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EXPERIMENTS ON HIGH PRESSURES AT HARVARD

EXPERIMENTS with staggeringly high pressures, comparable to those found inside the earth, are in progress at Harvard University. They throw new light on possible geological syntheses of minerals deep in the earth.

By squeezing materials at pressures as high as 700,000 pounds to the square inch and twisting them at the same time, Professor P. W. Bridgman has caused dangerously violent explosions in such substances as celluloid and lead and magnesium dioxide. The explosions are not due to temperature increase, for this was found to be only 34° degrees centigrade.

In addition, Professor Bridgman found that under high pressure plus twisting: (1) Rubber was derubberized into a translucent horn-like material; (2) paper was similarly transformed; (3) wood and linen cloth were changed in comparable fashion.

Control tests on paper, Professor Bridgman adds in his report to *The Physical Review*, indicate that the 700,000 pounds to the square inch pressure will not, of itself, cause the transformation. The twisting or torque is also necessary.

The theory behind the experiments, Dr. Bridgman states, was that if atoms and molecules of substances could be made to slide over one another while under very high pressures they would take up new positions permanently and hence create new and different materials.

"The permanent transition from graphite to diamond was an attractive possibility, made plausible by the fact that the diamond structure can be approximately obtained from the graphite structure by a shear and an axial compression," Professor Bridgman said. The change occurred but was not permanent.

A difficulty of the work, Professor Bridgman pointed out, was to determine, with the very small amounts of materials available, whether any permanent change had occurred. Various organic dyes were therefore squeezed and twisted to see if color changes might occur. With the dye thymol blue there was no color change, but there was a striking decrease in its solubility. Lead dioxide was next tried, on the theory that the color change between lead oxide and the dioxide might be noted. Dr. Bridgman states to his great surprise lead dioxide detonates violently, leaving a residue of metallic lead.

The first attempt at synthesis was the combination of copper and sulfur. "The results were at once positive; there was a detonation at pressures of 20,000 (280,000 pounds to the square inch) without rotation, and the product was apparently the ordinary black sulfide." Some of the explosions were so great that half of the steel pistons used in creating the pressure were blown away.

Technically, the ability of a substance to assume several different forms, as was found in Professor Bridgman's experiments, is known as polymorphism. Of the significance of his tests he concludes: "Polymorphism may be expected to be a common phenomenon under the high pressures in the interior of the earth. The volume changes associated with polymorphic transitions combined with the greatly enhanced shearing strength under pressure of practically every substance must afford opportunity, at least locally and temporarily, for the development of high shearing stresses in the interior of the earth, under the action of which novel chemical reactions may well occur.

EFFECT OF THE SUN'S ERUPTIONS ON RADIO TRANSMISSION

RADIO transmission on certain short wave-lengths was wiped out by eruptions of the sun for a single day, October 24, according to a statement made by the National Bureau of Standards. The fade-out shed new light on the complex and baffling relation between radio transmission, sun-spots and magnetic storms.

Radio wave-lengths like those used by home radio receivers were not affected, but experimental radio transmission below certain short wave-lengths was completely wiped out. Commercial and amateur radiograms sent on the short wave-lengths were also seriously hampered.

Dr. J. H. Dellinger, chief of the radio section of the bureau, recently suggested in SCIENCE that the days from October 21 to 25 be watched for just such a fade-out happening. The October dates fitted in with his previous observation of an approximate 54-day cycle based on severe fading on March 20, May 12, July 6 and August 30.

"The occurrence of October 24," according to the report of the Bureau of Standards, "was a wiping out of radio transmission above a certain frequency throughout the daylight hours of the day in question."

The report adds: "At the time of a radio fade-out, there is doubtless some eruption on the sun much more sudden than the growth of a sun-spot, which abruptly changes the rate at which the sun sends certain waves or particles into the earth's atmosphere. Such eruptions produce magnetic disturbances also. There has hitherto been no way of identifying particular magnetic disturbances associated with such eruptions. The radio effects, on the other hand, are easily identified, and further study of them may furnish a means of closer insight into the mysteries of magnetic disturbances and other effects closely related to events on or in the sun."

Just prior to the fading there was a remarkable increase in sun-spot intensity starting on October 10. On the same date also there began a general improvement in radio transmission on high frequencies. By October 21 to 23 the upper limit of frequency was the highest value ever observed at the bureau. Then on October 24, for the single day, conditions completely reversed. On October 25 they returned to their former high values. The reversal was also accompanied by a remarkable change in the height of the upper ionized layers of the atmosphere which reflect radio waves. Prior to and following October 24 the height of this layer was 150 miles. During October 24 it was 290 miles.

Professor Henry G. Gale, of Mount Wilson, reports that a close relationship between the disappearance of the short-wave radio signals and solar activity was found at

Mount Wilson Observatory. Special observations were made of the sun from October 21 to 25. On the morning of October 24 a group of dark granular flocculi was observed on the sun's disk, but hardly large enough to be classed as a sun-spot. Photographs using only light from hydrogen atoms in the sun were then taken every fourteen minutes throughout the day. Later in the morning the size of the group increased greatly until it was the largest object on the sun's surface as observed by the hydrogen spectroheliograph. Finally in the evening the size of the solar object returned to its former value. The increased solar activity paralleled the strange radio fade-out. Technical details of the fading are given in the issue of *The Physical Review* for November 15.

VACCINATION AGAINST INFANTILE PARALYSIS

SCIENTIFIC opinion on the value and safety of vaccines for infantile paralysis is sharply divided, it appears from discussions at the meeting in St. Louis of the American Public Health Association, Southern Branch.

Is it safe to inject some of the active, living virus of the disease into a child's body, even if the virus has been weakened so that a large dose of it does not produce paralysis in monkeys? Does it do any good to inject doses of dead virus?

Parents and physicians all over the country are anxious to know the answers to these questions. So far, scientists have not agreed and from the discussions here it appears that the question can not be settled without much more extensive researches.

Disappointing results were obtained with the trial of the dead virus vaccine in last summer's epidemic of infantile paralysis in North Carolina and Virginia, because the trial proved nothing either for or against the vaccine.

The North Carolina test was made on 1,452 children, according to the report of Drs. A. G. Gilliam and R. H. Onstott, of the U. S. Public Health Service. These children were nearly of the same age, had equal chances of being exposed to the disease, and were children whose parents wanted them vaccinated in order to protect them if possible against the epidemic in the vicinity. They were divided impartially into two groups. All the children in one group, 458, were vaccinated with dead virus vaccine prepared by Drs. William H. Park and Maurice Brodie, of the New York City Health Department laboratories. The other children who did not receive the vaccine served as controls, to show whether those protected by the vaccine had any better chance of escaping the disease than those not so protected.

"No cases of poliomyelitis were reported in any of the 1,452 candidates and hence no conclusions concerning the efficacy of the vaccine can be reached from this study," Dr. Gilliam said. The study was carried out under the supervision of Dr. J. P. Leake, medical director of the U. S. Public Health Service.

It would be necessary to vaccinate 10,000 children and have 10,000 controls under conditions like those of this particular trial, to show conclusively the value of a perfect vaccine against infantile paralysis, Dr. Gilliam said. If the vaccine were only 80 per cent. effective, a total of 40,000 children would have been necessary.

Further trials of this vaccine are contemplated by Drs. Park and Brodie. Although some investigators hold that dead virus vaccine can not produce immunity or resistance to infantile paralysis, Drs. Park and Brodie reported they had found "anti-bodies," substances they believe indicative of immunity, in the blood of children vaccinated by their method.

Dr. John A. Kolmer, Research Institute of Cutaneous Medicine, Philadelphia, reported that vaccine, made of living virus weakened by chemical and other treatment, has been given to over 10,000 children. Ten of these children subsequently contracted the disease, five of them dying of it. Dr. Kolmer believes this was because they were already infected before they received the vaccine, and that it was given too late to prevent the onset of the disease. None of these ten children received the full doses which he considers necessary for full protection. Other investigators, skeptical of the safety of injecting living virus, see in these ten cases confirmation of their doubts and consider Dr. Kolmer's vaccine unsafe.

Hope that satisfactory vaccines will eventually be developed for protection against virus diseases, such as infantile paralysis, was expressed by Dr. Thomas M. Rivers, of the Rockefeller Institute for Medical Research, New York. Dr. Rivers pointed out the many difficulties in the way of developing such vaccines, difficulties due to the different behavior of viruses and to insufficient understanding of them at present.

GRASS GROWING AS A REMEDY OF SOIL EROSION

GRASS, growing in thousands of fields worn and tired from too much crop-bearing, will be the salvation of the soil and hence of the farmers that depend on it, Administrator Chester Davis, of the AAA, declared in an address before the meeting, in Washington, of the National Association of Land Grant Colleges. By reversing the forest-cutting, sod-breaking practises of tradition, where these have been carried to land-killing excess, by inviting the sod to return where it is needed, the present menace of erosion can be averted, he told his listeners.

No real blame can be fastened upon farmers of either past or present for the dangerous state of things that exist, Mr. Davis said. The pioneers acted instinctively, in their zeal to clear the land; the farms had to be won from the wilderness.

The present generation of farmers, who abandoned their crop-rotation systems and plowed up grassland that should have stayed under sod, knew that they were doing evil things; but they could not help themselves. With post-war low prices for farm products, and post-war high prices for industrial wares the farmer had to buy, he had no choice but to raise more bushels of corn, more bales of cotton, even at the cost of damage to the land.

Mr. Davis dramatized the situation: "The tillers of the soil became miners of the soil. Our pioneers became prospectors—prospectors digging desperately into the soil for all they could mine to-day regardless of to-morrow, even though the best they could get out of it was not enough to enable them to live the life their pioneer fathers had in mind when they won the West and plowed the prairies for them."

The retirement of surplus-producing acres, the helping of the farmer through the much-debated processing taxes, Mr. Davis held justified even without the support of the argument that it brought direct cash benefit to the distressed farmers, because it has made possible beginnings of scientific land restoration through return of erosion-checking permanent grass, and the planting of legumes to rebuild soil fertility.

UNIVERSITIES AND THE APPLICATIONS OF SCIENTIFIC RESEARCH

UNIVERSITIES should keep in closer touch with the world's needs for the products of scientific research, Dr. William Charles White, chairman of the division of educational relations of the National Research Council, recommended in an address before the meeting, in Washington, of the Association of Land Grant Colleges. As things stand at present, much research fails to be used efficiently, and, on the other side of the picture, many pressing problems drag along unsolved because they are not called to the attention of the right groups of men working in the right laboratories.

"I should like to suggest in this connection," said Dr. White, "that there should be attached to each university in the office of the president an officer, known as the correlator, whose function would be to attend all conferences with the purpose of uniting our great industries and our universities for the welfare of the public and to advise the president as to the steps that may be taken in the university for the provision of graduates for future special fields of endeavor."

As concrete examples of special interest to land grant college executives, Dr. White pointed out several fields of investigation looking to the industrial utilization of farm products and wastes, and the introduction of new crops of use mainly in industry. Such are the growing demand for industrial alcohol produced from surplus grain, fruit, potatoes, etc., and the absorption of large quantities of soybean oil in the manufacture of varnish, enamel and plastics.

However, the possibilities of more efficient research envisioned by Dr. White are not all in the field of immediate application in industry and engineering. There are many lines of research in fundamental science that need even more intensive investigation than they are receiving at present, and many problems on the "borderlands of science" that have as yet hardly been attacked at all.

An experimental approach that has been made with considerable success by four of the country's great universities was cited by the speaker. Each of these universities asks itself "what its objective is in relation to its environment, national work, and possible special value so far as may be seen into the future." Having set this objective, it begins analysis of its departments with a view to attaining this goal.

ITEMS

VERY hot stars, with surface temperatures around 40,000 degrees, have provided the latest evidence in favor of the Einstein relativity theory. Dr. Robert J. Trumpler, of the Lick Observatory, has found that the lines appearing in the spectra of those stars after their light had been analyzed through the prisms of a spectroscope, are shifted towards the red. This shift is greater than that shown by other stars closely associated with the hot ones. In a paper published in the current issue of the *Publications* of the Astronomical Society of the Pacific, Dr. Trumpler expresses the view that this shift is similar to one found previously in the sun and other stars, and which was predicted by Einstein. It is believed to be due to the fact that the light waves are lengthened slightly when they leave such a massive body.

A CHEMICAL cousin of synthetic perfume is now being used in steam boilers instead of water to increase the power output for each ton of coal burned. C. G. Brown, G. A. Gaffert, P. H. Konz and D. S. Ullock, all of the University of Michigan, have just completed tests on the new boiler chemical. Known as Dowtherm A, it freezes near room temperature, 54.7 degrees Fahrenheit, and is a mixture of di-phenyl and di-phenyl oxide. At the high temperatures in steam boilers it yields a steam-like vapor but develops much less pressure than steam—a decided advantage. The substance is related chemically to synthetic geranium perfume and to certain of the synthetic resins used in making plastic products.

SHELTERBELT tree plantings in the Plains area are to be made in future from seedling descendants of trees already growing in the region and used to conditions there. At a meeting of biologists, in Washington, Paul H. Roberts, of the U. S. Forest Service, told of a 1935 harvest of 57 tons of seeds and fruits of various Plains tree species, enough to supply 100,000,000 young trees for shelterbelt plantings. Of this quantity, 85 per cent. came from trees in the shelterbelt area, 10 per cent. from trees in immediately adjacent regions in the West, and 5 per cent. from other sources, chiefly Chinese elm, a species claimed to be especially well adapted to cultivation in the West. During the first shelterbelt planting season, just closed, 125 miles of shelterbelt were set out, besides 5,000 acres of farmstead tree plantings. Much of the stock, secured on an emergency basis from private nurseries, was not as suitable to the purpose as might have been desired, Mr. Roberts said, but even so, between 70 and 85 per cent. of the plantings have survived.

RESEARCH conducted jointly by the antarctic research ship, *Discovery*, the British Museum of Natural History and the London National Institute for Medical Research, show that a female sex hormone, known as progestin, and widely used in gynecological practise can be obtained as a by-product of the whaling industry instead of from sows killed in slaughter houses. The hormone, surprisingly enough, can be obtained under ordinary whaling conditions and can be preserved in formalin for many months. Authorities in London believe that the hormone from whales will be widely used, at least until the hormone can be produced synthetically on a commercial scale. Progestin is produced by the corpora lutea of the ovaries. Besides playing a secondary sex-stimulating rôle, it prepares the uterus for reception of the fertilized egg and pregnancy.