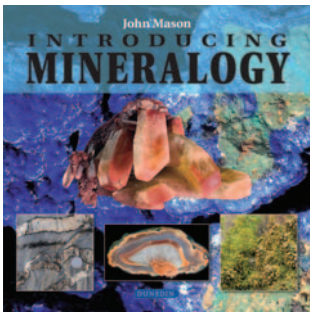
INTRODUCING MINERALOGY[1]

Introducing Mineralogy is aimed at the amateur collector and anyone interested in minerals. It would also be appropriate for an introductory mineralogy class for nonscience majors. The author, John Mason, has done an outstanding job of presenting complex notions in simple terms, providing many examples to which the reader can relate. The book is divided into seven chapters, and throughout, terms defined in the exhaustive glossary are highlighted. The book is also well illustrated, with over 100 color photographs mostly illustrating examples from the UK.



The first chapter presents the basics of mineralogy and crystallography. It can serve as a quick refresher if your notions of mineralogy are dusty. Chapter 2, Typical Mineral Occurrences, introduces the main rock-forming minerals in the context of the three great rock classes. In chapter 3, Atypical Concentrations of Minerals, the processes leading to the formation of ore deposits are explained. Chapter 4, for the would-be collector, introduces this wonderful hobby and gives many tips on how to start. I found it interesting to read about the UK situation as regards mineral collecting. In chapter 5, Studying Mineral Assemblage and Parageneses, the minerals are discussed under different scales of magnification, starting with hand sample observations and passing to thin section characteristics and scanning electron microscope images. The uses of minerals are outlined in chapter 6. The book closes with a discussion of minerals and the environment. In this chapter, the author illustrates how minerals can both cause and cure pollution.

This book would have benefited from rigorous copyediting to reduce many long-winded sentences. The peculiar usage of hyphens (ore-deposits, magma-chambers, heat-engine, fracture-plane, fracture-systems, etc. versus platinum group metals, hand-in hand, fracture walls) and capitals was also distracting to this reader. But all in all, the book is a good introduction to the science of mineralogy.

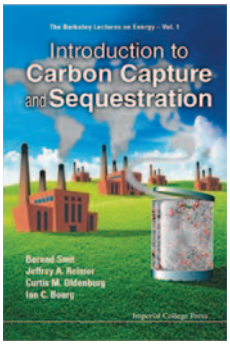
The publisher, Dunedin Academic Press (www.dunedinacademicpress.co.uk), offers many Earth science titles, including a series on classic European localities and an introductory series on aspects of Earth sciences (volcanology, sedimentology, tectonics, etc.).

Pierrette Tremblay, Lévis, Canada

1 Mason J (2015) *Introducing Mineralogy*. Dunedin Academic Press Ltd, Edinburgh, ISBN 9781780460284, 118 pages

INTRODUCTION TO CARBON CAPTURE AND SEQUESTRATION[2]

Introduction to Carbon Capture and Sequestration is the first volume of the Berkeley Lectures on Energy series and is published by Imperial College Press. The book has a very appealing visual format, one that captures the attention of the reader without creating unnecessary distraction. The US-based authors, Berend Smit, Jeffrey A. Reimer, Curtis M. Oldenburg and Ian C. Bourg, are well-known researchers of carbon capture and sequestration (CCS).



The book is organised such that the reader, whether familiar or new in the field, can build up their knowledge of the main questions regarding energy production and usage and what the consequences of each are in terms of carbon emissions. Following the introductory chapter on energy and electricity, there follows a very good description of current atmospheric and climatic models and a discussion of their associated uncertainties (chapter 2). In this chapter, the authors venture into the realm of philosophy to discuss the "Truth" behind climate models and how scientists approach these very complex systems that are fraught with uncertainties.

Chapter 4 provides an excellent mix of describing the current technological solutions to carbon capture and explaining the thermodynamic laws that control gas separation. A graph showing the dependence of separation work on molar content of CO_2 is most informative and the discussion on parasitic energy of the carbon capture process makes very good teaching material. In the following chapters (5–7), the authors get inside the main carbon capture process and discuss absorption, adsorption and membrane techniques. Again, the mix of technological descriptions with thermodynamic basis and insights into molecular design is very pedagogic and nicely illustrates the different research areas involved in these carbon separation processes. There are also some simplistic cost analyses relating to the absorption and adsorption CCS technologies that might give the reader an idea of the complexity of investment decisions regarding this expensive technology. The chapter on membranes (chapter 7) is more front-edge and research-oriented and provides insights into the potential routes for carbon-capture efficiency.

In chapter 8, the authors provide a basic introduction to geological sequestration. Here, they illustrate the main CO_2 trapping mechanisms involved and the various geological settings that are favourable to carbon-dioxide storage. The mechanisms and their associated scientific challenges are discussed in chapter 9, called "Fluids and Rocks": a deceptively generic title that hides a thorough description of the various trapping processes. Chapter 10 is a discussion of the consequences and challenges of large-scale CO_2 geological sequestration (storage); the final chapter (chapter 11) discusses the difficult issue of geo-engineering as a mitigation route for CO_2 emissions.

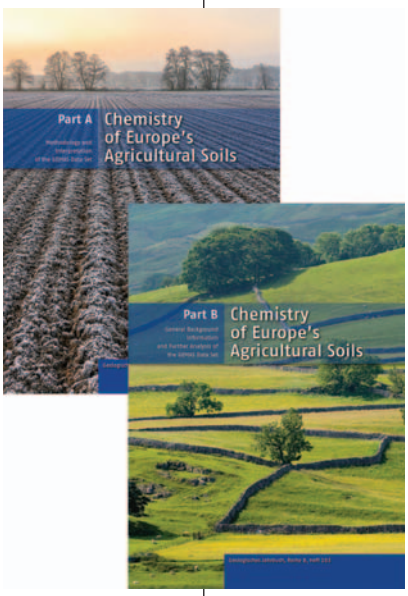
Overall, I highly recommend this book for any scientist wishing to understand CCS from different perspectives: the culprits, the global consequences, the potential solutions for mitigation of carbon emissions, the technologies involved in carbon capture, and the science behind the processes controlling carbon capture and storage. Everything is written in a clear and rigorous fashion with plenty of illustrations and associated web support. My only negative comment is that the authors do not use the international metric system in their work. This is somewhat surprising for a book that touches on a global issue. Nevertheless, I wish that this excellent book had been available when I started working on CCS some 15 years ago.

Jordi Bruno, Barcelona, Spain

2 Smit B, Reimer JA, Oldenburg CM, Bourg IC (2015) *Introduction to Carbon Capture and Sequestration*. Imperial College Press, London, ISBN 978-1783263288, 596 pages

CHEMISTRY OF EUROPE'S AGRICULTURAL SOILS[3]

This two volume set (Parts A and B) arose from a project called the Geochemical Mapping of Agricultural and Grazing Land Soil in Europe (GEMAS). In this project, 2108 soil samples from ploughed land (0–20 cm depth)and 2023 samples of grazing land (0–10 cm depth) were collected in 2008/9 over an area of 5.6 million km^2, at a density of about 1 per 2,500 km^2. This was accomplished by a tremendous consortium of European national geological surveys, geologic institutions, academics, and industry. These groups used the same sampling protocols, with chemical analyses of all samples being carried out at specific labs. This ensured maximum comparability of the results from 33 countries across Europe. Oh, except Albania, Belarus, Malta, Moldova and Romania, which appear as blank spaces on the maps. Others outside Europe were also involved, from Australia, Canada and New Zealand. It was a truly international effort.



I hear you ask, "What chemical analyses did they make on these samples?" Well, quite a lot: too many to list here, in fact. In summary: total elemental analysis for 41 elements, aqua regia extractions for 53 elements, pH, effective cation exchange capacity (eCEC), total carbon, total organic carbon, lead isotopes, magnetic susceptibility, partial extractions for 56 elements, percent clay, and solid–liquid partitioning of elements. A real data-fest! Apparently, the project is not finished: for example, Sr isotope data are now being collected.

You may have noticed that industry was involved, and wonder why. The GEMAS project, and much of the funding, came from the European and international metals industries and industry associations. The chief reason behind this is the European Registration, Evaluation, Authorisation and Restriction of Chemicals (REACH) regulation that came into force in 2007. In that same decade, many of us were involved in the collection of biological data on the risks of metals in soils. These studies developed algorithms that relate biological effects to key soil properties, which ultimately control the bioavailability in soils of metals on a continental scale. Hence, the GEMAS project was borne to provide the soil chemical data in order to perform the risk assessments for each substance.

Part A covers the sampling protocols, preparation methods, analyses and quality control of the results in a clear way, followed by the more mathematical aspects, such as the methods used for data analysis and mapping. Multivariate analyses include cluster and principle component analysis of the elemental data. The remaining four fifths of this volume gives detailed information on the distribution of each analyses, followed by a synthetic discussion chapter that looks at the influence of geography, geology, mineralisation, natural processes, anthropogenic influences, soil management (ploughed versus grazed land) and deficiency, and toxicity.

Part B is quite different. The first half provides background information on the soils, geology and mineral deposits in Europe, as well as several chapters on specific materials of interest (e.g. radionuclides, aeolian deposits, the elements As, B, C, Cd, Cl, F, and Se). The second half is divided into two parts: the first on mobility and risk assessment of metals; the second on regional interpretations, which concentrate on Norway, Sweden, Finland, and the Ukraine. Remembering that REACH was a big motivation for the GEMAS project, it is the mobility and risk assessment portion of this volume that really stands out. Furthermore, the methodology for using the data under REACH is excellently described by two industry authors. They use Cu and Mo as examples to illustrate the amazing range of "predicted no (biological) effect concentrations" (PNECs) in European soils. Their specific examples illustrate how the combination of biology (toxicity assays in different soils) and soils data can be used for risk assessment and control of chemicals. In great contrast, the chapter on the use of mobile metal ion analysis (MMI®) sticks out, because the details of this partial extraction are not given and, as a result, we do not know what the extractants are. Furthermore, all of the REACH studies showed that these kinds of partial extractants did not improve the relationships between toxicity bioassays and soils data.

Perhaps the most disappointing finding for the project members was that there were very few differences in any of the measured chemical properties (apart from organic carbon) between ploughed and grazed soils. As these were *agricultural* soils, it may be that grazed soils are not permanent in the sense that they are often tilled and re-seeded. Indeed, the sampling instructions for this survey state that soil should not have been disturbed by ploughing in the last 10 years. How would the surveyors know, and is 10 years long enough time to be considered "undisturbed"? Nevertheless, interactions between climate, geology and substrate on the distribution of many elements shone through, as did the effects of glaciation and aeolian deposits. Both books have a list of abbreviations, and there are particularly useful statistical Appendices in Part B. One omission I feel is that there is no index in either book.

A focus on REACH (i.e. potential toxicity) is not the only use of these volumes. They will be useful for teaching and research in many areas, including environmental, climate (soil carbon), agriculture and food, geological and geochemical processes, amongst others. In this context, Part A includes a DVD with all of the data sets (I am already using them in a research project), graphics and maps, along with additional maps, graphics and tables that are not in the book. These are invaluable resources. At 3.6 kg together, these books are not light reading on the plane. But what they do represent is an unrivalled reference source on the geochemistry of Europe's agricultural soils.

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Harpenden, United Kingdom

3 Reimann C, Birke M, Demetriades A, Filzmozer P, O'Connor P (eds) (2014) *Chemistry of Europe's Agricultural Soils*. Part A: Methodology and Interpretation of the GEMAS Data Set. 538 pages, ISBN 978-3-510-96846-6, €118 and Part B: General background Information and Further Analysis of the GEMAS data set. 352 pages, ISBN 978-3-510-96847-3, €78. Published by Schweizerbart Science Publishers

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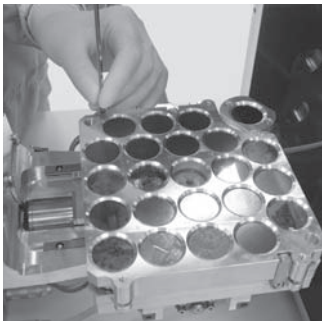

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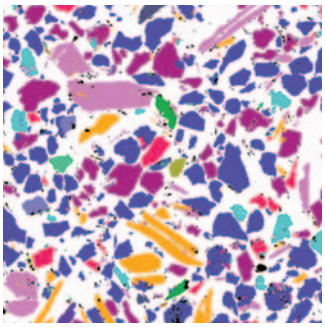

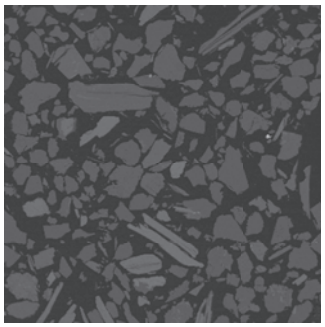

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