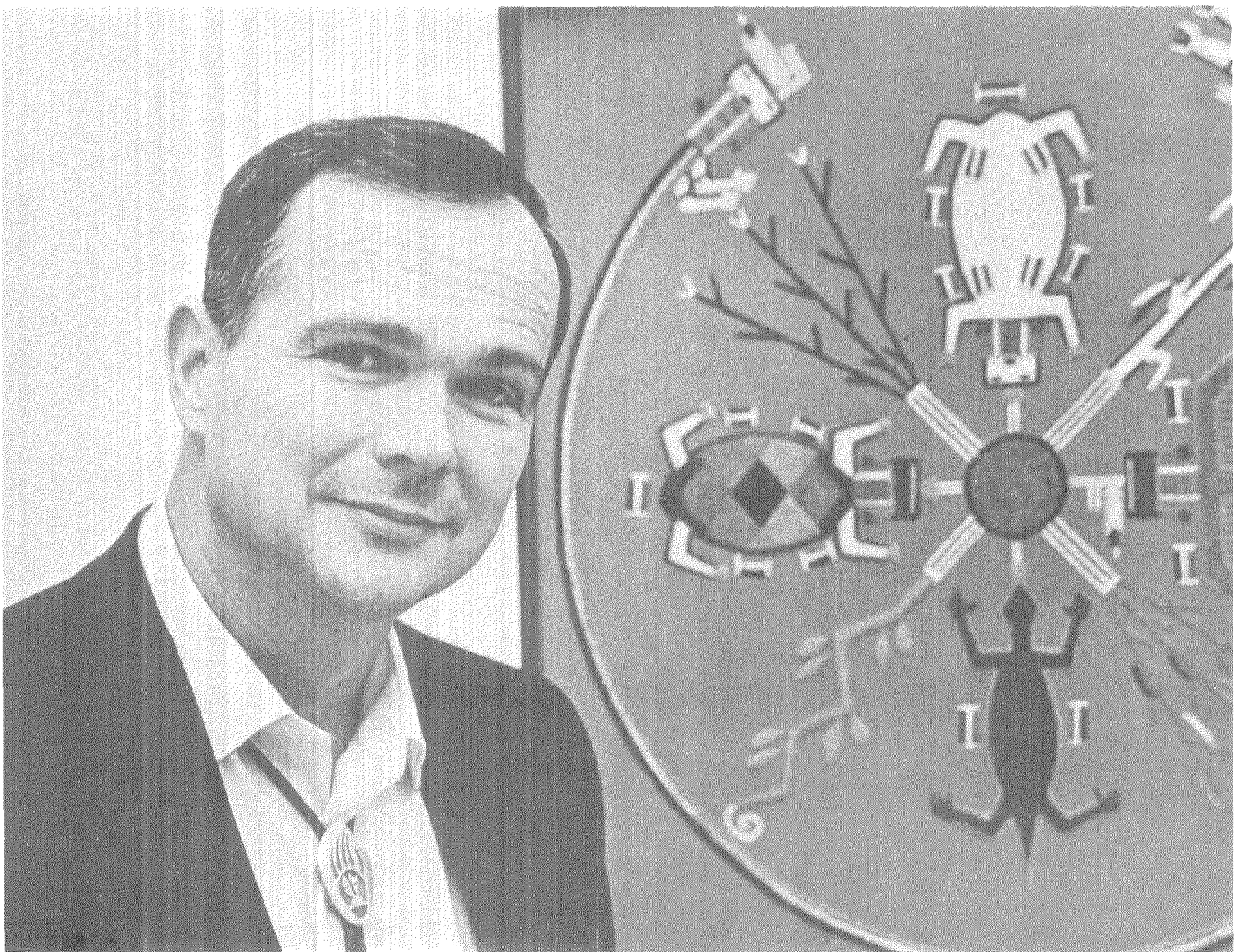


Eugene Shoemaker:



## Down to Earth

Eugene Shoemaker, after ten years' work on the United States lunar program, is looking to the time when he can settle down to some important earthly concerns—in particular the chairmanship of Caltech's division of geological sciences.

Shoemaker accepted the job more than a year ago, but it wasn't until January of this year that he found time to move onto the Caltech campus—and even now, after almost five months, the chair behind the chairman's desk is often empty.

Shoemaker is a member of the Lunar Planetary Missions Board and of the Lunar Sample Analysis Planning team. In addition, he heads the Apollo Lunar Geology Field Experiment team of ten scientists, and expects to be spending considerable time on this for the next year.

"I thought I had everything timed so that the manned lunar landing would have been accomplished before I came, full time, to Caltech," he says. "Then the Apollo fire tragedy at Cape Kennedy

set us back a good year, so here I am—my first year on campus and the lunar landing still downstream. I'm going to have to play it by ear for a while.”

With his particular geological background, Eugene Shoemaker's playing it by ear is almost certain to produce a successful performance. He and geology found each other when he was seven and he started studying rocks and minerals. His father knew just enough about them to satisfy his son's earliest interest and to whet it to the point where Gene was collecting seriously by the time he was eight.

During his early school years the family lived in Buffalo, New York, where the Museum of Science was pioneering a program in science education for youngsters. “I bicycled down on Saturdays and weekday evenings,” he says, “and took a whole slug of classes in everything from aquatic biology to geology and mineralogy—so by the time I was ready for high school I knew I wanted to be a geologist.”

The family was living in Los Angeles at the outset of World War II. His mother, known in education circles as an able, dedicated teacher, was at the Rosewood Elementary School. (She just retired last year.) His father was working as a “grip” in a movie studio. A man of unusual ability and versatility, he had wanted to go to college enough to put himself through by playing football. He was later, in turn, a teacher, farmer, businessman, and politician. (“He always had to prove himself. He'd see something and wonder whether he could do it or not, then take it on and do it. It would take him about a year to satisfy himself that he could, and then he'd go on to something else.”)

“My father always talked up Caltech to me,” Shoemaker says. “In those days around here, it was considered the *only* place to go if you were science-minded.”

Shoemaker was 16 when he entered Caltech in the fall of 1944. He found the geology department practically defunct. Most of its faculty were off on strategic metals programs or other war work, and its chairman, John P. Buwalda, and Chester Stock were just maintaining a limited number of courses. So Shoemaker met the requirements in everything else until his senior year. Then, when the staff returned at the end of the war, he took nothing but straight geology.

In that era, colleges were one big ebb and flow of students going off into—or returning from—service. Shoemaker was too young to be drafted, and,

as a civilian, could also take advantage of the accelerated program given the V12 students being trained for the Navy. He was graduated in three years, in the spring of 1947. Even at this smart clip, though, he found time to be head yell leader, a *Big T* editor, glee club member, and student secretary of the YMCA.

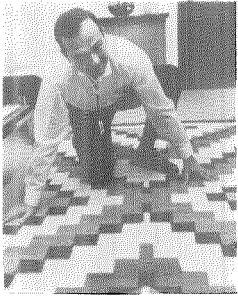
Shoemaker stayed at Caltech for a Master's degree, then got a job offer from the U.S. Geological Survey to work on the uranium exploration program in Grand Junction, Colorado. He was ready to get away from school for a while; he had had a pretty concentrated dose of it. He was still not old enough to vote.

The Colorado Plateau at that time was one of the most exciting places in the world for a geologist to be. The exploration and discovery of uranium there produced the only full-fledged mining boom we have had in the United States in the 20th century—and the most intensive geological effort that had ever been applied in one area in mineral exploration.

Shoemaker was caught up in the excitement of mineral exploration and the unfolding of new geological techniques that were being applied in the uranium program. When his project was temporarily recessed, he applied to Princeton and spent a year there working for his PhD, then came back for another summer in Colorado. He was married that summer to Carolyn Spellmann, the sister of his Caltech roommate, and they were packed to go back to Princeton when he was offered a chance to develop a new research project for the Survey. They unpacked—and for two years Shoemaker worked on the geochemistry of the Colorado Plateau uranium ores and their regional geochemical environment.

Shoemaker finally went back to Princeton with the bulk of the field work done on the problem that he planned to use for a thesis. But the year went by, and he was back in Colorado with the Survey again without having finished it. In fact, *several* years went by—and no thesis.

“It got so I'd see my professors from Princeton at some meeting,” says Shoemaker, “and they'd say, ‘You know we liked that last paper you wrote; it would make a good thesis.’ So finally I asked the department chairman, Harry Hess, how he'd like to have a thesis on Meteor Crater, because that was at the top of my pile at the time, and he said, ‘Fine, we'll take it.’ And so about ten years after I started at Princeton I finally got my PhD.”



*Eugene Shoemaker moves  
into a new office—and  
a new job—on the  
Caltech campus*

Before joining Caltech this year, Shoemaker was chief scientist of the U.S. Geological Survey Center of Astrogeology at Flagstaff, Arizona. He is still a consultant to the Center, which grew out of the USGS Branch of Astrogeology, which he organized in 1961. He was an investigator for the television camera experiment on the Ranger spacecraft series that took closeup pictures of the moon in 1964 and 1965. And he was principal investigator for the Surveyor spacecraft television camera from 1963 to 1968.

Shoemaker's interest in the moon goes back to the days when it had to be a pretty clandestine affair.

"I got to thinking about the state of rocket development and I figured that, all other things being favorable, it was likely there would be manned expeditions to the moon during my professional career," he says. But he kept fairly quiet about it because sensible people weren't talking about going to the moon then.

He started reading about the moon, though, which led him to study the violently eruptive volcanos of the Navajo and Hopi country. His interest in these volcanos led him to the problems of underground nuclear explosions—which got him into the problems of impact craters. His comparison of nuclear craters with Meteor Crater in Arizona and his subsequent study of impact and shock propagation mechanisms worked directly into an interpretation and understanding of the moon's surface.

His careful study of the best available telescopic photographs of the moon led Shoemaker to the conclusion that its outer part is stratified, and that the distribution of the exposed strata could be mapped. The strata consist primarily of layers of ejecta from large craters. Other deposits of possible volcanic origin appeared to be interlayered with the ejecta. He initiated an extensive program of geological moon mapping, which has been carried on by his

colleagues at the U.S. Geological Survey. The primary purpose of this work is to determine the stratigraphic sequence on the moon in order to unravel the sequence of major events in lunar history. Geology, after all, is a historical science.

By 1962 Shoemaker's work had attracted so much attention that Caltech invited him to come back as a visiting professor. He accepted because it gave him a chance to attempt a synthesis of lunar research—particularly the new problems of understanding and interpreting impact structures on the moon and earth. He started a course he called astrogeology and, as he says, "It seemed to sell."

Caltech suggested he join the Institute on a permanent basis, but he was too much a part of the lunar program to leave it at that point.

"Now I can finally begin to make the break," he says.

He flies every weekend to Flagstaff, and uses this time not only to work with colleagues on the Apollo project, but to see his family. His wife and children—Christine, 16; Patrick, 13; and Linda, 12—will call Flagstaff home until they move to Pasadena in September. On these flights he looks down on one of the geological mysteries he hopes to have a hand in solving: the Basin Range Province, a region of linear mountains and valleys, from about 500 to 1,000 miles across, that lies between the Rocky Mountains and the Colorado Plateau on the east and the Sierra Nevada on the west.

"It's a very unusual part of the earth," he says, "where we have an oceanic rise intersecting the edge of the continent." He believes the solution to its origin is part of the larger set of questions raised by geology's new excitement—global tectonics, the investigation of the forces producing movements of the earth's crust.

"Global tectonics has brought—for the first time—geophysicists and geologists together in an intense dialogue with each other. Part of the story will be worked out by seismology, part by studying the magnetization of the rocks, part by ocean bottom geology, and part by classical techniques of geology on continental parts of the crust. The new global tectonics brings together a whole range of disciplines, and it cuts across discipline lines."

As he anticipates his career reentry into the earth's atmosphere, he suspects he may have a little bit of his father in him. "After a period of time I like to do something different. Now, I'm anxious to put some new irons in the fire down here on earth."