SCIENCE NEWS

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SUBMARINE OBSERVATIONS OF SUB-OCEAN PRESSURES

PRESSURES along the bottom of the Atlantic Ocean force Porto Rico up and the ocean bottom north of it down to form the great Nares deep. This is indicated by observations of the intensity of gravity in this region made from the submarine *S–21*. Dr. F. A. Vening-Meinesz, of the Netherlands Geodetic Commission, who was in charge of the work, told about the investigation at a meeting of the Washington Academy of Sciences, the U. S. Navy Department and the Carnegie Institution of Washington. Dr. F. E. Wright, who, with E. B. Colline, of the Navy Department, accompanied Dr. Vening-Meinesz, spoke about the results and described some of the details of the trip. It lasted about two months and covered also the Gulf of Mexico and the Caribbean Sea.

Gravity measurements are made for two purposes, Dr. Vening-Meinesz explained. One is to ascertain the exact shape of the earth, while the other is to study the behavior of the crust of the earth.

The only way of measuring the intensity of gravity with the required accuracy is by timing the swings of a pendulum. A pair of scales would not show its variation because both sides of the scales would be affected equally. A pendulum, however, vibrates more rapidly the greater the gravitational pull. Previously, it has only been possible to make such gravity measurements on land, as the shaking of a ship interfered with the pendulum. Dr. Vening-Meinesz, however, invented a method of using two pendulums. While both are affected by the sway of the ship their motion may be combined in such a way that the result is the same as of one steady pendulum. As, however, the method can only be applied if the ship's motion does not exceed a certain limit, he made his observations from a submerged submarine, where the motion of the waves has very small effect. Two trips in a Dutch submarine from Holland to Java, in opposite directions, showed the practicability of the device. As a result of the cooperation of the U. S. Navy with the Carnegie Institution, he was extended the use of the American submarine *S–21* for gravity observations in the Gulf of Mexico and Caribbean Sea.

Submarine measurements have some advantages over land observations, he said. One is that there are no local irregularities of mass to cause disturbances, as there is nothing in the immediate vicinity of the submarine but water and air. Also, erosion, by which atmospheric conditions, such as wind and rain, rapidly shift land masses, is entirely absent on the ocean bottom.

In general, the investigations confirm the theory of isostasy, by which the earth's crust is supposed to consist of masses of various densities floating on a more or less fluid mass below. However, they found a departure of equilibrium in certain regions, which reveal stresses in the ocean bottom or in the subcrustal layers. One of these regions is the central part of the Gulf of Mexico. Besides that, two great ocean deeps were studied. One is the Bartlett deep, about 22,500 feet, southeast of Cuba and between that island and Jamaica. Here they had the busiest time of their trip, for in 18 hours they made 5 separate dives and observations. Altogether 49 gravity observations, each requiring a separate dive, were made. The Bartlett deep, however, rather unexpectedly showed no great stresses.

North of Porto Rico they studied the Nares deep, which showed great stresses at work. In the deep itself, the sides of which slope as much as 40 degrees in some cases, there was a deficiency of gravity, while to the south there was an excess. Dr. Vening-Meinesz thinks that this indicates that there is a horizontal pressure in a north and south direction in the ocean bottom in this region. This pressure causes a buckling, pushing Porto Rico up, and the deep down. The observations show that this pressure extends to even as far as East Cuba, *i.e.*, much farther than the configuration of the ocean floor indicates.

From their studies in the Gulf of Mexico, off the delta of the Mississippi, they found no evidence that the large masses which the river is continually depositing on the ocean bottom disturb the equilibrium. Apparently as fast as this deposit is laid down, the adjustments take place.

When the computation of the results is complete, some new light may also be shed on Wegener's theory that North and South America and Europe and Africa were originally joined, but that the western continent is floating away from the eastern. In his previous observations Dr. Vening-Meinesz found an excess of gravity off the Pacific shore of Central America, which might furnish an indication that the Americas were pushing westwards. This would be in accord with Wegener's ideas. Now during this expedition, observations were made off the Atlantic coast. If these prove that there is a deficiency of gravity in this region, it would be in accord with this theory, for it would show a pull, instead of a pressure, on the bottom. If it proves that gravity is in excess here also, however, the theory will get no confirmation.

Dr. Vening-Meinesz expressed his thanks to the U. S. Navy authorities and the Carnegie Institution for making this scientific investigation possible. He acknowledged the whole-hearted cooperation of Lieutenant Fisher in command of the *S–21*, of the commandant of the expedition, Lieutenant Nash, and of the officers and crew of the submarine.

MEASUREMENT OF THE HEAT OF THE STARS

How an infinitesimal electric current, which would have to be amplified twenty billion times to make it a single ampere, is used to study the temperatures of the stars and planets, was described on November 27 by Dr. Seth B. Nicholson at the Carnegie Institution of Washington.

Dr. Nicholson is an astronomer at the institution's Mt. Wilson Observatory. One of his discoveries, made in 1914, while at the Lick Observatory, was a previously unknown moon of the planet Jupiter.

"The greatest success in measuring the heat received from the stars has been obtained with the thermocouple," he said. "A thermocouple consists of a junction of two elements which, when heated, generates an electric current, that can be measured with a galvanometer, which is an extremely sensitive ammeter. The weight of a complete thermocouple with receivers one half millimeter in diameter, including the connecting wires, is about one thousandth that of a drop of water. The mass of the receiver which is heated by the star is only one third that of a complete thermocouple.

"A star, of the same color as the sun, which is just bright enough to be easily seen without a telescope, radiates on the whole United States about the same amount of heat as is radiated by the sun on one square yard. When the heat from such a star which falls on the 100-inch mirror of the Hooker telescope at Mt. Wilson, the area of which is six square yards, is focused on the receiver of a thermocouple, the temperature of the receiver is increased about one half millionth of a degree Fahrenheit, and a current of electricity is made to flow through the galvanometer. The current thus generated is about one twenty billionth of an ampere. The currents produced in this way are proportional to the amount of heat received by the thermocouple, so that the deflection of the galvanometer when a star is focused on the thermocouple is a measure of the heat received from the star.

"The heat from many stars has been measured in this way, and of those measured more heat reaches the thermocouple from the red star Betelgeuse, in the constellation of Orion, than from any other. Much of the heat from stars and from the sun is absorbed by the earth's atmosphere. This absorption is especially large in the blue and violet light and when allowance is made for this loss we find that more heat reaches the earth from the blue star Sirius than from any other star."

Though the planets shine with reflected sunlight and are far cooler than the stars, the thermocouple can be used to measure their temperature, he said, in telling of results.

"Mercury is certainly very hot and has little if any atmosphere. The maximum temperature is about 1,300 degrees Fahrenheit. The distribution of radiation over its surface is much like that of the moon. Venus is covered with clouds and the radiation measured is from the high cloud surfaces and tells very little except by inference about the actual surface temperature. The night temperature on Venus is much higher than that on Mercury or the moon, being about 9 degrees below zero Fahrenheit. The temperature on Mars varies greatly with the season and the time of day, but the temperatures there are somewhat like those on the earth, at least like those at very high elevations where the atmosphere is rare. The outer planets are very cold, as might be suspected from their great distances from the sun, unless they give off heat from their interiors. Not many years ago it was commonly supposed that Jupiter was warm, probably warm enough to give out some light of its own. The thermocouple measures show that this is not the case, and that the temperature of Jupiter is about 216 degrees below zero Fahrenheit."

THE RISING OF SAP IN TREES

SAP does not rise in trees, it gets pulled up. There are no hearts or other pumps, and the mysterious "root pressure" that used to be talked about is little more than a myth. And water, though "as weak as water" in large masses, is as strong as wire when confined within the walls of the tiny tubes that make up the sap-wood of trees.

These are elements in the picture of the inside of a plant's water-distributing system, worked out by Dr. D. T. MacDougal, of the Desert Laboratory, Tucson, Ariz., who lectured before the Carnegie Institution of Washington on December 12. One of Dr. MacDougal's most recent discoveries is that the air confined in the dead vessels of a tree trunk forms a single connected system, just as the sap does. By applying pressure instruments to different parts of the tree's anatomy, he discovered that changes of pressure in one part of the confined air were rapidly transmitted to all parts of the tree.

The paradox of water having a tensile strength, and holding up a weight as though it were made of wire, is the problem that has engaged Dr. MacDougal's major attention for several years. Pioneer work in the same field was done by a British plant physiologist, Dr. H. H. Dixon, and other workers on the continent. These experiments have shown that as water evaporates from the surface of the leaves it creates a condition of tension in the interior. This tension is transmitted through the leaf-stem and branches to the trunk and down to the roots that draw upon the water supply in the soil.

INSECT ECOLOGY

THE more "modern" insects, the species most recently evolved, have a higher metabolic rate, faster physiological processes, move more rapidly, and prefer bright sunlight and the warmer parts of the earth.

This is the thesis advanced by Dr. Clarence H. Kennedy, of Ohio State University, writing in the current issue of the scientific journal *Ecology*. He has made a special study of the dragon-flies, but has examined also the family trees and present modes of living of a large number of other groups of insects, and in general he finds that they all fall into line with his theory.

"Modern" or recently evolved insects in general have three preferences. They like the tropics as a place to live, they prefer open, sunny places rather than dim woods or shelters under bark or stones, and when they needs must live in a cooler zone they thrive best in the hot summer rather than in the cool spring. Insects of this group include such active and relatively intelligent orders as the ants and bees, the higher dragon-flies and the day-flying butterflies.

The tastes of the old-fashioned insects, which have sometimes been called "surviving fossils," are just the

opposite. They develop their maximum numbers in the cooler parts of the earth, fly in the cooler parts of the day or lurk in the shady woods or even in dark crevices, and are most active in the cooler seasons. These hexapod fogies include stoneflies and mayflies, thrips, booklice, and the lower families of the grasshopper, moth and fly orders.

Another point developed by Dr. Kennedy has to do with the length of life of the groups compared. The "slow" insects live long—breed only once a year as a rule, or sometimes require several years to come to maturity. He cites one primitive genus, an intermediate form between crickets and cockroaches, which takes three years to come to maturity, and which has to be raised on ice in a refrigerator. The "fast" moderns, on the other hand, mature and reproduce much more rapidly, a couple of weeks sufficing for the whole life cycle of some of the higher flies. Theirs seems to be a short life and a merry one.

FEDERAL APPROPRIATIONS FOR THE STUDY OF CANCER

PROMISING results for further work looking towards the solution of the public health problem of cancer have been obtained in experiments with high-frequency electrical currents, Dr. Hugh S. Cumming, U. S. Surgeon-General, told the House Appropriations Committee, according to the hearings on the Treasury Appropriation bill.

The work with high-frequency currents has been carried on by the Public Health Service both at Harvard University and at the public health laboratories at Washington. Dr. Cumming testified that an appropriation of $75,000 had been asked of the Budget Bureau for research work into the causes and nature of the malignant growths known as cancer, but that this amount had not been allowed. The item in the bill now before the House is $15,760 for cancer work by the Public Health Service for the fiscal year ending June 30, 1930.

"During the studies at Harvard," Dr. Cumming said, "it was found that high-frequency electrical currents would injure the tissue and that it seemed to bear a relation to the frequency of the currents. Without going into it in greater detail Dr. Scherechewsky, who is in charge of that work, has apparently cured a great many cases of tumor in the animals he has worked on. I have seen some of the work myself. He has not felt that the time has yet come when he could try it on human beings, but I am persuaded that he could get a great many volunteers.

"Experimental work was begun with a transplantable mouse sarcoma of high virulence," he continued. "In a considerable number of instances tumors exposed in this way recede and disappear, with the eventual recovery of the tumor-bearing animal, while in control animals the tumor grew progressively, causing the death of the animal in from four to six weeks.

"The action of these currents appears to be different from the action of ordinary high-frequency currents applied by means of conventional therapeutic high-frequency apparatus, as under suitable conditions the healing effect upon the tissue is slight. Nevertheless a few minutes' exposure—from 3 to 3½ minutes—of the tumor tissue to a current of 250 to 300 milliamperes at a frequency of 66,000,000 to 68,000,000 cycles per second is sufficient to produce in many instances complete insarction of the tumor and destruction of the tumor cells with subsequent disappearance of the tumor."

ITEMS

A SUBCOMMITTEE of the Radio Manufacturers' Association's committee on engineering, with Dr. D. E. Replogle as chairman, recently met in Chicago with representatives of the leading manufacturers, and others interested in radiovision, including C. Francis Jenkins, of Washington. Although there are still only a few radiovision broadcasters, compared with the sound broadcasters, they have been employing a variety of methods. The committee adopted as standard the system used by C. Francis Jenkins in broadcasting movies from his station in Washington. This makes use of 48 lines in the scanning disc, arranged so that the lines follow each other from top to bottom, and left to right consecutively, like lines of type on a printed page. The committee also adopted the use of the word "frame" as referring to a single picture area. It is expected that all the television broadcasters will now adopt these standards, so that one radiovision receiver with one scanning disc will be able to receive any of them.

WISE men of Egypt knew Euclid's mathematical methods fifteen centuries before the famous Greek organized the subject and set his material down in such perfect form that college boys still study "Euclid." Proof is available through the translation of the "Mathematical Papyrus" which lies in the collection at the Hermitage Museum, and has long challenged the best efforts of Egyptologists. A report from Leningrad states that this papyrus has finally been deciphered. It dates back to the eighteenth century before Christ, and contains twenty-five problems on geometry and algebra. "Mathematical methods applied in the papyrus are almost 1,500 years ahead of Euclid, corresponding entirely to the present time."

EYE stress is a great thief of nervous energy and is responsible for many cases of insomnia, disturbances of circulation and gastrointestinal tract, according to a report by Dr. E. L. Jones in *International Clinics*. Because of the extremely close relation between the nerves that govern the focusing muscle of the eyes and those nerves that govern the heart and organs of the intestinal tract, many symptoms of distress and actual disease of heart and intestinal tract may be largely due to eye stress. Eye stress, according to Dr. Jones, is "the overcoming, by unconscious effort, of an impediment in the focus of the eye, to obtain its best vision." It has no relation to neat or fine work and is most common in persons having nearly perfect or perfect vision, either with or without glasses.