Continental Landforms

Geomorphic Systems of North America. WILLIAM L. GRAF, Ed. Geological Society of America, Boulder, CO, 1987. vii, 643 pp., illus. $48.50. Decade of North American Geology Project: Centennial Special Volume 2.

In 1879 the first edition of G. K. Gilbert's volume on the geology of the Henry Mountains left the Government Printing Office. That landmark contribution included a chapter entitled "Land sculpture" in which Gilbert developed the concept of equal action and interdependence between landforms and the processes acting on them, a theory of "dynamic equilibrium." A decade later, William Morris Davis in a lecture to the National Geographic Society on the rivers and valleys of Pennsylvania proposed "to go back . . . to the early date when central Pennsylvania was first raised above the sea and trace the development of the . . . river systems . . . from their ancient beginning to the present time" and thus determine the denudation chronology of the central Appalachians. Gilbert and Davis, in what might well be considered the first decade of modern North American geomorphology, revolutionized the discipline with these ideas.

As part of its series on the state of knowledge of North American geology and geophysics in this decade, the Quaternary Geology and Geomorphology Division of the Geological Society of America has produced a volume that represents a century of research on the landscape of North America. This volume is testimony that the themes that Gilbert and Davis advanced, the dynamic interaction of landforms and surface processes and the erosional history of landscapes, remain as strong as ever within modern geomorphology.

Organized by physiographic regions, this is an ambitious work, a synthesis that outlines significant advances and points to important areas for future research. Since Gilbert and Davis, classic geomorphic problems of landscape evolution—the evolution of large river systems, such as the Appalachian drainage and the Colorado River system, and the development of widespread erosion surfaces, such as occur in the Front Range of the Colorado Rockies and in the Sierra Nevada—while by no means resolved, have been attacked with the benefit of new tectonic models of crustal deformation as well as increased stratigraphic detail and absolute-age control. Remote-sensing technology has provided a regional view of the landscape, supplied important analogies for understanding landforms on other planetary surfaces, and enabled analysis of previously inaccessible terrain. Still, vast areas of the continent—the Arctic Lowlands, the Canadian Shield, the Alaskan Coastal Ranges, and the Basin and Range—remain relatively understudied, and our knowledge of landform evolution in these areas is rudimentary and fragmentary.

Process geomorphology studies have advanced to such a degree that detailed budgets of sediment production, storage, and output can be constructed for small drainage basins; weathering rates and residence time can be calculated for regolith profiles like the Piedmont saprolites; and microlaminations in desert varnish can be correlated with climate change. But the lack of coverage of certain topics clearly highlights the need for future research. The dearth of information on the fluvial terraces in the Appalachians and the Atlantic and Gulf Coastal Provinces, despite their significance for measuring neotectonic crustal adjustments and for understanding the response of river systems to sea-level fluctuations and Quaternary climate change, is one example. Likewise, far more work is needed before we understand the range in magnitude of earth surface processes and the relative effect of different frequency processes in land sculpture.

Given the diversity of the regions and topics covered, this book is a tremendous resource. I found the chapters that dealt with areas with which I am unfamiliar the most interesting. For example, the chapter on the Canadian Shield is excellent. Here, the glacial landforms, spectacularly illustrated with aerial photographs, are presented as distinct assemblages forming concentric zones about the Keewatin Ice Divide, assemblages that provide clues to the dynamics of the ice sheet. From this perspective the book excellently fulfills the function of educating geomorphologists about different regions and should play an important role as a starting point for research. Nevertheless, the coverage is by no means uniform or exhaustive; instead individual chapters and, in most cases, sections of chapters are standalone contributions that stress the important research in each region. The inevitable unevenness of the writing is a small price to pay for the expert commentary on so vast a subject.

Finally, the volume is a bellwether for geomorphic research in North America. One clear trend, evident in nearly every chapter, is the increased attention to the interplay of tectonism and geomorphic processes. Geomorphic data are used to determine rates of tectonic processes (for example, uplift of the Nicoya Peninsula in Costa Rica), and landform evolution is explained in conjunction with well-constrained tectonic data (for example, the evolution of the Columbia River system). Most important, though, is the broad regional view that the contributors to this volume have provided by using data collected during a century of research to focus once again on the geologic evolution of a continental landscape.

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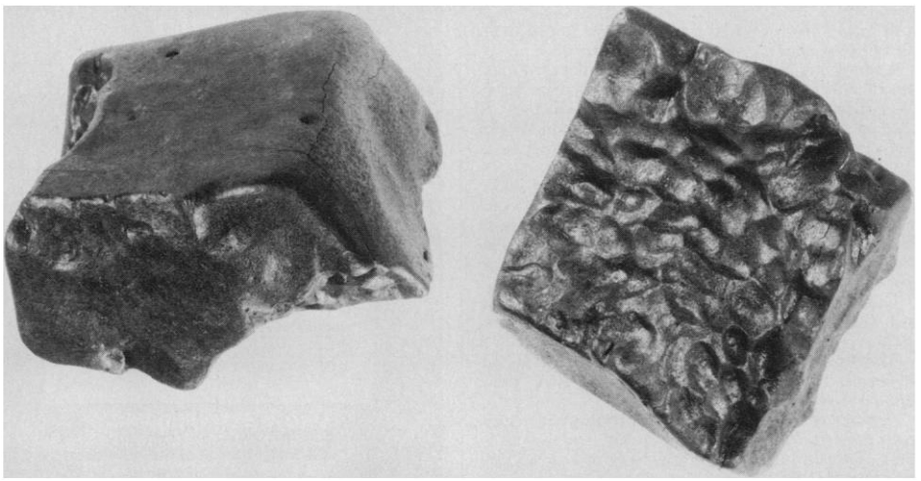
Samples of the Solar System

Meteorites and Their Parent Planets. HARRY Y. MCSWEEN, JR. Cambridge University Press, New York, 1987. xii, 237 pp., illus. $24.95.

Meteoritics is a difficult subject to present at an elementary level. One cannot assume that the reader understands the nuances of petrology, radioisotope dating, celestial mechanics, or of many other specialized topics that are integral parts of the study of meteorites. In *Meteorites and Their Parent Planets*, however, Harry McSween succeeds remarkably well in presenting this complex subject in a way that any well-educated person can understand.

After an introductory chapter that summarizes the history of the study of meteorites, the book is arranged in a series of paired chapters, the first of which summarizes what is known about a given category of meteorites and the second of which describes what is inferred about their parent bodies. The jargon of meteoritics is defined in the text, and these definitions are supplemented by a comprehensive glossary at the back of the book. Specialized topics such as radioisotope dating, partial melting and fractional crystallization, and metamorphism are explained in brief asides as they become important to the discussion. An especially valuable aspect of this mode of presentation is that it gives the reader a feeling for the nature of science as a process, not simply an accumulation of facts. McSween clearly shows that there are alternative interpretations of the data and many unresolved questions. The annotated references at the end of each chapter are helpful in steering the interested reader toward more complete discussions of certain topics and to the primary literature.

The style and format of McSween's book contrast with those of another recent semipopular book on the subject, *Thunderstones and Shooting Stars* by R. T. Dodd. Although Dodd covers much of the same material as McSween, his presentation is less technical, as in his rather clever analogy between a



"The heat built up during rapid deceleration and the violent air movements around a falling meteorite may also produce thumbprint-like depressions called 'regmaglypts'. These two different views of the Allan Hills 81013 (Antarctica) meteorite illustrate the smooth appearance of the leading edge during flight [left] and regmaglypts on the trailing edge [right]." [From *Meteorites and Their Parent Planets*; photographs courtesy of the Smithsonian Institution]

packing crate filled with fruits and nuts and the crystal structure of the mineral olivine. Dodd's book is more an overview of the history of meteoritics and a summary of the currently most widely accepted interpretations of meteorite data. It is a smoother, more polished presentation, but it glosses over or ignores many controversies and has a disappointingly short reference list.

I have one quibble with McSween's book, and that concerns the discussion of cratering in the first chapter. First, the collision of a high-velocity meteoroid with a planet produces an impact crater, not an explosion crater. The difference is not simply one of semantics: although there are many similarities in the physics of how impact and explosion craters form, there are also significant differences. Second, the discussions here and in the book suggested for further reading are based on a fairly outdated model; unfortunately, I know of no nontechnical reviews of the more current models of crater formation.

The degree of simplification of complex issues required for a book of this type necessarily involves the omission of a certain amount of detail, and specialists might complain that in some cases the simplification verges on distortion. This is not, however, a book for specialists, as are R. T. Dodd's *Meteorites: A Petrologic-Chemical Synthesis* and J. T. Wasson's *Meteorites: Their Record of Early Solar System History*, the two most up-to-date technical monographs on the subject. It is valuable as an easy-to-read introduction to the science of meteoritics that cogently integrates the many disparate lines of evidence concerning these samples of our solar system and their origins. It can be read with profit by those who wish to expand their general knowledge and may, it is to be hoped, tantalize some young people into pursuing careers in this intriguing field.

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State-of-the-Art Materials

Fine Ceramics. SHINROKU SAITO, Ed. Elsevier, New York, and Ohmsha, Tokyo, 1987. xxii, 352 pp., illus. $59.95.

"Fine ceramics" are those high-technology, inorganic, nonmetallic materials that are characterized by a uniform, fine grain structure. They are made from specially synthesized raw materials processed to have properties appropriate for demanding thermal, mechanical, biological, magnetic, electronic, optical, and nuclear applications. This book describes recent Japanese research and technical achievements in 39 chapters prepared by many different specialists. Coverage is equally divided among ceramic processing, characterization of materials, structural ceramics, and electronic ceramics. The topics are discussed in a concise, comprehensive way that will give the book lasting value. Ceramics is a field in which the Japanese have been leaders in new discoveries and in technological developments. For working materials scientists, technologists, and engineers, and for those designing devices incorporating state-of-the-art ceramics, this English-language compendium describing recent Japanese work will be very useful indeed.

On another level, the breadth and depth of the new synthetic materials together with the Japanese leadership in the field give pause for thought about the nature of our technology and the ways in which we think about the material world. Shinroku Saito writes in his introduction, "Arguably the most important aspect of the Industrial Revolution is the drastic change in human thinking that it engendered, especially with regard to materials." With regard to electronic ceramics, Hiroaki Yanagida suggests three reasons for the remarkable development of these materials in Japan. "First, the rapid growth of the electronics industry has created an intense requirement for better electronic materials. Second, the Japanese have shown an impressive aptitude for technology and are skilled in the fine arts. Third, education and training have made it possible for people to respond quickly to rapidly changing requirements." These opinions are not explicitly argued, but they are supported by the book as a whole, the data in which suggest that there has been a drastic change in the way engineers and technologists can and do think about materials. We are leaving the era of off-the-shelf purchases and entering an era of materials custom-tailored to optimize device reliability and performance. The Japanese seem to be the leaders in this new way of thinking.

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Bananas. R. H. Stover and N. W. Simmonds. 3rd ed. Longman Scientific, Harlow, U.K., and Wiley, New York, 1987. xvi, 468 pp., illus. $120. Tropical Agriculture Series.

Basic Biotechnology. A Student's Guide. Paul Präve *et al.*, Eds. VCH, New York, 1987. xii, 344 pp., illus. Paper, $29.95. Translated from the German edition (Wiesbaden, 1982).

The Biomedical Investigator's Handbook. For Researchers Using Animal Models. Foundation for Biomedical Research, Washington, DC, 1987. xii, 86 pp. Paper, $10.

Bones of Contention. Controversies in the Search for Human Origins. Roger Lewin. Simon and Schuster, New York, 1987. 348 pp. + plates. $19.95.

The Classification of Stars. Carlos Jaschek and Mercedes Jaschek. Cambridge University Press, New York, 1987. xvi, 413 pp., illus. $79.50.

Cogeneration and Decentralized Electricity Production. Technology, Economics, and Policy. Michael D. Devine *et al.*, Westview, Boulder, CO, 1987. xx, 303 pp., illus. Paper, $28.50. Westview Special Studies in Natural Resources and Energy Management.