

VANADIUM

STAINED GLASS, HELPFUL METAL

By Joel O. Lubenau, M.S.

One of the highlights of the Special Collections gallery at the Heinz History Center is a large stained glass window dominated by a winged woman holding aloft a tablet that reads “Vanadium.” Few probably know that vanadium is a metal, that it was once very rare until efforts undertaken in Western Pennsylvania made it easier to extract, or that its development led to advances with radium, another rare and very important metal.

The window, and the stories it holds, is a legacy of two entrepreneurial Pittsburghers, brothers James J. and Joseph M. Flannery, whose commercial ventures made vanadium and radium widely available for medical and commercial use. When Joseph¹ and then James² died in 1920, their achievements were widely reported and commented on, but their remarkable story has since been largely forgotten.

Joseph Flannery.

Courtesy Joel Lubenau, *History of Pittsburgh and Environs*.

Before the Model T

As Henry Ford pursued auto-making at the turn of the 20th century, he entered his cars in organized races to promote the cars and secure investors for future endeavors. In January 1904, Ford himself set a land speed record of 91.37 mph on frozen Lake St. Clair in Michigan. A month later, his record was broken on the broad, hard-packed sand stretching from Ormond Beach to Daytona Beach, Florida, but it may have been there that Ford became aware of the special qualities of vanadium steel.³ Though accounts vary,⁴ it's likely he took notice when a French racing car, a Panhard, was badly damaged and severely bent, yet its lightweight steel did not break.⁵ Ford learned the parts were made of a vanadium steel alloy.

The properties—and possibilities—of vanadium steel were just becoming known through articles in trade magazines that were read by Ford and his executives.⁶ Other automobile manufacturers used size and weight to cope with the era's rough roads; Ford's vision was to instead market lightweight "runabouts"⁷ built of lightweight steel resistant to metal fatigue.⁸ Writing in a letter to the editor to *Automobile* in January 1906, Ford declared, "The greatest need to-day is a light, low-priced car with an up-to-date engine of ample horsepower, and built of the very best material. One that will go anywhere a car of double the horsepower will; [yet] that is in every way an automobile and not a toy."⁹

Vanadium steel might fit the bill. But where would the vanadium come from and who would make the vanadium steel?

From Bridgeville to Peru

In Pittsburgh, brothers James and Joseph Flannery were expanding their business interests. In January 1904, the pair—undertakers by trade—purchased a bolt manufacturing company south of the city in Bridgeville and incorporated the Flannery Bolt Company.¹⁰ Its chief product was staybolts, used in the construction of steam locomotive



A Tate Flexible Staybolt of the type made by the Flannery Bolt Company.
Photo by Joel Lubenau.

After purchasing the patent rights to an improved design for staybolts, the brothers looked into further improving them by using stronger steel.

James Flannery.

HHC L&A, *The Book of Prominent Pennsylvanians: A Standard Reference*.



boilers to connect the walls of the firebox to the boiler shell. After purchasing the patent rights to an improved design for staybolts, the brothers looked into further improving them by using stronger steel.

English and French metallurgists had already established that adding the metallic element vanadium in low concentrations—less than one percent—to ordinary carbon steel greatly increased the strength of the steel.¹¹ Heat-treating the alloy enhanced this effect even more. Products made from vanadium alloy steel could be made lighter yet performed as well as those made from ordinary carbon steel. Also, vanadium steel could be more easily pressed, forged, or bent without breaking, and it was more resistant to metal fatigue.

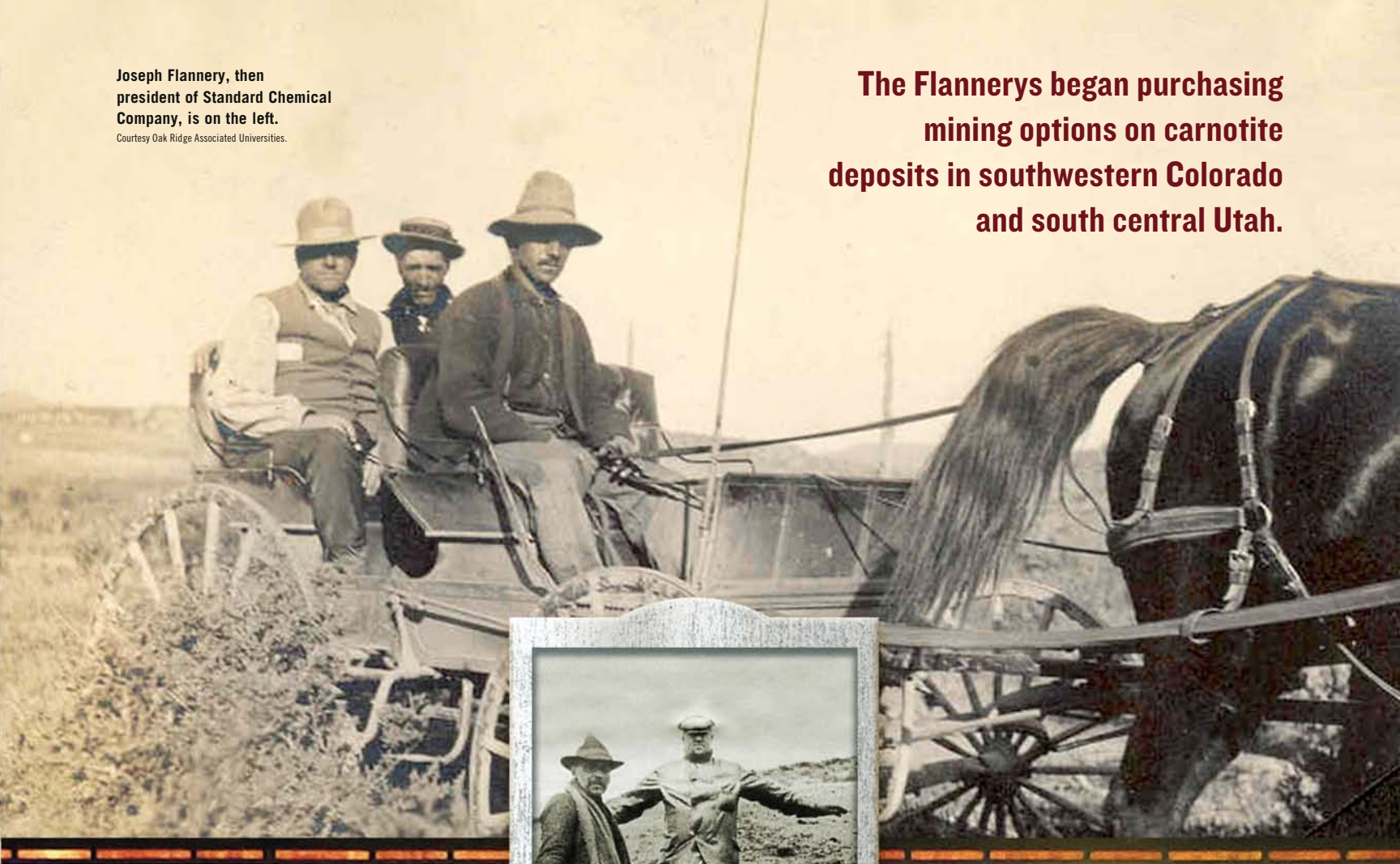
Vanadium in its natural state was discovered in 1801 but was not confirmed as an element until 1830. The metal is not rare but bodies of ore containing high percentages of vanadium are uncommon.¹² One promising source was a canary-yellow mineral in the American southwest, carnotite, that contained vanadium and uranium. The Flannerys began purchasing mining options on carnotite deposits in southwestern Colorado and south central Utah.¹³ Then in 1905, James Flannery met two gentlemen from South America who informed him of vanadium ore in Peru.¹⁴ The ore lay in the Pasco region: north of Peru's capital, Lima, and east of the Andes Mountains. High in elevation, the area is rich in mineral resources; silver was found in 1630 followed by discoveries of copper, lead, bismuth, and zinc. By the end of the 19th century, most of the mining came under the control of an American syndicate, the Cerro de Pasco Corporation.¹⁵ Only a few independent local mine and smelter operators remained, the most prominent being Eulogio Fernandini.

Fernandini's holdings included fields of asphaltite, a natural solidified petroleum mineral used locally as coal. In 1894, the asphaltite was reported to contain vanadium in low concentrations.¹⁶ In 1905, local Indians searching for coal in the asphaltite fields found

Joseph Flannery, then president of Standard Chemical Company, is on the left.

Courtesy Oak Ridge Associated Universities.

The Flannerys began purchasing mining options on carnotite deposits in southwestern Colorado and south central Utah.



an unusual mineral, later named patronite, that contained high concentrations (9.5–15 percent) of vanadium.¹⁷

To investigate these reports, James Flannery sent a company vice president, Arnold J. Thompson, and a Lehigh University metallurgical engineer, D. Foster Hewett, employed by Pittsburgh Testing Laboratory.¹⁸ To reach Fernandini's asphaltite, Thompson and Hewett traveled by train over the Andes and trekked through snow over 15,000-foot mountain passes, experiencing breathing difficulties and bleeding from the nose and ears.¹⁹

Hewett confirmed that Fernandini's asphaltite fields contained an extensive, rich strike of patronite. In a handwritten, 11-page letter to Joseph Flannery detailing his findings, he recommended purchase of the property based upon a valuation of \$100,000.²⁰ James Flannery put aside plans to mine U.S. carnotite and focused on gaining control of the Peruvian



LEFT: Joseph Flannery showing the width of the patronite vanadium ore vein, with Antonor Rizo Patron in Peru.

The Pittsburgh Press, February 10, 1991.

deposit. He dispatched his brother, Joseph, to join Hewett in Peru to purchase the mineral rights from Fernandini.

A Deal is Struck

Eulogio Erasmus Fernandini y Quintana was born in Peru in 1860. Educated in Germany and Austria, he returned to Peru to become a miner, rancher, and planter. He owned bismuth and copper mines, a smelter, and sheep and

vicuña ranches, grew sugar and cotton, and was vice president of Banco Popular del Perú.²¹ Fernandini collected gold coins; when he died in 1947, Peruvian tax assessors found antique chests filled with coins valued at nearly \$2 million.²²

Joseph Flannery might have known of Fernandini's collecting habit. When he arrived in Peru, he carried a bank's letter of credit for \$20,000. What happened next became legend.

At a local bank he converted the letter of credit to gold coins, which he placed in a carpetbag. When he met Fernandini, Flannery emptied the carpetbag's contents onto the table and divided the pile of coins into two. Pushing one half towards Fernandini, he said that half was for the rights to mine the ore. Pulling the other half towards himself, he said that half was to develop the mine and pay Fernandini a good salary to supervise operations.

Flannery paid Fernandini \$20,000 cash, with \$10,000 of it for the mining rights.²³ But Fernandini held out for more. Flannery sweetened the deal by offering Fernandini a stake in the newly organized American Vanadium Company. Fernandini agreed to an appointment as first vice president and a 10 percent stake worth \$70,000, making the deal's total value \$90,000.²⁴ Afterwards, while walking to the lawyer's office to record the agreement, Fernandini received a cablegram from a British syndicate offering \$100,000 for the mineral rights. He tore it up, telling Flannery, "It is a good offer, but too late."²⁵

The Flannerys now controlled the world's richest vanadium ore body. The ore was shipped to the company's reduction plant in Bridgeville, which they built just north of the Flannery Bolt Company.²⁶ Beram D. Saklatwalla, a native of Mumbai, India, who earned a doctorate in engineering from the University of Berlin, was put in charge; he had met the Flannerys on a trip to the U.S., and they hired him on the spot.²⁷ In collaboration with an American chemist, Warren F. Bleeker, Saklatwalla developed a process to reduce the Peruvian ore.²⁸ The result? In 1892, vanadium went for \$4,792 per pound.²⁹ After the Flannerys accessed Peruvian ore, and Bleeker and Saklatwalla devised their process, the American Vanadium Company could market vanadium for an astounding \$5 per pound.³⁰

Steel for the Model T

Perhaps the most important addition to the company was J. Kent Smith. He had worked in British steel mills and was involved in some of the earliest tests quantifying the effects of vanadium on steel, becoming an expert on the alloy and an advocate for its use.³¹ He joined the American Vanadium Company in America as its chief metallurgist.

In early 1906, Smith visited Ford's Detroit factory to discuss vanadium alloy steel. After their meeting, Ford remarked to assistant production manager Charles Sorenson, "Charlie, this means an entirely new design



Fernandini collected gold coins; when he died in 1947, Peruvian tax assessors found antique chests filled with coins valued at nearly \$2 million.

requirement. We can get a better and lighter car and cheaper car as a result of it."³²

No U.S. steelmaker could make vanadium alloy steel in the quantities Ford needed, and they were reluctant to try even when Ford offered the vanadium at no cost. A mutual acquaintance of Ford and the Flannerys suggested the United Steel Company, operators of a new plant in Canton, Ohio, equipped with three 50-ton, basic open-hearth furnaces. Its manager, Edward Lagenback, agreed to make the steel and directed the open-hearth supervisor, Fred Griffith, to work out the furnace chemistry with Smith.³³

That summer, success seemed within reach. United Steel made acceptable batches of vanadium alloy steel and Ford placed an order for more. Smith returned to Pittsburgh.

To the disappointment of Ford and the consternation of Griffith, the quality of the vanadium alloy steel that was shipped to Ford deteriorated; less and less vanadium was in the steel and Ford rejected the shipments. The failure to meet Ford's specifications caused

Eulogio Fernandini.

Pennsylvania Department of Education, Bureau of State Library.

heavy losses for United Steel. Smith was recalled to Canton to solve the problem.

Vanadium is an oxygen scavenger. Successfully adding vanadium to steel requires minimizing the oxygen in the melt, otherwise, vanadium combines with the oxygen and its oxide migrates to the slag floating atop the steel. Controlling the level of oxygen in the melts in United Steel Company's open-hearth furnaces proved difficult so the vanadium was disappearing into the slag. Smith's solution was elegantly simple—add the vanadium to the steel when it was poured from the furnace into the ladle. Three trial heats were proposed.

Lagenback agreed ladling was feasible but mindful of the losses, demanded prepayment for the costs of the trial heats. Ford agreed to put up half the money.³⁴

On March 24, 1907, the mill poured the first of three heats of vanadium alloy steel using Smith's system. Satisfied with the result, Smith invited Ford, the Flannerys, and an impressive group of other U.S. industrialists to Canton on March 28 to witness the second and third heats. When those heats met Ford's specifications perfectly, the men lit celebratory cigars and brought in a photographer to record the occasion.

The local newspaper, the *Canton Repository*, headlined,

STEEL MEN IN CANTON
Second Heat Of Vanadium Steel In
This City
SAID TO EXCELL FIRST
Casting of Twenty-Five Ton Lot
Witnessed By Representatives Of Most
Important Interests.³⁵

Ford returned to Michigan and placed an order with the United Steel Company for \$750,000 of vanadium alloy steel—more than \$17 million in 2010 dollars—the largest order up to that time.

Ford was manufacturing Model N and S automobiles at his Michigan plant when he placed that impressive order, and began substituting components in these models with those made of vanadium alloy steel.³⁶ At the same

Celebrating with cigars following the successful pour of vanadium alloy steel at the United Steel plant in Canton, Ohio, 1906. J. Kent Smith is second from left; Joseph and James Flannery (tall man in bowler) are fourth and fifth from left; Henry Ford is third from right.

From the Collections of The Henry Ford.



time, he and his staff were designing the Model T in secret. In October 1908, the first production Model T's rolled off the line at a retail cost of \$850. Fifty percent of the steel in a Model T—the crankshaft, gears, driveshaft, connecting rods, and springs—was vanadium alloy steel.³⁷ Ford ads emphasized its importance.

Over the next 19 years, Ford produced more than 15 million Model T's, the price *dropping* almost yearly until it reached \$360. More than any other automobile, the Model T revolutionized Americans' travel habits and changed the American landscape. Vanadium alloy steel made the Model T possible, and the Flannerys supplied the vanadium.



Library of Congress.

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Pittsburgh, 1907–1919

Ford's order provided a solid financial start for the American Vanadium Company, but the Flannerys recognized the need to expand. They developed a business plan to create markets for, and vigorously promote, vanadium products. The brothers convinced General George Washington Goethels, supervising the building of the Panama Canal, to incorporate vanadium alloy steel into the hinges of the lock gates; 5,000 tons were ordered.³⁸ To promote vanadium, the company exhibited at technical and industrial meetings and provided speakers for technical and manufacturing society meetings. J. Kent Smith frequently spoke and his talks were reprinted in company brochures. These and other brochures about vanadium (many illustrated and including technical and test data) were distributed at company expense.

A subsidiary, Vanadium Chemical Company, sold pharmaceuticals containing vanadium that were likewise promoted by brochures.³⁹ A sanitarium called the "Vanadium Hotel" at the former Rider Hotel in Cambridge Springs, Pennsylvania, possibly sprang from vanadium's reputed therapeutic value.⁴⁰

With the onset of World War I, military demand for vanadium alloy steel for armor and heavy ordnance increased and so did the price of vanadium.⁴¹ The company's control of the Peruvian ore deposit placed it an enviable position.

The company and subsidiary offices were scattered throughout downtown Pittsburgh, mainly in the Frick Building. They purchased property (possibly as an investment and to corral their growing company into one location) in Pittsburgh's Oakland section at the corner of Meyran and Forbes avenues and engaged well-known Pittsburgh architect Frederick

John Osterling to design their new offices.⁴² Completed in 1911 and named the Vanadium Building, the steel-framed, five-floor structure featured a mezzanine and a heavily ornamented terra-cotta and brick exterior. The interior included marble stairs and marble veneer stairwell wainscoting and hallways.

The Flannerys commissioned Rudy Brothers Studio in Pittsburgh to create a vanadium-themed stained glass window to be the focal point of the Vanadium Building's interior. Contemporaries of Lewis Comfort Tiffany and John La Farge, the Rudy Brothers furnished stained glass windows for the H.J. Heinz home and factory. They crafted the 9x10 foot vanadium window in 1912 in the American opalescent style. Mounted on a rear wall that provided a southern exposure, the window faced the main entrance, where visitors entering the building could not help but see it.⁴³

The window's central figure is the Scandanavian goddess of love and beauty, Freyja Vanadis, for whom vanadium is named. She wears a robe to which is attached wings of a falcon and holds aloft a placard with the word "VANADIUM." A figure to her left, holding a pickaxe, represents the mining of vanadium ore; a bearded man to her right with a hammer and anvil symbolizes the maker of the miracle alloy, vanadium steel. Rudy neatly captured the story of the Flannery brothers' vanadium venture: the element vanadium, the goddess for which it was named, and the dual challenges of mining it and then alloying it with steel.

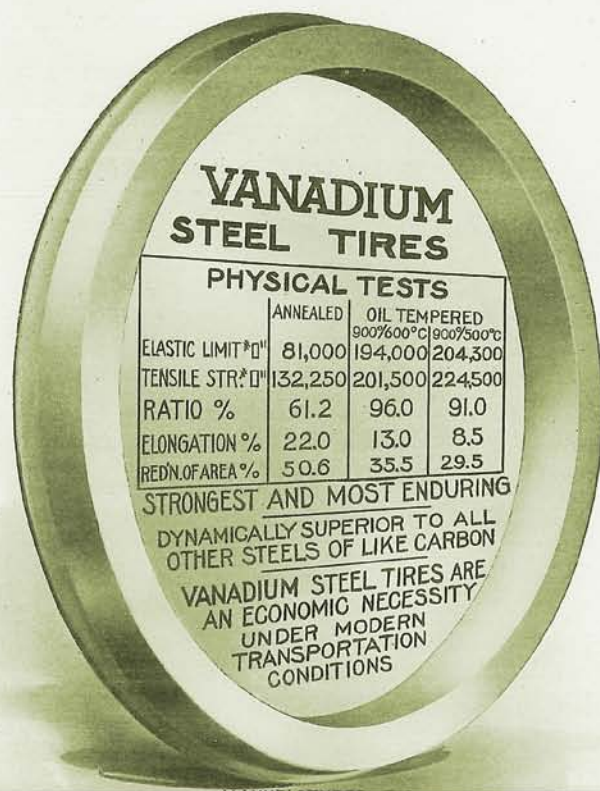
The company produced about 90 percent of the world's supply of vanadium.⁴⁴ For many years it paid dividends up to 40 percent.⁴⁵ In 1916, a syndicate headed by Pittsburgh steel investor J. Leonard Replogle purchased the company at \$1,000 per share. James Flannery became board chairman, Replogle assumed the presidency, Fernandini remained first vice president, and Salkatwalla was a board member. For the original investors that had held onto shares that cost \$100, the sale represented an enormous profit.



A Ford ad proclaiming the strength of Vanadium Steel.

Vanadium Steel: Some interesting and Profitable Facts that Everyone Should know about This Remarkable Product. Trade Catalogue Collection, Hagley Imprints, Hagley Museum and Library.

Only springs and axles of Vanadium Steel could safely carry such a load as this—three times the weight of the Ford Model T itself. Carrying fifty young passengers, this car was driven two miles on high gear, through the streets of Payne, Ohio



This Vanadium Steel Tire ad was attached to a 1908 letter to Hewitt from Joseph Flannery.

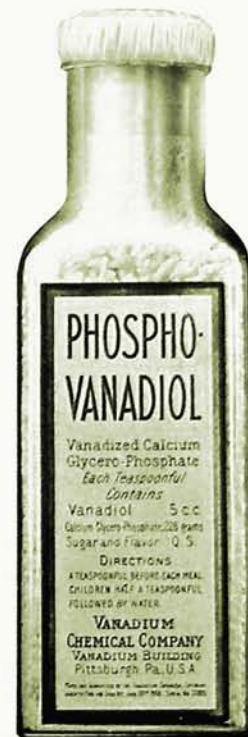
Courtesy Vincent E. McKelvey Collection, Box 48, Correspondence File, American Heritage Center, University of Wyoming.



Vanadium Building, corner Forbes and Meyran Avenues, Pittsburgh, Pa.

This image of the Vanadium Building is rare, as it shows the name on the front.

Courtesy the Historical Medical Library of The College of Physicians of Philadelphia.



DOSE—One teaspoonful. Children ½ teaspoonful followed by water.

Ad for Phosphovanadiol medicine.

Courtesy the Historical Medical Library of The College of Physicians of Philadelphia.

For Eulogio Fernandini, who acquired his 700 shares at no cost as part of his agreement with Joseph Flannery, the sale proved his wisdom in putting in with the Flannery brothers.⁴⁶ Even before this sale, Fernandini was pleased with his meeting with Flannery. Afterwards, his chief mining engineer, Felipe de Lucio, remarked in a letter to Hewett,

“He [Fernandini] is better disposed to Mr. Flannery, to make business with, than anybody else. He always likes to recollect Flannery’s straightforward ways ... never heard him speak so openly of anybody.”⁴⁷

Meanwhile, Joseph Flannery had moved on to another endeavor.

A Turn to Radium

When Marie and Pierre Curie discovered radium in 1898, they waived patenting the process for extracting it from the pitchblend obtained from Austria⁴⁸ and partnered with French chemical companies to produce radium.⁴⁹ They produced radium just to meet the needs of chemists,

physicists, and physicians researching the element, but Austrian restrictions on export of its pitchblend affected even that modest goal. As an alternative, Europe was importing American carnotite, which even Marie Curie purchased.⁵⁰

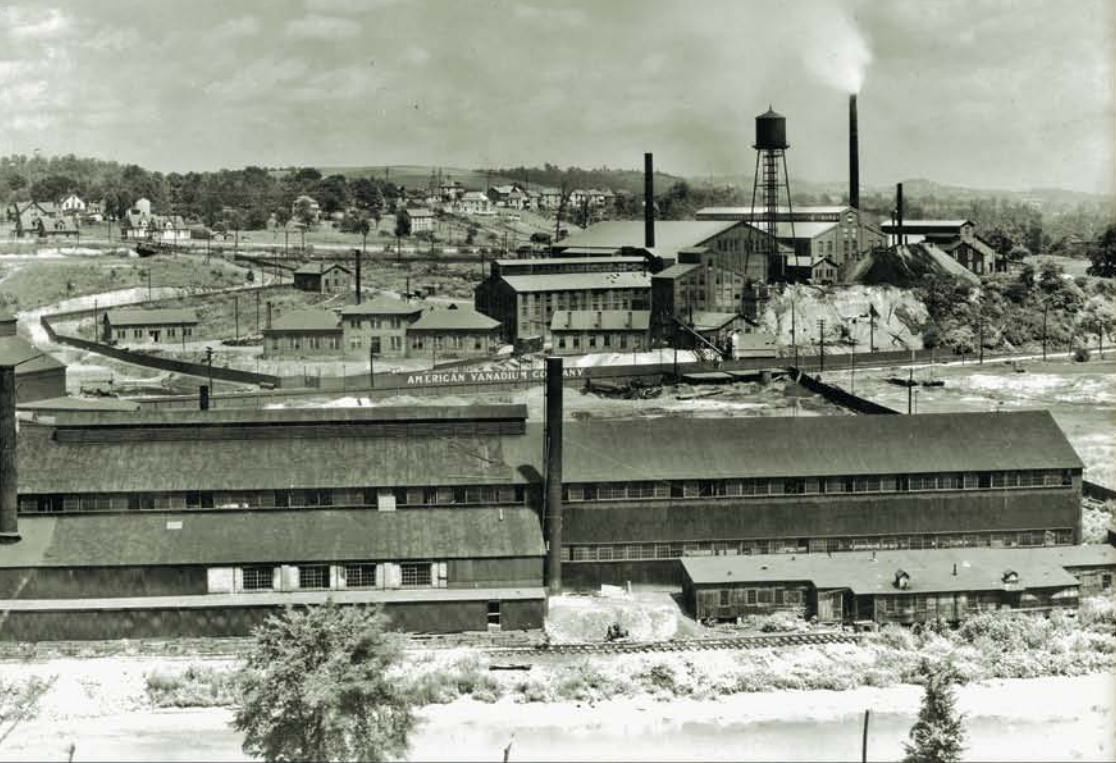
In 1909, the Flannery brothers’ sister was diagnosed with an untreatable cancer. Joseph Flannery had learned that radium might be useful in treating his sister’s cancer but the U.S. had little medical radium and the situation in Europe meant no radium was available there. As noted in a company sketch of his life following his death, “Mr. Flannery determined to make his own radium in this country.”⁵¹

Thanks to their vanadium venture, the Flannerys owned mining options of carnotite in the American southwest and had experience in mining ore in a remote mountainous region, transporting it, and reducing it. Joseph Flannery withdrew from the vanadium company and turned his attention to developing a U.S. radium supply,⁵² organizing the Standard Chemical Company (SCC) in 1911.⁵³ Its carnotite mining

operations were centered in the Paradox Valley in southwestern Colorado. The ore was shipped to a reduction mill built in Canonsburg, Pennsylvania, near Bridgeville.

Experimental milling of the carnotite began under the direction of Otto Brill, an Austrian chemist. After Brill was recalled to Austria, Charles Viol, a physicist who studied at the University of Chicago, conducted the research. Working with Warren F. Bleeker,⁵⁴ the same chemist who collaborated with Saklatwalla, Viol completed development of the ore reduction process.⁵⁵ The mill’s product was then shipped to the Vanadium Building, where the radium was purified in top-floor laboratories. Commercial production began in 1913.

By the end of 1915 more than half of the company’s output went to Europe, with the rest going to U.S. buyers. To remedy the lack of an American market for medical radium, Flannery applied the vanadium business model, namely, to create markets for and vigorously promote radium products.



Ford's order provided a solid financial start for the American Vanadium Company, but the Flannerys recognized the need to expand. They developed a business plan to create markets for, and vigorously promote, vanadium products.

American Vanadium Company plant in Bridgeville, 1920s.

Courtesy Chemical Heritage Foundation, Othmer Library, 96:13.009.

SCC established a Pathology Laboratory to study the effects of internal administration of radium on animals.⁵⁶ Clinical studies that followed involved injecting 1,500 to 2,000 patients with radium to determine doses for successful therapy.⁵⁷ The company journal, *Radium*, published the results. Building on the research, a Free Radium Clinic directed by William H. Cameron, M.D., was set up to treat patients. The American Medical Association Council on Pharmacy and Chemistry accepted the company's radium remedies for inclusion with "New and Non-official Remedies."⁵⁸ First published in April 1913, *Radium* was co-edited by Viol and Cameron. Distributed mainly to physicians without charge, the journal promoted medical radium, reporting in-house experimental results and re-publishing similar articles appearing in other journals.⁵⁹

In 1916, Viol and Cameron were instrumental in organizing the American Radium Society, which continues today as the oldest society devoted to study and treatment of cancer. Their involvement in the Society enhanced the SCC's scientific credentials.

Medical radium research at SCC had become a commercial industrial enterprise. The company researched new medical applications for radium and then promoted their use, a

very different approach from the European companies that produced only enough to meet existing demand. It was a "radical innovation."⁶⁰ SCC even teamed with Pathe movie company to produce short movies about radium.⁶¹ The movies did not identify SCC but its operations and staff are identifiable as SCC's. Different cuts were produced for specific audiences, e.g., British vs. American, technical vs. general.

Non-medical applications of radium were developed especially after America's entry into World War I, when the military demanded large amounts of luminous paint. SCC organized a subsidiary, Radium Dial Company, to produce and market luminous paint and painted products.

From 1899 to 1911, radium's price ranged from \$3,000 to \$120,000 per gram.⁶² The price continued to rise, peaking at \$180,000 in 1912–14, fueled by the military's demand for radium luminescent paint. After the war, the price stabilized at \$120,000 per gram. By then, SCC had established a domestic market for medical radium and a growing consumer product market was replacing the military demand for luminous paint. SCC's radium production peaked in 1920 with 18.5 grams.⁶³ By 1921, SCC had produced more than half of the world's 140 grams of radium. That year, the women of the American Radium Society purchased a

gram of radium as a gift to Marie Curie. After receiving the certificate of gift from President Harding at The White House, she traveled to Pittsburgh specifically to visit the SCC facilities in Canonsburg and the Vanadium Building.

Commercial production of radium was, as *Scientific American* has called it, "The First Nuclear Industry,"⁶⁴ and it began in Western Pennsylvania when Joseph Flannery applied the business principles used by him and his brother, James, in their vanadium venture. Joseph M. Flannery died in Pittsburgh February 18, 1920, at age 52. A few weeks later, James J. Flannery passed away at age 65. James C. Gray, their longtime attorney, became SCC president. SCC's role as the world's pre-eminent supplier of radium ended after 1922 when radium from Belgium was introduced.⁶⁵ Union Minière produced the radium from Belgian Congo pitchblend ore, selling it for \$70,000 per gram, a price SCC could not match. SCC discontinued production, sold off its assets, and in 1933 went out of business, just 13 years after its peak year.

In 1929, Vitro Chemical Company acquired the Canonsburg site, producing uranium for glass and ceramic industries, which used it as a coloring agent. During World War II, the government brought Vitro into the Manhattan Project to supply uranium.

After the war, the company supplied uranium to the Atomic Energy Commission for its nuclear weapons production program. But in a similar life cycle, by 1960 the plant had closed. The property sold for redevelopment but the radioactive contamination from the SCC and Vitro operations stymied that prospect. Contaminated material from the site and many off-site locations was consolidated and buried on-site in an engineered disposal cell at a cost of \$48 million.⁶⁶ The property is enclosed by a fence, posted with radiation warning signs, and periodically inspected by the U.S. Department of Energy and the state.

Vanadium continues to be used to strengthen and toughen steels. For example, vanadium alloy steel is used in dies, gears, crankshafts, cutting tools, and wrenches, and vanadium high strength low alloy (HSLA) steel is used in the auto industry and for pipelines. However, Ford and others found it was not a cure-all for increased strength: engineers learned "Vanadium steel proved impractical for crankshafts, for example, whereas properly heat treated manganese carbon steel worked admirably in that capacity."⁶⁷

The Vanadium Building was renamed the Flannery Building, although precisely when this occurred is unclear. Not until 1958 did anyone realize it too was radioactively contaminated. After many attempts, the building was successfully decontaminated at a cost of \$8 million and released for public use in 2002. Now known as the Parkvale Building, it is a commercial office building along busy Forbes Avenue in Oakland.

The Vanadium Window was removed from the building but saved by the Pittsburgh History and Landmarks Foundation, which donated it to the Heinz History Center. Using funds provided by the Hillman Foundation, it was brought back to its original glory by Kirk Weaver Stained Glass Restoration. Today, it

reminds visitors at the History Center of the remarkable accomplishments of James and Joseph Flannery.

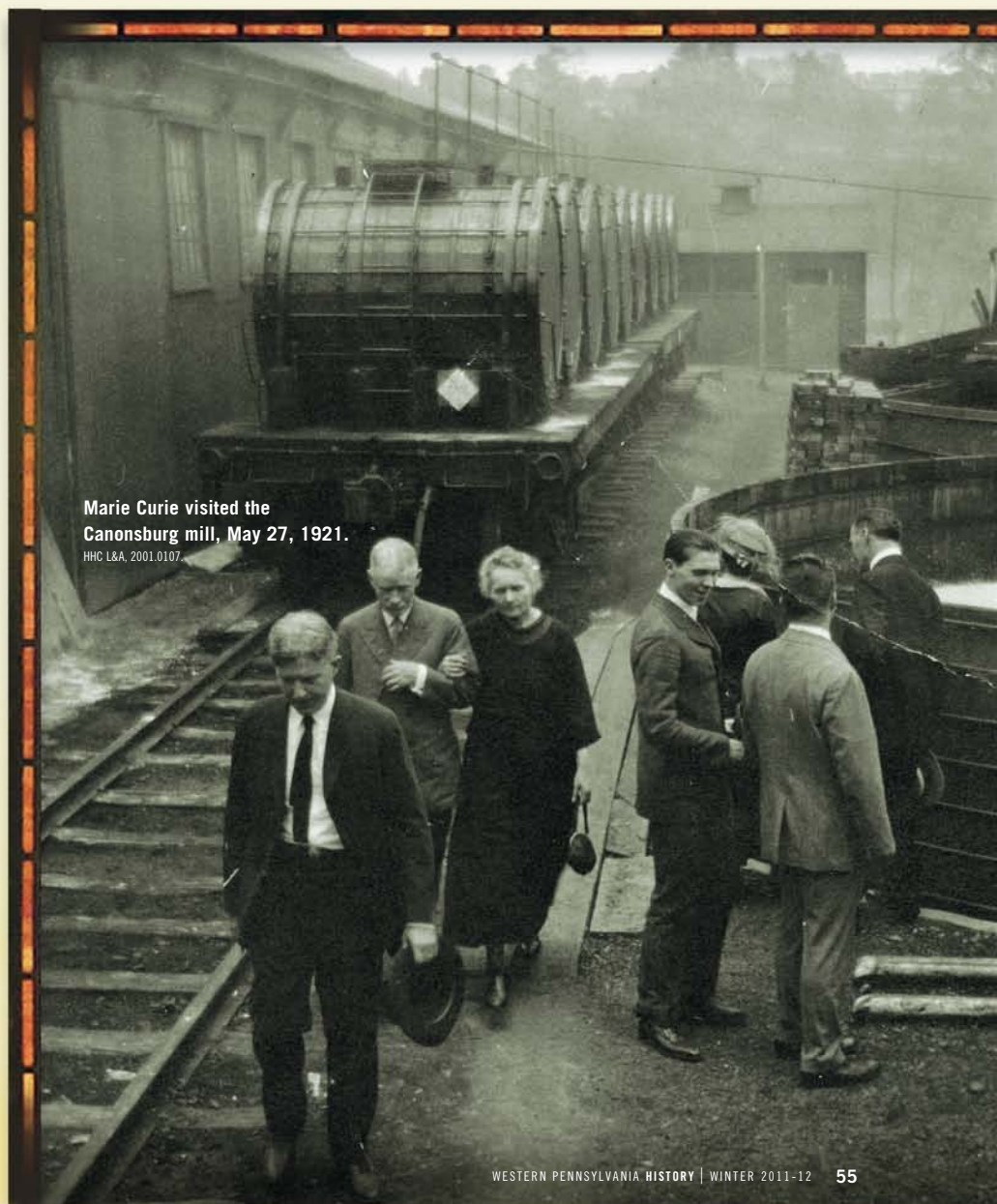
Joel O. Lubenau received a civil engineering degree from The Cooper Union, New York City, and an M.S. in radiological health from Rutgers University. He was a Commissioned Officer in the U.S. Public Health Service, and worked for the Pennsylvania radiation control program, the Atomic Energy Commission, and the Nuclear Regulatory Commission. Now a writer, he resides in Lititz, Pa.

¹ "Well-Known Pittsburgh Business Man Succumbs to Attack of Pneumonia," *Pittsburgh Sun* Feb. 19, 1920.

² "Death Takes Bank Head - Oakland," *Pittsburgh Dispatch* (March 8, 1920).

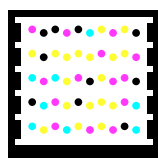
³ Henry Ford and S. Crowther, *Henry Ford - My Life and Work* (New York: Doubleday, 1923). In his autobiography, Ford recalled the year as 1905 and the place as Palm Beach, Florida. But organized auto races were not held in Palm Beach in 1904 or 1905. There is no report of a Panhard wrecked in the Ormond-Daytona Beach races in 1905 but such a wreck *did* occur in 1904 when the Panhard lost an outboard wheel on a sharp turn, tumbled over, and injured the driver. See footnote 4.

⁴ Some insight can be gleaned from Christopher W. Wells, "The Road to the Model T: Culture, Road Conditions, and Innovation at the Dawn of the American Motor Age" in *Technology and Culture*, Vol. 48, Number 3, July 2007, pp. 497-523, published by The Johns Hopkins University Press, footnote 41: "Accounts vary of Ford's first encounter with vanadium steel. Ford himself claimed he came across it 'almost by accident' when he salvaged a valve stem from a wrecked French racing car in Palm Beach, Florida (Ford, *My Life and Work* [n. 15 above], 65-66). As Nevins points out, however, accounts of vanadium steel and its properties had been published in scientific journals that Ford executives read, and had been exhibited at an engineering



Marie Curie visited the Canonsburg mill, May 27, 1921.
HHC L&A, 2001.0107

At one time the Flannery Building was said to contain the major portion of the world's inventory of processed radium. Learn more about the building and its decontamination here.





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The laboratories were located on the upper floors of the Flannery Building.
Note the scientists' lack of protective clothing.

Courtesy Oak Ridge Associated Universities.

convention in 1905 that a chief Ford executive had attended (Nevins [n. 3 above], footnote, 348–49). Douglas Brinkley concludes that C. Harold Wills, Ford's most influential designer at the time, discovered the alloy for the company (Brinkley, *Wheels for the World: Henry Ford, His Company, and a Century of Progress* [New York, 2003], 101–2). Thomas J. Misa, on the other hand, claims that Wills came across the alloy only when he hired J. Kent Smith, a British metallurgical engineer, as a consultant (Misa, *A Nation of Steel: The Making of Modern America, 1865–1925* [Baltimore, 1995], 223–25)."

⁵ F.E. Spooner, "The Florida Race Meet," *The Horseless Age* 13:5 (Feb. 3, 1904), pp. 141–144. See also E.T. Heald, "Stark County Story, Vol. III, Industry Comes of Age 1901–1917" Stark County Historical Society, Canton, 1952. A contribution to the Ohio Sesquicentennial of 1953, "Stark County Story" is a compilation of scripts for radio broadcasts over WHBC-WHBC-FM recounting the history of the county. Of interest is script #96, "Edward A. Langenbach—Steel Industrialist, 1886," #98, "John E. Carnahan, Pioneer Tin Plate Manufacturer, 1897," #104 "Transue & Williams, Steel Forgings, 1895," and #156, "The Henry Ford Steel Tests at Canton, 1906–1907."

⁶ Some examples are Léon Guillet, "Vanadium Steel," *Iron and Steel Magazine* 8 (1904): 253–56; "Vanadium and Vanadium Steel," *Iron and Steel Magazine* 10 (1905): 134–40; and Léon Guillet, "The Use of Vanadium in Metallurgy," *JISI* no. 2 (1905): 118–65.

⁷ Henry Ford, "Arranging to Build 20,000 Runabouts," letter to the editor, *Automobile*, January 11, 1906, p. 107.

⁸ R. Casey, *The Model T—A Centennial History* (Baltimore: Johns Hopkins University Press, 2008).

⁹ Ford, Crowther, op. cit.

¹⁰ The Pennsylvania Department of State Corporation Bureau, Harrisburg, houses records of companies incorporated in or doing business in the state. Business entity filing histories can be accessed at <http://www.corporations.state.pa.us/corp/>.

¹¹ H.B. Sankey and J.K. Smith, "Heat Treatment Experiments with Chrome-Vanadium Steel," *Proceedings, Part 2, Institution of Mechanical Engineers (Great Britain)* Dec. 1904, pp. 1253 ff.

¹² Vanadium was discovered *twice*. The first discovery was claimed in 1801 by a Spanish mineralogist Andres Manuel del Rio (1764–1849), who prepared salts from a mineral from Mexico. Because the salts turned red on heating, del Rio called the element erythronium ("red"). However, his claim was disputed by a Frenchman, Hippolyte Collet-Descotils (1773–1815), and del Rio withdrew the claim. Then, in 1831, the Swedish physician and chemist Nils Gabriel Sefström (1787–1845) isolated a new oxide when working with iron ores. He named the element vanadium for the Scandinavian goddess of love and beauty, Freya the Vanadis, which means ruling goddess. Later that year, the German chemist Friedrich Wöhler (1800–1882) came into possession of del Rio's samples and confirmed del Rio's 1801 discovery of vanadium, but the name, vanadium, was not replaced by the original erythronium. See J.O. Lubenau & R.F. Mould, "The Vanadium Window with special reference to Joseph and James Flannery's contribution to the American steel and radium industries," *Nowotwory*

58:4 pp. 187e–192e (2008). Had del Rio's claim not been disputed, erythronium, would have been the element's name and we would never have had the vanadium window!

¹³ J.E. Lounsbury, "Famous Pittsburgh Industries The Standard Chemical Company of Pittsburgh, Pa.," *The Crucible* v. 22. Published in three parts, pp. 86–89, 109–113, 134–137 (1938).

¹⁴ R. Flemming, "How Vanadium Came to Pittsburgh," *The (Pittsburgh) Press World of Today*, July 27, 1930.

¹⁵ L.A. Clayton, *Peru and the United States: The Condor and the Eagle* (Athens: Univ. of Georgia Press, 1999).

¹⁶ D.F. Hewitt, "Vanadium-Deposits in Peru," *Transactions of the American Institute of Mining Engineers* v. 40 (1910) pp. 274–299.

¹⁷ The earliest reports on the deposit were published by Jose J. Bravo, a well-known Peruvian scientist and D. Foster Hewett. See: J.J. Bravo, "El Vanadio de Minasragra," *El Comercio* (newspaper), Lima, September 20, 1906 (I am indebted to Ms. Deanne Horst, Lebanon, Pa. for translating the article), and Hewett, D. "New Occurrence of Vanadium in Peru," *The Engineering and Mining Journal* 82:9 (September 1, 1906). Both suggested naming the mineral patronite after Antenor Rizo Patron Lequerica, a metallurgist employed by Fernandini, who recognized it as a new mineral.

¹⁸ Pittsburgh Testing Laboratory (PTL) was established in 1881 and that year inspected the cables of the Brooklyn Bridge. In a remarkable example of historical connectivity, a century later when the cables were



Bridgeville Area Historical Society

This is the 10-year anniversary for the Bridgeville Area Historical Society, which began in 2001 as a planning committee for the Bridgeville Centennial. The organization has remained active and even expanded over the past decade.

- The Historical Society has a large collection of photographs from Bridgeville and the surrounding area dating to the early 20th century, memorabilia from around the area, and local ephemera.
- The collection on display includes C.P. Mayer bricks, Higbee Glass goblets, and Bridgeville Bottling Works pop bottles.
- The society recently moved to a new location at 414 Station Street, the Kathleen Banks Building (once the Pennsylvania Railroad Station and an attached caboose).
- With the help of many local volunteers, the Bridgeville Area Historical Society safely moved to its new location, which offers much more space to display the Bridgeville area's rich industrial history.
- Contact the Bridgeville Area Historical Society at www.bridgevilleboro.com/history or (412) 221-5651.

The History Center Affiliate Program, HCAP, is a membership-based network that allows local and regional historical societies and museums access to museum professionals and best practice standards through the Senator John Heinz History Center.

To find out more about HCAP or to apply for membership for your organization, please contact Natalie DeRiso, Community Programs Manager, at nderiso@heinzhistorycenter.org or (412) 454 6373.



Steel Vault, first floor, of the Flannery Building, where the finished Radium Salts were stored. After the closure of Standard Chemical, the Oakland Branch of the Peoples First National Bank and Trust Company of Pittsburgh took over the building. The bank found the vault convenient and used it. Unfortunately, the vault was contaminated.

Courtesy Oak Ridge Associated Universities.

rehabilitated, PTL, now a division of Professional Service Industries, Inc. inspected them. From the Professional Service Industries' website, www.psiusa.com/services/nde.aspx/, accessed May 14, 2011.

¹⁹ "The Romance and Marvels of Vanadium," *The New York Times* (July 14, 1907).

²⁰ D.F. Hewett letter to James Flannery dated February 27, 1906. This letter is in Box #48 of the Papers of Vincent E. McKelvey, Acc. #5058, in the American Heritage Center, University of Wyoming, Laramie, Wyo. Box #48 contained notes and papers of F. Foster Hewett, chiefly regarding vanadium resources in Peru. The center has no explanation for Hewett's papers on this subject finding their way to this collection.

²¹ W.B. Parker, ed., *Peruvians of Today* (Lima, Peru: Hispanic Society of America, Southwell Press, 1919). Accessed Jan. 3, 2010 at <http://ebook.lib.hku.hk/CADAL/B31402513/>

²² "American Beauty," *Time* (Nov. 21, 1949).

²³ R. Thorp and G. Bertram, *Peru, 1890-1977: growth and policy in an open economy* (New York: Columbia Univ. Press, 1978).

²⁴ W.H. Weed, *International Edition — The Mines Handbook, An Enlargement of the Copper Handbook, Vol. XIII*. (New York: W.H. Weed, 1918).

²⁵ Article in an undated, unidentified newspaper by James Hay, Jr., "He Filled His Carpet Bag with Gold." American Heritage Center, Box #48, Papers of Vincent E. McKelvey, Acc. #5058. See footnote 17.

²⁶ Saklatwalla, B.D. "American Chemical Industries: The Vanadium Corporation of America and Its Predecessor,

The American Vanadium Company," *Industrial and Engineering Chemistry* 17:3 (March 1925) pp. 321-322. See also Lounsbury, op. cit.

²⁷ Anon. "Saklatwalla's Step." *Pittsburgh Bulletin Index* (Sept. 26, 1935) pp. 17-18.

²⁸ Moore, R.B., Kithil, K.L. "A Preliminary Report on Uranium, Radium and Vanadium," Bureau of Mines Bulletin 70 Mineral Technology 2, Government Printing Office, Washington (1913). See also Lounsbury, op. cit.

²⁹ Anon. "Vanadium Company Sold for \$7,000,000," *The New York Times* (August 23, 1916).

³⁰ The story of the cost of vanadium parallels that of aluminum. In 1858, the price of aluminum was \$17 per pound, about the same as silver, and was used in making jewelry. Napoleon III provided only his most important dinner guests aluminum cutlery, others had to make do with silver. In 1869 only two metric tons were produced worldwide. In 1884, the Washington Monument was topped with a six-pound aluminum cap. But, by the end of the 19th century innovations in production had progressed to the point that large-scale production became possible eventually leading to 1907 when the Aluminum Company of America (Alcoa) was established in Pittsburgh. See Tom Geller, "Aluminum: Common Metal, Uncommon Past," *Chemical Heritage* 25:4 (Winter 2007-8).

³¹ Sankey, H.B., Smith, J.K. op. cit.

³² Watts, S., "The People's Tycoon — Henry Ford and the American Century," (Alfred A. Knopf, New York, 2005).

³³ Heald, op. cit.

³⁴ Ibid.