physics with no guarantee that any specific part of it is relevant to geologic problems. Even if he is able to absorb the new material and to develop the ability to use it to solve specific problems, there is the final hurdle of translating geological observations into solvable physical problems. It is doubtful that any textbook or course can make the task an easy one, but *Physical Processes in Geology* is a remarkably successful attempt to make it less frustrating.

Let me illustrate the style and organization of the book by considering its treatment of sheet structure in granites. The author starts with a review of observations of the sheeting phenomenon and proceeds to a discussion of the details of sheeting fractures, including quantitative data on the length, number, and spacing of fractures as a function of depth. This section, which contains a considerable number of new observations by the author, is an excellent introduction to the phenomenon. It is followed by a theoretical interlude in which the concepts of strain energy, initial stress, and Griffith crack theory are developed in a clear, self-contained treatment, building on earlier theoretical portions of the book. These concepts are then used to develop a theory that explains quantitatively many of the observed relations. Finally, the concepts are used to discuss the problem of brittle fracture of rocks in general.

By applying this technique to an imaginative choice of geological topics Johnson is able to interweave a remarkably complete introduction to solid mechanics with discussion of specific mechanical processes in geology. Bending of layers is dealt with in the context of laccolith formation, buckling of layers in terms of Bailey Willis's experiments on the formation of Appalachian folds, use of polar coordinates in terms of the Spanish Peaks dike swarm, plastic flow in terms of the flow of debris in channels, and slip lines and plastic indentation problems in terms of the transport of large boulders by debris flows. The mathematical background required is differential and integral calculus and a smattering of differential equations. The reader who has the perseverance to read the whole book carefully and work the numerous problems in the text will be introduced to more advanced topics such as differential equations, both ordinary and partial, separation of variables, Fourier series, and the use of characteristics in hyperbolic partial differential equations. With respect to solid mechanics, the persevering reader will find a sound introduction to the strength-of-materials approach, two-dimensional elasticity including polar coordinates, slow viscous flow and the elastic-viscous analogy, perfectly plastic, power-law, and Bingham materials, the Mohr circle, the Coulomb fracture criterion, strain energy, and Griffith crack theory. The only important topics in static and quasistatic solid mechanics that are not treated are variational and numerical methods.

More important than the breadth of material covered, however, is that for each topic the reader will see the method developed to the point of solving nontrivial problems. In addition, he will see numerous examples of the process of formulating a solvable physical problem from a set of geologic observations. Continually stressed by precept and example is the point that the physical model of a geologic process should be simple enough that it can be solved and its predictions tested against the real world and complicated enough that it explains the principal features of the natural situation. For example, in discussing debris flows Johnson considers models that use perfectly plastic, Newtonian viscous, Bingham, and power-law rheologies. He points out that the main selection criterion is that the rheology should be adequate to model the particular aspect of the phenomenon under consideration, and that different models may be equally valid—neither perfect plasticity nor viscosity is adequate to explain the main features of the flow of debris in channels, but the Bingham and power-law models fit the observed data equally well.

A number of the geologic problems discussed are based on work by Johnson and his students, appearing in print for the first time. Although this work is both interesting and significant, I think the principal value of the book is as a teaching tool. It is a truism today that research and education in geology should become more quantitative and process-oriented; *Physical Processes in Geology* is both an example of how this reorientation can be carried out and a demonstration of the increased understanding of geological phenomena that will be gained.

WILLIAM M. CHAPPLE
Department of Geological Sciences,
Brown University,
Providence, Rhode Island

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