

Chapter 2 Minerals

Learning Objectives

After reading this chapter, completing the exercises within it, and answering the questions at the end, you should be able to:

- Describe the nature of atoms and their constituents, particularly the behaviour of electrons and the formation of ions.
- Apply your understanding of atoms to explain bonding within minerals.
- Describe mineral lattices and explain how they influence mineral properties.
- Categorise minerals into groups based on their compositions.
- Describe a silica tetrahedron and the ways in which tetrahedra combine to make silicate minerals.
- Differentiate between ferromagnesian and other silicate minerals.
- Explain some of the mechanisms of mineral formation.
- Describe some of the important techniques for identifying minerals.

Minerals are all around us: the graphite in your pencil, the salt on your table, the plaster on your walls, and the trace amounts of gold in your computer. Minerals can be found in a wide variety of consumer products including paper, medicine, processed foods, cosmetics, electronic devices, and many more. And of course, everything made of metal is also derived from minerals.

As defined in Chapter 1, a mineral is a naturally occurring combination of specific elements arranged in a particular repeating three-dimensional structure (Figure 1.4.1).

“Naturally occurring” implies that minerals are not artificially made. Many minerals (e.g., diamond) can be made in laboratories, but if they can also occur naturally, they still qualify as minerals.

“Specific elements” means that most minerals have a specific chemical formula or composition. The mineral pyrite, for example, is FeS_2 (two atoms of sulfur for each atom of iron), and any significant departure from that would make it a different mineral. But many minerals can have variable compositions within a specific range. The mineral olivine, for example, can range all the way from Fe_2SiO_4 to $\text{FeMg}_2\text{SiO}_4$ to Mg_2SiO_4 . Intervening compositions are written as $(\text{Fe},\text{Mg})_2\text{SiO}_4$ meaning that Fe and Mg can be present in any proportion, and that there are two of them for each Si present. This type of substitution is known as **solid solution**.

Most important of all, a mineral has a specific “repeating three-dimensional structure” or “lattice,” which is the way in which the atoms are arranged. We’ve already seen in Chapter 1 how sodium and chloride atoms in halite alternate in a regular pattern. That happens to be about the simplest mineral lattice of all; most mineral lattices are much more complicated, as we’ll see.

Some substances that we think must be minerals are not because they lack that repeating

Chapter 2 Minerals

Tobias Bleicker



Chapter 2 Minerals:

Rawlins Resource Management Plan United States. Bureau of Land Management. Rawlins Field Office, 2004
Resource Management Plan Amendment for Federal Fluid Minerals Leasing and Development in Sierra and Otero Counties, 2003

Minerals *latu sensu* and Human Health Celso Gomes, Michel Rautureau, 2021-05-18 This volume provides a comprehensive academic review of both positive and negative effects of minerals on human health and quality of life The book adopts the concept of mineral *latu sensu* mineral *l s* which encompasses a broad spectrum of natural inorganic solid and crystalline of natural and inorganic chemical elements metals and metalloids of modified natural minerals of biominerals and of syntetic minerals all products that branch across the disciplines of earth soil environmental materials nutrition and health sciences Using this broad framework the authors are able to provide a multidisciplinary assessment on many types of minerals which can be essential beneficial and hazardous to human health covering applications in medical geology medical hydrology or balneotherapy pharmacology chemistry nutrition and biophysics The book performs historical analyses of the uses of minerals for therapeutic and cosmetic purposes to better understand current trends and developments in mineral research and human health The book will be of interest to students public health officials environmental agencies and researchers from various disciplines as well as scientific societies and organizations focusing on medical geology health resort medicine crenotherapy hydrotherapy and climatotherapy and on pharmaceutical cosmetic and biomedical applications

Macro-Economics of Mineral and Water Resources Kaulir Kisor Chatterjee, 2015-03-06 This book highlights the indispensability of minerals the vulnerability of humans and issues faced by governments around the world regarding the management of natural resources It addresses the growing land ecology mining conflicts energy security and water policies of different countries bringing these issues into focus and critically analyzing them The book discusses the role of governments regarding the security centric issues pertaining to sustainability of mineral supply and the welfare centric aspects of sustainable development of mineral resources The latter includes the current trends for corporate social responsibility political viability of mining projects industrial ethics human health and human resource development The Annexure I is unique It is a list of 925 familiar consumer products and processes with the names of the minerals metals and rocks as well as the intermediate chemicals and alloys that go into the making of that product or process alongside each Annexure II is an up to date exhaustive list of about 835 minerals metals rocks and intermediate chemicals and alloys and against each of them is a list of the names of the end products and processes for which they are used These two annexures will serve as a day to day reference source for teachers students and professionals concerned with minerals as well as other interested readers The book will be useful to any university institution with undergraduate and post graduate teaching research facilities and libraries in the field of geology mining mineral economics planning and natural resource management About the Author Kaulir Kisor Chatterjee studied Applied Geology at the Indian School of Mines Dhanbad for his post

graduate and PhD degrees He served in the Indian Bureau of Mines for over three decades and retired in early 2004 as Chief Mineral Economist Post retirement he has occupied himself mostly with writing teaching and lecturing in various institutions of repute in India on the subject of mineral economics Besides 50 technical papers he has authored eight books He has worked in various Government committees and expert groups and was involved in organization of national mineral inventory UN Framework Classification system of mineral resources rationalisation of the mineral taxation royalty and mineral legislation framework in India He has been examiner and member of selection boards of UPSC India and is also a recognised guide of the Nagpur University for doctoral research His resume has been included in the Marquis Who Is Who of the World and in the 2000 Outstanding Intellectuals of the 21st Century Cambridge Environmental Management of Solid Waste Wim Salomons,Ulrich Förstner,2012-12-06 Dredged Material and Mine Tailings are two of the same thing once they are deposited on land they must be safe guarded wash out must be prevented and they must be protected by a plantcover This comprehensive two volume treatise covers both important aspects of their management Environmental Management of Solid Waste turns to the practical applications such as prediction restoration and management while in Chemistry and Biology of Solid Waste the principles and assessment are scientifically studied and discussed Previously dredged material was a commodity it could be sold as soil e g to gardeners In the meantime dredged material from the North Sea e g the Rotterdam or Amsterdam harbor must be treated as hazardous waste Many environmentalists managers and companies do not know how to solve the inherent problems This new work deals with the chemical physical and biological principles the biological and geochemical assessment the prediction of effects and treatment and finally with restoration and revegetation It is written by many leading scientists in the various fields and will prove invaluable for managers and politicians who are concerned with the present environmental situation

United States Code United States,1928 **Mines and Minerals** ,1915
Geology of North Carolina: chap. 1. The minerals and mineral localities of North Carolina, by F.A. Genth and W.C. Kerr
North Carolina Geological Survey (1883-1905),1875 **Surface Management of Public Lands Under the U.S. Mining Laws, 43 CFR 3809** ,1980 **Minerals, and how to Study Them** Edward Salisbury Dana,1896 Oil and Gas Rights on the Public Domain and on Private Lands Robert Stewart Morrison,Emilio Dominguez De Soto,1920 *Mason's United States Code Annotated, 1926* United States,1929 *Publication - Michigan Geological and Biological Survey* Michigan. Geological and Biological Survey,1911 *Industrial Minerals and Rocks* American Institute of Mining, Metallurgical, and Petroleum Engineers,1960 **Minerals and Mining Industries in the Areas Served by the Canadian National Railways** Canadian National Railways. Department of Natural Resources,C. Price-Green,Canadian National Railways,1927 *Revised Civil Statutes, Penal Code & Code of Criminal Procedure of the State of Texas* Texas,1926 **The Mining Laws of the British Empire and of Foreign Countries** Gilbert Stone,Commonwealth Institute (Great Britain),1920 *Principles of Metallurgy* Charles Herman Fulton,1910 **The Canada Year Book** Canada. Dominion Bureau of Statistics,1929

Wisconsin Session Laws Wisconsin, 1872

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