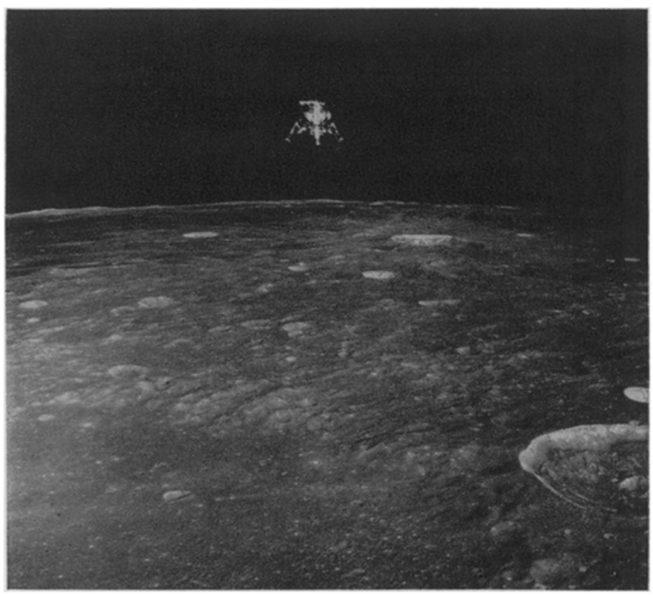
More surprises from the moon

Apollo 12's samples are younger and excitingly different from the Apollo 11 moon rocks



NASA

Apollo 12 brought inconsistency from Ocean of Storms.

Before Apollo 11, several prominent lunar specialists believed that the moon's maria would prove to have formed as geologically recently as 500 million years ago. A first look at the Apollo 11 rocks overturned the estimate, revealing that the samples were at least 3.1 billion years old. A more refined dating technique (SN: 11/15, p. 445) provided the age to be even more startling: some 4.6 billion years, as ancient, by some estimates, as the solar system itself.

Researchers had suspected that the Apollo 12 rocks, gathered from the Ocean of Storms on the western side of the moon's visible face, might be even older than the Apollo 11 crop from the Sea of Tranquility.

Instead, reports Dr. Oliver Schaeffer of the State University of New York at Stony Brook, they appear to be much younger, perhaps as little as 2 billion years old, ranging back to about 2.5 billion years.

More precise dating may alter the exact number, but the evidence is likely to remain that the two groups of rocks differ widely in their ages, possibly by more than a billion years. This vast span of time, says Dr. Schaeffer, means that the heat-producing activity that formed the rocks, "whether volcanic or meteoritic activity, took place over an extended period of time, not on a short time scale."

Even so, says Dr. Elbert King Jr., former curator of the Lunar Receiving Laboratory and now at the University of Houston, that span of events, however broad, took place early in the moon's history. Even the two billion years since the Apollo 12 rocks were presumably formed is a long time for the moon to have been quiescent, considering the fact that the earth is still geologically active.

Dr. John O'Keefe of Goddard Space Flight Center, however, sees the great disparity in the two rock groups' ages as evidence that the moon may not be completely inactive after all. If there was so much heat present during the moon's formation that it kept geologic processes going two billion years later, he hypothesizes, some of that heat ought to be left today.

The possibility of heat remaining in the depths of the moon is one of the most active of lunar controversies; the Apollo 13 astronauts will provide valuable data toward an answer by sinking a pair of sensitive temperature probes nine feet down into the moon's crust.

Another unexpected, and particularly welcome, discovery was the great abundance of rare gases—helium, neon, argon—in the lunar soil. "We were quite surprised by the very large volumes of gas in the surface material," says Dr. King. "The obvious source is the solar wind."

This raises an intriguing possibility, he says, if rocks were lying on the moon's surface being bombarded by the solar wind and then were splashed over by molten glass created by meteorite impacts. "We may have little time capsules of trapped gas to tell us much about the previous physics of the sun."

If the abundance of rare gases is exciting, there is an equally important absence: the marked shortage of a class of elements known as siderophiles, heavy metals that sink to the core of a planet during its molten phase, leaving rocky slag making up the mantle and crust. This is what happened when the earth formed, but why should the moon, which presumably has little or no metal core, show the same lack? Dr. O'Keefe and Dr. Ross Taylor of the Australian National University have the same explanation: the moon's siderophiles—nickel among them—are instead in the core of the earth. This might seem to suggest agreement on the moon's origin, but it doesn't.

Dr. O'Keefe sees the lack of heavy lunar metals as strong evidence that the moon was ripped from the side of the already-formed earth, after the siderophiles had already sunk to earth's core. But Dr. Taylor argues that this should result in a moon with the same elemental makeup as earth's mantle, whereas instead it has those uncharactertistic abundances of titanium, zirconium and other refractory (high-melting-point) elements. Dr. Taylor therefore opts for the theory that the moon condensed from a Saturn-like ring of debris circling the earth while the planet was still only partly formed.

As scientists discussed what they had learned from their existing lunar data this week, one researcher made a proposal that, if not completely unworkable, will certainly prove to be one of the most controversial in space research.

To astonished scientists gathered at the annual meeting of the American Geophysical Union in San Francisco, Dr. Gary V. Latham of Lamont-Doherty Geological Observatory announced that he will officially propose dropping a nuclear bomb on the moon.

The one-to-five-kiloton device, delivered by rocket to explode on contact, would be aimed to hit on the far side of the moon, directly across the moon's center from one of the passive

seismometers left by the Apollo astronauts. The blast would create a crater about one kilometer wide, says Dr. Latham, who maintains that it would be the only way of producing seismic waves capable of penetrating all the way to the lunar core.

Despite possible treaty violations, Dr. Latham says, "I don't think the project is impossible if we include the Russians." He plans to submit the proposal to the National Academy of Sciences for approval, since "It won't work without their cooperation."

It was Dr. Latham, chief scientist for the Apollo seismic experiments, who proposed crashing the Apollo 12 lunar module into the moon to provide large impact (SN: 11/29, p. 493), as well as doing the same thing next March with the whole third stage of the Apollo 13 rocket.

The nuclear blast, Dr. Latham believes, ought to be timed between Apollos 15 and 16, when there will be enough lunar seismometers to form an adequate network, but hopefully before any of them have time to wear out. □

APOLLO 12

Manmade lightning

When the launch vehicle carrying the moonbound Apollo 12 astronauts lifted into the thick cloud cover above Cape Kennedy last month, the crew suddenly found itself staring in astonishment at a fully lighted panel of warning lights (SN: 11/22, p. 470).

A surge of electricity had caused the spacecraft fuel cells to disconnect automatically and had given an on-board computer incorrect instructions to realign a gimbal on a device that indicates orientation of the spacecraft. Five minor temperature sensors were burned out, and 100 types of measurement were affected for somewhat less than a second. None were essential to the mission.

The blowout was caused, scientists at the fall American Geophysical Union meeting in San Francisco were told this week, by two moderate-sized lightning strikes triggered by the passage of the launch rocket into the clouds. The first came 36.5 seconds after launch, when the vehicle and its three-quarter-mile-long ionized plume served as a conducting rod for the cloud to discharge its electrical energy to the ground. The second came 52 seconds after launch, when a bolt of lesser intensity passed between two cloud layers.

"It was, in effect, man-created lightning," said Donald Arabian, chief of the Apollo test division at the National Aeronautics and Space Administration's Manned Spacecraft Center.

"We didn't realize we could discharge a cloud this easily," Glenn E. Daniels of NASA's Marshall Space Flight Center noted. "We had no evidence before that this would happen."

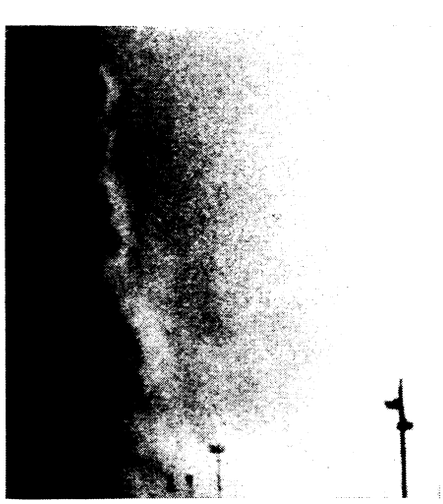
As a result, NASA officials are planning to revise launch rules on lifting off into electrically charged clouds. No hardware changes are planned on the spacecraft or booster, however.

"If we were to have the same conditions in March for the Apollo 13 flight, my hunch is that we would not launch," said Arabian. He heads the NASA group investigating the incident. Discussions with atmospheric physicists at the AGU meeting this week are part of that effort. The group's report will be completed about the end of January. This will be in time to put modified rules into effect before the Apollo 13 mission.

"We probably will make some restriction on launching," Arabian says, but he expects the increase in restrictions to be very small.

In present launch procedures the vertical differences in the electric field are measured continually at eight sites in the Cape Kennedy area. Radars search out thunderstorms and another set of instruments records and locates lightning strikes.

To provide greater insurance, some instrument modifications may be proposed; some lightning experts, for instance, feel a different kind of potential gradient recorder could give better results. But the major problem is one of scientific interpretation. They are seeking to arrive at some guidelines on how better to predict man-caused lightning—a problem not previously anticipated by NASA personnel.



NASA

Glitch on 12; now preventive action.

STIMULATING INTERFERON

Human trials with poly I:C

Interferon is the body's first line of defense against viral infection. In response to invading viruses, levels of interferon, a protein, rise in the blood as this natural agent begins combatting the invaders. It appears to act against viruses of all types.

For some time immunologists have been working with a synthetic drug that mimics the infectious core of a virus to stimulate the production of interferon. Increased interferon production could theoretically control virus infections that are otherwise unassailable.

First identified two years ago by Dr. Maurice R. Hilleman (SN: 8/19/67, p. 173), the synthetic polymer called poly I:C (polyriboinosinic-polyribocytidylic acid) has been shown to stimulate interferon production in animals and in cultures of human cells. It also possesses some antitumor properties that have reduced cancers in mice (SN: 1/18, p. 60).

Now Dr. Hilleman, of the Merck Institute for Therapeutic Research in West Point, Pa., and two physicians from the Sloan Kettering Institute for Cancer Research in New York, report evidence that poly I:C actually induces interferon production in man.

Clinical trials of the drug began only a few months ago and data are preliminary, but, Dr. Hilleman says, "We have successfully taken another step in our research for an antivirus agent." With Drs. Charles W. Young and Erwin H. Krakoff, Dr. Hilleman announced experimental results this week at the Third Annual Symposium on Medical and Applied Virology in Ft. Lauderdale, Fla.

The scientists have been giving varying but generally low doses of poly I:C to cancer patients who were initially free of detectable levels of inter-

Merck

Hilleman: Another successful step.