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COSMIC RAYS AND THE ORIGIN OF THE ELEMENTS

PENETRATING cosmic rays striking the earth for eons of time may have caused the formation of the varied elements, found in the top few miles of crust, from the supposed iron and nickel core. This is the suggestion of Professor Gilbert N. Lewis, professor of chemistry at the University of California.

Professor Lewis' theory, entitled "The Genesis of the Elements," appears in the *Physical Review*. Professor Lewis is world-famous among chemists for his researches, among them the development, with Dr. Irving Langmuir, of the so-called Lewis-Langmuir atomic theory.

In summarizing his hypothesis, Professor Lewis writes: "The hypothesis is suggested that a great part of the matter in the universe is composed chiefly of iron and nickel, like the metallic meteors, and that such material which is thermodynamically stable with respect to all spontaneous transmutations, except at extremely high temperatures, is superficially attacked by cosmic radiation to produce the material represented by the earth's crust and by the stony meteors."

The metallic meteors consist of more than 99 per cent. iron and nickel, while the stony meteors are much less dense and are more like the rock of the earth's crust. "It occurred to me," continues Professor Lewis, "that if the crust of the earth, and especially if the stony meteors, are representative of the material produced by the disintegration of the primal substance of the metallic meteors, then there should be discernible some immediate genetic relationship between the abundance of the main atomic species of the stony meteors and of the metallic meteors." Professor Lewis has found striking agreement in his search for such relationships.

The analysis of metallic, iron meteors reveals that over 99 per cent. of the mass present consists of two isotopes or iron and two isotopes of nickel. If cosmic rays had energies sufficient to split these iron and nickel atoms in half, two atoms of silicon would be formed for every atom of the twice-as-heavy iron and nickel atoms. Next to oxygen, silicon is the most prevalent element found in the earth's crust, and comprises more than a fourth of the mass of the crust. In turn, the various isotopes of silicon might be disintegrated by cosmic rays to form magnesium and helium. Magnesium occurs widely, in combination, throughout the earth's crust in great abundance. Counting three isotopes each of silicon and magnesium and aluminum and sodium which, conceivably, could be formed in the two steps outlined, eight of the eleven most prevalent constituents of stony meteors are accounted for.

Concluding his report, Professor Lewis states "It has been my purpose, not to erect any complete cosmological theory which would state the origin of the disintegrating rays, or where or when the material represented by the metallic meteors has been converted into the material represented by the stony meteors, but rather to present the very strong evidence for a genetic relationship between these two kinds of material, and to consider the various processes by which the genesis may have occurred."

CAUSE OF THE STRATOSPHERE BALLOON FAILURE

BECAUSE the giant stratosphere balloon, *Explorer*, on its ill-fated flight in July had the lower part of its rubber-sticky fabric tucked up inside the balloon, great tears occurred which brought a precipitate ending to the flight.

This is the finding of a scientific inquiry as to the cause of the accident made by a board of review consisting of Dr. L. J. Briggs, *chairman*, National Bureau of Standards; Dr. John O. La Gorce, National Geographic Society; Brigadier-General O. Westover, U. S. Army Air Service; Dr. W. F. G. Swann, Bartol Research Foundation, and Dr. L. B. Tuckerman, National Bureau of Standards, as reported by Dr. Briggs and Dr. Tuckerman.

To avoid difficulty in inflation and launching, great folds of fabric that would not be expanded by gas until the balloon had risen about 60,000 feet in its 75,000-foot projected climb were accordian folded inside with the idea that as the bag increased in size in the rarefied atmosphere it would come loose neatly. But the designers did not realize that the new way of folding would not allow the adherent rubber-coated fabric to peel loose, as happens with the usual method of folding. The inside layers became taut first, setting up shearing stresses that broke the fabric. So at 60,000 feet, the tears began and forced a descent.

An explosion of the lifting hydrogen gas mixed with air oxygen admitted by the torn balloon was the final act in the disaster and caused the disintegration of the balloon. The three Army officers scrambling for parachute jumps from the gondola below heard no explosion. Set off by a spark of static electricity, the explosion took from 5 to 6 seconds, Dr. Tuckerman estimated, and its low rumble was masked by the sound of the motor of an airplane flying nearby. This explosion disintegrated the upper portion of the balloon and allowed the remains to fall freely 3,000 feet to the earth.

Drs. Briggs and Tuckerman are sure that the cause of the ripping can be eliminated if future stratosphere balloons are built for another trial under the auspices of the National Geographic Society and the U. S. Army. The lower portion of the balloon, for instance, might be folded outside instead of inside, as in older balloon practise, and the difficulties in inflating and launching overcome by a different method of handling.

FERTILIZING AND SOIL EROSION

FERTILIZING and liming soil pays not only in increased crop yields but indirectly in decreased losses of top soil due to erosion. This point was stressed in an address at

the Iowa State College by R. E. Uhland, of the U. S. Soil Erosion Service, before a group of investigators assisting in the commemoration of the first modern laboratory in the natural sciences, established at the college sixty years ago by the late Professor Charles Edwin Bessey.

Mr. Uhland told of experiments conducted under his direction at a soil erosion station near Bethany, Mo. Here strips of sloping soil are planted in various crops, with and without fertilizer, and the losses in run-off water and eroded top soil are kept accurately checked. Unfertilized land under corn lost soil 300 times as fast as did the comparison strip under the much closer-growing alfalfa, and had nine times more loss in run-off water.

The use of fertilizer greatly increased the contrast between "close" crops like alfalfa and grass and "open," vegetation-free soil. From areas cropped under a three-year rotation of corn, wheat, clover and timothy the loss of soil where neither fertilizer nor lime was used was at the rate of little less than 12 tons per acre, as compared with only 3.74 tons per acre, where lime and fertilizer was applied and the same rotation used.

These results show that "lime and fertilizer applied once in the rotation may greatly reduce erosion," according to Mr. Uhland. "This fact was very forcefully demonstrated in 1932 when land in corn following clover that had formerly been limed and fertilized at wheat seeding time lost soil at the rate of 9.8 tons per acre, as compared with a loss of 19.6 tons per acre from adjoining land, which was not limed or fertilized, but which had the same cropping system. This same year land in corn, following corn, lost soil at the rate of 48.6 tons per acre, which was more than five times the loss from fertilized land on which a good cropping system was followed. This indicates that there is a marked residual effect of both the preceding crop and fertilizer treatment. It shows also that there is a marked difference in the soil loss from land in the same crop especially where the crop is poor."

AREA OF LOW MORTALITY IN THE CENTRAL AND NORTHWEST STATES

THE healthiest regions of the country, judging by the annual death rates for a three-year period, are three states in the Northwest and an area in the very middle of the United States which extends from Texas to the Canadian border.

In North and South Dakota less than eight out of every thousand persons die each year, an exceptionally low death rate. The rate for the country as a whole is ten per thousand. Next lowest death rates, between eight and nine per thousand, are found in Nebraska, Kansas, Oklahoma, Minnesota, Iowa and Wisconsin, and in the three states of the northwest corner, Washington, Oregon and Idaho. These figures are for white persons including Mexicans, standardized to allow for variations in age distribution, and were analyzed by statisticians of the Metropolitan Life Insurance Company. They relate to the three-year period, 1929–31.

The death rates have a curious geographic distribution, the statisticians point out. Just as the lowest rates are found in adjoining areas, the highest rates are also found in adjoining states, Arizona and New Mexico, with the next highest in adjacent Colorado and Nevada. The first two states had rates of over 12 per thousand, the latter two between 11 and 12.

The entire Eastern seaboard from Florida to New England and including Massachusetts, Maine, West Virginia and Tennessee, form another contiguous area having the same range of mortality, all falling between 10 and 11 per thousand. Illinois and Louisiana belong in this group, but no states west of the Mississippi River have death rates falling in this group.

Following the death rates further on the map, the statisticians found that states having a range of between 9 and 10 form two areas just to the east and west of the areas of lowest mortality. The eastern group is made up of Ohio, Michigan, Indiana, Kentucky, Missouri, Arkansas, Mississippi, and, jumping over the southern tip of Alabama, takes in Florida. The western group includes Montana, Wyoming, Utah and, skipping across Nevada, adds California.

The low death rates in the Dakotas are explained by the statisticians as due to the favorable climate and relatively safe, comfortable life on farms and small towns which combine to keep people well in these states and adjacent areas. The large proportion of Mexicans and the influx of many persons suffering from tuberculosis probably account in part for the high death rates in Arizona, New Mexico, Colorado and Nevada.

ITEMS

LEPROSY may be spread by healthy, unsuspected carriers of the infection, as typhoid fever and diphtheria are occasionally spread. Evidence that this may be the case has been reported to the U. S. Public Health Service by one of its officers, Dr. N. E. Wayson, director of the Leprosy Investigation Station at Honolulu. Persons may be infected with the bacillus of leprosy and remain well for a long time, if not indefinitely. A group of children of leprous parents were carefully examined over a period of years. Minor but definite evidence that the disease was attacking them was found in the condition of their small blood vessels and certain nerves long before other signs of leprosy could be detected. Nerve changes suggestive of the disease may stop or the nerves may grow more nearly normal again without the development of other signs accepted as characteristic of the disease.

BORON, familiar to most of us in its common compound borax, can cause spots that look as though they were caused by disease organisms, according to Dr. J. J. Christensen, pathologist of the University of Minnesota. Excess boron in the soil frequently brings them out. The boron spots resemble the common spot blotch disease of barley, making it difficult to diagnose the condition without careful laboratory examination. The spots may be artificially induced by adding either borax or boric acid to the soil in which the plants are growing.