type specimen is from Colorado, from a higher horizon in the Jurassic than that of *Megalosaurus*. Nearly every part of the skeleton of this genus is now known, and the more important portions have been described and figured by the author. *Creosaurus*, also from the Jurassic, is an allied form, and *Dryptosaurus*, from the Cretaceous, is, perhaps, also closely related. A very distinct form in the Jurassic is *Labrosaurus*, described by the author, in 1879. It is known from detached specimens only, but these, especially the jaws, edentulous in front, show it to represent a distinct family.

The most perfectly known of American *Theropoda*, and by far the most interesting, is the genus *Ceratosaurus*, founded by the author, in 1884. This is the representative of a very peculiar family, which differs in some important respects from all other known Dinosaurs. The skull and nearly all the various parts of the skeleton are known. When found, they were entire, and in the position in which the animal died. The skull and some of the more interesting parts of the skeleton have been figured by the author, and all will soon be fully described.

The skull bears a large elevated horn-core on the median line of the nasals. The cervical vertebræ differ in type from those of any other known reptiles, having the centra plano-concave. All behind the axis have the anterior end of each centrum perfectly flat, while the posterior end is deeply cupped. This genus, moreover, differs from all known Dinosaurs in having the elements of the pelvis (ilium, pubis, and ischium) coössified, as in all existing birds. The metatarsals, also, are firmly united, as in birds. No representatives of the *Ceratosauridæ* are known in Europe.

In conclusion, it may safely be said that the four great groups of *Dinosauria* are each well represented both in Europe and America. Some of the families, also, of each order have representatives in the two regions, and future discoveries will doubtless prove that others occur in both.

No genera common to the two continents are known with certainty, although a few are so closely allied, that they cannot be distinguished from each other by the fragmentary specimens that now represent them. It must be remembered that the great majority of genera have been named from portions of skeletons, of which the skull was unknown, and until the latter is found, and definitely associated with the remains described, the characters and affinities of the genus can be only a matter of conjecture, more or less definite, in proportion to the perfection of the type specimens.



From Asia and Africa, also, a few remains of Dinosaurs have been described, and the latter continent promises to yield many interesting forms. Characteristic specimens, representing two genera, one apparently belonging to the *Stegosauria*, and one to the *Theropoda*, are already known from South Africa, from the region so rich in other extinct Reptilia.

From Australia, no *Dinosauria* have as yet been recorded, but they will undoubtedly be found there, as this great group of Reptiles were the dominant land animals of the earth, during all Mesozoic time.

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ART. XXXV.—*Notice of New American Dinosauria;* by O. C. MARSH.

IN the large series of Dinosaurian remains brought together by the writer, in the last few years, and now under investigation, there are a number of new forms, some of which are briefly noticed below. These will all be fully described and figured in the memoirs now in preparation, by the writer, for the United States Geological Survey.

*Anchisaurus major*, sp. nov.

The remains of this reptile are from the sandstone of the Connecticut River valley, which has long been known for the great variety of footprints it contains, especially those supposed to have been made by birds. The extreme rarity of any bones in these beds is equally well known, not more than half a dozen finds having yet been made, and only a few of these of much scientific interest. A portion of a skeleton found near Springfield, Mass., and described by Hitchcock, in 1865, as *Megadactylus*, has hitherto been by far the most important of these discoveries. It is a typical member of the order *Theropoda*, and has apparently for its nearest allies in the old world, *Thecodontosaurus*, from the Trias of England, and *Massospondylus*, from the same formation in South Africa.

The remains here described represent a later discovery, in 1884, near Manchester, Conn., in essentially the same horizon as the Springfield specimen. They indicate an animal of larger size, but in many respects nearly allied to the one

described by Hitchcock. Both apparently belong to the same genus, which the writer has called *Anchisaurus*, as the name first given was preoccupied.

The present specimen is part of a skeleton which was probably complete, and in position, when discovered, but for want of proper appreciation at the time, only the posterior portion was secured. This consists of the nearly entire pelvic arch, with both hind limbs essentially complete, and in position. As this was one of the animals that are supposed to have made the footprints, one of the hind feet is figured below.

FIG. 1.

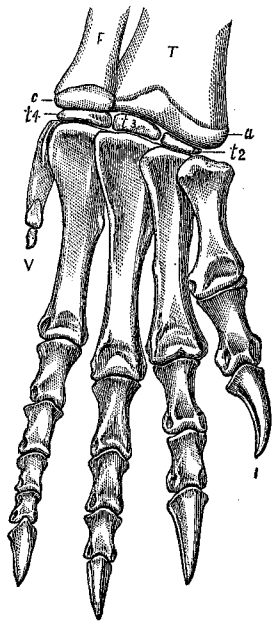


FIGURE 1.—Right hind foot of *Anchisaurus major*, Marsh; front view. One-fourth natural size.

In the present specimen there are only three sacral vertebræ. All the dorsal vertebræ preserved have their articular ends biconcave, or nearly plane.

The ilium has a slender preacetabular process, thus differing from most of the other *Theropoda*. The ischia are very slender, and are directed backward. For the posterior half of their length, they are closely adapted to each other.

The known remains of this species indicate an animal about six or eight feet in length.



*Morosaurus lentus*, sp. nov.

One of the most interesting specimens of *Sauropoda* in the Yale Museum pertains to a species of *Morosaurus* much smaller than *M. grandis*, the type, and differing materially in other respects. The skull is not known, but nearly all the important parts of the skeleton are well represented, and in excellent preservation. The individual was not fully adult, and hence, the elements of the vertebræ and sacrum are, in most cases, separate, thus affording special facilities for investigation.

The limb bones and feet show that the fore and hind legs were much shorter than those of the other species of the genus. The vertebræ, also, are shorter, more massive, and the cavities in them, smaller. All parts of the skeleton preserved are of similar density, indicating that the whole osseous structure of the animal was more solid than any other of the known *Sauropoda*. The vertebræ of the cervical and dorsal regions have their centra more depressed than in the other species of this genus, and may easily be distinguished by this feature alone. The neural arch rests directly upon the centrum, instead of being elevated on pedestals above the articular faces. This feature is well shown in the figure below.

FIG. 2.

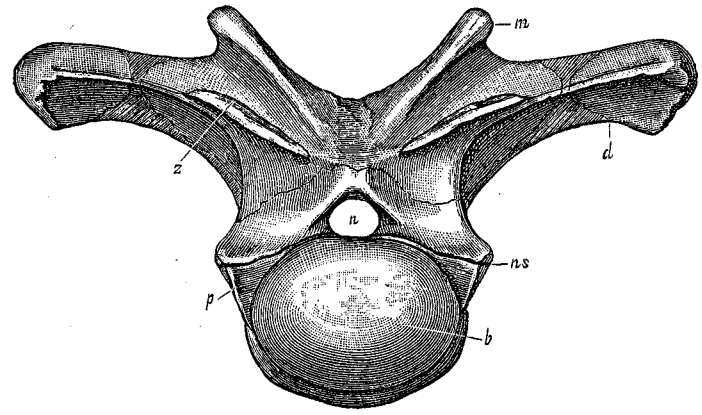


FIGURE 2.—Posterior cervical vertebra of *Morosaurus lentus*, Marsh; front view. One-fifth natural size.

The type specimen of the species here described indicates an animal about thirty feet in length. The known remains are from the Atlantosaurus beds of the Upper Jurassic, in Wyoming.

*Morosaurus agilis*, sp. nov.

A second new species, which apparently belongs to the same genus, is represented by the posterior half of the skull, the anterior cervical vertebræ, and other parts of the skeleton. This animal was in direct contrast with the one last described, the skull and skeleton being especially light and delicate in structure for one of the *Sauropoda*. It was also much smaller in size, being the most diminutive known member of the genus, probably not more than fifteen feet in length.

The figure below represents the back of the skull with the atlas attached, and the postoccipital bones in place. The axis and third cervical were also found in position. These will serve to distinguish the present species from the others of the genus, as they are proportionally much longer, and of lighter structure.

FIG. 3.

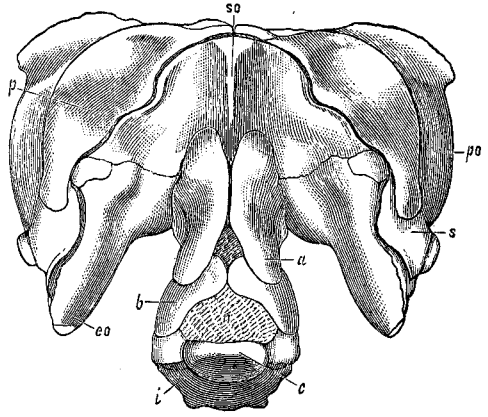


FIGURE 3.—Skull of *Morosaurus agilis*, Marsh; posterior view. One-half natural size.

The hind feet of the present specimen agree in general structure with those of *Morosaurus grandis*, but differ in having the first digit unusually large and massive in comparison with the others. The third, fourth, and fifth, are especially slender.

This interesting specimen was found in the Upper Jurassic beds of Colorado, by Mr. M. P. Felch, whose researches have brought to light so many important remains of the *Dinosauria*.

*Ceratops horridus*, sp. nov.

The strange reptile described by the writer as *Ceratops montanus** proves to have been only a subordinate member of

* This Journal, vol. xxxvi, p. 477, Dec., 1888. *See also* p. 327 of the present number. The specimen figured in vol. xxxiv, p. 324, may prove to belong to the same genus.



the family. Other remains received more recently indicate forms much larger, and more grotesque in appearance. They also afford considerable information in regard to the structure of these animals, showing them to be true *Stegosauria*, but with the skull and dermal armor strangely modified and specialized just before the group became extinct.

The vertebræ, and the bones of the limbs and of the feet, are so much like the corresponding parts of the typical *Stegosaurus* from the Jurassic, that it would be difficult to separate the two when in fragmentary condition, as are most of those from the later formation. The latter forms, however, are of larger size, and nearly all the bones have a peculiar rugosity, much less marked in the Jurassic species. In the form here described, this feature is very conspicuous, and marks almost every known part of the skeleton.

In the type specimen of the present species, the posterior horn-cores are much larger than these appendages in any other known animal, living or extinct. One of them measures at the base, no less than twenty-seven inches, and about sixteen inches around, half way to the summit. Its total height was about two feet. In general form, these horn-cores resemble those of *Ceratops montanus*, but the anterior margin is more compressed, showing indications of a ridge.

The top of the skull, in the region of the horn-cores, is thick and massive, and strongly rugose.

This skull as a whole must have had at least fifty times the weight of the skull of the largest *Sauropoda* known, and this fact will give some idea of the appearance of this reptile when alive.

As previously stated, the posterior pair of horn-cores of this family are hollow at the base, and in form and surface markings are precisely like those of the *Bovidæ*. The resemblance is so close that, when detached from the skull, they cannot be distinguished by any anatomical character. This accurate repetition, in later and still existing forms, of the highly specialized weapons of an extinct group of another class is a fact of much interest.

The present specimen is from the Laramie formation of Wyoming, but fragmentary remains, which may be referred provisionally to the same species, have been found in Colorado.

*Hadrosaurus breviceps*, sp. nov.

An interesting specimen in the Yale University Museum, from Montana, indicates a large Dinosaur, apparently belonging to the genus *Hadrosaurus*, and hitherto unknown. It is the dentary portion of the right maxillary, and is so characteristic, that it is here briefly described and figured. Its main features are well shown in figures 4 and 5 below.

The teeth are very numerous, and form a tessellated surface, as in *Hadrosaurus Foulkii*, Leidy, but they are more elongate, and the outer enamelled faces ard less distinctly rhomboid in form. The grooves, also, in which the inner surfaces of the fangs were inserted, are less regular, than in that species.

FIG. 4.

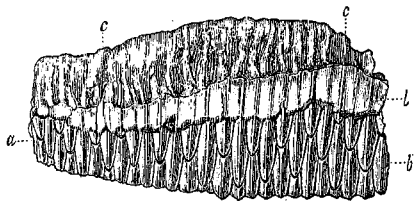


FIG. 5.


FIGURE 4.—Right maxillary of *Hadrosaurus breviceps*, Marsh; outside view.
FIGURE 5.—The same jaw; showing worn surface of teeth.
Both figures are one-fourth natural size.

The present specimen is from the Laramie formation of Montana.

*Hadrosaurus paucidens*, sp. nov.

In strong contrast with the species above described is another from the same region and same formation. The best preserved specimen that now represents it is a left maxillary, nearly complete. With this was found some other portions of the skull, but the maxillary affords the best distinctive characters. All, however, indicate a skull of extreme lightness and delicacy of build for one of the *Ornithopoda*. The maxillary is especially slender, and the anterior and posterior extremities are pointed. The middle of the bone is more massive, but yet very light for this portion of the skull. The teeth are of the general type of those in this genus, but are comparatively few in number, and only one row appears to have been in service.

The maxillary preserved is about ten inches in length, and three inches high near the center. The row of teeth in use contains about thirty.

The remains on which the present species is based were found in 1888, in the Laramie formation of Montana, by Mr. J. B. Hatcher, of the United States Geological Survey.

New Haven, Conn., March 25, 1889.

THE

# AMERICAN JOURNAL OF SCIENCE

[THIRD SERIES.]

## ART. XXXVI.—*The Electrical Resistance of Stressed Glass;* by CARL BARUS.

THE thermal relations of the resistance of glass, originally studied by Buff,* have more recently been made the subject of research in memoirs by Beetz,† Foussereau,‡ Perry,§ Thos. Gray,‖ and others. Warburg's¶ experiments, however, throw new light on the inquiry, by showing that the apparent polarization evoked by the passage of current, is due to a layer of non-conducting silica depositing at the anode. If this be continually dissolved by an electrode of sodium amalgam, the apparent polarization is so far removed that an almost constant current may be kept up indefinitely. If the film be not removed, conduction soon ceases and the glass behaves like a condenser of measurable capacity.

The effect of temperature on the conductivity of glass has thus been mapped out with considerable detail, and it will be superfluous to add new data in the following paper. I purpose therefore to confine myself narrowly to the effects of

* Buff: Lieb. Ann., xc, p. 257, 1854.
† Beetz: Pogg. Ann., Jubelband, p. 23, 1874.
‡ Foussereau: Journ. de phys., II, xi, p. 254, 1883.
§ Perry: Proc. Roy. Soc., xxiii, p. 468, 1875.
‖ T. Gray: Proc. Roy. Soc., xxxiv, p. 199, 1883.
¶ Warburg: Wied. Ann., xxi, p. 622, 1884; ib., xxxv, p. 455, 1888.