The First Experiments on Platinum

WILLIAM BROWNRIGG AND HIS SCIENTIFIC WORK

By J. Russell-Wood, M.Sc., Ph.D.

> Upon the whole, this Semi metal ſeems a very ſingular Body, that merits an exacter Inquiry into its Nature than hath hitherto been made; ſince it is not altogether improbable, that, like the Magnet, Iron, Antimony, Mercury, and other metallic Subſtances, it may be endowed with ſome peculiar Qualities, that may render it of ſingular Uſe and Importance to Mankind.

The history of the discovery of platinum in the Spanish American colony of New Granada has been well told by McDonald in recent issues of this journal. The first published reference to the existence of this new metal was in 1748, when there appeared in Madrid Don Antonio de Ulloa's account of his voyage and explorations, but the interest of the scientific world was not aroused until specimens of platinum in its native state had arrived in Europe and had been submitted to examination by qualified persons able to report their findings adequately.

The first such experimental work forms the basis for this story, linking a quiet, shy country doctor living in Cumberland and giving his spare time to scientific researches, his sister's husband employed as an assay master in Jamaica, and the distinguished London scientist Sir William Watson.

William Brownrigg, the central figure of this narrative, spent practically the whole of his working life in Cumberland. The genealogy of the family starts with Gawen Brownrigg, who lived in the time of Henry VII at the head of Lake Derwentwater. His two great-great-grandsons were William, born at High Close Hall on March 24th, 1711, and his brother George, who later emigrated to America. There was also a sister, Jemima, who later married Charles Wood, the assay master whose part in the story will be told later.

Little is known about the early education of Brownrigg. He appears to have been apprenticed to a surgeon in Whitehaven and to have studied in London from 1733 to 1735. Later, he went to Leyden to study "physic", anatomy, botany and experimental philosophy, and he graduated in 1737 as Doctor of Medicine on presentation of a thesis entitled "De Praxis Medica Ineunda" in which he discussed the state of the air, climate, and various other contingencies affecting the locality where a physician proposed to reside.

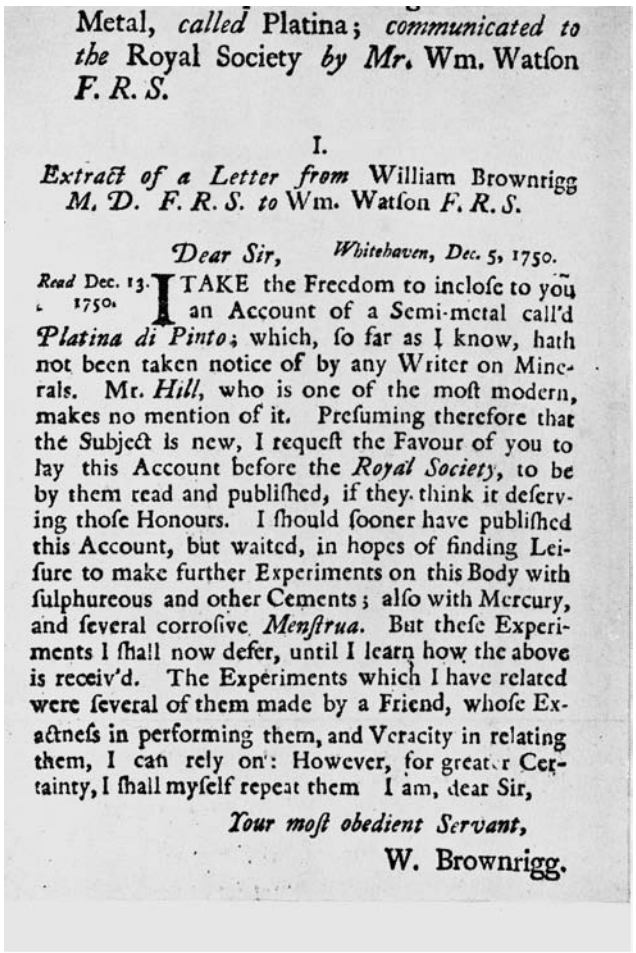
Brownrigg settled in Whitehaven as a physician in 1737. He kept an extremely neat and painstaking case-book, which is now in the library of Tullie House, Carlisle. On August 3rd, 1741, he married Mary, the daughter of John Spedding of Whitehaven.

In 1742 he was elected a Fellow of the Royal Society, subsequent to the reading of his paper on the mineral exhalations from the poisonous lakes at Avernie, which paper had induced Sir Hans Sloane and Dr Stephen Hales to advise Brownrigg to prepare a general history of "damps". In 1766 Brownrigg was awarded the Copley medal, the highest award of the Royal Society, for his

experimental work on the waters of Spa, in Germany, as being the best original publication of the year. He showed that these waters owed their sharp taste to the presence of carbon dioxide, hence the possibility of making such waters artificially. This work gave Brownrigg an acknowledged name in science.

Eighteenth-Century Chemistry

During the period of Brownrigg's life, a closer association developed between "pure" and "applied" science. Great advances were made in pneumatic chemistry by Priestley on oxygen, sulphur dioxide and other gases, by Cavendish on hydrogen and by Black on carbon dioxide. It was, indeed, Priestley's work on "dephlogisticated air" that led to the overthrow of the phlogiston theory of combustion by Lavoisier and the introduction of the oxygen theory, although Priestley himself was a confirmed phlogistonist right up to his death. But all the different gases known were considered as ordinary air contaminated with impurities, and the very word "gas", which had been used earlier by Van Helmont, was avoided by English chemists. A new method of distillation had been introduced by Hales which consisted in blowing air through the heated liquid undergoing distillation. Woulfe (of Woulfe bottle fame) distilled substances such as common salt and sulphuric acid and absorbed the volatile product in water. Much work was done on natural waters, primarily to



Metal, *called* Platina; *communicated to the* Royal Society *by Mr.* Wm. Watſon *F. R. S.*

I.

Extract of a Letter from William Brownrigg *M. D. F. R. S. to* Wm. Watſon *F. R. S.*

Dear Sir, *Whitehaven, Dec.* 5, 1750.

Read Dec. 13. 1750. I TAKE the Freedom to incloſe to you an Account of a Semi-metal call'd *Platina di Pinto*; which, ſo far as I know, hath not been taken notice of by any Writer on Minerals. Mr. *Hill*, who is one of the moſt modern, makes no mention of it. Preſuming therefore that the Subject is new, I requeſt the Favour of you to lay this Account before the *Royal Society*, to be by them read and publiſhed, if they think it deſerving thoſe Honours. I ſhould ſooner have publiſhed this Account, but waited, in hopes of finding Leiſure to make further Experiments on this Body with ſulphureous and other Cements; alſo with Mercury, and ſeveral corroſive *Menſtrua*. But theſe Experiments I ſhall now defer, until I learn how the above is receiv'd. The Experiments which I have related were ſeveral of them made by a Friend, whoſe Exactneſs in performing them, and Veracity in relating them, I can rely on: However, for greater Certainty, I ſhall myſelf repeat them I am, dear Sir,

Your moſt obedient Servant,

W. Brownrigg.

Born in Cumberland two hundred and fifty years ago, William Brownrigg combined a distinguished scientific career with a modest and retiring nature. Among his numerous contributions to eighteenth-century chemistry were the first experiments to be carried out on the properties of platinum, reported to the Royal Society in 1750 by his friend Sir William Watson. The covering letter from Brownrigg, published in the Philosophical Transactions of the Royal Society, is reproduced here

find an explanation of their medicinal properties.

The eighteenth century was a quiet time, atomically, after the fervour of the corpuscular theory. Emphasis was still laid on the shape and size of atoms, but a new concept of forces being lodged in atoms was adopted. There was little to be found in the applied chemistry of the seventeenth century that did not have its origins in early Egyptian civilisations, although techniques may have improved. But in the first half of the eighteenth century great advances were made in this direction; for instance, Le Blanc originated the soda industry and Brownrigg himself put forward suggestions for making cheaper and better salt, partly to help the British fishing industry, which had been hard hit by the War of the Austrian Succession, and partly to improve the health of the nation.

The quantitative aspect of chemistry was being realised. Lavoisier, in his work on the fermentation of sugar solutions, insisted that a chemical reaction could be postulated as an algebraic equation, a clear assertion that the Law of Conservation of Mass applied to a chemical reaction. Improvements were made in the collection of gases; Brownrigg himself introduced a method of collecting gases by fixing a squeezed bladder to the neck of a flask containing substances which would generate the gas. The teaching of chemistry began to acquire more importance, freeing itself from superstition and ceasing to be a mere appendage to medical teaching. Against such a background of knowledge Brownrigg did his work.

The Samples of Platina

In 1741 Charles Wood, in the course of his duties as assay master, acquired some samples of "platina" which he was told came from Cartagena, the port of New Granada. They consisted of a mixture of native platinum with black sand and other impurities as found in the mines, some native platinum separated from these impurities, some that had been fused, and another piece that formed part of the pommel of a sword. These he brought home to England and gave to his brother-in-law, Brownrigg. It was not until nine years later—December 5th, 1750—that Brownrigg passed these specimens on to the Royal Society, together with his historic letter, through the good offices of his friend William Watson. The first page of his covering letter to Watson is reproduced on the previous page.

Apparently it was Charles Wood, described by his brother-in-law as "a skilful and inquisitive metallurgist", who, at Brownrigg's instigation, carried out certain of the experiments, but Brownrigg himself conducted some of the earlier tests, while he also repeated Wood's experiments a little later, giving an account of them in a further letter to the Royal Society dated February 13th, 1751.

In the first letter Brownrigg described how he had come into possession of the samples of platinum and went on: "It is found in considerable quantities in the Spanish West Indies (in what part I could not learn) and is there known by the name of Platina di Pinto. The Spaniards probably call it Platina from the resemblance in colour that it bears to silver. It is bright and shining, and of a uniform texture; it takes a fine polish, and is not subject to tarnish or rust; it is extremely hard and compact; but, like bath-metal or cast iron, brittle, and cannot be extended under the hammer."

Brownrigg then went on to describe how he kept platinum in an air furnace for two hours "in a heat that would run down cast iron in fifteen minutes" but it did not melt, nor did any melting take place if it were mixed with borax and heated under the same conditions. Brownrigg found that when platinum was heated with lead, silver, gold, copper or tin it readily formed a molten alloy which gave a hard and brittle solid on cooling; he found neither a change in weight nor any corrosion when the platinum was heated with aqua regia for twelve hours.

"It appears," he concluded, "that no known body approaches nearer to the nature of gold,

in its most essential properties of fixedness and solidity, than the semi-metal here treated of; and that it also bears a great resemblance to gold in other particulars. Some alchemists have thought that gold differed from other metals in nothing so much as in its specific gravity; and that, if they could obtain a body that had the specific weight of gold, they could easily give it all the other qualities of that metal. Let them try their art on this body; which, if it can be made as ductile as gold, will not easily be distinguished from gold itself."

Experiments on Cupellation

In the second letter Brownrigg gave an account of an experiment he made to show that platinum did not resist the action of lead in cupellation, as he had hitherto thought. This led to a possibility of refining gold and silver containing platinum. He wrote: "By adding to gr. xxvi of platina fifteen times its own weight of pure lead, that I had myself reduced from lithage. To the lead put into a coppel, and placed in a proper furnace, as soon as it was melted I added the platina, which in a short time was dissolved in the lead. After the lead was all wrought off, there remained at the bottom of the coppel a pellet of platina, which I found to weigh only gr. xxi; so that in this operation, the platina had lost near a fifth part of its weight." Charles Wood had found, earlier, that the platinum had gained weight during the cupellation. Brownrigg says that "one Mr Ord, formerly a factor in the South Sea Company, took, in payment from some Spaniards, gold to the value of £500 sterling, which, being mixed with platina, was so brittle that he could not dispose of it, neither could he get it refined in London, so that it was quite useless to him; although, if no error hath been committed in the above-mentioned experiment, it might probably have been rendered pure by a much larger dose of lead than is usually applied for that purpose."

Brownrigg was an extremely humane and Christian gentleman. He made inquiries into fire-damp hoping that they might help to solve the diseases to which miners were subject. His invention of better and cheaper methods of making salt, referred to above, gave to England the great boon of having this commodity freed from all tax before the end of the first quarter of the nineteenth century. He was a founder member of the Whitehaven dispensary, in 1783, the purpose of which was "to alleviate the exquisite sufferings of disease, obviate its malignant tendency . . . and interrupt its powerful communication".

Brownrigg died on January 6th, 1800, and was buried at Crosthwaite Church, near Keswick. The *Cumberland Pacquet* of January 14th referred to him in a memorial notice as "this venerable philosopher and physician . . . possessed of every excellent quality which could adorn the great and good".

In an obituary notice in *The Gentleman's Magazine* reference is made to the President of the Royal Society's remarks when presenting a gold medal to Priestley for his researches on the nature of air: "It is no disparagement to the learned Dr Priestley that the vein of these discoveries was hit upon . . . some years ago by my very learned, very penetrating, very industrious, but too modest friend Dr Brownrigg."

The Importance of Brownrigg's Work

While Brownrigg's actual contribution to our knowledge of the properties of platinum was not perhaps of major importance, he none the less played a vital part, in that the publication of his findings in the *Philosophical Transactions* of the Royal Society brought them to the notice of scientists throughout England and Europe. They thus led swiftly on to the many other investigations, such as those carried out by Scheffer, Lewis, Marggraf, Buffon, Achard, and later by Knight and Wollaston, that firmly established the nature and characteristics of platinum. Possibly Brownrigg's most significant comment was that reproduced at the head of this article.