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Survey and Geoarcheological assessment of a Megafauna Locality along the Loop 88 Project, Lubbock County, Texas

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Report for Archeological Survey

Survey and Geoarcheological assessment of a Megafauna Locality along the Loop 88 Project, Lubbock County, Texas

Christopher Ringstaff Principal Investigator,
Antiquities Permit No. 8222

The environmental review, consultation, and other actions required by applicable Federal environmental laws for this project are being, or have been, carried-out by TxDOT pursuant to 23 U.S.C. 327 and a Memorandum of Understanding dated 12-16-14, and executed by FHWA and TxDOT.

Abstract

The Texas Department of Transportation (TxDOT) proposes to construct a new loop along a portion of the existing Farm-to-Market Road (FM) 1585 from 0.5 miles northwest of US 62/82 to 0.5 miles east of US 67 in Lubbock, Texas. The overall Loop 88 Project has a length of approximately 12.38 miles with a width that varies from approximately 150 feet to 300 feet and an area of potential effects (APE) consisting of 736.6 acres. Based on the recommendations of a prior survey conducted under Texas Antiquities Permit 8023, the current investigation examined a 0.2 acre portion of the overall 736.6 acre APE. The survey area is (Area location redacted)

TxDOT conducted the Intensive Archeological Survey and Georcheological Assessment of the 0.2 acre area within existing and proposed new ROW of the Loop 88 Project in Lubbock County, Texas. No previously recorded archeological sites are recorded within the project area although the discovery of fossil mammal remains near a playa 0.23 miles east of the intersection of FM 1585 and FM 179 (under Permit 8023) necessitated the current survey and geoarcheological evaluation. Gradall scraping was proposed to relocate the prior trenches, reach the depth of the purported finds, and carefully scrape to assess presence or absence of additional elements.

During the archeological survey and georcheological assessment of the location presently identified as the Megafauna Locality, the investigations yielded additional disarticulated megafauna remains thought to be mammoth and possibly bison. Pleistocene megafauna remains have been found in archeological sites in the region such as Lubbock Lake, Plainview, and Miami Texas. As such, TxDOT is proceeding cautiously given the potential for a site of considerable antiquity. Given the unusual nature of the find, TxDOT is recommending the Megafauna Locality be treated as eligible for listing to the National Register of Historic Places (36 CFR 800.16(l)) and designation as a State Antiquities Landmark (13 TAC 26.12).

Project Identification

- **Date:** 2/1/2018
- **Date(s) of Survey:** 11/28/2017-11/30/2017
- **Archeological Survey Type:** Reconnaissance ☐ Intensive ☒
- **Report Version:** Draft ☐ Final ☒
- **Jurisdiction:** Federal ☒ State ☒
- **Texas Antiquities Permit Number:** TAC 8222
- **District:** Lubbock
- **County or Counties:** Lubbock
- **USGS Quadrangle(s):** Busterville, Texas 7.5 min Quadrangle
- **Highway:** N/A
- **CSJ:** 1502-01-028
- **Report Author(s):** Christopher Ringstaff and Jim Abbott
- **Principal Investigator:** Christopher Ringstaff

Texas Historical Commission Approval

Signature Date

Project Description

Project Type: Roadway widening and new location project.

Total Project Impact Acreage: 0.2 acres

New Right of Way (ROW) Acreage: 0.2 acres

Easement Acreage: 0.0 acres

Area of Pedestrian Survey: approx. 0.2 acres

Project Description and Impacts: As shown in the attached project location map (Figure 1), the Texas Department of Transportation (TxDOT) is completing archeological survey for the Loop 88 roadway improvement project. The current survey area addressed in this report examined a 0.2 acre location in the western APE. The area was recommended for additional archeological survey and geoarcheological assessment by a prior archeological survey.

Area of Potential Effects (APE): The Area of Potential Effects (APE) for the overall proposed Loop 88 Project has a length of approximately 12.38 miles with a width that varies from approximately 150 feet to 300 feet and an area consisting of 736.6 acres. Based on the recommendations of a prior survey conducted under Texas Antiquities Permit 8023, **the current investigation examined a 0.2 acre portion of the overall 736.6 acre APE**. The survey area is located (Area location redacted)

Project Area Ownership: State of Texas.

Project Setting

Topography: The project area is located in the Southerrn High Plains physiographic region.

Geology: Although the geoarcheological assessment in Appendix A thoroughly addresses the geologica setting, generally the site can be described as being located on the margin of Pleistocene Playa Deposits.

Soils: Based on an overlay analysis using the USDA Soil Survey Geographic Database (SSURGO) data reveals the survey area is located in Acuff Loam 0-1 percent slopes.

Land Use: The APE is located on Agricultural Lands with transportation ROW immediately to the south. .

Vegetation: At the time, the survey area was cleared agricultural fields. Some grasses and tumble weed present.

Estimated Ground Surface Visibility: Excellent. The survey area is located in an open cleared agricultural field.

Comments on Project Setting: This relatively small 0.2 acre area is located immediately north of FM 1585 in an open agricultural field. The setting provided ease of access to heavy equipment required for the undertaking.

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Figure 1

Previous Investigations and Known Archeological Sites: For this project, an archeological survey was conducted by archeologists on behalf of TxDOT from June 5-9, 2017. The survey examined both new and existing ROW for the overall 12.38 mile project and included pedestrian survey, shovel testing, and backhoe trenching. The survey encountered no archeological sites however a single locality of scattered bone along a playa margin in the western portion of the APE. Additional survey with geoarcheological assessment was recommended for that location.

Surveyors: Christopher Ringstaff and James Abbott

Survey Methods: A thorough and detailed description of the field methods for the geomorphic assessment is presented in Appendix A. Generally, the survey consisted of an Intensive Archeological Survey as defined by 13TAC26. Given the depth of the previously reported faunal elements, gradall scraping was utilized by TxDOT archeologists as a means to relocate the previous trenching and bone scatter reported by the prior archeological survey.

Subsurface Excavation:

A single gradall trench (Figure 2) was excavated to a maximum depth of approximately 7 feet. Given the depth of the trench, the Gradall scrape was opened to a maximum width of approximately 40 feet for safety. The length of the trench was approximately 73 feet. Detailed discussion and pictures of the excavation are presented in Appendix A.

Collection and Curation: NO ☒ YES ☐ If yes, specify facility.

Survey Results:

Detailed results of the survey and geoarcheological evaluation is provided in Appendix A: *Geoarcheological Observations Preliminary Trenching at Megafauna Locality on Planned Loop 88, Lubbock County, Texas* although a summary of the investigations is provided in this section. On the recommendation of survey conducted under Permit 8023, the Megafauna Locality was revisited for a more thorough evaluation. With the aid of Gradall scraping, trenches from the previous investigations were relocated, the playa sediments containing the purported remains identified, and additional specimens encountered. Presently, the specimens are thought to be Pleistocene in age consisting of large mammal bone that may include mammoth and bison. As there was no transfer of ownership agreement with the landowner, the elements were stabilized in situ and mapped with survey grade GNSS prior to backfilling. Though no cultural materials were found with the remains, Pleistocene mammal remains have been found in archeological sites in the region such as Lubbock Lake, Plainview, and Miami Texas. As such, TxDOT is proceeding cautiously given the potential for a site of such antiquity.

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Figure 2

Recommendations:

A TxDOT archeologist evaluated the potential for the proposed undertaking to affect archeological historic properties (36 CFR Part 800.16(1) or State Antiquities Landmarks (13 TAC 26.12). During the archeological survey and georcheological assessment of the location presently identified as the Megafauna Locality, the investigations yielded additional disarticulated megafauna remains thought to be mammoth and possibly bison. Pleistocene megafauna remains have been found in archeological sites in the region such as Lubbock Lake, Plainview, and Miami Texas. As such, TxDOT is proceeding cautiously given the potential for a site of considerable antiquity. Given the unusual nature of the find, TxDOT is recommending the Megafauna Locality be treated as eligible for listing to the National Register of Historic Places (36 CFR 800.16(l)) and designation as a State Antiquities Landmark (13 TAC 26.12).

APPENDIX A.

Geoarcheological Observations
Preliminary Trenching at Megafauna Locality on Planned Loop 88, Lubbock County, Texas

Geoarcheological Observations, Preliminary Trenching of Megafauna Locality on Planned Loop 88, Lubbock County, Texas

CSJ: 1502-01-028

James T Abbott, Environmental Affairs Division

Introduction

This brief report describes geoarcheological observations made during mechanical exploration of an apparent megafauna locality site in the planned ROW of Loop 88, southwest of the City of Lubbock in Lubbock County, Texas. Figure 1 illustrates the general location of the site in Texas. This work was conducted to explore the area immediately around a few fragments of massive-walled bone discovered in an exploratory trench excavated by an archeological crew from Cox-McLain Environmental Consulting. The thickness of the cortical bone and the size of one possibly identifiable element (an apparent rib segment) suggested to us that the remains represented Pleistocene megafauna. The purpose of the current investigation was to conduct scraping around this trench to determine (1) if more bone was present, and if so, what it represented; and (2) if possible, if it was associated with evidence of human predation or utilization. Christopher Ringstaff (ENV) served as the Principal Investigator. Fieldwork was conducted on November 29-30, 2017. While sediment samples were taken and are being analyzed, this report is based on field observations only, and all interpretations should be considered preliminary statements. The report is being produced at this time for regulatory purposes, so that the next phase of investigation can move forward. See Ringstaff (attached) for additional details of the project history, regulatory context, and discussion of the archeological results.

Figure 1: General location of the site in Texas in relation to the High Plains surface (dark gray). The term "Southern High Plains" is often reserved for that portion of the High Plains surface south of the Canadian River, which cuts across the Texas panhandle and bisects the surface. However, the discussion in the text applies equally to all of the Texas High Plains.

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to protect sensitive materials

Figure 2: Detail of the Geologic Atlas of Texas, Lubbock and Brownfield sheets, showing the geological setting of the site. Star in inset illustrates the approximate location of the site.

Background and Study Area

Planned Loop 88 provides an outer loop for the City of Lubbock on the Southern High Plains. Figure 1 shows the general location of the site in relation to the State of Texas and the Texas portion of the Southern High Plains. The Southern High Plains, or Llano Estacado, consist of a vast, nearly level surface underlain by a thick Tertiary fluvial sequence termed the Ogallala Formation, overlain by a thinner, dominantly eolian cap of Quaternary age termed the Blackwater Draw Formation (Barnes, 1993; Figure 2). A thick series of indurated calcic soils termed the caprock are developed through the upper Ogallala Formation (Reeves 1976), and stacked calcic soils occur through the Blackwater Draw formation (Holliday 1989). The Blackwater Draw Formation consists of successive layers of eolian sand and dust welded by long-term soil processes, and is up to 27 m thick (Holliday 1989; 1990). This surface is drained by only a few small integrated drainages, such as Yellow House Draw, which flows through Lubbock. Instead of a developed network of surface drainage, the Llano Estacado is dotted with thousands of internally drained playa lakes (Ostercamp and Wood[1987] estimate the number on the Southern Plains at more than 30,000) varying from a few meters to several kilometers in diameter (see Figure 2). Previous studies have demonstrated that playa lakes were a focus of prehistoric activity, almost certainly due to their association with water, and with the organisms that depend on it, in this vast and relatively inhospitable semi-arid setting. Equally important from an archeological perspective, playa lakes provide an important locus of sediment deposition to bury and preserve archeological evidence. The site is associated with one of these myriad, unnamed playa lakes, south of the small town of Wolfforth on the southwestern side of the Lubbock metropolitan area. The area is currently undeveloped and is dominated by cotton fields and dispersed farms, but agriculturally-focused businesses and several small subdivisions of low-density single family homes are also present in the vicinity.

Hovorka (1995) identifies four fundamental geomorphic components of playa lakes in the vicinity of the Pantex Plant near Amarillo. These components consist of the playa lake itself, the playa basin slope, the upland, and a shoreline feature termed the annulus, which is often marked by a slope break at the normal high-water mark of the lake, and may include a wave-cut shoreline and/or small deltas formed where internally-draining gullies empty into the lake. An additional landform sub-assemblage that is often present, but not explicitly included in Hovorka's breakdown, are lunette-shaped dunes derived from deflation of playa sediments during dry episodes in the Late Pleistocene and Early Holocene (Holliday 1997). The current locality share most, and probably all, of these basic features. It is not entirely clear whether a well-developed annulus is present at this locality, as the playa itself lies south of the ROW, and was not examined except from a distance. However, aerial imagery such as Google Earth suggests that an annulus probably is present, and the current playa basin shares many other characteristics with those described in Hovorka's study, including overall size, relief, an asymmetric profile with a steeper side on the west side of the lake, and occasional small, incised centripedal drainages (gullies). Finally, soils data (see below) suggests that two different lunette dunes may be present, one in the basin and the other upslope on the rim of the depression.

With the exception of a few of the largest and deepest features, which host saline lakes, the playa lakes of the Southern High Plains are ephemeral fresh-water features, and are recognized as the primary source of recharge of the Ogallala aquifer (Scanlon et al 1994). Processes of playa formation remain somewhat controversial (Ostercamp and Wood 1987), with proposals including eolian deflation, subsidence related to subsurface dissolution of carbonates and evaporites in the deep subsurface and/or in the phreatic zone, animal wallowing, or even meteorite impacts. While previous studies (e.g., Reeves 1990) have generally assumed that most small to intermediate-sized playas are relatively recent features incised into the mature Blackwater Draw surface, Hovorka's 1995 study provides an appreciation for the depth of playa deposits, and by extension, the likely time-depth of many playa basins. In this study, Hovorka uses systematic coring of a number of basins to show that they are frequently underlain by tens of meters of stratified lacustrine fill with many mature, stacked paleosols, and suggests that the playas have existed during much of the accumulation of the broader Blackwater Draw Formation, and are therefore stable, long-

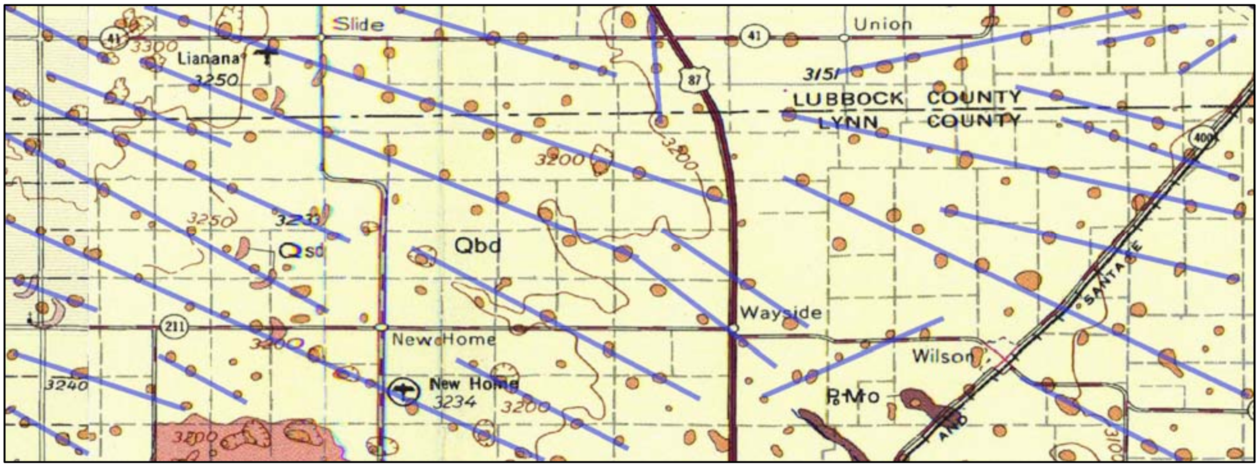

Figure 3: Detail of GAT map south of study area, showing a very strong association between playa locations and arbitrary lineaments.

term features that have developed concomitant with the long-term evolution of the High Plains surface.

While Hovorka's study is informative about the stratigraphic complexity, time depth, and persistence of these geomorphic features, it does not explain their initial formation. Eolian deflation clearly plays some role, as demonstrated by the frequent presence of associated lunette dunes, and subsurface piping also plays a demonstrated role in the development of some features (Ostercamp & Wood 1987). However, patterned placement of playas in many areas (see, for example, Figure 3) suggests that some form of underlying structural control is also in operation. Gustavson et al. (1995) discuss the role of subsidence resulting from salt dissolution in Permian deposits at depth in the formation of playas near the Pantex plant. The linear or quasi-linear arrangement of playas may reflect patterned zones of dissolution of Mio-Pliocene calcretes (Reeves 1990) or Permian evaporites at depth (Gustavson et al. 1995) resulting from subsurface fracture patterns, or buried topographic features in the top of the Ogallala Formation that allowed depressions to persist, or even the influence of modern drainages on patterns of subsurface dissolution and subsidence (Ostercamp & Wood). Whatever the relative import, it is likely that playa lakes formed, and continue to persist, as the result of the complex interplay of several suites of these processes, particularly subsurface dissolution and eolian deflation coupled with climatic controls on rainfall and dust influx.

Soils mapped in the vicinity of the megafauna locality consist of sandy to clayey upland, eolian, and playa soils. Figure 4 is from the USGS Web Soil Survey and shows the mapped distribution of these soils. For comparison, Figure 5 shows a topographic map of approximately the same area. The characteristics of mapped soils are summarized in Table 1. The active playa is dominated by Randall soils, which are typical of all playa floors in the region. These soils consist of dark gray clays exhibiting seasonal cracking and gilgai

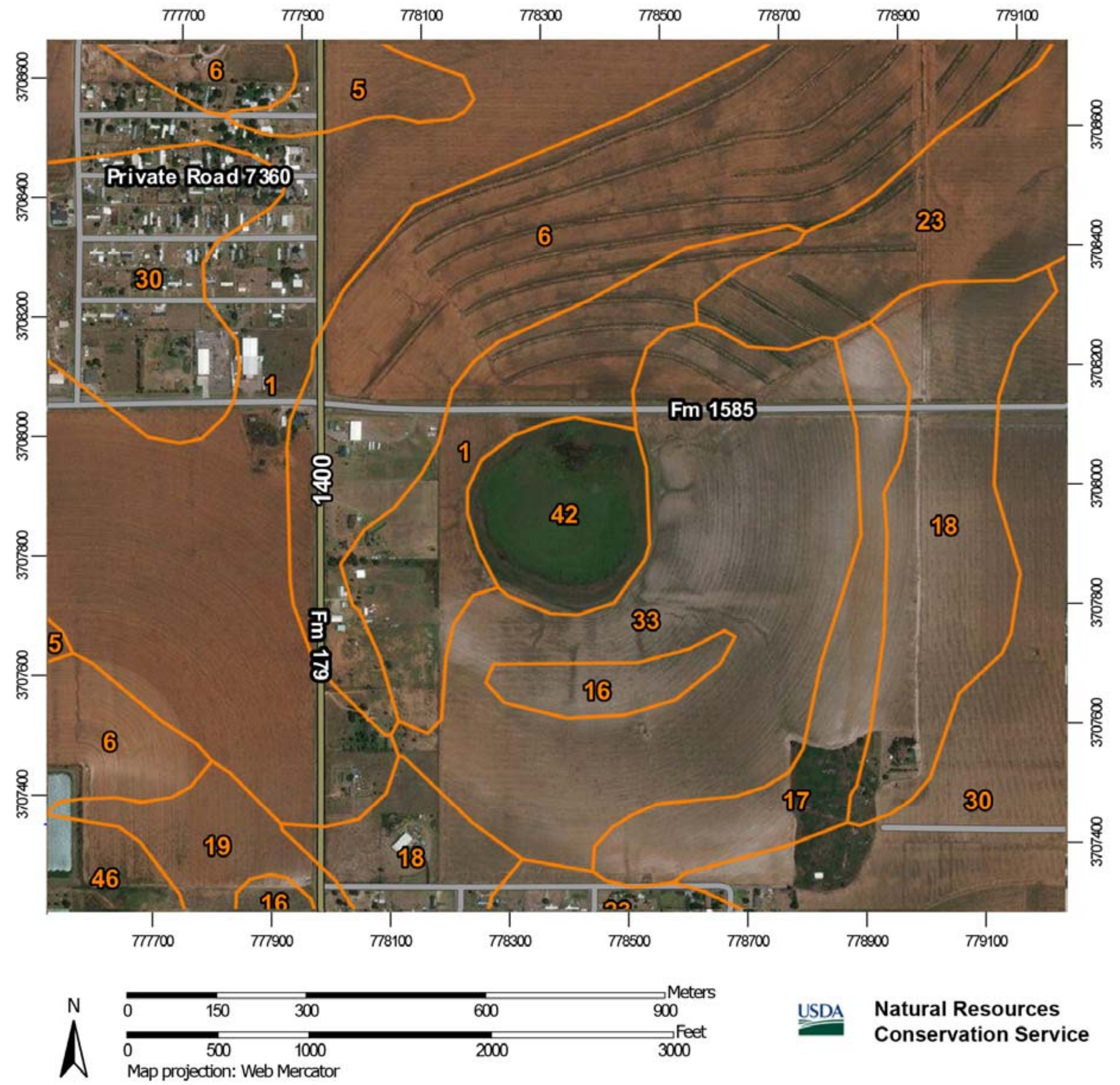

Figure 4: Detail of Web Soil Survey image of playa. Key to soil mapping units: 1= Acuff loam, 1-6% slopes; 5 = Amarillo fine sandy loam, 0-1% slopes; 6 = Amarillo fine sandy loam, 1-3% slopes; 16 = Drake clay loam, 1-3% slopes; 17 = Drake clay loam, 3-5% slopes; 18 = Estacado clay loam, 0-1% slopes; 19 = Estacado clay loam, 1-3% slopes; 23 = Lofton clay loam, 0-1% slopes, rarely ponded; 30 = Olton clay loam, 0-1% slopes; 33 =Portales loam, 0-1% slopes; 42 = Randall clay, 0-1% slopes, rarely ponded; 46 = Zita loam, 0-1% slopes.

microrelief. Surrounding this central zone, which floods on a frequent basis, are soils typical of playa slopes (Acuff, Amarillo, Estacado, Lofton, and Olton series soils), playa floors (Portales series soils), playa margin dunes (Drake series soils), and uplands of the Blackwater Draw Formation (Acuff, Amarillo, Estacado, Olton, and Zita series soils).

The active playa (mapped as Unit 42—Randall clay-- on Figure 4) is approximately 300 meters in diameter, and lies on the south side of FM1585 (130th Street). The actual fossil

Table 1: Characteristics of mapped soils.

Series	Class (Great Group)	Parent Material	Landscape position	Typical Profile	texture	color range
Acuff	Aridic Paleustolls	loamy eolian sediments of the Blackwater draw Fm	Nearly level to gently sloping plains and playa slopes	Ap-Bt1-Bt2-Bt3-Btkk-Btk	loam grading into sandy clay loam	5YR hues throughout
Amarillo	Aridic Paleustalfs	loamy eolian sediments of the Blackwater draw Fm	Nearly level to gently sloping plains and playa slopes	Ap-Bt-Btk-Btkk-B'tk1-B'tk2	fine sandy loam grading into sandy clay loam	Ap horizon is 7.5YR 4/4; all others are 5YR hues.
Drake	Aridic Calciustepts	calcareous, loamy eolian deposits resulting from deflation of playas	linear or curvilinear playa dunes	A1-A2-Bk1-Bk2-Bk3-Bk4	stratified loam, fine sandy loam, and sandy clay loam	grades from 10YR to 2.5Y hues with depth
Estacado	Aridic Paleustolls	calcareous, loamy eolian deposits of the Blackwater draw Fm	Nearly level to gently sloping plains and playa slopes	Ap-Bt1-Bt2-Btk-Btkk	clay loam	10YR grading down to 7.5YR hues
Lofton	Vertic Argiustolls	clayey lacustrine deposits of the Blackwater Draw Fm	playa steps or shallow depressions	Ap-Bt1-Bt2-Btk-Bk	clay loam grading to clay and silty clay	low chroma, 10YR hues
Olton	Aridic Paleustolls	calcareous, clayey eolian deposits of the Blackwater draw Fm	Nearly level to gently sloping plains and upper side slopes of playas and draws	A-Bt1-Bt2-Btk1-Btk2-Btk3	clay loam	7.5YR at surface, grading down through 5YR to 2.5YR hues with depth
Portales	Aridic Calciustolls	moderately fine-textured, calcareous, lacustrine sediments of Pleistocene age	nearly level to gently concave plains associated with playa lake basins	A-Bk1-Bk2-Bkk1-Bkk2	loam and clay loam	low chroma, 10YR hues
Randall	Ustic Epiaquerts	lacustrine sediments derived from the Blackwater Draw Fm	the floor of playa basins	A1-A2-Bw-Bss1-Bss2-Bss3-Bkss	clay	low chroma, 10YR and 2.5Y hues , largely decalcified
Zita	Aridic Haplustolls	calcareous, loamy eolian deposits of the Blackwater draw Fm	nearly level and gently-sloping plains	Ap-A-Bw-Bkk1-Bkk2	loam grading to clay loam	10YR hues

locality lies within the mapped distribution of Unit 1—Acuff loam—which occupies the lower part of the steeper northwestern side of the playa basin. Also of note is the presence of lunettes demarcated by two distinct crescents of Drake soils on the southeast side of the playa basin, including a low relief one in the bottom of the playa pan (mapped as Unit 16), and a second along the southeastern rim (mapped as Unit 17).

Acuff soils are typical of uplands and playa slopes. They are classified as Aridic Paleustolls, and exhibit a typical profile that grades from a dark brown (7.5YR 3/2), 30-cm plow zone into a well-developed sequence of three stacked argillic horizons nearly 70 cm thick. These argillic horizons are composed of reddish brown (5YR 4/4; 5YR 5/4) to yellowish red (5YR5/6) structured clay loam that lightens in color and transitions from decalcified to strongly calcareous with secondary threads and nodules of $CaCO_3$ with depth. At approximately 1 m bgs, the lowest Bt horizon grades abruptly into a plugged (Stage III), pink (5YR8/4), sandy clay loam Btkk horizon that is 50 cm thick and more than 50% carbonate by volume. Below 147 cmbs, this calcrete horizon grades into a reddish-yellow (5YR6/6)

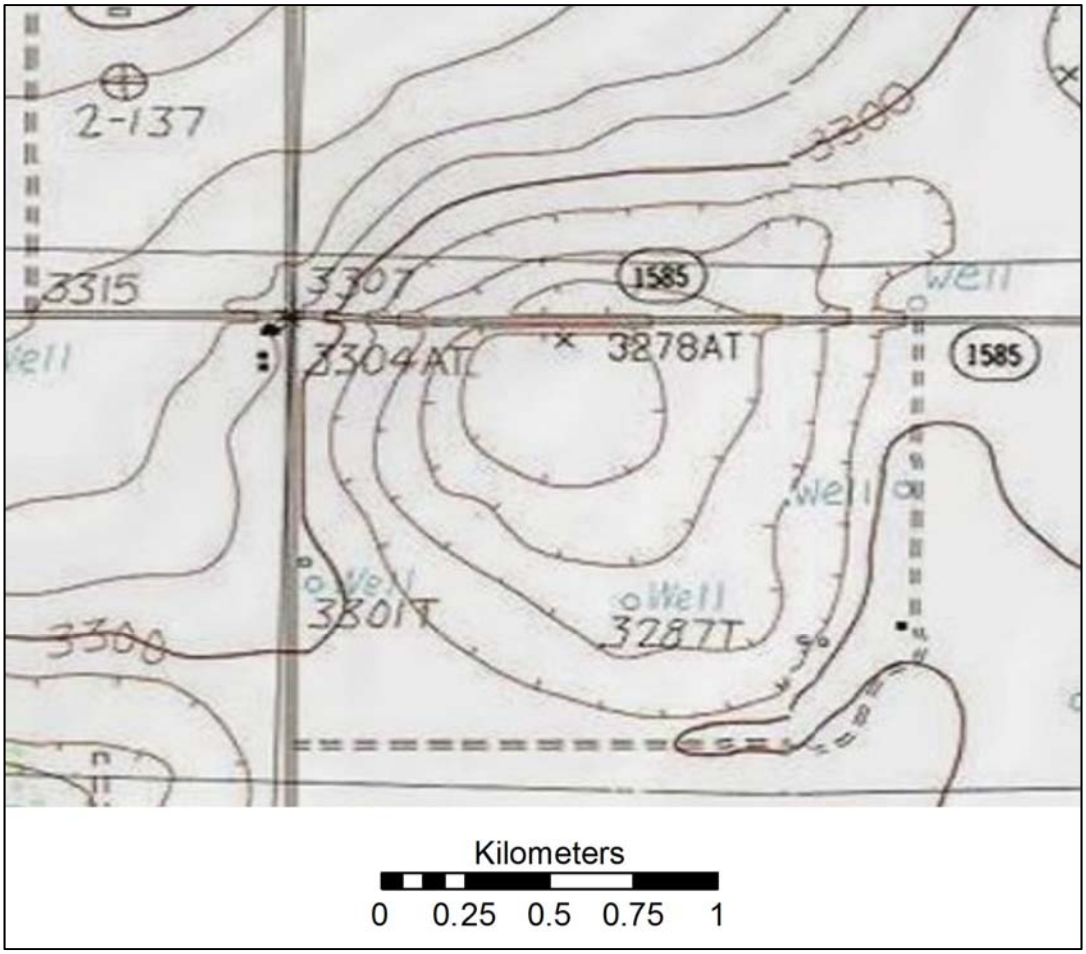

Figure 5: Detail of USGS topo showing configuration of the playa lake. Contours are 5 feet. Compare with Figure 3, which is reproduced at a similar scale.

sandy clay loam Btk horizon that is approximately 20% secondary carbonate nodules, masses, and finely disseminated carbonate.

Randall soils are very different in character. The surface (A1 and A2) horizons consist of very dark gray (10YR 3/1) clay that exhibit iron staining, iron accumulation in pore linings and ped surfaces, and occasional fine, black iron-manganese masses. They grade from fine granular structured in the A1 horizon to fine to moderate blocky structure in the A2. Their combined thickness is 23 cm. The next horizon consists of a dark gray (10YR4/1), angular blocky clay Bw horizon with brown iron staining and iron-manganese masses. It is 20 cm thick, and grades into three dark gray (10YR4/1 to 2.5Y 4/1 with depth) Bss horizons exhibiting crack fills, slickensides, and iron-manganese concretions. They extend from 43 cmbs to 157 cmbs, and ultimately grade into a dark grayish brown (2.5Y4/2) Bkss horizon with about 3% fine masses of carbonate that is greater than 45 cm thick. The sparse amount of carbonate typical of Randall soils is generally believed to reflect carbonate leaching as the playa recharges the aquifer (Scanlon et al. 1994).

Figure 5: Photo comparison of pelvis element at the site with a photo of a mammoth pelvis obtained from the web. Because the elements were not recovered, the tentative identification of the elements as mammoth/mastodon is based solely on this visual comparison.

Work Performed

The current fieldwork was designed as a rapid evaluation to 1) relocate the trench excavated by Cox-McLain; 2) define its boundaries with scraping; and 3) explore the natural matrix immediately surrounding it (i.e., within 1-2 m) to determine if additional megafauna remains are present, and—if possible—whether they are associated with evidence of cultural (human) activity. To this end, the trench location was relocated using a survey-grade Trimble GPS unit, and scraping was begun using a Gradall hydraulic excavator with a five-foot bucket. The outline of the previous trench was quickly found, and monitored scraping was continued at a distance of approximately one meter from the original trench. Scraping continued until bone or other anomalies were noted, when the trench was entered and explored by hand. Once the character of such anomalies was resolved to the archeologist's satisfaction, small bone fragments were mapped with GPS and removed, and scraping continued. This process ultimately resulted in the discovery of two large faunal elements and a number of smaller

(Figure 6 has been altered to protect sensitive materials)

Figure 6: Large element exposed in the sidewall by the last Gradall scrape. The exposed portion of the bone is outlined for visibility, but does not represent the shape of the bone because most of it remains imbedded in the sidewall. Note the contrast between the Bkg horizon containing the bone and the underlying calcrete.

fragments. Although neither was collected, both of the large elements appear to represent a mammoth or mastodon pelvis (Figure 5). As scraping was concluding at one end of the excavation, and the first of the large elements was being carefully exposed by hand at the other, the second large element, was exposed (and damaged) as one of the last scrapes of the bucket was dragged up the sidewall (Figure 6). Scraping was discontinued at a depth of between 200 and 250 cmbs, yielding a pit approximately 4 m wide and about 15 m long, with an additional shallow excavated platform on the north side of the western end that served as a platform for the gradall, and a pedestrian access ramp approximately 2 m wide and 5 m long on the eastern side (Figure 7). Observation of the trench during scraping was conducted by two archeologists and a variety of district personnel. No systematic screening of sediments was conducted.

Geoarcheological documentation of the locality was based on sampling, sketching, and photo-documentation of the western end-wall. Description of the profile reflected a hybrid of stratigraphic and soil –based observations designed to address both depositional environments (e.g.,Reineck & Singh 1983) and subsequent soil processes

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Figure 7: View of the excavation pit after scraping had concluded. Note the location of the large elements and the documented profile.

(e.g.,Schoeneberger 2002) A series of twenty samples were collected from two offset columns to quantitatively characterize the texture, organic matter, carbonate content, and magnetic susceptibility of the sediments, but those samples have not been analyzed at this time. Three samples of megafauna bone weighing between 25 g and 152 g were submitted to Beta Analytic for radiocarbon dating of the collagen fraction, but no collagen was present in any of the samples and no dates were obtained. Given the prominent calcic nature of the playa sediments, dating of the mineral fraction was not considered advisable. No attempt was made to remove either of the large elements.

Geoarcheological Observations

In the absence of pending laboratory data, geoarcheological observations at the Loop 88 megafauna locality are relatively brief, and most of the relevant information can be summed up by a single figure (Figure 8). The upper part of this figure includes two overlapping photographs of the excavation end wall with differing exposures taken at different times, which was necessary because the positioning of the excavation did not allow full illumination of the profile, while the lower part consists of a line drawing illustrating key features in the

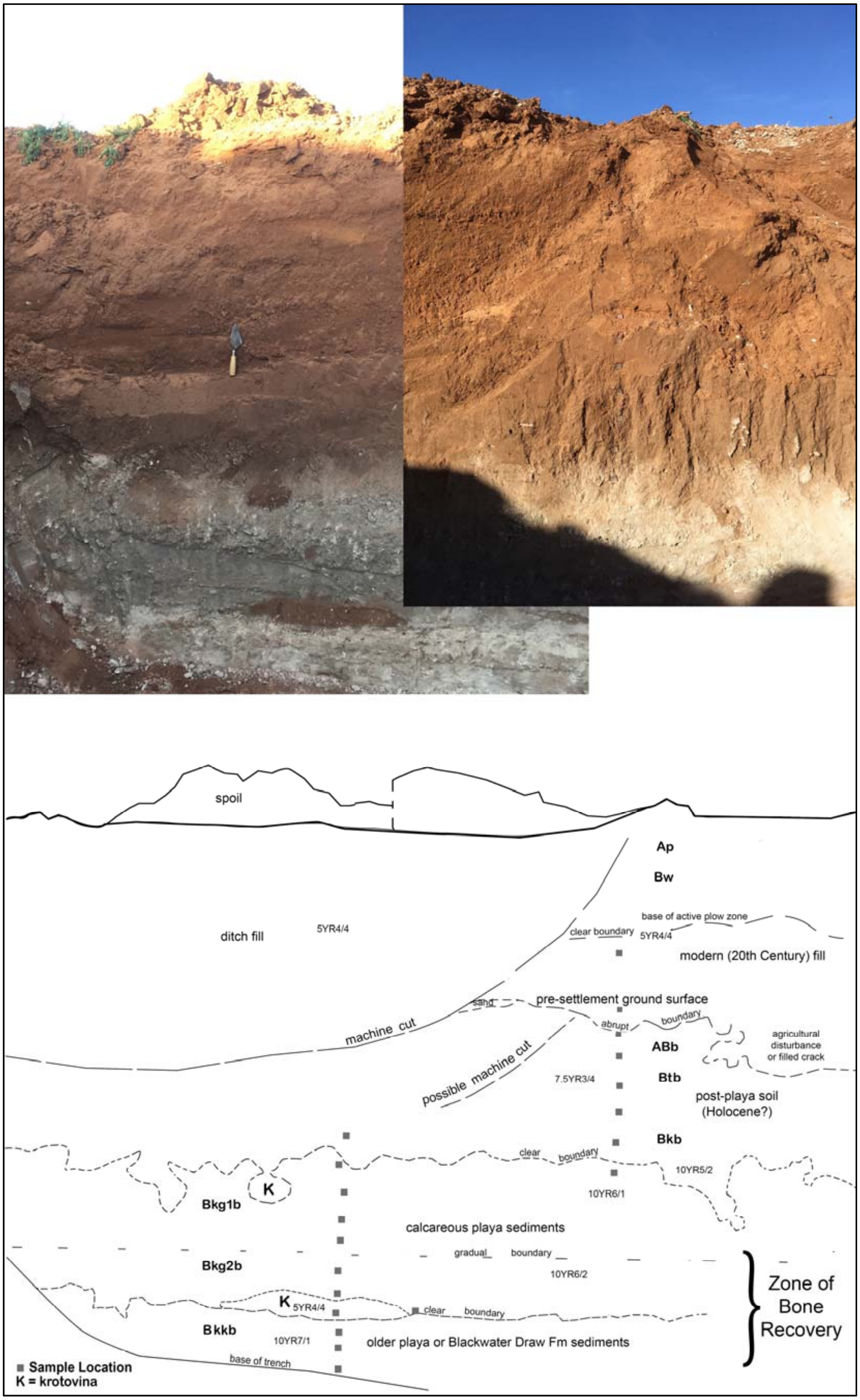

Figure 8: Stratigraphy of the Loop 88 faunal site. See text for discussion.

Figure 9: View of trench annotated to show the relationship between the trench and the two previous Cox-McLain trenches.

photographs. The block was positioned to expose the margins of the original trench cut by Cox-McLain personnel (Figure 9). Approximately 1 m of additional exposure was added to the north and south sides of the trench, and around 3 m of additional exposure was added to the western end. The eastern end was roughly coincident with the end of the original trench.

As the scraping progressed, we began to note several thin beds of loamy fine sand that ran along the southern wall of the block (i.e., the side closer to the road) at depth of approximately 50 cm to more than 100 cm. I was initially unsure what these thin stringers of sand represented, particularly as they did not appear to exist in the opposite wall. However, when the end wall was scraped for recording, the origin of these sands became clear, as the upper part of the profile on the eastern side clearly represented an infilled cut that apparently represents a roadside ditch. The sand lenses represent eolian sediments interbedded with the dark reddish brown (5YR 3/4 to 5YR 4/4) sandy loam ditch fill. This feature was somewhat unexpected, as the block is located on private property (currently) some distance from the road, and at least one buried utility (a phone line) is present between the block and the edge of the existing ROW (Figure 10; also see Figure 7).

This ditch laterally truncates an Ap-Bw sequence that is approximately 80-100 cm thick, and consists of reddish brown sandy loam (5YR 4/4) with little structure. The lower boundary of this packet is wavy to irregular where it overlies a truncated natural soil with a strong profile. This sediment appears to represent eolian and possibly slopewash deposition on the toeslope of the playa slope, and is probably thickened due to agriculturally-stimulated erosion. All of this surface material has been subjected to repeated plowing, and it appears to have aggraded during the historic period. The lower boundary is irregular where the cut sliced through a filled pocket (e.g., burrow opening) or soil crack, and wavy elsewhere. There are small gravels in this irregular pocket, but none were noted elsewhere in the deposit, adding support to the proposition that it represents a filled burrow, where sediments exhumed deeper in the profile were deposited.

Figure 10: View of scraping in progress. Note orange pin flag on far right of frame, which marks location of road-parallel buried utility. For a different perspective, see Figure 7.


Figure 11: Detail of Btb horizon, showing well-developed argillans.

The buried soil broadly resembles the Acuff soil mapped at the location and the Amarillo soil mapped upslope, in that it is a mature soil with a strong Bt horizon (Figure 11) underlain by a strong, and ultimately plugged (Stage III or higher) calcic horizon. However, both Acuff and Amarillo soils exhibit 5YR hues throughout, with light pink calcretes at depth. The Loop 88 megafauna sequence, in contrast, transitions to a dark gray, carbonate-enriched soil that clearly represents ancient playa sediments. In this regard, the lower soil more closely resembles the lacustrine deposits of Portales series than the pink carbonates of these more freely drained soils developed in the Blackwater Draw Formation (see Table 1). This suggests that the margin of the Pleistocene playa lake once extended this far, but that it contracted early enough that playa slope sediments were able to prograde over the top of the lake deposits and form a well-developed soil before the onset of agricultural activity in the late 19th and 20th centuries.

The faunal remains were discovered dispersed throughout the lower part of the gleyed lacustrine sequence (Bkg2b horizon) and the upper part of the underlying calcrete (Bkkb horizon). When related to the west wall witness profile, the faunal material lay between approximately 220 cm and 250 cmbs. However, various elevations determined by the Trimble GPS presents those depths as much shallower, roughly between 110 and 160 cm bgs. In the absence of more compelling data, the reader is encouraged to view the accompanying photographs and judge for themselves.

As each bone fragment was uncovered in the machine scrape, it was assigned a number and exposed quickly by hand. Most fragments proved relatively small, albeit with thick cortical walls indicating that they represent one or more megafauna taxa. These fragments were removed. However, one small exposure of what appeared to be a cluster of bone (labeled “bone cluster 1”) proved to be a largely intact portion of a pelvis, tentatively identified as mammoth or mastodon (see Figure 5). As this bone was being exposed by hand, scraping was continued in the western end, and a second likely pelvis fragment (possibly the other half of the same pelvis) was found as the bucket was dragged up the sidewall, as luck would have it, for the very last time (see Figure 6). This identification was based primarily on the presence of a comparably sized socket; no effort was made to expose the bone any further. Both of the large elements were marked to facilitate relocation and left in place. Recording of the stratigraphic sequence was conducted on the western wall profile. The profile face was cleaned with a shovel, photographed, sketched, and sampled with two offset, overlapping columns of magnetic susceptibility cubes (Figure 12).

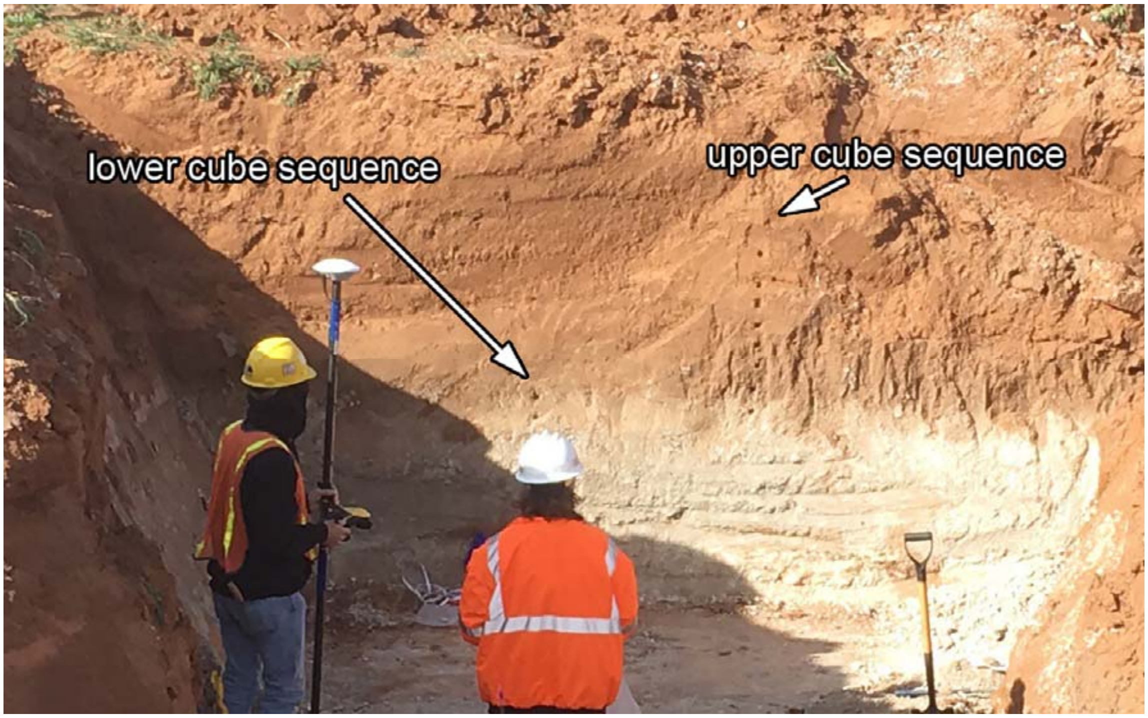

Figure 12: This detail of Figure 7 shows a better view of the witness profile (west wall) and the location of the two offset sample cube sequences.

(Figure 13 has been altered to protect sensitive materials)

Figure 13: Examples of krotovina presumably representing recent prairie dog burrows exposed in the floor of the block during scraping (probably Bkg2 horizon).

Three large fragments of bone, weighing between 25 g and 160 g, were submitted to Beta Analytic for AMS dating of the collagen fraction. No collagen was recovered from any of the samples. Given that the remains were recovered from soil horizons with considerable secondary carbonate accumulation, no attempt was made to date the mineral fraction, as carbon exchange between bone and the surrounding soil environment that would bias the age is extremely likely. Accordingly, the age of the faunal material is unknown, although the size of the animals and the character of soil development both indicate Pleistocene age.

One other aspect of the excavation is worth noting, and that is the detection of large (width of 20 cm+) krotovina at great depth (>2 m) in the profile (Figure 13). The size of these suggests they represent prairie dog burrows, and the lack of consolidation and secondary carbonate in the fill suggests that they are probably quite recent. While they were readily recognized, it is much less certain that substantially older krotovina would be obvious. Because the size of such features is adequate to allow most artifacts to infiltrate deeply into the subsurface, sediments surrounding any cultural material found at depth should be carefully evaluated to minimize the possibility of translocation from higher in the profile.

Conclusions and Recommendations

The work done in November 2017 confirmed the presence of megafauna remains—probably mammoth or mastodon—on the margin of a playa lake deposit. Attempts to date the remains were not successful. Given that human involvement cannot be ruled out, additional work is considered warranted.

The following conclusions are possible given current information:

- The remains are associated with carbonate-enriched (Stage II+), low-chroma clays that are interpreted as playa lake sediments, and underlying clays that are plugged with secondary carbonate (Stage III) but not particularly indurated. It is unclear why the material exists in both of these stratigraphic zones; multiple events may be present, materials may have been mixed by trampling (no evidence for this was noted in the field, but given the intense post-depositional carbonate overprint, it could easily have gone unnoticed), particularly if the sediments were wet, and post-depositional burrowing may have displaced individual fragments.

- The margin of the lake fluctuated in the past. It is unclear if the underlying deposits hosting the Bkk horizon are associated with the playa lake or with freely drained deposits on the margin of the lake, but the former is considered a more likely scenario.

- The overlying deposits represent freely drained deposits that prograded into the basin as the playa withdrew. They probably represent a combination of colluvial, slopewash, and (possibly) eolian activity at the foot of the playa basin slope. The playa has not expanded to cover the locality since this progradational episode occurred.

- The freely-drained deposits were in place for a sufficient amount of time for a soil with a well-developed argillic horizon to form at their surface. Enrichment of the Bk, Bkg, and Bkk horizons almost certainly occurred during the same time frame. It is unclear if all carbonate in the basin deposits is pedogenic, as evaporation of carbonate-rich water at the margin of the playa may have also played a role in their development.

- The upper meter of the deposit consists of reddish brown sandy loams that have been affected by agriculture. The thickness of these deposits is probably a result of colluvium, slopewash, and/or eolian reworking of upland sediments following disruption of the natural sod for agriculture.

- While human involvement in the death or dismemberment of the megafauna cannot be discounted at present, it must be noted that the location on the margin of an ephemeral water body has strong analogs in both the loci of natural elephant deaths in modern Africa, and dispersal and preservation of the carcass after death (e.g., Haynes 1991). This type of event may occur as an elephant weakened by environmental stress (e.g., drought, famine) approaches a diminishing waterhole, breaks through a dry surface crust and is mired in underlying mud—Haynes notes that such an event is far more likely to prove fatal for juvenile and elderly animals than for a mature animal in the prime of life. Of course, miring is not necessary, as animals are generally more likely to die in proximity to waterholes because that's where they gather, particularly in times of environmental stress (Haynes 1988; 1991; Watoa et al. 2016). In any case, the discovery of pelvic elements without related femurs indicates that the skeleton(s) were disarticulated before burial. This may reflect the activity of predators or scavengers (including humans), or it may simply reflect natural processes of decay and dispersion.

- Whatever the method of death, the likelihood of long-term preservation is much greater if the remains are encased in sediment relatively quickly after death, because exposed elephant bone begins to weather into fragments in a matter of months (Haynes 1988). We believe that is the case here—death and decomposition occurred either on the lakebed or on its retreating margins, while subsequent encasement in sediment and preservation occurred in the lakebed itself, possibly as a result of expansion of the lake in the rainy season.

Recommendations:

- Additional work should focus on quickly identifying, exposing and mapping the remains in an area surrounding the current block, and particularly on the side away from the road, where more area is available.

- These investigations should be initiated at the top of the Bkg1 horizon. Overlying sediments should be quickly stripped by a backhoe or excavator, and careful mechanical stripping should be used to speed the process where feasible. It may be possible to quickly determine the distribution of large preserved elements using ground-penetrating radar (GPR) on the stripped surface. Exposed elements should be mapped and examined for taphonomic evidence.

- Attempts to date the bone should focus on the surrounding sediments (e.g., optical-stimulated luminescence) or uranium-thorium (U/Th) dating, but radiocarbon dating of bone material and/or decalcified limnal sediments should provide a minimum age.

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