Book Reviews

Davis and the Davisian Cycle

The History of the Study of Landforms or the Development of Geomorphology. Vol. 2, The Life and Work of William Morris Davis. RICHARD J. CHORLEY, ROBERT P. BECKINSALE, and ANTONY J. DUNN. Methuen, London, 1973 (U.S. distributor, Barnes and Noble [Harper and Row], New York). xii, 874 pp., illus. $46.

The first volume of this work, subtitled "Geomorphology before Davis," appeared in 1964. This second volume is devoted entirely to William Morris Davis (1850–1934), American leader in the establishment of geomorphology as a special field of study.

Davis is best remembered for his "geographical cycle," which the authors interpret as an application of the evolutionary idea to the scientific study of landscapes. If some low-lying region were uplifted and subjected to erosion, Davis envisioned that a predictable series of landforms would evolve in the course of denudation. The end result would be an erosional surface of low relief, a peneplain. Configurations of landforms developed during any interval of the cycle would be governed jointly by the structural characteristics of the underlying rocks, the nature of the erosional processes (fluvial, glacial, and so on), and the stage in development toward the peneplain. Successive stages in his ideal cycle Davis characterized in physiologic terms as youthful, mature, and old. Regional uplift prior to or following completion of a cycle might rejuvenate the landscape.

Borrowing terms from the Davis cycle, the authors divide the biography into four parts entitled Youth, Maturity, Old Age, and Final Rejuvenation.

The first section traces Davis's career to 1885, when he was named assistant professor of physical geography at Harvard. Several traits of his personality—his seriousness, his belief in the power of logical persuasion, and his "inflexible faith in his own opinions"—are attributed to the influence of his Quaker grandmother, Lucretia Mott. Grandmother Mott's political and social activism in the causes of women's rights, trade unions, and abolition seems not to have rubbed off on the young Davis, however. Reserved and studious from childhood, he had already developed strong interests in mineralogy, astronomy, and entomology before entering Harvard at the age of 16.

The authors identify three events in Davis's youth that turned him toward geology. In the summer of 1875 Davis took leave from work as a bookkeeper in his father's coal company to attend a summer school of geology in Kentucky and Tennessee. There Nathaniel Southgate Shaler invited him to return to Harvard as his assistant. Davis accepted, but as late as 1882 he had not advanced beyond the rank of instructor, and President Eliot had written advising that there was no immediate prospect of his promotion. Eliot's letter stimulated Davis to improve his professional standing. In the summer of 1883 he undertook geological studies of central Montana under the direction of Raphael Pumpelly; and it was there, as he later remembered, that he began to develop the scheme of the erosional cycle.

The second and longest part of the book traces Davis's rise to international prominence during the interval 1885–1912. With the aid of extensive quotations from Davis's writings, the authors show how the proposition that "all the varied forms of the land are functions of structure, process, and time (or stage)" became the basis of a system of geomorphic analysis that was widely accepted and not seriously challenged until the 1920's. These quotations reveal how Davis expanded the geographic range of the cyclic idea from river valleys to drainage basins, and finally to whole regions; how he extended the conceptual scope of his system to embrace polycyclic as well as monocyclic landscapes; and how he and his followers devised special theoretical models to explain the geomorphic evolution of shorelines, arid regions, glaciated regions, and regions of karst topography. Separate chapters are given to an analysis of the Davisian methodology and to Davis's effectiveness as a teacher and propagandist in his own cause.

The part on old age carries Davis to 1928, when at the age of 78 he published his large book on the coral reef problem. In successive chapters the authors trace Davis's ups and downs related to the death of his wife, the growing opposition to his geographic system in central Europe, his remarriage and "first rejuvenation," the loss of his second wife, his third marriage, and the stimulus provided by his studies of coral reefs. The chapters recounting the attacks on the geographic cycle by Siegfried Passarge, Alfred Hettner, Albrecht Penck, and Walther Penck are particularly illuminating. In the view of these critics the cycle was unreal; it ignored effects on landscape due to changes in climate and to local variations in structure and lithology. At best the cycle was a special case in which upheaval of a region was followed by tectonic rest and *then* erosion. Walther Penck insisted that landforms result from erosion *versus* uplift rather than erosion *after* uplift. Davis's rejoinders to these and other objections, quoted at length in this section of the book, show his stubbornness and skill as a debater. To preserve his system he was willing to make some curious concessions. Valleys which either by reason of slow upheaval or the presence of weak rocks are opened with graded slopes as fast as they are deepened might be described as "born mature," he allowed. Or, if denudation kept pace with slow sustained uplift, the resulting erosional plain might be described as "old from birth."

The final section tells of Davis's last busy years as a lecturer, investigator, writer, and defender of the geographic cycle. During and following his 80th year, Davis wrote 33 original articles, mostly on the physiography of the American West. In the last chapter the authors offer an appraisal of Davis's contributions as preserved in more than 500 articles and books. These publications are listed chronologically in an appendix. Other appendices include a reproduction of Davis's popular philosophical lecture "The Faith of Reverent Science," the Davisian family tree, and a classification of Davis's publications according to subject.

The principal aims of this book are to assess Davis's role in the progress of geomorphology and to identify the environmental factors that molded the man and his ideas. The authors have accomplished both of these objectives, and more. Numerous lengthy quotations selected from Davis's best work,

illustrated with reproductions of his fine landscape sketches and block diagrams, give the book something of the character of an anthology. The bibliography itself is a contribution that will be appreciated by collectors and scholars. Undoubtedly the book will become an indispensable source of reference for geomorphologists.

In his generally favorable review of the first volume (*Science* **146**, 1665 [1964]), J. Hoover Mackin expressed reservations regarding the great length of the book, due partly to the inclusion of topics not directly related to geomorphology. He estimated that the entire work of three volumes would run to around 2000 pages. This estimate will surely prove too small; for now, with 1568 pages behind them, the authors announce that there will be not one but two more volumes. Size, however, is no longer the only problem for the aspiring reader; the second volume is so expensive that many students will not be able to buy it, and the publishers have announced that the first volume is out of print.

Mackin also took exception to certain judgments of Davis's work which he considered unduly harsh, but he withheld free use of his cudgel until the authors could have their full say in volume 2. As it has turned out, Chorley and company have treated Davis with a respect bordering on affection. To be sure they are critical of the Davisian system of geomorphology, mainly on the grounds that it was qualitative and all too little concerned with the dynamics of landscape modification. But the net effect of the book is to magnify rather than detract from Davis's accomplishments.

As a person, Davis emerges as "a Victorian gentleman—proud, disciplined and aloof." As a scientist he is given full credit for demonstrating the dominant role of fluvial processes in arid regions, and more generally for stimulating advancements in most branches of geomorphology. As an educator he is credited with establishing geography as a respected academic discipline in the United States. His major biographical essays on John Wesley Powell and Grove Karl Gilbert are praised as substantial contributions to the history of geological thought.

Members of the Davis Protective Society may now lay down their cudgels.

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Problematic Creatures

Bigfoot. The Yeti and Sasquatch in Myth and Reality. JOHN NAPIER. Dutton, New York, 1973. 240 pp. + plates. $8.95.

Supposed sightings of Yeti and Sasquatch are disappointing evidence in favor of large manlike creatures' living in the mountains of Asia and the Pacific Northwest or anywhere else. The eyewitness always turns out to be a victim of a hoax, commercially implicated, inept at keeping live specimens from getting away, tardy about seeking medical corroboration of rape, or otherwise less than credible. Then, too, honest men make honest taxonomic mistakes about real creatures glimpsed at a distance, or in poor light, or among bushes. Real creatures, however, keep leaving marks behind them in snow or mud, thereby providing tangible evidence for the skeptical and the credulous to throw at one another.

In the Himalayas eight different mammals have played a part in keeping alive the Yeti legend, which, alas for its zoological respectability, seems to depend on a selection of tracks produced by some quadruped moving with a particular gait under the right conditions of snow crust, melting, sublimation, or other processes. A ninth mammal—man himself—adds further confusion: accidentally in the Himalayas by treading barefoot or shod in the tracks of a fellow pilgrim (or perhaps of a snow leopard), deliberately on the Pacific coast by using footprinting devices of various degrees of sophistication. Not all tracks are fakes, according to the author, himself an authority on human walking patterns; indeed, he is impressed by how genuine some tracks seem to be, and how sad it is that at Bossburgh, Washington, the local Sasquatch has a club foot. No hoaxer, the author believes, would be sick enough to create a deformed Sasquatch, strong enough to trundle heavy footprinting equipment through the coastal forests, or smart enough to cover up a conspiracy of counterfeiters operating between California and British Columbia. On the other hand, living off the edible resources of the western mountains would be tough going even for isolated individuals of a large manlike animal, let alone for the populations needed to keep it off the list of endangered species. Also, its waste-disposal habits would have to be a good deal tidier than those for which man himself is noted.

The author's fence-sitting is unlikely to satisfy the extremists; but in a twilight zone of fact and fiction, who cares about scientific realism? Attributing survival value to a belief in the abominable snowman may be going a bit far, but the author has obviously had a wonderful time on his excursion into the art of the insoluble.

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The Study of Amphibia

Evolutionary Biology of the Anurans. Contemporary Research on Major Problems. Proceedings of a symposium, Kansas City, Mo., Aug. 1970. JAMES L. VIAL, Ed. University of Missouri Press, Columbia, 1973. xiv, 470 pp., illus. $20.

It is a fact about the study of the modern Amphibia in the second half of the 20th century that it has still been possible to recommend Noble's *Biology of the Amphibia*, first published in 1931, as a better-written overview and a more intellectually satisfying introduction to this group than anything done since. The book here reviewed does not provide grounds for altering that recommendation.

The title of the volume is itself a misnomer. The phrase "evolutionary biology" currently has much wider implications than these papers would indicate. "The Evolution and Classification of Frogs" would have been a better title. In this regard, the tenor of the book is set by the first chapter, by Frank Blair, which purports to identify "the salient problems in Anuran evolution and those areas of investigation likely to produce significant resolution."

The symposium from which the book results was held in 1970, but the editor advises us that "the contributors have allowed me to revise and elaborate upon their manuscripts until press time in 1972. Thus the papers published here have a recency and a greater body of evidence than the original publications."

The succeeding chapters do provide an impressive fund of information, but the resolution of salient problems that Blair hoped for is not achieved.

Between Noble's book and the present one there came into prominence (all at about the same period, in the late '50's and early '60's) four hypotheses or discoveries that looked especially promising for exactly the topics this book covers: the Orton classification of frogs by larval types (1953,