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Per Enghag

Encyclopedia of the Elements

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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

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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.

The Swedish National Committee for Chemistry, the Knutsberg Foundation, Uppsala, and the Carl Trygger Foundation, Stockholm, have given economic support.

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

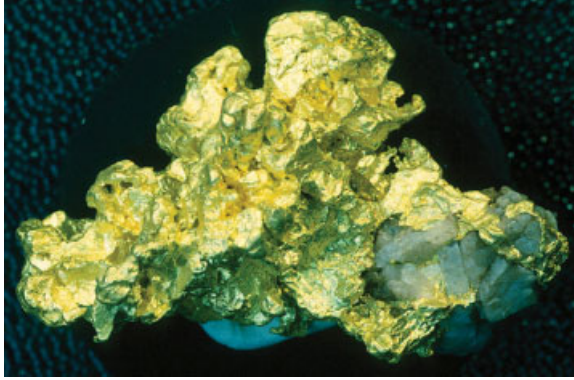
It is the author's expectation that professional chemists, physicists, mineralogists, and metallurgists as well as students on different levels will find the history of the elements, their discovery and properties interesting and exciting. Also that the fact tables at the beginning of every element chapter 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

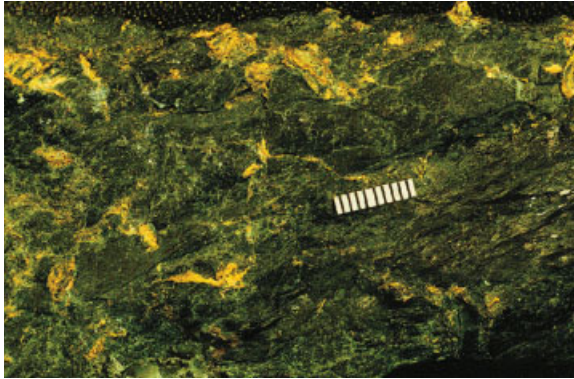
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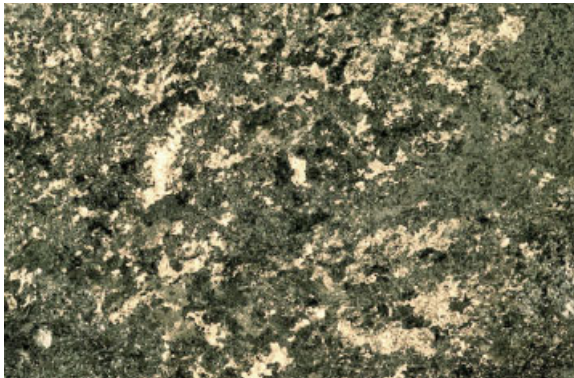
M1 Gold Au, aggregate of fine cubic crystals from Ditz Mine, Mariposa County, California, U.S.A.



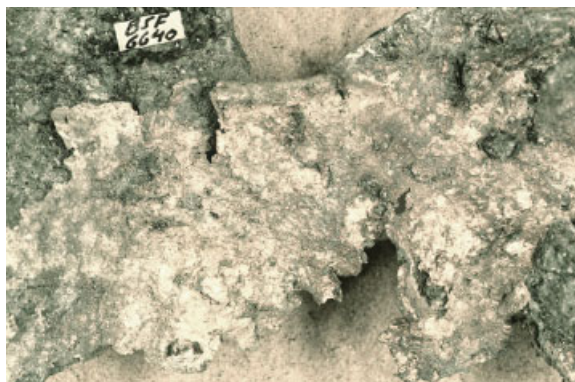
M2 Gold Au on mylonitic rock, from ETC's gold mine Sheba, Barberton, South Africa. From the collection of Rob H. Hellingwerf.



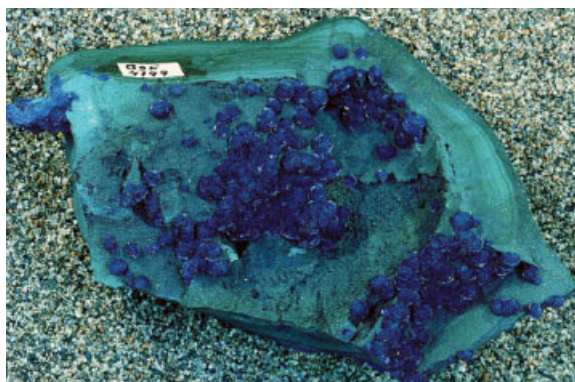
M3 Gold-silver alloy, electrum Au-Ag from the copper mine in Falun. The sample is from the 350 m level.



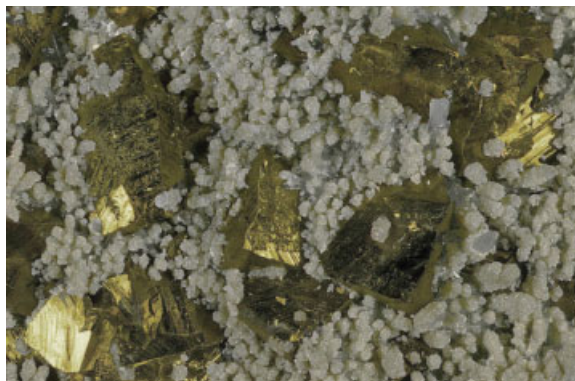
M4 Silver Ag from North Ltd, Zinkgruvan Mine in central Sweden. The silver has been precipitated on a fracture in a working stope on the 190 m level.



M5 Malachite and azurite. Monoclinic crystals of blue azurite $\text{Cu}_3(\text{OH})_2(\text{CO}_3)_2$ on green malachite $\text{Cu}_2(\text{OH})_2\text{CO}_3$. From Bogoslovsk in the Ural Mountains, Russia.



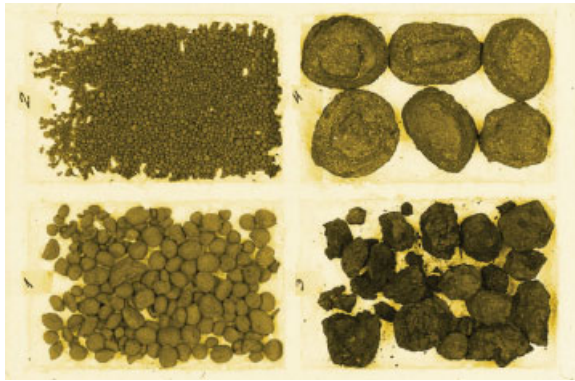
M6 Chalcopyrite CuFeS_2 . Yellow tetragonal crystals of chalcopyrite between smaller, white crystals of quartz, overgrown with barite (heavy spar, barium sulfate BaSO_4). From the mine Baia Mare in Romania.



M7 Meteorite iron with Widmanstätten structure, found in Xiquipilco, the Toluca region in Mexico.



M8 Lake and bog iron ore, mainly consisting of limonite, hydrous iron oxide, FeOOH with varying quantities of water. 1, 2, and 4: Pearl, powder and penny ore from lake bottoms in Småland and Värmland, Sweden; 3: Bog ore from Långban, Sweden.



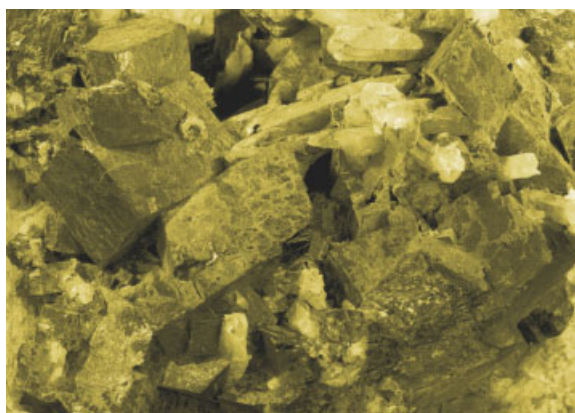
M9 Magnetite Fe_3O_4 or rather, to separate divalent from trivalent iron, $(\text{FeO} \cdot \text{Fe}_2\text{O}_3)$. Octahedral crystals from Norberg in central Sweden.



M10 Hematite, Fe_2O_3 , trigonal crystals, black with a blood-red color when crushed to powder (Greek aimatites, blood stone). From the island of Elba, Italy. Collection of Stig Adolfsson.



M11 Siderite FeCO_3 , trigonal (hexagonal rhomboedric) brown crystals and quartz crystals. Named after the Greek word sideros for iron. From the Ivigtut cryolite mine in Greenland.



M12 Halite, rock salt NaCl . Cubic crystals from the salt mine in Wieliczka, about 1000 years of age, in southern Poland.

