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NORTHERN LIGHTS

THE mystery of the green color of the northern lights and the problem of the Heaviside layer, believed to make long distance radio broadcasting possible, may have been solved as the result of a series of researches just completed by Dr. J. C. McLennan, professor of physics of the University of Toronto, and described by him to the Royal Society of London. From this work it seems that the upper atmosphere, at a height of sixty miles or more, consists largely of helium, the gas used to float dirigibles, even though at the earth's surface the air contains only a minute fraction of a per cent. of this useful gas.

A number of years ago the English physicist, Sir William Crookes, produced what are called cathode rays by passing a high-voltage electric discharge through a tube from which the air had been exhausted. These are now known to be rapidly moving electrons, the minute electrical charges of which the atoms of matter consist. As some of these phenomena appear very much like the aurora borealis, it was suggested that cathode rays were being emitted by the sun and that when these encountered the gases in the upper atmosphere of the earth, auroras were produced. In confirmation of this theory, a Scandinavian scientist, Professor Kristian Birkeland, placed a magnetized sphere representing the earth in a vacuum, and when he bombarded it with cathode rays artificial auroras appeared.

But while the aurora could be partly reproduced in the laboratory, there was one effect that could not be duplicated. If a photograph is made of the northern lights, or even of the northern night sky, with a spectroscope, which analyzes the light into various colors, a prominent green line appears, along with a number of others. Professor L. Vegard, a French scientist, worked on the problem of its origin in Leyden, Holland, at the laboratory of Professor Kamerlingh Onnes, one of the two places in the world where extensive low temperature research is carried on. He found that many of the colors of the aurora were due to the action of the cathode rays on nitrogen; and finally, in the spring of 1924, he announced that he had obtained the green line artificially by freezing nitrogen to a solid, with a temperature of 346 degrees below zero, Fahrenheit, and subjecting it to the action of the rays.

At first this seemed conclusive, but Professor McLennan, director of the physical laboratory at Toronto, the only other laboratory in the world possessing such equipment for low temperature investigations, repeated it, with the assistance of Dr. G. M. Shrum. He found the green color, but as he used a more powerful spectroscope than had Vegard, also found that it did not agree with the line in the aurora. The line in the spectrum obtained from the solid nitrogen turned out to be double, with one part on one side, and the other on the other side, of the green line in the aurora spectrum.

In his latest work, Dr. McLennan has been able to reproduce the line artificially, in precisely the same place as it occurs in the natural aurora. As helium is so light, he supposed that the atmosphere at an altitude of 60 miles would contain a large proportion of it, so he passed the cathode rays through a partly exhausted tube containing about 25 parts of helium to one of oxygen. The line was obtained, even though the use of oxygen or helium alone did not show it. Thus, the origin of all the observed colors in the northern lights are known, and even more important evidence is obtained as to the composition of the upper atmosphere. The Heaviside layer, supposed to consist of ionized gases which reflect radio waves back to the earth, instead of going out in space to be wasted, may consist largely of helium, and the northern lights study may lead to a better understanding of one of the greatest mysteries of radio.

THE USE OF RADIUM IN THE TREATMENT OF LEPROSY

THE successful use of radium in the treatment of leprosy which, it is hoped, will result in the abolishment of the law of segregation that is imposed on those suffering from the dread disease, is reported by Drs. M. H. Neil and R. P. Sandidge, of the Kalihi Leper Receiving Hospital at Honolulu. So far as can be discovered, this is the first use of radium in the treatment of leprosy.

Following a series of experiments, the surgeons announce that in all cases treated with radium, "the leprous nodules disappeared. It is hoped that, by the use of radium, many lepers may be converted from dangerous carriers, emitting millions of bacilli from their noses, to persons not dangerous to public health and thus no longer in need of segregation."

Experiments with the radium treatment for leprosy have extended over a period of six months, the study being concentrated on the use of the element with especial reference to treatment of leprous lesions of the nose.

Seven cases having nodules in the nose were treated by the insertion of a 50-milligram tube in either nostril, alternating at intervals of from two to three weeks, exposure to the treatment being from one and a half to two and a half hours.

In all cases the nodules disappeared, it is said. In three of the cases the bacteria disappeared from the area under treatment. Other similar cases, not receiving the radium treatment, showed no change in nasal condition.

"It is the intent to extend the scope of this work to determine the permanence of its effects and the effect of clearing up the nose on the patient's general condition."

PEARLS FROM THE OHIO MOUND

PEARLS from the Ohio mound hoards show that the ancient Indians who built them and accumulated the jewels found in them were as fastidious as modern jewelers about their quality, according to Dr. Walter Hough, of the U. S. National Museum. They used only

perfectly shaped pearls, rejecting even the baroque that receive at least minor favor from Europeans.

The Ohio finds, though unusually fine, even sensational in their quality, are not the first discoveries of pearls in the Indian mounds of that region, Dr. Hough said. Some years ago an expedition under the late Dr. F. W. Putnam, of the Peabody Museum of Harvard University, worked on mounds near the Miami and Muskingum rivers in Ohio, and found great quantities of pearls, nearly a peck of them in all. Unfortunately, they had been buried in acid soil, which had roughened and discolored their surface. If the surface layers were peeled off the nacre underneath shone with an exceedingly beautiful but evanescent luster, like the "peeled" pearls of modern jewelers' practice. Pearls, Dr. Hough explained, are chemically quite similar to limestone, and unable to withstand even the weak acids of the soil. Cleopatra's famous stunt of dissolving a pearl in vinegar can be repeated by any one willing to stand the expense. Fortunately, the pearls recently found were buried in a limy, alkaline soil and have not been spoiled. Dr. Hough recalled also a store of pearls found by an expedition under William C. Mills, which had been perfectly preserved by burial in ashes. Included in this find was one necklace of an estimated value of $150,000.

The source of the pearls is obvious enough. The mussels or "clams" abundant throughout the Mississippi Valley frequently contain pearls, which are sometimes of great value. The mound-builders were mussel-eaters, and must therefore have found many pearls, which became part of their tribal hoards. There is small likelihood that any of them came from the sea, for though the mounds sometimes contain sea-shells obtained in barter from more southern tribes there is no indication that sea-pearls were thus obtained.

The tools used by the ancient Indians were primitive, but their basic technique was surprisingly like that of modern jewelers. Some of the pearls were bored for stringing by means of a fine stone splinter, but most of them by means of a slender stick and a little sand and water.

Pearls were also used as eyes in the carved stone ceremonial pipes that have been found in the mounds. These pipes are more frequently carved in the form of birds, but represent other animals also, and usually with the greatest realism and faithfulness of detail.

The copper ceremonial masks, Dr. Hough stated, were probably made by hammering sheet copper into shape over a wooden base or mould. They are all grotesque, and some of them are representations of animals. Some deer masks have been found, with branching horns that project well above the head.

Dr. Hough said that there is no question but that the mound-builders were Indians, so far as can be determined from a study of their skulls. About five or six years ago, however, there were discovered in some of the old mounds intrusive burials of another people, whose remains are still a riddle to anthropologists. These invaders possessed bone harpoons, weapons unknown to the Indians; moreover, in one place a jade ax was found, and the Indians never used jade. These remains strongly hint at a high-northern, Eskimo-like invasion; but no study of their skulls has yet been made, so that nothing positive has been determined.

THE OPIUM TRAFFIC

THE appalling swiftness with which international traffic in narcotic drugs has grown during and since the World War is told by John Palmer Gavit, former New York newspaper editor. Figures gathered by the opium advisory committee of the League of Nations show that narcotic drugs are manufactured in quantities ten times as great as even the most generous estimates of legitimate medical and scientific needs allow, he says.

The evil is not now an exotic affair of the Far East, for, although the eating, drinking and smoking of raw opium are injurious enough, these are surpassed by the present-day use of derivative drugs in concentrated form. These are compact, easily disguised and much more profitable to smuggle, especially with the push of Western criminal genius behind the traffic.

The opium advisory council of the League of Nations estimated the amount of opium and crude cocaine needed for medical and scientific purposes by the part of the world's population that is within reach of such service. Four hundred and fifty milligrams of raw opium and seven milligrams of cocaine is allotted for each person. It is estimated that 744,000,000 people of an assumed world population of 1,747,000,000 are within reach of medical service; therefore the legitimate world need for drugs is estimated as follows: opium, 100 tons; morphine, 136 tons; codeine, 84 tons, and heroin, 15 tons, making a total of 335 tons of narcotics.

Allowing 450 milligrams of opium to every man, woman and child in the entire world, regardless of needs, would require a total of 786 tons annually. "No one knows how much is actually produced," says Mr. Gavit, "but conservative estimates converge with remarkable closeness to 8,600 tons a year, including the 5,000 tons attributed to China. Since the most generous estimate of world needs calls for only 786 tons, less than one tenth of it could possibly find legitimate use."

If the opium advisory committee of the League of Nations were given powers, Mr. Gavit believes it could ration supplies among the nations, and the production of manufactured narcotics could be controlled at the factories. With the cooperation of the various governments the trade could be very well patrolled, for the factories are few and the governments know where to find them.

SCRAP IRON AND DYNAMITE SUGGESTED FOR FROST PROTECTION

WITH the coming of late fall, and the approach of colder weather, fruit growers in different parts of the country are beginning to take elaborate precautions to protect their orchards from the ravages of Jack Frost, but not all the suggestions that have been made to the Weather Bureau, at Washington, will be used. According to J. B. Kincer, chief of the Department of Agricultural Meteorology, a great many of the suggestions that enthusiastic inventors send in are wildly impractical.

"The 'crank' proposals," says Mr. Kincer, "range all the way from hanging pieces of scrap iron in the trees to 'absorb' the frost, to exploding dynamite in the air above the trees to break it up before it can 'fall.' Another extreme proposal was to throw cotton strings over the tops of the trees and allow the ends of the strings to dip into a pail of water to conduct the frost into the water where it could do no harm. This was actually patented."

However, orchards can be protected from frost by tried and approved means. The citrus growers in Florida and California have used these methods more extensively than any others, said Mr. Kincer. The most efficient devices are the oil heaters, with tall chimneys, from which a large amount of heat is radiated. Each holds about nine gallons of oil, and about fifty heaters are required to the acre for adequate protection. In a single grove, he said, there may be as many as 10,000 heaters and as much as $3,000 worth of oil may be burned on a bad night.

PAPER-MILL WASTE

INSTEAD of fouling streams, the waste from Swedish paper pulp mills is expected henceforth to help keep dust out of the air. Though the air in Stockholm is on the average ten times as free from dust as that of London in a heavy fog, for instance, a campaign has been started to make it as nearly dust-free as possible, and in this a valuable ally has been found in the sulphite lye which the pulp mills of Sweden have hitherto poured away as worthless waste. This summer all the macadamized or unpaved roadways and streets in Stockholm have been sprayed with the lye, to which lime water has been added to make it less soluble in rain. The city authorities of Malmoe and other places have also begun to buy the sulphite lye by the car load to use it on the roads, and a separate company has been formed to exploit the new dust-binding material.

The measurements of dust particles in the air have been made by the meteorologists and the Swedish Government's official meteorologist, Professor Andres K. Angstrom, has calculated that on the average the air in Stockholm contains 4,000 dust particles per cubic centimeter, while in London the usual figure is 10,000 and in heavy "pea soup" fogs runs up to 50,000. The number of dust particles inhaled each minute by a person walking through a London winter fog has thus been estimated at 450,000,000.

ITEMS

THE long-sought-after process of melting carbon, whose lack has stood in the way of the manufacture of genuine diamonds, has been discovered by a group of German chemists, Drs. Alterthum, Fehse and Pirani. Carbon has been one of the most heat-resistant substances known, and for that reason it has been used in arc lights and carbon filament lamps where a powerful current sent through this substance found such resistance that it raised it to white heat without melting. But the existence of diamonds which are pure crystallized carbon tantalized chemists for years, because it proved that at some time in the past carbon had been in a molten state before it formed the transparent eight-faced diamond crystal. Graphite has been known for a long time and can be made artificially, but unlike the diamond, it is softer, opaque and forms six-faced crystals. Dr. Alterthum and his coworkers heated a graphite cylinder about five and a half inches in length and an inch and a half in diameter, the thickened ends of which were sent in copper electrodes, by means of an electric current. The various temperatures attained were measured at the middle of the cylinder through an opening. It was definitely determined that some degree of melting actually occurred within the bore of the carbon cylinder, and the melting point was determined as about 6,300 degrees Fahrenheit.

THE process of evolution, going on in full swing, has been shown to exist in a little island in the South Seas, by Professor H. E. Crampton, of Barnard College, who has been at work on this problem for nearly twenty years. Appropriately, for so leisurely a process as evolution, the animals studied were snails. One particular genus, wide-spread in the south Pacific islands, is represented on the little island of Moorea, one of the Society group, by a number of distinct species. The island is high and mountainous, with numbers of deep little valleys running toward the inland range, so that it offers plenty of chances for separation of races and the development of their distinctive characters. One of the most constant of specific characters in these snails is the direction of the twist of the shell. A given species will twist to the right or to the left, never both; for a "left-shelled" snail to occur in a "right-shelled" species is as unheard of as a man with his head on backwards. Yet Professor Crampton found "waves" of "left-shelled" snails rising in "right-shelled" species, and *vice versa*, together with other evidences of changing character. Professor Crampton treats his discovery very conservatively, for he says, "While the degree to which real diversities have been brought about does not amount to that of specific distinction, yet the differences actually demonstrated are exactly the same in nature as those by which true species are distinguished." He adds also: "That mutation as a real and a contemporaneous process is proved by the existence of divergent individuals of adult growth.

CARRYING its own private waterfall to run itself by a water turbine, a railway car utilizing a new type of power transmission is attracting the attention of Swedish transportation engineers. The prime motive power consists of an internal combustion motor of the usual type, but instead of using gears or electric transmission, the motor operates a centrifugal pump, which supplies water under pressure to a turbine directly geared to the driving axle. The speed of the car is governed by the height of the artificial "head" of water created by the pump. With a motor of 180 horse power the car has attained a speed of 50 miles per hour. An especial advantage claimed for the new transmission method is freedom from jerks in starting and stopping. Swedish railroads have already ordered the manufacture of four motor railroad cars and one Diesel locomotive equipped with the new hydraulic drive.