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ELECTRONIC WAVES

A THIN film of pure gold, far thinner than the thinnest gold-leaf, affords new evidence that electrons are waves, or, at least, accompanied by waves. Electrons, the building blocks of which atoms are supposed to be made, were formerly thought of as being like small particles, but modern physicists think that they more nearly resemble waves like light or even radio waves, though much shorter in length, or higher in pitch.

Professor George P. Thomson, of the University of Aberdeen, and son of Sir J. J. Thomson, one of the most eminent of present-day English physicists, has made the gold-film experiments, which he recently reported to the Royal Institution. A thin film of metal, such as he used, is a screen of molecules that permits the physicist to tell waves from particles. The arrangement of the gold molecules forms a lattice. If a stream of tiny particles is aimed at the screen, they hit molecules at a variety of angles, and so the stream emerges from the other side spread out as a cone. But waves are affected differently. When they go through such a screen they prefer to bend at certain angles. Therefore, if a photographic plate, which is darkened by the electrons, is placed a short distance back of the gold film when the electrons are passed through, a black spot will appear on the plate, surrounded by a series of concentric rings. The black spot represents the bulk of the electrons, which pass through without deviation, the rings represent those which are bent at various angles.

In performing this experiment, Professor Thomson obtained exactly this effect. Furthermore, to prove that it was not due to light, which is known to behave in a similar manner, he repeated the experiment with a magnet near by. Electrons are pulled out of their course by a magnet, while light is not. With the magnet, the rings were displaced, as they should be if the effect were due to the electrons. So it is demonstrated rather conclusively that a stream of electrons contains waves. Whether these waves are the electrons themselves, or merely accompany the real electrons, is still a speculation. However, Professor Thomson has measured their wavelength and has found that their pitch is more than a million times higher than that of visible light, far higher than that of X-rays, and, except for the cosmic rays, higher than that of any known radiation.

But Professor Thomson points out that the electron waves are not like light waves. Even if they were as low in pitch as light waves, they would not be the same. They travel at different speeds, the electron waves are bent by electric and magnetic fields, while ordinary light is not, and their penetrating powers are quite different. "If they are actual motion of an ether," he says, "it must differ in some way in the two cases."

Besides the evidence for the electronic waves afforded by the gold film experiment, similar evidence has been found by Drs. C. J. Davisson and L. H. Germer, of the Bell Telephone Laboratories in New York City. They fired a beam of electrons into a crystal, and found that it behaved in the same way as X-rays or other waves, that is, it was diffracted at several preferred angles, instead of being scattered in all directions.

DUTCH EAST INDIES EXPEDITION TO STUDY MOUNTAINS IN MAKING

A GREAT mountain system, now slowly forming under the waters of tropic seas, whose peaks and partially emerged ranges are now known as the East Indies, is to be the object of study by a Dutch scientific expedition now about to take the field.

The eastern portion of the East Indian Archipelago is a region which is probably more subject to present-day geological activity than any other area on the earth. The sea bottom between Borneo, New Guinea and the Australian shelf is different from any other, not even excluding the West Indies. It is an area of most marked unrest, studded with islands and active volcanoes, arranged in an intricate system of looped arches encircling deep basins. Coral reefs, which can only live and grow within a few feet of the surface, indicate that this entire region is subject to continuous changes of level.

These conditions make the Moluccan Archipelago a region of exceptional interest for oceanographic, biological and geologic research. The very pronounced relief of the sea-bottom and the occurrence of a number of individual deep basins, separated from the open ocean by shallower sills, cause a complicated subsurface circulation of water and anomalies as to deep-sea temperatures, chemical constitution and food supply of the water, which influence life in these deep basins in a peculiar manner. All this is of the greatest interest to the oceanographer, the zoologist and the geologist.

It is the general opinion among geologists that we are witnessing here a truly Alpine chain of mountains actually in the making: a product of the violent compression of a wide region between the continental masses of Australia (including New Guinea), and of southern Asia (including Borneo). The present sea-bottom and the topography of the islands are the surface expression of the mountain folds at the time of their formation. In the Moluccas we have now the means to observe the actual making of mountains. But, being largely submarine, we need the oceanographer to give us the accurate picture.

Physical and biological conditions in these isolated deep basins in the ocean floor, subject to active deposits of sediment from the numerous tropical islands, are very different from those in the open ocean, and of the greatest interest for the interpretation of the rocks which we find in the mountains of former geological periods, where conditions of their deposition must have been very similar.

Past oceanographic expeditions have largely confined themselves to the open ocean and have scarcely touched the East Indies. The only exception of note is the important Dutch Siboga expedition of 1899, the object of which was largely zoological. The number of existing off-shore soundings is still very small for a region with such intricate relief. This becomes very clear if we compare the area with any mountainous district on land. It would be as if the relief of the Alps in Switzerland were known from only 40 to 50 date levels.

A new oceanographic expedition in the Moluccan seas is now in preparation under Commander P. M. van Riel, chief of the oceanographic section of the Netherlands Meteorological Institute at De Bilt, near Utrecht, with the support of the home and colonial governments and several institutions and individuals. The funds have been secured to a sufficient amount to permit about 15 months of active work. The expedition is to leave early in 1929. It will use a newly launched surveying vessel of the Dutch Government, the *Willibrord Snellius*.

In addition to an extensive program of physical, chemical and biological research, particular stress will be laid on the configuration of the bottom and the sediments now being deposited there. In addition to the latest oceanographic sounding and sampling equipment and the biological outfit, the vessel will carry sonic sounding apparatus, with which it is expected to make at least 10,000 new depth determinations, in order to obtain a reliable and fairly detailed map of the submarine topography of this most interesting region.

It is planned that a submarine of the Dutch Navy will cooperate with the expedition, in order to make gravity observations at sea by the method developed by Professor Vening Meinesz.

UNDERSEA CAMERA FOR STUDYING THE TIDES

A UNIQUE motion-picture camera, recording automatically the velocity and direction of currents beneath the surface of the water, was used to advantage this past summer by the U. S. Coast and Geodetic Survey during what is stated to be the most comprehensive survey of tide and current conditions in Chesapeake Bay ever attempted.

While the device is so new that it has not yet been perfected fully, it has shown results that indicate it will be used as a regular part of standard current testing equipment. The camera is designed to take the place of a complete human observing unit composed of one boat, one officer and six men. It contains within it a compass and revolution dial of which pictures are made each half hour, and works continuously without attention for an entire week.

The purpose of the survey's probe this summer was to bring aids to navigation, such as mariner's charts and current tables, absolutely up to date. From the data gathered this year and last, current tables will be published from which at any future time the direction and velocity of currents at any place in the bay may be ascertained. The information likewise will be valuable in enabling engineers of surrounding cities to make proper disposal of their sewage. They must know at precisely what point the ebb of the tide will be able to convey the sewage farther out to sea than the flood current is able to bring it back.

Fishing interests will be aided by the data since certain fish are known to bite better at certain tidal stages than at others.

Headed by Lieutenant George L. Anderson, the survey engineers, four all told, conducted their investigations from four 65-foot launches. A unique feature was that 24 college boys, selected from leading universities in the East and mid-West, acted as special observers, their purpose being to gain technical experience to add to their engineering knowledge.

PASTURES AND THE RANGE OF INSECTS

THAT an ordinary barbed-wire fence may be almost as effective in excluding grasshoppers and other insects as it is in excluding cattle is one of the curious results obtained by Professor A. O. Weese, of the University of Oklahoma, in his recent studies of buffalo pastures in the Wichita National Forest. However, it should be added, the insects respect the fence primarily because it is cattle-proof.

The fence in question serves to separate an area of moderately grazed typical virgin prairie from an area of grassland which has been seriously overgrazed. Botanists have known for some time that overgrazing of native pastures tends to throw the balance of vegetation towards a drier type than normal. That is, a pasture in the moist region of tall-grass prairie near the Mississippi will be converted by excessive grazing into a pasture composed of plants usually found much farther west, in the region known as the short-grass plains. Thus a straight fence-line will often be found separating groups of plants which ordinarily would be found separated by long distances in nature.

Professor Weese and his students have been sweeping two such adjacent types of grassland with their nets and identifying the insects caught. In doing this they have discovered that the associations of insects are quite as rigidly distinct on the two sides of the fence as are the associations of plants. What is more, they find that very rarely indeed do the insects characteristic of the drier short-grass group of plants stray over into the more luscious, if unfamiliar, vegetation of the normal prairie.

EARLY SWEDISH SURGERY

TREPANATION of skulls and other major operations were performed in Sweden 5,000 years ago, it has been brought out by excavations made on the Swedish island of Gothland in the Baltic Sea, by Dr. Gustaf Nihlen, archeologist of Stockholm. On the site of the present city of Visby, called "the city of ruins and roses," he found remains of an ancient fishing village dating from the Stone Age.

Examining a number of human skeletons, Dr. Nihlen discovered that experienced surgeons must have existed at

that period. Neat, round holes were discovered in several skulls, showing that the art of trepanning as a cure against various kinds of ills was known. In performing these delicate incisions, the surgeons used an ordinary stone auger or drill, and it appears that in most cases the patient survived the operation.

Dr. Nihlen's examinations also disclosed numerous abnormal conditions, excrescences and deformities, showing that this prehistoric race must have been afflicted with rheumatism of the joints and similar diseases. These were probably brought on to a great extent by the hard climate and partly perhaps due to the exclusive meat diet, which also has been found to cause deformations of the jaws. It appears, too, that the Swedes in those days must have suffered very much from decayed teeth and toothaches. Another disease which evidently haunted ancient Visby and its inhabitants was rickets, and frequent epidemics seem to have ravaged the population. The death rate among children must have been very great.

PREHISTORIC RUINS IN COLORADO

A TRAGIC fire which laid waste a western Indian village more than 2,000 years ago is now proving an aid to modern science. The flames left the charred ruins in a state particularly favorable to preservation through the centuries. A Smithsonian scientist who excavated the abandoned village this summer has found there important evidence of a missing link in America's prehistory.

The village is in a remote district of southwest Colorado on the Piedro River. Dr. Frank H. H. Roberts, Jr., Smithsonian archeologist, has found there in the ruins a variety of skulls, many bone and stone implements and 250 pieces of pottery. These finds are now being studied by scientists at the Smithsonian Institution, and Dr. Roberts believes that they may be pronounced acceptable evidence of the hitherto missing link in the development of the prehistoric Pueblo people.

The oldest known inhabitants of the Southwest were the Basket-Maker Indians, who did not learn to make pottery until the closing days of their era. These were followed by the cliff-dwelling Pueblos, whose unique domestic habits and signs of high intelligence have made them a subject of intensive scientific research.

"One of the major questions confronting the archeologist and anthropologist in America to-day," said Dr. Roberts, "concerns what happened to these Basket-Maker Indians who immediately preceded the Pueblos. Did the Basket-Makers mix peacefully with the Pueblo tribes and lose their identity in the course of generations? Or were they wiped out by warfare?

"While I can not answer the question definitely now, my finds of this summer seem to throw important light on it, indicating that the first alternative is correct, and that the Basket-Makers did not perish suddenly as a race."

The architecture of the newly excavated village is of a transition type, between the old style Basket-Maker houses, and the later Pueblo ideas. All but three of the skulls are Pueblo in type, round-headed, with artificial flattening of the head caused by binding the babies' skulls to the cradles. The other three are long-headed and not flattened, representing the older race and the older idea of baby handling. The bone needles and tools were comparatively primitive, representing the older culture, but the pottery showed progress into the art ideals of the Pueblos.

The fire trapped some of the inhabitants of the village, and their charred skeletons were found still lying in the ruins of their homes. Jars filled with corn, beans and dried fruit, lying about the homes, indicated that the harvest had just been gathered when the catastrophe occurred.

ITEMS

MORE than 1,000 square miles of Alaskan wilderness, never before mapped and barely penetrated before by the white men, were surveyed by the U. S. Geological Survey during the past summer by means of the hitherto untried airplane-packhorse method, it is announced by S. R. Capps, geologist in charge of the expedition. Four trips were made by plane, Mr. Capps said, over the treacherous region of the Alaska Range in the south central part of the territory. Starting from Anchorage, the planes flew to the head of Lake Chakachamna, a body of water unknown to science until last year. "It took just about half as many hours to make the 150-mile trip," Mr. Capps pointed out, "as it does weeks to force a pack train through the roadless wilderness covered with glaciers, winding streams and deep-set gullies. Under the most unfavorable conditions, the planes made the journey in an hour and a half at most, whereas it took other members of our party close to three weeks to penetrate the same territory by pack-train."

TREES native to the temperate zone have made remarkable growth on the mountainsides of Hawaii, the U. S. Forest Service states. Coulter pines set out some 17 years ago at an elevation of 6,750 feet, east of Puu Nianiau on the private land of Kalialinui, have attained a height of 25 feet and a diameter of 12 inches. The pines have spread out enormously, much more so than in the United States, and have deposited a mat of needles six inches in depth, affording excellent watershed protection. In the same plantation western red cedars of the same age are now 21 feet high and eight inches in diameter, and white pines are 17 feet high and six inches in diameter.

EXPERIMENTS made at Giant Forest, Sequoia National Park, have shown that the California Big Tree, or *Sequoia gigantea*, sometimes retains its cones for sixteen years before they drop and discharge their seed contents. The seeds are preserved from weather and fungi by a powdery pigment which gives them a water-proof and germ-proof gloss. This pigment, when dissolved in water, makes a good writing fluid or furniture stain of a rich maroon color.