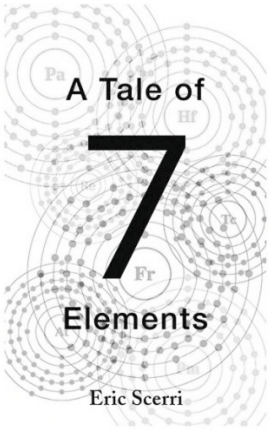
Book Review

A Tale of 7 Elements by Eric Scerri



That a mere seven elements from the periodic table are selected for this book is an immediate attraction to open its covers to find out more.[1] In fact, the focus of the book is on the discovery of the seven elements in the periodic table which fill the gaps in Mendeleev's original periodic table. But Eric Scerri wants to do more than this for his reader; he sets the scene in the Introduction by addressing the central issue of how the discovery of a chemical element should be defined, and the criteria by which priority of the discovery should be determined, showing that the latter is a good deal more fraught than might initially be imagined. The significance of the Introduction only becomes apparent later in the book.

Interesting though the two chapters that follow are – on the development of periodic table and its 'invasion' by physics, respectively – they do distract from the flow of the book. To be fair, Scerri notes that these chapters are effectively condensations of his earlier works,[2] and indicates that the reader might wish to skip to Chapter 3.

That said, the most significant section of these first two chapters for the development of this book is the 1½ pages devoted to Henry Moseley's work. His 1913 paper recognised the importance of atomic number rather than atomic weight in assigning the position of elements in the periodic table,[3] and is an important precursor for the ultimate discovery of the seven chemical elements with which the book is concerned.

Following some discussion about the merits of several orders of presentation, the seven elements are presented in the order of their discovery, as shown in Table 1.

As each story unfolds, Scerri successfully incorporates information on the relevant experimental techniques needed or developed to enable the discovery and the impediments to progress brought about by war, international pride, and personal circumstances: providing a delightful if complex mix of technological development and sociological issues.

The co-discoverers of protactinium, Lise Meitner and Otto Hahn, for example, were respectively a physicist and a chemist who initially worked together, but became separated in their endeavours, firstly by the demands of the First World War, and then by the anti-Jewish sentiments of the inter-war period. Although Meitner and Hahn are recognised as co-discoverers in the text of this book, it was Hahn alone who received the Nobel Prize. For some elements, the controversy of priority of discovery continues to this day, albeit in somewhat muted form. The discovery of hafnium by Dutchman Dirk Coster and Hungarian György Hevesy was contested by the French researchers Georges Urbain and Alexandre Dauvillier, the scientific claims being complicated by feelings of partisanship in the interwar years. Much more recently the implications of the involvement of Niels Bohr and Fritz Paneth in prompting the direction of the research undertaken by Coster and Hevesy has come under renewed scrutiny by Scerri and others.

The discovery of rhenium (element 75) by Walter and Ida Naddock is portrayed as less controversial than the other elements.[4] Over many years the claim of the one other serious contender for priority, Masataka Ogawa's 'nipponium', has been persistently reconsidered, but consistently dismissed. This narrative of this particular chapter is complicated by the Naddocks' involvement in the hunt for Element 43 – technetium – a quest in which they were not successful. The chapter on technetium is the longest in the book. This is not only because the earliest claim for discovering Element 43 dates back to 1823, and was followed by several unsubstantiated claims from around

Table 1.

Chapter	Three	Four	Five	Six	Seven	Eight	Nine
Element	Protactinium	Hafnium	Rhenium	Technetium	Francium	Astatine	Promethium
Symbol	Pa	Hf	Re	Tc	Fr	At	Pm
Atomic no.	91	72	75	43	87	85	61
Earliest claim	1899	1911	1909	1827	1925	1931	1927
Discovery year*	1917	1923	1925	1937	1939	1940	1945
Senior Discoverer*	Meitner†	Hevesy†	Ida and Walter Noddack	Segrè†	Perey†	Segrè	Marinsky
Co-discoverer	Hahn†	Coster	Berg	Perrier		Corson† MacKenzie	Glendenin
Pages (% of text)	27 pp. 13%	17 pp. 8%	17 pp. 8%	29 pp. 14 %	22 pp 11%	11 pp. 5%	21 pp. 10%

*From *A Tale of 7 Elements*, figure 0.1, p. xvi
†Photographs included in *A Tale…*, some of which are portraits on postage stamps, evidence of the nationalism that has accompanied the discovery of these elements.

the world, but because the story details a protracted controversy related to Noddack, Tacke and Bern's discovery of the element they called 'masurium'. Regardless of the science, their naming an element after a disastrous battle won by the Germans against the Russians, when scientists of both countries were vying for prominence in the discovery of the elements was both provocative and unhelpful. Ultimately, the Italian Emilio Segrè discovered element 43, 'mining' it from a cyclotron. As the first artificially produced element, this raised a further issue about the validity of the claim, which Scerri discusses in some detail.

By comparison, the story of the discovery of francium appears rather more straightforward, complicated only by Fred Allison's alleged discovery of element 87 (and also element 85) based on an ultimately refuted approach using a development of the Faraday effect first noted in 1845. Scerri observes that Allison's approach and other spectroscopy-based attempts were unlikely to succeed in discovering elements beyond bismuth (atomic number 83) because these elements were radioactive, i.e., "any researcher hoping to discover element 87 had to be working in the field of radiochemistry if they stood any chance of being successful" (p. 154). Allison and Segrè feature again in the chapter on astatine, being unsuccessful and successful, respectively; and, as with the other elements, "the various claims for its discovery reveal many nationalistic traits" (p. 165). Scerri appropriately acknowledges the contribution to this particular chapter from recent work by Brett Thornton and Shawn Burdette, who he describes as "two young chemists".[5] International controversy, albeit less connected with post-First-World-War sentiments than for some of the other seven elements, swirled around the discovery of promethium – the element of the book's penultimate chapter. For this element, claims based on relationships of chemical properties (Bohuslav Brauner, from Bohemia) and X-ray spectra (Luigi Rolla and Lorenzo Fernandes, from Italy; Charles James, from Britain; Smith Hopkins, from the United States) ultimately foundered in the face of the conclusions drawn by Jacob Marinsky[6] and Lawrence Glendenin from analysis of fission products using ion-exchange chromatography.

Each chapter concludes with at least one section on the properties and applications of the element. While the chemistry of and uses for these lesser known elements are interesting in their own right, these sections tend to distract from the theme of the book, and add little to its overall narrative.

Surprisingly, the book does not attempt to weave the commonalities and differences of the individual stories into a concluding chapter. Such a chapter could have picked up on the themes of the Introduction; it could have explored the effects of interwar and postwar nationalism or perhaps the delaying influence of outdated or inappropriate investigative techniques. Instead, Scerri uses his last chapter, 'From Missing Elements to Synthetic Elements' to traverse new ground. Even this chapter does not really reach a conclusion; thus, at page 208 the narrative just stops.

The text is supported by notes which cite additional research material and provide further anecdotes about the discovery process; and by a bibliography, which includes many primary sources, but not necessarily the papers written by the discoverers, as well as secondary sources that generally provide more recent comment and perspectives.

A Tale of 7 Elements will be an enjoyable read for those with a chemistry background, but those who supervise research in other disciplines may also find it insightful. This book reminds us all that real research does not neatly fit into a narrowly prescribed linear model, that its progress is constrained by technological and sociological factors, but is no less worthwhile for that. For at least the non-chemist audience, it would have been helpful for the periodic tables that head each chapter to also show atomic numbers, especially as in the text elements are frequently identified by atomic number, as is appropriate for the time before the name of the particular element was formally accepted.

In concluding this review, I can do no better than note Oliver Sacks' comment in the Preface to *A Tale…* that Scerri "allows us to see chemistry, and science generally, as an essentially historical enterprise – a human adventure that shows the best, and sometimes the worst, of human nature" (p. x), and agree that the book has succeeded in doing exactly that.

References

1. Scerri, E. *A Tale of 7 Elements*, Oxford University Press: New York, 2013.
2. Scerri, E. *The Periodic Table, Its Story and Its Significance*, Oxford University Press: New York, 2007; Scerri, E. *A Very Short Introduction to the Periodic Table*, Oxford University Press: Oxford, 2011.
3. Moseley, H.G.J. *Nature* **1913**, *92*, 544. *A Tale…* does not include a photograph of Moseley, but one is available at: http://en.wikipedia.org/wiki/Henry_Moseley.
4. *A Tale…* does not include photographs of the senior discoverers of this element, but a photograph of Ida Naddock is available at: http://en.wikipedia.org/wiki/Ida_Noddack.
5. Thornton, B.F.; Burdette, S.C. *Bull. for the Hist. of Chem.* **2010**, *35*, 86-96.
6. *A Tale…* does not include a photograph of Marinsky, but one is available at: http://en.wikipedia.org/wiki/Jacob_A._Marinsky.

Peter Hodder

Victoria Business School
Victoria University of Wellington
and
HodderBalog Social and Scientific Research
Wellington