Gathered in Houston last week from the preliminary studies of Apollo 12 moon rocks

PASSIVE SEISMOMETER

More lingering signals

The passive seismic experiment designed to monitor lunar seismic activity, and free oscillations of the moon and meteoroid impacts, recorded 60 signals of natural origin, ranging in duration from 15 to 104 minutes.

Dr. Gary Latham of the Lamont-Doherty Geological Observatory says the longest signal, lasting 104 minutes, is similar in nature to the one recorded from the lunar module ascent-stage impact (SN: 11/29, p. 493). "And while one cannot preclude the possibility that this was a shallow moon quake," Dr. Latham says, "the most likely hypothesis is that it was caused by a meteoroid impact some 100 kilometers from the experiment."

The number of signals received can be explained by the frequency of meteoroid impacts. "It appears that the moon is quiet seismically, much less active than the earth; the interior seems to attenuate or dampen seismic energy and the moon itself appears to be a rather cold body," says Dr. Latham.

Scientists are still in doubt as to what may be responsible for the length of the signals, which varies from the expected 3-minute signals to the received 55- to 104-minute signals. They could result from such prolonged occurrences as impact-triggered rock slides within craters, or from a peculiar lunar structure.

Some of these questions may be answered next month when the Apollo 13 crew deploys the experiment in the highlands, which may have a structure quite different from the possibly fragmented structure of the lunar plains.

MAGNETOMETER

A localized lunar field

In its orbit the moon becomes embedded in several different magnetic field regions: the solar wind in interplanetary space, the interaction of the solar wind and the earth's magnetic field while in the bowshock and transitional regions, and the earth's intrinsic field while in the geomagnetic tail region. The Apollo 12 magnetometer was designed to measure the moon's steady magnetic field, as well as the variations caused by these other fields.

Initial data from the instrument lead scientists to believe that a portion of the moon near the Apollo 12 Ocean of Storms site is magnetized. Dr. Charles P. Sonett of the NASA-Ames Research Center believes that the field is localized and 30 gammas in magnitude, or one-thousandth the strength of the earth's field.

The lunar field may be a residual or paleomagnetic field.

Such fields are usually formed from iron in a lava flow or dike that cools from a molten state and acquires a magnetism determined from the magnetic field to which it is exposed. Dr. Sonett believes that possibly two billion to four billion years ago the area of the site could have been hot and exposed to such a magnetic field.

There are two possible ways in which a residual field could have been formed, says Dr. Sonett. The moon may have come close to the earth, orbiting inside earth's magnetosphere. This would provide the field, but there are theoretical difficulties in locating the moon so close to the earth at the time the field was formed. Alternately the field might have been acquired from an interplanetary magnetic field.

ION DETECTOR

Low-energy ion clouds

The suprathermal ion detector measures the flux, composition, energy and velocity of low-energy positive ions and high-energy solar-wind particles. The ion detector recorded such activities of the astronauts as the ascent-engine firing and the ascent-state impact.

Scientists are puzzled by the readings of sporadic low-energy ion clouds during the moon's passage through the earth's transition zone. Dr. Kent Hills of Rice University says it is difficult to see what might be generating these ion clouds and keeping them around. One hypothesis is that the clouds may be caused by fluctuations in the electrical and magnetic fields of the solar wind.

The solar wind might not be the only source. "We could be getting the magnetic field of the moon itself, or interaction between the magnetic fields and the solar wind," he says. How and why these fields fluctuate is unknown.

Another surprising reading has been an indication of the presence of very energetic protons and alpha particles when the instrument is on the night side of the moon.

Scientists did not expect to see solar-wind particles when the moon has its back to the sun. One speculation is that perhaps the magnetic field of the moon is bending the particles around the moon.

SOLAR-WIND SPECTROMETER

No bowshock for the moon

The solar-wind spectrometer measures the flow of electrons, protons and other charged particles from the sun striking the lunar surface.

The experiment deployed on Apollo 12 confirms earlier findings of satellites and of the solar-wind composition experiment of Apollo 11: The solar wind strikes the surface of the moon without alteration. This contrasts with the situation as the solar wind approaches the earth, whose magnetic field sets up a shock wave where it comes in contact with the incoming wind plasma (SN: 8/31, p. 216).

Dr. Conway Snyder of the Jet Propulsion Laboratory says that every time the experiment has been in a position to see the solar wind, it has been there: in interplanetary space, in the earth's bowshock, and in the magnetopause between the earth's magnetic influence and the bowshock. While the moon is in the earth's geomagnetic tail, he says, the experiment detects essentially no solar plasma; during the lunar night, the plasma is similarly unmeasurable by the experiment.