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CALIFORNIA EARTH MOVEMENTS MAY LEAD TO EARTHQUAKE PREDICTION

Slow movements of the earth's crust are in progress in California, Col. E. Lester Jones, director of the U. S. Coast and Geodetic Survey, has announced. The eventual result of the precise surveys showing these changes may be the prediction of the time and place of earthquakes within reasonable limits.

Field parties this year found irregular movements of the coastal region within 200 miles of San Francisco amounting to as much as 16 feet as compared with accurate surveys made 30 or more years ago.

The discovery of the movements was made possible by the Survey's field operations under special Congressional appropriations, and the cooperation of the Seismological Committee of the Carnegie Institution of Washington, headed by Dr. Arthur L. Day. The field work consisted in the redetermination of the latitude and longitude of certain peaks, principally of the Coast Range, and of certain lighthouses, the positions being determined by reference to two massive peaks of the Sierras, Mount Lola and Round Top. The actual measurements were made by two triangulation parties, one under C. L. Garner in 1922 and one this summer under F. W. Hough.

The movements shown bear a general relation to the famous San Andreas fault line, a slip along which was the immediate cause of the great earthquake of 1906. Points south and west of this line have with a few notable exceptions moved in a northerly direction; while those to the north and east of the line have nearly all moved toward the south. There is little uniformity in the amount of the movements.

For example, San Jose peak, about ten miles southwest of the fault line and about 40 miles inland from San Luis Obispo, has moved north 16 feet while Santa Lucia peak 80 miles to the northwest has moved only 7 feet northwards.

Near San Francisco bay the differences in direction are most marked. The lighthouse on South East Farallon island has moved westward 6 feet, while Point Reyes lighthouse on the mainland 18 miles away has moved 11 feet to the north. Mt. Tamalpais has moved south about 5 feet.

Loma Prieta peak about 50 miles southeast of San Francisco has moved southeastward 6½ feet, while Sierra Moreno peak about half way to San Francisco and on the opposite side of the fault line has shifted 3 feet to the westward.

Major William Bowie, Chief of the Division of Geodesy, under whose direction the work during the past two years has been done, says of the results:

"They are epoch-making and may lead to the eventual predicting within reasonable limits of the time and place of earthquakes. They will certainly have great influence on geologic thought in the study of the earth's crust. The remarkable thing is that the peaks do not move the same amount for any given direction, the complicated movements seemingly indicating the action of local forces rather than one of a world-wide origin.

"The results have much interest and value to the engineer, the surveyor and map maker, the geophysicist, and the geologist. It has long been known that the earth moves horizontally along a fault line, but how far back from the fault does the movement take place? Our surveys found decided movements for stations 15 miles or more from the fault and the creeping of the surface probably is going on at even greater distances. Field work carried on in the future will reveal this. I believe the theory of isostasy must be taken into account in the explanation of what is going on in California and in other active earthquake regions."

READING REFERENCE - Davison, Charles. The Origin of Earthquakes. New York, Macmillan Company, 1912.

FINDING A USE FOR THE GERMAN METAL

By Dr. Edwin E. Slosson

The so-called "rare elements" when once discovered often turn out to be obtainable somewhere in sufficient abundance to be useful. For instance, the "rare earths", ceria and thoria, are now used in gas mantles on the street and in the home. The gas "helium" which was discovered by its spectral lines in sunlight twenty-seven years before it could be found on earth is now procurable in sufficient quantity to fill balloons.

Three of the rare metals were known and described long before anybody had seen them, even their spectral form. About fifty years ago, a Russian chemist, Mendeleeff undertook to arrange the chemical elements in an orderly scheme and when he had placed the seventy or so then known in their proper pigeon-holes he found three vacancies which he ventured to predict would sometime be filled by metals yet to be found. Sure enough, they were all discovered within the next sixteen years by chemists of three different nationalities, a German, a Scandinavian and a Frenchman, who were so patriotic that each named his new element after his fatherland, germanium, scandium and gallium.

The three nationally named metals remained mere chemical curiosities but recently the German one was found to be obtainable in quantity from the residues of a New Jersey zinc refinery. The stuff thrown away at the works contains as much as five pounds of the rare metal to the ton. Now it worries a chemist to leave anything on the dump heap that might be made useful so Dr. J. H. Muller

of the University of Pennsylvania was consulted on the question of what germaniu was good for. He surmised from the position of the element in Mendeleeff's periodic system that germanium might have similar medicinal effects to arsenic yet not be so poisonous. So he took into partnership on the investigation Dr. F. S. Hammett of the Wistar Institute of Anatomy and the two have been working abou five years on the problem. Experiments on rats, rabbits and guinea pigs and finally themselves have shown that the effect of injecting the oxide of germaniu into the veins or swallowing it is to increase the number of red corpuscles in the blood. A minute dose given to a guinea pig adds a million red blood cells in every cubic millemeter of the blood, which is a very small drop.

Now the red corpuscles play an important part in maintaining our vitality. They carry the oxygen of the air from the lungs to all parts of the body, even to the very marrow of our bones. If they run short we get anemic, pale and weak, and unable to resist the invasion of disease germs.

So it is possible that germanium may prove to be a useful remedy for such a malady. Fortunately, it has been found by experiments on animals that germanium is not poisonous like arsenic. It would require about an ounce of the oxide to endanger the life of the average adult while a dose of 10 to 15 grains is sufficient to stimulate the formation of the red blood cells. Such metals as arsenic and lead may be poisonous even in minute amounts if the dose is repeated for they accumulate in the body until a sufficient quantity is collected to be dangerous, but an excess of germanium is speedily eliminated by the kidneys without any noticeably injurious effects.

So this almost unknown element with the unpopular name may prove a valuable addition to the medicine chest and hence a household word.

READING REFERENCE - Slosson, E. E. Creative Chemistry. Chapter XIV. New York, Century Company, 1920.

VAPORIZED METAL SPRAYED ON SURFACES BY HOT BLAST

Bronze covered statues, copper-covered shingles, concrete piles, or railroad ties, and gold covered furniture are some of the possibilities ensuing from a process for spraying metals, which after years of study is approaching perfection at the U. S. Bureau of Standards. An exhibit showing stone, cement, metal, wood, and glass which had been coated by the new process attracted wide attention when shown by the Bureau in the recent Chemical Industries Exhibition in New York.

The essential of the process is that the metal is first vaporized and then sprayed onto the surface to be coated by means of a powerful blast which congeals it to the solid form as quickly as it strikes the surface. Details of the process are withheld by the Bureau at present for military reasons, except for the statement that it is based on a new principle and that electricity is used in the vaporization process.

Applications of the method, which results in a firm coating of metal upon any surface to which it is applied, are many and varied. Stone, wood, metal, and

glass are all equally suitable basic surfaces. Pottery may be successfully coated with metal, pointing to important developments in the ceramic industries.

An important application is in the use of the metal coating in building construction. Shingles may be made fire resisting by coating them with copper, which weathers well and produces an artistic green color on the roof. Experiments are already being made along the lines of copper coating other roofing material and stucco.

Soldering of metal to glass, a difficult problem, has been easily accomplished by means of this method. The glass is first coated with a layer of copper and the metal connection is then soldered to the copper. Processes somewhat similar are used in the soldering of aluminum.

The preservative qualities of metal-coated articles are attracting attention from many quarters. It may be used in airships, and is being experimented with as a marine paint for naval vessels, certain alloys being highly resistant to salt water corrosion and inhospitable to the growth of barnacles. For the same reason it may be used to protect piling andits preservative action may also be used to conserve railroad ties.

On the decorative side the uses of the method are many. Statues or other sculptured designs may be hewn from soft and easily worked stone and then coated with bronze, giving the effect of a bronze statue and weathering equally as well. Gold plating or decoration may be applied in the same way to furniture or table ware.

A coating of copper one thousandth of an inch in thickness may, so its inventors say, be applied at the rate of two square feet a minute and at a cost of two cents a square foot exclusive of the cost of labor. Cheaper and more easily fusible metals such as lead would cost less.

FIRE HOSE COUPLINGS UNLIKE IN SAME CITY

Many cases in which fire hose couplings in use on fire engines in American cities could not be connected to other apparatus in the same department were brought to light in an investigation just completed by the U. S. Bureau of Standards and the National Board of Fire Underwriters. Several different threads were found to be in use, and for the same number of threads and the same nominal diameter there is often so much variation as to prevent interchangeability. Such a condition greatly increases the fire hazard on account of the inability of apparatus from nearby cities, or even from different parts of the same city, coming to the aid of the local apparatus in the event of a serious fire.

Only 25 per cent of American fire departments are now using the standard thread, according to D. R. Miller, chief of the gage section of the Bureau of Standards. And there are often cases where new apparatus is ordered without specifying the thread or where an old thread which may be under or over sized is sent in as a sample for cutting the new threads.

A simple and inexpensive remedy has been devised in the form of rethreading tools with which most of the various couplings now in use can be changed to stan-

dard at very moderate cost.

"Millions of dollars have been lost in past conflagrations," Mr. Miller stated, "because the fire department of one city could not come to the aid of another on account of a difference in couplings. At the time of the Baltimore fire, apparatus brought from Philadelphia and Washington was of little use for this reason, and at the present time the couplings used in the fire departments of New York, Baltimore, and Washington are in no case interchangeable."

THE FATE OF STAR-DUST

By Isabel M. Lewis,
of U.S. Naval Observatory

That nebulae, in their normal state, are dark rather than luminous and that they are composed of minute particles of matter driven off from the stars themselves by radiation or light pressure is a comparatively new theory that is now very generally accepted among astronomers.

Radiation pressure becomes so powerful as to overbalance gravitation itself for minute particles of matter with diameters smaller than a wave-length of light. We have only to consider how comets "grow" their tails in the vicinity of the sun and keep them persistently turned away from the source of light as a result of radiation pressure to realize that this is true.

It is among the hottest stars that this radiation pressure is most effective, and it is precisely such stars that are most generally involved in nebular surroundings. The enveloping clouds of nebulosity may be luminous in the vicinity of the stars, either by reflected star-light, or as a result of electrical excitation produced by the stars involved; but in general they are dark and show up either as dark spots or streaks against a luminous background or by their blotting out effect on stars beyond which produces a sudden falling off in the number of stars in that region.

The Orion stars, know also as the helium-type stars, are extremely hot stars and they are frequently found associated with nebulosity. It was the old theory that these "young stars", as they were generally called, were in process of being formed from the surrounding nebula, and that they represented local condensations of the nebula into stars. It is now known as an independent fact, however, that stars of the Orion type, that are so frequently associated with nebulosity, are not the youngest stars. In fact they are quite middle-aged. The red giants, such as Antares and Betelgeuse, represent the youth of the universe while the hottest of the stars, the bluish-white stars, such as occur in great numbers in the constellation of Orion, are the more mature adults of the stellar race.

They are the stars that are parting most generously with their substance and decreasing their mass most rapidly as a result of excessive radiation pressure. In special cases we might imagine such stars disintegrating completely as a result of an abnormally high radiation pressure. Possibly we should look rather for such disintegrating stars among the Wolf-Rayet stars, a peculiar type which are even hotter than the Orion stars and which have nebular characteristics.

Our own star, the sun, is a dwarf, comparatively cool, and well along in years, and must have parted with much of its original substance in the course of its long and eventful life. Yet it still possesses an extensive nebular envelope known as the solar corona, which is composed of numberless minute particles of matter shining by reflected sunlight or electrical excitation. This nebulous appendage is fed, partially at least, by the solar prominences, composed of incandescent vapors of many elements, that leap constantly to heights of many thousand miles above the surface of the sun, carrying minute particles of the solar substance with high and accelerated velocity to the solar corona whence they may escape eventually to space beyond.

There is evidence that there is an abundance of these dark nebulae in space, vast clouds of whirling star-dust expelled from the stars, gradually drifting away from the regions where stars are densest and radiation pressure is most effective. These nebulae are moving in the general direction of the outer confines of the universe of the stars. We can as yet only conjecture what part they play later in the scheme of the universe.

SALT PREVENTS HEAT EXHAUSTION

Dilute sea water, or salt water in any palatable form may be the basis of future soft drinks for hot weather and tropical climates. A long series of experiments on workers in hot mines in England has shown that a small quantity of salt daily has the power to relieve the men of much of the exhaustion supposed to be due to severe toil at high temperatures and to prevent altogether the development of the dreaded miners' cramp. Men given about one third of an ounce of common salt dissolved in a gallon of water reported themselves stronger and fitter in every way.

The experiments were carried out under the direction of K. Neville Moss, professor of coal mining at Birmingham University. They showed that during work at high temperatures men lost an abnormal quantity of salt through the perspiration. Since salt is an essential constituent of the blood, Professor Moss thought it likely that the cramps and nervous symptoms due to excessive heat and work might be alleviated or prevented by administering salt to the workers and the results have justified his theory.

Measurements showed that during a five and a half hour working shift at a temperature around 100 degrees, the men lost from nine to eighteen pounds through perspiration and respiration. This was not a net loss as during that time they consumed an average of seven and a half pounds of water. Other men who worked in a specially heated testing room in a laboratory showed similar losses and a loss of about twice as much salt from the system as would occur under normal conditions.

It has long been known that the drinking of large quantities of water while at work was apt to cause cramps among workers at high temperatures, but this had been attributed to local causes in the stomach. Professor Moss believes it to be due to the washing out of the essential salt from the blood and to confirm his theory points to experiments on animals in which similar symptoms have been caused by forcing large quantities of water down their throats.

He also discovered that men who worked in hot mines showed a greater taste for salt food than those who worked under normal conditions, the average consumption of salt being a third greater among the former class. Another surprising fact brought out was that the workers in the hot mines ate more food of all sorts than those who worked where it was cool. The reason for this he says is not clear but it may be due to the extra work put on the sweat glands.

It was also shown that the ability to sweat freely is acquired by practice. Men not accustomed to mine work who were put through the tests did not perspire anything like as much as experienced workers, while one of the latter after a vacation was several days getting back his perspiratory pace.

RED AND BULLS

Another perfectly good comic picture situation has been ruined. Long have we laughed at the unfortunate wearer of a red shirt being chased or thrown across the fence by an angry bull. We blamed the redness of the shirt.

But a University of California professor of psychology, G. M. Stratton, says that the popular idea in this case is wrong and that red does not necessarily incite cattle to anger.

He tried out all sorts of colors on bulls, cows and calves, and found that they paid much more attention to peaceful white than warlike red. A sudden flutter of any color was mildly startling. But no color, even when bright, strange, or moving, caused the animals to become angry, provided the colors were dissociated from people.

It is the person who wears red and not the red that he wears that angers the deadly male of the species. A green shirt or white shirt would have done just as well in the comic picture so far as science is concerned, but of course it would not have been as funny.

Most of the cattlemen from whom Prof. Stratton obtained opinions and evidence on red and cattle anger had had too much experience to share the popular idea and those who sided with the people could not offer any effective evidence for their claims. Prof. Stratton went out in the pasture and discovered the truth by planting banners of different colors among both wild and domesticated cattle. The only real effect was the fear shown by some of the experimenters.

But surely red blood is exciting. It used to be fashionable for a young lady to faint if she saw a drop of blood caused by a pin prick. Experienced cattlemen say blood always excites cattle of either sex, causing them to bawl, paw and horn the ground.

Yet buckets of blood failed to excite cattle during Prof. Stratton's experiments. Neither sight nor smell of the vital fluid caused strong interest and many of the cattle sniffed at the professor's clothing in preference to the blood. If there is excitement of cattle when one of the herd is bleeding, it must be du

to the cries of pain and the movements of the wounded animal. Removed from the cause of blood-shed, blood is mere colored liquid.

Red danger signals, red flags of revolution, and red blood have prejudiced us against this color and made us ready to accept the angry bull of fallacy. Yet doctors agree that crimson is harmless. They have found that rooms decorated in crimson do not inflame the emotions of the occupants, but that red imparts an air of delicacy. Children in a room with crimson-tinted walls or reddish light have been found to work more eagerly.

Man would be wise to emulate the bull and not rage at mere color of things, be they clothes, skin or flags. Spilt blood should often create more excitement than it does.

Red symbolizes many dire things: Royalty, fire, blood, war, hatred, revolution, lust. Yet how pleasing are red apples, red autumn leaves, red cheeks, titian hair, and ruby lips.

BRAIN REALLY SEES, COLORS BLEND IN EYE

We see with our brains as much as with our eyes, and the fundamental problem of how we see is as much psychological as physical, Dr. Leonard T. Troland of Harvard University told members of the Optical Society of America in his presidential address at the annual meeting of the society recently.

"Vision may be separated into a series of events," Dr. Troland said, "the first of which lies outside the observer and consists in the emission and reflection of light by objects. Next is the stimulation of the retina by the light which has passed through the pupil of the eye. This is physiological and the process continues in the currents which pass up the optic nerves to the brain. The final phase is psychological, the appearance of the object as a perception in the observer's consciousness.

"These processes in the living nervous system are even more important than those which precede them and the science of the optics of the nervous system deals with the manner in which the images which are formed on the two retinas are represented in the complex nerve currents that lead to the higher brain centers. It is now possible to work out experimentally the character of the image at different points from retina to brain, how the nerve currents generated in over a hundred million sensitive receiving cells in each retinal surface are condensed into the half million conducting fibres of each optic nerve; how at the crossing point of these nerves the currents from the left hand sides of both retinas are grouped together and passed on to the left side of the brain, while those from the right hand retinal areas go to the right hand half of the brain; and how the two half visual fields are respectively mapped out in a distorted but determinate representation of the two retinal images, and thus of the object before the eyes."

The essential thing in seeing is the brain, Dr. Troland emphasized, but of how it sees we know little.

"Given the brain images, we see a world, whether it is there or not," he said.

"In the absence of the brain images we see nothing, not even darkness. The things we see are in some sense creations of the brain images, although it is quite evident that these objects are not localized in the brain. This is the greatest of the mysteries with which the science of optics presents us. Its solution leads us into the depths of metaphysics and suggests that in addition to the physical side of the science there may also be needed a philosophical optics."

Wm. Mayo Venable of Pittsburgh told the society that compound colors, formed by mixtures of primary colors, are not due to a psychological combination of sensations in the brain but to a physical and material combination of stimuli in the nerves and organs of sight. Different colors set up differently timed impulses of differing intensity along the optic nerve, he said, and when the colors are mixed the resulting color is due to the reaction of these impulses with each other, the result being a simple sensation which is transmitted to and perceived by the brain.

Considering the practical side of color vision, Mr. Venable said that while all bright colors were tiring and injurious, bluish purple or violet was the most injurious of all, the injury being due wholly to the intensely stimulating effect on the receiving apparatus of the eye and not to any psychological effect. He ascribes brightness only to three colors, white, yellow, and green, and holds that the other colors, such as red, blue, purple, and brown, owe their brightness to these three but are darkened by a dampening effect of the retina itself.

STARVATION CONDEMNED AS EPILEPSY TREATMENT

Starvation is no longer considered a proper treatment for epilepsy, although for years it has played an important part in all attempts to cure this disease, according to the American Medical Association. Observations made at the State Village for Epileptics at Stillman, N.J., show that although dieting admittedly reduced the number of epileptic fits, its beneficial effect is only temporary and that at the end of the period of dieting it may even prove to have done actual damage.

MICROSCOPIC PARTNERS HELP POTATOES AND ORCHIDS GROW

Common potatoes and beautiful orchids owe their existence to queer partnerships with tiny fungus plants, Dr. George H. F. Nuttall, Director of Molteno Institute for Research in Parasitology of Cambridge University pointed out in an address in Liverpool recently.

When potato plants are raised from seed, tubers are not formed upon the root unless they are invaded by a microscopic fungus. In soil free from the fungi, tuberization does not occur.

In the case of many orchids, the seed will not germinate without the assistance of fungi. Cells in the exceedingly small orchid seed apparently emit a secretion that attracts certain fungi. Each species of orchid possesses a species variety, or race of fungus that is particularly adapted to it. When

the mutually adapted fungus and orchid seed are brought together, the thread-like tubes of the fungus penetrate the seed and the seed proceeds to sprout, giving rise to a small tubercle which later produces leaves and roots.

Dr. Nuttall said that this condition of partnership life may be regarded as balancing between two extremes; complete immunity and deadly infective disease. It probably originated as a conflict in which one of the partners was a parasite on the other, but in course of time ended in mutual adaptation. It is by no means so rare a phenomenon as was formerly supposed, he explained. In some cases, the microscopic partner becomes a permanent inhabitant of the cells of the host plant or animal and may even be transmitted from host to host hereditarily.

He predicted further discoveries in parasitism and in these mutual partnership arrangements of life.

READING REFERENCE - Ganong, W. F. The Living Plant. New York, Henry Holt and Company, 1913.

TABLOID BOOK REVIEWS

FOREST RESOURCES OF THE WORLD, By Raphael Zon and William N. Sparhawk. In Two Volumes. New York, McGraw-Hill Book Company, 1923.

This is one of the really big books of the year. It is not only an invaluable compilation of forestry statistics well illustrated with excellent maps and presented in an orderly fashion for ready reference by lumber experts, but contains meaty interpretations of the facts which should be of interest to the general reader.

In a sense it is the official publication of the U. S. Forest Service as it is written by two of that Bureau's leading authorities in cooperation with other government workers and with the National Research Council. It not only tells where our present timber comes from, but points out where we must look for our future supply.

While there are still more than four acres of forests for every man, woman, and child on earth, most of this wood is in the tropics where lumbering is undeveloped and where the home demand is bound to increase tremendously with the rapid extension of transportation facilities and consequent development.

WHITE LIGHTNING. By Edwin H. Lewis, Dean, Lewis Institute, Chicago, Covici-McGee. Chicago, 1923.

A chemist's novel, in which even the 92 chapters are numbered and named for the elements that make up all matter. But it is chemistry with life and love intermingled as it should be and often is. This is a book ahead of its time for most of the people who are only beginning to know about science, but it is in the advance guard of a new type of fiction that will spin stories around science as they have been written about crime, the sea and other age-old themes.
