

BOOK REVIEW

The Origin and Evolution of Planetary Atmospheres. By A. Henderson-Sellers. Adam Hilger Ltd., Bristol, 1983. 263 pp., \$34.00.

This book is unconventional, if there is any convention in a field as undeveloped as planetary atmospheric evolution. For example, there is no derivation of the rate of Jeans' escape, probably the most formal, mathematical, and well-established topic in the field. There is no explanation of the important role of vertical transport in the escape process, a subject that has dominated thinking about escape for more than 10 years. There is no discussion of photochemical escape, a concept that is considered central to the evolution of the atmosphere of Mars. There is no exploration of the conditions for or consequences of hydrodynamic escape, a process that is frequently assigned an important role in the evolution of the atmosphere of Venus.

These and similar omissions disqualify this volume as a text. Even in the field of planetary atmospheric evolution, it is necessary for students to learn and understand the topics that are fairly well established before they can go on to read about the speculation.

How then does the book succeed in meeting the second objective of the author, as a "monograph for the research community?" In my opinion, not very well. The book fails because of a lack of explanation of important topics, critical examination of the concepts described, and detailed exploration of the mechanisms proposed. The interdisciplinary nature of research in planetary atmospheric evolution makes careful treatment essential if a monograph is to be useful. This work assumes too much familiarity with the field. For example, the Milankovitch mechanism of climate change is mentioned with references, but not explained. Atmospheric scale height is introduced on page 39 but never defined. There are misprints in the units of the quantity quoted at the top of page 43 and in formula (1.4). Such misprints can be quite confusing to readers not already familiar with the subject.

The text reveals inadequacies in the author's understanding of some aspects of the subject as, for example, on page 27 where we read that crustal growth "is likely to have occurred by the creation of new continental material at mid-oceanic ridges." On page 41 we are told that the well-mixed region of the terrestrial atmosphere is called the troposphere. On page 156 it is

reported that "methanogenic bacteria use H₂O as the hydrogen source with which to reduce CO₂." Questions that are, in fact, subjects of considerable controversy are presented, without comment, as fact. For example, on page 25 it is stated that "on Venus chemical equilibrium between CO₂ and the surface has been established." There is a heavy dependence on secondary sources, so much so that the reader who is familiar with the field is likely to learn little from this volume. The reader who is new to the field is likely to be confused or misled.

The situation, actually, is worse. The reader new to the field is likely to be turned away. The organization of the book is confusing and the text is frequently hard to read. Here is one example, from page 171: "observational data on climatic change for the terrestrial planets are constrained by (1) the number, type and objective of space missions and (2) subsequent planetary and climatic changes." There are numerous parenthetical references or footnotes directing the reader to later or earlier chapters. These create the false expectation that the material that is inadequately dealt with here is adequately dealt with somewhere else in the book, thereby raising hopes that are generally disappointed. The subheadings and titles of the chapters are not descriptive of the contents.

The book will perhaps be most useful as an uncritical compilation of references. There are about 360 of them in the bibliography. But this function is compromised by the omission from the bibliography of the titles of the cited articles, an idiosyncratic absence of punctuation, and the misspelling of authors' names.

The thesis of the book is summarized on page 205. "The existence of surface liquid water on earth and the associated global hydrological cycle seem to be the dominant factors in environmental feedback processes." This thesis constitutes a sound and stimulating focus for a research program, but on the basis of the evidence and arguments presented in this book I must judge the thesis to be now no more than an hypothesis.

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