When a cyclone has once been inaugurated, in whatever way this may be effected, it presents itself as a mountain of air with a tendency to rise to a great height into the prevailing over-current. If established before starting on its journey, there was an inrush of air from every direction, and to the extent of the momentum of this inrush the mountain was a hollow one and its area a 'low.' At a variable distance above the earth's surface the crest of the cyclone is struck and carried away forward by the prevailing over-current, which in the tropics is the returning loop of the uplifted trades as they journey west, after that this same loop becoming the antitrade as it takes a brief turn poleward, and finally the prevailing westerlies in the temperate regions.

Now it is well known that the prevailing westerlies, or any other steady winds blowing across a mountain chain, draw up the air on the leeward side of the mountain, condensing its moisture into a constant cloud. There is also a well-known instrument now widely used by surgeons and painters, which consists of a tube opening at right angles to the mouth of another tube which dips into the fluid to be sprayed. By blowing through the first tube a liquid is made to rise up through the second or perpendicular one. In both these instances the horizontal current, by the momentum of its trajectory, has to a greater or less extent removed the pressure of the superincumbent atmosphere and permitted the surrounding pressure to force the air or the liquid upward.

Now in the case of the beheading of our cyclonic mountain, the available energy is the momentum of the horizontal trajectory of the upper prevailing winds. Twenty-seven inches of mercury is probably the extreme of 'low' for any cyclone, and this shading off to zero at the edges, so that an average fall of one inch over the entire area of a cyclone is the highest probably ever attained if, indeed, it goes nearly so high. This prevailing wind is operative at from 2,000 feet to ten or more miles high, while moving at a speed of from, say, 50 to 250 miles an hour. But, whether it embraces the entire operative force or not, this prevailing overcurrent supplies a vast amount of the energy of motion to cyclones and is to that extent a *vera causa*. Again, the translatory energy, as well as the gyratory, may be derived from the same source. While the crest of the cyclonic mountain is being dragged away forward, the body of the cyclone itself is made to lean in the same direction. In this case air, drawn into the cyclone from in front, reaches its body at a given height in less time than a like mass drawn in from the rear, and this still more when the cyclone is in motion. The result altogether will be that the diameter of the base of the cyclone is added to more rapidly in front than in the rear. This of necessity results in a forward movement of the center of gravity; and, since the cyclone is rotating, it must continuously advance in order to make its axis correspond with its center of gravity. Indeed, so much is this the case that the axis of a cyclone is probably curved—advanced at the base and at the top while lagging in the middle.

D. T. Smith.

SPECIAL ARTICLES.

RECENT DISCOVERIES OF QUATERNARY MAMMALS IN SOUTHERN CALIFORNIA.

Several months ago Mr. F. M. Anderson called my attention to a deposit of bones occurring in asphalt beds near Rosemary Station about nine miles west of Los Angeles. In a small collection of specimens kindly presented to me by Mr. Anderson there were represented a number of Quaternary mammalian species which are either new to the fauna of the Californian region or have been very imperfectly known.

Recently Mrs. Ida Hancock, the owner of the property on which the asphalt deposits are located, has very kindly given to the University of California permission to carry on excavation work in these beds, and a considerable collection of valuable material has been obtained.

The beds in which the bones occur extend over many acres. So far as I am aware the bottom has not been reached in excavations carried to the depth of at least fifteen feet in quarrying the asphalt. Bones are scattered through a large part of the deposit, but are very unevenly distributed. In some localities they are present in large numbers and in fairly defined layers.

The asphalt has in many cases penetrated even the minute pores of the bone, but the original material of the skeleton is practically unchanged.

The remains recognized up to the present time include the following forms: *Elephas, Equus, Bison,* a mylodont, *Smilodon, Canis indianensis* (?), *Canis* (small species), and camel remains. Numerous bird bones and remains of insects are also found.

In a considerable number of cases large parts of skeletons are found together, showing that the carcasses were entombed so quickly that there was not sufficient time for decomposition to permit separation of the parts.

Of the specimens obtained up to the present time an extraordinarily large percentage represent carnivora. The number of carnivores is certainly relatively larger than the usual percentage in a well-balanced fauna, and this abundance must be attributed to peculiar conditions under which the bones accumulated. Undoubtedly most of the remains are those of animals that have been entrapped or mired in the asphalt at times when it formed a deposit around tar springs. The surface of the asphalt is very sticky in some places at the present time, and where cuts are opened in it tar may ooze out. Such pools have probably existed here interruptedly through a long period, and particularly during Quaternary time when the deposit was forming. Carnivores are numerous because they were attracted by birds and mammals caught in the asphalt. Perhaps it is not entirely a coincidence that the carnivore remains are usually associated with those of birds or mammals, which would be their natural prey. The considerable number of young sabre-tooth cats present may indicate that the younger and less experienced individuals were more easily lured into the tar pools.

During the first examination of the beds several small, pebble-like bones were obtained which resembled the dermal ossicles of the ground-sloth, *Grypotherium,* recently described by Dr. A. Smith Woodward[1] from skin fragments obtained in a cave at Last Hope Inlet, Patagonia. The ossicles were in association with remains of a large ground-sloth somewhat similar to *Mylodon* in foot structure. Realizing that the peculiar conditions of accumulation offered an especially favorable opportunity for preservation of the dermal armor of a ground-sloth, during the second study of the deposits an attempt was made to find a specimen in which the armor might be recognized. Several hundred yards from the location of the first specimen, a large scapula resembling that of a mylodont was found partly exposed, with a row of small ossicles immediately over the outer side. The section of the bed containing these bones has recently been worked out, and the row of small bones proves to be the edge of a distinct layer including between 250 and 300 individuals. They mantle over the outer surface of the scapula, being removed from it by about an inch of asphalt.

The layer of bones as we find it has probably been disturbed somewhat and does not occupy its original position exactly, but the fact that it remains as a distinct layer with a tendency toward similar orientation of the individual ossicles indicates that the disturbance has not been great. As the position of the layer in the asphalt was nearly vertical, the presence of the large number of ossicles together may not be attributed to the washing together of scattered elements on the floor of a small basin of deposition.

The ossicles are not closely pressed together and are not superimposed. The individuals range in size from a cross-section of 6.5 x 4.5 mm. to 21 x 16 mm. Excepting a few of the largest ones, which are nearly square, the greater number are rounded and rather irregular in form. The outer side is in some cases more regularly modeled than the inner. The surface of the bones is somewhat roughened or pitted in some instances, but no markings are present which would be considered as definite

[1] A. Smith Woodward with Dr. F. P. Moreno, *Proc. Zool. Soc. Lond.,* 1899, pp. 144–156, pls. 13–15; also A. Smith Woodward, *Proc. Zool. Soc. Lond.,* 1900, pp. 64–79, pls. 5–9.

sculpturing. The microscopic structure has not yet been examined.

In general the form, size and arrangement of the ossicles are much as in the bones in the *Grypotherium* skin from Patagonia. The skin fragment first described by Woodward was thought to represent mainly the region of the neck and shoulder. The Californian specimen mantles over the outer side of the scapula, and is presumably not far removed from its original position with relation to this bone. The generic position of the form represented by this specimen appears as yet somewhat uncertain, but a satisfactory determination of its affinities will probably be possible when the skeletal material available has been finally assembled.

John C. Merriam.

A SUGGESTION FOR INTENSIFYING THE DÖPPLER EFFECT.

It has never been pointed out, I believe, that the relation between the conjugate foci of a concave mirror furnishes, at least in theory, a means of enormously intensifying the Döppler effect. If we have a source of light a little outside the principal focus of a concave mirror we shall have an inverted image formed at a considerable distance; and if the source move toward or from the mirror the image will move in the opposite direction with a much greater speed.

Let f_1 and f_2 be any two conjugate focal distances, and F the principal focal distance; then

$$\frac{1}{f_1}+\frac{1}{f_2}=\frac{1}{F}$$

Differentiate with respect to t;

$$-\frac{1}{f_1^2}\frac{df_1}{dt}-\frac{1}{f_2^2}\frac{df_2}{dt}=0$$

Writing v_1 and v_2 for the speeds of the source and the image, we have

$$\frac{v_1}{v_2}=-\frac{f_1^2}{f_2^2}$$

that is, the speeds are proportional to the squares of the distances from the mirror.

To show the theoretical possibilities of this formula let us suppose a source of light moving with a speed of 10^3 cm. per second at a distance of 10 cm. from the mirror, whose focal length, of course, must be a trifle less than this figure; at what distance must the image be formed in order that its speed shall be 10^{10}, one third of the speed of light?

$$\frac{x^2}{10^2}=\frac{10^{10}}{10^3}$$

$x=316$ meters, nearly, a distance obtainable in the laboratory with a moderate number of reflections.

The chief difficulty to be overcome in any experiment of this nature would be the faintness of the image due to its great size. A continuously moving source of light could be obtained either by a wheel with mirror teeth or with a self-luminous rim.

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THE COMPULSORY RETIREMENT OF THE DIRECTOR OF THE BRITISH MUSEUM OF NATURAL HISTORY.[1]

In a letter which we publish to-day Professor Ray Lankester, who is this year president of the British Association, tells the story of the summary termination of his directorship of the Natural History Museum, some imperfect versions of which have obtained currency. The standing committee of the trustees have taken advantage of the civil service rule that the head of a department may call upon any officer in it to retire at the age of sixty, upon such pension as he is entitled to by the general regulations. That rule is not usually acted upon in the absence of some special reason, unless the officer has completed such a term of service as entitles him to the *maximum* pension. Dr. Lankester was appointed at the age of fifty-two, so that when he reaches sixty next May a regulation intended to apply to men who have spent their lives in a government office decrees that his pension shall be £160, which the treasury of its goodness may raise to £300. In any country but this it would be thought grotesque and monstrous that a distinguished man of science asked to serve the state after the age

[1] From the London *Times*.