

BOOK REVIEW

Environmental Interactions of Clays, edited by A. Parker and J.E. Rae. Springer, Berlin, 1998, 271 pages. [\$87.95]

In *Environmental Interactions of Clays*, Park and Rae have written an introductory chapter and assembled six additional chapters on crucially important topics involving clay-size minerals and our understanding of them. These are topics we need to understand as we cope with our environment in our collective attempts to live without fouling our nest. The authors of these chapters were keynote speakers at a 1996 meeting at Reading, England. The aim of the editors “is to illustrate the importance of clays in a wide range of environmental studies through the use of some specific examples.”

As major fields of study divide into disciplines and these into more and more sub-disciplines, it becomes more difficult to understand the jargon, and even concepts, from one sub-discipline to another. Many scientists cannot keep up with all aspects of their own specialty, let alone those that border their disciplines. The most important aid in keeping communication open among disciplines and sub-disciplines is careful attention in using a common vocabulary and the avoidance of jargon that excludes all but those within a small group. This is why nomenclature committees are so important. In addition, all who write hoping to reach audiences beyond their own laboratories need to empathize with the reader, recognize which words or equations are likely to be confusing, and recognize which concepts can be conveyed better with a carefully designed illustration. Editors of books such as this one have a particular obligation to monitor how their contributors use language, to insist on the use of accessible language, and to identify aspects that need clarification. In addition, I think readers have the right to expect that chapters in collections such as this one are current and are written at approximately the same level.

The editors of this book do not meet these obligations and expectations. My primary objections are: (1) The quality and the technical level of the audience addressed by these chapters varies widely. (2) In several of the chapters, published work on the topic at hand is not well covered. (3) The chapters vary widely in how current they are. (4) Most of the chapters do not consistently use nomenclature advocated by the internationally recognized nomenclature committees of the Association Internationale pour l'Etude des Argiles (AIEPA) and The Clay Minerals Society (CMS).

The introductory chapter signals the problems encountered in some of the following chapters. The editors offer an unconventional classification of clay minerals, referring to them as “layer-lattice aluminosilicates” on one page and “sheet silicates” on the next. They warn that the authors have interpreted *clays* in various ways, which they have. Parker and Rae (p. 4) have reversed the meanings of *absorption* and *adsorption* (AGI Glossary, 1997). In light of the difficulty in distinguishing montmorillonite from beidellite, and that beidellite is probably the more important form of smectite in soils, it would have been a welcomed clarification if the authors had uniformly used smectite instead of montmorillonite,

except in the specific instances where montmorillonite is warranted.

There is much useful information here. The best example is T.A. Jackson's chapter, “Biogeochemical and Ecological Significance of Interactions between Colloidal Minerals and Trace Elements,” which sizzles with the author's energy and enthusiasm that he sustains through a long 112-page chapter; the summary alone takes four and a half pages. In this exemplary chapter, one is deluged with 362 references. For example, in support of one statement he offered 43 references. Jackson uses conventional nomenclature, with these exceptions: at one point he slips and uses “layer-lattice” as a descriptive term for the structure of the clay minerals and uses “montmorillonite” instead of “smectite.” He clearly states how he is using the terms clay and clay mineral, and I was pleased to find crystal “structure” instead of crystal “lattice.” His use of nomenclature suggests that he understands mineralogy. He mentions the work of almost everyone pertinent to his topic, including major workers like Sposito and Schwertmann. He emphasizes the ubiquity of microbial influences, and argues that organics and oxides of Fe and Mn are often more effective than clay minerals as sorbents. These oxides tend to coat everything from clay minerals to the hard parts of insects and single-celled organisms. The involvement of these coatings in sorption and desorption reactions, he concludes, is generally overlooked or underestimated. Jackson clearly summarizes the problems that need addressing and the complexities of natural systems in which there is a mixture of heavy or trace elements, colloid-sized organic matter, simple oxides, organisms, and clay minerals. Currently, Jackson asserts, despite data from experiments in which variables can be controlled and from a number of careful field studies, there is no way to predict reliably how a heavy or trace element will behave in a natural setting.

The chapter by W.A. House, “Interactions of Non-Volatile Micro-organic Pollutants and Clay Minerals in Surficial Environments,” also offers much information. However, this chapter is also an example of jargon forming a firewall between author and reader. The chapter was pretty confusing the first time through. With the help of colleagues, a second reading was more illuminating. Still, we were not able to understand the term “micro-organics,” other than as it relates to small organic compounds, but without any indication of what small means or why it might be important. Nomenclature was again a problem. For example, “gibbsite” should not be used to describe the octahedral-sheet surface of kaolinite; “gibbsite-like” comes close, but why not be specific? This chapter bothered me more than any other because it appeared to have something significant to say, but I couldn't quite fathom what it was.

In “Transport of Radionuclides in Smectite Clay,” R. Pusch offers a straightforward description of using smectite to isolate radioactive materials. As a model of the lattice (*sic*) of smectite, he offers a choice (p. 7–8) between the model of Hofmann/Endell/Wilms, which was published in 1933, and the model of Edelman/Favejee, published in 1940, without

any justification for these anachronisms or why they were included.

The chapter by J.B. Dixon, "Roles of Clay and Oxide Minerals in Soil," although a short, simple, and clear exposition of the topic, is of little use to most readers. One would be better served by going to *Minerals in the Soil Environment*, Dixon and Weed, 1989, for a more complete coverage of this and related topics.

"Clay Barriers in Landfills," by J. Arch, is quite different than the chapter by Jackson. Arch takes the reader on a slow, unfocused walk through his topic pointing here and there, and does not seem prepared to deal in any depth with the topic. I encountered vocabulary and concepts that I found puzzling, e.g., "bentonite" is not a "synthetic" clay, "well-graded" apparently means the opposite of "uniformly-graded," "It is also well established that permeability increases at moisture contents dry of optimum: . . .;" and terms such as "plant" and "teething problems" used in unusual ways. Other unfamiliar terms include "grouzers," "travellers," "proof rolled," and "blinding layer." Some of these terms were not recognized by my engineering-geology colleagues, suggesting that these terms are from outside of their discipline. Arch writes using almost an outline form or list style. The last 14 of his 33 pages is a case study of the actual paperwork, weekly and monthly reports, detailed quality control (QC) and quality assurance (QA) steps, assignment of responsibilities for particular steps to specific people, etc. If he is writing for engineers, this chapter has little value. For those outside of the engineering-geology discipline, it is inaccessible.

J.C. Wagner and co-authors finish the book with "Clay Minerals and Health." Although this chapter may have unfamiliar terms for many readers, the authors provide a glossary that covers nearly all. These authors, more than any of the others, make connections between social forces and their science. The authors comment, for example, that reducing dust levels is expensive and more lung problems are tolerated in some situations than in others on this basis. This chapter seems a rather light review of the topic and not very current.

References cited by each author measure how current the treatment is and how fully the treatment is integrated with

the work of others on related topics. On the first point, there is wide variance in this volume. Jackson's chapter includes at least one 1997 and several dated 1996 and 1995. In contrast, Pusch offers only six references other than to his own publications. Wagner and co-authors offer the most out-of-date references. Of 43 references, eight are 1991 or later, and only three are as late as 1994. For the second point, as I compared similar works on the same topic, I was amazed at the lack of overlap of the references. For example, Wagner *et al.* make no mention of the *Health Effects of Minerals Dusts* (Guthrie and Mossman, 1993).

A word about price: \$23 for one of the short-course notes of The Clay Minerals Society (CMS), *Organic Pollutants in the Environment* (Sawhney, 1996) (\$18.00 for members) and \$32 for the Mineralogical Society of America (MSA) volumes, *Health Effects of Minerals Dusts and Geomicrobiology: Interactions Between Microbes and Minerals* (Banfield and Nealson, 1997) (\$24 for members), are far better bargains than \$87.95 for this one, which covers many of the same topics.

In summary, illustrations are generally clear and useful, although too few; there are few typographical errors, and there is a useful index. However, you had better come to this book, at least for most of the chapters, with a deep understanding of clay-size minerals, their properties, and their generally accepted nomenclature, or you may be misled. I repeat, these are crucially important topics, and other than the MSA and CMS volumes mentioned above, I can think of no other place where such information is collected. Except for the chapters by Dixon and Jackson, they do not communicate very well beyond a rather small audience. Expect to have to work unnecessarily hard to understand some of these chapters. The distance between sub-disciplines will not decrease until we rather deliberately begin to write more user-friendly articles with the intended, broader audience clearly in mind.

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