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Geologic Time (Second Edition)

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actions géologiques externes sans se perdre dans les détails mais par contre sans généralisation trop poussée et en gardant une optique plus ouverte que la plupart des traités de géologie. Le chapitre sur les actions géologiques internes comprend une bonne discussion de la dérive des continents et de la tectonique des plaques, ce qui n'est pas si fréquent qu'on pourrait l'espérer. Le chapitre (11) sur la géologie des planètes est inhabituel dans un livre de ce genre et y ajoute une nouvelle dimension. Il ne traite pas uniquement de l'aspect géologique, il inclus l'atmosphère, le relief et les possibilités de vie sur les différentes planètes. Le chapitre 12 porte sur l'origine et l'histoire de la terre. En parlant d'un exemple québécois, il traite des généralités planétaires sur l'origine des océans, des terres émergées et des variations climatiques. Le dernier chapitre qui précède et introduit la conclusion est consacré à l'arrivée de l'homme. L'auteur parle de l'homme fossile (méthode d'étude-évolution) mais aussi de l'homme actuel et de son influence. Le livre se termine sur une page de réflections nécessaires... mais si rares dans ce genre d'ouvrage.

Partout, dans ce livre, on perçoit la forte personnalité et la très grande culture de son auteur, entre autre dans la diversité et le nombre des exemples et aussi par certaines phrases de conclusions partielles qui ouvrent aux lecteurs de nouveaux horizons. En cela le livre est très loin du "text book" habituel et est beaucoup plus enrichissant. Ce livre devrait sûrement être un des éléments de base de la bibliothèque d'une personne intéressée aux sciences de la terre. Il sera aussi utile au professeur et à l'étudiant par la clarté de la présentation et le nombre impressionnant de figures, qu'au traducteur par la précision du vocabulaire et les références fréquentes à la terminologie anglaise.

MS received January 6, 1977

Geologic Time (Second Edition)

By Don L. Eicher
Foundations of the Earth Science Series, Prentice-Hall, 150 p., 1976.
$7.95

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Geological time is implicit in historical geology, and most geologists, directly or indirectly, seek to explain the history of some part of the Earth's crust. Time, therefore, should be as central to the thinking of the student, teacher, and practitioner of geology today as it was to that of the founding fathers of the science one to two centuries ago. But it is far from so. With an apparent indifference to the wealth of information now available to them, many modern geologists think about time only casually and imprecisely, almost intuitively; they continue to have only vague notions of the concepts of absolute and relative time, of how time is measured and time-scales constructed, of the relationship between material stratigraphic sequences and abstract geochronologic sequences, and of the distinctive nomenclatures for these sequences now advocated by national and international commissions. By preparing a second edition of his slim but informative book on *Geologic Time*, Eicher has refocused attention on the place and on the unifying role of time in the many and varied fields of the geological sciences, and he has revamped a much-needed contribution to a woefully thin, generalized literature specifically on this topic.

Considering its length, *Geologic Time* is remarkable in its scope. It achieves both breadth and depth, because Eicher has chosen wisely to summarize not *what* is known about geological history but *how* it has come to be known. He begins logically by recounting some important historical events, such as the conclusions of Hutton and Lyell on the vastness of geological time, shattering the pre-eighteenth century, quasi-Biblical belief that the Earth was only a few thousand years old; the central role accorded geological time in the formulation of Darwin's theory of organic evolution by natural selection; the fallacious methods followed and spurious results obtained in the early attempts to make quantitative assessments of geological time; and Becquerel's discovery of radio-activity and the birth of radiometry. Eicher then proceeds to discuss the rock record and discontinuities within it, thereby setting the stage for bringing rock and time together in an account of the chronostratigraphic record. In perhaps the longest section in the book, he discusses the place of time in a number of stratigraphical concepts and principles: correlation, facies recognition, transgressive and regressive sequences, paleogeographic reconstruction, and continental and polar movements. An ensuing section on biostratigraphy initially discusses organic change in space and time, which provides a basis for a detailed account of different kinds of zones, how these zones are established, and what their relative usefulness is likely to be. Appropriate in the context of Eicher's general discourse, this portion doubles as a useful adjunct to the biostratigraphic portion of the American *Code of Stratigraphic Nomenclature* in that it provides just the kind of explanatory exposition that, conveniently, now has been included in the new (1976) *International Stratigraphic Guide*. *Geologic Time* concludes with sections on the methods (both biological and physical) of making quantitative measurements of time. Considering the desirability of integrating as closely as possible the absolute and relative time-scales, the inclusion of a review of the radiometric methods and their limitations as comparably detailed, yet as succinct, as the summary of the biostratigraphic methods is appropriate.

As a contribution to the general geological literature, *Geologic Time* stands alone, and it fills a niche long left vacant. Compared to Shaw's (1964) *Time in Stratigraphy*, Eicher's book offers a shallower but wider treatment of the topic, and it is as clearly directed to the student as Shaw's work is directed to the professional. In more than one respect, therefore, these books complement one another. Harbaugh's (1968) *Stratigraphy and Geologic Time* perhaps comes closest to Eicher's

Geologic Time, but it is less specific in its focus, and as an even briefer treatment of an even vaster topic, inevitably it is more limited in scope and is deficient in depth. It is suitable only for a junior undergraduate readership. *Geologic Time*, some sections substantially reorganized compared to the first edition of 1968, is lucidly written, liberally laced with informative, simple illustrations, well bound, and reasonably priced. It should be required reading for students; it could be profitable reading for many practising geologists.

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History of the Earth Sciences during the Scientific and Industrial Revolutions with Special Emphasis on the Physical Geosciences

By D. H. Hall
Elsevier Scientific Publishing Co., 297 p., 1976.
Soft cover $19.95

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The steadily increasing costs of printing, and in consequence of book prices, must inevitably cause changes in publication styles and methods. A deterioration in the quality of books may be an inevitable, though unwished-for, result.

Any assessment of the book here reviewed necessitates consideration of the fashion in which it has been produced. Only the 11 preliminary pages were typeset, all the rest are photographic reproductions of typescript. Unfortunately the pages have been over-reduced, so that the lettering is too thin and small and the pages too light, making the book very hard to read. This will unquestionably deter many readers.

Unfortunately, the book suffers also from inadequate editing and equally inadequate proof-reading. There is much duplication between sections (for example, the third paragraph of pages 96 and the last of page 98); some misspellings are consistent (e.g., "Edmund" for "Edmond Halley") and some clearly unintentional (e.g. "Ptolmaic", p. 101); and more major mistakes have also survived uncorrected (e.g., the nearly identical sentences on p. 60, the second quite incomprehensible!). Such inconsistencies as the citation of the same reference as "Crowther, 1960a" on page 92 and as "Crowther, J. G., 1960a" on page 93 should surely have been eliminated well ahead of publication. Other faults include wrong conjunctions (p. 12, "It is in fact doubtful that the pace of science could be halted "), tautology (p. 48, "Lunar geology and geophysics on the moon . . ."), faulty punctuation (e.g., near the foot of p. 86) and confused imagery: "Sometimes the thread is strong and continuous; at other times it diminishes in size and may even die out. If it dies out, it may reappear unexpectedly at another time or place" (p. 97). Prime responsibility for the elimination of such faults rests with the publishers and their readers. Since their survival into publication will inevitably reflect most heavily on the author, he deserves our sympathy.

Having successfully surmounted all these handicaps to reading and comprehension, one perceives that the title of the book is decidedly misleading. This is *not* a history of the earth sciences during the Scientific and Industrial Revolutions. Instead, it is a discursus on the philosophy of science as applied to the earth sciences, with a heavy overt reliance on the opinions of Crowther and Bernal. A history is indeed given of some aspects of geophysics, but that is all.

In this regard, the reference list is revealing. Of 123 works cited - a slim total for a work thus titled - the vast majority are either general works on the history and philosophy of science or works concerned with those aspects of geophysics. The author cites only six other references on the history of geology - the classic texts of Adams, Geikie and Zittel, plus three biographical works on Hutton - and only two on the history of geography. Was this, then, the extent of his reading?

The single aspect of the history of earth sciences that *is* thoroughly treated, the story of the development of the magnetic compass and its use, along with the pendulum, in determining the figure and structure of the earth - is handled well and interestingly. Other historical material is meagre indeed.

Do not, then, expect this work to fill out your knowledge of the general history of the earth sciences, for it will not do so. Do not expect to agree with all the author's judgements. I do not personally consider "geomagnetism, the first of the earth sciences" (p. 106) in point of time or in importance (and indeed it is an effect, not a science!). Nor do I believe that the oceans have yet been thoroughly explored, as the author claims on p. 46; their exploration is surely only beginning.

However, the author's reflections on the course of the development of science are controversial enough to be stimulating; some of his comments strike a responsive chord. When he comments (p. 13) that "a consideration of the history of his subject is rapidly becoming a necessary part of a scientist's education and professional development", one can wholeheartedly agree and wish that Canadian Universities in general were aware of this fact!

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Stress and Strain

By W. D. Means
Springer-Verlag, New York, Inc. 339 p., 1976
$14.80 paperbound

Reviewed by P. M. Clifford
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To understand structures, we still need clear descriptions and definitions, as of old. But nowadays structural geologists borrow freely from physicists, metallurgists and engineers, applying their ideas with some success. When we do this, however, we run into a language barrier, namely, *our* understanding of *their* concepts and mathematics. Means' book is designed to alleviate part of this bilingual problem. It provides an outline of the elementary notions of continuum mechanics, by considering