Summary of the late Quaternary geology of Lake Animas, Hidalgo County, New Mexico

Fleischhauer, Henry L., Jr., 1978, pp. 283-284

in:

Land of Cochise (Southeastern Arizona), Callender, J. F.; Wilt, J.; Clemons, R. E.; James, H. L.; [eds.], New Mexico Geological Society 29th Annual Fall Field Conference Guidebook, 348 p.

This page is intentionally left blank to maintain order of facing pages.

SUMMARY OF THE LATE QUATERNARY GEOLOGY OF LAKE ANIMAS, HIDALGO COUNTY, NEW MEXICO

H. L. FLEISCHHAUER, J R.
Department of Geosciences
University of Arizona
Tucson, Arizona

INTRODUCTION

During the late Quaternary, a small lake occupied the Lower Animas Valley west of Lordsburg, New Mexico. This body of water was named Lake Animas by Schwennesen (1918), who first recognized lacustrine shoreline features on piedmont toe-slopes surrounding the playas variously known as the Lordsburg Playas, or the North and South Alkali Flats. He identified the lowest shore ridge, which ranges in elevation from 1,269 to 1,276 m (4,165 to 4,185 ft), on the east and west sides of the valley and recognized slightly higher shore features in two areas near the playas. However, Schwennesen (1918, p. 88) postulated a high-stage elevation of 1,338 m (4,390 ft) on the basis of a ridge found near Animas, New Mexico, some 30 km south of the playas. Such a lake would have been over 60 m (200 ft) deep in the Animas Valley and would have extended across the present divide into the valley of the Gila River.

Subsequent workers in the Animas Valley have largely confined their studies to surrounding mountains, though brief statements have been made regarding Lake Animas. Gillerman (1958) mapped lacustrine shore deposits at elevations slightly below 1,280 m (4,200 ft). Flege (1959) mapped the trace of two shorelines on the east side of the valley. The lower of these was placed below 1,280 m, but the higher was placed at about 1,292 m (4,240 ft). Flege (1959, p. 2) interpreted the latter shoreline as a wave-cut terrace.

It is apparent from the existing literature that discrepancies exist regarding the former level and extent of Lake Animas. This study was initiated in an effort to resolve this question as well as questions of age and geologic history of the lake. W. J. Stone, R. H. Weber and J. W. Hawley of the New Mexico Bureau of Mines and Mineral Resources, and J. R. MacMillan of the New Mexico Institute of Mining and Technology provided valuable help during the course of the investigation. Partial financial support was provided by the New Mexico Geological Society and the New Mexico Bureau of Mines. C. V. Haynes, T. L. Smiley and L. D. McFadden of the University of Arizona reviewed the manuscript.

SHORELINES, STRATIGRAPHY AND AGE

Shoreline features of Lake Animas are generally constructional in origin, taking the form of asymmetric ridges of sand and gravel. In profile, they often have steep landward slopes, flat to convex crests, and concave foreshore slopes. Depending upon the locale, the ridges may number from 2 to 5, but 3 are usually present and can be traced with a fair degree of continuity. Mapping in this investigation has revealed that in all instances shoreline features are confined to an elevation interval of 1,269 to 1,280 m (4,165 to 4,200 ft). The 1,292 m (4,240 ft) shoreline of Flege (1959) is a fault scarp that in places cuts obliquely across the contour of the piedmont, a characteristic not typical of shorelines. Some of the shorelines mentioned by Schwennesen (1918) near Animas, New Mexico, may in fact be fault scarps and others are ridges of erosional origin.

The high shore ridge ranges from 1,277 to 1,279 m (4,190 to 4,195 ft) in elevation and is the least prominent and continuous of the three. A definite beach in a protected or sheltered area occurs near the upper end of this range, while the bases of two wave-cut slopes (slopes oversteepened by wave erosion; analogous to sea cliffs, but lacking vertical slopes) occur near the lower end of the range. Thus, the high stage is fixed between features that tend to give maximum and minimum values, respectively, and the mean of the interval, 1,278 m (4,193 ft), is probably the best estimate of the stage elevation. At high stage, Lake Animas had a surface area of about 390 km^2 (150 mi^2) and depth of nearly 15 m (50 ft).

The low and intermediate shorelines contain a variety of features, including beaches, spits, baymouth bars, offshore bars and barriers. Consequently, stage elevations are more difficult to estimate owing to a greater variability of elevations of shore features. The intermediate shore ridge ranges between 1,273 and 1,277 m (4,175 and 4,190 ft). The estimated stage elevation is 1,276 m (4,185 ft), which is the mode of observed values and the lowest elevation observed on the west side of the basin. The low shore ridge ranges from 1,270 to 1,276 m (4,165 to 4,185 ft). The mode of observed values is 1,274 m (4,180 ft) and the stage elevation is assigned to the interval 1,273 to 1,274 m (4,175 to 4,180 ft). The variability in elevations of the low and intermediate shore ridges can be accounted for by depositional environment and shore processes. The nearly identical elevation of the high shore ridge on both sides of the lake, together with its narrow elevation range, virtually precludes post-lacustral, tectonic movements as a mechanism to produce the observed variability in elevations of the lower two shore ridges.

Stratigraphic relations of lacustrine and alluvial sediments are demonstrated in numerous areas where arroyos have breached the low shore ridge (fig. 1). Older, pre-lake sediments

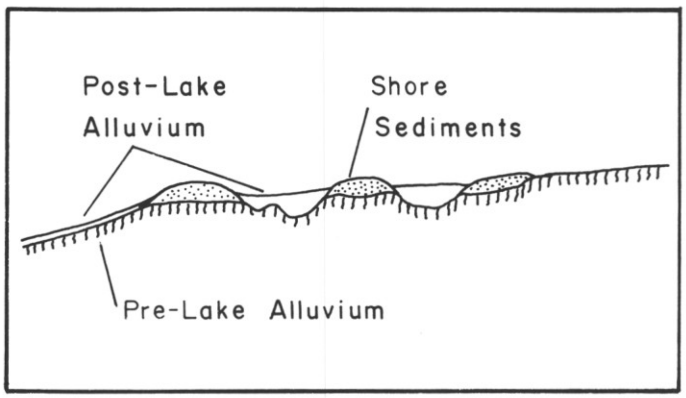

Figure 1. Diagrammatic cross-section showing the stratigraphic relations of lacustrine and alluvial sediments in the Lake Animas shore zone.

and soils comprising the piedmonts of the Peloncillo and Pyramid mountains are buried in toeslope areas by shore deposits and younger, post-lake alluvium. The younger alluvium fills modern stream channels and inter-ridge areas, and comprises small fans constructed lakeward of the low shore ridge. In inter-ridge areas, this alluvium is fine-grained and was apparently deposited following an erosion interval that cut into older alluvium. The younger alluvium is thus inset against both shore ridges and older alluvium. An important result of this erosion interval is that it left the shore ridges stratigraphically isolated from one another. Thus, the determination of lake history on the basis of shoreline stratigraphy is difficult, and the answers to important questions remain conjectural. For example, do the shore ridges represent temporary stillstands during a continuous decline of the lake level following the rise to high stage, or are they separated from each other in time by periods during which the lake was dry or nearly so?

To date, no suitable paleontologic or archeologic evidence has been found by which Lake Animas can be precisely dated, nor has any suitable material for C-14 dating been located. The chief means in this study of estimating the age of Lake Animas was the comparison of the morphology of soils developed in the shore ridges (Fleischhauer, 1977a, 1977b) with dated soils in the Las Cruces area, New Mexico (Gile, 1975).

The low and intermediate shore ridges have soils that are nearly identical in morphology and horizonation, suggesting that they are closely spaced in time. These soils are characterized by cambic horizons and carbonate with stage I morphology (Gile and others, 1966; Hawley and Gile, 1966), and compare with soils developed in parent materials of middle Holocene age (7000-4000 years Before Present) near Las Cruces (Gile, 1975). The soil of the high shore has an argillic horizon but lacks accumulations of pedogenic carbonate. It appears to be older than lower shore ridges by virtue of higher clay content and slightly redder colors, and by greater degree of erosion of the ridge itself.

Chronologies developed by Smith (1968) and Morrison and Frye (1965) indicate that a lacustral cycle began about 6000 years B.P. and reached a maximum about 4000 to 3000 years B.P. in Searles Lake and Lakes Bonneville and Lahontan. On the basis of flora and fauna preserved in deposits of Howell's Ridge Cave in the Little Hatchet Mountains, Van Devender and Wiseman (1977) postulated comparatively wet conditions until about 4500 years B.P. and again about 3000 years B.P. in the Playas Valley to the southeast of the Animas Valley. Also, a metate that appears to predate soil formation was found in the intermediate shore ridge deposits of Lake Animas. However, the artifact may be intrusive and is therefore not necessarily contemporaneous with the existence of the lake. In short, on the basis of regional and local studies, and on the basis of meager archeologic evidence, an estimate of middle Holocene for the low and intermediate shore ridges, as derived from soil morphologies, is not unreasonable. The age of the high shore ridge can only be surmised, but from the chronologies of Smith (1968) and Morrison and Frye (1965), dates of 13,000 to 12,000 years B.P. or 10,500 to 10,000 years B.P. seem most likely. An age much older than 13,000 years seems unreasonable from the standpoint of soil development.

There is the alternative that all three shorelines are late Pleistocene in age. Long (1966) obtained one C-14 date of 10,000 ± 500 years B.P. from calcium carbonate beneath a possible lake clay in one of the two lower shore ridges. However, the exact stratigraphic position of the sample is not clear. In more extensive dating of the deposits of Lake Cochise near Willcox, Arizona, Long (1966) concluded that this lake disappeared by about 10,000 years ago and remained dry through the Holocene.

In conclusion, the age of Lake Animas remains problematic. The estimates presented above are based on comparison and analogy, and the only archeologic evidence is not helpful since the artifact may be intrusive. Soil morphology and degree of shoreline preservation would suggest that the time-separation is greater between the high and intermediate shore ridges than between the intermediate and low shore ridges. Thus, an interval of drying prior to deposition of the intermediate shore sediments might be postulated, but this is speculative. No shoreline features above an elevation of 1,280 m (4,200 ft) have been identified in this study. Although older and possibly deeper lakes may have existed in the Animas Valley, evidence in the form of unequivocal shoreline features was not found, and earlier estimates of higher stages appear to be in error.

REFERENCES

Flege, R. F., 1959, Geology of the Lordsburg Quadrangle, Hidalgo County, New Mexico: New Mexico Bur. Mines and Min. Resources Bull. 62, 36 p.

Fleischhauer, H. L., Jr., 1977a, Soil-age relationships of alluvial and lacustrine deposits, Lower Animas Valley, southwest New Mexico [abs.] : Geol. Soc. America, Abs. with Programs, v. 9, p. 18-19.

_ 1977b, Quaternary geology of Lake Animas, Hidalgo County, New Mexico [M.S. thesis] : Socorro, New Mexico Inst. Min. and Tech., 149 p.

Gile, L. H., 1975, Holocene soils and soil-geomorphic relations in an arid region of southern New Mexico: Quat. Res., v. 5., p. 321-360.

– ---, Peterson, F. F., and Grossman, R. B., 1966, Morphological and genetic sequences of carbonate accumulation in desert soils: Soil Sci., v. 101, p. 347-360.

Gillerman, E., 1958, Geology of the central Peloncillo Mountains, Hidalgo County, New Mexico, and Cochise County, Arizona: New Mexico Bur. Mines and Min. Resources Bull. 57, 152 p.

Hawley, J. W., and Gile, L. H., 1966, Landscape evolution and soil genesis in the Rio Grande region, southern New Mexico: Friends of the Pleistocene, Rocky Mountain Section, 11th Field Conf. Guidebook, p. 25-31.

Long, A., 1966, Late Pleistocene and Recent chronologies of playa lakes in Arizona and New Mexico [Ph.D. dissertation] : Tucson, Univ. Ariz., 141 p.

Morrison, R. B. and Frye, J. C., 1965, Correlation of the middle and late Quaternary successions of the Lake Lahontan, Lake Bonneville, Rocky Mountain (Wasatch Range), southern Great Plains, and eastern Midwest areas: Nevada Bur. Mines Report 9, 45 p.

Schwennesen, A. T., 1918, Ground water in the Animas, Playas, Hachita, and San Luis Basins, New Mexico: U.S. Geological Survey Water-Supply Paper 422, 35 p.

Smith, G. L, 1968, Late Quaternary geologic and climatic history of Searles Lake, southeastern California, *in* Means of correlation of Quaternary successions: I NQUA VII Congress Proc., v. 8, Salt Lake City, University of Utah Press, p. 293-310.

Van Devender, R. R. and Wiseman, F. M., 1977, A preliminary chronology of bioenvironmental changes during the paleoindian period in the southwest, *in* Paleoindian Lifeways: West Texas Museum Assoc., The Museum Jour. XVII, p. 13-27.