
Chemical Elements in the Environment

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Clemens Reimann · Patrice de Caritat

Chemical Elements in the Environment

Factsheets for the Geochemist
and Environmental Scientist



Springer

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PREFACE

CHEMICAL ELEMENTS IN THE ENVIRONMENT

The idea of compiling geochemical and environmental data from existing literature probably has occurred to many of our readers. We can hardly claim any originality here! In our case, the constant frustration of searching, sometimes vainly, sometimes repeatedly, for data with which we could compare the results from a major multimedia, multielement ecogeochemistry project on the Kola peninsula, was the impetus for commencing this task. Thus, we set out to collect real data from regional, multielement studies available in existing literature. It was quite an eye-opener to realise how few such reliable studies exist, how limited in scope most are (either spatially or in terms of analytical breadth), and how haphazardly organised some previous attempts at data collation appear.

We have thus tried to collect reliable information on the 92 elements reported to occur in nature. The resulting factsheets, which form the core of this book, consist of four pages of data for each element. For each of these elements, we have started the factsheet by giving essential physico-chemical information, followed by the abundances in typical rocks and crustal materials, and an indication of which important minerals are likely to contain the element in question. Subsequently, we have listed the concentrations of each element in various geochemical or environmental sample media, ranging from rocks, to soils, plants, waters, and even to human body fluids. As explained below, we have selected carefully the sources from which we extracted the data. Finally, we close each factsheet with a discussion of the biological significance, uses, environmental pathways, mobility, action levels, production and prices of each element. We have done our utmost to reproduce these values faithfully, and we hope that our readers will inform us of any mistakes or omissions, so that possible later editions might be improved.

We would also like to mention that while preparing the manuscript for this book we met several scientists who were reluctant to contribute their data. Their unwillingness, rational as it may first appear, was generally fuelled by the suspicion that they would not be credited for their work, whereas we would. It is important to stress here that the purpose of this book is to prepare a collection of easily comparable data sets. We urge readers wanting to use these data in their own work to go back to, and cite, the original sources, or at least the contributor's name (e.g., "Manning as cited in Reimann and Caritat"). In any case, it is always strongly advisable to acquire and consult the original reference to find out more about sampling strategy, exact area covered, number of samples collected and analysed for each element, analytical details, and quality assurance and quality control procedures. The tendency to "hide" original data presents a real danger to the further development of science. In recent years, more and more papers have been published without data tables or even without data statistics. In other cases, only data for the three or four "most important" elements are given, even though very many more have obviously been analysed for. A good and easily

accessible collection of existing data is fundamental to advance the understanding of the behaviour of chemical elements in the environment, to identify gaps in our knowledge and, last but not least, to generate new research ideas.

Chemical Elements in the Environment is intended as a workbook for the professional geochemist and environmental scientist, to which, we hope, they will often refer when interpreting their own data sets. While working on the manuscript of this book, we also bore in mind students in natural sciences at the university or college level who would be curious about the distribution of chemical elements on our planet - e.g. where are the main reservoirs of beryllium and rubidium? What do we know about tin in the environment? By how many orders of magnitude can the concentration of uranium in groundwater vary? The answers to these and many other questions can be found within these pages!

In addition to the libraries of our fellow scientists, we hope that this book will find a place on the shelf, or preferably in the hands, of legislators in environmental protection or management around the world. We believe that they, perhaps more than anyone else, need a book like this one to keep in touch with real data and hard facts about the environment.

We hope all readers will find this work useful. However, we cannot accept responsibility for any consequences resulting from the use of information in this book.

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Clemens Reimann and Patrice de Caritat
Trondheim, February 1998

CONTENTS

INTRODUCTION	1
FACTSHEET DESCRIPTION	5
GETTING MORE OUT OF THE FACTSHEETS	11
INFORMATION SOURCES	17
REFERENCES	23
FACTSHEETS	27
Ac Actinium	28
Ag Silver	30
Al Aluminium	34
Ar Argon	38
As Arsenic	42
At Astatine	46
Au Gold	48
B Boron	52
Ba Barium	56
Be Beryllium	60
Bi Bismuth	64
Br Bromine	68
C Carbon	72
Ca Calcium	76
Cd Cadmium	80
Ce Cerium	84
Cl Chlorine	88
Co Cobalt	92
Cr Chromium	96
Cs Cesium	100
Cu Copper	104
Dy Dysprosium	108
Er Erbium	112
Eu Europium	116
F Fluorine	120
Fe Iron	124
Fr Francium	128
Ga Gallium	130
Gd Gadolinium	134
Ge Germanium	138
H Hydrogen	142
He Helium	146

Hf	Hafnium	150
Hg	Mercury	154
Ho	Holmium	158
I	Iodine	162
In	Indium	166
Ir	Iridium	170
K	Potassium	174
Kr	Krypton	178
La	Lanthanum	182
Li	Lithium	186
Lu	Lutetium	190
Mg	Magnesium	194
Mn	Manganese	198
Mo	Molybdenum	202
N	Nitrogen	206
Na	Sodium	210
Nb	Niobium	214
Nd	Neodymium	218
Ne	Neon	222
Ni	Nickel	226
Np	Neptunium	230
O	Oxygen	232
Os	Osmium	236
P	Phosphorus	240
Pa	Protactinium	244
Pb	Lead	248
Pd	Palladium	252
Po	Polonium	256
Pr	Praseodymium	260
Pt	Platinum	264
Pu	Plutonium	268
Ra	Radium	270
Rb	Rubidium	274
Re	Rhenium	278
Rh	Rhodium	282
Rn	Radon	286
Ru	Ruthenium	290
S	Sulphur	294
Sb	Antimony	298
Sc	Scandium	302
Se	Selenium	306
Si	Silicon	310
Sm	Samarium	314
Sn	Tin	318
Sr	Strontium	322
Ta	Tantalum	326
Tb	Terbium	330
Te	Tellurium	334
Th	Thorium	338
Ti	Titanium	342

Tl	Thallium	346
Tm	Thulium	350
U	Uranium	354
V	Vanadium	358
W	Tungsten	362
Xe	Xenon	366
Y	Yttrium	370
Yb	Ytterbium	374
Zn	Zinc	378
Zr	Zirconium	382
APPENDIX		387
Table A1. Conversion between element and oxide masses		388
Table A2. Conversion between mg, mmol and meq		392
Table A3. Conversion between selected units		396
Table A4. Conversion between common concentration units		398