Explaining the Look of the Moon

Lunar Geology. GILBERT FIELDER. Dufour, Chester Springs, Pa., 1967. 184 pp., illus. $8.95.

Perhaps all of this decade's books about the moon will be looked back upon as interesting historical curiosities, full of strange speculations by men too eager to have answers and too impatient to wait ten years for them. Yet there are many motives for studying the moon, including some admirable ones, and it is not unreasonable to want to set down what we think we know and what we want to know. If judged in this context *Lunar Geology* gets mixed scores, for while it raises fundamental issues, it strains to prove a thesis: "many—if not most —of the structures on the Moon are volcanic."

Fielder describes his book as a personal view, not a disinterested summary, and it is an interesting account because Fielder himself began his studies of the moon believing that "all [sic] the lunar features" were produced by impact. Today the pendulum is swinging through middle ground toward Fielder's present view. It has already gone through several swings now, and I conclude that when reputable scientist A can't convince reputable scientist B of his own hypotheses, then it is the fault of A's presentation and lack of data, not of B's obtuseness. Hence, rather than argue the arguments again here, let us leave the impact-volcanism controversy at that. It looks as if we will have to consider our present views to be working hypotheses, not knowledge, for some years still.

To Fielder's credit, there remains interesting material in this book. He demonstrates the need to integrate geology into lunar studies. For the student who has little background in physical geology there is an account of the theory of faulting. We are introduced, in an extensive chapter on craters and ring-structures, to the variety of types of volcanic ring-structures on the earth. (There remains the appalling lack of a first-rate review of terrestrial volcanism.)

There are certain lunar phenomena which are global in nature and hence must be studied, at least in part, from cis-lunar space. That is to say, there are some things we can do now as well as we will ever be able to. Much of Fielder's book properly is devoted to his data gathering and views on such subjects: crater statistics, tectonic structures, and global "grid-systems" of faults. His work on the latter has been exceptionally important, and *Lunar Geology* serves as a summary.

Quite apart from the impact-volcanism controversies, one could pick many bones. The chapter on volcanic structures should have stressed our profound ignorance of the fundamental, deep-seated origins of volcanism and tectonic activity rather than listing "types" of craters. The arguments about convection, caldera formation, and ring-like extrusive structures have a superficial, qualitative tone that can be improved only by geological and geophysical field studies which should be considered an integral part of the national planetary exploration program. Does a map (p. 67) of the earth's island arc systems really have any place in an argument to support the hypothesis of deep-seated origin of lunar rings? Is it reasonable to *assume* (p. 133) that the cratering rate (of whatever cause) has been uniform since the beginning, and conclude as a direct result that the tremendous activity that produced the maria was confined to the last 700 million years?

WILLIAM K. HARTMANN
Institute for Astronomy, University of Hawaii, Honolulu

Cultural Evolution Explained

The Myth of the Machine. LEWIS MUMFORD. Harcourt, Brace and World, New York, 1967. 352 pp., illus. $8.95.

It has generally been held that tool-using was an important factor in the very biological evolution of early man and that throughout human history technological devices for adapting to the environment have been instrumental in shaping society. This is a myth, says Lewis Mumford. In a discourse on the entire 2 million years of cultural development, he argues that social "machines" created by men's minds have had greater importance than material machines. Owing to the prejudices of the modern "machine-infatuated age" we have projected material explanations backward in time.

Mumford's thesis may satisfy those who so cherish the notion of human freedom and creativity that they recoil from any intimation that causes may lie outside man himself. But explanation of each stage of cultural evolution by a theory that repudiates any causal role of technology involves some astonishing hypotheses, dubious auxiliary suppositions, and strange allegations of fact. This is especially true of the first half of the book, which explicates human development through all of prehistory to the Neolithic farm villages of about 5000 B.C. The second half of the book, which takes us to the 16th century A.D., finds Mumford in his own area of competence and provides many original and fascinating insights.

The long-standing theory of human evolution is that bipedalism among early hominids liberated the hands to manipulate the environment by means of tools, which furthered the development of the visual, auditory, speech, and other areas of the brain. Present evidence, in fact, indicates that the australopithecines had such small brains, even though they probably used tools, that their speech capabilities are in doubt. Mumford, however, declares that man's brain developed far in excess of his survival needs (pp. 39 and 43)—but he does not say why—and that toolmaking came later. His explanation is that during a proto-human stage, men had confusing and frightening dreams which somehow induced them to participate collectively in rhythmical bodily movements, which became protective ritual, and to utter sounds, which acquired symbolic meaning as language. Evidence to support the importance of ritual is drawn from practices of certain modern hunting-and-gathering societies of *Homo sapiens* on the incredible assumption that these have survived a million years or more from the time of the australopithecines. This evidence is both irrelevant and incorrect. Modern pre-farming societies, which I have studied for many years, mostly lack any important ritual.

In minimizing the importance of toolmaking, the author has special reference to stone tools, especially the lowly, all-purpose fist-hatchet, which he claims were unimportant and do not indicate hunting prior to the Upper Paleolithic. Archeological opinion is also beginning to question the hunting abilities of the australopithecines; but implements for food gathering were also tools, even though made of perishable materials, so that early man's technological equipment cannot summarily be ignored.

Mumford concedes that there was considerable technological development in the weaponry, lamps, clothing, and

shelter of the hunters of the last ice age of Europe. Further technological achievement was manifest in plant and animal domestication of the Neolithic villages. At this point, Freud, who has lurked in the wings, takes center stage. Owing to her importance in farming and fertility, woman assumes control. She is the cultivator, the symbol of life and growth, and the container, as are the pots she makes. Indeed, sex becomes highly enjoyable. Ethnographic evidence, unfortunately, indicates that in most independent farm villages where crops exceed hunting in importance, men rather than women are the tillers and assume the authority roles.

The Neolithic village was idyllic compared to the subsequent era of the megamachine, which robbed men of their creativity, independence, and dignity, dehumanizing them under the rule of all-powerful divine kings. This machine, we are told, has eluded archeologists because it is invisible—a social arrangement that got monumental structures built and maximum food and other goods produced without a comparable advance in technology. This astonished reviewer fails to distinguish the megamachine from the state, which we have recognized and speculated about for some years.

In fact, the archeological record leaves little doubt that the beginnings of the state were based on specialized production and sometimes irrigation under the peaceful control of a priesthood. Mumford's assertion that the first kings and their warriors were carryovers from the glacial-age hunters involves a time gap between about 10,000 and 4,000 B.C. and a change of environment from arctic Europe to the moderate, semi-arid Near East.

The first megamachine began to break down by about 600 B.C., and the divine kings were replaced by "axial" religions centering around prophets, from Buddha to Mohammed, who appealed to the common man. But technological progress, though no longer manifest in monumental architecture, was not suspended. The Greeks contributed scientific knowledge if not always their technological applications. Later, the Christian orders of monks, followed by craft guilds, continued to make innovations. Until the second megamachine that developed after the 16th century, basic inventions were made by small societies or states.

The so-called industrial revolution was simply the capture of production and distribution by concentrated power. With conscious scientific research, the second megamachine acquired such capabilities that it could indulge in mass destruction through use of bombs and napalm (pp. 12–13), and the president of the United States could by means of a faked emergency "wield such power and politically sanctify his cumulative errors of judgment . . . [as to justify] his inhumane acts in Vietnam" (p. 178).

The thesis of this book has inescapable moral and political implications for the contemporary world. If 2 million years of cultural evolution resulted from man's mind rather than from the imperatives of technology, man is presumably able to devise a better society. But we are not told how this may be done. If, on the other hand, economic, social, and political institutions are inevitable responses to mass production and distribution, to what extent can the human mind, or reason, reverse or deflect the trends? Can small, independent utopian communities, something like the Greek cities, the Neolithic villages, or the monasteries, be created within the context of the second megamachine?

JULIAN H. STEWARD
Department of Anthropology, University of Illinois, Urbana

The Geography of a Vast and Varied Realm

Arid Lands. A Geographical Appraisal. E. S. HILLS, Ed. Methuen, London; Barnes and Noble, New York, 1967. 479 pp., illus. $13.50.

It is doubtful that a reader interested in any aspect of the world's dry lands will fail to find new and interesting information somewhere in this volume. Conversely, he is equally certain to encounter sections and perhaps chapters that are at best trivial or irrelevant. I find it difficult to decide whether the successes and failures stem from the contributions themselves or from the fullnesses and gaps in my own background. Would, for example, E. B. Edney's discussion of the physiologic and morphologic adaptations to dry environments by animals in several phyla seem as fascinating as it does to me were I less innocent of the subject matter? This subjectively posed question leads to a more general one. Is it possible to write a generally satisfying and comprehensive geography of so vast and varied a realm as the two-fifths of the earth's land surface in which moisture shortage places obvious limits on the development of life?

For more than a decade UNESCO maintained an active Arid Zone Program, and its work is being continued under another title. Through sponsoring research and surveys, conferences, and publications it endeavored to enlarge and disseminate knowledge of arid environments so that such regions could contribute to greater human welfare. The 17 contributors to this volume represent many disciplines, but all had some connection with the Arid Zone Program and most draw heavily on its publications for their material. There is no shortage of specialized expertise. The dominant theme of most contributions is that of learning about all aspects of arid environments in order to be able to expand and maintain their productivity and thus support more humans at higher living standards. A healthful realism is generally present. Discussion of opportunities for development is at least balanced by recognition of special problems that confront man in arid lands: waterlogging and salinization of irrigated soils, the fragility of ecologic complexes in dry lands and the irreversibility of certain sequences of degradation, the extra burdens of isolation and water costs that must be borne by all economic activities in arid regions. One can gratefully record that this is no tract promising salvation to some of the world's poorest people if only the right button, labeled technology and a modern economic approach, is pressed.

The publishers clearly hope that this handsomely illustrated volume will be widely adopted as a text for courses entitled "Geography of Arid Lands," but as a geography of the arid lands the book must be rated as unsuccessful. The diversity of the region to be dealt with overwhelmed every contributor, even though the topics many wrote on were quite sharply circumscribed. Some attempted to restrict themselves to generally valid statements, and even the blandest of these need qualification. An example (paraphrased) that recurs repeatedly: "The most important problem for man is the scarcity of water except in certain irrigated localities where waterlogging occurs and drainage works are needed." Other authors were willing to give anecdotal examples from the regions with which they are