SCIENCE NEWS

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NEW ELEMENT NO. 93

THE heaviest element known to science—No. 93—is a substance whose properties make it a chemical relative of the hard, brittle metal manganese. The nature of the new element, together with proof of its existence, will appear in the forthcoming issue of *Nature* over the signature of its discoverer, Professor Enrico Fermi, of the Royal University, Rome. The first announcement of the discovery was made by Senator Mario Corbino before the Lincei Academy in Rome.

In describing his research, which added another element to the 92 already known to science, Professor Fermi stated that the crucial test was to add salts of the metal manganese to a solution of uranium after the latter had been bombarded with nutrons. Uranium is the dense "mother" element which breaks down by radioactive disintegration to produce a variety of lighter elements including radium.

Following the addition of manganese salts to the uranium fluid, a cloudy precipitate formed in the vessel and fell to the bottom. Most of the radioactivity floated down with this precipitate, indicating that a disintegrating substance, other than uranium, was present. The precipitate was a chemical salt of the new element No. 93. The addition of salts of other elements—uranium, lead and barium—while forming precipitates in some cases did not remove the radioactivity from the uranium mixture.

This precipitation test, Professor Fermi indicates, shows that element No. 93 probably is a heavy-weight relative, or homologue, of manganese. The experiment is not quite conclusive, however, in the sense that the yet-unfound elements 94 and 95 may have been present.

The use of chemical tests to prove radioactivity is not new. In the epoch-making experiments of Irene Curie and her husband, F. Joliot, last January, in which science for the first time produced artificial radioactivity, the French scientists shot the cores of helium atoms at boron nitride. By heating the boron nitride target in caustic soda, ammonia gas was formed. The radioactivity present then separated from the boron compound and was carried away as a gas with the ammonia vapor. The active substance in the ammonia, said the Joliots, was a form of nitrogen gas breaking down spontaneously by radioactive disintegration. Professor Fermi, in a comparable test, finds the radioactivity going off with the precipitate.

Element 93, as kin to manganese, fits into group seven of the periodic table of the elements after they are arranged into classes according to their characteristics. Companions of manganese and element 93 in group 7 are fluorine, chlorine, bromine, iodine and the rare substances masurium and rhenium.

THE ORIGIN OF COSMIC RAYS

COSMIC rays, the mysterious radiation which bombards the earth from all sides, may originate in the strange rare phenomena during which stars flare up with sudden bursts of energy that make them shine as bright as the planets.

This is the theory of cosmic ray origin advanced by Dr. W. Baade, of the Carnegie Institution's Mount Wilson Observatory, and Dr. F. Zwicky, of the California Institute of Technology, in a report published in the *Proceedings* of the National Academy of Sciences.

The special "erupting" stars which Drs. Baade and Zwicky believe cause cosmic rays are called super-novae. After traveling through space for eons of astronomical time they suddenly flare up and reach a brightness which, on occasions, has rivaled that brightest of all stars, Sirius. Some super-novae in distant nebulae produce as much light as does the whole star system which contains them. In the short space of a few years the shining splendor of the novae type stars fades away to their former obscurity. Novae flare-ups are rare occurrences which last about as long in comparison with the millions of years in astronomical time as the fleeting flare of a rocket compares with a century.

Super-novae stars, according to Drs. Baade and Zwicky, are ordinary stars which blow up like a bursting shell. The velocity of expansion of the star may, in some cases, be nearly that of the speed of light. Some stars, in the process, may lose over half their mass by radiating it away into space. Visible and ultra-violet light are known to come off in the star eruption. It is suggested now that cosmic rays may be emitted at the same time.

Cosmic ray observers are requested to call attention promptly to any systematic intensity changes that last even a few days. If such information were obtained quickly enough astronomers could push the search for possible novae stars. Cosmic ray intensities fluctuating over a period of years in rhythm with the appearance of super-novae stars would be strong support for the new hypothesis.

Applying their theory of novae bursts to cosmic rays, Drs. Baade and Zwicky point out that in all the discussion about cosmic rays there is only one point on which all investigators—Millikan, Compton, Regener, Hess and others—agree: cosmic rays originate outside the star system which contains the sun and its companion earth.

This general agreement on the extra-galactic origin of cosmic rays fits the hypothesis of the emission of cosmic rays by super-novae stars. Cosmic rays do not come from within our own star system, for the simple reason that no super-nova flare-up has occurred near the neighborhood of the earth during the twenty years during which the rays have been studied systematically. Moreover, theoretical deductions on the possible intensities of cosmic rays, which would come out of erupting novae stars, correspond to the observed intensities.

Astronomical calculations lead also to the belief that super-novae type stars should occur in any particular star system like our Milky Way once in 1,000 years on the average. Sometime between 1934 and 2934, there-

fore, investigators of the future—if they are still interested in cosmic rays—will probably have a chance to test the Baade-Zwicky theory. During the next thousand years one star in the system containing the sun should flare up and become a super-nova. If this happens, according to Drs. Baade and Zwicky, cosmic ray intensities should increase a thousand fold.

It will not be necessary, however, to wait 1,000 years for a test of the new hypothesis. There are about 1,000 star systems, or nebulae, which are comparatively near the earth. Every year, therefore, some one of these ought to have a star eruption. Such annual eruptions should be sufficient to change cosmic ray intensities on the earth by about one per cent. over a period of a few days.

EARTHQUAKES AND SOAP BUBBLES

THERE is a very close analogy between the passage of earthquake waves through the earth's crust and the passage of light waves through a soap bubble. The analogy is only skin deep, but it is for that reason all the more significant.

When the film in a soap bubble becomes so thin that it matches a wave-length of visible light the light no longer passes easily through it, but suffers from so-called interference effects which manifest themselves in the brilliant colors seen in thin soap films.

A leading geophysicist, Dr. Beno Gutenberg, and an expert on light waves, Dr. P. S. Epstein, both of the California Institute of Technology, in the course of a conversation drifted over to the analogies in their two fields. They noticed that the earth's crust has approximately the thickness (about 25 miles on the average) of one wave-length of an ordinary earthquake. The result of this conversation was of scientific importance because they worked out a method of telling the direction of the earthquake ray through the earth from its altered direction as indicated by recording instruments on the surface of the crust.

The calculation in the case of earth motions is more complicated than in the case of light because the elastic motions of the earth have both longitudinal and transverse vibrations, while light waves are exclusively transverse. This means that a single earthquake impulse striking the crust from the denser interior of the earth is broken up into four rays while there would result only two in the case of light.

The various earthquake beams soon undergo further reflections and splittings and result in a maze of interfering vibrations which make an earthquake so hard to analyze in detail. Earlier theories failed to predict the true behavior of earthquake waves in their passage through the crust and the best results were obtained by disregarding the junction between the crust and the core. This puzzling result is shown to be quite in accordance with the theory by the calculations of Drs. Gutenberg and Epstein.

THE GROWTH OF ANIMALS AND PLANTS IN HEAVY WATER

EXPERIMENTAL evidence that plants and animals grow more slowly in the new "heavy water" than in the ordinary kind which they ordinarily meet in nature may come about because the protein in them will not absorb as much.

Speaking before the American Chemical Society meeting at Berkeley with the American Association for the Advancement of Science, Drs. H. Q. Woodard and L. C. Chesley, research scientists of Memorial Hospital, New York City, described experiments on measuring the absorption of heavy water by the protein substance—gelatin.

Standard amounts of gelatin absorbed 20 per cent. less heavy water by volume in a given time than did equal amounts in ordinary water.

Ninety per cent. heavy water was used. This was supplied by Dr. Harold C. Urey, of Columbia University, who was one of the trio of original discoverers of the heavy, double-weight form of hydrogen called deuterium.

Two atoms of deuterium combining with one atom of oxygen forms heavy water just as two atoms of ordinary, light-weight hydrogen will unite with one atom of oxygen to form the kind of water man drinks.

Drs. Woodard and Chesley point out that since the absorbing of water plays an important part in life processes, it is important to compare the swelling of protein material in heavy and ordinary water.

The results of these experiments are of interest because of their relation to those biological processes in which absorption of water plays an important part.

VITAMIN D

FEEDING a baby milk to which vitamin D has been added may be a good way to give him this important, rickets-preventing vitamin, but such milk can not at present be relied on as sole source of the vitamin.

This opinion, important to mothers and physicians alike, was expressed by baby specialists and nutrition experts at the meeting in Cleveland of the American Association of Medical Milk Commissions and the Certified Milk Producers' Association of America.

The reasons for this warning were brought out by Professor Julius H. Hess, of the University of Illinois. In the first place, the amount of vitamin D in a quart of milk varies under present methods of manufacture and can not be known definitely for any given quart. This is partly because testing for vitamin D in milk is so expensive that even large dairies can only afford to do it once a month, and partly because there are no uniform and satisfactory standards for vitamin D as yet available. Different research groups use different standard units and different methods of determining them and just what they mean in terms of rickets-prevention in a human infant is a moot question. In the second place, babies and children vary in their susceptibility to rickets, so the amount of vitamin necessary to prevent the disease must be determined for each child by his own physician. Incidentally, Dr. Hess pointed out that rickets is no longer a scourge. Nowadays comparatively few children develop it.

A little vitamin D in milk is probably good for all growing children and for adults as well, according to Dr. Edwin T. Wyman, of the Harvard Medical School. The present tendency to add vitamin D to many foods

was criticized. Professor E. V. McCollum, of the Johns Hopkins Medical School, is of the opinion that "certainly not more than two and probably only one food should carry vitamin D." Milk and bread should be the two, and if only one is used as carrier of extra vitamin D, it should be milk.

HAY FEVER AND TIMOTHY FLOWERS

HAY fever victims, who owe their distress to their susceptibility to timothy pollen, are the indirect beneficiaries of researches on the flowering habit of timothy conducted by Dr. Morgan W. Evans, of the Timothy Breeding Station at North Ridgeville, Ohio, as reported in *The American Journal of Botany*.

The investigation embraced studies on the flowering habits of the plant, methods of collecting the pollen, and the effect of fertilizers, climatic conditions and the time of year on the production of pollen.

Timothy blooms, according to Dr. Evans, at very definite periods of the day, usually the largest number of florets opening about sunrise. The pollen, from which extracts for the alleviation of hay fever are made, may be collected by harvesting the stems on afternoons during the flowering season and placing them with the heads over sheets of paper. On the following morning the florets usually bloom in much the same way as in the field. The pollen may then be shaken off and collected on the paper.

The largest yields of pollen, Dr. Evans explains, are usually produced on days when the temperature is about normal or above normal, and when there is no rainfall and a relatively high percentage of sunshine. So long as favorable weather continues, the process of blooming occurs at about the same time each day during the flowering season. When the weather becomes cloudy or rainy, and especially if the temperature becomes subnormal, the process of blooming may be suppressed for one or even two days. When favorable weather conditions return, the florets bloom in unusually large numbers.

By growing early and late varieties of timothy, Dr. Evans was able to collect pollen for two weeks longer than usual.

ITEMS

A SHARP earthquake rocked the region of the Kurile Islands between Japan and Kamchatka on June 12, at 8:51 P.M., eastern standard time. From telegraphic reports to Science Service, experts of the U. S. Coast and Geodetic Survey located the epicenter of the quake at 46 degrees north latitude; 150 degrees east longitude. This would fix the center of the disturbance on or near the island of Urup, northeast of Japan and southwest of the Kurile Islands.

NEGATIVE particles of electricity—the electrons—are being "kicked" down evacuated glass tubes at the University of Virginia with speed reaching 94 per cent. that of light. Light travels 186,000 miles a second, or, 667,600,000 miles an hour. Electrons speeded up in the apparatus of Professor J. W. Beams and H. Trotter, Jr., have reached velocities of 174,840 miles a second. Reporting their experiments in *The Physical Review*, the method of obtaining very high speed particles for use in research on bombarding atoms where large energies of impact are required is described. Electrons having kinetic energy comparable with that achieved if a million volts of storage batteries were connected in series, are obtained by the use of only 300,000 volts alternating current from power lines. Or, if a small Van de Graaff type electric generator is employed, electrons having energies well over a million volts are obtained with only 30,000 volts. The apparatus for this last case increases the energy by a factor of over 40. The method, which makes this high energy gain possible, is to apply the small voltages at just the right times as electrons pass through the tube.

THE mild winter of 1933–34 in the western National Park area may be of doubtful value from the standpoint of the wild animals. Not only was the weather much milder than usual throughout the entire northern range, but the snowfall was much less heavy than in former years. As a result, the animals wintered well and sought the higher altitudes much earlier than usual this spring. Unfortunately, however, there is cause for concern in the drought conditions that have followed the mild winter, and fear is expressed by park officials that should a hard winter follow these drought conditions the wild animals may suffer severely. A mild winter always means less forage produced, greater utilization of the range, and a higher birth rate among the wild animals, thus complicating the situation.

AN unusual case of "stones in the brain" was reported before the meeting of the American Psychiatric Association by Dr. Jacob Kasanin, of the Rhode Island State Hospital for Mental Disease. This condition is a disease of the blood vessels of the brain in which calcium, the mineral found in bones, is precipitated into the small arteries. Physicians believe the disease tends to run in families and that it is associated with epilepsy and mental deficiency. It should be easy to diagnose the condition by x-ray pictures, Dr. Kasanin said. Only about half-a-dozen such cases have been reported in America, and the first ones were thought from the patients' symptoms and behavior to be brain tumors. The underlying cause of the condition is not known, except that it is some degenerative condition of the brain.

DR. T. D. STEWART, physical anthropologist of the Smithsonian Institution, is making a study of the directions in which hair grows over the whole body. He is comparing man in this respect with various members of the anthropoid family, the gorillas, chimpanzees, orangs. Orang-outans have a somewhat similar pattern of hair to the human cowlick, but it occurs on the back of the head, not the crown. The cowlick is a point of divergence, at which the hair streams out in all directions. The cowlick is the most conspicuous divergence of hair in a human being, but the hair direction pattern of the back is perhaps even more striking. The hairs start from both sides and converge at about the middle of the spine. In anthropoid apes the back hair streams downward from the back of the neck and shoulders, suggesting a continuation of the head hair pattern.