almost inseparable companions. And so it happens that nearly every friend who writes of Luther Burbank feels it his duty to protect him by quoting the notice now placed at each gate of the Burbank grounds ("By the Friends and Relatives of Luther Burbank"): "Positively no visitors allowed. Warning! Any person entering or trespassing on these grounds will be prosecuted," and portions of the circular published for the information of the public, stating that the public has no moral, legal, or other right to invade his grounds, his home, his private office or his laboratories; and that Mr. Burbank has nothing for sale; he is not a nurseryman, not a florist, not a seedsman, not a dealer and not a raiser of any plants or seeds for sale.

THE USE OF BALLOONS FOR THE PREVENTION OF HAIL.

BY THE BERLIN CORRESPONDENT OF THE SCIENTIFIC AMERICAN.

Because of the terrible damage wrought by hail in some parts of Europe, scientists have directed their attention to designing a means by which the outbreak of hail could be prevented, and some success has been obtained by the use of hail guns, firing a shot of either gunpowder or acetylene against the hail cloud and thus dispersing it.

Though a number of societies for the installation, of these guns have been founded, both in Southern France and Italy, their usefulness is not universally accepted. Other experimenters have tried rockets, and these have been adopted at some places.

Now, it would probably be more efficient to attack the cloud as it were from its very seat, than to act upon it from the ground. In fact, as far back as 1847 Arago and Dupuis - Belcourt suggested the use of a small captive balloon made entirely of copper, so as to be impervious, and the surface of which would be covered with sharp points. The suggestion was not tried.

The same idea has now been taken up by two Belgian aeronauts, Capt. Marga and Mr. Adhémar de la Hault, who however use a free balloon, carrying some powerful explosive, such as dynamite or gun-cotton, which is ignited by some attachment as soon as the balloon has penetrated into the hail-carrying clouds. The balloon used by the experimenters is pear-shaped and of three cubic meters capacity. When filled with hydrogen gas it has an ascensional force of more than four pounds. Five hundred grammes of an explosive, with a nitro-cellulose basis, designed by Capt. Marga, are carried, together with a slow match.

Experimental ascents have proved successful, and show that in the case of a gathering storm-cloud, it will be possible to so time a charge and direct a balloon as to obtain an explosion in a favorable position for dispersing the clouds. The explosive, suspended at some distance below the balloon, does not injure it, and the latter may be recovered and used again.

Some more extensive experiments will shortly be undertaken at the meteorological station at Mogimont, which has been recently installed by Mr. de la Hault, especially for the purposes of investigating the behavior of thunder storms and hail.

According to a consular report, Russian and American lubricating oils are sold nearly as cheaply in Spain as in the United Kingdom. One large Russian firm keeps a depot in Barcelona, and imports in tank steamers, selling duty paid to its clients. Before the convention with the United States, and under the old tariff, lubricating oils from the United States paid 10 pesetas more per 100 kilos than those entering under the minimum tariff. Resort was therefore often had to the expedient of denationalizing American oil by shipping it to continental ports, changing the marks of the consignments, and re-shipping to Spain.

TRACHODONT, THE DUCK-BILLED DINOSAUR.—SKELETONS OF PREHISTORIC REPTILES MORE THAN THREE MILLION YEARS OLD.

BY BARNUM BROWN, OF THE STAFF OF THE AMERICAN MUSEUM OF NATURAL HISTORY.

Recently there was placed on exhibition in the American Museum of Natural History in New York city two unusually complete skeletons of that interesting group of extinct reptiles known as dinosaurs.

Many single skeletons representing a variety of these creatures have been mounted at different times in museums of this country and Europe. But the fortunate acquisition by the American Museum of two nearly complete skeletons of the same genus made possible a notable advance in the method of exhibiting fossil animals, namely, the mounting of two specimens in a single group, each in a characteristic attitude, with accessories suggesting the natural surroundings of the animal during life.

The conception of this group takes us back more than three millions of years to the Cretaceous Period, during which this variety, the Trachodonts, were one of the most numerous of the various kinds of dinosaurs. While two of them are feeding along the marshes, one is startled by the approach of their carnivorous enemy, the *Tyrannosaurus*, and stands on tip-toes to better overlook the foliage. The other, unaware of danger, continues peacefully to crop the foliage. It is not such a far cry to picture a scene of this kind, even in that remote period, when aided by complete skeletons, impressions of leaves, rushes, tree

"Look what a carcass!" he exclaimed, reining up his horse.

"It's the biggest buffalo I ever seen," said his companion.

"It ain't no buffalo, it's one of them mastodons that bug-huntin' outfit's looking for"; and to prove his assertion, jumped to the ground and kicked off all the bones in sight, thereby proving by their brittle nature that they were stone, and not buffalo bones.

A neighbor who had heard of the find, and knew that it was valuable, "traded" Mr. H— a six-shooter for his interest in it. The six-shooter wasn't a good one, and was eventually "swapped" for a pinto pony which Mr. H— now calls "Dinosaur." The specimen was purchased and excavated by the American Museum expedition of 1906 and mounted in 1907, thus ending the events of a long and checkered career.

The companion skeleton, mounted in a feeding attitude, was found near the Moreau River, South Dakota, in badlands of the same age. It was discovered by Dr. J. L. Wortman and Mr. R. S. Hill, collectors for Prof. Cope, in 1882, and was one of the principal specimens in the Cope Collection, which through the generosity of Mr. Morris K. Jesup, the late president, was purchased and given to the American Museum.

The Trachodonts were kangaroo-shaped reptiles with long hind legs, reduced fore legs, and a long tail. That they were strictly herbivorous is clearly shown by the elaborate dental apparatus. The mouth was expanded in a broad duck-like bill, which during life was covered with a horny sheath as in birds and turtles. In

each jaw there were from 45 to 60 vertical and from 10 to 14 horizontal rows of teeth, or more than 2,000 teeth altogether in both upper and lower jaws.

The fore limbs are reduced to about one-sixth the size of the hind limbs, and from the size and shape of the foot bones, could not have borne much weight. They were probably used in supporting the fore part of the body when the creature was feeding, also aiding it to recover an upright position. The specimen represented as feeding is thus posed, so that the fore limbs carry very little of the weight of the body. There are four toes in the fore foot, but the thumb is greatly reduced. The

hind legs are massive, with three well-developed toes ending in broad hoofs.

The long, deep, compressed tail was especially adapted for locomotion in the water. It probably served also as a balance when the creature stood erect on shore. The broad expanded lip of bone, known as the fourth trochanter, on the inner posterior face of the femur or thigh bone was for the attachment of tail muscles, similar to those that enable the crocodile to move its tail from side to side with such dexterity. In dinosaurs with short tails that are known by their construction to have been land forms, such as *Stegosaurus* and *Triceratops*, this trochanter is absent. The tail muscles were attached to the vertebrae by numerous rodlike tendons, which are preserved in position as fossils on the erect skeleton. This family of dinosaurs is thought to have been expert swimmers. Unlike other dinosaurs, their remains are frequently found in rocks that were formed under sea water, probably bordering the shores but nevertheless containing typical sea shells.

Among living reptiles, the small South American iguana (*Amblyrhynchus*) is thought to be comparable in its feeding habits and movements. These modern saurians live in great numbers on the shores of the Galapagos Islands off the coast of Ecuador. They feed exclusively on marine productions and swim out to sea in shoals, feeding on seaweed that grows at the bottom some distance from shore. The animal swims with perfect ease and quickness by a serpentine movement of its body and flattened tail, the legs during

An Experimental Balloon with a Basket for Recording Instruments.

Dispatching an Experimental Balloon Loaded with a Nitro-cellulose Explosive.

THE USE OF BALLOONS FOR THE PREVENTION OF HAIL.

trunks, and fruits that lived during the same epoch. Indeed, the left hind foot of the erect specimen bears three gashes made by some carnivorous enemy, a possible result of such a scene.

The Trachodonts lived near the close of the Age of Reptiles in the Upper Cretaceous Period. They had a wide geographical distribution, their remains being found in New Jersey, Mississippi, and Alabama, but oftener in Wyoming, Montana, and the Dakotas.

Some suggestion of the great age of these specimens may be gained from the fact that since the animals died, layers of rock aggregating several thousands of feet in vertical thickness have been slowly deposited along the Atlantic coast, during a period of time that has been estimated by geologists as covering more than three million years.

In the western States there are restricted areas wholly or in part devoid of vegetation. Hills and valleys alike are banded in soft neutral tints or vivid colors as the case may be, and composed of alternating beds of clay and sandstone, the resulting accumulation along prehistoric marshes and river flood-plains. During deposition the material was gradually built up evenly, but as soon as accumulation ceased, the erosive forces wind, frost, and rain combined to sculpture the sediments into the present picturesque "Badlands." It was in these terraced badlands near Crooked Creek, central Montana, that the erect skeleton was found in 1904. Two ranchmen were riding among the hills looking for cattle one day, when rounding a knoll one of them espied a large skeleton partly uncovered.

this time being motionless, close pressed to its side. This is also the method of propulsion of the crocodile when swimming.

The carnivorous dinosaurs that lived on land, such as *Allosaurus* and *Tyrannosaurus*, were protected by their sharp biting teeth, while the land-inhabiting herbivorous forms were provided with defensive horns as in *Triceratops*, sharp spines as in *Stegosaurus*, or completely armored body as in *Ankylosaurus*.

Trachodont was sufficiently protected from carnivorous land forms by the power to seek and remain in the water, and was not provided with horns, spines, or plated armor. Its skin was covered with small raised scales, pentagonal in form on the body and tail where they were largest, with smaller reticulations over the joints, but never overlapping as in snakes or fishes. One of these skeletons was recently found with an impression of the skin surrounding the tail bones, thus giving even the contour of the tail. Preserved in the rocks with these dinosaur bones are impressions of a variety of leaves, fruits, and tree trunks. The living representatives of these trees are for the most part now found in the sub-tropics or warm temperate zones, showing that the climate of that period was very humid and warm.

During the lifetime of the *Trachodonts* several species of palms grew in the present States of Montana and Wyoming; one closely resembles the living cabbage tree or palmetto of Florida. Fig leaves and fruits were abundant, and banana and persimmon leaves are common in these rocks. Here occur also such present widely separated trees as the *Ginkgo* now native of China, and the *Sequoia* or big tree of California. Horse-tail rushes were abundant and luxuriant in those early marshes; one specimen of *Equisetum* was found more than sixteen feet long and still incomplete at each end.

An elevation of the continent caused a drainage of the marshy lowlands, and a change from the tropical

climate to one of lower temperature, with a consequent change in the vegetation. This probably was the chief factor in the extinction of the dinosaurs at the close of the Cretaceous period.

In the rivers and bayous of that remote period there

groundwork, thus completing a realistic and comprehensive picture of that remote period.

Deposits of Meerschaum in New Mexico.

Deposits of meerschaum have been located in New Mexico, according to a report made to the Geological Survey by Douglas B. Sterrett, one of its special agents. These deposits are in the upper Gila River Valley, one about twenty-five miles northeast of Silver City and the other at a mine about twelve miles northwest of Silver City. Mr. Sterrett recently visited the deposits and secured samples which when tested contained iron and particles of grit. Although inferior to the meerschaum of Asia Minor, the more compact massive material may perhaps be found free from iron stains and of better quality at a greater depth.

The Dorsey mine, lying twelve miles northwest of Silver City, is in the bottom and walls of the cañon of Bear Creek. This cañon has steep cliffs about 100 feet high at the base and other cliffs above rising to a height of several hundred feet. The rock forming the cañon walls is chiefly light and dark

gray to brownish gray limestone, with some sandstone strata included. The meerschaum occurs in veins, lenses, seams, and balls in the limestone. All but the balls are fillings of fractures and joints which do not seem to be confined to any definite direction. The veins are filled with chert, quartz, calcite, clay, and meerschaum.

The principal source of meerschaum supply has been for many years the deposits in the plains of Eskishehr in Anatolia, Asia Minor, about 120 miles southeast of Constantinople. Deposits of the mineral are also reported to occur in Greece, on the island of Eubœa;

in Moravia, Austria, near Hrubshitz; in Spain, near Vallecás, Madrid, and Toledo, and in Morocco.

On the French Northern Railway many carriages are lighted by acetylene, and the results of using this method of illumination are said to be satisfactory.

By courtesy of Charles H. Beck.

Iguanas (*Amblyrhynchus*) on the Galapagos Islands. These Resemble *Trachodonts* in Feeding Habits and Movements.

A. *Trachodont* Mounted to Show Its Extreme Height (17 Feet) When Standing Erect.

B. Rear View of the *Trachodont*.

C. Section of the Tail, Showing Impression of Skin.

lived also a great variety of *Unios* or clams and other fresh-water shells, interesting because they are the precursors of the modern Mississippi invertebrates. Impressions of the more common plants found in the rocks of that period, with sections of tree trunks and casts of these shells, have been introduced in the

Camp on Crooked Creek, Montana, Showing Excavation From Which *Trachodont* Skeleton Was Taken.

Trachodont Skeleton Found Near Crooked Creek.

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