lunar sciences

Gathered last week at the 2nd annual Lunar Science Conference in Houston

EROSION

Cosmic rays and meteoroids

In November 1969 the astronauts of Apollo 12 landed in the Ocean of Storms not far from the Surveyor III spacecraft, which had been on the moon since April 1967. They returned to earth the TV camera and visor which had been exposed to the lunar atmosphere and solar particles for 31 months. The camera parts, distributed to lunar scientists, have been examined for galactic cosmic-ray tracks, particle tracks and effects from the solar wind.

Drs. P. B. Price of the University of California at Berkeley and R. L. Fleischer of General Electric's Research and Development Center presented preliminary results of their study.

One unexpected result is that there was no evidence of micrometeoritic impacting of the camera. A more unexpected find was the high density of particle tracks.

These two findings taken together lead the scientists to attribute the great degree of erosion and gardening that has taken place on the lunar surface more to the effect of solar wind particles and galactic cosmic rays and less to the bombardment of micrometeroids than they previously believed.

PALEOMAGNETISM

Evidence for former magnetic field

Whether the moon at one time had a magnetic field is still a controversial point among lunar scientists. But as a result of the Apollo 12 studies evidence seems to be mounting in favor of the previous existence of one.

Prior to the results reported in Houston scientists had two sources of data on the subject: the Explorer 35 spacecraft, which had found evidence of a lunar-wide magnetic field of 6 to 10 gammas, and the Apollo 12 magnetometer, which had found a localized field of 35 gammas.

After examination of electrical properties of the Apollo 12 samples, Dr. David W. Strangeway of the University of Toronto says that about 3.5 billion years ago the moon might have had a magnetic field one-tenth that of the earth's. This could have been an intrinsic field, he says, or the moon could have been exposed to magnetism.

This evidence, he says, probably means that the moon did have a liquid core at least 3.3 billion years ago. But scientists are far from agreement on that point.

SELENOLOGY

Electrostatic processes

Most lunar scientists agree that the material covering the surface of the moon must be moving. They see fillets or gently rounded drifts on the side of the rocks and evidences of down-slope creeps; but they do not agree about the mechanism responsible for this phenomenon.

One explanation is the view of Thomas Gold of Cornell University that an electrostatic process on the moon is responsible for the transport of dust from place to place. Gold, who has propounded this theory for years, now points to new supporting evidence from the Apollo 12 sample studies.

Examination of the core samples from the Ocean of Storms shows distinct striation or layering. The layers, some as thin as one centimeter, differ both in chemistry and grain size and distribution. This distinct layering, Gold believes, is caused by a gentle filling-in process that is proceeding faster than the digging rate process caused by meteoroid impact.

If the lunar surface were bombarded by electrons with energies of 200 to 800 electron-volts, the grains of the surface would become charged differently. The resulting agitation of the soil would account for the movement as well as the filling-in process. Gold believes that such an electron bombardment could occur as the moon passes through the earth's magnetic tail four days each month.

LUNA 16

An unusual core

Lunar scientists believe that a thin veneer of unconsolidated particulate debris, called lunar regolith, covers the surface of the moon at varying depths. It is generally assumed that the deeper the regolith, the older the region, or the longer it has been exposed to the processes of meteoritic impact.

Thus it was that the results from the preliminary analysis by the Russians of the core tube sample from Luna 16 presented some surprises. Academician Alexander P. Vinogradov of the Soviet Academy of Sciences concluded that the thickness of the Sea of Fertility, which scientists believe is the oldest mare, is very small. From a core sample 35 centimeters deep, he concludes that the mean thickness of the regolith is possibly 0.5 to 1 meter; the thickness at the Apollo 11 and 12 sites was 4 and 3.5 meters, respectively.

LUNAR ALBEDO

Some possible explanations

Ever since selenologists first began unraveling the optical properties of the lunar surface, they have been puzzled by the moon's low albedo, or reflectivity, and its reddish spectrum. Adding to the confusion were younger craters such as Tycho and Copernicus that have a very high albedo. To explain this difference, some scientists have concluded that the low albedo is due to an external darkening process.

It is thought that the lunar surface or regolith is formed by a grinding up of crystalline rocks that were originally deep in the moon by meteorite impacts. And yet, when Drs. B. W. Hapke, W. A. Cassidy and E. N. Wells of the University of Pittsburgh ground up this rock, the resulting powder was very light colored. The question is, says Dr. Hapke, "What else has been done to the soil besides pulverization to turn it to dark material?" He says a vaporization process could do it.

Dr. Michael Maurette of France's Laboratory of Spectrometry at Orsay, found a direct correlation between grains that were heavily damaged by the solar wind and those having a low albedo, suggesting that this process might have a role in the mystery.