Book Reviews

A Centennial Retrospect

Geologists and Ideas. A History of North American Geology. ELLEN T. DRAKE and WILLIAM M. JORDAN, Eds. Geological Society of America, Boulder, CO, 1985. x, 525 pp., illus. $37.50. Centennial Special Volume 1.

Geologists and Ideas is the first in a series of topical volumes, field guides, maps, and transects that are scheduled to be published by 1988 as part of an ambitious project to celebrate the centennial of the Geological Society of America under the Decade of North American Geology (DNAG) project.

This volume consists of 34 chapters volunteered in response to a call for papers by the editors and the society. As the editors concede, "Any volume that depends on the generosity of contributors . . . is not intended to be comprehensive." Unfortunately, the subtitle leads the reader to expect a completeness that is not found.

The volume is written by earth scientists for earth scientists, and earth scientists will find all the chapters interesting—some even exciting. Others will find much of the material heavy going. The science historian, philosopher, or layperson will have to search to gain a feeling of the excitement that the concept of plate tectonics has brought to the earth sciences in recent decades.

The papers provide a sampling of ideas, personalities, and institutions that have been important in the past century of North American geology. To geologists and geophysicists the names of noted contributors—including J. Tuzo Wilson, Preston Cloud, Brian J. Skinner, and Bruce A. Bolt—will in themselves convey some sense of the range of the volume.

The chapters on James Hall and the "discovery of the craton" by Robert H. Dott, Jr., on E. O. Ulrich and "American stratigraphy" by George Merk, and on Joseph A. Cushman and the study of Foraminifera by Ruth Todd underscore the way the imagination, enormous energy, and dedication of individuals advanced the science across a range of subdisciplines. However, many readers will wish that their own geologic heroes had been chosen for special attention.

A chapter on G. K. Gilbert would have seemed mandatory. But Gilbert's presence and influence could not in any event be denied, and his contributions are noted in a review of quantitative geomorphology by Marie Morisawa and in an account of the controversy about the origin of Coon Butte Crater (Meteor Crater) by Ellen T. Drake. Gilbert's contribution to hydrology through the study of mining-induced aggradation of streams in California is described in a chapter about "application as a stimulus to geology" by William M. Jordan.

That small schools as well as large universities have made unique contributions to geology is established by including the histories of geologic programs at the University of Pennsylvania, at Yale, and at Augustana. Brian J. Skinner and Barbara L. Narendra have constructed an artful and interesting history by "rummaging through the attic" at Yale. A diagram that displays the sequence and overlap of personalities at Yale from Silliman through Dana, Penfield, and Pirsson on to Longwell, Knopf, and Flint and to the present faculty suggests how powerfully the timing of personal interactions can influence the science and the profession.

Considering the significance of minerals to the industrial nations, the ten-page chapter by Jordan, although well crafted, interesting, and well illustrated, seems meager indeed. The contribution of geological ideas to the finding of oil and gas is developed in a fascinating account by John T. Galey, who focuses on the "anticlinal theory." The stories of several men who influenced the birth and development of the oil and gas industry, including John H. Galey (the author's great uncle), document how the unusual combination of entrepreneurship and technical vision of a few have advanced both science and industry. This account by Galey is one of the few in the volume that touches on the importance of the interaction between the oil and gas industry and geology.

Chapters representing the development of ideas in geophysics and their impact upon our understanding of the earth include one on paleomagnetism by John Verhoogen, a review of findings about the crust and upper mantle in the western United States by L. C. Pakiser, and a brief history of the development of earthquake seismology, principally in California, by Bruce A. Bolt. The last chapter in the volume looks at North America from space. Paul D. Lowman, Jr., illustrates how remote sensing can give a different perspective of the land over which earlier investigators so laboriously trod. Views of planets and their satellites suggest principles and processes that originally shaped our planet and thus provided the framework for North American geology.

In the chapters by W. O. Kupsch and J. Tuzo Wilson about the exploration of Canada and the Canadian shield and the account of the fate of Barney the mule by Ross R. Brattain, we are reminded of the difficult logistics and hardships, as well as joys and satisfaction, that many of us experience in the field—our geologic laboratory.

The role of governmental organizations in the development of geology is represented by a chapter by Gordon B. Oakeshott on the state geological surveys, with emphasis on that of California, and one primarily devoted to the Geological Survey of Canada by W. O. Kupsch. The perennial difficulties with funding and support are recounted in both chapters. Recognition of the symbiotic relation between universities, provincial surveys, and the Geological Survey of Canada is a significant part of the history. Surprisingly, no chapter is devoted to the U.S. Geological Survey. Even such giants in the geological sciences as Clarence King and John Wesley Powell are barely mentioned; the volume's index shows one reference to King and none to Powell.

The chapter "Wrong for the right reasons: G. G. Simpson and continental drift" by Léo F. Laporte should be required reading for all scientists and students. The history of the geological sciences is replete with examples of great men who, at times, were totally wrong and who, because of the power of personalities, temporarily diverted the flow of ideas away from the correct answers. The fact that an intellect as keen and perceptive as Simpson's, using enormous amounts of data, could marshal such powerful arguments against the concept of continental drift should be sobering to all. Progress in science involves considerable stumbling.

In addition to Laporte's discussion of Simpson's arguments against continental drift, Roger T. Faill and Kenneth J. Hsü include sections about plate tectonics in their papers, and Faill also brings the concept somewhat up to date by a brief mention of "suspect terranes" and "microcontinents." Readers will wish for much more on the subject. Among many other topics and disciplines that are covered incompletely or not at all are geochemistry and petrology. Neither word, and not even the word "granite," is listed in the index. Canadian geologists will be surprised to find that nothing north of about the 50th parallel is considered to be North America, at least according to the maps inside the front and back covers.

Illustrations in the volume include delightful original sketches by such scientist-artists as Dr. Atl and Orestes St. John, and reproductions of many field notes remind us that notetaking can also be an art form. Many portraits of eminent geologists, group pictures, and photographs of places of importance to geology, as well as diagrams and maps, both old and new, give a visual impression of the flow of history.

Despite the misleading subtitle—this is not "A History of North American Geology"—and disappointing omissions, the volume contains a wealth of information and

geologic lore. Adjust one's expectations and one will find the volume to be an important and valuable reference. Some of the chapters certainly will become required reading for all students of the earth sciences.

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Plant Population Biology

Genetic Differentiation and Dispersal in Plants. P. JACQUARD, G. HEIM, and J. ANTONOVICS, Eds. Springer-Verlag, New York, 1985. xviii, 452 pp., illus. $65. NATO Advanced Science Institutes Series G, no. 5. From a workshop, Montpellier, France, May 1984.

The title of this work is somewhat misleading since it implies a specific focus on dispersal and its genetic consequences. Instead the volume represents a sample of current research in plant population biology; some papers examine genetic differentiation and others examine various dispersal phenomena, but these topics are often incidental to their main themes. The main merit of the volume for a North American audience is its strong European, and particularly French, flavor. Fifteen of the 28 contributions are from France, with four each from the Netherlands and the United States and the remainder from Belgium, Germany, Japan, and the United Kingdom. Since all papers are in English, the work serves to introduce the North American reader to current research projects being undertaken in some of the major European laboratories.

The work is organized into four sections, commencing with genetic differentiation, first at the level of molecular variation and single gene polymorphisms and second at the phenotypic level. This is followed by treatments of dispersal, first involving gene flow and second by what is termed phenotype dispersal. The editors have not provided any significant introductory material, conceptual or otherwise. This lack, the scant subject index, and the large number of typographical and translation errors combine to give the impression of a hastily assembled volume.

Over a third of the contributions present electrophoretic data on enzyme polymorphisms both at a local scale and from regional surveys. The technique provides a rich source of markers for studies of mating systems and gene flow, but attempts to characterize the genetic variation and heterozygosity of populations on the basis of a few loci are of doubtful value and undermine the biological significance of a number of contributions. In their examination of the scale of population substructure in the clonal plant *Trifolium repens* Gliddon and Saleem demonstrate how electrophoretic techniques can be most profitably used by population biologists. A novel aspect of their contribution concerns the recognition that in clonal plants the vegetative "dispersal" of inflorescences as plants grow laterally can have an important influence on neighborhood size. Plants of different sizes will tend to disperse their genes by varying amounts. This contribution and a model by Van Dijk on neighborhood sizes in plantains highlight some of the difficulties in the application of Sewall Wright's nieghborhood models to plant populations.

Despite a strong surge of interest in the quantitative genetics of plant populations in North America, relatively few contributions in this volume examine the genetic basis and heritability of life history traits. An exception is Roach's study of phenotypic and genetic correlations between juvenile and adult characters in *Geranium*. Although population ecologists have long been aware that the magnitude of juvenile mortality has important consequences for the evolution of life history patterns, there has been little work on the nature of genetic variation during the prereproductive phase of the life cycle. Roach concludes that despite the presence of considerable genetic variation for fitness during this period in natural populations, response to selection of juvenile traits may be constrained because of maternal effects, negative genetic correlations with adult fitness components, and the enormous microsite heterogeneity of most plant habitats. A short review of interactions between environment and genotype by Kelley, including the "rediscovery" of Finlay and Wilkinson's regression methods for analyzing the performance of genotypes over a range of environments, may presage the emergence of a major field of inquiry in experimental quantitative genetics. It is surprising that despite the long tradition in plant biology of using clonal transplants for examining ecotypical differentiation, population biologists have been slow to take advantage of the clonal nature of many plants to examine how the fitness of genotypes can vary from place to place within patchy environments.

Another poorly understood topic in plant population biology is covered by Hayward in his review of the genetic organization of quantitative traits in rye grass populations. Long-term studies at the Welsh Plant Breeding Station have demonstrated both nuclear and extranuclear control of genetic variation. The latter involves somatic variation, which in rye grass is selectable at the vegetative level. Selection experiments for rate of tiller production within clones indicate that responses are both age- and genotype-specific. Whether somatic selection is an important evolutionary phenomenon in natural populations of clonal plants is not known, but the problem certainly deserves more attention than it has been given. Cytoplasmic variation is also examined in Van Damme and Graveland's study of gynodioecism in *Plantago* in relation to ecological differentiation. The remaining three contributions from the Netherlands also involve studies of plantains, which seem to have become the experimental organism of choice in that country. Similarly, the long-standing interest in *Thymus vulgaris* (thyme) by French workers at Montpellier is reflected by two contributions on the species. Dommee and Jacquard examine the influence of environmental disturbance on female frequency, and Mazzoni and Gouyon describe horizontal structure and covariation of terpene polymorphisms with the floristic composition of vegetation. Both papers emphasize the difficulty of providing conclusive evidence about the nature of selection on plant traits in long-lived perennial plants without the use of experimental transplants and demographic techniques.

In a short but thought-provoking general commentary, Antonovics suggests that the use of summary population statistics has obscured the complexity and internal dynamics of plant populations. The contributions in this volume emphasize this point and indicate how the contrasting spatial and temporal scales involved in population studies can make integration of ecological, genetic, and physiological approaches to the study of populations a difficult but challenging problem.

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Paleoclimatology

Late Cainozoic Paleoclimates of the Southern Hemisphere. J. C. VOGEL, Ed. Balkema, Rotterdam, 1984 (U.S. distributor, International Publishers Service, Accord, MA). xii, 520 pp., illus. $40. From a symposium, Swaziland, Aug. 1983.

The symposium of which this book is the proceedings was motivated partly by marine evidence of a phase shift in climatic change of the two hemispheres, with the southern leading by 3000 years. Australian and New Zealand Quaternists had previously found little evidence for such a phase shift, and there is not much in this book. Most authors