Book Reviews

Geological Thought from Hutton to Suess

Geology in the Nineteenth Century. Changing Views of a Changing World. MOTT T. GREENE. Cornell University Press, Ithaca, N.Y., 1982. 324 pp., illus. $29.50. Cornell History of Science Series.

For the better part of a century, Karl von Zittel's encyclopedic compendium *History of Geology and Palaeontology to the End of the Nineteenth Century* (London, 1901) has been the only systematic account of geology in the latter half of the 19th century, particularly with respect to continental Europe. Now Mott Greene has challenged this hegemony with a coherent intellectual history that will impress the geologist by its mastery of technical materials, the professional historian by its scope, and the general reader by its accessibility and pace. True, the challenge is not as sweeping as the title of the work suggests, since most of the subfields that constitute geology, including paleontology, stratigraphy, mineralogy, and petrology, are mentioned only in passing, if at all. Rather than a general history of geology in the 19th century, Greene is in fact offering a history of theories of mountain formation and of the origin of continents and oceans. But this restriction is defensible since these are, after all, among the central problems for geologists, and they have long been recognized as such. When William Conybeare declared that the problem of changing levels of land and sea was "the great and fundamental problem . . . of theoretical geology" in his pioneering textbook, *Outlines of the Geology of England and Wales* (1822), he was merely repeating what was already a truism.

Greene traces the successive approaches to this problem from the Huttonian-Wernerian debates of the late 18th century to the demise of the Suessian scheme in the early 20th century. In so doing he centers his account on three "global tectonics" that for brief periods looked as if they might unite the field: first, Elie de Beaumont's theory of a cooling, contracting earth in which episodes of paroxysmic upheaval accompanied by floral and faunal extinctions were separated by long, quiescent intervals; second, Eduard Suess's magisterial synthesis of the collective fieldwork of the 19th century in *The Face of the Earth*, with its insistence that contraction, subsidence, and the enormous lateral dislocations of the overthrust mountain belts were the key to geological understanding; and third, Thomas Chamberlin's efforts, in the face of challenges to the contraction theory posed by thermodynamics and isostasy, to develop a cosmologically and geologically sound synthesis that also preserved the concepts of periodic orogeny and marine cycles of transgression and regression. But Greene's message is that none of these syntheses survived for any length of time and that the science of geology in the 19th century progressed not through the adoption of a rigid theoretical framework but through persistent debate and controversy on even the most fundamental issues.

This perspective enables Greene to escape unthinking acceptance of widely held ideas about the history of geology. Many of these have already been abandoned by the small community of historians of geology, but the scope of Greene's alternative analysis should bring their weaknesses to the attention of a wider audience. For example, Lyell and other British geologists, normally revered for their influence on Darwin, turn out to be minor figures in this story, whereas European geologists such as Beaumont, Suess, and the Nappe theorists in the Alps, as well as Americans like James Hall, the Rogers brothers, and J. D. Dana, loom large. The usual identification of uniformitarians and catastrophists as the main camps in 19th-century geology is shown to fail to capture the divisions between different theorists in geotectonics. And the Taylor-Wegener hypothesis of continental drift no longer appears as a brilliant but inexplicable premonition of plate tectonic theory but simply as one of a number of equally plausible (if equally inadequate) responses to the collapse of the Suessian synthesis, others being advanced by Bailey Willis, John Joly, and Chamberlin. In short, Greene treats 19th-century geology as an exciting theoretical discipline in its own right, rather than as merely the activity that set the stage for the Darwinian revolution by extending the time scale and outlining the history of life on earth.

Naturally the work has limitations. Those who are primarily interested in the social, cultural, and institutional context of science will be able to glean little from Greene's brief introductions to each major figure in his story. His necessarily cursory treatment of the less significant theories occasionally gives the impression that they were randomly assembled from a pool of unit ideas, since he does not have the space to give their full rationale. And since the connecting theme in the narrative is the continuity of the geological problem, Greene largely limits his narrative with disciplinary boundaries. This restricts his ability to explore the influence of traditions outside geology that profoundly affected geotectonic thinking, such as those primarily associated with chemistry at the beginning of the 19th century and physics at the end. Equally, trails that led outside geology, such as that from Hutton to Lyell to Darwin, are abandoned once they leave the field of geology. This sometimes gives an impression of greater discontinuity in the history of science than there in fact was. But all these matters are limitations of the analysis, rather than flaws in it, and as such they will provide a stimulus to further work. Greene's major achievement of providing a coherent analysis of late-19th-century geology stands.

Finally, the work has a significance that goes beyond its specific and invaluable contribution to the history of geology. Unobtrusively, but regularly, Greene reminds his readers that this story is relevant to the general accounts of scientific change that have been developed in the past couple of decades. Though he himself never explores these implications at length, merely intimating that he believes his case confutes the major theories of scientific development, the vocabulary and units of analysis he employs make his history easy to relate to general philosophical issues about science. For this the book deserves serious attention not only from geologists and historians of geology but from all those who are interested in the evolution of science.

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