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

point may have been the obstruction. At that time the water, filled with floating ice, may have made the striæ as it flowed over the top of this dam; until finally it cut a chasm through the obstruction.

Another fact suggesting the same probability is that from this anticline for many miles up the river there are considerable Loess deposits. These may have been made before the obstruction was was cut through.

But while the striæ at this place might be thus accounted for, this would give no sufficient explanation of the presence of the bowlders. etc., scattered over these hills many miles from the river and several hundred feet above its bed. In fact there are now three or four feet of clay or soil overlaying the very rocks which have the supposed glacial scratches on them, and this clay, etc., has in it pebbles and small bowlders of the same kind as those scattered over the surface of this section.

So, upon the whole, I think bowlders, striæ, and all are of true glacial origin. J. W. KIRKPATRICK.

Fayette, Mo., Dec. 9.

Mexican Featherwork.

"THE most famous surviving specimen is the *standard*, described by Hochstetter, which is now in the Vienna Ethnographical Museum" (*Science*. Dec. 4, p. 311, 2d col., top). This splendid piece of old Mexican featherwork is the subject of special publications by Mrs. Julia Nuttall, entitled "Das Prachtstück altmexicanischer Federarbeit aus der Zeit Montezuma's im Wiener Museum" (Reports of the Dresden Museum, 1887), and "Standard or Headdress" (Archæol. and Ethnol. Papers, Peabody Mus., Harvard, 1888, Vol. I., No. 1). Both these papers are elaborately illustrated and bring forward overwhelming evidence to show that what has hitherto been considered an Aztec standard is really a head decoration. X.

Kansas Mosasaurs.

HITHERTO, no adequate description or figure has ever been published of the complete anatomy, or even of the skull, of any member of the extinct group of reptiles known as the Mosasaurs or Pythonomorpha. Fortunately, however, my able friend Dr. Baur has recently had the opportunity to thoroughly study an excellent specimen of one of the Kansas forms, and his figures and descriptions, when published, will doubtless be of great interest. The University of Kansas has, within recent years, obtained one of the most valuable collections of these animals now extant. Among this material, there is one specimen of especial interest, by reason of its remarkable completeness, consisting, as it does, of skull and connected vertebræ to the tip of the tail, with ribs, extremities, and cartilages in position.

Before briefly describing this specimen, which belongs to a different genus from that studied by Dr. Baur, I may be permitted to offer the following remarks upon the nomenclature of the Kansas forms, based upon larger opportunities than have been enjoyed, I believe, by any other investigator.

The following generic names have been proposed or adopted by various writers for the different forms of these reptiles from the Kansas Cretaceous: *Liodon* Owen, *Platecarpus* Cope, *Clidastes* Cope, *Sironectes* Cope, *Lestosaurus* Marsh, *Tylosaurus* Marsh, *Edestosaurus* Marsh, and *Holosaurus* Marsh. Three genera, only, can be readily and positively distinguished among the material. The names now recognized for these, and with justice, are: *Liodon*, *Platecarpus*, and *Clidastes*. Two others, *Sironectes* and *Holosaurus*, have, possibly some claims for recognition, but the evidence in favor of either is, so far, very weak. *Holosaurus* is not synonymous with *Sironectes*, as affirmed by Cope and followed by Dollo. *Holosaurus* rests almost solely upon a single character, the non-emarginate coracoid; in other respects nothing is known to separate it from *Platecarpus*. In fact, *Platecarpus* itself may possess this very character. That the character was not considered by the author of *Holosaurus* as important is evidenced by the following. In the *American Journal of Science* (Vol. iii., June, 1872, p. 5 of separate) he says: "There is certainly no emargination in the coracoid of *Clidastes*, *Edestosaurus*, and *Baptosaurus*, as specimens in the Yale Museum conclusively prove." A figure of the coracoid of *Clidastes* (*Edestosaurus*) *dispar*, given in the same paper, shows the bone entire. In the same paper in which *Holosaurus* is figured and described (*Amer. Jour. Sci.*, vol. xix., pp. 83–87) a restoration is given of the shoulder girdle of "*Edestosaurus dispar* Marsh," in which the coracoid is very conspicuously seen to be emarginate. That this was not an error on the part of the artist, I can vouch, for the specimen from which the figure was made was collected and restored by myself. There is a lack of consistency here somewhere.

A fuller discussion of the genera and generic characters of the Kansas material, I leave to a future occasion. As there have been more than twice too many generic names given; so, too, it is pretty evident that there is even a greater proportion of synonyms among the specific names. The specific nomenclature is, at present, however, a subject of great intricacy, of which no one is master. Mr. E. C. Case of the State University will shortly publish a paper on this subject.

With these general observations, I will now give a brief description of the specimen above mentioned; a fuller description, with illustrations, will appear later. The specimen is a *Clidastes* (*Edestosaurus*) and, from Mr. Case's studies, probably *C. velox* Marsh, which is apparently the same as the earlier described *C. cineriarum* Cope. The specimen measures, from the tip of the tail to the tip of the rostrum, one hundred and thirty-nine and one-half inches, including altogether one hundred and seventeen vertebræ, the whole regionally divided as follows: skull, seventeen and one-half inches; cervical region, seven vertebræ, eight and one-half inches; costifarous, post-cervical region, thirty-four vertebræ, fifty-four and one-half inches; non-rib or chevron-bearing region, seven vertebræ, eight and one half inches; chevron bearing region, sixty-eight vertebræ, fifty-one and one half inches. All of the cervical vertebræ, save the atlas, have ribs, those of the axis, though, are very small, increasing in the last cervical to about three inches in length. The first to the ninth dorsal, or true thoracic, ribs, those articulating with the cartilaginous sternum through the intervention of cartilaginous ribs, are of nearly equal length, about eight and one-half inches, and are moderately curved. The eleventh dorsal rib is but four inches long, and thence to the thirty-fifth or last, they decrease gradually to about two inches. The rib-bearing processes, as well as the vertebræ themselves, do not differ much throughout the series. The longest costal cartilage preserved does not measure over four inches; this will give, with the sternum and vertebræ, a total circumference of the thorax not exceeding thirty inches.

Immediately following the last costiferous vertebra, are seven vertebræ with elongate transverse processes, and without chevrons. From the position of the pelvis, it was evidently attached to the first of these vertebræ, none of which can be properly called lumbar. With the first chevron-bearing vertebra, the transverse processes begin to decrease in length, and finally disappear in the twenty-fifth or twenty-sixth.

The tail is elongate, slender, and compressed, the spines and chevrons having their greatest length only about one foot from the extremity, where the tail measures nearly six inches in height.

Of the paddles little need be said. The hind pair was decidedly smaller and less strong than the fore pair, the latter having an outstretched expanse of about thirty inches.

As a whole, this, one of the most specialized species of the most specialized genus of known extinct or recent lizards, was most marvellously serpentine and slender in its build, with an elongate, flattened, pointed head, short neck, very slender body, long, lithe, and vertically flattened tail, small but broad and strong paddle-like limbs. It is doubtful whether there was ever another vertebrated animal so admirably adapted for rapid and varied movements through the water. Though the smallest of the Mosasaurs, it was by far the most graceful in its proportions, the most delicate and exquisitely constructed in its details.

It is certain that none of the Kansas forms of this order were covered with bony scutes, as described by Marsh, the bones so described being, undoubtedly, sclerotic plates.

S. W. WILLISTON.

University of Kansas, Dec. 1.