Wollaston's Platinum Thermometer

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The achievements of William Hyde Wollaston are well documented in the literature concerning the platinum metals and their early utilisation in science and industry. He it was who first showed the way to produce malleable platinum on a commercial scale – incidentally the first successful example of powder metallurgy – and he was the discoverer of two new elements in native platinum which he named palladium and rhodium (1, 2).

Fortunately he left a considerable quantity of notebooks and memoranda recording both his experiments and his financial transactions, most of these still preserved in the care of the University of Cambridge and others in the Science Museum, and it was in the course of examining his miscellaneous income and expenditure accounts that the writer came across an entry of particular interest. This records a payment to one Malacrida of the sum of 19*s* for two platinum thermometers (3).

It appears that one of these two thermometers was intended for the use of Wollaston's scientific and financial partner Smithson Tennant, the discoverer of iridium and osmium, for among the miscellaneous Wollaston papers preserved at Cambridge there exists a loose sheet of paper on which is written "Platina Thermometer, for Mr Tennant". The other was presumably employed by Wollaston himself.

So far as the writer is aware no reference has been made in the literature to such a thermometer, nor has any description of it been given. There is some reason to suppose, however, that it was of the bimetallic type, with platinum as one of the compound metals and that it was a forerunner of the many kinds of thermostatic elements that are now so widely employed.

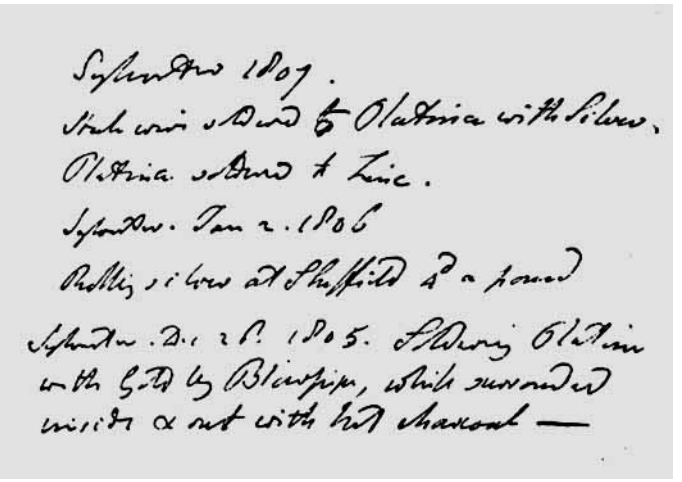
William Hyde Wollaston

From a sketch made with the camera lucida by Sir Francis Chantrey

In his paper to the Royal Society, in 1805, "On the Discovery of Palladium" (4), Wollaston described his use of the bimetallic principle to obtain a rough idea of the linear coefficient of expansion of palladium:

> I rivetted together two thin plates of platina and of palladium; and observing that the compound plate, when heated, became concave on the side of the platina, I ascertained that the expansion of palladium is in some degree the greater of the two. By a similar mode of comparison I found that palladium expands considerably less than steel by heat; so that if the expansion of platina between the temperatures of freezing and boiling water be estimated at 9 parts in 10,000, while that of steel is known to be about 12, the expansion of palladium will probably not be much more or less than 10, or one part in 1,000 by the same difference in temperature.

It is clear that this particular experiment of Wollaston's was not designed for measuring temperature, and the riveted device should in



An extract from one of Wollaston's notebooks. This includes references to one Sylvester of Sheffield soldering steel wire to platinum and platinum to zinc, and (in the lower part) to his soldering of platinum with gold by blowpipe while the metal was surrounded with hot charcoal

no sense be regarded as a bimetallic thermometer. But from a short account given by Andrew Ure in 1821 in his Dictionary of Chemistry (5) we learn that in 1809 Wollaston had shown him

> 'a slip of copper coated with platinum, which exhibited by its curvature, over flame, or the vapour of water, the expanding influence of heat, in a striking manner'.

It seems unlikely that Ure would have used the word "coated" to describe a bimetal formed by riveting, and it is interesting to speculate on the precise method of attaching the two metals.

Now among some of Wollaston's notebooks covering the period 1807 to 1809 there are references to a Sylvester of Sheffield, almost certainly one Charles Sylvester, who has been described as formerly a plated wire worker and as becoming an eminent practical chemist. The notebooks record Wollaston as supplying Sylvester with 28 oz. 9 dwt. of platinum in December 1805, and in the same month, the fact that Sylvester was soldering platinum with gold, using a blowpipe. In 1807 Sylvester also apparently soldered platinum to zinc and bonded together steel wire and platinum, using silver as his joining medium. One of the notebooks also records, in March 1807, Sylvester's plating with platinum, and it seems further that he had succeeded in rolling copper plated with platinum on one side until the bimetal was about 0.1 inch in thickness. The Wollaston material also contains a scrap of paper on which is listed the following sequence of operations:

> *'1 Platina well anneald 2 Metal flatted & then anneald 3 Clean filed 4 Well tinned 5 Platina tinned 6 Metal hot enough to melt the solder 7 Platina rolled on'.*

The handwriting is not that of Wollaston. Could this be Sylvester's recipe for coating a metal with platinum? And was it perhaps the method adopted for making a bimetallic strip for a platinum thermometer?

The problem remains unsolved, and the writer has been unable to trace the identity of Malacrida or the nature of his connection with the platinum thermometers.

References

1 Donald McDonald, "The History of Platinum", London, Johnson Matthey & Co Limited, 1960

2 L. F. Gilbert, "W. H. Wollaston MSS. at Cambridge", *Notes and Records, Royal Society*, 1952, **9**, 311

3 J. A. Chaldecott, *Annals of Science*, 1971, **27**, 409. This gives a more fully documented account of the entries in the Wollaston material, and forms the basis of the present article

4 W. H. Wollaston, "On the Discovery of Palladium", *Phil. Trans.*, 1805, **95**, 316

5 Andrew Ure, "A Dictionary of Chemistry", London, 1st edition, 1821, article on "Thermometer"