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Chapter 1 : The Platinum Notebooks of William Hyde Wollaston | Johnson Matthey Technology Review

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Biography[edit] Wollaston was born in East Dereham , Norfolk , the son of the priest-astronomer Francis Wollaston â€” and his wife Althea Hyde. The family, which included 17 children, was financially well-off and were part of an intellectually stimulating environment. In , after he had received a large sum of money from one of his older brothers, he left medicine. He concentrated on pursuing his interests in chemistry and other subjects outside his trained vocation. He was elected a Fellow of the Royal Society in , where he became an influential member. He served as president in He died in London in and was buried in Chislehurst , England. He held the details of the process secret until near his death and made huge profits for about 20 years by being the only supplier in England of the product which had many of the same qualities as gold, but was much cheaper. Later Heinrich Rose proved in that columbium and tantalum were indeed different elements and he renamed columbium " niobium ". Niobium and tantalum, being in the same periodic group , are chemically similar. The mineral wollastonite was later named after Wollaston for his contributions to crystallography and mineral analysis. In , he performed an experiment showing that the electricity from friction was identical to that produced by voltaic piles. His optical work was important as well, where he is remembered for his observations of dark Fraunhofer lines in the solar spectrum , [6] [7] which eventually led to the discovery of the elements in the Sun. He invented the camera lucida which contained the Wollaston prism the four-sided optics of which were first described basically by Kepler [8] and the reflecting goniometer He also developed the first lens specifically for camera lens, called the meniscus lens , in The lens was designed to improve the image projected by the camera obscura. Wollaston also devised a cryophorus , "a glass container containing liquid water and water vapor. It is used in physics courses to demonstrate rapid freezing by evaporation. His paper "On the non-existence of sugar in the blood of persons labouring under diabetes mellitus" [10] concluded that sugar must travel via lymphatic channels from the stomach directly to the kidneys, without entering the bloodstream. Wollaston supported this theory by referring to the thesis of a young medical student at Edinburgh, Charles Darwin â€” , "Experiments establishing a criterion between mucaginous and purulent matter. And an account of the retrograde motions of the absorbent vessels of animal bodies in some diseases. Wollaston prophetically foretold that if once an accurate knowledge were gained of the relative weights of elementary atoms, philosophers would not rest satisfied with the determination of mere numbers, but would have to gain a geometrical conception of how the elementary particles were placed in space. Honours and awards[edit] Fellow of the Royal Society ,

Chapter 2 : Wollaston, Northamptonshire - Wikipedia

The Wollaston Journals: Volume 3, is the final volume of a revised edition of the journals of John Ramsden Wollaston, an Anglican clergyman who migrated to Australia with his family in

The physical and chemical details of that work are of course well known from his published papers to the Royal Society, including the Bakerian Lecture of which he prepared just before his death. But, until recent years, little was known about the circumstances in which he undertook and carried on the work and a number of legends have grown up about it. These have latterly been dispersed, and the true facts brought to light, by the long and painstaking work of the late Mr L. Gilbert, who devoted many years to a study of the subject but unfortunately died before he could collate and publish the results in full. He was, from to , a lecturer in chemistry at University College, London, and his papers are in the custody of its Library, but have not so far found an editor to prepare them for the publication for which those interested have hoped. William Hyde Wollaston â€" Born years ago, Wollaston was the first to refine native platinum on a logical and scientific basis and to develop its industrial use. In the course of his researches he also discovered palladium and rhodium. This article describes the circumstances in which Wollaston undertook and carried on his work and puts his achievements into proper perspective with those of his predecessors and collaborators Portrait from a mezzotint by W. His father was an astronomer and one of his uncles a well-known doctor, William Heberden; both were Fellows of the Royal Society. His main schooling was at Charterhouse â€"78 and in July he was admitted to Gonville and Caius College, Cambridge, to study medicine with a view to making a career in it. While there, he met fellow students with interests in the pure sciences and became attracted by their work. He tried his hand at astronomy and botany, but it was chemistry and physics that appealed to him most and in he took up serious study in them under Isaac Milner. He was five years older than Wollaston and had been to the Continent and met leading chemists there. This experience had made him a clever experimenter and Wollaston was fascinated by the results. He did some work himself in his own rooms and in the laboratory of his brother, Francis, also studying at Cambridge, and so were laid the foundations of his scientific knowledge and the openings for his own genius in experiment. In he moved to London to forward his medical studies by attending lectures and walking the hospitals and eventually, in , he took up practice at Huntingdon. This lasted only a few months and he moved to Bury St Edmunds, where he stayed until , becoming qualified as a Fellow of the Royal College of Physicians in He was popular in his district and had a full programme of social engagements, but still found time for the study of nature. In his friends persuaded him to move to the wider scope of London and then, in , to the surprise of everyone, he threw up his practice and retired from medicine. Work with Smithson Tennant His reasons for doing this have been much debated but there seems to be no reason to doubt his own statement that mental anxiety about his patients caused him excessive and painful distress. At the same time there had opened for him some hopes of being able to make beneficial use of his experience in chemical research, which he was tempted to develop in association with his friend Smithson Tennant. The latter had also prepared himself to practice medicine but he too had given it up, though for reasons different from those that affected Wollaston. Tennant was casual in his approach to life and had inherited sufficient money to support himself; Wollaston was serious and steadfast but had to earn his living. The combination of the two had the promise of being effective and they duly came together for business, turning their attention to the preparation of platinum for commercial and scientific use, a subject that had already attracted the attention of both in the laboratory. To explain their reasons for choosing it and to emphasise the importance of their work, it is necessary to give some attention to past history. Until well into the present century it was generally believed that Wollaston alone was the pioneer in making platinum available for fabrication. But in this he makes little reference to his predecessors, none to his collaborators and none to the use to which his process was put. He did however in another place make a public statement that he made no claim to have originated it, but merely to have improved its details. Platinum Fabrication before Wollaston Native platinum was first brought to the notice of European scientists in after occasional rumours of its existence in New Granada. As soon as samples were available a number of well-known chemists got to work upon it and by a great deal had been found out. Naturally its powers of resistance to melting at the highest temperatures then available and to corrosion by all the simple acids soon gave rise to hopes of using it. The French chemist Baume produced evidence that it could be consolidated by forging at a high temperature like iron, but it was soon found that when this was applied to the grains of the native metal they often failed to cohere. This was due to the fact that the mineral contained a small quantity of alloyed iron and, at the very high temperature used, this oxidised to a surface film of magnetite. To secure bonding, therefore, this iron must be removed. The first process used was a scorification of the mineral with an oxidising mixture of potash and white arsenic. This not only removed the iron, but yielded a molten eutectic product that could be cast into thin discs from which, by careful heating just below the melting point, the arsenic could be volatilised and the resulting medallion forged to good malleable metal. This method was exploited by the French goldsmith Janety over the period to and by its aid he made jewellery, crucibles and other laboratory ware. The principal example of his work that has survived is the four original Standard Metres, all of which are still preserved in Paris. The arsenic process was slow, painful and dangerous, and alternative methods were at once sought. These concentrated on dissolving the mineral in aqua regia, precipitating the platinum with sal-ammoniac, calcining this to a sponge of platinum metal, heating this to the highest temperature possible and then forging the product. This too was developed in France by a series of distinguished chemists of whom the last, de Milly, communicated the details to Fausto de Elhuyar in Spain, who had been encouraged by his Government to study possible uses for this Spanish-American product. Don Fausto soon produced a workable process in conjunction with a French colleague, Pierre Chabaneau, but had then to go to other duties, leaving the latter to put it to commercial use. Empirical Methods It is apparent therefore that considerable quantities of reasonably good malleable platinum had been prepared and used well before But the methods used were purely empirical, the product varied in quality and sometimes failed mechanically. There was no real fundamental knowledge of the composition of the native mineral or of the nature and properties of the products derived from it. At its best, the principal one reasonably satisfied a need and no notable progress was made until Wollaston and Tennant decided to seek it. At least three people were stimulated to do some work on the subject. The first was Richard Knight, who sent a paper to the Philosophical Magazine in on a new method for making the metal malleable. In it platinum sponge was prepared as his predecessors had done but, before forging, he compressed it by hand-pressure into a white-hot mould and only applied the hammer after this had been done. The second interested party was William Allen, the famous pharmacist who, with a young assistant named Thomas Cock, took up the study a year or two later. This resulted in the production of some crucibles in but nothing was known about the methods until Cock published them in Then it was disclosed that the sponge metal was now pressed in a cold mould, first by hammering and then by means of a screw press. Only after that was heat applied and forging begun. Meanwhile the third interested party in comprised Wollaston and Tennant. They entered into a loose partnership to investigate thoroughly native platinum from the scientific point of view and then to develop its industrial uses. According to Gilbert, at the beginning they shared expenses until earnings began to come in to help with them. Profits did not appear until but then improved rapidly; Wollaston as working partner was allowed 10 per cent of income before the rest was equally divided. In all, from to , about 47, troy ounces of native platinum were treated and nearly 36, ounces over one ton of malleable platinum obtained. The first operations were purely scientific. The result was that Wollaston discovered palladium and rhodium, and Tennant iridium and osmium. This cleared the way for work on the solution and, by February , five crucibles had been made and sold, the price being 5s per ounce. But the really important sales came from a new use introduced by Wollaston, namely, the manufacture of boilers for concentrating the weak sulphuric acid, produced by the chamber process, to oil of vitriol. Nearly ounces of metal were sold in this form, against ounces for crucibles, and Gilbert gives a surprising figure of 17, ounces as going to gun-makers, ostensibly for touch-holes but probably for decoration as well. A note on the facing blotting paper reads: I believe the C meant Ceresium a name which I once thought of giving to Palladium. The essential points are that the aqua regia used for dissolving the mineral should be dilute about The yellow precipitate produced by salammoniac was to be well washed and then well pressed, before being gently heated at a low heat to produce platinum sponge. He emphasised that the heat must be only just enough to bring this about and, in any grinding required, the metal must on no account be burnished. He recognised the need to preserve in the sponge a certain virginity about its surfaces if the subsequent welding was to be successful. A century later his acumen in this respect provided a vital foundation for the science of powder metallurgy. Having got his sponge into a fine and uniform powder by hand-rubbing, he washed and elutriated it thoroughly with water. After pouring off the excess of this, he transferred the metal mud to a brass mould and then closed this with a steel stopper wrapped in blotting-paper and topped with some wool, which allowed the excess water to escape under hand-pressure. A plate of copper was then put on top and the whole introduced into a powerful horizontal press of his own design. This produced a hard cake of metal which was next exposed to the greatest heat that he could obtain and then forged by hand on an anvil. An ingot of about 20 oz of malleable platinum resulted and this could be hammered into sheet or drawn into wire. Such was the material which Wollaston and his fabricators used for their articles for sale. He himself used the full procedure throughout the rest of his working life, but his successors never took up the wet part of the process, preferring to follow Knight and Cock in compressing the sponge in a dry state before forging it. The rest of his discoveries they were very pleased to adopt, and the platinum fabricating industries of both England and France used them to improve their existing methods. This invoice was for his second boiler, weighing ounces and made in for R. It does seem, however, that he did achieve his object of financing his research activities by means of this work. He invented valuable optical instruments, gave early support to the new atomic theory, and made important discoveries in the directions of stereochemistry, spectroscopy, electromagnetic induction, refrigeration, photography and the above-mentioned powder metallurgy. His contribution to the advancement of science was a very large one.

Chapter 3 : molecular biology of leaf senescence | Journal of Experimental Botany | Oxford Academic

Wollaston's Picton journal (): being volume 1 of the Journals and diaries () of Revd John Ramsden Wollaston, M.A / collected by Canon A. Burton: edited with introduction and notes by Canon Burton and Percy U. Henn.

History[edit] In common with the rest of Northamptonshire, Wollaston is noted for its shoe industry. NPS has been in operation in the village since and now has a factory shop. Martens boots were made in Wollaston. Martens footwear was resumed in the Cobbs Lane Factory in Wollaston. The village has four churches: The oldest parts of the building are 13th-century. Romano-British[edit] Settlement and activity in the area are known to date from at least Roman times. The course of a Roman road passes roughly east â€" west just south of the modern part of Wollaston. The course of another Roman road passes north â€" south to the east. High Middle Ages[edit] The oldest visible part of Wollaston is known as Beacon Hill, [11] an ancient castle earthwork or burial mound which once belonged to Bury Manor. The mound was once surrounded by a great ditch which dates back to the 12th century. A wall plaque records that this was the site of a Norman motte-and-bailey castle. She died circa At the time David Hennell, a lace dealer from Wollaston wrote "I lament that this field is now agoing to be enclosed. Some that have large quantities of land are set upon it, and pay no regard to the many little ones that may be injured, and I fear many ruined. The school was private and was run by a curate, the Reverend JJ Scott, from his own funds. The school did not come under government control until The school has moved several times, finally being established on College Street in a building dating from May In this period significant industry came to Wollaston in the form of shoe-making. The Wollaston Vulcanising Co-Operative was another local business. This section does not cite any sources. Please help improve this section by adding citations to reliable sources. Unsourced material may be challenged and removed. March Learn how and when to remove this template message Dr Martens Offices Shoe-making, and the mechanisation of this work, continued in the early 20th century with a number of nationally known shoe-making companies establishing themselves in Wollaston and surrounding area. In Scott Bader moved manufacturing to Wollaston from London; the move became permanent and the company is now an integral part of the local community. The company founders, Ernest Bader and Dora Scott, established the Scott Bader Commonwealth in the s, gifting the whole company to its employees for all time. The company now functions as a co-operative with profits divided between investment in the company, bonus for employees and charitable donations. From the early s to the late s LSM Engineering, a manufacturer of model steam engines, was based in Wollaston. Henry Keep was born in Wollaston and emigrated to Australia in the s, later becoming a member of the Western Australian Legislative Assembly Cyril Perkins â€" 21 November , was the oldest living first-class cricketer who played for Northamptonshire and Suffolk.

Chapter 4 : Wollaston, John Ramsden () - People and organisations - Trove

The Wollaston Journals - Volume 3 is the final volume of a revised edition of the journals of John Ramsden Wollaston, an Anglican clergyman who migrated to Australia with his family in

East Dereham, Norfolk, England, 6 August ; d. London, England, 22 December chemistry, optics, physiology. His great-grandfather, William Wollaston, was the author of Religion of Nature Delineated, a widely read work on natural religion published in His father, Francis Wollaston, a vicar and fellow of the Royal Society , was interested in astronomy and compiled a catalog of stars, Fasciculus astronomicus, which appeared in The famous physician William Heberden was his uncle. William went to school at Charterhouse and in entered Caius College, Cambridge, as a medical student. There he pursued his favorite field, botany, but also studied some astronomy and, most important for his future work, became interested in chemistry. He attended the lectures of Isaac Milner, Jacksonian professor of chemistry, and performed experiments in the laboratory of his elder brother, Francis, who then held a lectureship in mathematics and who later lectured in chemistry, succeeding Milner in His interest in chemistry was also stimulated by Smithson Tennant , who was also studying medicine. William graduated in and then completed his medical studies in London. He first practiced in Hunting don in , but after a few months he went to Bury St. He became a fellow of the Royal Society in Four years later he moved to London. In , either because of his failure in a contest for the appointment of physician to St. In he was awarded the Copley Medal of the Royal Society for his published papers. He became secretary of the Royal Society in As a member of numerous committees he gave advice on matters of scientific interest. He was associated with the attempts to bring uniformity into the system of weights and measures and recommended the introduction of the imperial gallon, which was accepted in Between and he was an active member of the Board of Longitude, and was particularly concerned with nautical instruments. Shortly before his death on 22 December , he made notable donations for scientific research. He gave two thousand pounds to the Royal Society for promoting research, so initiating the Donation Fund. He also invested one thousand pounds in the name of the Geological Society, of which he had been a member since In the same year that he left the medical profession Wollaston formed a partnership with Tennant which was to bring him fame and wealth. Tennant had traveled to Sweden and met J. Gahn, an adept of chemical analysis on the small scale. When extent to which Wollaston had developed this art. The bottles contained the common reagents and were so stoppered that their contents could be extracted in drops. Substances were investigated on a small piece of glass. Wollaston and Tennant were both interested in platinum, which continued to resist the efforts of chemists particularly intensive since the middle of the eighteenth century to produce it in a satisfactory malleable state in which it might be worked. Tennant bought a large quantity of crude platinum ore, and the partners began work on the intractable metal. Tennant was soon able to announce his discovery of osmium and iridium, new elements in the crude ore; but Wollaston was the harder worker, and it was through his continuing experiments, conducted in his private laboratory, into which he was reluctant to admit anyone, that the difficult practical problem was solved. It had become common practice to refine the crude ore by dissolving it in aqua regia and then to precipitate platinum by means of ammonium chloride , with which it forms an insoluble complex salt. To recover any platinum still in solution Wollaston added bars of iron, and treated the precipitate as before with aqua regia and ammonium chloride. Adding iron for the second time, he obtained a precipitate with unexpected properties. When it was treated with nitric acid , a red solution formed. This gave an amalgam when treated with mercury, which in turn was decomposed by heat, leaving a white metal. Instead of reporting his discovery openly Wollaston sent out anonymous printed notices in April , describing the properties of the new metal and advertising its sale at a Soho shop. This attracted the attention of Richard Chenevix, a chemist, who suspected fraud from the way in which the discovery was announced. He bought the advertised stock and performed many experiments. In spite of his conviction that palladium was an alloy of known metals, none of his many attempts to analyze it succeeded. He claimed, however, that he had synthesized palladium by mixing a solution containing mercuric oxide and platinum in aqua regia with a solution of ferrous sulfate. When heated, this mixture produced a precipitate that fused into a button, supposedly indistinguishable from palladium, though it was in fact a compound of platinum with silicon and boron contained in the powdered charcoal used for the fusion. Chenevix concluded that palladium was an alloy of platinum and mercury. He felt he had found the key to reducing the number of the elements, whose recent rapid increase had led him to suspect their real simplicity. One critic, congratulating Chenevix, pointed out that the pursuit of alchemical transmutations was not as ridiculous as it had seemed. The repeated failures to achieve this result soon convinced chemists that palladium was a genuine new metal. In Wollaston announced his discovery or rhodium in the crude platinum ore. Yet he withheld the identity of the discoverer of palladium until February For these metals are only present in platinum ore in small amounts. From one thousand grains of crude ore he had extracted five grains of palladium and four grains or rhodium. His paper earned him the Royal Medal of the Royal Society. No one had yet succeeded in fusing platinum in larger quantities. Previous workers had tried the effects of heat and pressure on the platinum sponge, obtained by the ignition of the complex ammonium salt. Through trial and error, and a careful attention to detail in the treatment of his material, Wollaston brought remarkable refinements to this method. His techniques included the slow thermal decomposition of the ammonium salt, the avoidance of burnishing by gently powdering the platinum sponge, sieving, and sedimentation. This process produced a uniform powder, essential to the production of malleable platinum. Impurities were removed by washing and forming a compact mass under water. The cake so formed was powerfully compressed by a toggle press. Finally the compact metal was carefully dried and forged. His process was not immediately adopted in industry; but it was followed, at least in part, by Liebig at the Giessen laboratory. Wollaston sold the laboratory apparatus which he made from his malleable platinum. He drew very fine platinum wires by a process that is still used, and superintended the construction of platinum vessels for the concentration of sulfuric acid. These are the earliest platinum boilers known. They were sold to manufacturers. His own attitude to atomic chemistry varied remarkably between bold speculation and complete skepticism. In he described his experiments on carbonates, sulfates, and oxalates, which proved that the composition of these substances was regulated by the law of multiple proportions. These additional instances of the law were easily verifiable and were often mentioned as standard examples. He speculated on the possible atomic composition of the oxalates of potash. With brilliant intuition he predicted that arithmetical relations between atoms would be insufficient to explain chemical combination, and that spatial considerations would have to be introduced. He stated that a compound of four particles of one type and one of another would be stable if the four surrounding particles were arranged tetrahedrally. This surmise was confirmed much later in the century with the development of the stereochemistry of the carbon atom. He discussed this idea in more detail in his paper on the structure of crystals, which was read in He remarked that the existence of ultimate Physical atoms was not established and that virtually spherical particles, consisting of mathematical points surrounded by forces of attraction and repulsion, would explain the structure of crystals equally well. Later Faraday would accept it in favor of the extended mass atoms of Dalton. In Wollaston discussed the atomic theory in a way that was to have a surprisingly wide appeal. His tone was totally different from that of his earlier treatment of the subject. He therefore proposed to draw up a scale, based on the most reliable analyses available, which would express the proportions in which the common chemical substances combined. This summary of chemical facts would provide chemists with immediate answers to the routine problems of laboratory work. Referring all combinations to a standard oxygen unit of 10, he calculated the combining proportions of various substances, and distributed their names and values on a sliding rule, along a line logarithmically divided from 10 to He was thus able to compute mechanically chemical proportions that before had been obtained only by lengthy multiplication and division. Chemists were not yet employing tables of logarithms for their calculations. Abandoning atoms and conjectures Wollaston had attempted to strip chemistry of all but the factual content of experimental results. There appeared to remain a purely descriptive chemistry, a body of recipes for producing desired effects, summarized on an instrument. Yet this was an illusion. Chemists, particularly in England, succumbed to this apparently factual presentation. For example he assumed that the two oxides of carbon consisted of one equivalent of carbon united to one and two equivalents of oxygen. Like Wollaston, he presented his numbers as deduced from experiment and free from theoretical assumptions. Chemists were convinced that equivalents expressed the unalterable facts of chemical proportions. Reluctant to introduce theories of matter into their science, or to accept calculations of atomic weights Berzelius conceded these were based on unproved suppositions of atomic constitution and were therefore subject to revision , they felt the language of equivalents was safest. It was left for later generations of chemists to distinguish between equivalents, atoms, and molecule, and to show how atomic weights could be unambiguously determined. The instrument was reportedly sold in the bookstores of New York and Vienna. Faraday, in his practical manual, described it as a commonly used calculating device. With startling boldness he asserted that conclusive tests on the existence of atoms could be made through the observation of planets. He argued that the particles of the atmosphere of the earth were subject to the opposing forces of their mutual repulsion and gravity. If there were a limit to the divisibility of atmospheric matter, The weight of these ultimate particles would prevent further atmospheric expansion. But if matter were endlessly divisible into lighter and lighter particles, the force of repulsion would overcome gravity. Then the atmosphere of the earth would not terminate at a finite height, but would expand freely into celestial space and collect about the planets through gravitational attraction. Wollaston therefore believed that the classical problem of the divisibility of matter could be decided by a crucial test in astronomy. In May Venus was passing very close to the sun in superior conjunction.

Chapter 5 : Pure Intelligence: The Life of William Hyde Wollaston, Usselman

Wollaston was the first to detect metallic titanium in the slag of iron furnaces. He published also analyses of meteoric iron, showed that potash exists in sea water, and de vised a sliding scale of chemical equiva lents.

Article Synopsis Examination of the laboratory notebooks of W. Wollaston makes possible a complete reconstruction of his platinum researches, and valuable insights into the financial details of his platinum business, originally in partnership with Smithson Tennant, may be obtained. The leading role played by Wollaston in both the research and marketing aspects of the business is confirmed. Although the use of platinum for laboratory ware and vessels for the concentration of sulphuric acid were important applications, the gunmakers provided the greatest market for malleable platinum over the years to The business ground to a halt in when Wollaston could no longer procure supplies of crude platinum. I do not publish for the gratification of idle curiosity but to friends I make no mystery of my intentions. I am partial to Chemistry; I have here room for a laboratory, and though many have spent fortunes in such amusements more have made fortunes by the same processes differently conducted. Is it impossible to mix the utile dulci â€”if it be I have erred egregiously and may be ruined, but I have no fears at present. When I quitted the terra firma of Physic this was my sheet anchor, though not my only hope. I thought it possible that something more eligible might offer, therefore kept my own counsel till it was decided , nothing has appeared equally so, and I now hope that I am fixed for life. Over the course of the first three decades of the nineteenth century, Wollaston published nearly 60 papers, each characterised by careful, yet often highly imaginative, reasoning and rigorous attention to experimental detail. He made fundamental discoveries in physiology, optics, crystallography, electrochemistry, astronomy and botany, but his fame derives principally from his contributions to chemistry and metallurgy. Of his chemical researches, those on the platinum metals are of greatest general interest, for his isolation and characterisation of palladium and rhodium remain a highlight of early nineteenth-century analytical chemistry, and the production of pure, malleable platinum represents a milestone in the history of powder metallurgy 2. Despite the scientific achievements which placed Wollaston with Humphry Davy, Thomas Young, and John Dalton as the major figures of English science in the early nineteenth century, he has been little studied by historians of science. We now know that they passed on to his close friend Henry Warburton, who intended to publish a full biography, but was prevented from completing the task by an increasingly active political career. Late in the nineteenth century, the Wollaston papers could no longer be traced. By immense good fortune, a collection of notebooks and documents was discovered in the Department of Mineralogy and Petrology of the University of Cambridge in , and they were identified as the valuable Wollaston papers. The collection, now in the Cambridge University Library, was examined by L. Gilbert and a brief but fascinating description of the material was published 3. One pertains to the metal palladium, and three contain miscellaneous experiments on a wide range of subjects, including early research on crude platinum. In this paper I will present a brief summary of the contents of the platinum notebooks, together with some of the most interesting information which they have yielded. In fact, there are two notebooks currently in the collection which were not referred to by Warburton. Platinum Purchases Full records were maintained in the notebooks on the acquisition and sale of platinum. Crude platinum was purchased at irregular intervals from to from various suppliers. The prices ranged from a low of 2s. The prices paid by Wollaston include interest charges at 5 per cent of the purchase price, paid to the supplier from the time the order was placed until delivery. In one instance Wollaston did not receive the ordered platinum until days after the order was placed, and delays of days were the norm. This suggests that platinum was not immediately available in London, but was imported, likely from Jamaica, to which platinum smuggled out of Colombiaâ€”the major source at the timeâ€”found its way. Thus the average price of crude platinum given by Gilbert as 2s. Of the total amount purchased over the years at least 36 per cent was purchased from John Johnson, whose son, Percival Norton, was the founder of Johnson Matthey and Co Limited. It is quite possible that Johnson supplied much more than 36 per cent, for only 18 per cent of the total purchased can be definitely traced to other suppliers. There has been some debate over the reason why purchases of platinum ceased in , but it was certainly not due to lack of demand, which remained strong. Evidence in the notebooks suggests that Wollaston could no longer purchase crude platinum at a price he felt reasonable. There are notes which reveal that he sought to purchase crude platinum in the early s in Jamaica and Colombia. Taylor and Simpson of Kingston, who replied by letter on June 12, Upon enquiring amongst the Spaniards we find that this article [platinum] has never been brought to this Island, but in very small Quantities and from the Information we have yet received, we have not been able to ascertain that the Quantity can be materially increased by offering an adequate encouragement for its import 5. Presumably, the amounts brought to the island acknowledged by the Spaniards represented the legal imports, for there is much evidence that Jamaica was the source of a great deal of smuggled platinum in the early nineteenth century. On a piece of paper in one of the notebooks, Wollaston wrote: By a letter from Mr. Henderson English Consul General at Bogota in his enumeration of articles prohibited to be exported is Platina under penalty of loss of metal and also a fine of 50 dollars per pound 6. In a different notebook, Wollaston dates the prohibition as November, An entry in one of the notebooks reads: I understand from Mr. Tennant that [platinum] retorts have been made in Paris of about 30 gallon capacity and weighing about ounces at 15 shillings per ounce 8. Partnership with Smithson Tennant The account books present in the collection reveal that Wollaston formed a partnership with Tennant in , a collaboration unannounced and unsuspected at the time. The two originally agreed to share the cost of all platinum, chemicals and apparatus, and to divide the income evenly. The leading role played by the younger Wollaston is even more dramatically illustrated if the amount spent on the purchase of crude platinum is excluded. The inequity of this situation was partially rectified early in , when the two men came to a new agreement which stipulated that Wollaston was to receive some payment for platinum sold before division of the profit. From the account books there is evidence that from April 1, onwards Wollastonreceived 10 per cent of the profits before division. Although the notebooks provide much evidence for the diminishing role played by Tennant, there is little doubt that he rendered much assistance in the early years of the partnership, and it is quite possible that Wollaston might not have chosen to pursue chemistry as a career without the initial financial and intellectual support of Tennant. Many more details of the chemical partnership of these two men could be cited, but a thorough treatment is beyond the scope of this paper. Platinum Sales From the crude platinum processed over the years, a little over 38, ounces of purified, malleable metal were sold at an average price of nearly 16s. Wollaston obviously became a wealthy man through his platinum business. The ultimate success of the endeavour, however, was not foreshadowed in the early years of the partnership, for only in did yearly revenue begin to exceed expenditure, and it was not until that the entrepreneurs began to show an overall profit from the platinum operation. Information concerning the commercial market for platinum is also available in the notebooks. Nearly all the platinum was sold in ingot form by William Cary, a respected London instrument maker, who received 10 per cent of the selling price as commission. One of the notebooks records the weights of platinum delivered to Cary, and from the nature of the entries it is possible to determine the use to which the platinum was put 9. If this assumption is correct, then 27, ounces, or 70 per cent of the total weight of platinum sold, was consumed by the gunmaking industry. In retrospect, this figure should not be too surprising, for even at 17s. The remaining 3, ounces sold by Cary were put to use for crucibles, balance pans, evaporating dishes, wire and other miscellaneous items. Entries on March 4, May 4 and July 4 represent payment by Philip Sandmann for the platinum boiler purchased early in The totals reflect accumulated income from January 1, In addition to the amounts sold by Cary, Wollaston disposed of 8, ounces himself, all but ounces of which were used in the manufacture of boilers for the concentration of sulphuric acid, see Figure 2. Over the years to , sixteen boilers were fashioned and sold. The selling price was based on the weight of platinum employed, usually at 15s. For all but the first few, Wollaston had the boilers made to his specifications by local metalworkers, principally John Kepp of Chandos Street, who fabricated the last ten boilers. The larger weights were used for the construction of boilers, and the smaller for various accessories, such as siphons, etc. The amounts sold to Johnson in were for the construction of a boiler for Pepper, one of the few boilers not fabricated by Wollaston or Kepp An interesting entry in a notebook devoted primarily to boiler construction attests to the value of the platinum boilers to the manufacturers of sulphuric acid They boil off 3 times per day [oil of vitriol] and turn out 50 bottles of lb per week. Demand for boilers remained strong in the early s. The Production Process The chemical analysis of the crude platinum by Wollaston and Smithson Tennant which was carried out in the years to and resulted in the isolation and characterisation of the metals osmium, iridium, rhodium and palladium is now widely recognised as a brilliant example of early nineteenth-century analytical chemistry. It is perhaps sufficient to say that he was plagued initially by the same problems as his predecessors. After the platinum was precipitated from solution as ammonium chloroplatinate, NH3 2PtCl6, and ignited to obtain a somewhat purified spongy metal, the platinum was consolidated under pressure, and forged. The earliest ingots produced frequently cracked on hammering or blistered badly on heating, see Figure 3. Wollaston at first attributed the source of such difficulties to impurities, and refined his purification technique to minimise the inclusion of base metals and the newly discovered platinum metals in the spongy precipitate. Even with improvements in the chemistry of the process, an inconsistent product was frequently obtained. As a consequence, Wollaston directed his attention more to the metallurgical aspects of the process, and improved it to a point where a consistently malleable product was the rule. Only by about could Wollaston confidently market platinum with the mechanical properties required by the purchasers, and the business then began to prosper rapidly. The unsuitability of the product is evident from the frequent mechanical failure of the ingots during forging In general, the crude metal purchased by Wollaston contained roughly 75 per cent platinum, 16 per cent iron, 3 per cent copper, 3 per cent sand, 2 per cent osmium and iridium, and 1 per cent rhodium and palladium. The processing began and continued over the years in 16 to 30 ounce batches, and Wollaston early calculated the average cost of processing as 2s. This, coupled with the 3s. Consequently, at a selling price of 15s. Why did Wollaston and Tennant guard so carefully the secret of their partnership? Why were the details of the platinum process only published in , eight years after Wollaston had brought the business to a halt? These and other questions intrigue historians of science and I am optimistic that answers will soon be forthcoming. References 1 Letter from W. Hasted, November 16,

Chapter 6 : William Hyde Wollaston | Johnson Matthey Technology Review

The occurrence of the bicentenary of Wollaston's birth affords an opportunity to review in these pages the important scientific and technical work that he did in the field of the platinum group of metals.

See Article History William Hyde Wollaston, born August 6, , East Dereham , Norfolk , Englandâ€"died December 22, , London , British scientist who enhanced the techniques of powder metallurgy to become the first to produce and market pure, malleable platinum. He also made fundamental discoveries in many areas of science and discovered the elements palladium and rhodium Early life and education Wollaston was the seventh of 17 children born to Althea Hyde and Francis Wollaston. Theirs was a financially comfortable family, which was well positioned in British scientific and religious circles. Wollaston was raised in an intellectually vibrant household, schooled at Charterhouse School in London, and studied medicine at Caius College, Cambridge. He obtained a medical degree from Cambridge in and practiced medicine in rural England until , when he moved to London. Thus, upon receiving a large sum of money from his older brother George in , Wollaston abandoned medicine to pursue his much stronger interests in science, particularly chemistry. Platinum and new metals In Wollaston formed a cost-sharing partnership with Smithson Tennant , whom he had befriended at Cambridge, to produce and market chemical products. Although Tennant achieved only limited success in his independent endeavours, Wollaston was spectacularly successful. He set about trying to produce platinum in a pure malleable form, something that had been attempted unsuccessfully by others before him. After a few years of research, he was able to perfect a chemical process for converting inexpensive granular platinum ore smuggled out of New Granada now Colombia into platinum powder of high purity and of consolidating the powder into malleable ingots, which he sold at substantial profit over the next 20 years. The pure metal, which had properties similar to gold but sold at one-quarter the price, found many scientific and technological uses. He kept the details of his process secret, and, by purchasing all of the available platinum ore, he became wealthy as a result of being the sole supplier of pure platinum in England. He published the details of his process only at the time of his death. Careful chemical analysis of the metals that dissolved with platinum in the first step of his purification process led Wollaston to the discovery of two new metallic elements, palladium and rhodium. Tennant undertook the analysis of the less-soluble constituents of the platinum ore and discovered two other new metals, osmium and iridium. The discovery of these rare elements established the reputations of both men as gifted experimental chemists. Wollaston, especially, became famous for his ability to analyze small quantities of substances, and he was continually called upon by mineralogists to determine the chemical components of new minerals. The mineral wollastonite was named in his honour for his many contributions to crystallography and mineral analysis. Other scientific achievements Wollaston never married. Although he had a wide circle of friends, he was most contented when pursuing his scientific interests in the quiet of his own home. He had a remarkably acute and imaginative mind and made, in addition to his chemical work, significant contributions to the fields of botany , mechanics , electrochemistry , astronomy , crystallography, physiology , optics , and scientific instrumentation. He obtained a patent for a new form of spectacle lens , and he patented the camera lucida and published a book on its design In he invented the reflective goniometer, an instrument that accurately gives the angles between the faces of crystals. In he reported the inability of most humans to hear the high-pitched notes of bats and insects, and in , while investigating the possible physiological basis for his own recurring visual problems now known as hemianopia , he deduced the correct anatomical arrangement of human optic nerves. He served for many years on the Council of the Society as secretary or vice president, and he even held the presidency in between the terms of naturalist Joseph Banks and chemist Humphry Davy. Later years Wollaston closed down his platinum business in when supplies of crude platinum ore dried up. Although he continued to publish scientific papers, he spent more time traveling and visiting friends after closing his business. In Wollaston began to suffer transient periods of partial paralysis and reacted by methodically but quickly dictating the last of his scientific papers, selecting mementos for his closest friends, and distributing his wealth among his many brothers and sisters. An autopsy revealed that he died of a brain tumour, which he had earlier suspected as the cause of his declining health.

Chapter 7 : William Hyde Wollaston | British scientist | calendrierdelascience.com

[] JOURNAL OF THE HISTORY OF PHILOSOPHY ~ OCT t of which the agent makes a declaration, and in his book Wollaston provides some thirty-odd examples of actions he considers declarative. 3 One of his dearer cases is the breaking of a promise: if I promise to do X and then ignore my vow, I act as if I had never promised to do X, and.

Chapter 8 : William Hyde Wollaston | calendrierdelascience.com

William Hyde Wollaston PRS FRS (/ Ëˆ w ÊŠ l É™ s t É™n /; 6 August - 22 December) was an English chemist and physicist who is famous for discovering the chemical elements palladium and rhodium.

Chapter 9 : Project MUSE - The Problem of Circularity in Wollaston's Moral Philosophy

Senescence is a complex, highly regulated, developmental phase in the life of a leaf that results in the co-ordinated degradation of macromolecules and the subsequent mobilization of components to other parts of the plant. The application of molecular biology techniques to the study of leaf.