SCIENCE NEWS

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SCIENTIFIC CRUISE OF SUBMARINE AND NAVAL BOATS

USING a submarine to weigh the earth's crust instead of to sink ships is the task about to be undertaken by the U. S. Navy Department, in cooperation with the Carnegie Institution of Washington. On Tuesday afternoon, October 2, there sails from the Navy Yard the submarine S-21, accompanied by two eagle boats, on one of the most novel cruises ever undertaken—a cruise reminiscent of Jules Verne or Conan Doyle.

The submarine will be a floating gravity observatory. By means of an instrument invented by a Dutch scientist, Dr. F. A. Venning Meinesz, of the Geodetic Commission of Holland, measurements of the force of gravity can be made at sea for the first time. So important are these observations that Dr. Meinesz was invited to the United States by the Carnegie Institution. The Navy Department has now given him the use of the eagle boats and submarine for a period of several months. During this time they will cruise around the region of the Gulf of Mexico and the Caribbean Sea. Assisting Dr. Meinesz are Dr. Fred E. Wright, of the Carnegie Institution's Geophysical Laboratory, and Elmer Collins, of the Hydrographic Office of the Navy.

In order to know the exact shape of the earth, scientists must know the force of gravity, and the only way of measuring this is by accurately timing the swings of a pendulum. Such measurements have been made on land for many years, but since the largest part of the earth's surface is covered with ocean, it left a large unknown area. The motion of the ship made pendulum observations impossible at sea.

Dr. Meinesz decided to make use of a submerged submarine, which is much more steady than a ship on the surface. But his improved apparatus is so successful that he now believes it possible to use it on a ship on the surface in still water and with the engines stopped to prevent vibration. Instead of using a single pendulum, he uses three, arranged as two pairs. They all have the same period, but are swung somewhat out of step. Tiny mirrors attached to them reflect a beam of light back and forth as the pendulum moves. Unlike an ordinary pendulum, however, the light goes from one pendulum to the one next to it and then back to a moving strip of photographic paper, on which a record is made as a wavy line. Though the motion of the ship affects each pendulum, and each would give a very irregular record if recorded separately, the combination of the two results in a record like that of a single, steady pendulum. The apparatus was tried on a Dutch submarine, in which two trips were made from Holland to Java, one by way of the Suez Canal, the other by way of Panama.

The importance of these observations is that they afford an indirect method of weighing blocks of the earth's crust, said Dr. William Bowie, of the U. S. Coast and Geodetic Survey. Then, if it is found that the weight under water is the same as that of the crust under the land, it means that the density of the block of the crust under the ocean is greater, and that this part of the earth is in what the geophysicist calls "isostatic equilibrium." This gives a better and more accurate idea of the exact figure of the earth, and so provides data of fundamental importance to students of the earth. The region in which the coming cruise will be made is one of several important ocean deeps, great submarine rifts in the earth's crust. As an ocean deep is a favorite place for the occurrence of earthquakes, more exact knowledge of their characteristics may prove of special value.

Though this is the first time that this work has been done except on the Dutch submarine, Dr. Bowie hopes that it will eventually be performed by all the navies of the world. "There is plenty of room in the oceans," he said, "for everybody." He also advocates that the U. S. Navy continue the work in the future, even after the present project is completed, by permanently equipping a submarine with the apparatus. As the accuracy of the charts used by the Navy depends upon exact knowledge of the earth's figure, the work is of considerable practical value.

INSIGHT INTO THE STRUCTURE OF MATTER

A VERY recent discovery by a Hindu scientist, Professor C. V. Raman, that intense light of a single color is partly changed to other colors when it shines on various transparent substances "opens up a wholly new field in the study of molecular structure." This statement was made by Professor R. W. Wood, of the Johns Hopkins University, in announcing that he had completely verified Professor Raman's discovery in the private laboratory of Alfred L. Loomis.

According to Professor Wood, who has just completed an investigation of the subject with improved apparatus and a more powerful spectroscope than the one employed by Raman, the effect occurs when monochromatic light, which is light of a single color, and, unlike white light, is entirely of a single wave-length, shines on transparent substances such as quartz, chloroform or water. The light that is scattered from the material is mostly of the same color, or wave-length, as that of the light illuminating it. The spectroscope, the instrument that analyzes light, shows, however, that part of the light is changed to wave-lengths a little longer or a little shorter than the source. On the spectrum photographs the result is a heavy line attended on either side by narrower and fainter lines. The fainter groups of lines on one side are the same as those on the other, except that they are reversed, as if reflected in a mirror, the center line being the mirror. Professor Raman found only a single and very faint line on the high frequency side of the exciting line, but Professor Wood has found groups of lines on this side almost as strong as the groups on the other in the case of carbon tetrachloride and chloroform.

The importance of the discovery comes from the fact that the difference between the frequencies of the light given off, and those of the light which shines on the substance is precisely the same as the frequencies of the absorption bands of the same substance for infra-red light —light which is vibrating too slowly to be seen or even to be recorded on the photographic plate without great difficulty. By means of the Raman effect, the physicist can now study these bands of absorption indirectly.

Professor Wood also pointed out that the effect was one of the most convincing proofs of the quantum theory of light, which supposes that light consists of separate pulses, or "quanta," rather than waves, as was formerly supposed. Only by the quantum theory, he thinks, can the effect be explained.

Most of his research was done with crystalline quartz, or such liquids as chloroform and carbon tetrachloride, illuminated with a mercury vapor arc lamp. He is now planning to repeat the work with a spectroscope of 40-feet focus, which will give even more convincing results than those he has now obtained.

MUSCULAR ENERGY INCREASED BY PRESSURE

A STIMULATING influence of high pressures on the function of the muscles has been discovered as a result of experiments conducted by Dr. McKeen Cattell and Dr. D. J. Edwards, of the Cornell University Medical College, which are reported in *The American Journal of Physiology*. The ordinary effect of pressure on a tissue is to stop its functioning. However, when pressure is made on muscles that are completely immersed in a fluid, the muscle on contracting does more work, according to the unexpected results of these experiments.

When local pressure is applied to a muscle, injury is readily produced, due to the tissues becoming deformed and the fluid in the tissues being displaced. But when muscular tissue is completely immersed in a fluid, as it was in these experiments, the only effect of the pressure is a slight change in volume caused by the pressure acting upon a liquid system, which is what the muscle and the fluid it is immersed in form. Under these conditions it was found that the muscle was markedly stimulated to greater energy production. The investigators used pressures as great as 1,000 pounds per square inch and found that the higher the pressure, the greater the stimulation. The average tension developed by the muscle under pressure when stimulated was increased one third over the tension under ordinary air pressure. There was an increase in heat production corresponding to the tension changes when pressure was applied. No conclusion as to the practical application of the work has been reached, but it may throw interesting light on the mechanism of muscular contraction.

PRIMITIVE SKULLS AND THIGH-BONES

HAS man gone up the evolutionary ladder literally feet first? Did his legs evolve into human legs faster than his head evolved into a human head? The possibility that there has been a tendency in the human genus to evolve from the bottom up in more than the figurative sense is suggested by Dr. Wilhelm Gieseler, of the University of Munich, writing in the German scientific weekly *Forschungen und Fortschritte*.

Dr. Gieseler has made a study of the two most-disputed human or near-human remains so far discovered, the Pithecanthropus or Ape-Man of Java and the Broken Hill Man of South Africa. Both of these *n*th degree great-uncles of the human race had very primitive skulls, the cranium of Pithecanthropus especially being so "low-brow" that many anatomists are still disposed to deny it human rank at all, but to classify it instead as the skull of an extinct species of gibbon or East Indian ape.

Dr. Gieseler defends his opinion that Pithecanthropus was human, largely on the basis that his eye-sockets are man-like rather than ape-like, although he admits that the skull is so low that the doubts of some of his colleagues are easily accounted for.

But an examination of the thigh-bones of both Pithecanthropus and Broken Hill Man tells an entirely different story. Not only is the thigh-bone of Pithecanthropus quite unlike that of a gibbon, but the thigh-bones of both the extinct humans (or near-humans) are so much like those of modern man that doubts have been expressed in both instances as to whether they really belong with the skulls at all. If they do not, it is an extremely striking coincidence that *two* debatable skulls should have happened to be found with thigh-bones that did not belong with them. If they do, we have the astonishing spectacle of men, or man-like creatures, with very decidedly primitive skulls walking on leg-bones built on a decidedly modern pattern.

WILL-O'-THE-WISP

TWO close-up observations of the will-o'-the-wisp, those weird and elusive flames that appear over marshy ground, have recently been put on record by German observers. H. H. Sven, a German scientist, observed one night in November, 1927, near an iron mine in Bohemia upon a swampy tract of land, four small bluish phosphorescent flames. They were of the height of a candle-flame and a diameter of about an inch and were constantly hopping up and down. Near them appeared a flame of about three feet in height of a yellowish green color and diameter of about a foot. The light of the flames was sufficient to read the face of a watch and to make notes, but they had no heat when touched. After the phenomenon had lasted 15 minutes they went out.

In the vicinity are several springs with radio-active water. Upon returning to the place in the daytime Mr. Sven could find no trace of the source of the flames. He learned, however, that while will-o'-the-wisps appear to be independent of air temperature they are dependent upon air pressure; the higher the pressure the less the light.

W. Schulze, during the war an officer in the army, describes the following. In September, 1914, his battalion was withdrawn from the front lines and had to recross the

river Muerthe. During the afternoon artillery had also crossed. The route led through dense woods and had become almost impassible because of heavy rains. Schulze saw on both sides of the route, where a corduroy road had been attempted, pale greenish and yellowish thin flames shooting up and down from about 12 to 18 inches high. More accurate observations could not be made, but the flames were doubtless produced by the great pressure caused by the passage of artillery, combined with heat and rain. Gases apparently streamed from the moist earth and caused the flames.

HURRICANES AND TORNADOES

THOUGH the hurricane which devastated Porto Rico and the tornado that destroyed property in Rockford, Illinois, arrived a little more than a week before the autumnal equinox, neither of them can be called the "equinoctial storm." The fact is that the old idea of a severe storm occurring at the time the sun "crosses the line" is a superstition, unsubstantiated by any scientific fact.

The autumnal equinox, when the sun crosses the equator on its southward journey, and autumn commences for people in the northern hemisphere, occurred this year on September 23. Sometimes it happens on September 22, but any severe storm within a week or so of this date is apt to be called the equinoctial storm by some people. The hurricane season in the West Indies begins during the late summer and reaches its height in September, so there is almost sure to be some kind of a storm at this time.

Tropical hurricanes, such as the Porto Rican one, the one that damaged Miami in September, 1926, or the famous Galveston storm of September, 1900, originate over the Atlantic Ocean in the tropics somewhere north of the equator. Calm air, high temperature and humidity are the most favorable conditions for the formation of a hurricane, and these are most likely to be fulfilled in the "doldrums" of the North Atlantic Ocean in the late summer or early fall. Hurricanes may, however, occur at any time of the year, or in other places. They also occur in the Pacific Ocean and in the Indian Ocean. Those that occur south of the equator differ from those experineced in the West Indies and other parts of the Northern Hemisphere, because the winds in the northern hurricanes spin in a direction opposite to that of the hands of a clock, while those of the southern ones whirl clockwise.

Usually the north Atlantic hurricanes travel northwesterly until they reach the region of the westerly winds off the American coast, then they recurve to the northeast, and sometimes may not even be noticed on land. On Saturday, September 15, officials of the U. S. Weather Bureau declined to predict whether or not the Porto Rico storm would reach Florida, but stated that they expected it to be over the Bahamas on Sunday, September 16, and that strong winds at least might be expected in Florida by Sunday night.

The fact that the Rockford tornado occurred at the same time as the hurricane was a mere coincidence. About a hundred tornadoes occur a year in the United States, but most are in the period from March to October. Like the hurricanes, they are rapidly spinning whirls of air, but are much more limited in extent. They are even more vicious than the hurricanes.

ITEMS

AN unusual feature of the Dresden Hygiene Museum of 1930, which will move into its own home in a specially constructed building in 1929, will be the exhibit showing human beings and their existing conditions of life with measures by which the injurious effects of these conditions may be counteracted. On the practical side, primary importance will be given to: first, nutrition and the hygiene of food; second, the hygiene of clothing and, third, the hygiene of the dwelling. In 1930 the museum will be the center of a great exhibition which will be devoted to the advance in hygiene since 1911, when the German Hygienic Museum originated.

THE General Sherman Big Tree in the Sequoia National Park, estimated to be at least 4,000 years old, is still producing an annual crop of cones from which fall millions of fertile seeds. The park rangers have nurseries which contain many young trees, the progeny of this oldest and largest living thing. The Methuselah of the forest perpetuates its kind to-day as it did when Cheops built the Great Pyramid in Egypt.

A SIMPLE test for determining rices that will prevent beriberi in human beings and polyneuritis in pigeons and other fowl has been developed by Dr. Edward B. Vedder, of the U. S. Army Medical Corps, stationed at Manila, and R. T. Feliciano, chemist of the Manila Bureau of Science. The rice grains are stained with an iodine solution, the starch granules taking on a blue color. The proportion of external layers, which remain unstained, and which contain the beriberi-preventing factor, may be determined with reasonable accuracy by simple inspection, report these investigators. This method is so quick that it may be used during the milling process to determine the degree of milling. A chemical index for beriberi-preventing rice was also determined.

HUGE trees growing without any visible means of support are a striking feature of the great Zapata Swamp of southern Cuba. This swamp, nearly 1,800 square miles in extent, includes an area of limestone that is filled with holes and covered with a variety of tropical trees. Silk-cotton trees four feet in diameter, big mahoganies, and many other kinds are found growing on this limestone area where not so much as a single spoonful of soil could be gathered from an acre. The trees make their start in small pockets and holes in the limestone where collections of leaves and slight accumulations of disintegrated rock furnish them with cover for growth. The roots stray about over the surface of the rock in search of food, finally plunging through holes to find sustenance in soil hidden deeply in the cavernous recesses of the coral stone.