
# *Late Cenozoic strata of the El Paso-Juarez area*

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# LATE CENOZOIC STRATA OF THE EL PASO-JUAREZ AREA

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## ABSTRACT

Strata of Pleistocene age crop out in the Rio Grande Valley in the El Paso-Juarez area. Two formations are recognized. The Fort Hancock Formation, composed of clay, silt, and fine sand, is of early Pleistocene age. It was deposited in the basin of intermittent Lake Cabeza de Vaca. The Camp Rice Formation, of middle to late Pleistocene age, consists of silty clay, sand, and gravel, and was deposited by the Rio Grande.

## RESUMEN

En el valle del Rio Grande, area de El Paso-Juarez, afloran stra tos de edad pleistocénica. Se conocen dos formaciones. La Formación Fort Hancock del Pleistoceno temprano, está compuesta de arcillas, limo y arenas finas, y fue depositada en la cuenca del lago intermitente Cabeza de Vaca. La formación Camp Rice, del Pleistoceno medio a tardio, consiste de arcillas limosas, arenas y gravas, y fue depositada por el Rio Grande.

## GEOLOGIC SETTING

Pleistocene rocks crop out in the El Paso-Juarez area in the valley of the Rio Grande and its tributaries. West of the metropolitan areas, Pleistocene strata are exposed along the escarpment of the valley where the Rio Grande flows through the Mesilla bolson. Here these strata are covered by several feet of caliche and shifting sand which form the La Mesa surface and characterize the floor of the Mesilla bolson. South of Juarez, Pleistocene strata crop out to a very limited degree in the intermittent streams which mostly head in the Juarez Mountains. East of El Paso and Juarez, Pleistocene sedimentary rocks are exposed on the surface in the Rio Grande Valley near the southern margin of the Hueco bolson.

Early in the Cenozoic, folding and faulting established a basin-and-range topography. The structural framework is that of a series of bolsons separated by mountains.

During the early Cenozoic the bolsons filled separately with sediment washed from the surrounding mountains. At that time the waters of the Rio Grande probably flowed into Chihuahua in the vicinity of Laguna de Guzman and Laguna de Santa Maria (Kottlowski, 1958 ). By early Pleistocene, increased rainfall established lakes in many of the bolsons, and during periods of heavy precipitation the waters became confluent. In this region the intermittent Lake Cabeza de Vaca ( Strain, 1966) formed as a result of the coalescing of the waters filling the Hueco, the Mesilla, and the various bolsons in northern Chihuahua.

About middle Pleistocene, probably in the late Kansan, Lake- Cabeza de Vaca was drained. Outlet cutting south of the Quitman Mountains, approximately 75 miles southeast of Juarez, drained the lake and diverted the Rio Grande from the Mesilla bolson into the Hueco bolson and thence to the Gulf of Mexico. Since that time the Rio Grande has entrenched itself in basin fill by a series of cut-and-fill cycles which developed the various terraces along the valley.

As a result of the draining of Lake Cabeza de Vaca and the diversion of the Rio Grande, the bolsons in northern Chihuahua have remained unbreached and have continued to fill to the present. Because of a lack of stream trenching of the bolson fill in these basins, no extensive knowledge exists of the character of the Pleistocene strata in them. It is logical to assume that these strata are similar to at least the oldest strata exposed in the Rio Grande Valley because the sedimentary history is similar.

Because there was continuous filling of the bolsons in northern Chihuahua during the Cenozoic, an uninterrupted sedimentary sequence must exist in them. If suitable exposures of these rocks could be found, they should reveal an unbroken evolutionary sequence of vertebrate animals ranging from early Cenozoic to the present.

In the El Paso-Juarez area there are two late Cenozoic formations exposed. Strain ( 1966 ) named the older of these the Fort Hancock Formation and the younger the Camp Rice Formation. The Camp Rice is separated from the Fort Hancock by a disconformity. Because these formations are probably typical of most of the Pleistocene rocks of northern Chihuahua, a detailed description of each is given.

## FORT HANCOCK FORMATION

The Fort Hancock Formation is composed of horizontal strata of fine sand, silt, siltstonc, and bentonitic claystone. It is usually yellowish-brown, but the color ranges from grayish-red to brown and occasionally greenish-yellow. A single stratum is seldom more than 15 feet thick and usually lenses out or grades into a different Ethic type in a mile or less. Generally the strata are evenly bedded, but occasionally lenses of cross-bedded silt or fine sand interrupt the uniform layering of the rock. In many places, particularly in the southeastern part of the Hueco bolson, gypsum in the form of selenite occurs as veins and laminae.

Although the maximum exposure of the Fort Hancock at any one locality is about 100 feet, a composite section 350 feet in thickness can be assembled. The base of the formation is not exposed, but wells drilled for oil in the deeper bolsons indicate that the Fort Hancock may be over 5,000 feet thick.

The upper boundary of the Fort Hancock Formation is a disconformity which separates it from the overlying Camp Rice Formation. The even bedding and fine texture of the deposits indicate the Fort Hancock was deposited in the lacustrine and playa environment of Lake Cabeza de Vaca. Erosion of the Fort Hancock produces a badlands-type topography except where it is protected by the overlying Camp Rice Formation and there it forms steep slopes.

Bones of vertebrate animals belonging to the Blancan Fauna indicate that at least the upper part of the Fort Hancock is Aftonian or early Kansan in age. The type section of the Fort Hancock Formation is in the NW1/4 NW1/4 Sec. 19, T. 7, Blk, 73, Hudspeth County, Texas.

## CAMP RICE FORMATION

During the early Pleistocene, outlet cutting drained Lake Cabeza de Vaca, ended the lacustrine depositional environment in which the Fort Hancock formed, and introduced a fluvial condition which characterized the depositional environment of the Camp Rice. Vertebrate fossils indicate that the river began to entrench itself in the old basin fill in Kansan time and the downcutting has continued intermittently to the present time.

The Camp Rice Formation rests unconformably on the Fort Hancock and is composed of gravel, sand, silt, volcanic ash, and caliche. The color range is from a very light gray through shades of pink and orange to light brown. The strata are horizontal and are mainly stream channel and flood plain deposits, interfingered with fanglomerate around the margin of the basin. The Camp Rice is easily distinguished from the Fort Hancock because it is unevenly bedded, has a wide range in particle size, and is lighter in color. The Camp Rice is capped by wind-blown sand, soil, caliche, flood plain, and pediment deposits of late Pleistocene and Recent age.

Volcanic ash, probably Pearlette, occurs in discontinuous lenses at various places both in the Mesilla bolson and the Hueco bolson. Channel gravel and sandstone are common in the lower part of the Camp Rice, and typical exposures can be observed at numerous places from near Las Cruces down river to the eastern end of the Hueco bolson. An important facies of the Camp Rice is a grayish orange-pink to light brown, moderately well-bedded, clayey siltstone which probably represents a flood plain environment.

Caliche capping the Camp Rice is as much as 15 feet thick. In many areas along the edge of the escarpment of the valley the caliche may represent a more or less continuous accumulation from middle Kansan time to the present.

The topographic expression of the Camp Rice varies from low, rounded hills to badlands-type topography. Vertebrate fossils indicate the Camp Rice ranges in age from late early to middle Pleistocene. The type section of the Camp Rice Formation is located in the NE1/4 NE1/4 Sec. 46, T. 6, Blk. 74, Hudspeth County, Texas.

## MEASURED SECTION

Following is a section measured adjacent to the Mexico-New Mexico boundary about 10 miles northwest of the El Paso-Juarez metropolitan area and in the SE1/4 NW1/4 Sec. 33, T. 28 S., R. 3 E., Dona Ana County, New Mexico. This locality is in the Mesilla bolson which structurally continues into Mexico. The stratigraphy at this place is assumed to be representative of that farther south in Chihuahua where significant exposures of the basin fill are lacking.

| | Thickness (feet) |
|---|---|
| CAMP RICE FORMATION | |
| 22. Caliche | 2.5 |
| 21. Sandy pebble gravel; pebble median 20 mm . . | 6.2 |
| Camp Rice total | 8.7 |
| Unconformity | |
| FORT HANCOCK FORMATION | |
| 20. Caliche; very pale orange (10YR 8/2) | 2.5 |
| 19. Clayey siltstone; light brown ( 5YR 6/4); forms slopes | 4.3 |
| 18. Fine sandstone; light brown ( 5YR 5/6); forms benches | 8.5 |
| 17. Siltstone, caliche nodules; light brown (5YR 5/6); forms benches | 4.2 |
| 16. Fine sandstone, poorly cemented, friable; light brown ( 5YR 5/6); forms steep slopes or cliffs | 4.8 |
| 15. Clayey siltstone; light brown ( 5YR 5/6); forms steep slopes | 16.2 |
| 14. Very fine sandstone, poorly consolidated, friable; grayish orange (10YR 7/4) | 3.8 |
| 13. Clayey siltstone, poorly consolidated; light brown (5YR 6/4 ); forms cliffs | 5.4 |
| 12. Silty claystone; light brown (5YR 6/4); forms slopes | 8.5 |
| 11. Clayey siltstone; light brown ( 5YR 5/6); forms cliffs | 7.2 |
| 10. Claystone; light brown ( 5YR 6/4 ); forms slopes | 6.0 |
| 9. Very fine silty sandstone, poorly consolidated, friable; light brown (5YR 6/4); forms ledges . . . | 2.9 |
| 8. Medium gravelly sand, pebble median 18 mm , concretionary lenses; very pale orange (10YR 8/2); vertebrate fossils | 13.8 |
| 7. Clayey silt; light brown (5YR 6/4); forms slopes | 2.9 |
| 6. Silty clay; light brown (5YR 6/4); forms slopes | 6.6 |
| 5. Medium sandstone, concretionary lenses, calcareous cement, friable; grayish orange pink (5YR 7/2) | 8.1 |
| 4. Fine sandstone, poorly cemented and friable, concretions; moderate orange pink (5YR 8/4) . | 3.7 |
| 3. Very fine sandstone, poorly cemented; light brown (5YR 5/6); forms benches | 4.4 |

2. Silty clay; moderate brown (5YR 4/4); forms slopes ..... 12.1
1. Very fine sandstone, poorly cemented, friable; pale yellowish brown (10YR 6/2); forms ledges 4.4

Fort Hancock total ..... 130.3
Section total ..... 139.0

## REFERENCES

Kottlowski, F. E., 1958, Geologic history of the Rio Grande near El Paso: West Texas Geol. Soc. Guide Book, 1958 Field Trip, Franklin and Hueco Mountains, Texas, p. 46-54.

Strain, W. S., 1966, Blancan mammalian fauna and Pleistocene formations, Hudspeth County, Texas; Texas Memorial Museum, Bull. 10, Austin, Texas.