Uncovering the Ancient Life of Mexico

By CHESTER STOCK

ONE of the attractive features of paleontological study is the opportunity it often affords to investigate the geologic history and characteristic life of the past in strange and out-of-the-way places, and on occasion in foreign lands. While thus far it has not been possible for the Division of the Geological Sciences to finance expeditions far afield, the Institute is favorably situated with regard to the exploration of countries near at hand. For the land of Mexico immediately to the south has been until relatively recently a veritable terra incognita in so far as the history of its past vertebrate life is concerned. A little more than a decade ago the Geology Division, with the cordial permission of the Instituto de Geologia in Mexico City, began its paleontological investigations in southern Nuevo Leon, and the discovery of San Josecito cave and its significant and interesting record of life of the Ice Age have been described in these columns (**Engineering and Science Monthly,** September 1943).

More recently the efforts of the Division have expanded in an attempt to penetrate more deeply into the geologic history of Mexico, in the hope that older stages of the fossil record of higher animals (mammals and birds) might be found. In this connection it should be stated that Mexico today, with the exception of its marginal low lands particularly where they border Central America, has many zoogeographic ties with and is closely related to the Sonoran region, as most of the United States is called. This relationship in its animal life existed during the Ice Age, and apparently during the Tertiary as well, although at present only the later stages in the history of life of this period are sufficiently well known to offer testimony that this is actually the case.

For these reasons, it was gratifying that field parties from the California Institute found abundant fossil evidence of an earlier epoch of the Age of Mammals in western Chihuahua. The area is in the drainage basin of the Rio Papigochic near the border of the State of Sonora (see map, Fig. 1). It lies about 175 miles west of Chihuahua City, the principal city and seat of government of the State of Chihuahua. This portion of the State is accessible by a road which traverses the country west from Chihuahua to Cuauhtemoc to Guerrero, thence north to Santo Tomas, through the fossil-bearing area in which are the villages of Matachic, Temosachic, Yepomera, and Rincon. From Rincon the road continues in a general easterly-northeasterly direction to Babicora, Namiquipa to Juarez.

A railroad line over which mixed passenger and freight service is carried about three times a week runs from Chihuahua to Rincon, Madera, Casa Grande to Juarez.

Matachic, Temosachic, Yepomera, and Rincon, all small settlements near which important and productive fossil localities have been discovered, lie in an intermontane basin bordered on the east by the continental divide and on the west by the Sierra Madre Occidental. This is the region traversed by the Rio Papigochic and its tributary, the Rio Boquilla (Fig. 2). The elevation is between 6000 and 7000 feet. The country is largely grass-covered range land with scattered communities and farms where limited tilling of the soil is carried on. No longer is it a region of haciendas, yet the individual landholder sometimes owns a rather large rancho. On the slopes of still higher country grow oak and juniper, with stands of timber (yellow pine) in the mountains. Here, in the more inaccessible parts may still be encountered an occasional group of banditos.

In riding through the valley and mesa area (Fig. 3) from Santa Tomas to Rincon one might readily conclude that the country rock is barren of fossil material, yet a little prospecting of the light-colored outcrops along the arroyos leading down to the Papigochic and the Boquilla tells at once a different story. Figs. 4 and 5 show the succession of strata and an excavation being worked.

The deposits whence come the vertebrate fossils are several hundred feet thick, and are nearly flat lying. In their upper part they consist of white or light-colored, not well indurated, silts and sands. Interstratified with these sediments are relatively thin limestone strata, the limestone being of fresh-water origin and containing volcanic ash. Lower in this section are greenish clays, thin flows of basalt and sandstone. The fossiliferous strata rest on distinctly older volcanic rocks (flows and tuffs) that are well exposed in the areas bordering the basin of accumulation. In places the the mammal-bearing beds are overlain by gravels laid down at a later time.

The fossil remains consist of bones and teeth. No complete skeletons are found, nor are skulls well preserved. Limb bones that are sturdily constructed are complete, but many are broken. Skulls are shattered and only the hard parts like teeth, and an occasional horn-core, are well preserved. The light-colored sediments particularly have yielded literally thousands of horse teeth, as a rule individually preserved but sometimes forming a series in a fragment of the skull or lower jaw. On the other hand, sufficient is known of some skulls to permit restoration of these types. (Fig. 6). Bird remains are rare.

The assemblage as a whole is a distinctive one, because of the variety of types which comprise it, and because the clear relationships of these animals furnish definite evidence of the geologic age of the formation

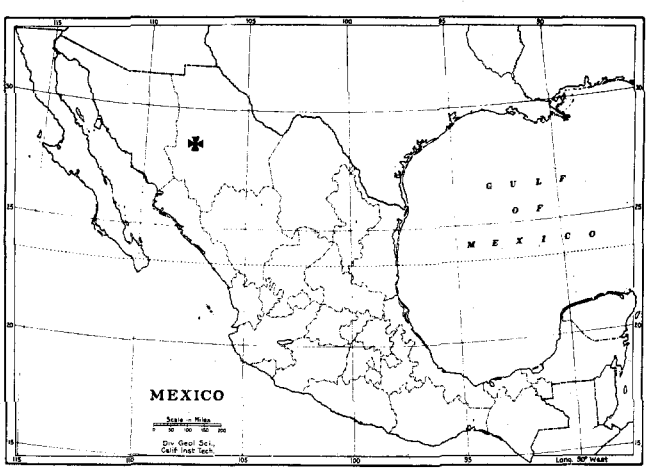
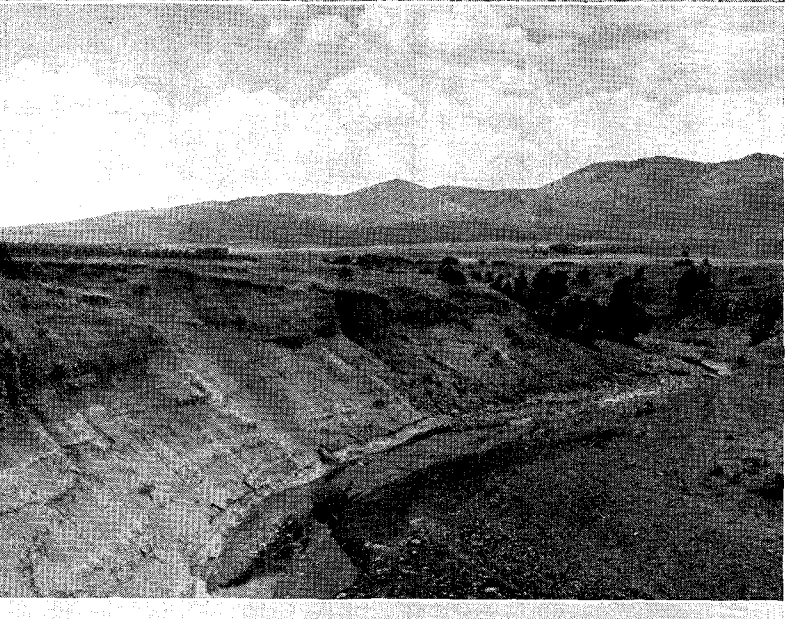


Fig. 1 Outline map of Mexico. Cross shows location of fossil-bearing Pliocene deposits in western Chihuahua.



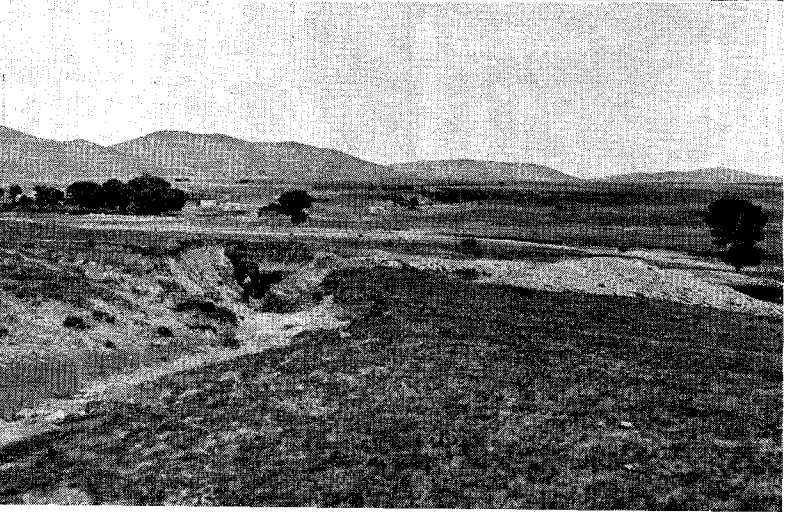


Fig. 2 The Geology Division Dodge Power Wagon crossing the Rio Boquilla north of Yepomera, Chihuahua, Mexico, in the basin of the late Tertiary rocks where fossil mammalian remains were found.

Fig. 3 View looking over the mesa south of Yepomera, Chihuahua, Mexico. Top of Power Wagon was frequently used as a vantage point from which the topography and geology of the region could be sketched. Picture shows graduate student Lloyd Pray, M.S. '43, mapping the fossiliferous deposits.

Fig. 4 View looking south showing exposures of Pliocene deposits along the Arroyo Huschin, western Chihuahua.

Fig. 5 Fossils were frequently found in bank of arroyos cut into the mesa country around Yepomera. Arroyo Los Ponos shown in foreground with excavation made during collecting of fossil material.

in which they occur. As may be surmised, the horses are the most abundant fossil mammals, and they represent at least four kinds. A small horse, measuring slightly more than three feet in height at the withers, possessed teeth in an advanced stage of evolution. It was likewise progressive in the development of its feet, because it appears to have possessed a single functional toe on each foot. With this horse occurred a still smaller form and two larger kinds. Two of these retained the more primitive construction of the foot in which three toes are present. Associated with the horses are rhinoceroses, camels, peccaries, six-horned antelopes, mastodonts, rodents, and rabbits. Along with these herbivorous animals were predatory types like wolves, coyotes, foxes, a great short-faced bear, several kinds of felines, and badgers. A fossil species of flamingo has been described from these deposits.

The assemblage is related in age to a fauna described a few years ago from the Hemphill beds in the Panhandle region of Texas. The latter and similar faunas found elsewhere in Texas and the middle west are regarded as of middle Pliocene age. The Rincon fauna or, as it may be better called, the Yepomera assemblage, on the basis of the stage of evolution of the mammals which comprise it, is later in time than that from the Panhandle, and belongs to a late stage of the middle Pliocene. From the standpoint of the evolution of the horses, the Yepomera species show, for example, an interesting advance beyond the forms known from Texas. The Neohipparion, a horse with many distinctive characters but not on the main line of descent to modern equines, represents definitely a stage in advance of the species from the middle Pliocene of northwestern Nevada, previously described in this journal (**Engineering and Science Monthly,** January 1945).

Perhaps the most remarkable fossil mammal, new to science, found in the Yepomera deposits is an antelope with six horns, three on each side of the top of the skull above the orbits. The restored head of this creature is shown in Fig. 6 in comparison with the head of a modern pronghorn antelope. The horn cores of each side consist of a large prong projecting forward and two prongs in back, arising from a common base, projecting upward and backward.

The history of the region during this stage of the Pliocene, reconstructed from the geologic and paleontologic facts, is that of a lake basin of considerable size with water deep enough to permit in the course of time the deposition of 200 feet or more of clastic sediments, and likewise limestone. During the period of accumulation, volcanic activity in the region gave rise to lava flows and ash showers. Moreover, in the progress of this episode, animal remains were washed into the lake and widely scattered before burial took place. Whether or not the imperfect preservation was due to the oper-

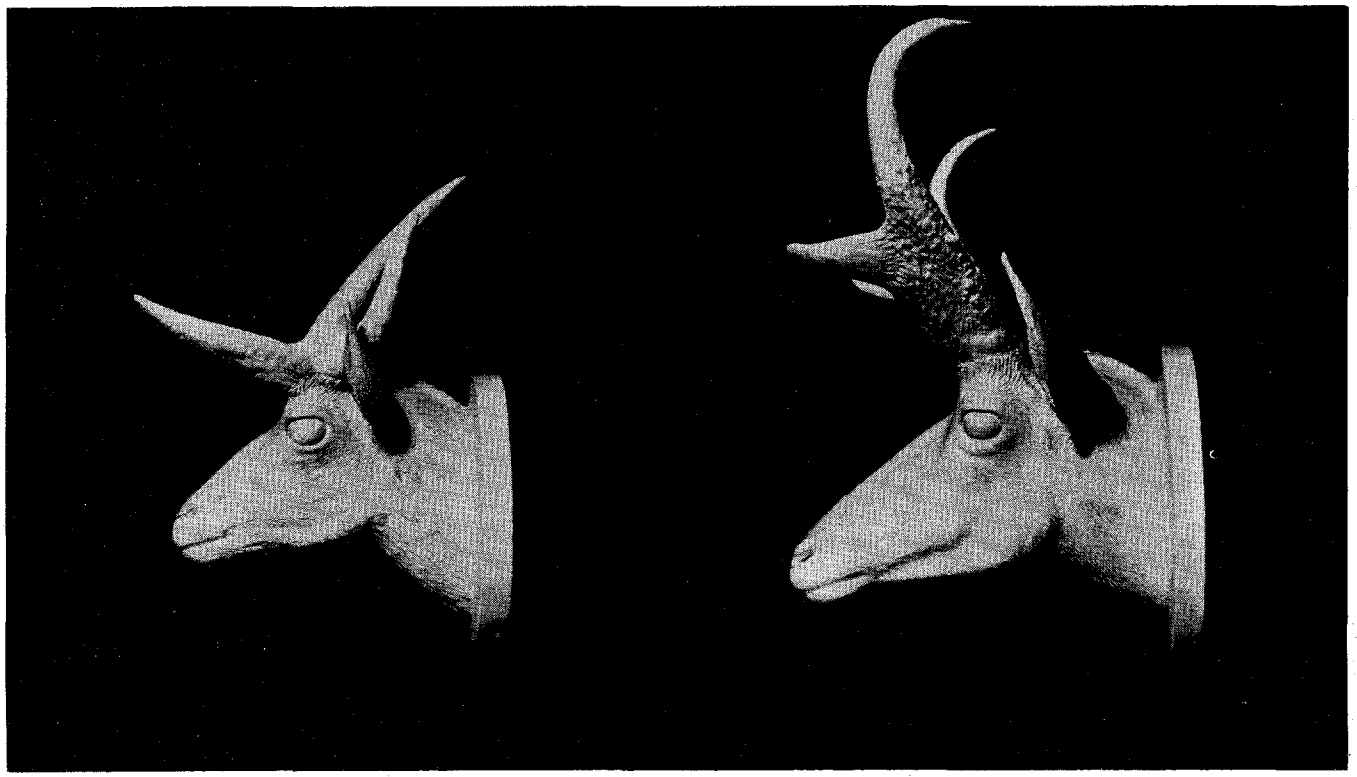


Fig. 6 Restoration of head of extinct 6-horned antelope from the Yepomera Pliocene deposits (on left), and of head of modern pronghorn antelope (on right). Both to the same scale. Restorations by Wm. Otto.

ation of destructive agencies when the organic remains were being transported to their final place of burial, has not yet been determined.

It is apparent from the wealth of material available that the areas immediately adjacent to the lake basin must have been well stocked with animal life. Large herds of horses roamed the country. With these were to be seen on occasion rhinoceroses, the latter representing some of the last of their kind before extinction removed them forever from the native animal world of North America. Smaller herds of camels, antelopes, peccaries, and a few mastodonts give further evidence of the richness of the mammalian assemblage. Large and small carnivores were present, but in fewer numbers, of course, than the herbivores. The hyena-like dogs, known by well-preserved remains at the Panhandle locality, are not so much in evidence in the Mexican assemblage. Small flamingos living in and along the borders of the lake added a picturesque feature to the environment. The remains of flamingos indicate that breeding birds were present at this locality. It is the oldest known occurrence of fossil flamingos in North America.

Only a beginning has been made in the exploration of this part of Chihuahua. The Division of the Geological Sciences plans to continue its geologic and paleontologic studies in the region this year.

Seismological Instruments Developed at C.I.T.

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Thus, under good conditions, the progress of a seismic wave across our network of stations can be measured with a precision of approximately 0.1 sec.

Formerly all seismograms were recorded on 12-x36-in. bromide photographic paper sheets. Since some 30 sheets per day are regularly used in the whole network of stations, the cost for paper is rather high. Moreover, the problem of storage of some 10,000 large sheets per year has been serious. To overcome these difficulties, a film-recorder was developed recently for use with 35 mm motion picture film. The resolving power of film is so much greater than that of paper that a single strip 36-in. long serves for a 24-hour record and actually shows more detail than the large paper sheet. The cost of the film is about one-fifth that of the paper and the storage space required is greatly less than that for paper.

Like the surface of the ocean, the earth's surface is never at rest. It is continuously disturbed by waves, the components of which have varying amplitudes, frequencies, and directions of travel. These minute waves are known as microseisms. Some microseisms are man-made, such as those resulting from traffic and explosions. Others are clearly produced by natural causes. In order to study the possible relation between microseisms and atmospheric pressure variations, a microbarograph was developed. The instrument has a conical diaphragm flexibly sealed in the side of a closed cubical box. A coil attached to the diaphragm is immersed in a permanent magnetic field. Fluctuations in atmospheric pressure move the diaphragm and thus induce electric potentials in the coil. The coil is connected to a galvanometric recorder similar to the ones used with the seismographs previously described. The usable sensitivity of this device is limited solely by the residual atmospheric unrest or noise.

It becomes evident from the description of instruments given above that a modern seismological laboratory requires a miscellany of specialized types of recording and timing devices to obtain the fundamental data on which seismological investigations are based. More than that, the task of planning and building these instruments is never completed. As seismological studies progress, the development continues; not only are better devices evolved, but entirely new instruments are created. The limit of this development seems at present to be defined principally by the ingenuity of the creator.