earth sciences

METEOROLOGY

Earth's primitive atmosphere

The main argument against the hypothesis that the earth's primitive atmosphere was composed of methane and ammonia is based on the rate at which hydrogen escapes into space. Based on the current 2,000-degree K. temperatures of the thin upper region of the atmosphere known as the exosphere, hydrogen's gravitational escape rate indicates that a methane-ammonia atmosphere would have lasted only 100,000 to one million years.

Now, however, a model has been proposed that shows how a primitive methane-ammonia atmosphere could have produced much lower exospheric temperatures, 500 to 1,000 degrees K. Photolysis of methane would have produced hydrocarbons that are very efficient infrared radiators. They would be able to cool the upper atmosphere sufficiently. As a result, the atmosphere of methane and ammonia would have been relatively stable.

In all probability, says Dr. Wayne E. McGovern of the National Meteorological Center, the earth had such an atmosphere, and it lasted at least 200 million years and possibly as long as a billion years.

The new model, published in the July JOURNAL OF THE ATMOSPHERIC SCIENCES, is a blow to the alternative hypothesis that the primordial atmosphere consisted primarily of carbon dioxide and molecular nitrogen.

SEISMOLOGY

Earthquakes and nuclear tests

Large underground nuclear explosions in Nevada generate unusual seismic activity for periods ranging from a few hours to at least several weeks, a new study has found. Most of this activity, however, is confined to the test site and probably originates within 20 kilometers of the blast.

A January 1968 explosion may have produced earthquake activity 40 kilometers away. There is a vague suggestion, the researchers say, that one or two of the earlier explosions caused seismic activity 50 to 100 kilometers away. Any more-distant effects are probably very minor.

Most of the earthquakes studied were of very small magnitudes. All were at least one magnitude less than the blasts themselves.

Three University of Nevada seismologists, Drs. Gary Boucher, Alan Ryall and Austin E. Jones, described the study in the July 15 JOURNAL OF GEOPHYSICAL RESEARCH.

GLACIOLOGY

Challenging the Northwest Passage

A 1,006-foot icebreaker tanker was set to leave Philadelphia late this week on an attempt to become the first commercial vessel to pass through the legendary Northwest Passage.

The goal of the voyage by the Humble Oil Co.'s newly rebuilt SS *Manhattan* is to test the feasibility of using icebreaker-tankers to transport crude oil, recently discovered in hugh reserves on Alaska's North Slope, through the Northwest Passage 12 months a year to refineries on the East Coast.

GEOLOGY

India-Australia similarities

Evidence continues to mount that India and Australia were once part of the same continent. A study published in the July 26 NATURE by Dr. A. R. Crawford of the Australian National University is based on analysis of Pre-Cambrian rocks.

He found that large areas of southwestern Australia and southern peninsular India have similar ages. The oldest rocks of northeastern India show similarities to the oldest rocks of northwestern Australia.

Particularly interesting was a 1,000-kilometer strip along the west coast of Australia called the Darling lineament, where mineral ages show three geological events. The same events are evident in Ceylon and southernmost India.

The closest comparisons are with rocks along the west side of Australia's Perth basin. Two areas of high-grade metamorphic rocks are directly comparable in type with rocks of Ceylon and the Indian coast north of Madras.

GEOPHYSICS

Origin of Arctic basin

The Arctic basin north of Alaska is a true and probably very ancient ocean basin with a floor of oceanic crust, according to a new interpretation of recent geologic and geophysical data.

If the interpretation is correct, it would disprove the theory that the basin is a relatively young feature formed by the subsidence of an ancient continental land mass north of Alaska.

Among the findings Dr. Michael Churkin Jr. uses to support his explanation of the basin's origin is that no surface earthquake waves of a particular type known to travel long distances only through continental crust, not oceanic crust, have been detected in the basin. Another is magnetic evidence for the identification of an undersea feature near the North Pole known as the Alpha Cordillera as a mid-oceanic ridge. His report is in the Aug. 8 SCIENCE.

WEATHER MODIFICATION

Stormfury at last

Project Stormfury, the Commerce Department-Navy effort to diffuse a hurricane by seeding it with silver iodide crystals, has finally found a target: Debbie.

Only two other hurricanes have been seeded in the last decade, Esther in 1961 and Beulah in 1963 (SN: 8/17/68, p. 153). Since then no hurricanes have appeared that looked likely to stay far enough from populated areas after seeding.

This week, Hurricane Debbie filled the bill. With Camille tearing into the U.S. mainland much too quickly for experimenting, Debbie was some 800 miles east of Puerto Rico. Planes flew there to dump their crystals, in hopes of causing supercooled water droplets in the hurricane's eyewall to condense. This releases heat, lowering the pressure in the eyewall and thereby reducing the pressure differential across it. This should ease the storm's winds, although early results were indeterminate.