

A POST-GLACIAL POLLEN SEQUENCE  
FROM DARK CANYON CAVE, NEW MEXICO

James Schoenwetter, Southern Illinois  
University  
and  
Wilfred H. Balgemann, Carlsbad, N. M.,<sup>1</sup>

ABSTRACT

Sediment samples taken from a cave in Southeastern New Mexico were processed for examination of their fossil pollen content. The samples were collected from various locations in the cave, some in stratigraphic sequence in a series of deposits which contain fossils ~~of~~ of extinct mammals and archaeological remains. The period of deposition can be shown to encompass most, if not all, of post-glacial time.

The resultant pollen diagram indicates that all of the pollen spectra are essentially the same and that no climatic change can be demonstrated over this long period of time, other than the recognition of somewhat different former riparian conditions. Such proof that the Southwest has been essentially semi-arid country in post-glacial time throws doubt upon hypotheses of mammalian extinction and cultural change which are based upon climatic fluctuations.

The site of investigation was Dark Canyon Cave, located at 3,500 feet elevation on the Newman Ranch near Carlsbad, New Mexico. Though disturbed by unsuccessful mining operations and the activity of pot-hunters, a stratigraphic sequence of deposits in this cave reveals an assemblage of Late Pleistocene faunal remains superimposed by cultural materials of proto-puebloan peoples. The excavation was undertaken by the junior author, an amateur archaeologist, and a group of volunteer students from Carlsbad. Identification of Basketmaker artifacts was kindly undertaken by the late Dr. S. Stubbs of the Laboratory of Anthropology, Santa Fe, New Mexico, and identification of faunal remains by ~~W.~~ L. Hargrave of the Southwest

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The cave is divided into a main chamber and a subsidiary chamber, both containing the same sequence of deposits. Sediment samples were collected by Balgemann from undisturbed pockets in the limestone walls and floors in each of the chambers and processed for pollen analysis by Schoenwetter. The site contains the following sequence of deposits:

Level I: The upper fifteen inches of sediment containing remains of livestock and other evidence of historic occupation as well as a few potsherds tentatively attributed to Pueblo III culture.

Level II: Sediments eighteen to twenty-four inches below the surface, containing baskets, projectile points, matting, ground stone implements, dartshafts, a weaving tool and burials referable to Basketmaker III culture.

Level III: One foot of deposit containing remains of mammoth and three carde projectile points.

Level IV: Three and one-half feet of deposit containing bones of Bison, Bootherium, Equus, Mammuthus, Tetrameryx and extinct forms of vultures and falcon as well as remains of such extant fauna as rabbit, badger, coyote, deer, squirrel and skunk and raven, hawk, grouse, quail, greebe, ducks, condor,

eagle, hawk and roadrunner.

The pollen sequences are shown in the upper part of figure 1. Figure 1 also shows the pollen analysis of samples collected from a buried limestone pocket in the cave wall, from rubble at the mouth of the cave, and from sediment washed from bones from Level IV.

Only a portion of the sediment samples was used for pollen analysis. The major fraction was screened for the recovery of microfossils. Walnut shells were the most common and conspicuous fossil of this type, but twigs, seeds, leaves, Dibers, feathers, bones (including jaws and teeth) of birds and rodents and fecal pellets were plentiful. This material has not yet been identified.

The most striking feature of the pollen diagrams is the similarity of all the samples. Though statistically significant fluctuations in the percentage of the major pollen components (Juglans, Compositae, Gramineae) may be observed, especially in the samples from the subsidiary chamber of the cave, the stability of species composition in samples from all levels is remarkable. Another important feature of the pollen sequence is that only one pollen type, Ulmus, is referable to a plant which is not native to the area at the present time.

Another noteworthy aspect of the fossil pollen flora is the presence of a number of types which are not wind-pollinated. While some of these (Nyctaginaceae, Malvaceae, Euphorbiaceae) are well represented in the fossil pollen records of floodplain sediments in the Southwest (Martin, et. al., MS), We believe the presence of Agave, Liliaceae, and Cactaceae pollen may be due to the droppings of flower and insect-eating bats. It is

noted that these pollen types are in greater frequency in the main chamber--where there are likely to be more bats-- in the smaller chamber of the cave.

The major feature of the pollen diagrams is the lack of major trends in pollen frequencies which might indicate a warming or cooling of the regional climate. There are no levels in which the frequency of pine (indicating cooler climate) increases, nor are there any in which the frequency of oak or grass increase which might indicate a trend toward a warmer, drier environment. It might be argued that the increase in walnut in Level III is evidence for a period of increased moisture, and the presence of a few pollen grains of elm in this level is certainly anomalous, since elm is not a part of the present native flora west of central Texas (Stefferdud, 1949). The association of these indicators of moister conditions with such definite indicators of semi-arid conditions as agave and cactus however, coupled with the lack of change in species composition, forces ~~the~~ the conclusion that ~~there~~ though a change in the local riparian ecology may have occurred no change in the regional climate can be adduced from these data. This interpretation is in substantiated by the presence of pollen of hackberry, ash, alder and sedges which indicate that riparian elements are an important feature of the local flora. As a final note, small quantities of pollen of elm, hickory and basswood have been recovered from floodplain sediments in Arizona (Martin, et. MS) dated about 8,000 years ago.

In the literature on the problem of post-glacial climatic change in the Southwest, much emphasis has been placed upon the

interpretation of floodplain alluvial sediments. Such physical features as buried pond deposits, the presence of wood of temperate trees and the association of now extinct animals with primitive tools have been taken as indicators of moister, cooler conditions in the pluvial and post-glacial period (Sayles and Antevs, 1941). The relationship of man and climate to the extinction of Late Pleistocene mammals which is now generally recognized has been presented by Kræger (1953:241):

"Man certainly had some part in the extinction of late Pleistocene mammals, but the primary causes were probably those of diminishing food supply, increased competition, and perhaps some degree of sterility due to diminishing nutrition. The vast expanses of tall, thick, nutritious grasses which are absolutely necessary to account for the great Pleistocene mammals must have been shrinking during early post-glacial time, then disappeared completely during the long dry period (Altithermal) which followed. Man's hunting of the survivors was made easier by their collecting around shrinking water holes.

Later (p. 243) the same author tells us that the presence of manos and milling stones indicates the transition from hunting economies to those based on plant foods "to supplement the dwindling supply of large Pleistocene mammals whose extinction was probably complete by the end of this stage."

The record from Dark Canyon Cave is a deterrent<sup>f</sup> to such hypotheses. The high percentage of Juglans in the sample<sup>s</sup> from Level I is undoubtedly due to the presence of many walnut trees near the cave today, and the present semi-arid environment is well represented in ~~this~~<sup>these</sup> sample<sup>s</sup> which contain Ephedra, Agave, Cactaceae and Pinus. The persistence<sup>f</sup> of these pollen types throughout the period of deposition, in approximately the same frequencies even to the predominance of walnut, seems direct evidence that no climatic change has occurred.

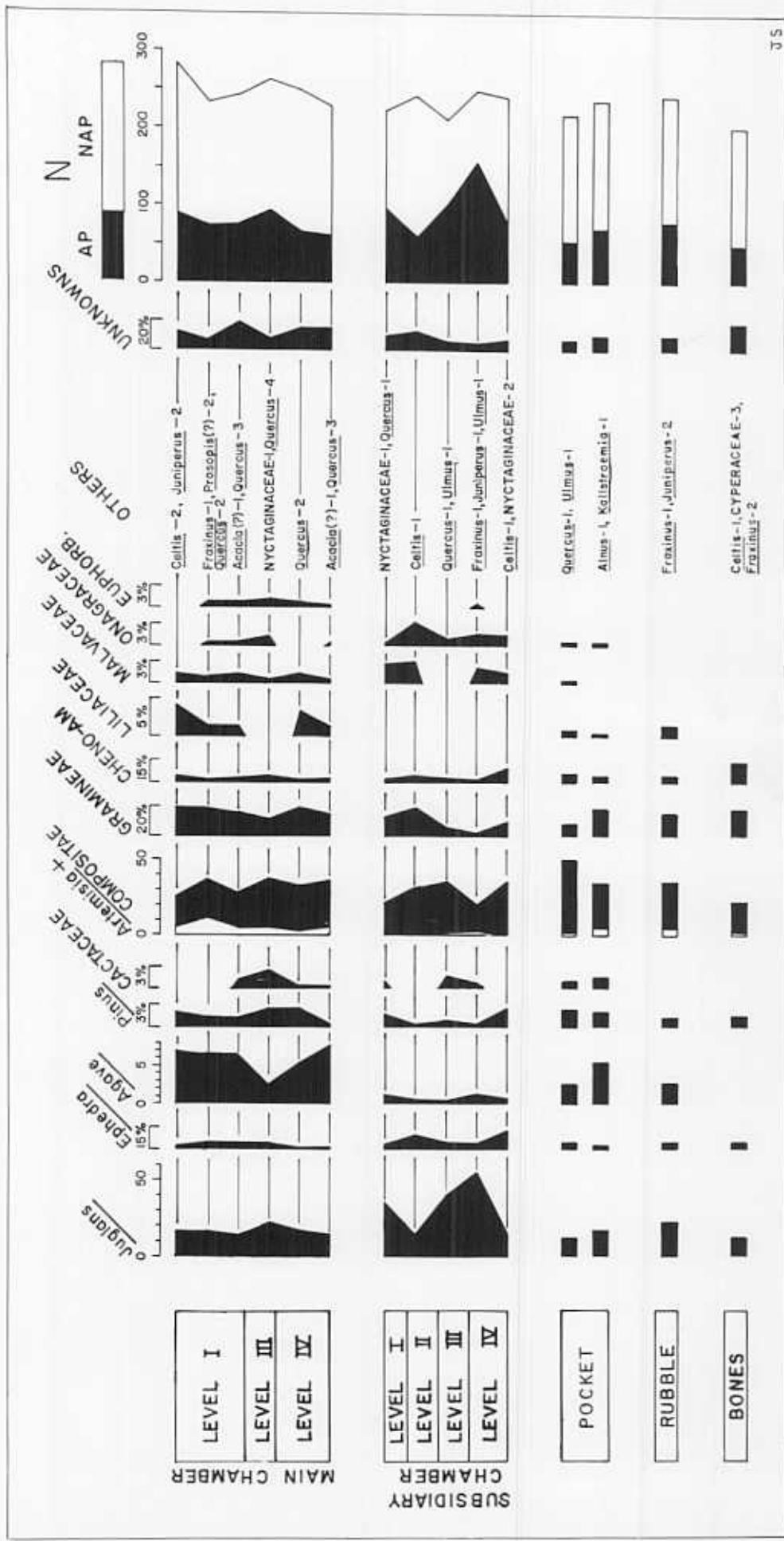
On the basis of the mammalian and cultural fossils, it can

be established with little doubt that the sedimentary deposit is representative of much, if not all, of the post-glacial time period. There is no need to assume that the record extends into full-glacial time, for most of the animals became extinct less than 10,000 years ago (Martin, 1958). It is recognized that the cultural period between the end of big game hunting (Level III ?) and the establishment of Basket-maker III agriculturalists is not represented directly in the sequence, but in the absence of any evidence of interruption in deposition one need not assume that this period is missing. In any case the evidence is clear that such extinct forms as horse, bison and mammoth once lived in an environment not substantially different from that of the present day.

The purpose of this paper is to present evidence rather than to propound interpretations on the causes of extinction of the Late Pleistocene mammals or the reasons for cultural change. We shall not attempt to claim that the extinction of these creatures could not have been due to a "diminishing food supply" or the other primary causes proffered by Krieger. Our basic conclusion is only that whatever the causes of extinction ~~my~~ may be they could hardly have been climatically induced, for evidence is here presented which indicates that climatic conditions have not undergone substantial change since they were alive. As a corollary, the transition from hunting to agriculture was not climatically induced if the extinction of prey was the major factor precipitating the change in economy.

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