

enjoyed by the widow of the deceased during her life-time, and after her death preferentially by some descendant of Professor Mueller's that shall be desirous of studying natural philosophy, or else by some other needy and worthy student of that science who shall have been educated at the public school of Lippstadt." Gifts to this fund may be forwarded to the treasurer of the Committee, Herr Stadtkammerer Wilhelm Thurmann, at Lippstadt.

7. *Rainfall returns.*—A circular has been issued by A. R. Binnie, M. Inst. C. E., F. R. Met. Soc., F.G.S., expressing his desire to receive copies of records of rainfall extending from as early a date as possible. It states that the observations should give annual falls only, and be continuous for a single locality for at least 15 years; that the results should be expressed in millimeters; that the name of the observer and the place of observation be attached. Mr. Binnie's address is Town Hall, Bradford, Yorkshire, England. Contributors are promised in return, a copy of the results of the enquiry. For a copy of the circular this Journal is indebted to the Signal Service Office, Washington.

8. *Monument to the great Paleontologist, Barrande.*—No more faithful or successful worker in Paleontology has lived than Barrande. Subscriptions to a monument to his memory will be forwarded by Professor A. Hyatt, Technological Institute, Boston.

#### OBITUARY.

SIGNOR QUINTINO SELLA, President of the R. Accademia dei Lyncei, of Rome, and for many years Minister of Finance in Italy, died on the 14th of March. His scientific researches were chiefly in crystallographic mineralogy, in which department his papers are of the highest excellence. His able statesmanship on the one hand brought order and system to the finances of United Italy, and on the other promoted the progress of the nation in literary and scientific culture and in whatever tended to contribute to the elevation of the people. Signor Mancini, in an address at a memorial session of the Chamber of Deputies, connects his name with three great achievements in the recent progress of his nation: "La restaurazione finanziaria della sua patria; la liberazione di Roma papale con la caduta del potere temporale; la grandezza intellettuale ed anche materiale di Roma moderna divenuta Italiana." He took an active part in the arrangements with reference to the geological survey of Italy and its geological map, and was President of the International Geological Congress at Bologna, in 1881. The Chamber of Deputies has appropriated 20,000 dollars for a monument to his memory.

A letter from Mr. T. McKenny Hughes, in Nature of March 27, dated Woodwardian Museum, Cambridge, March 25, states that "it is proposed to place a bronze wreath on the tomb of the distinguished Italian geologist and statesman, Quintino Sella," and that "English geologists are invited to express their sympathy with their Italian fellow-workers by sending their names with a small subscription."

## APPENDIX.

ART. XLVIII.—*Principal Characters of American Cretaceous Pterodactyls*; by Professor O. C. MARSH. Part I. *The Skull of Pteranodon.* (With Plate XV.)

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THE first remains of Pterodactyls discovered in this country were found by the writer, in the autumn of 1870, near the Smoky Hill River, in Western Kansas. These belonged to a gigantic species, which was described by the writer in 1871, and is now known as *Pteranodon occidentalis*. The geological horizon of these fossils was in the Middle Cretaceous, in the same deposits that contain the *Odontornithes*, or Birds with teeth. In the following year, additional specimens were secured by the writer in the same region, and referred to two new species of the same genus.\*

In 1872, the writer again visited this region, and made a careful search for other specimens, and for several subsequent years had parties exploring the same deposits systematically, with good results; so that at the present time the remains of more than six hundred individuals of these reptiles have been secured from this horizon, and are now in the museum of Yale College.

The most of these remains represent gigantic species, the largest having a spread of wings of nearly, or quite, twenty-five feet. These all belong to the genus *Pteranodon*, and pertain to five species. One species referred to this genus was comparatively small, having a spread of wings of not more than three feet. A few specimens were found, intermediate in size, and these represent the genus *Nyctodactylus*, of which only a single species is known.

\* This Journal, vol. i, p. 472, June, 1871; vol. iii, p. 241, April, 1872, and p. 374, May, 1872.

All these Cretaceous Pterodactyls, so far as known, differ widely from the members of this group in the old world, especially in the *absence of teeth*, and hence have been placed by the writer in a new order, the *Pteranodontia*, from the typical genus, *Pteranodon*.\* Other important characters of this order have since been made known by the writer, showing that these strange reptiles constitute a well marked group, much more specialized than any hitherto discovered.

In the present paper, the skull of one species of *Pteranodon* is described and figured as typical of the order, and the remaining part of the skeleton will be discussed in subsequent communications.

#### THE SKULL.

The skull in the genus *Pteranodon* is very large, and much elongated. The facial portion is greatly produced forwards, and an enormous sagittal crest extends far backward, and somewhat upward, as shown in Plate XV, figures 1, 2, and 3. Seen from the side, the jaws project forward like a huge pair of pointed shears. They are very long, sharply pointed in front, and entirely destitute of teeth. In no specimens examined, young or old, have any indications of teeth been detected. The margins of the jaws are smooth and thin, as in many species of recent Birds. The jaws were probably encased in a horny sheath.

The bones of the skull are nearly all of extreme tenuity. With the exception of the occipital condyle, and the lower ends of the quadrates, all seem to have been pneumatic.

Seen from above, the skull appears extremely narrow. A sharp ridge extends from the end of the premaxillaries along the median line to the true cranium, and is continued backward by the thin elevated crest. The large antorbital openings thus seem near the middle of the skull, and, as they are directly over the posterior nares, they form part of the vertical apertures in the cranium, seen in Plate XV, figures 2 and 3.

The palate is deeply concave, and covered with bone, as far back as the posterior nares.

The bones of the skull are nearly all firmly ankylosed together, and this makes it very difficult to determine the different elements.

\* This Journal, p. 507, vol. xi, June, 1876; p. 479, vol. xii, Dec., 1876, and vol. xxi, p. 342, April, 1881. See also vol. xxiii, p. 251, April, 1882.

The premaxillaries are very large, and have coalesced with the maxillaries. They appear to extend backward to the large antorbital vacuities. These apertures apparently include both the anterior nares, and the lachrymo-nasal fossæ, which are separate in most recent birds.

The orbit is of moderate size, and oval in outline, the apex being below. There was apparently no ring of bony sclerotic plates, since in the best preserved specimens no traces of this have been found.

The quadrate is firmly coössified with the other cranial bones, and projects strongly forward. Its distal end is one of the most characteristic parts of the skeleton.

The sagittal crest is of enormous size, and serves to balance the elongated jaws. It is very thin transversely, and during life was probably more or less flexible. In form and direction, it resembles the corresponding crest in the recent genus *Basiliscus*.

The occipital condyle is very small, and nearly hemispherical in form. It is directed backward, and but slightly downward, thus differing from this part in most of the members of the group.

#### THE LOWER JAWS.

The lower jaws are very long, and quite sharp in front, corresponding closely in this respect with the end of the upper jaws. The rami are closely united by a symphysis which extends from the apex to beyond the posterior extremity of the dentary bone, as in the mandible of *Rhynchops*, and some other birds. Behind the symphysis, the rami are comparatively slender. The upper face is strongly concave. The articulation for the quadrate is deeply grooved obliquely, and the joint is a very strong one. The front portion of this mandible during life was evidently protected by a horny covering, like that of the beak above.

The nearly complete skull here described may be regarded as a type of the genus *Pteranodon*. Its principal measurements are as follows:

Length, from extremity of sagittal crest to end of premaxillary, about 30 inches, or .....	760· mm
Transverse diameter of occipital condyle, .....	8·4
Distance from occipital condyle to distal end of quadrate, 105·	
Length of lower jaw, about, 23 inches, or .....	585·
Greatest depth, .....	62·
Depth at articulation for quadrate, .....	23·

The skull of *Pteranodon ingens*, described by the writer from the same geological horizon, is about four feet in length.

The skull of *Pteranodon* differs especially from that of the other known *Pterosauria*, in the following particulars: (1) the absence of teeth; (2) the absence of anterior nasal apertures distinct from the antorbital openings; (3) the presence of the elongated occipital crest; (4) the whole jaws were apparently covered with a horny sheath, as in recent birds.

Yale College, New Haven, April 24th, 1884.

### EXPLANATION OF PLATE XV.

FIGURE 1.—Skull and lower jaw of *Pteranodon longiceps*, Marsh; side view.

FIGURE 2.—The same skull; top view.

FIGURE 3.—The same skull; bottom view.

FIGURE 4.—Lower jaw of *Pteranodon longiceps*; top view.

*a*, Antorbital aperture; *b*, orbit; *c*, sagittal crest; *d*, angle of jaw; *e*, lower margin of upper jaw; *e'*, upper margin of lower jaw; *f*, articulation of lower jaw; *oc*, occipital condyle; *q*, quadrate bone; *s*, symphysis of lower jaw.

All the figures are one-sixth natural size.

