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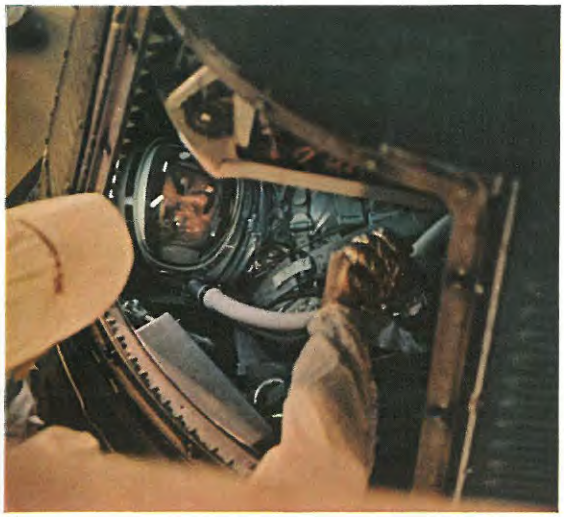
Ten years in an astronaut's life



EKTACHROMES FROM NASA AND (BELOW LEFT) BY JON SCHNEEBERGER

NASA'S "OLD MAN" AT 47, Alan B. Shepard, Jr., has twice soared beyond earth's atmosphere. In 1961 he rocketed to fame on America's first manned venture into space—the 15-minute flight of *Freedom 7* (**upper left**). A ticker-tape parade and NASA's Distinguished Service Medal greeted his return.

Ten years later he commanded Apollo 14 on man's first visit to the lunar uplands (**above** and page 136). A world made nonchalant by earlier landings rated this one as it might an eclipse—awesome, but not unique.

NATIONAL GEOGRAPHIC will continue to chronicle milestones in space. Invite your friends to enjoy such high adventure; nominate them for membership below.

The Climb Up Cone Crater

By ALICE J. HALL
NATIONAL GEOGRAPHIC STAFF

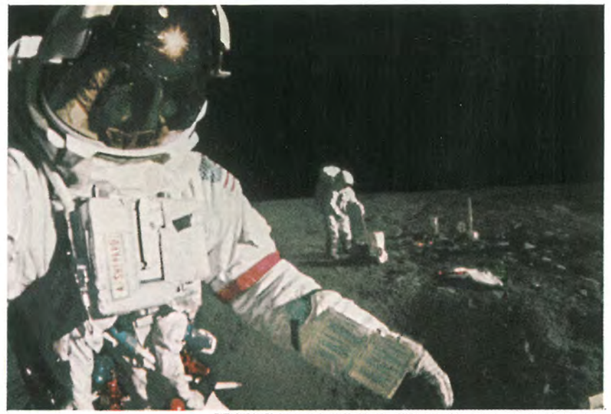
"AS TOUGH as trying to find your way around the Sahara Desert," recalls Alan B. Shepard, Jr., of the unprecedented trek that took him and fellow astronaut Edgar D. Mitchell of Apollo 14 almost to the lip of Cone Crater—man's longest lunar walk to date. They touched down last February 5 at 4:18 a.m., EST, for the most scientifically challenging mission thus far. America's third team on the moon, they sought clues to the origin and evolution of earth's closest neighbor, and of the solar system itself.

The essence of wilderness surrounds the lunar module at its landing site near Fra Mauro Crater. "We are in a depression here," the astronauts' words flash to earth. "A stark place . . . pockmarked by craters . . . the sky is completely black." Surface color varies between "mouse brown and mouse gray." The unrelenting morning sun glares above the gold foil of the 23-foot-tall LM *Antares*. But enthusiasm triumphs. "I think they put champagne . . . in the LM water," quips an exuberant Mitchell.

While Stuart A. Roosa orbits in the command module *Kitty Hawk* and photographs future landing sites, the ground team tackles the desolation. On their first walk, lasting almost five hours, the men range about 1,000 feet from *Antares* to gather rock samples and set out research gear. Solar-wind collector (**upper photograph, right**) traps atomic particles bombarding the moon. An umbrella-shaped antenna transmits to earth the crew's observations, as well as images from the TV camera, aimed by Mitchell at left.

Nearly a mile beyond the antenna, the whaleback ridge of Cone Crater, goal of the second walk, beckons (map, page 142). The large crater at extreme right, dubbed "Old Nameless," appears as close, but actually lies twice as far away. For this 136° composite photograph, Shepard shot a series of stills with his chest-mounted camera.

Checklist on Shepard's wrist (**right**) schedules some 200 tasks, including unloading equipment from a rickshaw-like cart. Mitchell, beyond, sets up a complex instrument unit he carried from the LM. For months its nuclear-powered sensors will radio data on seismic activity and the lunar environment.



EKTACHROMES BY ALAN B. SHEPARD, JR., (TOP) AND FROM MOVIE CAMERA (LOWER), NASA

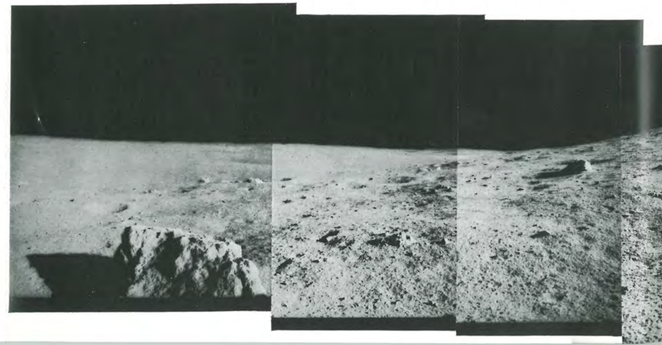
OPPOSITE PAGE FOLDS OUT

EKTACHROME (BELOW) AND 3D STEREOSCOPIC COMPOSITES BY © EDGAR D. MITCHELL, NASA

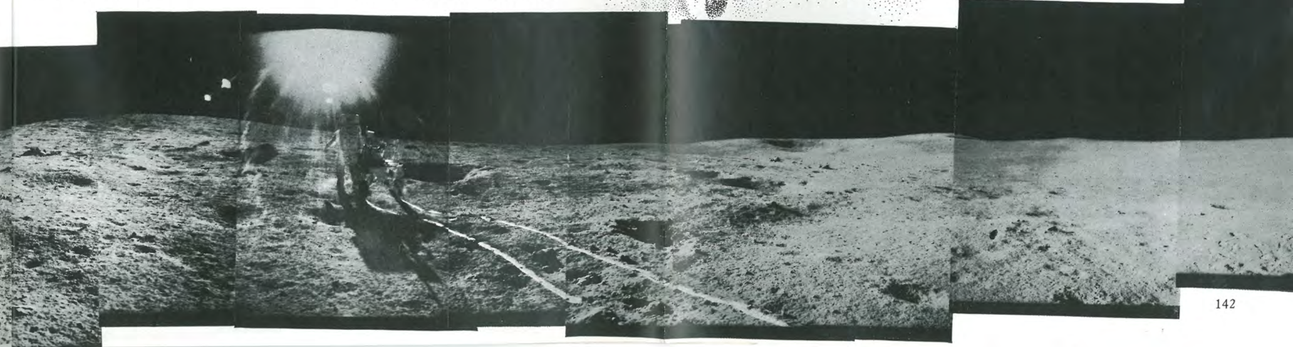
"LIKE RAINDROPS . . . have splattered the surface." Thus Mitchell describes the fragmented soil texture of the uplands as seen by the astronauts on their Cone Crater trek. The round trip of about two miles took 4 hours and 20 minutes.

Of the North Boulder Field (**above**), 80 yards from *Antares,* Mitchell says, "There's not a level portion out here." The boulder at left was later named "Turtle Rock" for the reptile-shaped formation atop it. From such on-the-scene descriptions, rock samples, and photographs, scientists now work to piece together a chapter of lunar geology.

New "road" on the moon (**left**), as crude as any pioneer's ruts, traces the astronauts' route as they pull the cart. Its tracks, up to 3/4 of an inch deep, reminded them of marks made by "driving a tractor through a plowed field." Loaded with tools, rock samples, and camera, the cart would have weighed 149 pounds on earth, but came to only 25 on the moon. When tools began to bounce off, one man walked behind to pick them up.

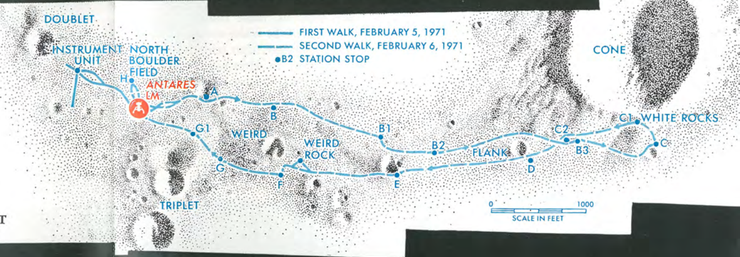


Approaching Cone Crater (**below**), Shepard pulls the cart up what looks like the last ridge. "The grade is getting steeper . . . the soil here is getting firmer," Mitchell reports near Station B2 (**map, right**). The maps the explorers carry, based on photographs taken by Lunar Orbiter 3, show features as small as six feet. But the surface keeps presenting obstacles: craters to skirt, another rise after this, then another. The men believe they are covering ground fast with their lunar lope—alternate hops and steps.



Elusive goal, Cone Crater lured the trailblazers nearly a mile from the LM. Eons ago a colossal impact 700 miles away blasted out the Imbrium basin and spread a blanket of debris over this area. Later, a meteorite gouged out stadium-size Cone, unearthing the old lunar material. On the way to the crater, the astronauts gathered rocks of a type not studied before. A huge boulder named Weird Rock helped guide them back to the LM.

GEOGRAPHIC ART DIVISION © N.G.S.



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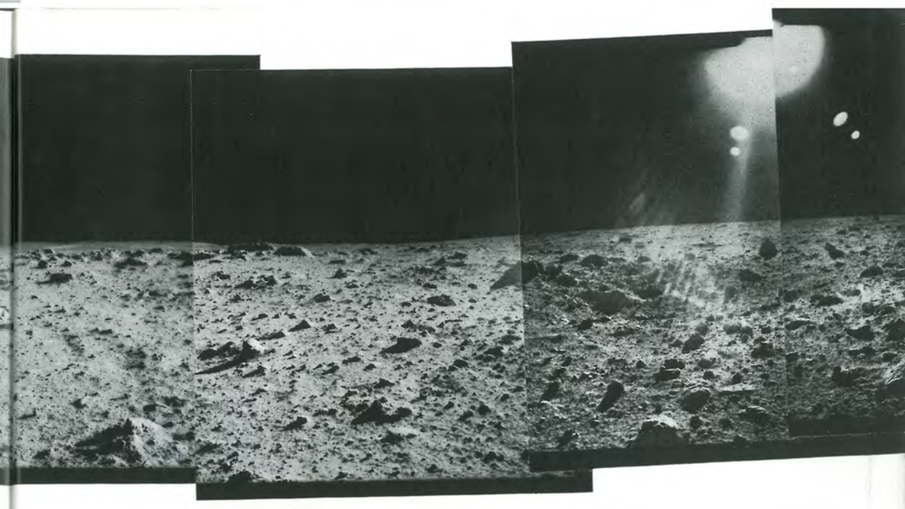
300° COMPOSITES BY ALAN B. SHEPARD, JR., NASA



"THE RIM . . . we haven't found that yet," the astronauts lament at Station C (**above**). But the number of large boulders increases. The men take more rock samples and measure the magnetic field with a portable magnetometer. They catch sight of Old Nameless at far left. Then, about 75 yards off, "almost white" rocks, on the ridge at center, draw the explorers on. "It's farther than it looks," says Mitchell, and Shepard sardonically replies, "That's the order of the day." Soon they stand "right in the midst of a whole pile of very large boulders" (**right**), evidence that the edge is near. But where?

With only eight hours until lift-off, the astronauts pick up loose fragments and chip off a piece of the white rock, and then turn back. Days later, after studying maps and photographs in Houston, they conclude that here at Station C1 (map, page 142) they came within 75 feet of their destination, which lay just beyond the white rocks. Geologists, however, believe that samples taken here are most likely identical with those at the crater's edge.

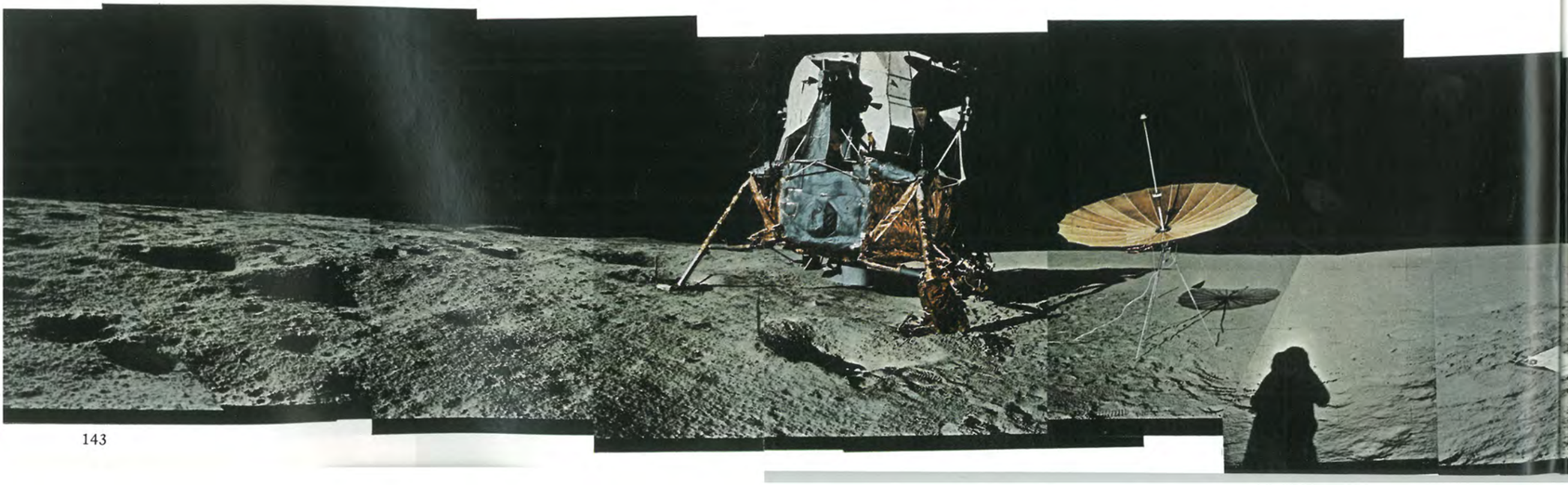
The downhill leg of the journey goes fast; the highly visible lunar module guides the astronauts home. They stop for more samples amid "country so rolling and undulating, with rises and dips everywhere, that you can be going by a fairly good-size crater and not even recognize it."

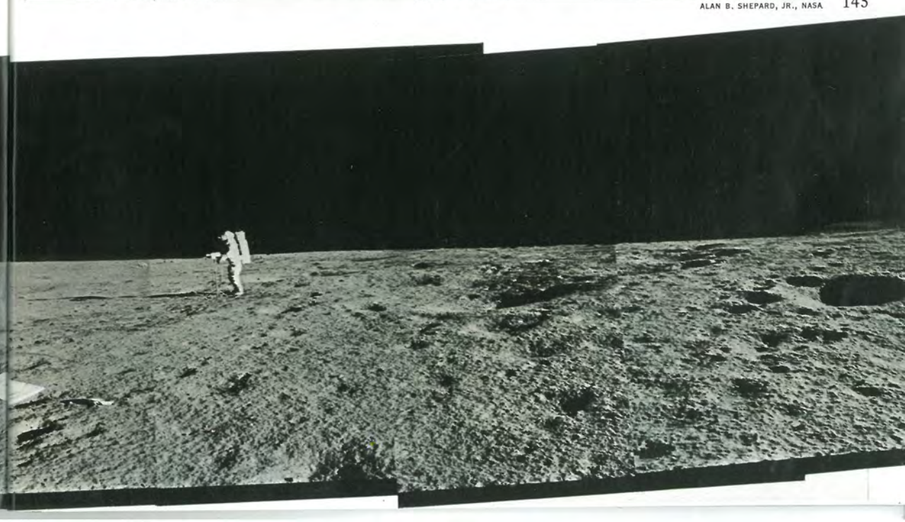
The slope at home base (**below**) gives a jaunty appearance to *Antares;* one of its grasshopper legs came to rest only inches from a yard-wide crater.

After working as pilot, geophysicist, and geologist, Shepard played tourist. Attaching the head of a six iron to a tool's 24-inch-long extension handle, he hit a golf ball—for "miles and miles and miles," he said in jest. Actually, his improvised club drove the ball less than a hundred yards.

Leaving behind the umbrella antenna, its white cover, and other equipment not needed on the return to earth, Shepard and Mitchell crowd themselves and 94 pounds of lunar material into the ascent stage of *Antares*. After $33\frac{1}{2}$ hours on the moon, they lift off to rejoin Roosa in *Kitty Hawk* for the three-day, 246,200-mile trip home.

ALAN B. SHEPARD, JR., NASA

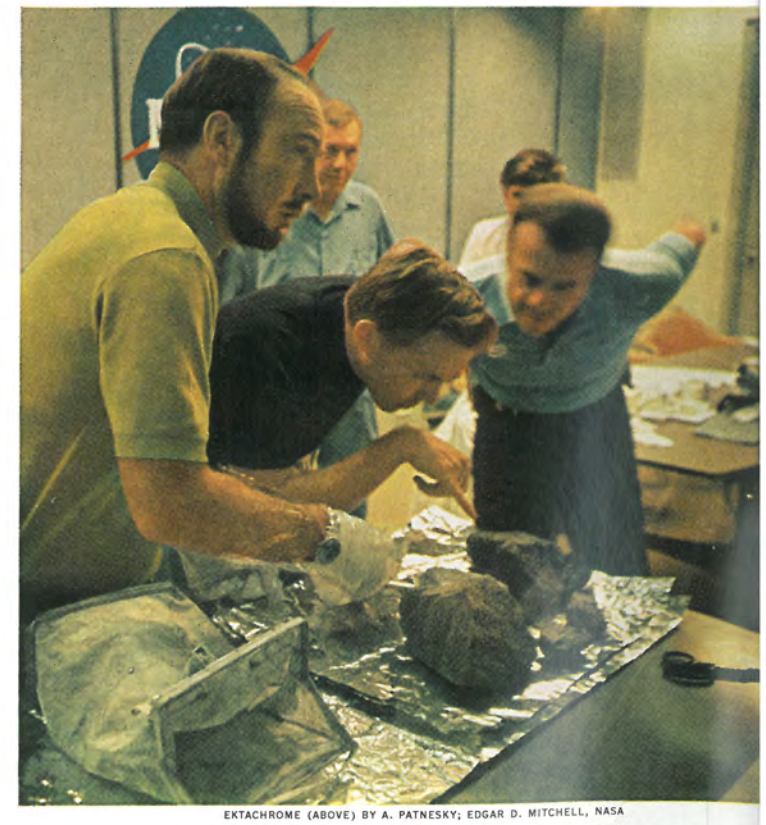




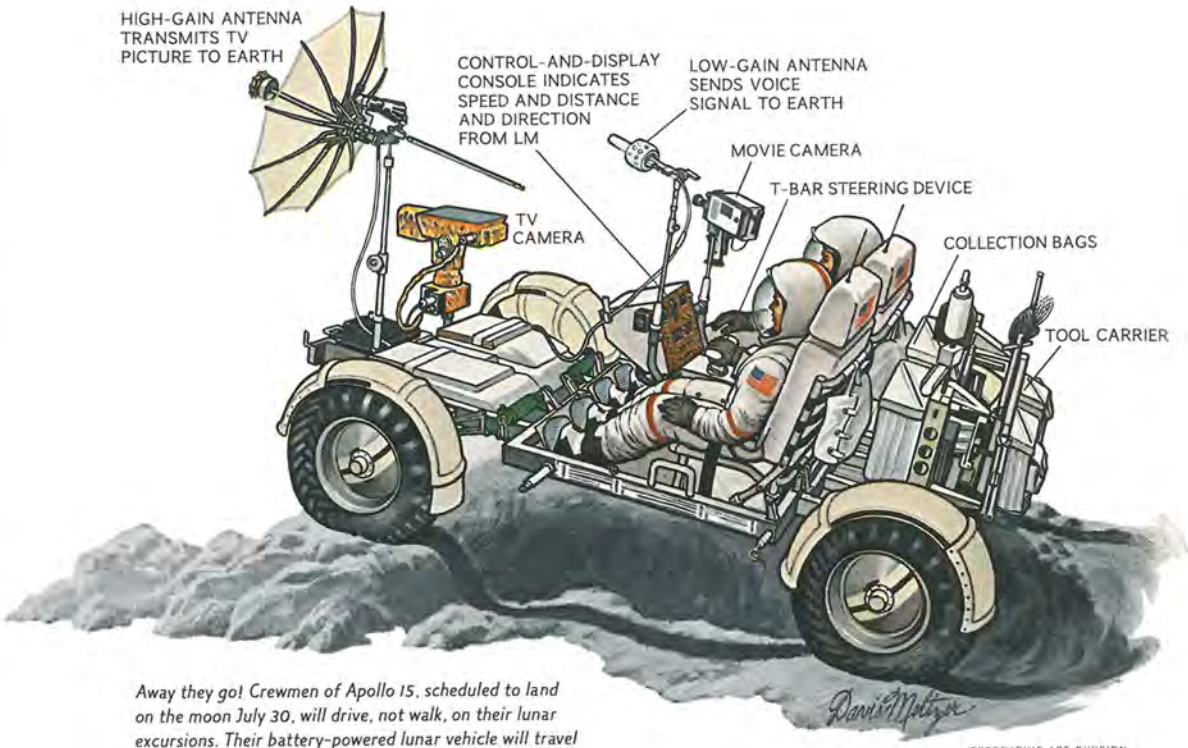
Spawn of Cone Crater: White rock that once rested under the lunar surface was broken by the impact of a meteorite and flung to the crater's rim. Most geologists believe that this material originated during the cataclysm that formed the Imbrium basin. Its energy, equal to millions of H-bombs, welded various types of minerals, dust, and rock fragments into an aggregate called breccia. The rounded surface of the boulders appears eroded, probably by the constant bombardment of micro-meteorites and stresses set up by 500° F. shifts in the moon's temperature.

After Mitchell photographed this boulder to show its setting, he hammered off a piece and dropped it in the cuplike sample container.

Hard-won souvenirs from space: At the Lunar Receiving Laboratory in Houston, Mitchell unveils two of the largest lunar rocks yet collected. Gloves protect the material from contamination as it is transferred to airtight cans for storage and later study. Here with Roosa, center, during their two-week quarantine at the lab, Mitchell and Shepard discuss with scientists the features and original location of these football-size rocks. NASA will not quarantine future Apollo crews since returning astronauts and moon rocks have carried no harmful agents or living organisms.



EKTACHROME (ABOVE) BY A. PATNESKY; EDGAR D. MITCHELL, NASA



Away they go! Crewmen of Apollo 15, scheduled to land on the moon July 30, will drive, not walk, on their lunar excursions. Their battery-powered lunar vehicle will travel at eight miles an hour on tires woven of zinc-coated piano wire; chevron treads of titanium, riveted to the wire mesh, will keep the wheels from sinking in deep dust.

BORROWING FROM THE PAST, building for the future, Apollo 14—in the words of Alan Shepard—"has shown we have reached maturity in the manned space program." Earlier missions, 11 and 12, emphasized the technology of landings. Like voyagers in the wake of Columbus, Apollo 14's crew systematically explored the new realm. In the final missions, 15, 16, and 17, men will venture into even more varied terrain.

The site selected for Apollo 15 holds many complexities. Plans call for the LM to land on a plain beside the lofty Apennine Mountains, where the astronauts hope to collect samples from the foot of the range itself. They may also investigate Hadley Rille, a feature of uncertain origin that appears on photographs as a dry river bed would on earth.

Apollo 15's LM will be able to stay on the moon 67 hours, twice as long as *Antares* did. Improved suits will allow greater mobility as the spacemen go about their chores.

As with earlier lunar samples, most of the rocks from Apollo 15 will be kept together in NASA's custody, but fragments will be distributed for extensive study among a thousand scientists the world over in a major program of international cooperation. □

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The National Geographic Society now spends more than a million dollars a year to support research projects in the many sciences related to geography. Naturally, it takes a few years after each grant is made before the results can be published. We are pleased now to announce the appearance of a new volume, reporting the findings resulting from grants made in 1965. All the reports in this volume are interesting, and some are exciting accounts of scientific breakthroughs.

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