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THE MOST DISTANT NEBULAE

EIGHT hundred and forty million million million miles (840,000,000,000,000,000,000 miles) is the distance of the farthest object that astronomers can see with the great 100-inch reflecting telescope of the Mt. Wilson Observatory, the largest in the world, Dr. Edwin Hubble said on December 7 in a lecture at the Carnegie Institution of Washington of which the observatory is part.

The work of Dr. Hubble with this giant instrument has shown that our "Milky Way" or galaxy is not alone in space, but that scattered around the sky are millions of other galaxies, many similar to our own, and all outside its confines. The spiral nebulae, which until recently were astronomical mysteries, are among these other galaxies, but they represent a late stage in their development, in Dr. Hubble's opinion.

"Their different forms," he said, "fall into a progressive sequence characterized by rotational symmetry around dominating nuclei. From small, compact globular masses, they flatten and expand into lens-shaped forms and then break up into the thin disc-shaped spirals." This observed series of observed forms of the nebulae, he pointed out, agrees well with a course of development outlined on theoretical grounds by Dr. J. H. Jeans, the English astronomer.

In some of the closer spiral nebulae that Dr. Hubble has observed, he has made photographs which actually show the individual stars, and from the study of these he has determined the approximate distances. But the ones that are farther removed have also had their approximate distances determined, because they all are of nearly the same average brightness. The fainter they appear, the farther away they are, on the average, and by counting the number with different apparent brightnesses, it is possible to determine their distribution in space.

"The faintest nebulae that can be detected with the largest telescope, the 100-inch reflector at Mount Wilson, are at an average distance of 140,000,000 light years, a light year being the distance which light will travel in one year, going at a speed of 186,000 miles per second. One light year is about 6,000,000,000,000 miles. A sphere of 140 million light years radius comprises the observable region of space. Within this sphere are some 2,000,000 nebulae, distributed in a fairly uniform manner. Great clusters of nebulae do exist, but their effect on the distribution is averaged out when large volumes of space are considered.

"The nebulae are so distant that in observing them we are witnessing scenes and events which actually occurred in past geological ages. The nearest of them all, the Magellanic Clouds, present the appearance they had back in the great ice age. The spiral in Andromeda is a Pliocene object. The border of the observable region takes us back to the late Paleozoic. Recent events are on their way, traveling with the speed of light, but only a daring prophet would expect that man will still be on earth to receive them.

"The existing limits to the observable region are of a mechanical nature; with faster plates and larger telescopes it will be possible to push them back to several times their present distance. In fact, with improvements that are believed to be thoroughly practical to-day, it might be possible to detect exceptionally brilliant nebulae at a distance of a thousand million light years, to photograph them with light that started on its journey when the earth itself was young."

POTASH IN TEXAS

AMERICAN potash, to break the European monopoly based on the Stassfurt fields, is a possibility held out by the results of a core drilling made in cooperation with the U. S. Geological Survey, in the southeastern corner of New Mexico. Mineralogists of the survey described to a representative of Science Service ten beds of potash minerals aggregating nearly thirty feet in thickness, which the drill struck at depths ranging from 790 feet to 1,760 feet. They also showed samples of the core brought up by the drill; most of these consisted of light colored polyhalite, sylvite and other salts, which they stated assayed as high as 18.5 per cent. potash (K_2O). The beds thick enough for mining averaged about 12.5 per cent., it was stated. The average run-of-the-mine minerals of the Stassfurt beds have a potash content of only 8 or 10 per cent. At about 1,430 feet one seventeen-inch bed of a different mineral, langbeinite, was found. This contains about 18 per cent. potash. Langbeinite is merely a mineral curiosity at Stassfurt.

"It must not be imagined that this is simply a lucky strike made at random," said Dr. G. R. Mansfield, of the survey. "We have believed for years that if paying potash deposits were ever to be found in this country the most likely place to seek them would be the panhandle region of Texas and the adjacent corner of New Mexico, and we have actually been hunting for them there since 1915. We have received many indications of the presence of potash, from samples brought up by oil well drills as from other sources, and recently the Congress appropriated sufficient money to begin a really critical investigation. The present core drilling, however, the first of its kind, which gives us a really accurate picture of what is under ground at that point, was put down by the Snowden-McSweeny Company, an oil concern, on their own initiative and at their own expense, but in full cooperation with the Geological Survey.

"Of course we can not tell from a single core drilling how extensive the new beds are," Dr. Mansfield continued, "but we do know definitely now that working quantities of rich potash minerals exist at this place, and our previous work indicates that potash

deposits of some sort exist in many places, distributed over an area about three hundred miles long by about half as wide, in eastern New Mexico and the Texas panhandle. We hope to make further core drillings to obtain a better idea of the extent of the really rich deposits.''

The new potash field is well served by railroads. Two lines run clear through it, and three others have branches into it at various points. Galveston is the nearest saltwater port, but practicable hauls might also carry the product to points on the Mississippi river. Geological Survey officials believe that for certain types of soil the minerals as they come from the shaft would need only grinding to make them satisfactory fertilizers, but for long hauls probably concentrating treatments would be advisable, to save bulk and weight. More or less rock salt occurs in between the layers of potash minerals, but this can be picked out easily by even the cheapest of labor.

The exact geological age of the deposits has not been determined, but they are believed to belong to the Permian. This was an age of drought that intervened between the Pennsylvanian or coal age and the times of the dinosaurs. The beds were probably formed by a series of advances and retreats of an arm of the sea, which formed great salt-water lakes. These dried in the arid climate just as the Caspian sea, or on a smaller scale the saline lakes of the West, are drying up today, and as they did so the various chemicals in solution were precipitated. The less soluble ones, like the compounds of lime and potash, came down first, and the easily soluble common sea salt only at the end of each drying-out, so that layers of salt now alternate with layers of potash and other minerals.

USE OF FURS IN THE UNITED STATES

THE universal demand of its women for fur coats has put the United States in the front ranks of fur-consuming countries. Though it is necessary to import large quantities of pelts to meet this demand, this country is still one of the largest producers, according to David C. Mills in a survey of the fur industry about to be published in a forthcoming issue of *The Journal of Home Economics*.

In the first three months of 1926 we imported furs from 55 countries, says the author. Of rabbit skins alone we imported over 100 millions. About one half of these are made up into fur garments and the other half become felt hats.

The United States, including Alaska, has been producing approximately 70,000,000 dollars worth of pelts a year to Canada's 15,000,000 and Russia's 35,000,000, Canada and Russia being the two largest fur-producing countries other than the United States. The smaller fur bearers have been able to hold their own by reason of their fecundity and the extermination of their larger natural enemies. For example, the muskrats in Louisiana have increased as alligators, their greatest natural enemies, have been reduced in number. From 14 to 17 million muskrats are taken in this country every year.

Fox farming is an established industry to-day and some of the fur farmers are making money. Indeed, practically all the silver and black foxes used in the United States are farm raised. Muskrat farming, which is really not farming at all but merely regulated trapping on privately owned or leased marshes, is being widely and profitably practised. Rabbit farming for meat and pelts is getting a good foothold in the West, especially in southern California. Over a million pounds of rabbit meat were produced and consumed in California in 1925 and the breeders are developing their market eastward as rapidly as possible. This of course means a large quantity of furs as a by-product, suitable for hatters' or furriers' use. Other animals such as marten and mink are being ''farmed,'' but so far this is entirely experimental.

Pelts of sheep, goat, pony and other domestic animals are now sold as furs. Indeed they play an important part in our affairs as, roughly speaking, they form about one third of our imports in value and over half in bulk. Some are used for their own sake, such as Persian lamb and caracul, while others are used to imitate more expensive furs. A leopard may not change his spots, but leopard spots stencilled on a sheared goat skin produce a striking and serviceable substitute for the more expensive fur. The use of low-priced skins dyed to resemble more expensive skins is a growing branch of the industry of considerable importance. It is not for the purposes of fraud or deception, but for the purpose of placing furs within the reach of all classes. When only the wealthy wore furs there was only a limited variety of skins in use.

RESEARCH ON TRAFFIC ACCIDENTS

WHILE public education and propaganda have touched upon the highspots of traffic dangers much research is needed on the less obvious causes of fatal accidents. Dr. H. C. Dickinson, of the U. S. Bureau of Standards, has reported to the Highway Research Board of the National Research Council that the responsibility of the highway engineer is greater than statistics would indicate.

The construction of highway surface, said Dr. Dickinson, is an important element in skidding accidents. While much has been done on banking and widening curves, more research is needed on this fruitful cause of fatalities.

''Running a tangent into an arc of a circle obviously produces a curve,'' continued the expert, ''which can be only approximated by a vehicle, since to follow the curve would require the instantaneous shifting of the steering wheel from the position of a straight line motion to that for the constant radius of curvature for the circular arc. This is evidently impossible. Doubtless a study of the traffic lines on a stretch of new concrete would show how nearly the average driver can approximate this instantaneous curve.''

Driving is a privilege, not a right, and should be granted only to competent persons, according to Dr. Dickinson. We must have more scientific study on the physiological and psychological demands made on

drivers, he explained, in order to weed out the incompetents.

The psychological effect of traffic laws and regulations on people is a point of considerable importance that should receive further attention, he declared. Most laws affect only the relatively small criminal element in the population but traffic laws are of concern to about half the citizens of the country. Consequently their right or wrong reaction to such regulations is of considerable importance. A too low speed limit is a common example that frequently defeats its safety purpose because the driver thinks it is too low, exceeds it and keeps his attention on "watching for the cop" instead of the safety of himself and his vehicle for which the law was designed. Fortunately the fault of this particular kind of legislation is being recognized and corrected in many localities, said Dr. Dickinson.

INTELLIGENCE TESTS IN PREPARATORY SCHOOLS

THE facility with which boys in preparatory schools outshine college students in intelligence tests is puzzling psychologists.

The "Army Alpha," famous test by which the brains of the American army were measured during the war, was recently given to the boys of a well-known preparatory school by Dr. Harold E. Jones, psychologist of Columbia University.

The results were combined with those obtained by investigators in other preparatory schools, and a comparison was made between preparatory school scores and scores from public high schools and colleges in various parts of the country. The preparatory school students not only out-ranked high school students in mentality, but also scored higher than college students who have taken the same test.

The intelligence scores in such a test tend to increase with age up to a certain point. In the first year of the preparatory school, which corresponds to first year high school, the middle score made by the boys was slightly lower than the median score of college freshmen. But in each of the three upper classes of the preparatory schools, the boys out-rated even the college seniors.

After considering various explanations for the superiority of the boys in preparatory schools, Dr. Jones concludes that economic and social selection play a significant part in their mental development.

"However distasteful the fact may be to equalitarians," he says, "it appears that the socially prominent schools and universities derive their intelligence ranking from the fact that their students are supplied chiefly from the upper social classes. At present we can only conjecture to what extent the tested differences are due to inheritance, and to what extent they are traceable to physical and cultural advantages, particularly during the pre-school period." The relationship of social status to intelligence scores has been demonstrated by a large body of evidence.

ITEMS

POTASH deposits in the district of Solikamsk, government of Perm, are declared by Soviet chemists to be Russia's delivery from the Franco-German fertilizer monopoly controlled through the Stassfurt beds, hitherto the world's principal source of this important mineral. The Russian deposits, it is stated, are found over an area a thousand square miles in extent, and beds capable of being mined exist as close to the surface as 300 feet.

THE childish trait of "taking it out" on an inanimate object when one has a fit of temper seems to have been a serious business in ancient Egypt. An archeological expedition of the Berlin Museum has just returned from Egypt with 290 pieces of pottery, fragments of some 80 clay vessels, all written over with the names of foreign princes and peoples with whom the Egyptians of about 2000 B. C. were at war, together with a number of Egyptian names as well, presumably of rebellious communities. These names, it is believed, were inscribed on the vessels, which were then shattered with suitable ceremonials, in the belief that the foes would thereby be injured.

THE small and scraggly black scrub oak, or bear oak, of barren lands in the northeastern United States is being made use of in France with considerable success to provide brush cover for similar lands used as game preserves on large country estates, according to Dr. David G. Fairchild, of the U. S. Department of Agriculture, who has recently returned from a botanical exploration that took him around the world. The species is a dwarf oak, hardly to be dignified by the name of tree, for its usual height is seldom more than nine feet, though specially favored specimens may reach eighteen or twenty. But it grows rapidly and seems to do better on stony ground in France than any of the native shrub or small-tree species.

WHAT is probably the first fossil to have been collected by man is in the possession of Barnum Brown, associate curator of fossil reptiles in the American Museum of Natural History. The priceless relic is an elephant's tooth dating back around 5,000,000 years and was picked up by Mr. Brown in the ruins of the Asklepieion, the medical school of ancient Greece, where Hippocrates, the father of medicine, carried on his studies. Hippocrates was the first to introduce principles of inductive philosophy in the practice of medicine which had hitherto consisted of a system of superstitious rites practiced wholly by the priests. It is surmised that the great master may have handled and discussed the prehistoric molar himself for it was found covered with fragments of statuary and figurines in one of the larger buildings of the ancient school. Two sites for fossil remains of elephants exist several miles from the Asklepieion so it is evident that the tooth was carried there at least 2,000 years ago, since Hippocrates was born around 460 B. C. and his famous school was in ruins by the beginning of the Christian era.