out, and found lying on this layer of limestone where it projects from a rather steep bank at the roadside. All of the other bones were found imbedded in the clay about a foot above the layer of limestone, and about ten feet from the spot where the teeth were lying. All the bones were at the same level, and were recovered from an area about three feet in length and one foot in width.

The bones are in a good state of preservation and though somewhat brittle, are easily freed from the rather soft clay matrix. Many of the bones are fragmentary, apparently having been broken before they were imbedded. Very few of them are distorted, though the clay which contains them is full of slickensides. No other fossils have yet been found in this bed. About twenty-five entire or fragmentary bones have been found. The most complete are an ilium, some ribs, and the pleuro-centra, hypocentra, and neural arches of vertebræ of the rachitomous type. All these appear to belong to amphibians, probably much like *Eryops,* from the Permian of Texas.

The reptilian remains consist of several chevrons, and a fragment of a jaw containing four small transversely elliptical, long-rooted teeth. These are evidently from a reptile belonging to the family Diadectidæ.

*Age of the Beds containing the Vertebrates.*—The Ames Limestone is not a local stratum, but can be "traced from Central West Virginia in Lewis County northward into Pennsylvania and continuously through Greene, Westmoreland, Allegheny, and Beaver Counties into Ohio, whence it can be followed without a break across that state to where it reenters West Virginia near Huntington in Cabell County, to disappear finally under water level at the Kentucky line in Wayne County, eight miles above the mouth of the Big Sandy River" (West Virginia Geological Survey, Vol. II., p. 259). The red clay and shale below the limestone seem to be coextensive with it. There is therefore no doubt of the position of the bed containing these fossils.

All of these vertebrates have evident affinities with Permian species, no reptiles having been found in strata known to be older than the Permian. Similar fossils have been found in beds on the border line between the Permian and the Carboniferous on Prince Edward's Island, and in Illinois, Kansas, New Mexico and Arizona. The formations containing the reptiles in those localities have been referred to the Permo-Carboniferous (*i. e.,* the base of the Permian).

The Conemaugh series of southwestern Pennsylvania has always been considered as Upper or true Carboniferous. Recently Dr. I. C. White has suggested that the Monongahela Series and that part of the Conemaugh Series above the base of the Buffalo Sandstone, should be removed from the Carboniferous and placed in the Permo-Carboniferous. He cites in favor of this action a change in the fauna and flora, and the introduction into the section of "red-beds" above the base of the Buffalo Sandstone (West Virginia Geological Survey, Vol. II., 1903).

The discovery of reptiles in the Pittsburg Red Shale, at a horizon about 150 feet above the base of the beds ascribed by Dr. White to the Permo-Carboniferous, presents an argument in favor of this suggestion. It should be noted, however, that the remains so far found indicate smaller and more simple animals than those found in the Permian of Texas, and thus suggest their somewhat greater antiquity.

The evidence obtained from the invertebrate fossils of the Conemaugh Series, so far as they have been studied, is not of great value in the correlation of these beds, for the fauna consists mostly of long-lived species.

No distinctly Permian fossil plants have yet been found below the Dunkard Series, and the preponderance of the evidence at the present time seems to be in favor of regarding the Conemaugh Series as Pennsylvanian.

Percy E. Raymond

Carnegie Museum,
November 19, 1907

## THE TUSKS AND SIZE OF THE NORTHERN MAMMOTH

The last report of the Smithsonian Institution is accompanied, as has become customary, by an "appendix" consisting of a selected number of scientific papers of very general in-

terest. One of these, by E. Pfizenmayer, deals with the northern mammoth and while very interesting, contains what I believe to be two very serious errors. The first one of these relates to the shape of the tusks, which are discussed at considerable length, the author concluding that the tips pointed forwards and downwards and were used in digging. To support this contention we are given figures of several tusks and a copy of a drawing in a cave at La Mouthe.

It seems a sufficient reply to this last bit of testimony to note that there are many other figures of the mammoth in existence, including various carvings, and in none of these are the tusks depicted as shown in the cave of La Mouthe.

Tusks of the mammoth exist in Alaska in large numbers and many have been brought from there during the past few years. None of them shows the great spiral twist and final downward curvature of the tusks figured by Dr. Pfizenmayer. Tusks of the mammoth, like those of the mastodon, vary very greatly in the amount of curvature and of their spiral twist. As a general rule the curvature is at first downwards and outwards, and then upwards and inwards. The tusks figured by Dr. Pfizenmayer are very evidently those of old individuals and are abnormal in shape. The tusks of the Beresovka mammoth do not exhibit the great spiral curvature of the specimen from Cracow and there is no reason to believe that, *as a rule,* the tusks of the mammoth pointed downwards and forwards. When in exceptional cases they did, it would be quite natural to use them for digging.

The second error is in ascribing to the northern mammoth a greater size than that of existing elephants. Unless I am mistaken, no Siberian mammoth has yet been found having greater height at the shoulders than nine feet six inches, a height occasionally equalled by the Indian elephant and exceeded by the African species, which stands eleven feet high and occasionally slightly more at the shoulders. Dr. Swanton, indeed, has recently recorded a specimen of the Indian elephant having a height of eleven feet, but this seems somewhat questionable. It must not be forgotten, however, that few elephants are allowed to reach their full age and size, much less to develop tusks of the greatest possible length, and this partly accounts for the comparatively small size of the tusks of modern elephants.

There is no tusk of the northern mammoth in existence so heavy as the heaviest examples of tusks of the African elephants and there are few tusks much longer than the greatest recorded length found among this species. The tusks of the northern mammoth average somewhat longer than those of either of the existing species of elephants, but they did not reach so great a diameter as the best specimens of tusks of the African elephant which measure from nine feet to eleven feet six inches long and weigh from 125 to 239 pounds for a single tusk.

It has frequently been shown that the northern mammoth was no larger than existing elephants, as a matter of fact it did not stand so tall as the Soudan elephant, but it seems difficult to effectually dispose of the belief that it was a creature of gigantic size.

The true giants among fossil elephants are *Elephas meridionalis* of southern Europe and *E. imperator* of our western and southwestern states, which stood from twelve feet six inches to possibly thirteen feet six inches high.

F. A. LUCAS

## *CURRENT NOTES ON LAND FORMS*

### A PENEPLAIN IN THE GRAND CANYON DISTRICT

THE existence of an uplifted and dissected peneplain in the Grand Canyon district of Arizona has been recognized for some years, and its relation to the great folds and faults of the region has afforded a subject for interesting discussions. Little has been known in detail, however, regarding the peneplain remnants. Dr. H. H. Robinson, of Yale University, recently offered a contribution to this subject in an account of "The Tertiary peneplain of the Plateau district, and adjacent country, in Arizona and New Mexico" (*Amer. Journ. Science,* XXIV., 1907, 109–129). He concludes that after the occurrence of the principal displacements the greater part of the region was reduced to a peneplain "of practically no relief." The broad uplift of