could still be relatively cold temperatures (below the melting point) at greater depths.

The seismometers now at three geophysical stations (Apollos 12, 14 and 15) are also yielding some unusual data. At apogee each month, when the moon is closest to the earth and the tidal strain is the greatest, moonquakes occur. Dr. Gary Latham, also of Lamont-Doherty, has identified about 10 active zones, but the most active has now been located about 1,140 kilometers south of the Apollo 12 and 14 stations and about 600 kilometers west of the crater Tycho. What may be more significant, in Dr. Latham's view, is that these quakes appear to be coming from a depth of 700 to 800 kilometers. This means that "the moon must be rigid enough at those depths to support these stresses," he says. (On earth, the deepest known quakes occur at 720 kilometers and they are rare.) A rigid moon would also corroborate the heat-flow model of a cooler moon at great depths and heating near the surfaces.

Seismic velocity changes from these quakes also indicate, says Dr. Latham, that the moon has a crust down to depths of 25 kilometers. "There is either a gradual or a sharp increase in velocities from 25 kilometers down to 60 kilometers," he says. At depths of about 60 kilometers, he sees velocities that reach 9 kilometers per second. In the earth such velocities are not achieved at depths less than 400 to 500 kilometers. The velocity pattern in the moon is difficult to explain, but it could possibly be due to the presence of peridotite. On earth, peridotite is believed to originate at great depths in the mantle. If further data support these findings, the moon may have a mantle-type structure as well as a crust.

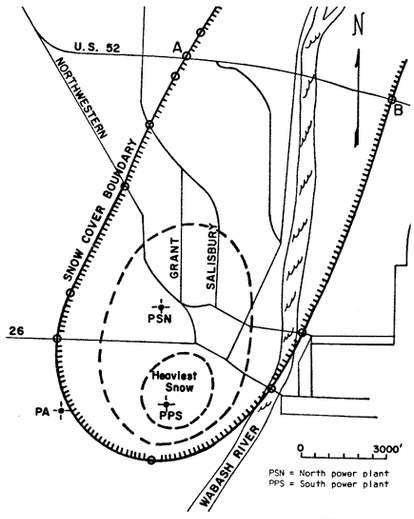
Another important discovery, says Dr. Latham, is that the moon has swarms of moonquakes—a series of small periodic quakes that on earth are quite shallow and are related to volcanic activity. By enhancing data received in April, Dr. Latham noted a swarm of 30 events over two and one-half days. They occurred at regular intervals of about two hours and culminated in the largest moonquake yet recorded.

What triggers these swarms and where they are occurring have not yet been determined. Dr. Latham suggests that they could result from the continued adjustment of the out-of-balance masses on the moon, such as mass concentrations known to exist in the large circular basins, or from mountains such as the Apennines.

Two magnetometers, one left on the surface at the Apollo 15 site and the other in the orbiting subsatellite, will obtain data that can be correlated with these findings. □

MAN-INDUCED SNOWFALL

Up went the ash, down came snow



E. M. Agee

Snow patterns and power plants.

Men have been deliberately seeding clouds for some time to produce rain, and a project under way in Colorado involves cloud seeding to produce snow. But man's activities may also sometimes accidentally produce precipitation.

The principle behind cloud seeding with silver iodide crystals is to provide nuclei around which water vapor in a cloud can condense. Evidence is accumulating that under proper atmospheric conditions particles discharged into the air by factories and power plants can play the same role as silver iodide and produce inadvertent rain.

On Jan. 11 of this year, favorable weather conditions and solid particles from the Purdue University power plants apparently combined to create a freak snowfall in Lafayette, Ind.

Dr. Ernest M. Agee of Purdue noticed that morning that throughout the city were patches of snow that varied in amount from place to place. He and two other Purdue scientists promptly surveyed the city to determine the extent of the snow. They found that the heaviest snow cover, about a quarter of an inch, occurred downwind from the larger of the university's two power plants. The boundaries where snow cover disappeared entirely described a roughly parabolic curve enclosing both power plants, and the boundaries of snow cover of one-eighth inch or more were an oval enclosing the plants.

These snowfall patterns alone were strong evidence of a relationship between plant emissions and precipitation. In addition, Dr. Agee reports in the BULLETIN OF THE AMERICAN METEOROLOGICAL SOCIETY, meteorological conditions were favorable for induced snowfall. A super-cooled fog had begun to blanket the area at 4 a.m. Addition of particles to such a fog would provide nuclei around which the water vapor of the fog could condense into snow. He hypothesizes that solid particle emissions from burning coal at the university power plants provided the nuclei. The plants were operating throughout the morning studied, and snow began to fall at 6:45 a.m. Previous studies of the chemical composition of fly ash from the type of coal used in the university power plants indicate the presence of several chemicals, such as aluminum oxide, that may have been effective nuclei.

There had been some precipitation elsewhere associated with a weak warm front that passed through Lafayette, but evidence indicates it was not responsible for Lafayette's snow.

To further confirm the hypothesis that the snowfall was locally induced, the scientists reasoned that other possible sources of industrial plant discharge might be surrounded by similar snowfall patterns. Cursory examination of snow cover around two factories in the area showed patterns similar to that at the university, with the snow cover encircling the factories and the heaviest snow concentrated downwind. The simultaneous occurrence of locally induced snowfall under similar conditions, he concludes, "lends support to the hypothesis that the snowfall was artificially induced by local influences."

Dr. Agee says he knows of only one other recorded accidental snowfall, in Oak Ridge, Tenn., in the early 1960's.

REVIEW ORDERED

AEC delays nuclear plants

The Atomic Energy Commission last week ordered reviews of construction permits and operating licenses for 96 nuclear power stations throughout the nation, with the main thrust to be reconsideration of thermal effects. The review will effectively prevent construction or, in the case of plants already built, operation of the nuclear plants until there is assurance thermal effects are either harmless or controllable. A Federal Court of Appeals decision on July 23 sharply criticized AEC for its environmental policies; last week's action, in response to this criticism, reversed AEC's earlier policy of concerning itself only with radiation hazards.

The plants affected by the AEC decision have a total scheduled capacity of 100 million kilowatts. This represents about one-quarter of the nation's present generating capacity, and the delays could seriously aggravate the current energy crisis. □