

*Per Enghag*

# Encyclopedia of the Elements

Technical Data · History · Processing · Applications

Title Picture: Sulfur crystals, photograph by Svend V. Sölver



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**Per Enghag**

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## Foreword

The publication of Per Enghag's book *Encyclopedia of the Elements* is a project that the Swedish National Committee has decided to support because the book and its message is important for teachers and pupils in senior high schools and also for students and scientists at the universities.

Apart from its considerable scientific and technical value to researchers and professionals in industry, the book is a well-written encyclopedia about the elements, their occurrence and use by mankind. The book is an exciting and also humorous general view of the element discoveries. It lets us meet the discoverers to see how they worked, thought and believed.

History of science deals with people and how they act towards scientific facts. One cannot enough emphasize the importance of this type of history to create interest for and understanding of scientific models and ideas. This book is a good example.

June 2004, Gothenburg

*Bengt Nordén*

Chairman of the Nobel Committee for Chemistry  
of the Royal Swedish Academy of Sciences





## Table of Contents

	<b>Foreword</b>	<i>V</i>
	<b>Preface</b>	<i>XXXVII</i>
	<b>Color Plates</b>	<i>XXXIX</i>
<b>1</b>	<b>Introduction</b>	<i>1</i>
1.1	What is an Element?	<i>1</i>
1.2	Elements known from Time Immemorial	<i>1</i>
1.3	Searching, Finding and Using	<i>2</i>
1.4	Systematic Searches	<i>3</i>
1.5	About this Book	<i>4</i>
1.5.1	A Bridge between Science/Technology and Culture/History	<i>4</i>
1.5.2	The Motive for a new Book	<i>5</i>
1.5.3	The Book's Layout	<i>5</i>
1.6	Useful Definitions and Facts	<i>6</i>
1.6.1	Some Geological Terms	<i>6</i>
1.6.2	Resources and Reserves	<i>8</i>
1.7	General Literature Sources	<i>8</i>
1.7.1	The History behind the Discoveries of Elements	<i>8</i>
1.7.2	Raw Materials and Production	<i>9</i>
1.8	Quantitative Element Descriptions	<i>9</i>
1.8.1	Units, Conversion Factors and Fundamental Constants in the SI System	<i>9</i>
1.8.2	Fact Tables	<i>9</i>
<b>2</b>	<b>About Matter</b>	<i>23</i>
2.1	Knowledge started in Handicraft	<i>23</i>
2.2	Early thinking about Materials	<i>24</i>
2.2.1	Four basic Stuffs	<i>24</i>
2.2.2	The Atomism or corpuscular Philosophy	<i>24</i>
2.2.3	An early Choice	<i>25</i>

2.3	Alchemy – Good and Bad	26
2.3.1	Not only Gold-making	26
2.3.2	Two Papyri – One Message from Ancient Alchemy	27
2.3.3	Alchemy comes to Europe	27
2.3.4	The bad and good Reputation of Alchemy	28
2.4	Paracelsus – A Phenomenon in Alchemy and Medical Chemistry	28
2.5	Two pragmatic Pioneers in the 16th Century	30
2.5.1	Vannoccio Biringuccio – Observer – Experimentalist – Writer	31
2.5.2	Georgius Agricola – A Renewer Of Mining And Metallurgical Technique	34
2.6	New Winds in the 17th Century	34
2.7	Phlogiston	36
2.8	Still in the 18th Century – the Chemical Revolution	37
2.8.1	Discoveries of new Elements	37
2.8.2	Lavoisier and the Chemical Revolution	37
2.9	A Breakthrough for Atomism	38
2.10	Accelerating Knowledge of the Atom	40
2.10.1	Atomic Weights	40
2.10.2	The Structure of the Atom	41
2.10.3	The Element is not Elementary	41
2.11	The Solid State	41
2.12	To Look into Matter	43
2.12.1	Electron Microscopy – a Review	43
2.12.2	Transmission Electron Microscopy (TEM) in Practice	44
2.12.3	Scanning Electron Microscopy (SEM) in Practice	45
2.12.4	A new Look at the Atomic World with Tunneling Microscope and Atomic Probe	46
2.13	Alchemy for a new Millennium – Nanotechnology	47
2.14	The Inorganic Chemistry of Life	48
2.14.1	Common Elements – Essential And Toxic	48
2.14.2	The Eleven Dominants – Bulk Biological Elements	49
2.14.3	Essential Trace Elements	49
2.14.4	Heavy Metals good for Life!	50
2.14.5	The Risk of Deviating from Just Right	50
2.14.6	A dynamic Earth	53
<b>3</b>	<b>The Elements – Origin, Occurrence, Discovery And Names</b>	<b>55</b>
3.1	The Synthesis Of Elements In Stars And In Supernova Explosions	55
3.2	The Earth	57
3.2.1	Building Up	57
3.2.2	The Earth's Crust	58
3.2.3	The Oceans – The Hydrosphere	60
3.2.4	The Atmosphere	61
3.3	The Periodic Table of the Elements	62
3.3.1	A Pattern for the Elements	62

3.3.2	The Modern Periodic Table	64
3.4	Element Discoveries	67
3.4.1	Stable and Unstable Elements	67
3.4.2	Who Made the Discovery?	68
3.5	Element Names	71
3.5.1	Elements Known in Antiquity	71
3.5.2	Elements from the Time of the Alchemists	72
3.5.3	Element Names from Celestial Bodies	73
3.5.4	Element Names from Mythology	73
3.5.5	Elements With Color Names	74
3.5.6	Names from Countries and Places as Element Names	74
3.5.7	The Family of Noble Gases	75
3.5.8	Personal Names as Element Names	76
3.6	Symbols for the Elements	76
<b>4</b>	<b>Geochemistry</b>	<b>79</b>
4.1	Common and Rare in the Earth's Crust	79
4.2	Analysis of the Earth's Crust – a Geochemical Task	80
4.2.1	Early Results from the US Geological Survey	81
4.2.2	Findings at the Vernadsky Institute in Moscow	82
4.2.3	A Small Number of Samples but Important Results	82
4.2.4	Odd and Even Elements. Harkin's Rule	82
4.3	The Development of Geochemistry	83
4.3.1	Rare Elements in the Earth's Crust – Compounds and Contents	83
4.3.2	Goldschmidt and the Modernizing of Geochemistry	84
4.3.3	The Russian Geochemical School	87
4.4	Some Geochemical Principles and Results	87
4.4.1	The Geochemical Classification of Elements	87
4.4.2	... if the Atomic Sizes are Suitable	89
4.4.3	Charge Intensity – Ion Potential in Water Solutions	91
4.4.4	Not Only Ionic Radius and Charge	92
4.5	Isotopes and Geochemistry	93
4.5.1	Isotopic Variations	93
4.5.2	Hydrogen isotope variations	94
4.5.3	Oxygen Isotope Variations and Temperature Variations 400 000 Years Ago	94
4.5.4	Carbon Isotope Variations and a Bold Hypothesis for Life	95
4.6	Radioactive Methods for Age Determination	96
<b>5</b>	<b>Gold</b>	<b>99</b>
5.1 Au	Facts about Gold	99
5.2	Gold in History	103
5.2.1	Most Prominent Among Metals	103
5.2.2	Gold from the Mysterious Country of Ophir and from the Queen of Sheba	104

5.2.3	Nubia – The Gold Country	105
5.2.4	The Golden Fleece	105
5.2.5	Esmeralda – The Gold Country	106
5.2.6	Gold Coins	107
5.2.7	Gold and Gold Rushes in the Modern Era	108
5.2.8	How Much Gold?	109
5.3	Is it Possible to Find Gold – Today?	110
5.4	Gold Ores and Gold Reserves	111
5.4.1	Gold Prospecting	111
5.4.2	Gold Reserves	111
5.5	Gold Production in Mines	115
5.6	Gold Manufacturing by Chemical and Metallurgical Methods	115
5.6.1	Older Techniques	115
5.6.2	The Cyanide Method – Environmentally Friendly!	116
5.6.3	Gold Manufacture from Sulfide Ores	116
5.6.4	Separation of Gold and Silver	116
5.7	Properties	117
5.7.1	A Ductile and Noble Metal	117
5.7.2	Why is Gold so Noble?	118
5.8	Uses	119
5.8.1	Pure Gold and Gold Alloys	119
5.8.2	Gold Surfaces	120
5.8.3	The Gold Content of Gold	120
5.9	The Biological Role of Gold	121
<b>6</b>	<b>Silver</b>	<b>123</b>
6.1	Ag	Facts about Silver 123
6.2		Silver in History 127
6.2.1		Knowledge of Metals Gradually Increased ... 127
6.2.2		The Bellows Puff and Blow in the Cupellation Process 128
6.2.3		Crete and Mycenae 129
6.2.4		King Croesus Coins Silver and Becomes a Proper Croesus 130
6.2.5		Athens a Basis for the West – Silver a Basis for Athens 131
6.2.6		Early Silver Supply in Central and Northern Europe 132
6.2.7		Silver Regions in South and Central America 133
6.3		The Geology of Silver 133
6.3.1		Silver Minerals 133
6.3.2		Silver Resources and Reserves 134
6.4		Mine Production of Silver 134
6.5		Silver Manufacture – Metallurgical and Chemical 135
6.5.1		Extraction from Lead Ores 135
6.5.2		Silver from Copper Ores 136
6.6		Properties and Uses 136
6.6.1		Alloys for Different Purposes 137
6.6.2		Oxides for Batteries and Bromides for Photography 137

6.6.3	Silver Plating	137
6.7	The Biological Role of Silver	138
<b>7</b>	<b>Copper</b>	<b>139</b>
7.1 Cu	Facts about Copper	139
7.2	Copper in History	143
7.2.1	A Copper Age between the Stone and Bronze Ages?	143
7.2.2	A Clear Greeting From the Copper Age	144
7.2.3	Copper in Many Regions	144
7.2.4	A Model for the Development of Mining and Metallurgy	145
7.2.5	Copper in the Roman Empire	145
7.2.6	Bronze – A Leap in Technology	146
7.2.7	Brass – Copper and Zinc	147
7.2.8	The Copper Mine in Falun	148
7.3	Copper Ores	151
7.3.1	Copper Minerals	151
7.3.2	Experimental Geology Discovers How Ores Were Formed	152
7.3.3	Types of Copper Deposits	154
7.3.4	Copper Reserves	154
7.3.5	Copper Production in Mines	155
7.4	The Manufacture of Copper Metal	157
7.4.1	Primary Production from Oxide Ores	157
7.4.2	Primary Production from Sulfide Ores	157
7.4.3	Electrolytic Refining of Copper	160
7.4.4	Bacterial Leaching	160
7.4.5	Secondary Production – Recycling of Copper	160
7.5	Copper Production	161
7.6	Uses of Copper	162
7.6.1	Copper Metal	162
7.6.2	Brass	163
7.6.3	Bronze	164
7.7	Copper and the Environment	165
<b>8</b>	<b>Iron</b>	<b>167</b>
8.1 Fe	Facts about Iron	167
8.2	Iron and Steel – Some Definitions	171
8.3	Metallurgy – Chemistry at High Temperatures	172
8.4	Ancient History – A Global Outline	174
8.4.1	Early Incidence of Iron	174
8.4.2	A Heavenly Metal	174
8.4.3	The Ores of Early Iron Manufacture	176
8.4.4	Not Cast but Forged – While the Iron is Hot	176
8.4.5	Steel – At Least on the Component Surface	178
8.4.6	No Blacksmith in All Israel	182
8.4.7	China – Persia – India	182

8.4.8	Nineveh Tests the Forgeability	184
8.4.9	Africa	184
8.4.10	Iron in Old Europe	185
8.5	Pig Iron – Impossible to Forge – But Forged to Bar Iron	187
8.5.1	More Iron!	187
8.5.2	The Blast Furnace	187
8.5.3	To Make Pig Iron Forgeable	189
8.5.4	Steel Manufacture from Wrought Iron	190
8.6	Sweden and England – Cooperation and Competition	191
8.6.1	Iron Ores With and Without Phosphorus	191
8.6.2	England–Sweden in Cooperation	192
8.6.3	The Puddling Process – An English Threat to Swedish Hegemony	193
8.7	Metallurgy Becomes a Science	195
8.7.1	Early Opinions and Methods	195
8.7.2	Carbon an Alloying Element?	196
8.7.3	Swedish 18th-Century Chemistry – Again	197
8.7.4	A Modern Version of Damascus Steel	198
8.7.5	Two Revolutions Take Over	199
8.7.6	Modern Metallurgy – A Diversified Science	200
8.8	Iron Ores	202
8.8.1	Minerals	203
8.8.2	Iron Ore Resources and Production	204
8.9	Modern Manufacture of Steel	205
8.9.1	Two Production Methods – From Iron Ore and Iron Scrap	205
8.9.2	Ore-Based Steel Production	206
8.9.3	Raw Steel from Scrap	206
8.9.4	Refining of Steel	207
8.9.5	Production of Stainless Steel	209
8.9.6	Techniques in Modern Steel Manufacture – A Summary	209
8.10	Steel for Many Purposes	210
8.11	Large Volumes of Steel in a Modern Society	211
8.12	Iron at the Center of Life – A Positive Biological Role for a Heavy Metal	212
<b>9</b>	<b>Hydrogen</b>	<b>215</b>
9.1	Facts about Hydrogen	215
9.2	Discovery	219
9.2.1	The Combustible Gas in Mars!	219
9.2.2	Lomonosov – The Founder of Russian Science	219
9.2.3	Henry Cavendish	220
9.3	The Occurrence of Hydrogen	225
9.3.1	A Universe of Hydrogen and Helium	225
9.3.2	Hydrogen on Earth	226
9.4	Manufacture	226
9.5	Uses	227

9.5.1	Chemical and Metallurgical Industry	227
9.5.2	Hydrogen – The Energy Carrier of the Future	228
9.5.3	Rocket Fuel	228
9.5.4	Fuel Cells	229
9.5.5	Lifting Gas for Balloons and Airships	230
9.6	Hydrogen Isotopes – Deuterium and Tritium	230
9.6.1	The Three Isotopes of Hydrogen	230
9.6.2	Deuterium	231
9.6.3	Tritium	232
9.7	Fusion Energy – “Energy From Water”	232
9.8	The Biological Role of Hydrogen	233
<b>10</b>	<b>Blowpipe and Spectroscope – Important Tools for Discovering Elements</b>	<b>235</b>
10.1	Analysis With the Blowpipe	235
10.1.1	Introduction	235
10.1.2	Mineral Analysis With a Blowpipe	236
10.2	The Fundamentals of Spectral Analysis	238
10.3	The Color of the Flame Gives Information on the Composition	241
10.4	The Spectrum – Visible and Invisible	241
10.4.1	A Prism Splits a Beam of Light According to the Wavelength	241
10.4.2	Infrared (IR) and Ultraviolet (UV)	242
10.4.3	Fraunhofer’s Lines and Gratings	242
10.5	The Development of Spectroscopy Continues	243
10.5.1	Separates Red From Red	243
10.5.2	Use of Electricity for Spectral Analysis	244
10.5.3	A Finding in a Fire-ravaged Glass Factory	244
10.5.4	Anders Ångström in Uppsala Makes Spectroscopy Quantitative	245
10.5.5	The Ångström Laboratory	246
10.5.6	A Research Milieu in Heidelberg	247
10.6	What Happens in the Atom During Spectral Analysis?	250
10.7	Atomic Numbers and X-ray Spectra	250
10.8	Modern Spectral and X-ray Analysis	251
10.8.1	Emission Spectral Analysis	251
10.8.2	Infrared Spectroscopy	253
10.8.3	Atomic Absorption Spectrophotometry	253
10.8.4	X-ray Fluorescence Analysis	254
10.8.5	EDS and WDS Analysis	254
10.8.6	Special Methods for Surface Analysis	255
10.8.7	Mass Spectrometry	255
10.8.8	Neutron Activation Analysis (NAA)	257
<b>11</b>	<b>Sodium and Potassium</b>	<b>259</b>
11.1 Na	Facts about Sodium	259
11.1 K	Facts about Potassium	263
11.2	The Alkali Metals – A Brief Outline	267

11.3	Sodium and Potassium in Chemical History	268
11.3.1	Alkali and Alkali – Saltpeter and Saltpeter	268
11.3.2	Potash	270
11.3.3	Soda	271
11.3.4	He Fell Into an Ecstasy Over an Element ...	271
11.3.5	A French Alternative	272
11.3.6	Why the Names Sodium and Potassium?	273
11.4	Chemical Engineering in a Dramatic Era	274
11.4.1	Alkalis and Salt – Essential Commodities	274
11.4.2	Gunpowder and Soap in Competition	274
11.4.3	Leblanc’s Soda Process – The Birth of Industrial Chemistry	275
11.5	Sodium in Our Time	280
11.5.1	Occurrence	280
11.6	Manufacture	281
11.6.1	Sodium Chemicals – Two Examples	281
11.6.2	Sodium Metal	282
11.7	Uses of Sodium Metal and Its Compounds	282
11.8	Potassium in Our Time	283
11.8.1	Occurrence	283
11.9	Uses	284
11.10	Sodium and Potassium in Biological Systems	284
<b>12</b>	<b>Lithium</b>	<b>287</b>
12.1	Li Facts about Lithium	287
12.2	Discovery	291
12.2.1	A Versatile Brazilian Prepares the Lithium Discovery	291
12.2.2	A New Employee Makes an Analysis and Ends Up in the History of Science	292
12.2.3	The Mines on the Island of Utö	294
12.2.4	Journeys and Informal Conversations in the Wake of Lithium	294
12.2.5	Lithium Metal	295
12.3	Occurrence	296
12.3.1	Minerals	296
12.3.2	Natural Brines	297
12.4	Manufacture	297
12.5	Uses	297
12.5.1	Glass and Ceramics	297
12.5.2	Catalysis and Components in Organic Chemistry	298
12.5.3	In Aircraft	298
12.5.4	New Batteries	298
12.5.5	A Special Use	299
12.5.6	Advanced Nuclear Applications	299
12.5.7	Lithium and Hydrogen	299
12.6	Lithium Saves Life	300



<b>13</b>	<b>Rubidium and Cesium</b>	<b>301</b>
13.1	Rb Facts about Rubidium	301
13.1	Cs Facts about Cesium	305
13.2	Discovery	309
13.2.1	Cesium – Named From the Blue Sky	309
13.2.2	Rubidium – More Red Than Red	310
13.3	Rubidium in Our Time	310
13.3.1	Occurrence and Manufacture	310
13.3.2	Uses	310
13.4	Cesium in Our Time	311
13.4.1	Occurrence and Manufacture	311
13.4.2	Uses	312
13.4.3	Cesium and Radioactive Pollution	313
13.5	Biological Roles	313
<b>14</b>	<b>Magnesium and Calcium</b>	<b>315</b>
14.1	Mg Facts about Magnesium	315
14.1	Ca Facts about Calcium	319
14.2	Alkaline Earth Metals – A Brief Outline	323
14.3	Magnesium and Calcium in Chemical History	324
14.3.1	Known Since Antiquity	324
14.3.2	Lime	324
14.3.3	Gypsum	325
14.3.4	Magnesia Alba and Usta	325
14.3.5	The Bitter Salt From Epsom	325
14.3.6	Carving in Stone	326
14.3.7	Magnesium and Calcium Metals	327
14.3.8	Etymology	328
14.4	Magnesium in Our Time	328
14.4.1	Occurrence	328
14.4.2	Manufacture of Magnesium Metal	329
14.4.3	Uses of Magnesium Metal and Compounds	330
14.5	Calcium in Our Time	332
14.5.1	Occurrence	332
14.5.2	Water Hardness	334
14.5.3	Manufacture of Calcium Metal	336
14.5.4	Use of Calcium Metal and Compounds	336
14.6	Biological Roles	338
14.6.1	Magnesium	338
14.6.2	Calcium	338
<b>15</b>	<b>Beryllium</b>	<b>341</b>
15.1	Be Facts about Beryllium	341
15.2	Discovery	345
15.2.1	Precious Stones Known Since Antiquity	345

15.2.2	Emerald – A Royal Nose Adornment	346
15.2.3	... Destroys Precious Stones but Discovers a New Element	346
15.2.4	The Next Step – Beryllium Metal	348
15.2.5	The Chemistry of Beryllium Confuses and Becomes Clearer	348
15.2.6	Beryllium in an Atomic Theory Breakthrough	349
15.3	Occurrence	350
15.3.1	Bertrandite and Beryl – Industrial Beryllium Minerals	350
15.3.2	Emerald for Gemstones	350
15.4	Manufacture	350
15.5	Uses	351
15.5.1	Special Applications	351
15.5.2	Volume Products	352
15.6	Beryllium – A Toxic Element	352

**16 Strontium and Barium** 355

16.1 Sr	Facts about Strontium	355
16.1 Ba	Facts about Barium	359
16.2	Strontium and Barium in Chemical History	363
16.2.1	Heavy Spar – Barite	363
16.2.2	Bolognian Stone – Shining in Darkness	364
16.2.3	Terra ponderosa From Strontian	364
16.2.4	The Actual Metals in the Alkaline Earths	365
16.3	Strontium in Our Time	367
16.3.1	Occurrence	367
16.3.2	Manufacture	367
16.3.3	Uses of Strontium	368
16.4	Barium in Our Time	368
16.4.1	Occurrence	368
16.4.2	Manufacture	369
16.4.3	Uses	369
16.5	Colors and Sparks in Fireworks	371
16.6	Biological Roles	372

**17 Scandium, Yttrium, Lanthanum and the 14 Lanthanides – Rare Earth Metals REMs** 373

17.1 Sc	Facts about Scandium	374
17.1 Y	Facts about Yttrium	378
17.1 La	Facts about Lanthanum	382
17.1 Ce	Facts about Cerium	386
17.1 Pr	Facts about Praseodymium	390
17.1 Nd	Facts about Neodymium	393
17.1 Pm	Facts about Promethium	396
17.1 Sm	Facts about Samarium	399
17.1 Eu	Facts about Europium	402
17.1 Gd	Facts about Gadolinium	405

17.1 Tb	Facts about Terbium	408
17.1 Dy	Facts about Dysprosium	411
17.1 Ho	Facts about Holmium	414
17.1 Er	Facts about Erbium	417
17.1 Tm	Facts about Thulium	420
17.1 Yb	Facts about Ytterbium	423
17.1 Lu	Facts about Lutetium	426
17.2	Rare Earth Metals in the Periodic Table – and in Nature	429
17.2.1	A Very Special Place in the Periodic Table	429
17.2.2	Rare – But Common	430
17.3	Many Complex Turns	432
17.3.1	They did it	432
17.3.2	Schedule and naming	433
17.4	The Long Story of Discovery	433
17.4.1	The Discovery of Gadolinite in Ytterby – The Beginning	433
17.4.2	The Element Yttrium	436
17.4.3	Bastnaes’ Contributions to REM Development	437
17.4.4	Ironworks Proprietor and Scientist	439
17.4.5	Jöns Jacob Berzelius – Chemist and Mineralogist	441
17.4.6	To Separate the Almost Inseparable	443
17.4.7	Mosander’s Discoveries Checked. Were They Correct?	446
17.4.8	A Research Leap in 1880 – Bold New Goals	448
17.4.9	Scandium – eka-Boron	451
17.4.10	Splitting of the Twin	454
17.4.11	Lutetium and Ytterbium	456
17.4.12	The Lanthanides and the Periodic Table	459
17.4.13	The Fourteenth and Last Lanthanide	461
17.5	The Special Nature of the Lanthanide Elements	464
17.5.1	Electron Configuration and Chemistry	464
17.5.2	Electron Configuration and Color	465
17.5.3	Electron Configuration and Magnetic Properties	467
17.6	Occurrence of Rare Earth Metals	468
17.6.1	Geochemistry Is a Guide	468
17.6.2	Monazite and Bastnaesite in Many Places ...	469
17.6.3	... But China Has Most of It	470
17.6.4	Worldwide Mine Production and Reserves	471
17.7	Separation of the RE Elements	471
17.7.1	Fractional Crystallization	472
17.7.2	Using the Differences in the Basicities of the Oxides	473
17.7.3	Separation Using Ion Exchange	474
17.7.4	Liquid–Liquid Extraction	474
17.8	Manufacture of Rare Earth Metals	475
17.8.1	REO Manufacture – One Example	475
17.8.2	Pure RE Metals	476
17.9	Rare Earth Metals in Modern Technology – Examples	476

17.10	Applications – Some Examples	477
17.10.1	Scandium	477
17.10.2	Yttrium	478
17.10.3	Lanthanum	480
17.10.4	Cerium	482
17.10.5	Praseodymium	483
17.10.6	Neodymium	483
17.10.7	Promethium	484
17.10.8	Samarium	485
17.10.9	Europium	485
17.10.10	Gadolinium	486
17.10.11	Terbium	488
17.10.12	Dysprosium	489
17.10.13	Holmium	489
17.10.14	Erbium	490
17.10.15	Thulium	490
17.10.16	Ytterbium	490
17.10.17	Lutetium	490
17.11	Prices – Not Just a Question of Metal Content in the Earth’s Crust	491
17.12	Biological Roles for Rare Earth Elements	492

**18 Titanium 493**

18.1	Ti Facts about Titanium	493
18.2	Discovery	497
18.2.1	Mind and Matter	497
18.2.2	Gregor’s Menachanite Returns as Klaproth’s Titanium	498
18.2.3	Hunting Titanium Metal	499
18.3	Titanium Minerals	500
18.3.1	A Widely Distributed Metal	500
18.3.2	Production of Mineral Concentrates	501
18.4	Production of Titanium Oxide – Titanium White	501
18.5	Titanium Metals and Alloys	502
18.5.1	Chlorine Metallurgy – The Kroll Process	502
18.5.2	Purification and Melting	504
18.5.3	Ferrotitanium	505
18.6	Modern Uses of Titanium and Titanium Compounds	505
18.6.1	Titanium White – Titanium Oxide	505
18.6.2	Corrosion-resistant Metal	506
18.6.3	Compatibility with Human Tissue	506
18.6.4	A Metal for the Space Age	506
18.6.5	Stainless Steels With Titanium – Stainless Even After Welding	507
18.6.6	Titanium Carbide and Titanium Nitride – Important Hard Materials	507
18.6.7	Coating With Titanium Carbide and Nitride in Chemical Vapor Deposition (CVD) Processes	507

18.7	The Biological Role of Titanium	508
<b>19</b>	<b>Zirconium</b>	<b>511</b>
19.1	Facts about Zirconium	511
19.2	Discovery	515
19.2.1	Hyacinth in the Revelations	515
19.2.2	A First Sight of Zirconium Metal	516
19.3	Zirconium Minerals	516
19.3.1	General	516
19.3.2	The Mineral Zircon – Zirconium Silicate	516
19.3.3	Baddeleyite – Zirconium Oxide	517
19.4	Modern Uses of Zircon and Zirconium Oxide	517
19.4.1	General Ceramic Applications ...	517
19.4.2	... and Some Very Special Ones	518
19.4.3	Transformation-toughened Zirconia	518
19.4.4	White Ceramics Containing Zirconia	519
19.4.5	Zirconium in Ultrasonic Transducers	519
19.5	Zirconium Metal and Alloys	520
19.5.1	The Start of Industrial Production	520
19.5.2	Modern Zirconium Metal Manufacture	520
19.5.3	Zirconium for Nuclear Power	521
19.5.4	Zirconium – Special Uses	522
19.6	Biological Role	522
<b>20</b>	<b>Hafnium</b>	<b>523</b>
20.1	Facts about Hafnium	523
20.2	Discovery	527
20.3	Minerals	528
20.4	Manufacture of Hafnium	529
20.5	Uses of Hafnium	529
20.6	Biological Role	529
<b>21</b>	<b>Vanadium</b>	<b>531</b>
21.1	Facts about Vanadium	531
21.2	Discovery	535
21.2.1	To the New World	535
21.2.2	A New Metal in Zimapan's Brown Lead Mineral?	536
21.2.3	A Doctor Becomes a Metallurgist	537
21.2.4	Iron With Cold Brittleness	538
21.2.5	Del Rio's Lost Element Appears in Sweden	538
21.2.6	A Scientific Triangle Drama	540
21.2.7	Vanadium Metal in History	542
21.3	Vanadium in Nature	543
21.3.1	Vanadium Minerals	543
21.3.2	Vanadium in Different Sources	543

21.3.3	Vanadium in Titaniferous Rock	543
21.4	Mine Production	544
21.5	Manufacture of Vanadium and Vanadium Products	544
21.5.1	Vanadium Pentoxide From Iron Ores	544
21.5.2	Manufacture of Vanadium Metal	545
21.5.3	Manufacture of Ferrovandium	545
21.6	Uses of Vanadium	546
21.7	Biological Role	546
<b>22</b>	<b>Niobium</b>	<b>549</b>
22.1 Nb	Facts about Niobium	549
22.2	Discovery	553
22.2.1	Native Peoples Hunting Minerals	553
22.2.2	A Discovery in the Museum	553
22.2.3	One Element or Two?	554
22.2.4	A New Name Question	556
22.2.5	The Element Niobium	556
22.2.6	The Niobium and Vanadium Discoveries – Great Similarities	556
22.3	Niobium and Tantalum Minerals	557
22.4	Industrial Niobium Manufacture	558
22.4.1	Separation of Niobium and Tantalum	558
22.4.2	Manufacture of Niobium Metal and Ferroniobium	558
22.5	Uses of Niobium	559
22.6	Niobium in Life	559
<b>23</b>	<b>Tantalum</b>	<b>561</b>
23.1 Ta	Facts about Tantalum	561
23.2	Discovery	565
23.2.1	Ekeberg – Weak, Strong and Versatile	565
23.2.2	Tantalus – Son of Zeus	566
23.2.3	Tantalum or Columbium?	566
23.2.4	The Element Tantalum	567
23.3	Tantalum and Niobium Minerals	567
23.4	Industrial Tantalum Manufacture	568
23.5	Uses of Tantalum	569
23.5.1	Excellent Corrosion Resistance	569
23.5.2	The Modern Capacitor	569
23.6	Tantalum in Life	569
<b>24</b>	<b>Chromium</b>	<b>571</b>
24.1 Cr	Facts about Chromium	571
24.2	Discovery	575
24.2.1	Europe Meets Asia	575
24.2.2	Siberian Red Lead	576

24.2.3	From the Outskirts of the French Revolution to the Center of Chemistry	576
24.2.4	The Discovery of the New Metal Chromium	577
24.2.5	Chromos in Cleopatra's Emeralds and in Red Rubies	578
24.2.6	Hard on the Heels of the Discovery of Chromium	579
24.3	Chromium Deposits	580
24.3.1	Large-scale Chromite Discoveries	580
24.3.2	Deposits and Production of Chromite in Our Time	580
24.4	Manufacture of Chromium Products	581
24.4.1	An Overview	581
24.4.2	Chromium Chemicals	581
24.4.3	Refractory	582
24.4.4	Chromium Metal	582
24.4.5	Ferrochromium – The Raw Material for Stainless Steels	583
24.5	Why Are Stainless Steels Stainless?	584
24.6	Chromium Plating and Chromating	585
24.6.1	Chromium Plating	586
24.6.2	Chromating	587
24.7	Chromium – A Poison or an Essential Element for Life?	587
24.7.1	Dangerous or Not Dangerous?	587
24.7.2	An Essential Element for Life!	588
<b>25</b>	<b>Molybdenum</b>	<b>589</b>
25.1 Mo	Facts about Molybdenum	589
25.2	Discovery	593
25.2.1	Molybdœna – A Lead Ore Without Lead	593
23.2.2	A Trainee Shows the Way	593
25.2.3	A New Earth Is Identified	594
25.2.4	A New Metal That I Called Molybdœnum	595
25.3	Molybdenum Deposits in Our Time	597
25.3.1	Types of Minerals and Ores	597
25.3.2	World Resources, Mine Production and Ore Concentration	598
25.4	Manufacture of Molybdenum Metal and Alloys	600
25.4.1	Molybdenum Metal	600
25.4.2	Ferromolybdenum	600
25.5	Modern Uses of Molybdenum	600
25.5.1	An Overview	600
25.5.2	Some Specific Examples	601
25.6	An Essential Trace Element for Life	603
<b>26</b>	<b>Tungsten</b>	<b>605</b>
26.1 W	Facts about Tungsten	605
26.2	Discovery	609
26.2.1	Jupiter's Wolf and the Wolf's Foam	609
26.2.2	Tungstic Acid Appears	609

26.2.3	The Mineral Tungsten	610
26.2.4	Hunting Tungstic Acid	610
26.2.5	The Seminary of Vergara in the Basque Country	611
26.2.6	The Spanish Brothers Discover the New Metal	612
26.2.7	A Tungsten Contribution of an Adventurer	614
26.2.8	A Name for the New Metal	615
26.2.9	Scheelite Remembers Scheele	615
26.3	Tungsten in Nature	615
26.3.1	Tungsten Minerals	615
26.3.2	Tungsten Deposits	616
26.3.3	Production Technique for Tungsten Concentrate	616
26.3.4	The World Production from Mines	617
26.4	Chemistry at Work With Tungsten Products	618
26.5	Metallurgy and Powder Metallurgy at Work with Tungsten Products	619
26.5.1	Ferrotungsten	619
26.5.2	Cemented Carbide or Hard Metal Produced With Powder Metallurgy	619
26.6	Modern Uses of Tungsten and Tungsten Products	619
26.6.1	General Applications	619
26.6.2	In Service for Lighting	620
26.6.3	Tungsten in Tool Materials	620
26.7	Tungsten in Life	623
<b>27</b>	<b>Manganese</b>	<b>625</b>
27.1 Mn	Facts about Manganese	625
27.2	Discovery	629
27.2.1	“Braunstein” for Coloring – and Discoloring – of the Glass Melt. Transforms Copper to Silver!	629
27.2.2	Braunstein, Pyrolusite, What Is It in Reality?	630
27.2.3	Early Attempts to Find the Metal in Pyrolusite	631
27.2.4	The Pyrolusite Chemistry Clears Up	631
27.2.5	Finally an Accepted Metal in Pyrolusite	634
27.2.6	A Name for the New Metal	635
27.2.7	Manganese in Iron Ores	636
27.3	Manganese Deposits in Our Time	636
27.3.1	Manganese Minerals	636
27.3.2	Manganese Ores	637
27.3.3	Mine Production of Manganese	637
27.3.4	Manganese Nodules in the Ocean	637
27.4	Manufacture of Some Manganese Products	638
27.4.1	Ferromanganese	638
27.4.2	Manganese Metal	638
27.4.3	Manganese Dioxide	639
27.5	Uses of Manganese and Manganese Products	639
27.5.1	Manganese in Steel	639



27.5.2	Manganese in Aluminum and Copper Alloys	640
27.5.3	Battery Applications	640
27.5.4	Other Uses of Manganese Chemicals	640
27.6	Manganese in Life	641
27.6.1	A Toxic Element ...	641
27.6.2	... but Essential for Life	641
<b>28</b>	<b>Technetium</b>	<b>643</b>
28.1 Tc	Facts about Technetium	643
28.2	Discovery	647
28.2.1	Element 43 Is Wanted	647
28.2.2	An Elusive Shadow	647
28.2.3	Arduous and Almost Impossible	648
28.2.4	To Discover an Element That Does Not Exist!	650
28.2.5	Finally a Name for Element 43	651
28.2.6	Was Masurium Element 43?	651
28.2.7	Technetium in Weighable Quantities	652
28.3	Technetium – Properties and Uses	652
28.3.1	The Isotopes	652
28.3.2	From the Nuclear Reactor to the Human Body – The Medical Uses of Technetium	653
<b>29</b>	<b>Rhenium</b>	<b>655</b>
29.1 Re	Facts about Rhenium	655
29.2	Discovery	659
29.2.1	Where Should Elements 43 and 75 Be Looked For?	659
29.2.2	The River Rhein but not the Region Masurien	660
29.2.3	A Worldwide Search for Rhenium	661
29.2.4	High Concentrations of Rhenium are Unexpectedly Found at Home!	663
29.3	Rhenium Sources in Modern Times	663
29.4	Modern Techniques for Manufacturing Rhenium	664
29.5	Uses of Rhenium	665
29.6	The Biological Role of Rhenium	666
<b>30</b>	<b>Cobalt</b>	<b>667</b>
30.1 Co	Facts about Cobalt	667
30.2	Discovery	671
30.2.1	Blue Glass and Pottery, Known to the Ancients	671
30.2.2	Kobolds – Demons in the Lower Regions	671
30.2.3	The Worthless Can Be Valuable	671
30.2.4	Why Did Glass become Blue?	672
30.2.5	A Cobalt Mine World-famous for Nickel	674
30.3	Cobalt Deposits	675
30.3.1	Cobalt Minerals	675

30.3.2	Cobalt Ores	675
30.3.3	Cobalt Reserves	676
30.3.4	The Production in Mines	677
30.4	Manufacture of Cobalt Products from Ores and Concentrates	677
30.4.1	Production Technique	677
30.4.2	Cobalt Metal Production	678
30.5	Uses of Cobalt	679
30.5.1	Alloys and Cemented Carbides	679
30.5.2	Catalysts	680
30.5.3	Coloring and Decolorizing – Glass, Paints, Aluminum Cladding	680
30.5.4	A Moisture Detector and an Invisible Ink	681
30.5.5	Collecting Solar Energy	681
30.5.6	Radioactive Cobalt	681
30.6	Cobalt in Life	682
30.6.1	Risks with Cobalt	682
30.6.2	Essential for Life	682
<b>31</b>	<b>Nickel</b>	<b>685</b>
31.1 Ni	Facts about Nickel	685
31.2	Discovery	689
31.2.1	“Cobalt That Has Lost Its Soul”	689
31.2.2	A Copper Ore Without Copper!	689
31.2.3	The Discovery of Nickel	689
31.3	A. F. Cronstedt – An Individual Chapter in the History of Chemistry and Mineralogy	692
31.3.1	A Short, Active Life	692
31.3.2	Preparation for Big Tasks	692
31.3.3	A New Mineralogical System	693
31.4	Were the Chinese First to Discover Nickel?	693
31.5	Nickel Deposits	694
31.5.1	Nickel Minerals and Ores	694
31.5.2	Nickel Occurrence	696
31.5.3	Mining of Nickel	697
31.6	Nickel in Nodules, in Meteorites and in the Earth’s Core	698
31.7	Manufacture of Nickel	699
31.7.1	Methods for Sulfide Ores – Matte Production	699
31.7.2	A Variety of Refining Processes	700
31.7.3	Methods for Laterite Ores	701
31.8	Uses of Nickel	701
31.8.1	Alloys	701
31.8.2	Nickel-based Batteries	702
31.8.3	Nickel Plating	703
31.8.4	Catalysts	704
31.9	Nickel in Life	704
31.9.1	Very Similar but Quite Different!	704

31.9.2	Nickel Toxicology	704
<b>32</b>	<b>Platinum Group Metals</b>	<b>707</b>
32.1 Ru	Facts about Ruthenium	707
32.1 Rh	Facts about Rhodium	711
32.1 Pd	Facts about Palladium	715
32.1 Os	Facts about Osmium	719
32.1 Ir	Facts about Iridium	723
32.1 Pt	Facts about Platinum	727
32.2	The Platinum Group Metals – PGMs – An Overview	731
32.3	Discovery of Natural Platinum	732
32.3.1	A Stranger Among the Hieroglyphs	732
32.3.2	Platinum in the Old World	732
32.3.3	Platinum in South America	733
32.3.4	Platinum and the Form of the Earth	736
32.3.5	Platinum in Europe	736
32.4	The Discovery of Platinum Metals in Platinum	740
32.4.1	Tennant and Wollaston	740
32.4.2	Osmium and Iridium	742
32.4.3	Palladium and Rhodium	743
32.4.4	Ruthenium	744
32.4.5	Malleable Platinum	745
32.5	Occurrence of the Platinum Group Metals	745
32.5.1	The Geology	745
32.5.2	Platinum Group Metals – Reserves	746
32.6	Production of Platinum-group Metals (PGMs)	747
32.6.1	Mining	747
32.6.2	Enrichment of the PGMs	748
32.6.3	Separating Platinum, Palladium, Iridium, Osmium, Rhodium and Ruthenium	748
32.6.4	Quantities of Platinum, Palladium and other PGMs Produced	749
32.7	Uses of the Platinum Group Metals	749
32.7.1	An Overview	749
32.7.2	Platinum	750
32.7.3	Palladium	751
32.7.4	Rhodium	754
32.7.5	Iridium	755
32.7.6	Osmium	755
32.7.7	Ruthenium	756
32.8	The Varying Value of Platinum Metals	756
32.9	Biological Roles of Metals in the Platinum Group	756
<b>33</b>	<b>Zinc</b>	<b>759</b>
33.1 Zn	Facts about Zinc	759
33.2	Zinc in History	763

33.2.1	A Metal From the Far East	763
33.2.2	Marco Polo in the Pioneering Region of Zinc Manufacture	764
33.2.3	Zinc Metal in India and China	764
33.2.4	Zinc Metal in Europe and America	766
33.3	Mining of Zinc	767
33.3.1	Minerals and Zinc Ores	767
33.3.2	Mine Production of Zinc	768
33.4	Modern Zinc Manufacture	769
33.4.1	Production of Zinc From Sulfide Ore	769
33.4.2	Production Volumes	771
33.5	Uses	772
33.5.1	Zinc Alloys – Not Only Brass	772
33.5.2	Corrosion Protection	772
33.5.3	Chemicals	774
33.6	Zinc in Life	775
<b>34</b>	<b>Cadmium</b>	<b>777</b>
34.1 Cd	Facts about Cadmium	777
34.2	Discovery	781
34.2.1	A Broad Field of Activities	781
34.2.2	White Zinc Oxide – Yellow!	781
34.2.3	Accused for Mixing Arsenic Into Medicine – Exculpated by Stromeyer	782
34.2.4	A Place in the Discovery Story of the Elements	783
34.3	Occurrence and Manufacture	783
34.4	Uses	785
34.4.1	An Outline	785
34.4.2	Corrosion Protection and Friction Reduction	785
34.4.3	NiCd Batteries	785
34.4.4	Cadmium Pigments and Cadmium Stabilizers Need Substitutes	786
34.4.5	Cadmium in “Guinness World Records”™	786
34.4.6	What to Do With Cadmium?	787
34.5	Cadmium in the Environment	787
34.5.1	Cadmium Uptake From Food and Air	787
34.5.2	Why Is Cadmium Toxic?	788
34.5.3	The Route of Cadmium in the Body	788
34.5.4	Successful Environmental Work Regarding Cadmium	788
34.5.5	Legislation and Government Programs	789
<b>35</b>	<b>Mercury</b>	<b>791</b>
35.1 Hg	Facts about Mercury	791
35.2	Mercury in History	795
35.2.1	Known in Old Egypt and in China	795
35.2.2	Minium and Cinnabar for Decoration	795
35.2.3	“Living Silver” – A Messenger From the Gods	796

- 35.2.4 A Major Element for Alchemy and for Experimental Physics 798
- 35.2.5 The Gold and Silver Countries in South America Needed Mercury 798
- 35.3 Occurrence and Manufacture in Our Time 798
- 35.4 The Toxicity of Mercury 799
- 35.4.1 Mercury and Mercury Compounds 799
- 35.4.2 Minamata Disease 800
- 35.5 The Sources of Mercury Emissions 801
- 35.6 The Technical Use of Mercury 801
- 35.6.1 Metal and Chemicals in Science and Technology 801
- 35.6.2 Mercury in Lighting 802
- 35.6.3 Mercury in Batteries 802
- 35.6.4 Amalgamation in Large-Scale Industry 802
- 35.6.5 Amalgam in Dental Fillings 803

### **36 Boron 805**

- 36.1 B Facts about Boron 805
- 36.2 Boron in History 809
- 36.2.1 Preludes 809
- 36.2.2 The Discovery of Boron 810
- 36.3 Boron Occurrence in Our Time 811
- 36.3.1 An Unexpected Find at the Building of a Sanitarium 811
- 36.3.2 Borate Deposits in the World 811
- 36.4 Common Boron Products and Their Uses 813
- 36.4.1 Borax and Boric Acid 813
- 36.4.2 Borax Glass Products 813
- 36.4.3 Boron in Laundry Products 814
- 36.4.4 Boron in Agricultural Products 814
- 36.4.5 Flame Retardants 814
- 36.5 Special Boron Products and Applications 815
- 36.5.1 Elemental Boron 815
- 36.5.2 The Special Boron Isotope 10B 815
- 36.5.3 Boron Carbide 816
- 36.5.4 Boron Nitride – Soft as Graphite and Hard as Diamond 816
- 36.5.5 Boron in Batteries and Fuel Cells 817
- 36.5.6 Boron in Steel 817
- 36.6 Boron in the Life of Animals and Humans 818

### **37 Aluminum 819**

- 37.1 Al Facts about Aluminum 819
- 37.2 Aluminum in History 823
- 37.2.1 The Early History of Aluminum is Alum's History 823
- 37.2.2 The Discovery of Aluminum 824
- 37.2.3 Aluminum – More Elegant Than Gold in the Imperial Service 825
- 37.2.4 Electrolysis in Molten Cryolite – Basis for Modern Aluminum Production 826

37.3	The Raw Materials for Aluminum Manufacture	828
37.3.1	Bauxite	828
37.3.2	Aluminum Oxide	829
37.3.3	Cryolite – “Ice Stone”	830
37.4	Aluminum Manufacture	830
37.4.1	Primary Aluminum	830
37.4.2	Recycled Aluminum (Secondary Aluminum)	831
37.4.3	Manufacture of Rolled Products (Plate, Strip, Sheet, Foil) and Extruded Profiles	832
37.4.4	World Production of Aluminum	833
37.5	An Alloy Family With Possibilities	833
37.5.1	The Properties of Aluminum	833
37.5.2	Aluminum Alloys	834
37.6	Surface Treatment of Aluminum and Aluminum Alloys	836
37.6.1	Surface Treatment of Aluminum – Why?	836
37.6.2	Anodizing	837
37.6.3	Chromating	839
37.7	Uses of Aluminum and Aluminum Alloys	839
37.7.1	Exclusive and Ordinary	839
37.7.2	The Right Alloy for Specific Purposes	842
37.8	Aluminum in Life	843
<b>38</b>	<b>Gallium, Indium and Thallium</b>	<b>845</b>
38.1 Ga	Facts about Gallium	845
38.1 In	Facts about Indium	849
38.1 Tl	Facts about Thallium	853
38.2	The History Behind the Discoveries	857
38.2.1	Thallium (1861)	857
38.2.2	Indium (1863)	858
38.2.3	Gallium (1875)	860
38.3	Occurrence	862
38.3.1	Gallium	862
38.3.2	Indium	862
38.3.3	Thallium	863
38.4	Manufacture of Metals and Compounds	863
38.4.1	Gallium	863
38.4.2	Indium	863
38.4.3	Thallium	864
38.5	Properties and Uses	864
38.5.1	Gallium	864
38.5.2	Indium	865
38.5.3	Thallium	866
38.6	Ecological Effects	867

<b>39</b>	<b>Carbon</b>	869
39.1	C Facts about Carbon	869
39.2	A Long History	873
39.3	Carbon in Space	874
39.4	Back to Carbon on Earth	875
39.5	Coal for Power Generation and Metallurgical Coke	876
39.5.1	Different Fields of Application	876
39.5.2	Environmental Problems of Burning Coal	877
39.6	Carbon Black and Active Carbon	877
39.7	Graphite	878
39.7.1	The Atomic Arrangement Determines Its Properties	878
39.7.2	Natural and Synthetic Graphite	879
39.7.3	Occurrence and Production	879
39.7.4	Applications for Graphite	880
39.8	Diamond	880
39.8.1	Graphite and Diamond	880
39.8.2	Structure and External Symmetry	881
39.8.3	Diamonds in the Ground	883
39.8.4	Winning of Diamond	883
39.8.5	World Supply of Natural Diamonds	884
39.8.6	Use of Natural Diamonds in Industry	885
39.8.7	Gemstone Diamonds	886
39.9	Fullerenes	889
39.10	Synthetic Diamond	889
39.10.1	Synthesis of Diamond	889
39.10.2	Uses of Synthetic Diamond	891
39.11	The Carbon Cycle	892
39.12	The Greenhouse Effect	892
39.12.1	General	892
39.12.2	Let Us Be Speculative ...	893
39.12.3	... and Realistic	893
39.13	Dating With the Carbon-14 Method	894
<b>40</b>	<b>Silicon</b>	897
40.1	Si Facts about Silicon	897
40.2	A Question From Antiquity Is Answered	901
40.3	Silicates – The Basic Building Blocks of Rocks	902
40.3.1	In the Middle of the Periodic Table	902
40.3.2	A Simple and Elegant Architecture	903
40.3.3	Nesosilicates	905
40.3.4	Sorosilicates	906
40.3.5	Cyclosilicates	907
40.3.6	Inosilicates – Chain and Band Structures	908
40.3.7	Phyllosilicates – Flat Sheets With Infinite Extent	909
40.3.8	Tectosilicates – A Three-Dimensional Network	911

40.3.9	Solidification of Molten Rocks and Formation of the Earth	912
40.4	Silicon – A Key Material in Modern Technology	913
40.4.1	Our Need for Amplification	913
40.4.2	Metal or Nonmetal?	913
40.4.3	Conductors and Semiconductors – Another Principle of Division	914
40.4.4	Silicon Disks From Silicon Valley and Integrated Circuits from Taiwan	915
40.5	Other Applications for Silicon	918
40.6	Silicon in the Environment	920
40.6.1	Silicosis and Asbestosis	920
40.6.2	Essential for Some Species	920
<b>41</b>	<b>Germanium</b>	<b>923</b>
41.1	Ge Facts about Germanium	923
41.2	The Discovery of Germanium	927
41.3	Occurrence and Manufacture	930
41.4	Properties and Uses	931
41.4.1	The Transistor – The Greatest Invention of the 20th Century?	931
41.4.2	Infrared Optics	932
41.4.3	Fiber Optics and Other Communications Networks	932
41.4.4	Polymerization Catalysts	933
41.5	Germanium in the Environment	933
<b>42</b>	<b>Tin</b>	<b>935</b>
42.1	Sn Facts about Tin	935
42.2	Tin in History	939
42.3	Tin, Stannum, Cassiterite – Why These Names?	941
42.4	Tin in Cornwall, UK	941
42.5	Tin Minerals and Ores in the World	942
42.6	Manufacture of Tin Metal	944
42.7	Uses of Tin	944
42.8	Tin Cry and Tin Pest	945
42.9	Modern Tinning	946
42.10	Tin in the Environment	946
<b>43</b>	<b>Lead</b>	<b>949</b>
43.1	Pb Facts about Lead	949
43.2	Lead in History	953
43.2.1	From Time Immemorial	953
43.2.2	Plumbum and Molybdos	953
43.2.3	Lead in Water Pipes and Kitchen Pans	954
43.2.4	Lead in the Armed Services	957
43.2.5	A Champion of the Environment in Antiquity	957
43.2.6	Historical Lead Deposits	958
43.3	The Geology of Lead	959



43.3.1	The Mineral Galena	959
43.3.2	Lead Ores	959
43.4	World Production of Lead in Mines	960
43.5	The Manufacture of Lead Metal	961
43.6	Lead Is Still Used	962
43.6.1	Lead in Crystal Glass	962
43.6.2	Metallic Lead	963
43.6.3	Lead in Alloys	964
43.6.4	Lead in Accumulators	965
43.6.5	Tetraethyl Lead for Knocking Protection – A Use That Is Disappearing	966
43.6.6	Paints – With and Without Lead	968
43.6.7	Environmental Actions Achieve Results	968
43.7	Why Is Lead an Environmental Problem?	968
<b>44</b>	<b>Nitrogen</b>	<b>971</b>
44.1 N	Facts about Nitrogen	971
44.2	Discovery of Nitrogen	975
44.2.1	Who Discovered Nitrogen?	975
44.2.2	Daniel Rutherford in Edinburgh	976
44.2.3	Air and Fire	977
44.3	Occurrence of Nitrogen	978
44.3.1	Nitrogen in Aquatic Ecosystems	978
44.3.2	Saltpeter – Potassium and Sodium	979
44.3.3	An Inexhaustible Store of Nitrogen	980
44.4	The Great Demand for Soluble Nitrogen	980
44.4.1	Birkeland and Eyde Set Fire to the Incombustible	980
44.4.2	Calcium Cyanamide	980
44.4.3	Technology Imitates Nature	981
44.5	Uses of Nitrogen and Nitrogen Products	982
44.5.1	Nitrogen Gas and Liquid Nitrogen	982
44.5.2	Ammonia and Nitrogen Oxides	983
44.5.3	Fertilizers	983
44.5.4	Gunpowder and Explosives	984
44.6	Nitride Ceramics	985
44.6.1	Engineering Ceramics in General	985
44.6.2	Special Nitride Ceramics	987
44.7	We Cannot Live Without “Malignant Air” – The Biological Role of Nitrogen	987
<b>45</b>	<b>Phosphorus</b>	<b>989</b>
45.1 P	Facts about Phosphorus	989
45.2	A Sensation in Europe	993
45.3	Phosphorus – A New Medicine	994
45.4	Phosphorus in the History of Discovering the Elements	995

45.5	Dangerous Matches and the Safety Match	996
45.6	Phosphorus – Occurrence and Modern Manufacture	997
45.7	Phosphorus for Plants	997
45.8	We Cannot Live Without Phosphorus	998
<b>46</b>	<b>Arsenic, Antimony and Bismuth</b>	<b>1001</b>
46.1 As	Facts about Arsenic	1001
46.1 Sb	Facts about Antimony	1005
46.1 Bi	Facts about Bismuth	1009
46.2	A Workshop for Alchemists	1013
46.2.1	Arsenic – Poison and Medicine	1014
46.2.2	Antimony – Needed for Making Gold	1014
46.2.3	Alchemy, Iatrochemistry and Remedies	1015
46.3	Arsenic	1016
46.3.1	The Discovery of Arsenic	1016
46.3.2	Arsenic Minerals	1017
46.3.3	The Toxicity of Arsenic	1017
46.3.4	Was Napoleon Arsenic-Poisoned?	1017
46.3.5	Manufacture of Arsenic Products	1018
46.3.6	Is There Any Use for Arsenic?	1018
46.3.7	The Assassin’s Poison and a Vital Element	1018
46.4	Antimony	1019
46.4.1	Ointment, Cosmetic and Medicine	1019
46.4.2	The Name “Antimony”	1019
46.4.3	Antimony Metal and Its Alloys in Ancient Times	1019
46.4.4	Antimony – Occurrence and Modern Uses	1021
46.5	Bismuth	1022
46.5.1	Bismuth Metal and Its Alloys in Ancient Times	1022
46.5.2	The Naming of Bismuth	1023
46.5.3	Occurrence and Manufacture of Bismuth	1023
46.5.4	A Metal With Special Properties	1024
46.5.5	Uses of Bismuth	1024
<b>47</b>	<b>Oxygen</b>	<b>1027</b>
47.1 O	Facts about Oxygen	1027
47.2	Oxygen in History	1031
47.2.1	Knowledge About Oxygen Before Its Discovery	1031
47.2.2	Carl Wilhelm Scheele’s Discovery of Oxygen	1032
47.2.3	Joseph Priestley – Faith and Knowledge	1033
47.2.4	The Discovery of Photosynthesis in 1771	1036
47.2.5	Priestley’s Discovery of Oxygen in 1774	1037
47.2.6	Oxygen Discoveries and the Chemical Revolution	1038
47.3	The Occurrence of Oxygen	1039
47.3.1	Oxygen in the Air and Photosynthesis	1039
47.3.2	Ozone	1041

47.4	Manufacture and Use	1042
47.4.1	Oxygen Gas	1042
47.4.2	Ozone	1043
47.5	The Biological Role of Oxygen	1043
<b>48</b>	<b>Sulfur</b>	<b>1045</b>
48.1 S	Facts about Sulfur	1045
48.2	Sulfur in History	1049
48.2.1	Native Sulfur	1049
48.2.2	Sulfur From Pyrite	1050
48.3	Occurrence of Sulfur	1051
48.3.1	Volcanic Sulfur Deposits	1051
48.3.2	Sulfur-Containing Rocks	1051
48.3.3	Sulfur in Natural Gas and Mineral Oil	1052
48.3.4	Pyrite	1052
48.4	Manufacture of Sulfur and Its Compounds	1052
48.4.1	Elemental Sulfur	1052
48.4.2	Sulfuric Acid	1053
48.4.3	Global Sulfur Production	1053
48.5	Uses of Sulfur and Sulfur Compounds	1053
48.5.1	Sulfuric Acid	1053
48.5.2	Sulfur Dioxide	1053
48.5.3	Elemental Sulfur	1054
48.5.4	Sulfur in Various Compounds	1054
48.5.5	Sulfur in Steel	1055
48.6	Sulfur in Life	1055
48.7	The Disturbed Sulfur Cycle	1057
<b>49</b>	<b>Selenium and Tellurium</b>	<b>1059</b>
49.1 Se	Facts about Selenium	1059
49.1 Te	Facts about Tellurium	1063
49.2	Discovery	1067
49.2.1	Tellurium	1067
49.2.2	Selenium	1068
49.3	Occurrence	1068
49.4	Manufacture	1069
49.5	Uses	1069
49.5.1	Selenium	1069
49.5.2	Tellurium	1070
49.6	Roles of Selenium and Tellurium in Biology	1070
<b>50</b>	<b>Halogens</b>	<b>1073</b>
50.1 F	Facts about Fluorine	1073
50.1 Cl	Facts about Chlorine	1077
50.1 Br	Facts about Bromine	1081

50.1	I	Facts about Iodine	1085
50.2		The History of Halogen Discoveries	1089
50.2.1		The Discovery of Chlorine in 1774	1089
50.2.2		Chlorine Bleaching – A Simple but Historical Process	1090
50.2.3		The Discovery of Iodine in 1811	1090
50.2.4		The Discovery of Bromine in 1825–1826	1091
50.2.5		The Discovery of Hydrofluoric Acid in 1771	1093
50.2.6		The Discovery of Fluorine in 1886	1094
50.3		Occurrence and Manufacture	1096
50.3.1		Fluorine	1096
50.3.2		Chlorine	1097
50.3.3		Bromine	1098
50.3.4		Iodine	1099
50.4		Uses of the Halogens	1099
50.4.1		Fluorine	1099
50.4.2		Chlorine	1100
50.4.3		Bromine	1101
50.4.4		Iodine	1102
50.5		Halogens and Health	1103
50.5.1		Fluorine – Skeleton and Teeth	1103
50.5.2		Chlorine – Vital Yet Highly Dangerous	1103
50.5.3		Bromine – Medicines and Drugs	1107
50.5.4		Iodine – Thyroid Gland	1107
<b>51</b>		<b>Noble Gases</b>	<b>1109</b>
51.1	He	Facts about Helium	1109
51.1	Ne	Facts about Neon	1113
51.1	Ar	Facts about Argon	1117
51.1	Kr	Facts about Krypton	1121
51.1	Xe	Facts about Xenon	1125
51.2		The Discovery of Argon	1129
51.2.1		A Hundred-Year-Long “Sleep”	1129
51.2.2		The Awakening	1129
51.2.3		A Scotsman Intervenes	1130
51.2.4		Assiduous Scientists and an Idle Element	1131
51.3		The Discovery of the Other Noble Gases	1132
51.3.1		Helium	1132
51.3.2		Krypton	1133
51.3.3		Neon	1134
51.3.4		Xenon	1134
51.3.5		Nobel Prizes for the Discoverers	1135
51.4		Manufacture of the Noble Gases	1135
51.4.1		Helium From Natural Gas	1135
51.4.2		Other Noble Gases From Liquid Air	1135
51.5		The Uses of the Noble Gases	1136

51.5.1	Signs, Lasers and Lighting	1136
51.5.2	Some Very Special Applications	1137
51.5.3	Protection or Shielding Gases	1137
51.5.4	Noble Gases in Plasma Coating	1138
51.5.5	Pressure Medium and Safe Balloon Filling	1140
51.5.6	Medical Use	1140
<b>52</b>	<b>Radioactive Elements</b>	<b>1141</b>
52.1 Po	Facts about Polonium	1141
52.1 At	Facts about Astatine	1144
52.1 Rn	Facts about Radon	1147
52.1 Fr	Facts about Francium	1150
52.1 Ra	Facts about Radium	1153
52.1 Ac	Facts about Actinium	1156
52.1 Th	Facts about Thorium	1159
52.1 Pa	Facts about Protactinium	1163
52.1 U	Facts about Uranium	1166
52.2	Elements Known Before Radioactivity Was Discovered	1170
52.2.1	Uranus – The Father of the Gods in Greek Mythology	1170
52.2.2	Thor – The God of Thunder in Norse Mythology	1171
52.3	Radioactivity	1172
52.3.1	Measuring Radioactivity – The Becquerel	1172
52.3.2	What Is Radioactivity?	1172
52.3.3	Radioactive Decay	1173
52.3.4	Activity and Dose	1174
52.3.5	Radioactive Decay Series	1174
52.4	Henri Becquerel Discovers Radioactivity	1175
52.4.1	X-rays	1175
52.4.2	Uranium Radiation	1177
52.5	Marie Sklodowska-Curie's Early Years	1182
52.5.1	A Young Girl Fights for Herself and Her People	1182
52.5.2	First Degrees and a Happy Time	1183
52.6	Marie Curie's Work for Her Doctor's Degree	1184
52.6.1	A Simple Problem Analysis	1184
52.6.2	Concentrated and Enriching Work	1185
52.6.3	The Discovery of Polonium	1186
52.6.4	The Discovery of Radium	1187
52.7	Marie Curie's Later Life ... and Death	1187
52.7.1	Rewarded for Her Genius	1187
52.7.2	The Tragedy of Death	1188
52.7.3	Curie and Debierne Prepare Radium Metal	1189
52.7.4	An Unprecedented Second Nobel Prize	1189
52.7.5	A Victim of Radioactivity	1189
52.8	Radium – its Importance and Use	1189
52.9	Two Other Key Radioactive Elements	1190

52.9.1	Actinium	1190
52.9.2	Radon	1190
52.10	The Periodic Table Becomes Complete	1192
52.10.1	Number 91, Protactinium – Discovered in 1913–1918	1192
52.10.2	Number 87, Francium – Discovered in 1939	1193
52.10.3	Number 85, Astatine – Discovered in 1940	1193
52.10.4	A Complete Periodic Table	1194
52.11	Thorium as a Technological Metal	1195
52.11.1	Occurrence	1195
52.11.2	Manufacture	1195
52.11.3	Uses	1195
52.12	Uranium as a Technological Metal	1196
52.12.1	Occurrence	1196
52.12.2	Production	1197
52.12.3	Manufacture of Uranium Metal and Isotope Separation	1198
52.13	Nuclear Fission	1199
52.14	The Nuclear Reactor	1200
52.14.1	With Enriched Uranium as the Fuel	1200
52.14.2	Breeder Reactors	1202
52.15	Oklo – Nature’s Own Reactor	1202
52.16	More Than Just 92 Elements – The Transuranium Actinides	1203
52.16.1	The Situation in 1940	1203
52.16.2	Synthesis and Discovery	1203
52.16.3	Uses of the Transuranium Actinides	1207
52.16.4	Physical Properties	1208
52.17	The Elements After the Actinides – The Transactinides	1208
52.17.1	The Situation at the Beginning of the 1960s	1208
52.17.2	New Discoveries	1209
52.17.3	Notes About the Elements	1210
52.17.4	An Island of Stability	1212
52.17.5	The Properties of the Transactinides	1213
52.17.6	Naming of the Elements – a Continuous Cause of Dispute and Controversy	1213

## Preface

This book was originally written as a trilogy in Swedish with the title *“The Elements on Earth and their Discovery”*. It was aimed to describe the history of the element discoveries but also the elements origin in the earth crust and their manufacturing as well as their properties and use in modern technology. The trilogy was published by *Industrilitteratur* in Stockholm 1998–2000 and was very well accepted. The books seemed to be suited for all interested in science and modern technology as well as for those interested in history of science. A periodical for teachers in natural sciences characterized the trilogy as a *“gold mine to dig in for all teachers in science but also for teachers in sociology and history”*.

In English the book is more than a translation of the Swedish trilogy. It contains indeed the same moments of discovery history, element occurrence, winning and manufacturing, as well as element properties and use. The environmental viewpoints have however been given more space. This book, unlike the Swedish original, also deals with the transuranium elements. Another difference is that the fact tables at the beginning of every element chapter have been considerably extended to provide encyclopedic character. The structure of the book is presented in Chapter 1, *Introduction*, where general information about the different literature sources is also given.

From the very beginning of the work with this book project, the *Swedish National Committee for Chemistry* supported it, for which I thank especially its chairman at that time, Professor Bengt Nordén. Many thanks are also due to Svend V. Sölver, former lecturer at the Swedish School of Mining and Metallurgy and to Dr. Sven Arvidsson at The Geological Survey of Sweden. They have commented on the manuscript, critically and amicably, and they have given much of mineralogical and geological information of value for the book. Svend V. Sölver has also provided all the mineral photos. Cordial thanks are also directed to Professor Stig Rundqvist of Uppsala University, Sweden, and Professor Fathi Habashi of Laval University, Canada, who have both shown great interest and support for the project. Stig Rundqvist also read the Swedish manuscript and discussed selected parts of it. I am also grateful to Dr. Björn Arén at Örebro University, who read and commented parts of the first manuscript in English.

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Their contributions and confidence made this book project possible. I warmly thank the Committee and the Foundations.

It is the author's expectation that professional chemists, physicists, mineralogists, and metallurgists as well as students on different levels will find the history of the elements, their discovery and properties interesting and exciting. Also that the fact tables at the beginning of every element chapter shall be useful both in industrial and academic research and education. I dare also believe that this book shall be a bridge-builder over the gap between science and technology on one side and culture and humanistic topics on the other side. To persuade technicians and scientists to be interested in cultural and historical questions and – on the other hand – make humanists interested in science as culture and of modern technical applications.

Örebro, June 2004

*Per Enghag*