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EVOLUTION OF WHALES

How whales have changed from land animals to the denizens of the deep they now are is one of the problems of science which Remington Kellogg, associate biologist of the U. S. Bureau of Biological Survey, is unravelling by studying the fossil remains of the great sea beasts' hearing organs.

At the annual exhibit of the Carnegie Institution of Washington Mr. Kellogg displayed a complete collection of these fossilized "ears" from the time of the early Eocene down to the present.

The ancestors of the present-day whales heard with eardrums just as humans and other mammals do, but as the force of circumstances, that geologists do not yet understand, compelled them to take to the sea for a living their different organs underwent various modifications. The family of sea mammals that are known as whale-bone whales eventually lost their external ears and the external auditory tube became completely closed to preserve the eardrum from rupturing under the pressure that prevails at great depths in the sea. They have acquired in addition an elastic cartilage arrangement around the blow holes on the top of the head that closes tighter the farther they go down.

As a result the whale-bone whales now actually hear through their noses and the eardrum has become useless. They have developed in its place a bony structure coiled up like a conch shell known as the bulla. The ear bones are the hardest bones in the body of the whale and for this reason have survived in fossilized form where the other bones have disappeared entirely. In some prehistoric species, says Mr. Kellogg, it is the only bone there is available for study. For this reason science has an unusually complete record of the gradual stages by which the whale-bone whales acquired their present kind of organ of hearing.

The actual process by which these coiled conch shell bones receive sound waves is a problem that puzzles both physicists and biologists. The fact that whales are unusually shrewd in detecting danger that can only be conveyed by sound, is considered, however, as a demonstration of its efficiency as an organ of hearing.

MAN AN EARLY FOSSIL

Who was the first paleontologist, the first collector of those records of life in the rocks from which science has built up the history of the earth? Barnum Brown, of the American Museum of Natural History, New York, recently reported the discovery of a 5,000,000-year-old elephant's tooth found in Grecian ruins that were once frequented by Hippocrates, the father of medicine. He asked then: "Is this the earliest known fossil collected by man?"

Now Dr. George Grant MacCurdy, of Peabody Museum of Natural History, Yale University, points out that what is probably the first fossil to have been collected by man is a trilobite found by archeologists when digging out the floor deposits of a cave near Arcy-sur-Cure in the department of Yonne, France.

"This cave was first inhabited by Neanderthal man," Dr. MacCurdy explained, "then there came in turn the Aurignacians, Solutreans and Magdalenians generally referred to as the Cro-Magnon races. It was one of the Magdalenians who found the trilobite and left it in the cave some 20,000 years ago, at least 18,000 years before some Greek left the elephant tooth at the Asklepieion. The trilobite is incised ventrally and also bears two lateral perforations—proof that it had been the property of some Magdalenian occupant of the cave. This cave has been very appropriately christened *grotte du trilobite* (cave of the trilobite)."

Trilobites are crustaceans and first appeared in great variety in the geologic age known as Cambrian some 225,000,000 years ago; they lived through a number of geologic ages and finally became extinct during the Permian period some 75,000,000 years ago.

A NEW MOSQUITO POISON

E. Roubaud, of the Pasteur Institute in Paris, has recently announced that a formaldehyde compound manufactured in France offers advantages over anything previously used in the fight against mosquitoes.

M. Roubaud is a man of such high scientific standing that U. S. government entomologists are going to make tests, it is announced in the Bureau of Entomology. The new compound may prove to be a weapon in the hands of Americans who are handling the question of mosquito control over very large salt marsh areas. Even if this should prove impractical it appears that the new substance will be available for easy treatment of small ponds, fountains and the like.

The preparation is said to be non-poisonous to warm-blooded animals and fish and to have no injurious effect upon aquatic plants. It is in the form of an extremely light dust, readily driven by the wind. Settling upon the surface of the water, it brings about the almost immediate death of the larvae of the malarial mosquitoes, which are top feeders, and with a subsequent slight agitation of the water sinks slowly in suspension where it is eaten by the larvae of other mosquitoes.

Roubaud recommends a mixture by weight of one part of the powder with fifty parts of very dry sand. This mixture has been tried successfully by him on fields in Alsace inundated by the Rhine. The cost of this method of treatment compares favorably with the arsenical dusts used in this country. It is said to amount to fifty francs to ten hectares of water surface, or about eight cents an acre at the present exchange rate.

BURR-KNOTS IN APPLE TREES

That frequently observed knotty, scarred appearance of the twigs and branches of apple trees does not neces-

sarily mean the trees are diseased. It may indicate an advantage over trees with clean smooth wood.

The appearance is often due to burr-knots which have been confused with aerial tumors of "hairy root" crown gall, but which are "root buds" or rudimentary stem-borne roots. Twigs bearing these knots when planted as cuttings readily take root and grow.

No American pomologist had advanced this theory until Charles F. Swingle, of the Bureau of Plant Industry, Washington, D. C., demonstrated it in a series of studies and experiments.

According to Mr. Swingle, it was known in England more than a hundred years ago that some varieties of apple trees with a certain class of knots propagated readily from cuttings, and he traces his interest in the subject to a conversation with R. G. Hatton, the English pomologist, who visited this country two years ago.

Mr. Swingle examined some five hundred varieties of apple trees in the Arlington orchard near Washington. Nearly half of this number showed the presence of the burr-knot. It was found to be a varietal characteristic. If they appeared on one tree of a given variety, they were found on all mature trees.

Cuttings were taken from many varieties bearing burr-knots and planted in moist sand. More than 80 per cent. rooted, in contrast to a average of about 1 in 1,000 in case of cuttings without burr-knots. Springdale, Wagner, Northern Spy, Early Harvest and Buckskin are among the varieties showing successful growth from cuttings containing such knots. Mr. Swingle is continuing his experiments along this line.

THE CONTROL OF SUGAR-CANE PEST

AIRPLANE dusting with sodium fluosilicate is meeting with considerable success in the control of the sugar cane moth borer which is threatening the cane-growing industry of the United States. This new method of control of the cane borer was described in a report by Dr. W. E. Hinds and Dr. Herbert Spencer, of the Louisiana experiment station, presented before the American Association for the Advancement of Science.

Results of a single application last year when the infestation was comparatively slight were most encouraging, the entomologists said. The average per cent. of infested joints in dusted areas, after the next generation had had time to develop, was only two fifths of that in the undusted areas, and the number of live borers per one hundred stalks was cut in half by the dust application. A higher degree of control may be possible in the future, they pointed out, with improved materials and a fuller knowledge of the conditions essential to the most effective work.

The treatment resulted in some burning of foliage but this was not severe enough, the entomologists stated, to be considered a serious matter. However, in some cases it was deemed advisable to mix 10 per cent. hydrated lime with sodium fluosilicate to reduce this danger.

The airplane dusting method was used because no ground machinery or hand guns can be used readily on a crop of full-grown sugar cane. The stalks overlap across the rows and it is impossible to get machinery through the fields.

"The practicability of applying insecticidal dust to a crop like sugar cane has been fully demonstrated at the Louisiana experimental station," the report concluded, "and the planters of Louisiana and of other countries as well may find in this method of treatment a valuable help in controlling various insect enemies of cane and other crops for which no method of treatment has been available heretofore."

GERANIUM-SCENTED BOILER ROOMS

DIPHENYL oxide, a white chemical with a powerful reek like geranium scent raised to the *n*th degree, is the newest effort of engineers to get double work out of every shovelful of coal that goes into the firebox. The trick consists simply of using the chemical in one boiler to run one engine, and then using the exhaust vapor from that engine, still very hot, to raise steam from ordinary water in a second boiler, according to Dr. H. H. Dow, manufacturing chemist of Midland, Mich. Dr. Dow has been experimenting with one of these bi-fluid boiler systems for some months, and states that it has proved itself quite successful and very economical of fuel.

The idea of getting double use from the original firing of fuel was tried first with mercury as the liquid in the first, or high-temperature boiler. From certain points of view this metallic liquid is almost ideal, but its great weight and considerable initial expense, together with constant losses, interposed engineering and economic difficulties. Furthermore, any leakage of mercury vapor is almost certain to be injurious to the workmen in the plant, because mercury is exceedingly poisonous. For these reasons, therefore, Dr. Dow sought for another liquid that would be light, cheap and non-poisonous, and still have high capacity for carrying heat over into the second boiler to generate steam for the second engine.

A number of organic chemical compounds were found to possess these qualities, but at the temperatures used in boilers they tended to break apart into other compounds useless for power purposes and to clog the boilers with carbonaceous materials of no use for carrying heat. Diphenyl oxide, however, has been used and recondensed and used over again many times at a pressure of 200 pounds per square inch and a temperature of 800 degrees Fahrenheit, with but little deterioration. It weighs but little more than water, as contrasted with mercury, which is heavier than lead. Its price is only 30 cents a pound in quantity lots, which according to Dr. Dow makes its cost, volume for volume, less than two per cent. that of mercury. The compound has been produced hitherto in comparatively limited quantities, because its only use has been in the perfume industry, but Dr. Dow states that there is no limit on the bulk that can be manufactured if it is desired for power plant uses.

THE SHALE OIL INDUSTRY

THE distillation of shale, which promises to become very important to the entire nation, is not a new way of getting oil at this time of approaching scarcity, but is merely an old method brushing its cobwebs off after over half a century of disuse in the United States. In France it is older yet, for there the production of oil from shale started in 1838, according to Dr. G. C. Riddell, consulting

engineer of New York. In Scotland, oil was obtained from shale before 1850, but the best of the raw material is to-day exhausted. Shale pits 3,000 feet deep show how the industry once flourished.

In 1850 oil was distilled from shale in Utah and Pennsylvania and the development of a great shale industry would have resulted but for the discovery of well oil. The "liquid gold" fever following the development of oil in drilled wells in Pennsylvania caused the interest in shale oil to dwindle and then die, just as an impending scarcity has brought it to life again.

To date 186 patents have been granted in the United States for the production of oil from shale. Five of these were granted in 1858, fifteen in the next six years and none at all after that until 1891. From 1891 to 1914 ten patents were granted, from 1915 to 1919, thirty-four and from then to the present time one hundred and seven.

The competitive production of oil by distilling of bituminous rocks is no longer in doubt, Dr. Riddell states, for in California it has been produced for three years at less than one dollar a barrel including all overhead charges. This is far below the average cost of American well oil.

The question as to what is to become of the vast amount of spent shale that will result with the development of the industry is puzzling many theorists. The by-products can be used for making pressed, refractory and insulating brick and tile, Dr. Riddell says, and at present it has found lesser uses as road material, concrete building blocks and as a filtering substance in the sugar industry.

That the new shale industry is destined to become as great as the coal industry is now, is recognized by engineers and geologists generally. The new business will be developed in the now sparsely populated regions, Dr. Riddell points out, and towns, roads, water systems, movies and other kinds of civilization will appear there.

PREDICTION OF LESS MEASLES

NEW YORK CITY and some other large cities this winter will be comparatively free from measles, judging by records of recent years. Last winter was a heavy measles year in New York and, from the findings of the Health Department, the city alternates its measles ratio from year to year. A year in which many children catch measles is followed by one in which most children escape the disease.

The reason for this variation is explained by Dr. William H. Park, director of the Bureau of Laboratories of the City's Health Department. During an epidemic year, he says, a moderate number of the city's school children catch measles. They carry it home to their younger brothers and sisters. Those who are old enough to run around spread it to others. The city is ravaged with the disease. The next year these children are immune to measles. Those who lack immunity are mostly babies from six to twelve months old. The number of cases developing falls sharply, and the city escapes a heavy epidemic. But the following winter changing population in a great city brings a new crop of "run-arounds" who have never had measles. In the schools there will be a certain number of pupils from out of town who likewise have never had the disease. Another measles year is due. And so the process repeats itself.

So far this winter, New York City is averaging twelve cases of measles a week. Last winter it averaged more than 200 a week. In 1925, the previous year of immunity, there was only one death from measles in the city during January. Last January there were fifty-nine deaths.

In smaller communities the epidemic years are apt to be farther apart as there are fewer chances for children to come in contact with the measles germ.

ITEMS

A NEW record for wind velocity recorded by weather bureau instruments was hung up in the Miami hurricane on September 18, 1926, Benjamin C. Kadel, in charge of instruments at the Weather Bureau in Washington, told members of the American Meteorological Society. At 7:40 A. M., the wind blew with a speed of 132 miles an hour, which was the highest recorded then, or ever before, he said. This speed corresponds to a pressure of 57 pounds per square inch instead of the normal 15 pounds. Thirty-two minutes later the wind gauge was blown down. The importance of this record, Mr. Kadel said, is that the center of the storm passed within a mile of the wind gauge, and that this gives engineers some idea as to how fast the wind blows within a hurricane.

GRADUALLY science is uncovering every step in the complicated life history of the tick that causes Rocky Mountain spotted fever. Dr. Roscoe R. Spencer, of the U. S. Public Health Service, who has already discovered much of the complex cycle of the organism causing the deadly disease, told the American Association for the Advancement of Science that the virus has a dormant stage in hibernating ticks. At this period the virus is not capable of producing the disease but will frequently confer immunization when injected in guinea pigs. In the spring after hibernation, when the ticks have had a meal of blood from an animal victim, the virus undergoes a highly fatal phase, but from it at this time, explained Dr. Spencer, a protective vaccine can be prepared. When it has been transferred to an animal's blood by the tick's bite it is less virulent than the active tick virus, but at this stage no protective vaccine can be made from it, he asserted.

HALF the forest fires that occur are caused by lightning, H. T. Gisborne, of the Rocky Mountain Forest Experiment Station, told members of the Society of American Foresters. Lightning's nearest rivals, "campers and smokers," as a source of forest fires are responsible for only 13 per cent. of all the forest conflagrations. Consequently weather and weather predictions assume a position of paramount importance in the field of forest fire research, declared Mr. Gisborne. Though weather forecasting is in the field of meteorology, the assistance of foresters is necessary in collecting data concerning the relation of weather elements and fire behavior. The U. S. Weather Bureau has already entered this field with all the force permitted by its finance but the cooperation of foresters is essential, stated Mr. Gisborne.