Neohipparion, A Three-Toed Horse

By CHESTER STOCK

NO other lineage of mammals illustrates quite so clearly or so fully its growth or evolution in geologic time as that of the horse. In the history of the Equidae many forms antecedent to the living animal are now known, each marked by readily identifiable characters in the teeth, skull and skeleton. From *Eohippus*, the "dawn horse" of approximately 50 million years ago, to the equines of today, a score or more different kinds of genera and numerous species of extinct horses have been described. The changes that have produced the large and specialized animal of today from the diminutive and distinctly less specialized Eocene ancestor of long ago are demonstrated by an amazing array of fossil remains, found for the most part in the land-laid formations of the western United States.

Tracing the evolution of the Equidae involves not only a determination of those kinds of horses that were in the lineal descent to modern *Equus*, but, likewise, a recognition of the types that belonged to collateral branches of the family tree. Among the latter are the hipparions and their offspring of the Pliocene. These horses, on the basis of the progressive characters of their teeth, were once regarded as ancestral to the existing *Equus*. They are, however, creatures that have persistently retained three toes in front and hind feet, although the side toes are elevated above the ground and no longer function as supporting elements of the foot. In the retention of the lateral digits the hipparions were distinctly less progressive than the contemporary and monodactyl *Pliohippus*, and it is from the latter that *Equus* is now regarded to have sprung.

The hipparion group persisted through the Pliocene, but disappeared with the coming of the Pleistocene or Ice Age, at least in North America. During the late Miocene or early Pliocene, the true hipparions are found in North America and Eurasia. By the middle of this epoch, perhaps eight or nine millions of years ago, these horses gave way to the larger, heavier neohipparions which were characteristically North American in distribution. They have been found fossil, for example, in Florida, Texas, the western Great Plains, the Great Basin province, California and Mexico. Although described from a number of localities, nowhere has a specimen been found sufficiently complete to permit the construction of a mounted skeleton.

During one of the early expeditions of the Division of the Geological Sciences, California Institute, well-preserved materials of the species *Neohipparion leptode* were uncovered in the middle Pliocene, Thousand Creek deposits of northwestern Nevada. These have now been

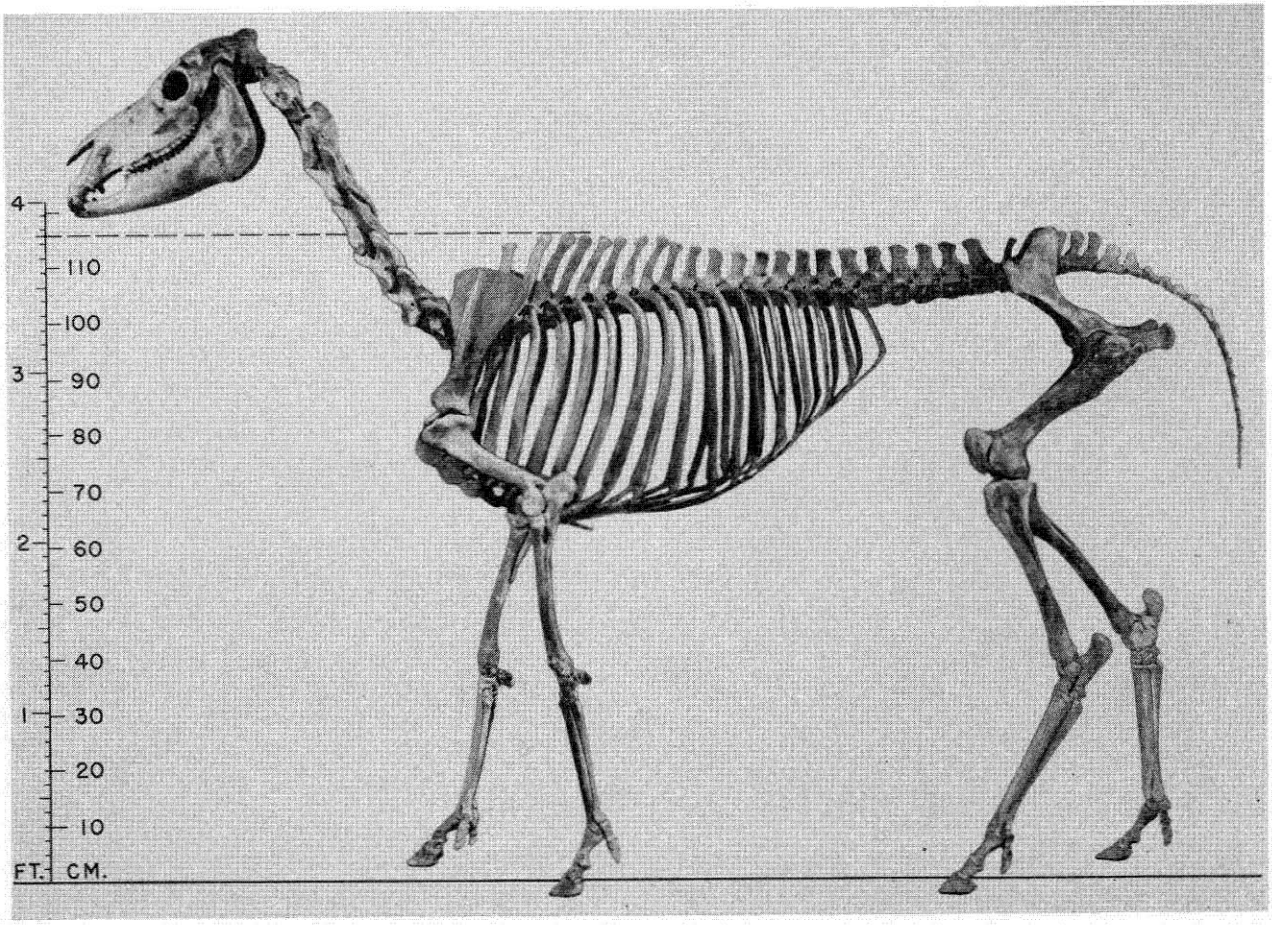

FIG. 1

prepared by E. L. Furlong, and an exceptionally fine skeleton (*Figs. 1 and 2*) the first of its kind, has been mounted by William Otto, preparator in Vertebrate Paleontology.

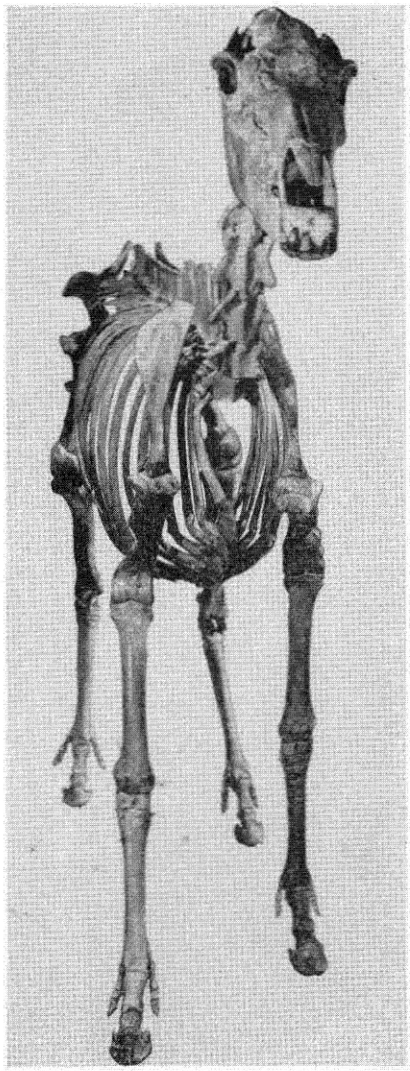

FIG. 2

The skull in this animal is of an adult male. The skeleton as it stands compares in size with that of the Burchell zebra, being a trifle over 3 feet 9 inches, or approximately 11½ hands, tall at the withers. However, the proportions of this Pliocene horse are noticeably different from those of modern *Equus*. A striking difference is seen immediately in the small size of the head. In the fossil specimen the skull is distinctly smaller in relation to the size of the body than it is in the zebra. While the body is proportionately as long as in the Burchell zebra, the sides are flatter, the chest appearing narrower and "slab-sided." The limbs are, likewise, differently proportioned, the principal bones of the fore and hind feet being very much longer in relation to the arm and thigh bones, respectively, than they are in the zebra. This extra length in the feet of *Neohipparion* caused its limbs to be some six per cent longer, in relation to the size of its body than even the highly-specialized limbs of the modern race horse. The side toes are beautifully preserved, and, as shown in the skeleton, are distinctly shorter than the middle toe. They do not touch the ground. The hoof of the third or middle digit is larger than in the zebra, and shows a small median fissure. In running, *Neohipparion* could probably exceed the speed of the zebra, at least for short distances.

The mammalian associates of *Neohipparion leptode*, when it roamed the grasslands in what is now the arid Thousand Creek region of northwestern Nevada, were the more progressive horse, *Pliohippus*, short-legged rhinoceroses, large camels, curious twisted-horned antelopes, peccaries, cats, dogs, badgers, and rodents.

Progress with Roads

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measuring space with time. Perhaps we are confronted with the need of more highly developing a mental process by which, given walking, driving and flying speed, we may arrive at the minimum of time for a given journey. Will this result in improving and increasing our mental ability, with beneficial progress?

PROSPERITY—DEPRESSION

We have seen that many of the notable civilizations of early history, the Egyptian, the Carthaginian, the Chinese, the Incan, and the Roman, during the height of their power, built hard surfaced roads over which the civilizing influences from any portion of the empire could flow to any other portion. All of these early civilizations reached a peak and declined, their road systems deteriorating with them. It is impossible to determine which was the cause and which the effect, but it is interesting to note that a decline of one element accompanied a decline of the other.

In the early 1930's the United States experienced the worst depression in its history. The depression was more than nation-wide; it was world-wide, and many able students marked it as the beginning of the end of our modern civilization. Road building decreased materially in the United States in this period. There was very little new construction, and many existing roads were allowed to deteriorate through lack of maintenance. Later, a definite increase in road building occurred, which in turn, was greatly slowed by war activity. In spite of this check, some major projects, such as the Alaska and Pan-American Highways, have been materially rushed forward, and we have a very practical hope in the years to come of greater and more extended international highway travel than ever. It has often been contended that these international highways may constitute one of the greatest civilizing influences of modern times, and it seems not too much to expect that we may still progress with roads.

Buried Voice Channels

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amount of protection desired against possible damage to the cable. Even at these depths some little trouble is caused by lightning in those areas where electrical storms are common. A number of installations have been made in which one or more copper lightning-protection or shield conductors have been buried above the cable, but these have not been completely effective. Some consideration is now being given to the use of a copper sleeve covering the normal lead sheath of the cable itself.

To determine the existence of current on the cable sheath, a recent installation was equipped with test points approximately every 3,000 feet. At these locations, two wires permanently attached to the cable sheath, 10 feet apart and insulated from the earth, were brought to the surface and terminated in a housing for the convenience of the tester who makes periodic checks of the current flowing on the cable sheath. Periodic tests are necessary, for, despite the fact that the cable is buried, there are a number of causes for changes in the effectiveness of the insulation, not the least of which are the rodents or pocket gophers previously mentioned. Only that part of the United States roughly east of the Mississippi River, exclusive of an area in the Southeast, is free from these pests.

GAS PROTECTS CABLE FROM MOISTURE

Since the paper insulation of the cable conductors readily absorbs water, every effort must be made to exclude moisture. Even a small amount of moisture reduces the insulation resistance and a little bit more may short-circuit two or more conductors and put circuits out of service. To protect the most important cables from the entrance of moisture and to provide a means of detecting