A PALEOSOL IN CENTRAL OKLAHOMA AND ITS ARCHAEOLOGICAL SIGNIFICANCE

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A paleosol is a general term introduced by Hunt and Sokoloff (1950) for a soil formed in the past. These "ancient soils" are informally classed into three groups, depending on their occurrence. Most common and easily recognized are buried soils which are covered by alluvium, dune sand, or lava. Exhumed soils were buried at one time but have since been uncovered by erosion of the overlying material. The third, relict soils, were formed under climatic conditions differing from those of the present and have remained unburied at the modern surface (Ruhe 1965). A relict soil undergoes changes in adaptation to the new environment. In time the soil will reflect effects of two different environments and is then called polygenetic (Bryan and Albritton 1943).

In arroyos of arid regions, dark soil bands and layers of caliche are often evidences of buried paleosols. The dark bands represent the carbonaceous A horizon, the top-surface zone of pedocalic soils, and caliche represents the B horizon, the zone of accumulation of calcium carbonate which has been leached from the A horizon.

Not always, though, are dark bands indicators of remnant soils. Miller and Leopold (1953) point out that a layer of fine-grained alluvium will hold water temporarily, thus giving the appearance of a dark carbonaceous layer. These bands and some authentic carbonaceous bands are often not continuous along the arroyo which, in addition to the absence of a zone of accumulation beneath the dark bands, suggest a local feature of little regional significance.

Similarly, caliche has drawbacks as a paleosol indicator. The accumulation of calcium carbonate may be due to a lowering of the water table, or calcium carbonate may accumulate in a zone of finer particle size. It is also possible that a calcareous rock unit in the subsurface may be the source of a large amount of calcium carbonate. Some calcareous accumulations are not calcium carbonate but gypsum (hydrous calcium sulphate) (Leopold, Wolman, and Miller 1964:472). However, the environmental conditions of gypsum accumulation are even less understood than those of calcium carbonate accumulation.

Despite the lack of understanding of caliche formation, large concentrations of nodules and compact cementation of calcium carbonate are generally thought to represent a long range of time of some regional importance. An example of this type of accumulation is a 14-inch layer of nearly solid caliche about 5 feet below the present surface on Tesequite Creek southeast of Kenton, Cimarron County, Oklahoma. On the other hand, small calcareous nodules less than one-half inch in diameter occur locally a few inches below the surface of presumedly unploughed prairie in northern Noble County and southern Kay County. Similar local occurrences of small calcareous nodules in the upper terrace soil on both sides of the Canadian River near Norman, Cleveland County, cannot be singled out for a general chronologic or climatic correlation owing to the present lack of data on the time requirements for caliche accumulation.

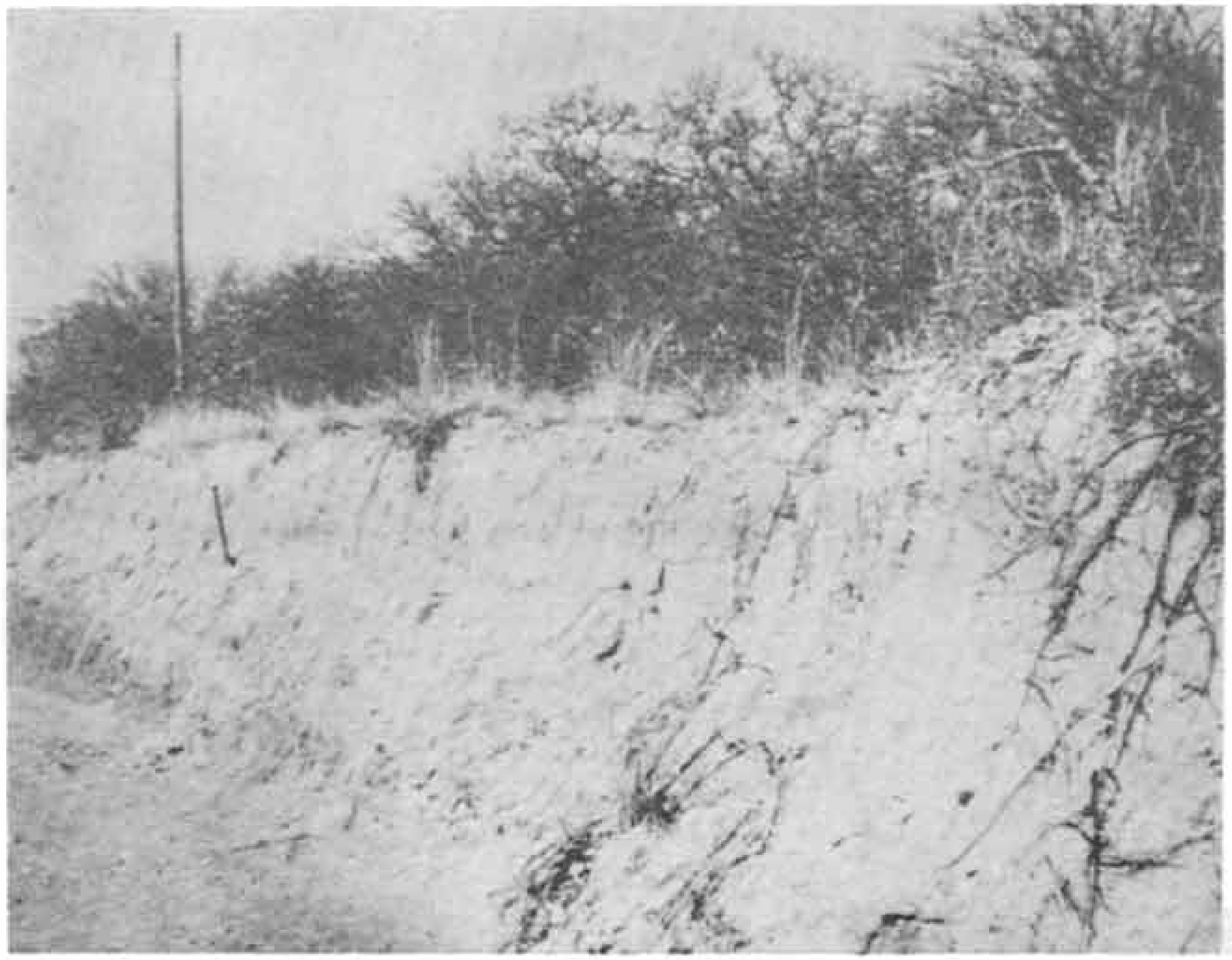
Eroded inactive sand dunes occur extensively on the scrub oak hills in Cleveland and Pottawatomie counties. A road cut near archaeological site Cl-20 exposes a remnant dune with a continuous dark band in the sand (Plate I; Nos. 1 and 2). The dark band does not conform to the present topography and is interpreted as the A horizon of a buried paleosol. The former soil was developed on dune sand which rests directly on the Garber-Wellington (Permian) formations.

In the immediate area of site Cl-20, archaeological materials are entirely absent above the projected hillside outcrop of the paleosol. Two other upland sites, Cl-41 and Cl-42, were discovered only after a portion of the overlying sand was removed by road construction. None of these three sites have produced ceramics. Projectile point typology includes at least 3 Plainview and 1 Ensor (Bell 1958:74; 1960:34), all of Cl-20.

Site Pt-3 is located on a hill on the present dune sand surface. The material assemblage includes a thin, shell-tempered pottery and Fresno and Scallorn projectile types (Bell 1960:44,84).

This evidence suggests that before the manufacture of pottery, sometime between 9000 and 2000 years B.P. (before present), climatic conditions promoted the formation of sand dunes in Cleveland and Pottawatomie counties which buried an old land surface with a fairly well-developed soil.

This time range corresponds to the Hypsithermal interval (Deevey and Flint 1957). The Hypsithermal refers to the period during post-glacial time of maximum warming after the climax of the last major Wisconsin glaciation about 20,000 years B.P. The worldwide warming trend reached an estimated



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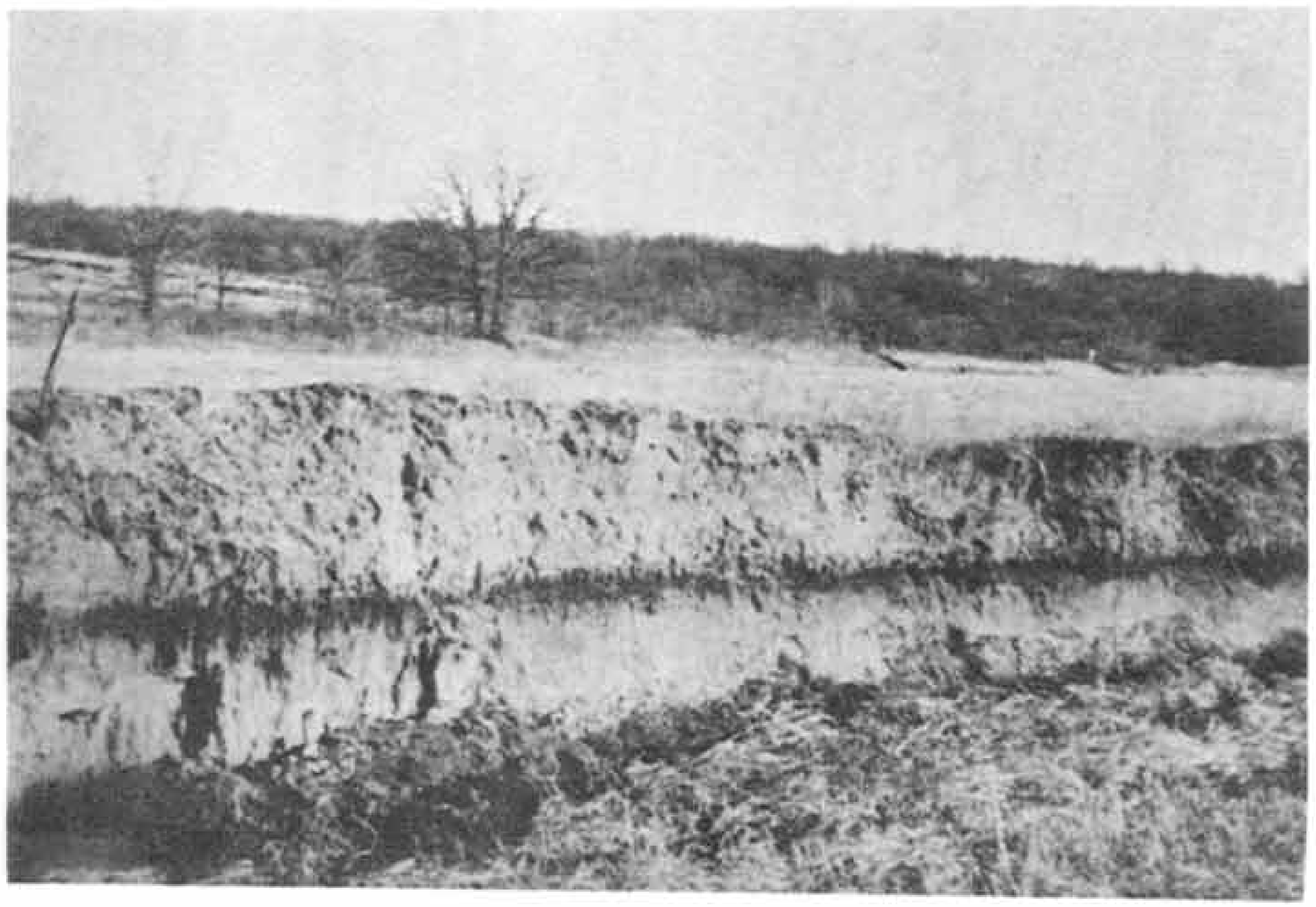

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Plate I

No. 1. Road cut exposing paleosol buried by dune sand near site Cl-20

No. 2. Close-up of No. 1; notice poorly developed humus zone on the modern dune sand surface.

No. 3. Paleosol buried by alluvium, east bank of Spring Creek, just south of bridge, north line of section 5, T. 7 N., R. 1 E., Cleveland County.

peak of some 2° to 3°C. warmer than present about 7000 years B.P. Since then, with short term fluctuations, the earth's climate has gradually become cooler.

Pollen analysis shows that 11,000 years B.P. (Before Present) the vegetation of western Oklahoma was similar to that of today (Wilson 1966), and the vegetation of the Hypsithermal is pictured as reflecting a much more arid climate.

During this time it is not difficult to visualize dune conditions in central Oklahoma. Dune trends in the Southern High Plains indicate a general paleowind direction from west to east during the post-glacial (Reeves 1965). The northeast sides of the major rivers (Cimarron, North Canadian, Canadian) in Oklahoma are dune areas, and some dunes near the present river channels are still active. Undoubtedly many archaeological sites remain buried which may account for the apparent paucity of sites on the terraces of these rivers.

Additional evidence of a paleosol is a buried soil profile which can be traced continuously several miles up and down the tributaries of Little River (Plate I; No. 3). A section was measured and samples collected on the west bank about 550 feet north of the bridge crossing the east fork of Jim Blue Creek, south line of section 9, T. 8 N., R 1 W., Cleveland County:

DESCRIPTION	INCHES
Red clay, very sandy, almost no accumulation of humus at top, small pieces of carbonized wood in lower 9 inches	28
Brown-gray clay, irregular contact with overlying red clay marked by 1-inch layer of sand, animal burrows filled with red sandy clay	10
Gray-black clay, contains small land snails	31
Light-brown clay with small white clay lumps, base not exposed	6

The collected samples were processed for pollen analysis, but no pollen was recovered. The absence of generally abundant soil fungi suggests that the pollen and spores have oxidized.

The paleosol is exposed only in shallow stream cuts, and I have seen no evidence demonstrating the relationship of the soil buried by alluvium with the soil buried by dune sand. Perhaps both represent one soil that stretched as a continuous topographic surface at one time. Additional field observations along with radiocarbon dates are desirable in order to define the relationship of this paleosol to post-glacial events and climates elsewhere.

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