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-

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The Olive View Sanitarium in Sylmar was supposed to be earthquake-proof.

tion recently published an extrapolation showing that Baja California and a sliver of California west of the San Andreas will eventually split off from the rest of North America and drift northward. In 10 million years, Los Angeles will be abreast of San Francisco, they predict, and in 60 million years it will begin to slide into the Aleutian trench. Thus on a geologic time scale, the die seems to be firmly cast. But on the time scale of civilized societies, earthquakes, not surface movements on a global scale are the immediate problem.

Scientific efforts to enable Californians to live with this perpetual hazard are taking two directions: prediction of the occurrence of earthquakes and reduction of their impact. Though the scientific knowledge to predict earthquakes is not far in the future (see p. 131), the actual capability of predicting them in practice is much further off. Dr. Charles Richter believes that earthquakes may not be predicted in the same way as the weather for another century.

In the meantime, several studies have suggested ways to reduce the human suffering and property damage caused by earthquakes. Last November, the Office of Science and Technology's Task Force on Earthquake Hazard Reduction released a report recommending such precautions as requiring earthquake-resistant design in all new Federal buildings and in other publicly owned facilities such as schools and hospitals; consideration of seismic risks in urban planning; development of plans for earthquake disaster relief; revision of income- and property-tax structures to provide incentives to reduce earthquake hazards, and improved measurement of earthquake risk.

Since the 1950's, when Los Angeles abolished its 13-story limit on the height of buildings, structures have risen to a height of 42 stories. One now under construction will reach 52 stories. These new skyscrapers, designed to weather earth tremors, were relatively unscathed by the Feb. 9 earthquake. But the new $23 million Olive View Sanitarium in Sylmar, a building which was supposed to be earthquake-proof, collapsed completely, killing three people. Forty-five deaths resulted from the collapse of a Veterans Administration hospital in Sylmar. Thousands of people were forced to evacuate a 20-square-mile area below a dam that was damaged by the quake.

Sen. Alan Cranston (D–Calif.) says he will seek a Congressional investigation of the collapse of the VA hospital. United Nations Secretary-General U Thant suggests the possibility of setting up a worldwide early warning system against earthquakes and other natural disasters.

The Alaskan earthquake of 1964 sparked similar requests for studies, one of which proposed a 10-year program for earthquake study that would ultimately cost $26 million a year. The study's recommendations have not been carried out, and Federal spending for earthquake research is now in the neighborhood of $10 million a year.

But the Alaska quake was in a thinly populated area. Perhaps this glimpse of the devastation an earthquake of only moderate magnitude can cause in a heavily populated area like Los Angeles will cause the public to demand a higher priority for earthquake research in the Federal budget and to seek faster solutions to the human and engineering problems of building safe structures in earthquake-prone areas. Or maybe there will only be another study. □

EKA-MERCURY

Evidence for element 112

Within an atomic nucleus both cohesive and disruptive forces operate. The balance between them is affected both by the size of the nucleus and the ratio of neutrons to protons. The heaviest nuclei, which are the largest and the richest in neutrons, are least likely to be stable.

Nuclei of the heaviest elements are apt, therefore, to end their lives in spontaneous fission or the lesser breakages of alpha or beta decay. The elements with the highest atomic numbers (and also the highest atomic weights) have such short lifetimes that they do not exist naturally on earth, but have to be manufactured.

Up until now the maufacturers have gotten as far as element number 105. (Number 92, uranium, is the highest found naturally on earth.) The higher the number, the more evanescent and elusive the element is, and the more difficult to make.

Lately, however, theorists have pointed out (SN: 12/14/68, p. 593), that although absolute stability cannot be expected above 92, certain configurations of neutrons and protons should produce relative stability in this region—lifetimes of millions of years rather than millionths of a second.

One of the most promising of these theoretically quasistable nuclei is element 114, and a number of experimental efforts have been mounted to find it. One of these projects now appears to have found element 112. The evidence is reported in the Feb. 12 NATURE by Drs. A. Marinov of the Hebrew University in Jerusalem, C. J. Batty and A. I. Kilvington of the Rutherford High Energy Laboratory at Didcot, Berkshire, in England, G. W. A. Newton and V. J. Robinson of the University of Manchester and J. D. Hemingway of the Universities Research Reactor in Risley, Lancashire.

The way to make a superheavy nucleus is to bang together two heavy nuclei and hope they stick. To achieve the fusion the nuclei must be going fast enough to overcome the electrostatic repulsion between the two positively charged nuclei.

The best of the current machines that accelerate whole nuclei, ion accelerators, cannot accelerate heavy ions up to the energy levels that could produce the superheavies. But there is an indirect alternative: If a heavy-element target is irridiated with high-energy protons, sometimes whole nuclei will recoil, and these recoil nuclei can have sufficiently high energies to make the fusions possible.

In the actual case, targets that were