

## SEISMOLOGY

### Depth of the inner core

Deep within the earth's liquid outer core is a solid inner core. Geophysicists have long known of its existence by the way seismic waves from earthquakes are refracted as they pass through its denser material. These waves continue on through the earth and are monitored at seismic stations on the opposite side of the planet from the earthquake.

Recent estimates of the depth of the inner core have ranged from about 5,120 kilometers to 5,150 kilometers; figures based on refraction data are subject to some uncertainties.

A precise determination of the depth of the inner core has been made by Dr. Eric R. Engdahl of the Environmental Science Services Administration's Coast and Geodetic Survey. His group's findings are based not on refraction data but on waves reflected nearly directly back off the surface of the inner core. The study, in fact, constitutes the first confirmed identification of waves, designated PKiKP, reflected off the inner core.

The figure for the depth is 5,145 kilometers. It is accurate to within less than 5 kilometers, says Dr. Engdahl, and further refinement should reduce the uncertainty even more.

The study made use of seismic data from earthquakes and underground nuclear explosions monitored from 1965 to 1969 by arrays of seismometers in Montana, Arizona, Utah and Oklahoma.

Dr. Engdahl presented the report at a meeting of the Seismological Society of America. Working with him on the study were Drs. Edward A. Flinn of Geotech, Inc. and Carl F. Romney of the Air Force Technical Applications Center.

## OCEANOGRAPHY

### Past changes in sea level

It has been generally estimated that the lowest level of the sea during the last 35,000 years was 130 meters below its present point. This occurred about 16,000 years ago during the last glacial period.

Two Australian scientists, Drs. H. H. Veeh of the Australian National University and J. J. Veevers of Macquarie University, report evidence in the May 9 NATURE that the low point was actually some 45 meters deeper.

Using a Japanese research submersible, the scientists collected two shallow-water coral specimens from deep terraces off the Great Barrier Reef. Radiocarbon dating and other analysis led them to conclude that the coral grew near sea level that was 175 meters below its present depth at some time within the interval 13,600 to 17,000 years ago.

## PALEOCLIMATOLOGY

### Pleistocene temperature variations

Fifteen years ago Dr. Cesare Emiliani, now at the University of Miami's School of Marine and Atmospheric Sciences, published what he called a generalized paleo-temperature curve. As extended further in 1966, it shows

how surface temperatures in the equatorial Atlantic Ocean and adjacent seas have varied over the past 425,000 years. The curve indicates nine warm periods when ocean temperatures generally reached about 27 degrees C., separated by colder, glacial periods when temperatures dropped to about a 21-degree average.

The work is based on analysis of the ratio of oxygen 18 to oxygen 16 in the skeletons of tiny marine animals, known as foraminifera, which are found in deep-sea cores. The ratio varies with temperature.

In recent years a few scientists have been criticizing his curve. Some say it is not in accord with foraminiferal evidence; others, that it represents not temperatures but isotopic variations in seawater; others suggest its time scale needs to be stretched 25 percent.

Dr. Emiliani, in the May 15 SCIENCE, presents a vigorous defense of the curve. Countering in detail the arguments of the critics, he concludes that the curve is correct to within 1 degree C., that it closely reflects faunal changes and that its time scale is correct to within a very few percent back to at least 175,000 years.

## PALEOMAGNETISM

### Supporting the Gondwanaland fit

Earlier this year two English scientists, Drs. A. G. Smith and Anthony Hallam, published a computer reconstruction of Gondwanaland based on geological evidence (SN: 2/28, p. 229).

Two Australian National University scientists, Drs. M. W. McElhinny and G. R. Luck, have recently completed studies in India and Australia that make available for the first time lower Paleozoic paleomagnetic data for each of the southern continents.

Using these and other data, they have made a reconstruction of the former southern giant land mass, Gondwanaland, based on paleomagnetic results alone.

Like Smith and Hallam's, their reconstruction, in the May 15 SCIENCE, is very similar to the one proposed by the South African A. L. du Toit in 1937.

## WEATHER MODIFICATION

### Rainmaking over forest fires

Techniques of weather modification are moving more and more toward operational status (SN: 5/9, p. 461). A new note on the subject was sounded last week when the Department of the Interior announced it will use cloud seeding as a weapon to help control forest and range fires over a portion of Alaska during the 1970 fire season.

Interior's Bureau of Land Management has accepted a proposal from Meteorology Research, Inc., in Altadena, Calif., to induce rain over fires spotted between June 1 and July 31 in a circle of 50 miles radius centering on Galena, Alaska, by seeding clouds with silver iodide. The area, meteorologically favorable for cloud seeding, is especially fire prone. Alaska had a dry winter, and a severe fire hazard is expected.

The project will be Interior's first use of weather modification to fight forest fires on a practical basis. A limited experimental seeding operation in the same area last summer produced hopes for the technique.