

**The Geology of Mars.** Thomas A. Mutch, Raymond E. Arvidson, James W. Head, Kenneth L. Jones, and R. Stephen Saunders. Princeton University Press, Princeton, N.J., 1976. 400 pp., \$35.00.

The Viking missions have substantially increased interest in Mars not only in the mind of the public but also in the view of the scientific community; and there is clear evidence that a number of previously Earth-bound geologists are now seriously considering the application of their discipline to the other terrestrial planets. Such comparative planetology is most exciting for Mars because the planet has a profusion of familiar processes—including volcanic, fluvial, aeolian, tectonic, impact, mass-wasting, and, probably, glacial events. The comparison of the geologies of Earth and Mars is bound to illuminate the present state and past histories of both planets. A comprehensive book on Martian geology could play a major role in making the subject accessible to traditional terrestrial geologists.

Because of the enormous windfall of Viking results it might be thought that this is precisely the worst moment to publish a book on Martian geology. Nevertheless, Thomas Mutch and his collaborators have produced a book which avoids almost all the avoidable pitfalls and which can be read with pleasure both by geologists and by planetary scientists. The book takes a global approach and makes excellent use of the full range of Mariner 9 data and interpretation. It begins with an excellent short summary of ground-based studies of the planet, comparable in quality to that in Samuel Glasstone's *Book of Mars*. This is followed by a discussion of spacecraft mission constraints and design, the geological provinces of the planet, cratering, volcanism, the little that is known about internal structure, aeolian and fluvial processes, and closes with a stimulating summary of the possible geological history of the planet.

All the authors are now at the Brown University Geology Department, or were recently graduate students there, but the points of view expressed are by no means parochial; in fact one of the many striking aspects of the book is how conscientious it is in attempting to present a range of alternative explanations of observations. The book is very rich in illustrative material including global maps of the dis-

tribution of crater populations and aeolian streaks; superb photography of comparable geological features on the Earth and the Moon; and a careful selection of many of the most instructive Mariner 9 photographs. There is also a last-minute supplement of early Viking photography and even some attempts at artistic reconstructions of Martian landscapes from aloft. Despite its title the book is not restricted to geology and there are useful discussions of the astronomy and atmospheric physics of the planet. Even in the potential quicksand of biology Mutch *et al.* have survived well:

First, nothing that we know about Mars rules it out as a habitat of life. Second, the three biology experiments [on Viking] are designed to give unambiguously positive results [but] one can imagine situations in which a borderline positive result will be difficult to interpret....

The Appendices provide an introduction to the vagaries of Mariner picture processing and data acquisition which will be very useful for neophytes, as well as a set of coupled geological and crater maps arranged province by province according to the MC charts. Except for the discussion of the water phase diagram there is very little contact with underlying physics or derivations from first principles. For example, in an excellent discussion of cratering statistics there is merely the statement, not the demonstration, of the correct value of the power-law exponent in the crater frequency/diameter relation for saturation cratering. (One minor error, which should be stamped out immediately before it spreads, is use of the word "aeroid" in presumed analogy to "geoid." But the Greek for Mars is Ares so the correct word probably should be "areoid." The word "aeroid" has to do, if anything, with atmospheric physics, not with geophysics.)

It is a pleasure to recommend *The Geology of Mars*. It is accurate, engrossing, a visual delight and will be the standard introduction to the subject for many years to come.

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