



## Book review: *Antimony, Gold and Jupiter's Wolf*

David Rickard

School of Earth and Ocean Sciences, Cardiff University, Cardiff, UK

**Correspondence:** David Rickard (rickard@cardiff.ac.uk)

Published: 23 January 2020

Wothers, P.: *Antimony, Gold and Jupiter's Wolf*, Oxford University Press, 273 pp., ISBN 9780199652723, GBP 20.00, 2019.

Dr. Peter Wothers MBE is a teaching fellow in the Department of Chemistry, University of Cambridge and a well-known chemistry educator. He is the author of a number of books including the textbook *Organic Chemistry* (Clayden et al., 2001) and the popular science books *Chemical Structure and Reactivity* (Keeler and Wothers, 2008) and *Why Chemical Reactions Happen* (Keeler and Wothers, 2003). All his books, like the present one, are published by Oxford University Press (OUP). He completed his PhD in chemistry at St Catherine's in 1996 having joined the college as an undergraduate in 1988. He is Keeper of College Silver and has amassed a collection of early works on the history of chemistry. He has used these together with the remarkable collection at the University of Cambridge to illustrate and enliven the present text.

The interface with mineralogists naturally occurs because the elements were originally mainly obtained from minerals. The early chemists could not order elements off the internet but had to make them themselves. And indeed, right up to Curie's discoveries, the elements were mainly found by investigations of the composition of minerals. This is a necessary weakness of the book. Wothers is a chemist and, as remarked by Berzelius (1815), "It thereby follows that one can surmise that the chemist's and the mineralogist's views of the same object not only CAN but MUST be different."<sup>1</sup>

I do not know who dreamed up the title of the book. It appears to have developed from the OUP public relations department since it refers to just antimony and gold – which I suppose may be catchy for the general public – and "Jupiter's Wolf" which was a poetic term for wolfram briefly used by Henckel in 1747. In other words the title has little to do with

the book contents and indeed, may do it a disservice, since the whole point of the work is to describe where the names of the elements come from (Preface p. vii). But then again, the OUP publicists are experts at their job and I know little about book selling.

The book consists of 273 pages divided into nine chapters. It is splendidly produced by OUP in trade Octavo and printed on uncoated paper by Clays of St Ives, now owned by the Italian firm Elcograf. The 48 illustrations are mainly line drawings and halftones and the general presentation is at the high standard expected from OUP and Clays. The hardcover volume is priced at GBP 20 and USD 25.95. Amazon is selling it already at GBP 10.63, with a Kindle edition at GBP 11.98 even though the publication date is 29 November 2019.

The book is not primarily concerned with the etymology of the element names and, indeed, etymological discussions are patchy. So, when Wothers states that his purpose is to describe where the names of the elements come from, he refers specifically to how they were discovered. In fact, the reader interested in where the names of the elements come from is best served by Peter van der Krogt's remarkable website *Elementymology & Elements Multidict* (<https://elements.vanderkrogt.net/index.php>, last access: 14 January 2020), which covers far more ground internationally and linguistically than Wothers' book – which is essentially focused on west-European chemistry. Likewise the account of the discovery of the elements does not surpass Mary Elvira Weeks' classical account, which is now freely available at [https://archive.org/stream/discoveryoftheel002045mbp/discoveryoftheel002045mbp\\_djvu.txt](https://archive.org/stream/discoveryoftheel002045mbp/discoveryoftheel002045mbp_djvu.txt) (last access: 14 January 2020).

Chapter 1 "Heavenly Bodies" (31 pp.) examines the original seven metallic elements and discusses their astronomical relationships. Wothers states (p. 1)

We can't properly understand why some of the more recent elements were named as they were

<sup>1</sup>"Häri från härleder det sig, att man kan föreställa sig, att kemistens och den egenliga mineralogens åsikter av samma föremål ej endast KUNNA utan MÅSTE vara olika."

without first understanding these earlier historical connections.

Some etymology might have been useful here. For example, gold comes from the proto-Indo-European *ghel-* meaning yellow-bright, like the Sun. Alchemists indeed used a circle (p. 7) as a symbol for gold – but Wothers misses the central dot and its meaning. Iron comes from Anglo-Saxon *isern* (Proto-Germanic *isarnan*) meaning strong metal. Some reference to the effect of the introduction of iron weapons might help explain why iron was associated with Mars, the god of war. Chapter 2 “Goblins and Demons” (27 pp.) considers the next swathe of metallic and submetallic elements to be discovered, including Sb, As, Bi, Co, and Ni. In this and the following chapters, the etymology is more detailed. Chapter 3 “Fire and Brimstone” (23 pp.) discusses sulfur and phosphorus. Chapter 4 “H Two O to O Two H” (41 pp.) is an exhaustive account of the discovery of the gases in air and the composition of water. It covers the discovery of hydrogen and oxygen and includes a sympathetic account of the phlogiston and caloric theories. The esoteric title of the chapter reflects Lavoisier’s fundamental mistake in naming hydrogen and oxygen: Wothers points out that, in reality, they have exactly the opposite attributes to those which the etymology of their appellations suggests. Chapter 5 “Of Ashes and Alkalis” (31 pp.) discusses the discoveries of the alkali metals and, in passing, the development of the modern chemical symbols. Again the chapter is very Eurocentric and, although alkali itself is a direct Arabic loan word, all the descriptions and illustrations are European and there are no references to the original works of the great Arab chemists of the Middle Ages, such as Muhammad ibn Zakariya al-Razi (Latinized as Rhazes), who had such an enormous effect on the progress of early European chemistry. In chapter 6 “Loadstones and Earths” (28 pp.) Wothers considers the origins of the alkaline earth metals as well as magnetism and manganese, tungsten, graphite, and aluminium. I might take exception to the Swedish *tungsten* being represented consistently as *tungste* (pp. 171 and 173) since *tung* means heavy and *sten* means stone (whereas *ste* means nothing) and perhaps Berzelius being introduced as “the last of a long list of Swedish chemists” (p. 157), but these are minor quibbles. The chapter is an interesting hotchpotch, as suggested in the title, and it is difficult for the reader to follow a common theme. Chapter 7 “The Salt Makers” (15 pp.) is a short chapter dealing with the halogens but ending with 17 lines on Mendeleev’s periodic table (together with a two-thirds-page facsimile of the original, courtesy of the Master and Fellows of St Catherine’s). It is not entirely clear why HCl gas was called “marine acid air” by Priestley which led to the term *muratic acid*. I learned that nitric, sulfuric, and hydrochloric acids are called mineral acids because they can all be obtained by heating combinations of minerals (p. 180). As usual the discussion is limited to western European – particularly English and French – contributions. Chapter 8 “From Under the

Nose” (29 pp.) looks at “the final group of the periodic table”. However, the periodic table and its groups have nowhere been introduced previously, except in the short reference to Mendeleev noted above. The chapters do not seem to consider the elements in terms of their groups, although it may be at least partly implicit. As usual in this gallimaufry, the chapter briefly mentions the rare earth elements on its way to discussing in some detail the isolation and identification of the noble gases. Wothers mentions the mineral “cleveite” (p. 227) in the context of the discovery of terrestrial helium, without noting that it is an impure form of uraninite. The final chapter “Unstable Endings” is just four pages long and very briefly considers uranium, thorium, and radium before even more briefly mentioning the transuranic and superheavy elements.

The book ends with 10 pages of endnotes which simply briefly list the author, date, and page referred to. This is followed by a 12-page bibliography with somewhat over a hundred references detailed, and a short, but wholly inadequate, index.

I am unsure who the book is aimed at. It is presented as a trade book, that is a book for the general public. But the level of presentation is extremely variable – sometimes it is suitable for school children otherwise it is quite advanced. I did not find it a good read – the swathes of cited text interrupt the flow. It is a book to dip into during quiet moments. The book is very Eurocentric: the first Far Eastern reference appears on p. 123 and even then this refers to a Japanese translation of a European textbook in 1837. Needham’s monumental work *Science and Civilization in China* is first mentioned on p. 133 and then only with respect to saltpetre and gunpowder. The great Arab chemists are, as mentioned above, largely ignored.

So what about the mineralogists, to whom this review is primarily addressed? Berzelius’ quotation about the differences between chemists and mineralogists is particularly apposite here. On the other hand, as an update to Weeks’ classic, it has some interesting anecdotes. I guess, if it were in your library you might dip into it while waiting for your tutees to arrive. But I doubt if you would suggest it for your students.

## References

- Berzelius, J. J.: *Afhandlingar I Fysik, Kemi och Mineralogi*, No. IV, 1815.
- Clayden, J., Greeves, N., Warren, S., and Wothers, P.: *Organic Chemistry*, 1st Edn., Oxford University Press, USA, 2000.
- Keeler, J. and Wothers, P.: *Why Chemical Reactions Happen*, Oxford University Press, 2003.
- Keeler, J. and Wothers, P.: *Chemical Structure and Reactivity: An Integrated Approach*, 2nd Edn., Oxford University Press, 2013.