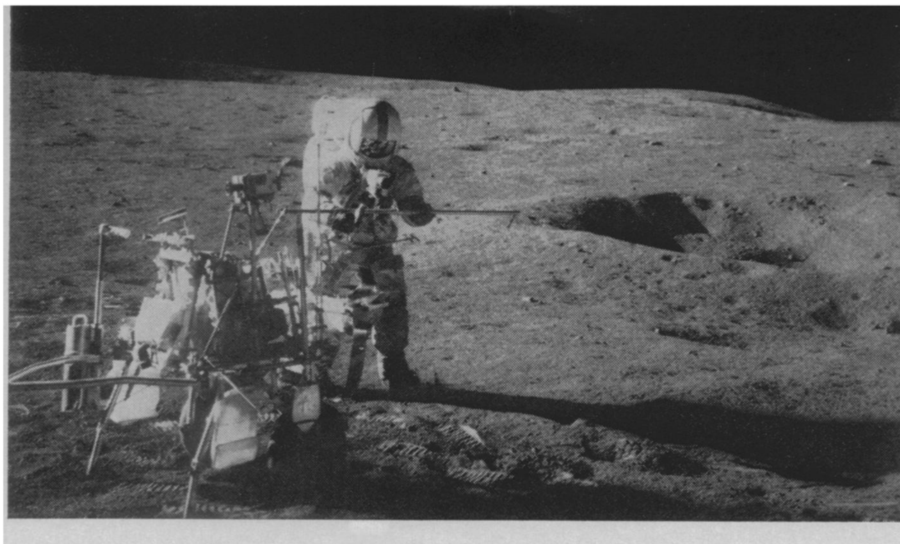
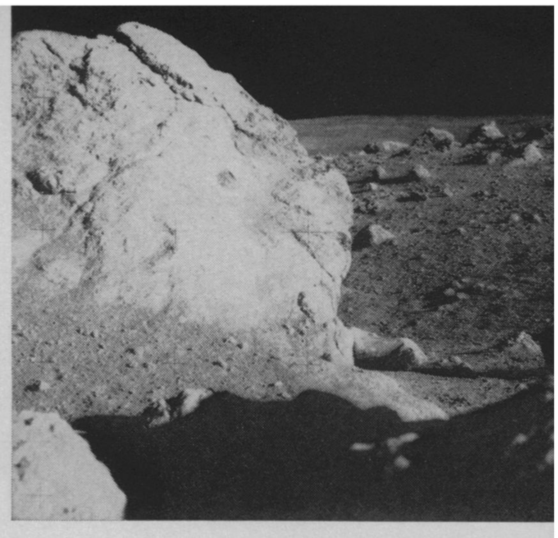


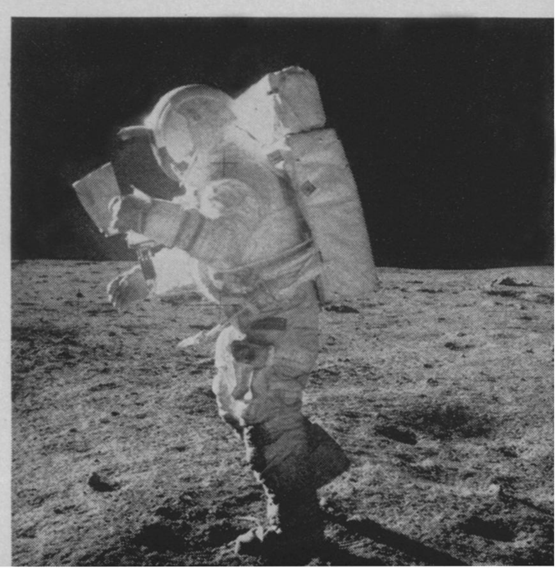


Back from the moon: Sample tests begin

The rocks from the Cone Crater area show promise of good scientific return

Shepard (above), readying core tube, and Mitchell sampled and photographed lunar boulders.

Photos: NASA



The stark, barren landscape of the moon, pocked by craters, outlined by mountains and maria, textured by rilles and silhouetted by a black horizon, is, to say the least, like nothing on earth. The men who travel to its surface are often deceived by the terrain, by colors, sizes and distances. What may appear white on the surface may or may not be white back on earth; what may appear to be a long distance may actually be short.

Thus this week as the Apollo 14 crew began their detailed debriefings of their 750,000-mile journey and scientists got their first glimpse of the new treasures returned, the truth began unfolding, bit by bit: The white rock chipped from a boulder near the rim of Cone Crater was indeed very white. A sampling of two retrieved rocks contained elements scientists had hoped to get from the highland area of the moon. And a meticulous boulder-by-boulder recap of the traverse up Cone Mountain revealed that Astronauts Alan B. Shepard and Edgar D. Mitchell were indeed closer than they thought to the actual rim (SN: 2/13/71, p. 110).

The scene of all of this was the National Aeronautics and Space Administration's Lunar Receiving Laboratory at the Manned Spacecraft Center in Houston, where both the astronauts and the rocks are in isolation for arduous examination.

The first rock box arrived last week at Houston about 12 hours earlier than Shepard, Mitchell and Stuart A. Roosa, who were pronounced fit and healthy. While the quarantined crew is being debriefed for three weeks on every minute of their nine-day trip, the lunar material will only be beginning the first leg of its earth journey. For 45 days the rocks and soil will go through a preliminary examination during which they will be analyzed for mineral and element content, weighed, photographed and documented before being distributed to the hundreds of scientists participating in the lunar program. It will then be anywhere from three to six months before the real scientific story of Apollo 14 is told. (The second rock box was opened Wednesday of this week. The two tote bags, containing the football-size rock, were to arrive in the Mobile Quarantine Facility from off the carrier New Orleans early Thursday and the spacecraft's command module was to arrive early Saturday.)

But the first box, opened last Friday, has already provided excitement. It contained four core tubes and 17 sample bags (including the bag with the lemon-size white rock) of the "cleanest material ever observed" from the lunar surface.

The white rock, ironically from bag 13, may turn out to be even more rewarding than Apollo 12's rock 13 (SN:

1/23/71, p. 62). In appearance it stands apart from anything yet seen from the moon. It is white with small angular gray inclusions. Rounded to some degree, it contains the characteristic pits found in previous rocks. And at first look, it does not appear to be igneous.

"By far the most significant finding so far, however," says Dr. Robin Brett, vice chairman of the Preliminary Examination Team at MSC, "is that we are finding high uranium, potassium and thorium" in at least two of the rocks. The first, separated from the other rocks in Samoa and flown directly to the radiation counting laboratory 50 feet beneath the LRL in Houston, contained 10 times as much potassium, thorium and uranium as any of the Apollo 11 and 12 basalts, although both KREEP and rock 13 (SN: 1/16/71, p. 43) were high in these elements. Another rock placed in the radiation lab this week turned up the same evidence. "If these represent characteristic material from the Apollo 14 site," says Dr. Brett, "It is very interesting."

The lunar highlands are believed to be a primitive layer segregated from the volume of the moon very early in the moon's history. "At least we were on the right track by going to the Fra Mauro highlands," says Don Beattie of NASA's Lunar Exploration Office in Washington. The rock is highly differentiated—more so than any previously seen from the moon. During the differentiation process, potassium, uranium and thorium preferentially settle out from the elements of less radioactive concentrations. "This is the kind of evidence you would expect to see if there were a lunar crust evolved early in the moon's history," says Beattie.

Adding to the scientists' pleasure was the discovery that the samples were taken even closer to the actual rim of Cone Crater than previously thought. As geologists retraced the traverse up Cone Crater with the astronauts, this time aided with photographs from the lunar surface, they found that the men had been stopped only 25 to 50 meters short of the actual rim. It was earlier thought they were at least a 100 meters away.

"The slope of the area is very misleading," says Dr. Everett Gibson, the science adviser for the Apollo 14 mission. As the men neared the rim the ground fell off slightly rather than continuing upward. They turned east toward the boulder field and a ridge which is actually higher than the rim itself. Had they continued north, they would have reached the rim.

"When Ed [Mitchell] saw the map and saw the boulder and how close they had been [to the rim], he was very disappointed," says Dr. Gibson of the debriefing session. At the time, however, the men had no way of knowing. By getting that close, says Dr. Brett, "they understand, as we do, that the scientific objectives of the traverse were reached."

Another interesting return was two lunar clods. Near station A on the traverse up the crater, the astronauts picked up a rock that fell into two pieces, but which they bagged anyway. According to Dr. Gibson, it is a very friable rock (easily crumbled), almost like a clod of dirt with small white fragments (possibly feldspar). No material as friable was returned on the other two trips.

The total 96-pound return is expected to include at least 16 documented samples, and possibly more. A documented sample is one that the astronauts photograph before and after picking it up; in addition they describe while on the moon the area and the position of the rock. Besides these documented samples and some special samples, the return should include at least nine grab samples (rocks not documented), eight soil samples and three core tubes of different lengths containing soil from beneath the surface.

Special samples include soil taken for environmental analysis near the bottom of a trench shoveled by the crew. The trench is of special interest to the scientists because the astronauts reported definite layering of the subsurface: three color variations ranging from dark to very light material. A biosample of 94 grams of lunar material is also under scrutiny for any evidence of viable organisms on the moon. This quick analysis must be completed before the crew can be released from quarantine.

Photographs taken by the crew from orbit and from the surface are expected to yield valuable data in themselves. In addition to the lunar orbit photography taken by Roosa, surface pictures include at least 17 stereo photographs to provide information on the texture of the regolith and on the surface of large rocks that could not be returned; 450 to 500 pictures taken with the Hasselblad cameras, including panoramas through the LM windows; 12 panoramas from the surface, and about 100 sample documentation pictures.

"We have good panoramic coverage from along the traverse line," says Dr. Gordon Swann, principal investigator of lunar geology from the U.S. Geological Survey's Astrogeology Branch at Flagstaff, Ariz. These panoramas are the primary means of reconstructing the traverse and studying in detail the geology site. According to Robert Sutton, also of Flagstaff, a 360-degree pan was taken at the highest point on the climb up Cone Crater, as well as at designated stations along the route.

The crew is scheduled to begin photographic debriefing with the scientists next week. □

CALIFORNIA QUAKES

Science has no remedy

At 6 a.m. Tuesday, Feb. 9, Los Angeles was struck by the first of a series of tremors centered in a little-known fault in the northern part of the Los Angeles basin. When the dust cleared, 64 people were dead and several thousand injured. A Los Angeles County engineer estimates that the property damage, now set at several hundred million dollars, may eventually mount into the billions.

Dr. Clarence Allen of the California Institute of Technology has identified the fault as the Soledad Canyon Fault in the Santa Susana fault system of the San Gabriel Mountains. The epicenter was apparently 10 miles east of the town of Newhall, 40 miles north of Los Angeles.

Casualties were minimized by the time of day at which the quake occurred. The toll would undoubtedly have been much greater, for instance, during the rush hour. Most residents of the hard-hit San Fernando Valley were still in bed.

Yet this was not even a major earthquake. The Los Angeles quake, rating a 6.7 on the Richter scale of magnitude, was about one-eightieth as intense as the great San Francisco quake of 1906, which seismologists estimate was about magnitude 8.3. There are 60 to 70 earthquakes every year with magnitudes comparable to the one in Los Angeles. They never gain public attention because they occur in unpopulated areas. In fact, the night before the Feb. 9 Los Angeles quake a much larger one—magnitude 7.3—occurred somewhere in the South Atlantic.

The great earthquake that scientists have been predicting for the notorious San Andreas Fault is yet to come, seismologists say. The San Andreas Fault was ominously quiet during the recent quake.

There is little doubt that earthquakes will continue to harass Californians. A recurrence curve recently plotted for the San Andreas Fault (SN: 10/31/70, p. 352) shows an eight-magnitude earthquake occurring every 102 years, and smaller shocks at shorter intervals.

The inevitability of it all has been starkly illuminated by the new understanding of surface movements on a global scale. The California fault system is a center of tectonic activity, marking the boundary between the Pacific and North American crustal plates. In response to still little-understood mechanisms in the earth's mantle, the western part of California is moving slowly northward relative to the rest of the continent. Drs. Robert S. Dietz and John C. Holden of the National Oceanic and Atmospheric Administra-