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?

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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