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Book Review

Book Review: Earth Materials: Components of a Diverse Planet
(2019) By Dexter Perkins, Kevin R. Henke, Adam C. Simon, Lance D. Yarbrough. CRC Press. ISBN 9780429197109, 556 pages. https://doi.org/10.1201/9780429197109

When reading the title, *Earth Materials*, there are immediate expectations raised that not only will mineralogy be discussed, but a discourse on petrology presented as well. There are relatively few texts available that meet both of these expectations. Mineralogy texts naturally concentrate on mineral chemistry, crystallography, and systematics, while most petrology texts emphasize igneous and metamorphic rocks, leaving sedimentary petrology to separate texts. With the broadening of interdisciplinary majors and degree tracks in geoscience or geoscience-related majors (i.e., engineering geology, environmental science), the need for concise, combined texts that appropriately represent the broad spectrum of Earth materials, and their contexts, has increased.

Across the 16 chapters of *Earth Materials: Components of a Diverse Planet,* the basic concepts of mineralogy and all three major types of rocks are discussed, with the appropriate supporting concepts from chemistry and physics, all with relevant examples placed generally within a plate tectonic context. Many of these examples are among the world-class locations frequently used in Earth materials textbooks, but are not always among the most physically accessible in the world. This book departs from other mainstream texts by including not just minerals and rocks, but other materials that are fundamental to the development and fractionation of Earth materials, such as sediments, soils, and water. Of particular note is the section on engineering properties, which is almost never included in Earth materials texts, yet offers vital applications of the preceding content and an interesting launch point for more advanced study in engineering geology.

The text starts in a fairly conventional manner with the composition of the Solar System and the Earth, and the necessary nucleosynthesis for the creation of elements within the periodic table. There is a standard progression through basic mineralogy, but the text in this section does not dwell on chemistry, mineral formulae, or deriving weight-percent composition of minerals. It offers only a brief description of mineral solid-solution series and ternary representations of composition, preliminary to later discussions of processes within the types of rocks themselves. What sets this text apart is the natural extension of this material into a very strong yet clearly presented section on mineral crystallography, which cannot help but to engage students. Multiple representations of mineral coordination, structure, and symmetry are presented in a logical sequence.

What follows are sections of plutonic and volcanic rocks and related landforms, sediments and sedimentary rocks and stratigraphic principles, and metamorphic rocks, all with a relatively light touch of chemistry and a heavy dose of physical processes, textures, and resultant features.

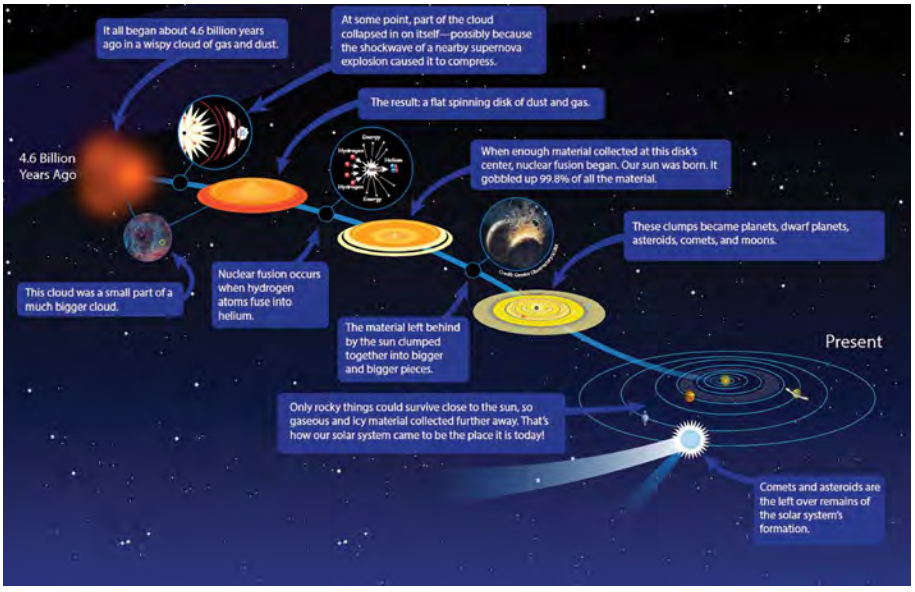

Figure 1.12 Stages in the formation of a solar system according to the Solar Nebula hypothesis. Drawing from NASA.

Figure 1.12, Earth Materials. (Perkins et al., CRC Press.)

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Fractionation as a process is discussed in a somewhat variable manner across these sections, being more strongly represented with igneous rocks, implicit in sediment texture development, and diminished with metamorphic rocks. The chapter on metamorphism seems overly brief, beginning first with texture development and then facies types and their representations through mineral reactions. Simplified phase diagrams are used, but these are focused on prograde processes. Unlike other sections, the metamorphic chapter has little in the way of tectonic setting representations.

Weathering is presented in a chapter separate from sedimentary rocks and processes, with a focus on how material is broken up rather than how it is distributed. Once again, chemistry is discussed in general terms, with an emphasis on the mineral antecedents and outcomes and less on the processes and reactions of chemical weathering in and of themselves. That said, the second focus in this section, on soil formation and distribution, is a vital connection between the geosphere, the hydrosphere, and the atmosphere. The text concludes with a fairly conventional yet detailed and contemporary discussion of economic and energy resources, with some concern for the environmental consequences of their exploitation. Human history with mineral exploitation is discussed, providing some context for students that may be pursuing a non-bedrock geology degree track. There is a substantial section on nuclear energy and the consequences of its use, as well. The final part, the aforementioned engineering section, offers a means of tying many previous components together into a much more specialized study. Appropriate quantitative modeling techniques are introduced, ready for use in more advanced courses.

The text is written in plain language at the appropriate level of conversational tone. It is never intimidating nor turgid and tends to draw the reader along quite handily. There are voluminous illustrations and diagrams throughout the text, the majority of which are clear and representative. Some of the illustrations, however, lack a clear scale that would aid students new to the material, and several schematic diagrams are simplified to the point of distortion. That said, the graphics support the text and are not mere ornamentation.

There remains the question of audience for this text. While it lacks sufficient depth in either mineralogy or petrology to be of use in conventional courses of either type, it would be of considerable value in courses that require both mineralogy and petrology, as well as related Earth processes. These courses could include an honors-level or advanced physical geology course, a pre-mineralogy or pre-petrology course, or a course for prospective teachers of science. While no specific laboratory exercises are provided, the vignettes at the beginning of each chapter would have utility in developing exercises for laboratory or online classes. The text would be of particular use to students majoring in environmental science, civil engineering, or engineering geology tracks, where the conventional year of mineralogy and petrology is both too much and not enough at the same time. *Earth Materials* fills a growing need as the geosciences, or the need for geoscience information, evolves into new curricula and more specialized programs.

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