5. Such a problem is presented in the future of the waste lands once covered by the pine forests of Michigan. It is certain before long to attract enough public attention to become a subject of legislation, and our present attitude may do much to determine the course of events in this direction.

6. Meantime there is every reason in favor of proceeding as rapidly as practicable, along lines already suggested, in the development of our State Biological Survey. This, in fact, if not in form, has long been in progress, as the studies of 'Unionidæ in Michigan,' the 'Birds of Michigan,' the 'Michigan Flora' and various other pieces of work of high scientific merit abundantly testify. But it is time now that the work should be organized, that the State should recognize its duty to this form of scientific work, and that we ourselves should be forming clear conceptions of the ecological problems that, in wonderful, if perplexing, interest, are sure to attend, into the twentieth century, the Natural History Survey of Michigan.

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A COMPLETE SKELETON OF CORYPHODON RADIANS—NOTES UPON THE LOCOMOTION OF THIS ANIMAL.

THE chief object of the American Museum Expedition of 1896 was to complete materials for the investigation of the evolution of the Amblypoda, and extend our knowledge of *Coryphodon*. Previous observations have been principally upon scattered and imperfect material, and it seemed of the utmost importance to secure materials sufficient to determine the relations of this animal to its ancestral form *Pantolambda*, and to its successive form, *Uintatherium;* also the proportions of the body, the positions of its limbs and the number of its vertebræ. Accordingly the Museum party, led by Dr. Wortman, spent the months of April and May in northwestern New Mexico, revisiting the locality where Cope's most complete *Coryphodon*, *C. elephantopus*, had been found. The search here in the 'Coryphodon' or 'Wasatch Beds' was entirely unsuccessful, but fortunately the underlying 'Torrejon Beds' yielded a remarkably complete series of *Pantolambda*. The party moved to the north in June, and devoted July and August to a most energetic exploration of the Big Horn Basin, especially of the exposures on the south side of the Gray Bull River from Brown's Ranch towards the Big Horn River below Otto.

As a result, parts of 18 individuals were found in the Wasatch Beds (supplementing the 30 individuals found in 1891), and 7 individuals in the Wind River Beds. The selection of portions of nine individuals for mounting was done with great care as follows: The mounted skull, 'American Museum Catalogue,' No 2,867, agrees exactly in size, and is specifically identical with the skull and jaws of No. 5,829. The latter (No. 2,829), while laterally crushed, had associated with it the right scapula and complete forelimb, left scapula and parts of left limb which were used in mounting; also all the vertebræ as far back as the pelvis; these vertebræ, while too much crushed to mount, enabled us to determine the formula and select, from series Nos. 2,865 and 2,863, vertebræ which exhibit the same characters. The latter individual (No. 2,863) included the pelvis and hind limb, thus determining *positively the correct proportions of the entire animal.* The mounting was done with great skill and care by Mr. Hermann.

In general one is struck by the very large size of the head, formidable front teeth, the shortness of the ribs, the heavy character of the girdles, the heavy limbs, and the semiplantigrade or subdigitigrade condition of the feet. It is probable, as already shown

by the writer, that in the hind foot the calcaneum nearly reached the ground in the forward step.

	FEET AND INCHES.	METERS.
Length, incisors to perpendicular of tail	7′ 9½″	2.38
Height at withers.....	3′ 4½″	1.03
Fore limb.....	2′ 8½″	.82
Hind limb.....	2′ 11½″	.90

The *skull* presents a very peculiar appearance with its powerful and spreading upper and lower canines, and widely spaced incisors, slender zygomatic arch and broad, flattened cranium.

The rudimentary horn observed for the first time in the parietals is prophetic of the great parietal horn of *Uintatherium*. Many other characters of the skull and skeleton are also prophetic, but there is little tendency displayed to reduce the upper incisors or lower canines into the Uintathere type.*

GENERAL APPEARANCE OF CORYPHODON.

The most accurate forecast of the appearance of the animal was that made by Cope† in 1874 :

"The general appearance of the Coryphodons, as determined by the skeleton, probably resembled the Bears more than any living animals, with the important exception that in their feet they were much like the Elephant. To the general proportions of the Bears must be added a tail of medium length. Whether they were covered with hair or not is, of course, uncertain ; of their nearest living allies, the

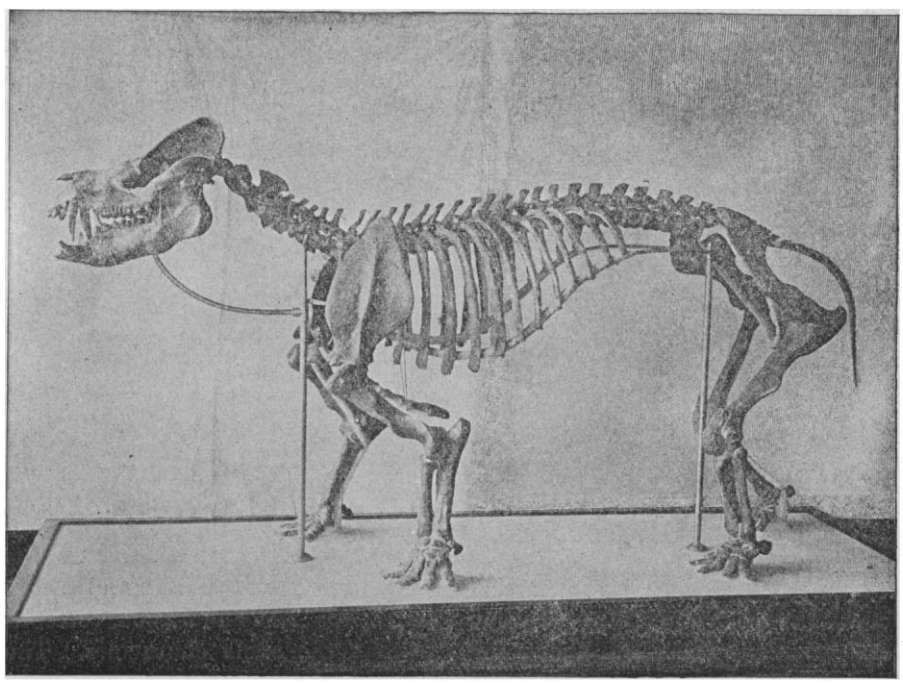

Fig 1.—Mounted Skeleton of *Coryphodon radians*. Slightly exceeding one-fifteenth natural size.

* *Bulletin American Museum of Natural History*, April 4, 1898.

†Vertebrate Paleontology, Vol. IV., Wheeler Survey, p. 203.

Elephants, some were hairy and others naked. The top of the head was doubtless naked posteriorly, and in old animals may have been only covered by a thin epidermis, as in the Crocodiles, thus presenting a rough, impenetrable front to antagonists.

"The movements of the *Coryphodons*, doubtless, resembled those of the Elephant in its shuffling and ambling gait, and may have been even more awkward, from the inflexibility of the ankle. But, in compensation for the probable lack of speed, these animals were most formidably armed with tusks. These weapons, particularly those of the upper jaw, are more robust than those of the Carnivora, and generally more elongate, and attrition preserved rather than diminished their acuteness. The size of the species varied from that of a Tapir to that of an Ox."

Osborn* in 1892 wrote as follows:

"The fact is, the position of the fore and hind feet of *Coryphodon* is absolutely different. The *fore foot was digitigrade*, like that of the Elephant; the *hind foot was plantigrade*, like that of the Bear. In other words, the carpus was entirely raised from the ground and the manus rested upon the distal ends of the metacarpals and upon the spreading phalanges, while the calcaneum and tarsus rested directly on the ground, together with the entire plantar surface of the foot. This substantial difference between the advanced state of evolution of the fore foot and retarded evolution of the hind foot is of great interest. It is clearly shown in the accompanying figures."

In 1893 Marsh,† in his description and restoration, presented quite a different conception of the animal as *unguligrade*. In regard to these matters he made the following statement: "The position first given to the figure is retained in the restoration after a careful investigation of the whole posterior limbs in a number of well-preserved specimens. In *Dinoceras* the terminal phalanges are much larger than in the Elephant, so that they thus bore a greater weight, the digits being undoubtedly free, although a pad may have helped to support the feet. In *Coryphodon* the digits were still more elongate and the terminal phalanges proportionately larger and broader, indicating that they were covered with hoofs that supported the feet. This would agree with the position given them in the restoration, which coincides with the anatomical structure of the entire hind limb."

It appears from our more complete material that the difference between the feet was exaggerated by Osborn, as already observed by Marsh. There is no doubt, however, that, as seen in the mounted specimen, in the forward step the calcaneum rested very near the ground, being separated merely by a thick plantar pad. The digits of the fore and hind feet have nearly the same relations to the ground. *Both feet are in a somewhat similar stage of transition between plantigradism and digitigradism. Pantolambda* has a long tuber-calcis and pes like that of the Bear. *Uintatherium* has a very short tuber-calcis and bore the pes slightly more plantigrade than the elephant. *Coryphodon* has a tuber-calcis intermediate in length; in the astragalus the upper facet for the tibia and lower facet for the navicular presents an oblique angle, the astragalus thinning out to a sharp edge in front (whereas in *Uintatherium* these facets are more nearly parallel, and the astragalus is truncate in front). The angles between the tibial and navicular facets of the astragalus, as shown in sections in Fig. 2, afford the most de-

*Fossil Mammals, of the Wasatch and Wind River Beds, Collection of 1891; Osborn & Wortman, Bull. Am. Mus. Nat. Hist., Sept., 1892, p. 121.

† 'Restoration of Coryphodon,' *Amer. Jour. Science*, Oct., 1893, p, 324.

cisive evidence that the pes of *Coryphodon* was intermediate between the nearly plantigrade *Pantolambda* and the sub-digitigrade *Uintatherium*.

In general *Coryphodon* had a very short back and short, spreading limbs, with a very clumsy, shuffling gait.

HENRY F. OSBORN.

THE MYTH OF THE OZARK ISLE.

THE Ozark uplift, which occupies nearly all of south Missouri and northwestern Arkansas, has long been known as the only noteworthy elevation existing in the whole continental interior plain. Geologically all of this vast region, stretching out from the Appalachians to the Rockies and from the Great Lakes to the Gulf, is made up largely of late Paleozoic or younger rocks, save in one spot, the Ozarks.

As a geographical feature the Ozark uplift is a great, broad dome. Its general surface still preserves the outlines of the great peneplain that existed in the region before the country was affected by mountain-making forces and bowed up. The margins of the elevation are marked approximately by the Missouri river on the north, the Mississippi on the east, the Neosho on the west and the Red river.

The geological structure of the uplift is relatively simple. In the highest or central part are the oldest rocks exposed in the entire Mississippi basin. These are the Algonkian granites and porphyries, the commonly called Archæan nucleus. Surrounding these massive crystallines and occupying nearly all of the central portions of the dome are the Cambrian and Silurian dolomites, the so-called great magnesian limestone series. Farther outward lie successively the Devonian, Lower Carboniferous and Coal Measures. The latter also form the principal surface rocks of the surrounding plain, beyond the margins of the uplift. Thus the great dome presents the oldest rocks in the central and highest parts, and towards the margins and foot younger and younger belts in concentric rings.

This striking and peculiar arrangement of the geological formations around the Ozark dome has long attracted notice, and it has always set forth as one of the direct proofs that the uplift is very old and that the region has remained practically unchanged above sea-level since pre-Cambrian times, forming in the midst of the broad and shallow continental sea a large, ever growing island around which sediments were constantly laid down during all the Paleozoic period. Starting with these premises there have been based recently a number of broad generalizations and rather fantastic hypotheses regarding the deposition and origin of various ores found in the region, the courses of Paleozoic ocean currents, the formation of unusually thick sediments of certain geological age, the distribution of some ancient and peculiar faunas, and even the isolated and independent development of life in the region. These various hypotheses are very attractive in themselves. Based wholly on the assumption of the existence of a large land area in the middle of the continental sea, the colateral evidence used in several of the arguments are strangely corroborative. But going back of the original proposition that has been taken for granted and that has served as the foundation for the several hypotheses advanced, a question naturally arises as to the real grounds for the premises and for the assumed great antiquity of the 'Ozark Isle.'

If there is one thing that modern geography teaches before all else in regard to the existence of an elevated land area, such as is claimed for the Ozark region during all the long span from the pre-Cambrian to the present, it is that it would have been long since worn down to a low-lying plain of faint relief, indistinguishable from the vast