country has been of remarkably recent development, when its present importance is considered. It was in 1867, that the mining of the phosphatic deposits in South Carolina commenced, while the mining of apatite in Canada dates only from 1872. It is not strange then, that an interesting, well illustrated and thoroughly practical book upon this subject has been appreciated at once, as shown by the fact that the first edition was exhausted before it had been on sale more than a few days. The scope of the work is given in the comprehensive title. The most original part of the book and perhaps that in which most interest will be felt is the chapter upon the newly discovered phosphate deposits in Florida, at which mining was not fairly begun until 1889. A good map of the state shows the points where operations are now being carried on, and some sixteen excellent full page illustrations give a good idea of the methods of occurrence, of exploitation, etc.

9. *The Kiowa Co. (Kansas) Meteorites;* by ROBERT HAY. (Communicated)—This spring some more meteorites were found, which extend the area of the find as described by Kunz, Snow and Winchell nearly a mile farther east and increase the number of meteorites *several thousand.* One mass eighty pounds in weight has been obtained, but the rest of the find represents a new feature in the remarkable fall. There has been one distinct meteorite of nineteen ounces in weight besides the large one, but the rest were found in groups of small meteorites from about a pound in weight to the size of a pea. Each group was scattered over an area of 15 to 30 square yards. The larger individuals of the groups show themselves true Pallasites and even some very small ones, but many of these latter are largely oxidized, the metallic iron having all disappeared. All stages of oxidation are shown in each group. The large mass and three groups—the smallest weighing three pounds and numbering 400 individuals—are in possession of the writer, Junction City, Kansas.

10. *Geological Survey of Kentucky, John R. Procter, Director.*—This survey has recently published a report of 20 pages, by G. M. SULLIVAN, on the Geology of parts of Jackson and Rockcastle Counties, with a colored geological map.

OBITUARY.

HENRY NOTTIDGE MOSELY, the able Naturalist of the Challenger Expedition of 1872 to 1876, and since 1881 Professor of Human and Comparative Anatomy at Oxford, died on the 10th of November last, at the age of forty-seven.

PHILIP HERBERT CARPENTER, Science-Master of Eton College, and the author of extensive elaborate researches on the structure of echinoderms and especially living crinoids, died October 21, aged thirty-nine years. Mr. Carpenter was the fourth son of Dr. W. B. Carpenter.

APPENDIX.

ART. XI.—*The Skull of Torosaurus;* by O. C. MARSH. (With Plates II and III.)

IN this Journal for September last, the writer described a new and remarkable genus of *Ceratopsidæ*, represented by two well-marked species.* In the type specimen on which the genus was based, the greater portion of the skull is preserved, and this presents so many points of interest, that a figure of it, one-twentieth natural size, is here given in Plate II. The second species is represented also by the skull, which, although not complete, supplements the type in several important respects, and figures of its posterior portions are likewise given in the accompanying plates. Both specimens are of gigantic size, one skull measuring five and one-half feet across the parietal crest, and the other is nearly as large. They differ widely, moreover, from the huge horned Dinosaurs hitherto found in the same general horizon, and present characters in the skull of much interest.

In *Torosaurus latus*, the species first described, the skull appears wedge-shaped when seen from above, as shown in Plate II. The facial portion is very short and pointed, and somewhat suilline in form. The nasal horn-core is compressed, with a sharp apex directed forward. The frontal horn-cores are large, and strongly inclined to the front, extending apparently in advance of the nasal protuberance. The long, slender squamosals diverge rapidly as they extend backward, their outer margins being nearly on a line with the facial borders in the maxillary region.

* This Journal (III), vol. xlii, p. 266, September, 1891. See also vol. xli, p. 167, February, 1891.

The parietal forms more than half of the upper surface of the skull, and is the most characteristic element in its structure. In the posterior part are two very large apertures, oval in outline, with their outer margin at one point formed by the squamosal. The rest of the border is thin and somewhat irregular, showing that the openings are true fontanelles. This is still better seen in the second species represented in the same Plate, fig. 2, *f'*. In the latter specimen, however, these vacuities are entirely in the parietal, a thin strip of bone separating them on either side from the squamosal. A second pair of openings, much smaller, apparently the true supra-temporal fossæ, are shown in the type specimen. These are situated mainly between the parietal and squamosal, directly behind the bases of the large horn-cores. (Plate II, fig. 1, *c*.) The same apertures are represented in the genus *Triceratops* by oblique openings, as in the skull shown on Plate III, fig. 4, where the front border of each is formed by the post-frontal.

Between these openings, in the type of *Torosaurus*, is a third pair of apertures (Plate II, fig. 1, *c'*). These are quite small, nearly circular in outline, and entirely in the parietal, although probably connected originally with the supra-temporal fossæ. Another pair of still smaller foramina may be seen in the same skull, close to the median line, and separated from each other by the anterior projection of the parietal. A deep groove leads forward to each of these foramina, along the suture between the parietal and post-frontal. The position and direction of these perforations suggest that they may correspond to the foramen seen in *Triceratops*, and shown on Plate III, fig. 4, *x*.

The extreme lightness and great expanse of the posterior crest in *Torosaurus* make it probable that it was encased in the integuments of the head, and that no part of it was free. The outer borders of both the parietal and the squamosals show no marginal ossifications, as in the other known genera of the group, but the presence of a large, separate, epijugal bone in one specimen suggests that epoccipitals may yet be found.

The open perforations in the parietal which have suggested the name *Torosaurus*, readily separate this genus from all the gigantic species hitherto known in the *Ceratopsidæ*, but may perhaps be found in some of the smaller and less specialized forms, from lower horizons of the same formation.

With the successive changes in the parietal there were corresponding variations in the squamosals, and these bones also will serve to distinguish the principal genera from each other. In Plate III, the squamosals of four genera of this group are shown, and the wide difference between them, when seen from

the inside, is especially noticeable. In figure 1, of this plate, the long, slender, right squamosal of *Torosaurus*, with its smooth outer border, is well represented. In figure 2 is seen the same bone of *Sterrholophus*, with a serrate outer margin, and smooth inner surface, also shown in figure 5. Next, in figure 3, is the small, short squamosal of *Ceratops*, nearly bisected by its deep quadrate groove. The free sculptured border of both the parietal and squamosals of *Triceratops* is clearly shown in both figures 4 and 6, especially in the latter, where the contrast with the corresponding parts in figure 5 is noteworthy.

Three other generic names have been applied by Cope to remains of *Ceratopsidæ* found in this country, namely: *Agathaumas*, *Polyonax*, and *Monoclonius*.* The first of these was based on part of a skeleton without the skull, found in Wyoming. The second name was given to various fragments from Colorado, including parts of horn-cores, regarded as ischia, but these may all be the same generically as the preceding specimen. The third name, *Monoclonius*, was used for a skeleton from Montana, with parts of the skull and teeth preserved. This animal was one of the smallest of the group, while the other remains pertained to reptiles of larger size, but not of the gigantic proportions of those more recently described. So far as can be judged from the descriptions and figures of the type specimens, the three generic names just cited cannot be used for any of those previously mentioned in this article. A comparison of the principal characters will place this beyond reasonable doubt.

In the type of *Agathaumas*, the remains best preserved are in the pelvic region, which according to Cope possesses the following features. The ilium has no facet nor suture for the pubis at the front of the acetabulum, and the base of the ischium is coösified with the ilium. There are eight, or perhaps nine, sacral vertebrae, with the neural spines of the first five mere tuberosities. The diapophyses are in pairs, and the last sacral vertebra is reduced and elongate. These characters, and some others found in the description cited, are certainly distinctive, but do not apply to any of the allied fossils described by the writer. Portions of the type specimen, moreover, are in the Yale Museum, as well as other remains from near the same locality. The fossils described as *Polyonax*, and other similar specimens collected in the same region, afford at present no evidence for separation from *Agathaumas*.

* Cretaceous Vertebrata, p. 53, Plates IV, V and VI; p. 63, Plates II and III, 1875. Also Proceedings Philadelphia Academy, p. 255, 1876, and American Naturalist, p. 154, 1886, and p. 715, Plates XXXIII, and XXXIV, for 1889, issued in 1890.

The small dinosaur, about as large as a Rhinoceros, for which the name *Monoclonius* was proposed, is perhaps generically distinct from *Agathaumas*, but no conclusive evidence of this has yet been presented. The description given makes the teeth, dorsal vertebrae, and pelvis, different from those of any of the larger forms, and the T-shaped parietal (figured first by Cope as an episternal bone), is especially distinctive. None of the other known *Ceratopsidæ* have the parietal fontanelles except *Torosaurus*, one of the most gigantic forms discovered, and this genus differs from *Monoclonius*, as described, in various important points. The very long frontal horn-cores, directed forward, the narrow, elongate squamosals, the absence of a median crest on the parietal, as well as the form and anterior connections of this bone, all serve to clearly distinguish the former from the latter.

These points, and others relating to the nomenclature of the *Ceratopsidæ*, will be fully discussed in a later communication, when the large acquisitions recently secured by the writer's able assistant, Mr. J. B. Hatcher, are ready for description.

New Haven, Conn., Dec. 22, 1891.

EXPLANATION OF PLATES.

PLATE II.

FIGURE 1.—Skull of *Torosaurus latus*, Marsh; seen from above.
FIGURE 2.—Posterior crest of *T. gladius*, Marsh; seen from above.

c, supra-temporal fossa; *c'*, anterior temporal foramen; *f'*, parietal fontanelle; *h*, horn-core; *h'*, nasal horn-core; *p*, parietal; *s*, squamosal.

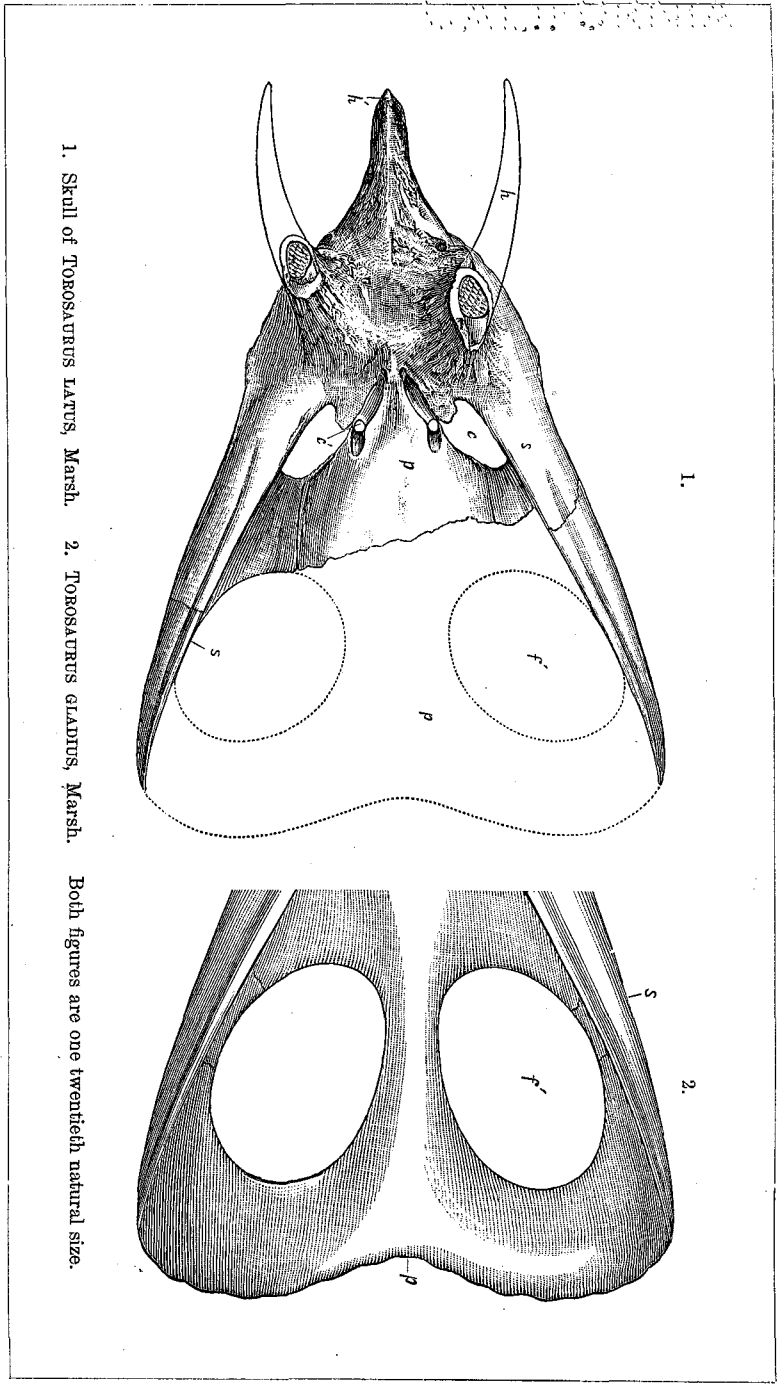
Both figures are one-twentieth natural size.

PLATE III.

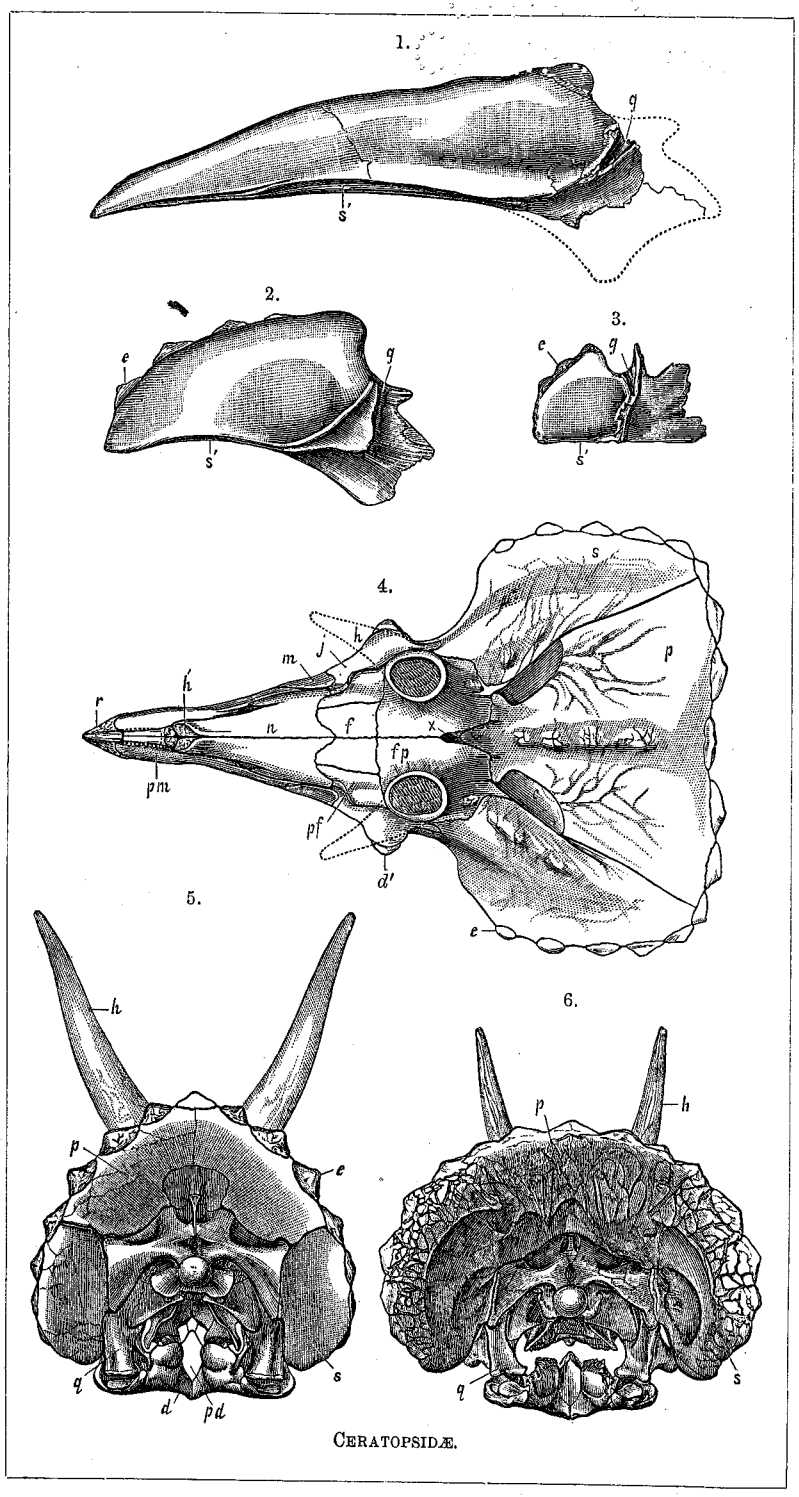
FIGURE 1.—Right squamosal of *Torosaurus gladius;* inner view.
FIGURE 2.—The same of *Sterrholophus flabellatus*, Marsh.
FIGURE 3.—The same of *Ceratops montanus*, Marsh.
FIGURE 4.—Skull of *Triceratops serratus*, Marsh; diagram; seen from above.
FIGURE 5.—Skull of *Sterrholophus flabellatus*; seen from behind.
FIGURE 6.—Skull of *Triceratops prorsus*, Marsh; seen from behind.

d, dentary; *d'*, epijugal bone; *e*, epoccipital; *f*, frontal; *g*, groove for quadrate; *fp*, postfrontal; *j*, jugal; *m*, maxillary; *n*, nasal; *pf*, prefrontal; *pm*, premaxillary; *s'*, suture for parietal.

All the figures are one-twentieth natural size.



1. Skull of TOROSAURUS LATUS, Marsh. 2. TOROSAURUS GLADIUS, Marsh. Both figures are one twentieth natural size.



CERATOPSIDÆ.