Principles of Igneous and Metamorphic Petrology; by ANTHONY R. PHILPOTTS, P. 498, num. figs. Englewood Cliffs, 1990 (Prentice Hall, $46.90).—This is a most impressive book. Philpotts has written the first text since Turner and Verhoogen's *Igneous and Metamorphic Petrology* to provide both an integrated and rigorously quantitative treatment of igneous and metamorphic systems. The book is intended to be an undergraduate petrology text, but it could certainly serve as a reference in many graduate courses as well.

Philpotts has achieved a beautiful balance between the descriptive aspects of petrology on one hand and the quantitative aspects required for interpretation of processes on the other. With respect to igneous rocks, standard topics such as classification schemes, forms of igneous bodies, phase diagrams, and igneous rock associations are all presented in an up-to-date and straightforward manner. This material is linked with clear expositions of fundamental processes including magma flow and crystallization, assimilation and magma mixing, convection, cumulate formation, and trace element behavior. In terms of metamorphism, Philpotts covers the "basics" such as metamorphic facies and textures and then goes on to discuss topics currently of great interest including diffusion, advection, and mass transport processes in general, heat transport and P-T-t paths, and thermobarometry. The presentations of igneous and metamorphic phenomena are unified with a comprehensive introduction to thermodynamics, including an extensive discussion of solutions. Furthermore, the important processes of crystal nucleation and growth, so often neglected in textbooks, are presented in detail, establishing a kinetic basis for petrologic interpretation. In the final chapter of the text, "Origin of Rocks," Philpotts does an outstanding job of integrating igneous and metamorphic systems in a general plate tectonics framework. Throughout the book's 22 chapters, derivations of important equations are clear and concise. Each chapter ends with an excellent set of problems designed to both reinforce and expand the student's understanding.

The only serious problem that I have with this book is that stable and radiogenic isotope systematics, such an important part of modern petrologic study, are regulated to one rather short chapter near the end of the text. Moreover, petrologic interpretations of isotopic data are virtually absent from the rest of the book. Thus, the student does not get a clear idea of what isotope petrology is "all about" and will have to learn this important information elsewhere.

Although designed primarily for undergraduates, instructors should keep in mind the advanced level of the text. Indeed, to appreciate fully all the material in this book, one should have a working knowledge of mathematics to the level of partial differential equations. In my experience using this book with undergraduates at Yale, I found that in order to be successful, students must have completed all their introductory mathematics, chemistry, and physics courses. While it is possible to skip

around in the book and leave out the most advanced material, this severely disrupts the flow of an undergraduate course and should be avoided. Once the students got over their initial shock of actually having to *use* their basic mathematical and scientific training, they truly began to enjoy this text. By the time final exams rolled around, most had acquired a genuine sense of accomplishment in having been able to apply quantitative analysis to geologic problems. Instructors should also keep in mind that in addition to many high-quality line drawings and field photos, numerous examples in this book are illustrated with photos of petrographic thin sections. In order to avoid confusion, students should either have already had optical mineralogy or be taking it concurrently with their lecture course in petrology.

In summary, this is a landmark text that is destined to become a classic. Every undergraduate, graduate student, and professional interested in igneous or metamorphic rocks should have a copy.

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