LITERATURE REVIEWS

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QUESTIONS ON THE METHODOLOGY OF GEOLOGY

THE STRUCTURE OF GEOLOGY. David B. Kitts. Dallas, TX: Southern Methodist University Press. 180 p.

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"The goal of geology is the derivation and testing of singular descriptive statements about the past" (p 39).

At least this is true for historical geology, and it is the structure of the science of historical geology that is studied in this book. It consists of a series of eight essays originally published in the technical literature over a period of eleven years.

To paraphrase the author's words: There has been a failure to produce a coherent account of the structure of geological knowledge in the two centuries since Hutton as a result of a confusion between metaphysical questions and epistemological concerns. Geological tradition is radically empirical and notably untheoretical, and although geology is recognized as a historical science dependent upon physics and chemistry for its theoretical foundations, little reflective attention has been given to the unique methodology required. When geologists discuss their science, they are likely to compare it to physics. The comparison is not apt, however, for geology is in a sense physics turned upside down. Geology takes the universals of physics and chemistry for granted and is mainly interested in finding and testing singular statements. Instead of prediction, it is concerned with "retrodiction."

The common thread that ties the eight essays together is the attempt to examine various areas of the science for epistemological clarity. The relation of geology to physical-chemical theory, the methodological differences that distinguish geology as a historical science from conventional history, indeterminism in geology, the paradigm shift associated with continental drift as a Kuhnian revolution, the relation between evolutionary theory and the fossil record are all in one way or another used to illuminate some aspect of Kitts' primary assumption.

This assumption is that the goal of geology is to develop an earth history consistent with the understood laws of physics and chemistry. "Modern geology assumes *all* of contemporary physical-chemistry theory and presents on the basis of this assumption a high degree of logical integration" (p 62).

It is not an easy book to read. The author's style is diffuse and wordy; the organization of any one essay is seldom clear, and it is inevitable that a group of essays written over such a long period are not going to appear particularly coherent when presented in book form. The reader is left with a desire for seeing a systematic treatment of the subject that would critically enlighten both geologists and non-geologists on the unique methods of geological science and the reasons for them in a comprehensive way. It is, however, an important book because of its content and one that I believe is well worth the attention of *Origins*' readers.

In thinking about applications for Kitts' concern with methodology, this reviewer was reminded of Barnes' (1979) challenge to the activities of those working in flood geology, a series of questions about the success possibility of any attempt at a "flood model." It appears that his questions cannot be answered without an analysis of the epistemological-methodological problems associated with the science of flood geology. Do the flood geologists hold with Kitts the laws of physics and chemistry as their basic assumption? This to Kitts is the uniformitarian principle and limits as a methodological device the generalizations used in geological explanation. Barnes' challenge appears to claim that one simply cannot get at the evidence of a "miraculous" event by this means. Is it possible to frame a reasonable set of assumptions that define the methodology of "flood scientists" or for any model that allows for divine intervention in nature?

Young (1979) makes the claim that flood geology is of necessity methodologically uniformitarian; that flood catastrophists may be less than consistent, but cannot escape being uniformitarians, as he and Kitts define the term. He, with Barnes, is asking for an examination of the foundations of flood geology in order to make it intelligible. Progressive creationists and theistic evolutionists also need to address themselves to the same basic questions.

In the most comprehensive essay in the book, "The Theory of Geology," Kitts raises several questions about the theoretical structure of the science and in an introductory remark places the questions in a context of the most appropriate educational curriculum for geology. According to him, scientific explanation has been regarded as a deductive operation and geology is different because it is of necessity inductive.

This leads to an examination of the credibility status of geological generalizations; he points out that the words "probably," "frequently," and "tends to" are common occurrences in geological "laws." Following Scriven (1959) generalizations of this type are called "normic statements" to distinguish them from the universal laws of physics. It is not necessarily a weakness for the science to rely on less-than-universal statements, since its goal is to "frame *general* statements, universal or not, on the basis of which explanation can be justified."

Following this discussion the author identifies with the curious (in this context) hope that "normic statements might become universal" and then says: "Certainly no consistent, economical, complete deductive system of geology exists, but I think that we can detect the suggestion of such a system." The reader is left with the impression that Kitts is unfairly comparing geology with physics, with an overemphasis on the deductive systems that exist in physics. Since no complete deductive system exists for physics either, it is an ideal apparently not realizable in fact.

Kitts does not pursue the question of the ideal curriculum; but it is one that cannot be answered without consideration for the structure of the science. A safe conclusion is that geological education that neglects concern for the study of the structure of the science will continue the confusions of the past.

In summary, the book is well worth reading for anyone interested in the foundations of geological science or the philosophy of science. Kitts' literary style makes it a difficult book to read, but the book is effective in that it deals with significant issues.

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