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Attention is called to the "Wants" column. All are invited to use it in soliciting information or seeking new positions. The name and address of applicants should be given in full, so that answers will go direct to them. The Exchange" column is likewise open.

MASTODON REMAINS ON NEW YORK ISLAND.

ON Nov. 27 last Lieut.-Col. Gillespie of the Engineers' Department, U.S.A., addressed a letter to the American Museum of Natural History, offering the remains of a mastodon tusk which had been found during the excavation for the Harlem Ship Canal at the upper end of New York Island. Col. Gillespie informs me that the specimen was found at a depth of sixteen feet below mean low-water, at the eastern end of Dyckman's Creek, at its junction with the Harlem River.

The portion of the tusk preserved and received at the museum is nearly three feet long, and has a diameter of seven and a half inches full, at its largest part; being the upper or socket end of the tusk, and is well preserved, although much shattered by drying and rough handling by the workmen before it came to the attention of the engineers in charge of the work.

A few days after the tusk was received at the museum I visited the excavation, and, by the courtesy of the engineers in charge, Messrs. A. Doerflinger and J. McC. Taylor, learned the particulars of its occurrence.

The excavation at this point is through the salt meadow of the Harlem River, showing from four to six feet of meadow sod and silt filled with the roots of the meadow grass; below this there is a deep bed of incipient peat, of which, at the spot where the tusk was found, there was fully twelve feet; next below comes a bed of sandy clay of very variable thickness, but at the spot in question measuring only eighteen or twenty inches in thickness. This clay rests immediately on the submerged slope of the dolomitic limestone ridge which forms the upper end of Manhattan Island, and extends northward beyond the Spuyten Duyvil Creek.

The tusk was found imbedded in the peat with the socket or "butt" end down, and slightly entering the sand, the shaft being in the peat and at an angle of about seventy degrees to the horizontal, showing that it had settled through the peat until it came in contact with the sand.

From the indications furnished by the conditions of its occurrence I should conclude that the tusk had not been transported from any other locality after the death of the animal, as there is no abrasion shown on its surface. Moreover, the peat in which it was imbedded is in the condition of its original formation, is clean and unmixed with any foreign matter, being entirely of vegetable origin; and contains quantities of seeds, apparently of Carices, or sedges, and grasses, as well as a few nutlets of some bush or shrub not yet determined, and examples of the elytra of beetles. At the top of the peat occur numbers of the stumps and roots of forest trees and fragments of wood. No evidence whatever is found of any marine substance below the roots of marsh grass, not a vestige of any kind of mollusks, marine or fresh water, can be detected, although now living and abundant in the salt water at the surface. The sandy clay between the peat and the surface of the limestone appears to me to be the result, principally, of the decomposition of the limestone in place, and not transported sand. Glacial markings are discoverable on the surface of the limestone a short distance south of the locality, where the soil has protected it from the action of the weather, but where the ledge has been uncovered by the removal of the peat and sand, it shows a deeply rotted surface covered by the sand.

Dyckman's Creek was an artificially excavated channel, made about 1818, for the purposes of a tide mill, through a natural depression at that point, and not a natural stream; consequently, it could have had no agency in the transportation of the tusk; and it seems probable that the animal to which the tusk once belonged either died near the spot, or by some accidental injury had it broken from its socket near where it was found.

The exact location of its occurrence is in the canal, about fifteen feet from its northern side, and about ten feet west of the centre of Broadway.

In April, 1885, Elisha A. Howland, then principal of grammar school No. 68, at 128th Street, between 6th and 7th Avenues, brought and donated to the museum the lower extremity of a mastodon tusk, nearly fifteen inches long by four in its greatest diameter, which had been found shortly before at Inwood, N.Y., while cutting a ditch through a peat bed near the Presbyterian Church at that place. This fragment shows fresh breaking at the upper end, and was undoubtedly much longer when first found.

R. P. W.

CO-OPERATIVE OBSERVATION OF THE SO-CALLED LUMINOUS CLOUDS.[1]

SINCE 1885 curious cloud formations have been seen on summer nights in both the northern and southern hemispheres, in evident connection with those phenomena which followed the great volcanic eruption at Krakatoa. The intense brightness of these formations, considering the position of the sun, denoted that they were situated very far above the earth's surface. Probably these clouds consisted of erupted particles thrown to a very great height and there illuminated on summer nights by the sun.

These cloud-like formations, commonly called luminous clouds are extremely interesting, both on account of the extraordinary height at which they have for years been moving above the surface of the earth (more than eighty kilometres) and of the movements themselves. A very important point about these clouds is that they are — so far as we yet know — visible in each hemisphere only in the summer. It is the more important that these phenomena should be carefully

[1] From Nature, Dec. 3.

and widely observed, since it is believed that they are gradually breaking up, so that probably in a very few years no distinct traces of them may remain (see also O. Jesse on so-called luminous clouds, in the journal *Himmel und Erde*, vol. i., p. 263).

Photographic results of the researches of O. Jesse are given in Part xl. of the Transactions of the Berlin Academy of Science for 1890, and Part xxvi. for 1891. It is very desirable that such photographs should be taken in as many different localities as possible, because from them we get the surest basis for consideration of the situation and movements of the clouds. But valuable aid may be given by the co-operation of numerous observers in various regions of the earth without the aid of any apparatus.

The principal points upon which stress is to be laid in this inquiry are: —

(1) By what method can the so-called luminous clouds be most surely distinguished from others, especially from the ordinary cirrus cloud?

Clouds or cloud-like formations which after sunset and before sunrise stand out brightly from the dark ground of the heavens, no earthly or unearthly sources of light being present on the horizon, can only produce this effect by means of their own light or else by light which they receive directly or indirectly from the sun or moon below the horizon.

Cloud-like formations which shine at night by their own light have doubtless been formerly observed above the surface of the earth. To these formations belong not only thunder and lightning clouds, but also some polar light and meteoric phenomena.

But the so-called luminous clouds do not belong to the various species of self-luminous clouds, for finer measurements of their light are wanting, besides which the fact that they are only seen within the zone of twilight proves that the sun below the horizon is the principal source of their light.

It is well known that there are clouds within this twilight zone which resemble high mountain peaks, and which in the first stages of twilight shine in the light of the sun, though the latter is below the horizon of the observer. It is easy to determine the relation between the position of the sun below the horizon, and the height of those layers of atmosphere which receive the sun's light and reflect it.

But the laws which govern the whole course of twilight are modified when the distribution of the sunlight-reflecting particles in the atmosphere is altered to any great extent. If, for instance, numerous minute atoms produced by volcanic eruption or by the breaking-up of meteoric bodies find their way into those heights above the earth's surface in which usually the gaseous elements of the atmosphere are present in a very scattered form, it may happen that such a layer, which reflects the sunlight very strongly, may curiously alter the course of the twilight.

So long after sunset as the masses of air beneath such a layer receive direct light from the sun and reflect it, the observer will not distinguish any deviation from the usual course of twilight. But as soon as the further sinking of the setting sun gradually deprives the lower layers of air of the direct light, the higher layer of dust still receiving light from the sun stands out in astonishing brightness, the particles of dust having strong reflecting power, thus giving to the close of twilight the curious effect of the sudden appearance of shining clouds on the broad surface of the heavens.

The phenomena of the luminous clouds corresponded when first perceived to the above description. At present they are no longer so strong or so extensive, but only form thin whitish-blue shining veils, similar in form to the so-called cirrus or feather-clouds, occupying but a comparatively small part of the floor of the heavens inside the twilight segment, and in our zone mostly near the horizon. Probably, the layers are now so thin that very near and exactly above us they can no longer be seen.

From the above considerations, it is clear in what way these clouds differ from those situated nearer to us, and especially from the cirrus clouds floating scarcely more than thirteen kilometres above the earth's surface. All these lower clouds appear in the later twilight gray and shadowy on a light ground, because the layers of atmosphere above them are the chief source of the remaining twilight. The luminous clouds differ too in shape and structure from the other kinds of clouds.

We must guard, however, against the error of mistaking cirrus for luminous clouds, when, in exceptional cases, the former look very bright, in consequence of receiving light either directly or indirectly from the moon or other sources. In this case, the question is decided by the relatively high degree of stability in position and form of the very high and distant luminous clouds, as ordinary clouds lie lower and nearer, and show much more rapid changes of position.

(2) When convinced of beholding so-called luminous clouds, to what points shall attention be especially directed, and what simple measurements of place, time, form, etc., shall be carried out in order to aid most usefully in the inquiry?

In answering this question, we will first consider those methods of research in which the observer can obtain no instrumental aid, except only a watch, which should be a sufficiently good timekeeper to estimate the time of observation to one minute, when compared with the correct time within eight or twelve hours after the observation.

Such simple observations are the more useful, since it frequently happens that in the well-fitted up and prepared stations, observation of the phenomena is prevented by bad weather, or else that the phenomena stretch over too large an extent of the earth's surface to be included in an organized series of observations. The farther the stations are apart, the more valuable are the most simple methods. For instance, in order to get corresponding photographic observations from two stations, thirty-five kilometres apart, such as Berlin and Nauen, the most rigid exactness, both as to time and place, must be observed.

If, however, observations are taken in East Prussia and in the Rhine province respectively, a from twenty to thirty times larger margin of difference as to time and place can be allowed than in the foregoing case, without in any way lessening the value of the result.

So, if without preparation and instruments to hand an observer believes he beholds luminous clouds, he must not imagine that he can render no service to science by examining them closely, for very possibly the most simple method may, taken in conjunction with other similar observations, prove to be of the greatest service.

It is desirable, too, to look out for luminous clouds at all seasons of the year, though, so far, they have only been seen in summer. In the northern hemisphere they have only been seen from the end of May to the beginning of August, with greatest frequency and brightness in the month of July.

During these weeks, usually two stars are seen simul-

taneously with the luminous clouds, a star of the first magnitude, Capella, and a star of the same constellation, of the second magnitude, β Aurigæ.

The brighter of the two stars, which is characteristic of summer nights, in the northern horizon, sets towards the end of June soon after eleven, and towards the middle of July before ten, on account of the northerly direction of the meridian, and, in North Germany, at a distance from the horizon of ten to twelve diameters of the full moon. At almost as great a distance from this bright star, and at a not very different distance from the horizon, the second magnitude star follows towards the west.

By estimating the distances and directions of these two stars, an excellent means is afforded of determining the outlines of a group of luminous clouds. It is only necessary to determine how great the distance of a certain part of the outline of the cloud group is from one or the other star, and in what direction this line lies with regard to one or the other star, or how far the line in question is above or below the prolongation of the connecting line of the two stars. A simple drawing of the course of the outlines and their situation with regard to the two stars is useful, even when it cannot be completed on the spot but must be finished from memory. The time at which the drawing was made should be noted within one half-minute.

If the group of clouds should be so far from the above-mentioned two stars as to make the determinations inexact, it is advisable to determine the outlines of the clouds for a certain time in the following way. Take up a position from which the outlines of houses, trees, etc., can be seen close to the position of the clouds, and fix thus the relative position of these earthly objects to the position of the clouds by a simple drawing, describing the spot from which the observation is made in such a manner that the place occupied by the head of the observer can be found again. The lines drawn from the position of the observer to the outlines of the earthly objects, and the resulting localization of the outline of the clouds in the heavens can then be determined at once by means of simple instruments for measuring angles, or on succeeding nights by the aid of a good star chart.

It is necessary to verify the exact point of time of these observations by comparison of the watch used with the time at a telegraph office, and correction of any errors should be made to the fraction of a minute.

In communicating these observations, the exact place at which they have been made must be accurately described.

Should a complete observation be impossible, owing to the time during which the luminous clouds are visible being too short for careful measurements and drawings or to any other cause, the observer should nevertheless communicate briefly to the Society of Friends of Astronomy and Cosmic Physics that he has seen what he believes from the foregoing considerations to be luminous clouds from a certain place, in a certain direction in the heavens, and within a certain quarter-hour.

The peculiar movements hitherto observed of the clouds in question lead to the suggestion that perhaps a period consisting of several days exists, within which one and the same group of clouds is visible at the same hour from the same place, other conditions of the heavens being favorable. Every communication as to these phenomena will be valuable in the decision of this important point, which it has hitherto been impossible to settle, owing to the uncertainty of the weather and the fewness of the observers.

Those co-operating in our branch of research who are in possession of astronomical, photographic, or other physical apparatus, will of course be able to give more exact details as to place, movement, and continuation of the luminous clouds.

Suggestions for these observations cannot be given so briefly and simply; but for the sake of full and complete agreement between different observers, especially as to the point of time selected for taking photographs and measurements, members of the Society of Astronomy and Cosmic Physics are invited to communicate with O. Jesse, Steglitz bei Berlin, Albrechtsstrasse 30. This course would also be advisable in the close optical examination of the clouds with regard to the peculiar changes in strength of light and the degree and kind of self-luminosity which they perhaps send out together with the reflected sunlight.

In the night from June 25-26 of this year the summer reappearance of the luminous clouds was observed very brightly from Berlin and the neighborhood.

More detailed particulars on the whole subject of inquiry are contained in a small paper by W. Foerster, which has been sent to all the members of the Society of Friends of Astronomy and Cosmic Physics.

LETTERS TO THE EDITOR.

*** Correspondents are requested to be as brief as possible. The writer's name is in all cases required as proof of good faith.*

On request in advance, one hundred copies of the number containing his communication will be furnished free to any correspondent.

The editor will be glad to publish any queries consonant with the character of the journal.

A Bowlder of Copper and Glacial Striæ in Central Missouri

A FEW weeks ago there was found near this place a small bowlder, or nugget, of copper, weighing twenty-three pounds. It is eleven inches long, six inches wide, and three inches thick at thickest part. It is almost entirely pure copper, but with a thin crust of the green carbonate all over it except at one end, where there is a slight depression, two inches wide, in which there is a thicker coat — somewhat crystalline — of the blue carbonate. In some crevices in it I found fragments of a coarse red sandstone.

This is a region of impure limestone and shale, of the coal measures, with no trace of copper. But all over the surface of the country in this vicinity pebbles and small bowlders (sometimes two or three feet thick) of granite, quartzite, etc., are found.

In at least one locality near here there are glacial(?) striæ upon the surface rocks. These are on the top of a bluff on the Missouri River and about twelve miles south-west of the place where the copper was found. The top of this bluff is at least a hundred and fifty feet above the present level of the river. Its upper layer of rock is of Burlington limestone, which is polished and much marked with striæ. These striæ are north and south in direction — nearly parallel with the river at that point.

Taking all these things together, I think my piece of copper is from the Lake Superior region and was brought here by a glacier. A geologist of note, to whom I reported the find, says, "It is undoubtedly of glacial origin, and probably from Michigan."

While thoroughly satisfied that this piece of copper is of glacial origin, I am not so decided in the opinion that the striæ referred to were made by a glacier rather than by floating ice for the following reasons:

The place where the striæ are found is at the summit of an anticline which can be plainly traced in the exposed edges of the bluffs for several miles. Standing on the summit of this anticline, and looking across the river, you can see, about two miles distant, the continuation of the same anticlinal ridge. This also presents a bluff towards the river. Between the two bluffs is the flat bottom land along the river and the river itself. Now it seems likely that this anticline was lifted up late in time, and may have temporarily dammed or obstructed the flow of the river — then much larger than now. Or an ice gorge in the river at this