papers, including: On the Geology of the Rosita Hills by W. Cross; on the nature of the chemical elements by C. S. Palmer; on the columbite and tantalite of the Black Hills by W. P. Headden and others. The address of the retiring President, R. C. Hills, on the orographic and structural features of the Rocky Mountain Geology, a paper of much interest, fills the last one-hundred pages.

4. *Volcano of Kilauea, Hawaii.*—Reports from Kilauea in the Hawaiian Gazette of Feb. 23, state that the great basin of Halemaumau in the southern part of the crater of Kilauea, contains a lake of lava 1300 feet in diameter, almost the whole surface of which is in constant action.

5. *Physiography:* a class book for the Elementary Stage of the Science and Art Department by J. SPENCER, B.Sc., F.C.S. 229 pp. London, 1891 (Percival and Co.).—The many subjects embraced under the head of Physiography are treated in this little book clearly and simply but, of necessity, with great brevity.

6. *A universal English-German and German-English Dictionary* by Dr. FELIX FLÜGEL. Fourth entirely remodelled edition of Dr. J. G. Flügel's Complete Dictionary of the English and German Languages. Braunschweig, 1890–1892. (George Westermann.)—This great work is now completed in three large volumes, of which the English-German part forms the first two and the German-English part the third. It has been a most laborious undertaking carried through with untiring scholarly effort and the final result is most satisfactory and reflects great honor upon the author.

7. *The Ward Collection of Meteorites.* 74 pp. 8vo. Rochester, N. Y.—This catalogue gives a descriptive price list of the meteorites in the large collection of Ward's Natural Science Establishment at Rochester; casts of a number of specimens are also included. Detailed descriptions with illustrations are given of a number of the meteorites, as La bella Roca, the Rockwood, Hamilton Co., Texas, Puquois, Chili, Washington Co., Kansas, and others.

Cyclone Memoirs, Part IV, Arabian Sea, pp. 301-424, large 8vo. An inquiry into the Nature and Course of Storms in the Arabian Sea, and a Catalogue and brief history of all recorded Cyclones in that sea from 1648 to 1889, by W. L. DALLAS, Esq. Published by the Meteorolog. Dept. of the Government of India, under the direction of J. ELIOT, M.A., Met. Reporter to the Gov. of India. Calcutta, 1891.

The Sextant and other Reflecting Mathematical Instruments with practical hints, suggestions and wrinkles on their errors, adjustments and use. With thirty-three illustrations by F. R. Brainard, U. S. Navy. 120 pp. 16mo. New York, 1891 (D. Van Nostrand Company).

Essentials of Physics, arranged in the form of questions and answers prepared especially for Students of Medicine, by Fred. J. Brockway, M.D. 330 pp. Philadelphia, 1892 (W. B. Saunders).

Outlines of Lessons in Botany for the use of Teachers, or Mothers studying with their children, by Jane H. Newell. Part II, Flower and Fruit. 393 pp. Boston, 1892 (Ginn and Company.)

Catalogue of the Type Fossils in the Woodwardian Museum, Cambridge, by Henry Woods, with a preface by I. McKenny Hughes, Woodwardian Professor of Geology. 180 pp. 8vo, Cambridge, 1891.

APPENDIX.

ART. XLVIII.—*Notes on Triassic Dinosauria;* by O. C. MARSH. (With Plates XV, XVI, and XVII.)

THE presence of Dinosaurs in the Trias is indicated by many footprints, and various bones, nearly all of which are fragmentary. The footprints were long supposed to be those of birds, while the osseous remains were most of them not sufficiently characteristic to admit of determination. Three or four specimens in this country, however, and as many more in Europe, each with characteristic parts of the skeleton, have been known for some time. These prove the Dinosaurian nature of the animals beyond question, but throw little light upon their exact affinities. Recently, the writer has obtained from the Connecticut River sandstone the greater part of three skeletons of small Dinosaurs, all of much interest. Some portions of these have already been described,* and, in the present paper, additional remains are figured, and with them a few nearly allied fossils from European localities. The Triassic *Dinosauria* as a whole will be discussed by the writer in a later communication.

Anchisaurus colurus.

The type specimen of this species, one of the most perfect Dinosaurs ever discovered, has now been worked out of the hard matrix in which it was imbedded, and the skull and limbs are represented in the accompanying plates.

The skull was somewhat crushed and distorted, but its main features are preserved, and its more important characters can be determined with certainty. In Plate XV, figure 1, a side view is given, one-half natural size. One prominent feature shown in this view is the bird-like character of the skull. The nasal aperture (*a*) is small, and well forward. There is a large antorbital opening (*b*), and a very large orbit (*o*). This is elongated oval in outline. It is bounded in front by the prefrontal, above by the same bone, and a small extent of the frontal, and further back by the postfrontal. The postorbital completes the orbit behind, and the jugal, below. The supratemporal fossa (*d*) is large, and somewhat triangular in outline. The infratemporal fossa is quite large, and is bounded below by a slender quadratojugal. The quadrate (*q*) is much inclined forward. The teeth are remarkable for the great number in

* This Journal, vol. xxxvii, p. 331, April, 1889; and vol. xlii, p. 267, September, 1891.

use at one time. Those of the upper jaw are inclined forward, while those below are nearly vertical. The lower jaw has the same general features of this part in the *Theropoda*.

In Plate XVI, figures 1 and 2, the same skull is shown, also one-half natural size. The top of the skull, represented in figure 1, is considerably broken, and this has made it difficult to trace the sutures, but the general form and proportions of the upper surface are fairly represented. In figure 2, only the back portion of the cranium is shown. The foramen magnum is remarkably large, and the occipital condyle is small and oblique. The basipterygoid processes are unusually short.

The neck vertebræ are long and slender, and very hollow. Their articular ends appear to be all plane or slightly concave. The trunk vertebræ are more robust, but their centra are quite long. The sacrals appear to be three in number.

The scapular arch is well preserved. The scapula, shown in Plate XV, figure 2, *s*, is very long, with its upper end obliquely truncated. The coracoid (*c*) is unusually small, and imperforate. The sternum was of cartilage, some of which is preserved. The humerus (*h*) is of the same length as the scapula, and its shaft is very hollow. The radius and ulna are also both hollow, and nearly equal in size.

There is but one carpal bone ossified in this specimen, and this is below the ulna. There were five digits in the manus, but only three of functional importance, the first, second, and third, all armed with sharp claws. The fifth (V) was quite rudimentary. The fore foot of the type species of *Anchisaurus* is shown one-half natural size, on Plate XVI, figure 3.

The pelvic bones are shown in figure 3 of Plate XV. The ilium (*il*) is small, with a slender preacetabular process. The ischia (*is*) are elongated, and their distal ends slender, and not expanded at the extremity. The pubes (*p*) are also long, imperforate, and not coössified with each other. The anterior part is a plate of moderate width. The ischia of the type species of this genus are shown on Plate XVII, figure 6.

The femur (*f*) is much curved, and longer than the tibia (*t*). The latter is nearly straight, with a narrow shaft. The fibula (*f'*) when in position was not close to the tibia, but curved outward from it. All these bones have very thin walls. The astragalus (*a*) is small, closely applied to the tibia, and has no ascending process. The calcaneum (*c*) is of moderate size, and free. There are only two tarsal bones in the second row.

The hind foot had four functional digits, all provided with claws. The fifth was represented only by a rudiment of the metatarsal (V). The first digit was so much shorter than the second, third, and fourth, that this foot would have made a three-toed track very much like the supposed Bird-tracks of the Connecticut River sandstone.

On Plate XVI, figure 4, is shown the hind foot, also one-fourth natural size, of *Ammosaurus*, a genus nearly allied to *Anchisaurus*. In this foot, the tarsus is much more complete. The astragalus has a slight ascending process, the calcaneum is closely applied to the end of the fibula, and there are three well-developed bones in the second row. The fifth digit had only a single phalanx. The sacrum and ilia of the type species of *Ammosaurus* are shown on Plate XVII, figure 3.

Anchisaurus solus, sp. nov.

A fortunate discovery has recently brought to light almost the entire skeleton of a diminutive Dinosaur, which may be referred to *Anchisaurus*, but clearly belongs to a distinct species. It was found in nearly the same horizon as the remains above described, and in the immediate vicinity, so there can be little doubt that it was a contemporary. The skeleton is imbedded in a very coarse matrix, so difficult to remove that the investigation is only in part completed. The portions uncovered show the animal to have been about three feet in length, and of very delicate proportions. The bones of the skeleton are almost all extremely light and hollow, but most of them are in fair preservation.

The skull, so far as it can now be observed, resembles the one just described. The teeth are numerous, and inclined forward. The orbit is very large. The quadrate is inclined forward, and the lower jaw is robust. The entire skull is about 65^{mm} in length, and the lower jaws the same.

The neck was very long and slender, the first five cervicals measuring 80^{mm} in extent. The dorsals are also elongated, the last six covering a space of 135^{mm}. The number of vertebræ in the sacrum cannot yet be determined. The caudal vertebræ are short, the first ten occupying a space of 140^{mm}.

The humerus has a very large radial crest, and is 66^{mm} in length. The rest of the fore limb, so far as made out, is similar to those in the species described. The tibia is about 88^{mm} in length. There were five digits in the hind foot, but the fifth is represented only by the rudimentary metatarsal. The animal when alive was about as large as a small fox.

The European Triassic Dinosaurs with which the above American forms may be compared are mainly represented by the two genera *Thecodontosaurus*, Riley and Stutchbury, from the upper Trias, or Rhætic, near Bristol, in England, and *Plateosaurus* (*Zanclodon*), von Meyer, from nearly the same horizon, in Germany. The writer has investigated with some care the type specimens, and nearly all the other known remains of these genera found at these localities.

The remains of *Thecodontosaurus* are of special interest for comparison, and a portion of the skull is given on Plate XVII, figures 1 and 2, and the fore leg on Plate XVI, figure 5. For these remains, the writer is indebted to the trustees of the Bristol museum. The base of the skull shown on Plate XVII differs in several important respects from that of *Anchisaurus*, particularly in its extended parasphenoid, and the very long basipterygoid processes. The fore leg as a whole, especially the fore foot, is much like that of *Anchisaurus*, but in the latter, the coracoid is very small, and without a foramen. In *Thecodontosaurus*, it is much larger, has a foramen, and is coössified with the scapula.

Plateosaurus (*Zanclodon*) includes reptilian forms much larger than those described above. The pubis and ischia both serve to distinguish this genus from the American and British forms. The ischia have their distal ends expanded, as seen in Plate XVII, while the pubes are broad, imperforate plates.

The further discussion of these remains and of the other Dinosaurs from the Triassic will be given elsewhere.

New Haven, Conn., May 24, 1892.

Explanation of Plates.

Plate XV.

Figure 1.—Skull of *Anchisaurus colurus*, Marsh; side view. One-half natural size. *a*, nasal opening; *b*, antorbital opening; *bp*, basipterygoid process; *c*, lower temporal fossa; *d*, upper temporal fossa; *f*, frontal; *j*, jugal; *n*, nasal; *o*, orbit; *oc*, occipital condyle; *p*, parietal; *p'*, paroccipital process; *pf*, prefrontal; *pm*, premaxillary; *ps*, parasphenoid; *q*, quadrate; *so*, supraoccipital.

Figure 2.—Bones of left fore leg of same individual; outside view. *c*, coracoid; *h*, humerus; *r*, radius; *s*, scapula; *u*, ulna; I, first digit; V, fifth digit.

Figure 3.—Bones of left hind leg of same individual; outside view. Both figures are one-fourth natural size. *a*, astragalus; *c*, calcaneum; *f*, femur; *f'*, fibula; *il*, ilium; *is*, ischium; *p*, pubis; *t*, tibia.

Plate XVI.

Figure 1.—Skull of *Anchisaurus colurus*: top view.

Figure 2.—Base of same skull; back view. Both figures one-half natural size.

Figure 3.—Left fore foot of *Anchisaurus polyzelus*, Hitchcock, sp.; back view. One-half natural size. *c*, central; *r*, radial; R, radius; U, ulna.

Figure 4.—Right hind foot of *Ammosaurus major*, Marsh; front view. One-fourth natural size. F, fibula; T, tibia; *t2*, *t3*, *t4*, tarsal bones.

Figure 5.—Bones of left fore leg of *Thecodontosaurus platyodon*, Riley and Stutchbury; outside view. One-fourth natural size.

Plate XVII.

Figure 1.—Base of skull of *Thecodontosaurus platyodon*; seen from the left.

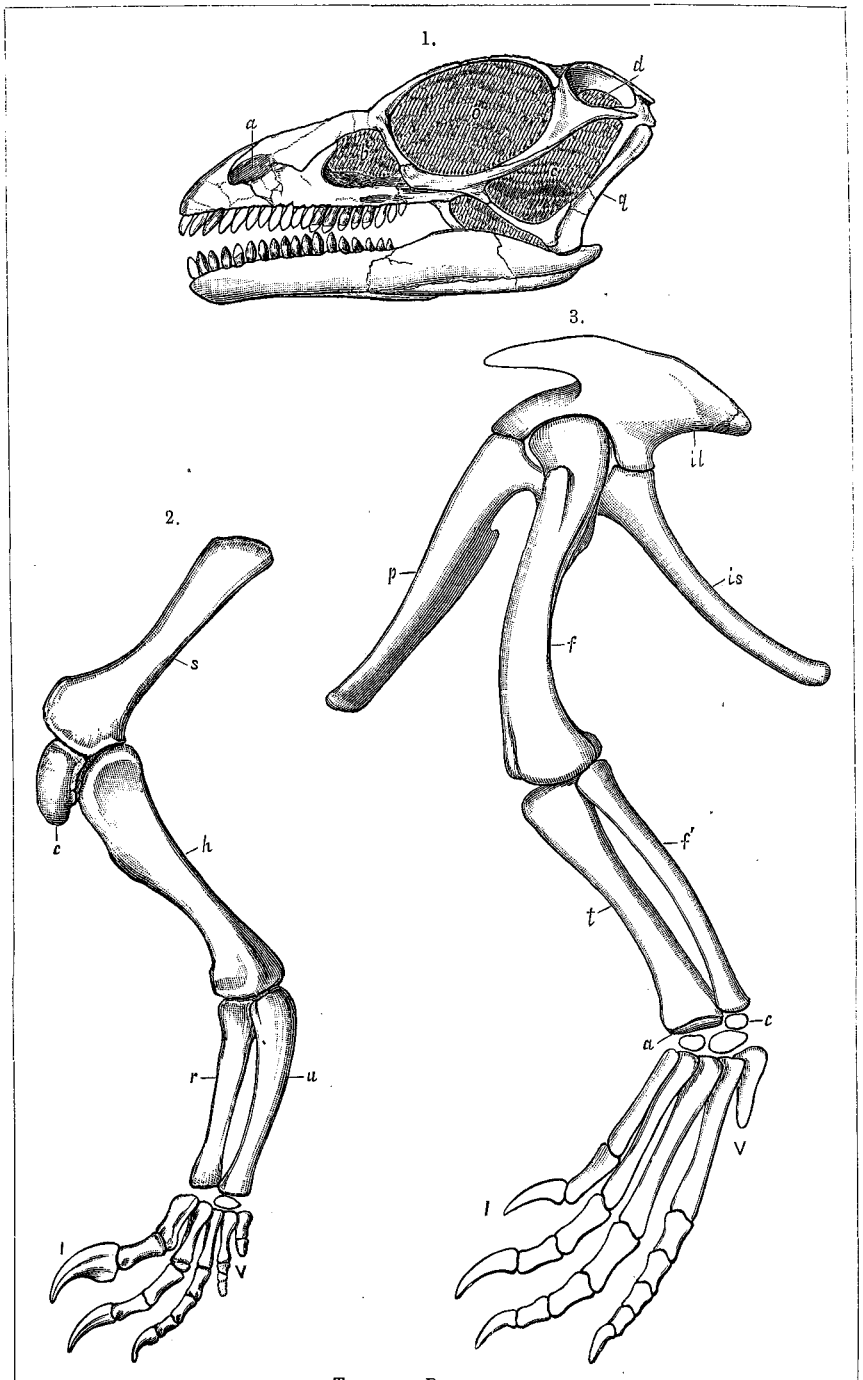
Figure 2.—The same specimen; back view. Both figures are one-half natural size.

Figure 3.—Sacrum and ilia of *Ammosaurus major*; seen from below. One-fourth natural size. *ac*, acetabulum; *is*, face for ischium; *pb*, face for pubis; *1*, *2*, *3*, sacral vertebræ.

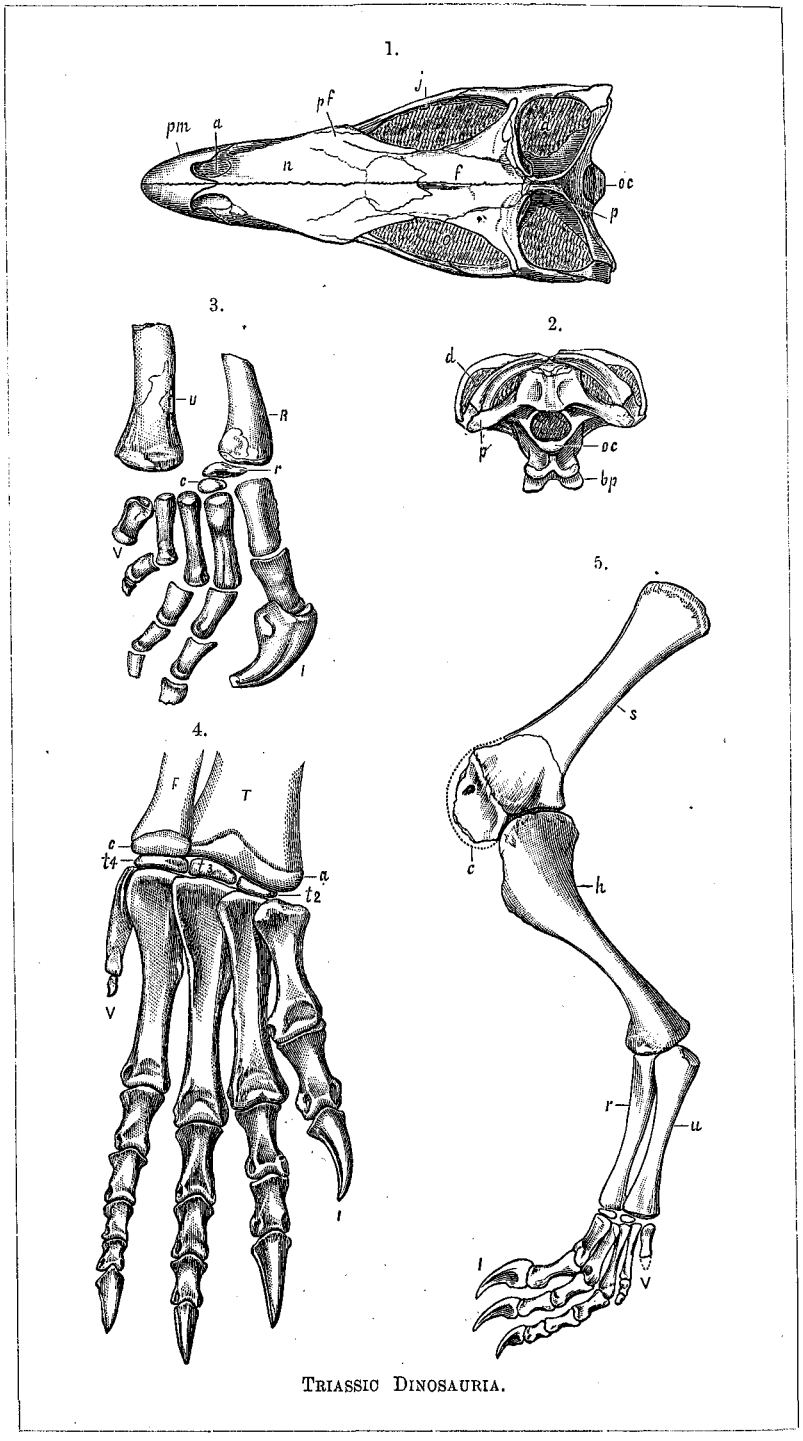
Figure 4.—Pubis of *Plateosaurus* (*Zanclodon*) *suevicus*, von Meyer. One-sixth natural size. *a*, front view; *b*, back view; *s*, symphysis.

Figure 5.—Distal ends of ischia of same. One-sixth natural size. *p*, posterior.

Figure 6.—Ischia of *Anchisaurus polyzelus*; seen from above. One-half natural size. *a*, distal ends; *il*, face for ilium; *pb*, face for pubis.



Triassic Dinosauria.



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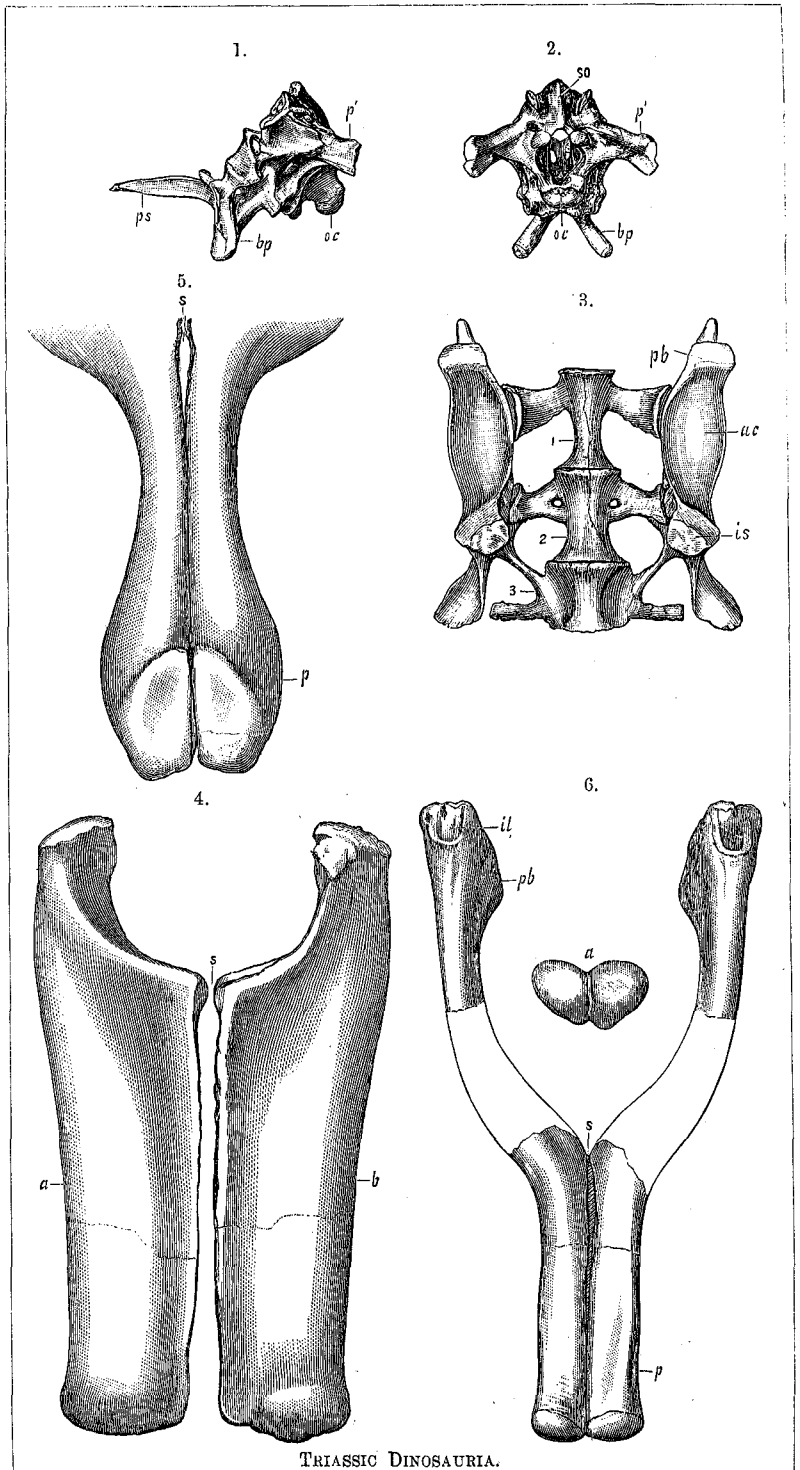

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