

## Book Review

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**Elements and their compounds in the environment: occurrence, analysis and biological relevance (three-volume set, 2nd, completely revised and enlarged edition)**

Wiley-VCH, 2004,  
1773 pp; price £355.  
ISBN 3-527-30459-2 (hardcover)

The title of this three-volume, six-part, 1773 page publication is so all-embracing that it sounds like a complete description of the physical world as far we know it is being attempted. Although the subtitle 'Occurrence, Analysis and Biological Relevance' provides some limits, it is a tribute to the industry of the editors that these volumes go a long way towards achieving the goals implied by the title and subtitle.

Advertising material for this book claims that experts from 15 countries have pooled their knowledge in its compilation. My count makes 20 countries represented, but with 38 of the 83 contributors from Germany. The compartmentalization of some areas of science by language is still a matter that requires some vigilance, and it is to the great credit of the editors and the majority of contributors that it does not appear to be a problem with this work; the studies cited are, with few exceptions, not greatly biased towards German-language primary publications.

Volume 1, Part 1 covers the distribution of the elements in the environment; Part 2 details the effects of the elements considered together, rather than individually, in the food chain and on human health; Part 3 covers most metals and their compounds and Part 4 most non-metals. The 'Particular Aspects' discussed in Part 5 include a compilation of standards and regulations regarding metals and their compounds in environmental materials, drinking water, food, etc., and Part 6 gives a small amount of additional information, including a useful glossary.

Each chapter dealing with the individual elements provides, at the very least, sections on physical and chemical properties, analytical methods, sources to the environment, distribution in the environment, in food and in living organisms, uptake, absorption, transport, metabolism, and health effects, including possible genotoxicity and carcinogenicity.

It is interesting that Part 4 includes nitrogen and phosphorus, but excludes carbon, oxygen and hydrogen. The latter two might be thought to be adequately covered by the other elements that combine with them. And water is perhaps more of an environmental compartment than a component of the environment. However, nitrogen and phosphorus provide examples of what must have presented real problems for the editors. Chapters on such major components of the biosphere and their compounds can only be dealt with in such a work in a very limited way. For nitrogen, for example, you can give methods of elemental analysis and you can make general statements such as '... an average person contains 1.5 kg nitrogen. ...', but you cannot hope to deal with the analysis and occurrence of all the important compounds of nitrogen that contribute to the structure and metabolism of living organisms. That would take many more volumes. The consequence of this is that the chapter on nitrogen is short (8 pages), as is that on phosphorus (11 pages), whereas the chapter on arsenic covers some 33 pages. This is because the environmental chemistry of arsenic can be rather adequately summarized in a chapter of that length and, of course, does not imply that arsenic has four-times the importance of nitrogen.

The above is but one aspect of a problem that has, perhaps, come to the fore since the first edition of this publication was compiled, and that is what is usually termed 'speciation analysis'. It is, of course, increasingly recognized that determination of the chemical forms of an element in any component of the environment, both their structures and their concentrations, has

far more relevance to every aspect of its biological importance than merely measuring the total quantity of the element that might be present. Although elemental analysis is well covered in most cases, and there is a chapter dedicated to 'Element Speciation Analysis', it is difficult not to get the feeling that, in most instances, the problem of speciation analysis has not been tackled head-on. One manifestation of this is that you can flick through the volumes more or less in vain looking for chemical structural formulae. This is not so much a criticism as perhaps recognition that the analysis of all chemical species of all elements that might have biological relevance just cannot be covered in a single monograph, even one of this size.

Although Part 3 deals with metals and their compounds and Part 4 deals with non-metals, it is the other parts, on elemental distribution, on food-chain and health effects, that provide the most interesting general reading. There are even chapters on 'Elements and their Compounds in Indoor Environments' and on 'Metal and Ceramic Implants'. The chapter on 'Standards and Regulations...' will be of great value to a particular class of reader. It is easy to see that this work will continue to be a major reference work for chemists, biologists, geologists, food scientists, toxicologists, and others involved in environmental research and remediation, risk assessment, food research and industrial hygiene. It will also inform undergraduates and will provide a wealth of information to the interested general reader. It is difficult to imagine any self-respecting technical or scientific library being without a copy.

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