coke in the blast furnace. The present Canadian iron and steel industry was later established in Nova Scotia and Ontario near coal deposits and the Saint-Maurice Ironworks is now an historic site.

The first attempt at iron production in Saint Maurice was in fact in 1733 and was based on American rather than French technology. The first owner of the Works, Francois Poulin de Francheville, sent three smiths to New England to collect information for building a forge. It is not known where these workers went, but most probably they went to Massachusetts, where an iron working industry existed. The forge produced two thousand pounds of wrought iron bars in 1734, but the furnace collapsed and was demolished either in 1734 or in 1735. The owner of the Works had already died at the end of 1733 and was survived by his widow, who unsuccessfully tried to operate the company.

The failure of the first attempt was not due to bad American technology - New England at that time had a relatively well established iron industry - but rather to the limited amount of funds available to Francheville, which forced him to choose the construction of a short furnace fueled by charcoal into which air was blown by small bellows. The temperature of combustion was 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 in order to squeeze away the slag and obtain a nearly carbon-free iron. This wrought iron was malleable and could be shaped into different forms.

When a new company was organized in 1736, more funds were made available by the French monarch as a subsidy and a more modern process was used. A taller furnace was constructed and larger bellows were used so that the temperature in the furnace was hot enough to obtain a molten product. Due to the high temperature, carbon dissolved in the iron and a product containing 2-4% C was obtained, known as cast iron. This product could be easily cast but was brittle. To obtain a malleable product, the cast iron must be melted again in an air stream in a small furnace called a finery to oxidize its carbon content. Most of the product, however, was used as cast iron.

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 industry continued to produce. War with England was a constant threat and so, for the next 20 years, production was concentrated on military equipment, such as cannon and cannonballs.



After the conquest of New France in 1760, the British realized the importance of the Forges. For the first few years of British rule, it was a government-run business. In 1767, however, it passed into the hands of private companies until it was shut down for good in 11 March 1883.

The Industrial Revolution started in England in 1709 when coke replaced charcoal for the first time in a blast furnace. In France this took place in 1782 and in Canada about 1910. In the United States the situation was different because of the presence of important anthracite deposits. Anthracite is very similar to coke and it started to replace charcoal in the 1840's. It was also about this time that coke production in United States was mastered and its use in blast furnaces was introduced. The importance of switching from charcoal (made from timber) to coke (made from coal) is due to the fact that coke is porous and more mechanically resilient than charcoal. Hence, it could be charged into tall furnaces without crumbling into powder. This, in turn, resulted in increased productivity and decreased costs.

In 1973 the Government of Quebec transferred administration of the site to the Federal Government so that it could be developed as a national historic park. 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 now been constructed to explain to visitors how iron was produced a hundred years ago, when the daily output of the Forges was three to four tons.

The park Forges du Saint-Maurice is an intriguing spot for

visits by laymen and professionals alike. A tour includes interpretations by well-informed guides as well as a Swedish documentary film dealing with a small blast furnace shut down at the beginning of this century.

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WHATEVER HAPPENED TO THE MICROCRITH?

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Until quite recently, authors of introductory chemistry texts have always been careful to point out that atomic weights are relative rather than absolute and that they consequently have no units. However, the use of the words relative and absolute in this context is in some ways unfortunate. The intent was, presumably, to point out that, although the masses of atoms could be determined relative to one another by arbitrarily selecting a particular atom as a standard, their values in grams or in other conventional mass units was unknown or, at best, only approximate. The problem, of course, is that *all* conventional mass scales are in reality relative and involve comparison with an arbitrarily selected standard whose use depends on the twin virtues of reproducibility and convenient size. Thus, in practice, the only thing which distinguished the so-called relative atomic mass scale from the conventional metric scale was a failure to give the former unit an explicit name, and the so-called dichotomy of relative versus absolute resolves itself into one of determining an accurate conversion factor between the two units.

It was apparently not until 1961 and the adoption of the $^{12}\text{C} = 12$ scale and the unified atomic mass unit (u) that chemists came to accept this point of view - apparently - because, in fact, a little-known atomic mass unit called the *microcrith* had actually been introduced into chemistry 90 years earlier and had enjoyed a brief, but limited, existence in American high school chemistry texts during the last quarter of the 19th century. The origins of this unit can, in turn, be traced back to an earlier unit called the *crith*, which was introduced into chemistry by the German chemist, August Wilhelm Hofmann (1818-1892), in the 1860's.

Though German-born and educated, Hofmann spent nearly two decades (1845-1864) as Professor of Chemistry at the Royal College of Chemistry in London. When he finally returned to Germany in 1865 to accept a position at the University of Berlin, his former students at the Royal College



August Wilhelm Hofmann

requested that he issue his famous course of lectures at the College in book form. Hofmann complied - at least in part. Deleting the later descriptive lectures, he published the first 12 introductory lectures, dealing with the theory of chemistry, in 1865 as a small volume entitled *Introduction to Modern Chemistry: Experimental and Theoretic* (2). This was quickly translated into German and, in this form, went through many subsequent editions and revisions (3).

As the word "modern" in the title suggests, Hofmann felt that chemistry had recently undergone a significant transformation, the most important components of which were the consistent and widespread use of Avogadro's hypothesis and gas densities to arrive at a self-consistent set of atomic and molecular weights and the emergence of the concept of valence. Indeed, it was in this very volume that Hofmann introduced the word valence into the chemical lexicon in the form of its longer variant - quantivalence (4).

The primacy of gas densities in the development of a self-consistent theory of chemical composition was emphasized by Hofmann throughout the book. Beginning with the volumetric decomposition and synthesis of the simple hydrides H_2O , NH_3 , and HCl , the laws of chemical combination by volume were developed first. Combination by weight was then introduced via the use of gas densities. Selecting the density of hydrogen at STP as a standard, Hofmann assigned each element and compound a real or hypothetical (for nonvolatile species) relative "Volumgewichte" at STP which allowed him to translate the volume formulas and reaction equations developed earlier in the book into the corresponding weight or mass relations.

In order to facilitate the use of his relative "Volumgewichte"