space sciences

From our reporter at the Third Lunar Science Conference in Houston

Speculating about the 'Genesis bean'

If scientists can determine by examiation of lunar samples how the moon was formed and what primordial material it was made of, it would help solve questions of the origin of the earth and the solar system. Until the first samples were returned from the moon, the only extraterrestrial material scientists had studied were meteorites. It would logically follow then that many current studies would be focused on the relationships of meteoritic material to lunar composition.

Now John A. Wood of the Smithsonian Astrophysical Observatory in Cambridge, Mass., and colleagues Ursula B. Marvin, J. B. Reid Jr. and G. J. Taylor report another puzzling similarity. They found a lunar object—a little green glass fragment dubbed "Genesis bean"—that is similar in chemical composition to a class of meteorites called howardites. Compared with other lunar material, the green bean is high in iron and magnesium and low in titanium. Because howardites are rare, says Wood, "you have to ask what it means that this composition is occurring both in meteorites and on the moon."

It is not regarded as likely that the material fell on the moon, or that howardites on earth come from the moon. "I really believe they came from different places in the solar system," says Wood. He suggests that the composition of the bean might be a fair approximation to the composition of some of the raw material the moon was made of.

Detecting uranium 236 and neptunium 237

Five Argonne National Laboratory scientists have found uranium 236 and neptunium 237 in lunar samples from the Apollo 12 and 14 sites. Neither had previously been found in nature.

On the theory that solar flare protons irradiating uranium 238 would produce those two isotopes, the scientists used a mass spectrometer to examine soil samples having high U-238 concentrations. They found neptunium 237 in a concentration estimated at 1.1×10^{-13} grams per gram of sample. Larger concentrations of U-236 were found—2×10^{-8} grams per gram of sample. After their discovery, the scientists found U-236 produced in terrestrial U-235 ores, but the concentrations were smaller than in the lunar sample concentrations.

The investigators were P. R. Fields, Herbert Diamond, D. N. Metta, D. J. Rokop and C. M. Stevens.

An out of whack moon

The moon is not spherical: it is asymmetrical and has a bulge perpendicular to the earth-moon line. The mean radius of the moon is 1,737 kilometers, but only two places actually have that radius. The near side averages two kilometers below the mean and the far side from six to nine above the mean (SN: 8/14/71, p. 106).

Now scientists studying the laser altimetry results have some more facts. W. M. Kaula and Gerald Schubert of the University of California at Los Angeles and W. L. Sjogren of the Jet Propulsion Laboratory in Pasadena report detection of a feature that helps account for the distortion—a large (1,400 kilometer-wide) unfilled basin on the far side at 180 degrees longitude. "This basin and the low mare on the near side with the highlands sticking out on the sides account for the distorted shape," says Schubert.

In addition, says Schubert, "The center-of-mass is displaced from the center-of-volume of the moon two kilometers in a direction 37 degrees east of the direction of the earth." As another scientist puts it: "It appears that, not the earth, but something else has the attention of the moon."

Dating lunar craters

Lunar rocks are dated from the time of their crystallization. But dating crater formations is another story. One method is to determine cosmic-ray exposure ages—how long the ejecta material has been near the lunar surface.

By this method, P. Eberhardt, O. Eugster, Johannes Geiss, N. Grogler, J. Schwarzmuller, A. Stettler and L. Weber of the University of Bern, Switzerland, attempted to determine when the KREEP material at the Apollo 12 site was brought to the surface and when a probable related event occurred—the formation of the crater Copernicus. Their results place both events 850 million to 900 million years ago.

Irradiation histories of the Apollo 14 Fra Mauro material as measured by D. S. Burnett, J. C. Huneke, F. A. Podosek, G. Price Russ, Grenville Turner and G. J. Wasserburg of the California Institute of Technology place the event that formed Cone Crater at 24 million years ago.

In addition, the larger boulder at St. George Crater on the edge of the Appenine front sampled by Apollo 15 astronauts "couldn't have been there 50 million years ago," says Russ.

Another vote for moon water

In the face of voluminous chemical evidence that the moon does not now, and probably never had much if any water, scientists continue to search for its traces. Their findings always stir up lunar scientists.

One report by John W. Freeman Jr. and H. Kent Hills of Rice University (SN: 10/23/71, p. 277) was the detection of water vapor by the Suprathermal Ion Detectors left at the Apollo 12 and 14 sites. The Rice group still cannot account for the vapor from a source other than the moon.

Now, S. O. Agrell, J. H. Scoon, J. V. P. Long and J. N. Coles of the University of Cambridge have reported finding a hydrous mineral, goethite, in a sample from Fra Mauro. The goethite occurs as a surface corrosive layer on iron grains—like rust on earth.

The team readily acknowledges that the "small amount of water required to form this goethite could have come from an external" as well as an internal source. Two external possibilities are comets or carbonaceous chondrites. But the discovery of the first lunar hydroxyl is intriguing, and the search will undoubtedly continue.

"The evidence seems good that we have found the first hydrous mineral formed on the moon," says B. J. Skinner of Yale.