**Principles of Igneous Petrology** by Sven Maaløe. Springer-Verlag, Berlin, 1985, 374 p., 291 figures, $48.50.

THE COMPLEXION OF igneous petrology has evolved considerably over the last decade or so, with new tools and approaches being applied to petrological problems with increasing frequency. Sven Maaløe's new textbook fills an important niche in this evolving field. Maaløe focusses primarily on chemical and physical processes in magmas, without any attempt to duplicate the more classical and descriptive aspects of igneous petrology covered in other texts. The book is written at a graduate student level and generally assumes some familiarity with the subject matter.

The book starts with a quantitative treatment of experimental and theoretical phase equilibria. Monary, binary, ternary and pseudobinary systems are explored in the first chapters through discussion of both abstract and real systems. Crystallization and melting paths are considered at some length. This is followed by chapters covering P-T diagrams, the principles of Schreinemaker's analysis, and the effects of volatiles on phase equilibria. The processes of partial melting and fractional crystallization are taken up again in two longer chapters, this time with a more pronounced emphasis on applications to the origin of common magma types and quantitative modeling methods. Fractionation laws for major and trace elements are treated in some detail. The next two chapters on magma kinetics and magma dynamics consider topics such as diffusion, crystal nucleation and growth, and the density, viscosity, convection and ascent of magmas. These two chapters collectively constitute nearly a third of the book and provide a good introduction to these rapidly advancing topics. The text concludes with a brief and rather independent chapter on isotope geology.

The book is extensively illustrated, with many interesting and original diagrams. Literature through 1981 is well represented in the bibliography, with more scattered citations to 1984. The index is quite brief, but this deficiency is partly offset by a remarkably detailed table of contents (about 200 entries). Several typographical errors were noted, a few of which could lead to some confusion.

The strengths of *Principles of Igneous Petrology* lie in its quantitative approach and in that it collects, in one place, discussion of many of the chemical and physical processes of importance to modern petrological studies. An extensive set of equations applying to phase equilibria, element fractionation, and other aspects of magma chemistry and physics make this book a valuable reference. The principal weakness of this book is that its readability and clarity are variable. Certain sections require very close attention in order to avoid confusion. In some cases, material or concepts are used prior to their formal introduction. A number of the figures could be improved by better and more complete labeling and captions. These problems generally will be but a minor inconvenience to professionals using the book, but students may encounter greater difficulty. More lucid discussions of certain topics can be found elsewhere (*e.g.*, phase equilibria as applied to basalts in S. A. Morse's text, also by Springer-Verlag), but I know of no text that is reasonably close to Maaløe's in overall scope and level of coverage. It is worth considering for use in graduate classes covering the chemistry and physics of magmas.

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**Chemistry of Atmospheres** by Richard P. Wayne. Oxford University Press, 1985, 355 p., $39.95 cloth, $19.95 paper.

IT IS A CURIOUS aspect of atmospheric chemistry that the remote ionosphere, at heights above 100 km, is better understood than the troposphere in which we live. Understanding of the chemistry of the middle atmosphere, the stratosphere and mesosphere, is intermediate. This inverse relationship between remoteness and understanding reflects different levels of complexity and different degrees of measurement difficulty. Ionospheric chemistry is relatively simple. Only a dozen or so chemical reactions are important and the chemically active species are the most abundant ions and neutral molecules. Their concentrations are therefore relatively easy to measure once the logistical problem has been overcome. In the troposphere, on the other hand, the number of important reactions is larger by at least an order of magnitude and the predominant species are chemically unreactive. The most important participant in tropospheric chemistry is the OH radical. Its mixing ratio or mole fraction is less than $10^{-13}$ and its concentration has not yet been directly measured. Our knowledge of this radical in the troposphere is entirely theoretical.

The scientific study of atmospheric chemistry has made great progress in the last two decades as a result of improved field and laboratory measurement capabilities and as a result of new awareness of possibly harmful changes in the atmosphere. There is now a sufficient body of knowledge to constitute an academic discipline or at least to provide the subject matter of a course at the graduate level. Richard Wayne has approached the subject from the point of view of a physical chemist and has written a textbook based on a course that he has taught at Oxford University. This textbook is easy to read and the material with which it deals is well chosen. The treatment of controversial or poorly understood subjects is balanced. While there are no citations in the text, each chapter includes a comprehensive, annotated bibliography.

The subjects covered are reasonably representative of research activity in this field. They include stratospheric ozone and anthropogenic threats to its concentration, chemistry of the troposphere including air pollution, acid rain, and increasing concentrations of several trace gases, ionosheric chemistry and the chemistry of excited metastable chemical species, air glow radiation, planetary atmospheres including their origin and evolution, climatic change and the climatic impact of trace gases. The opening chapters provide useful background information on chemical kinetics, biogeochemical cycles, atmospheric physics, and the function of numerical models of atmospheric processes. The value of this book for use in the classroom is diminished by an approach that is exclusively qualitative and descriptive. No calculations are presented. No examples are worked out. There are no exercises or problems. Indeed in only a few cases are rate constants even quoted. There is no opportunity for the student to decide for himself which reactions are important or how fast certain processes occur. So the book does not teach the methods of atmospheric chemistry. The reader does not learn how to think like an atmospheric chemist nor how conclusions were reached and results obtained. But, as an accurate account of the present state of knowledge in this flourishing new field of chemical research, this work is an outstanding success.

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