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A Middle Holocene Radiocarbon Date and the Geologic Context of Human Occupation in the Tulare Lake Basin of California

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In September 2001, during the course of an archaeological project on the western shore of Tulare Lake in Kings County, California, a human proximal phalanx of the left first digit of an adult of indeterminate sex was found in the wall of an irrigation canal in the Tulare Lake Basin, at a depth of ca. 180 cm. below the surface. The bone was subsequently radiocarbon dated to 4,360 ± 70 RCYBP (cal BP 5,270 to 5,170), making it the first human bone from the lake basin to be dated in this manner, and thereby adding to the sparse radiometric data base for Middle Holocene sites in the San Joaquin Valley. As an integral part of the cultural study, the geologic assessment of the project area demonstrated that intact archaeological deposits in this area of the lake basin would likely occur some distance west of the present 190-ft. elevation. Such deposits would also lie several feet below younger alluvial fan deposits.

In 2001 and 2002, the Center for Archaeological Research (CAR) at California State University, Bakersfield, conducted an archaeological assessment on behalf of the California Department of Water Resources (DWR) and the United States Bureau of Reclamation. The purpose of the DWR project was to explore the feasibility of the proposed Arroyo Pasajero Westside Detention Basin along the western edge of the Tulare Lake Basin in the southern San Joaquin Valley, Kings County, California (Fig. 1; also see Gardner 2003). The project was to entail the construction of levees and embankments along this part of Tulare Lake in order to increase the level of flood protection in this area. As part of this investigation, CAR conducted a sample survey of the approximately 13,000-acre project area just north and east of Kettleman City, adjacent to State Route 41. The survey, which was the largest single inventory conducted at Tulare Lake to date, resulted in the documentation of seven previously unrecorded prehistoric sites and 46 isolated prehistoric artifacts (Gardner 2003).

All but one of the sites (CA-KIN-80[1]; see below) and a majority of the isolates were found within 100 m. of the 190-ft. contour shown on the most recent topographic maps. In their discussion of the Witt Site, Riddell and Olsen (1969:121) proposed an elevation of 192 ft. above sea level as a possible Clovis-age shoreline along Dudley Ridge, a few miles southeast of the project area, and argued that this elevation appears to have been a recurrent lake level for a considerable period of time since the Late Pleistocene, at least along the southwest shoreline. This proposition was supported by the work of Gerrit Fenenga in the early to mid-1990s, when sites at or near the 190-ft. elevation containing Clovis materials—along with materials from subsequent time periods—were discovered (e.g., Fenenga 1992, 1993; Kaberline 1993; Jennings et al. 1994; Tidmore et al. 1994; Wolfe et al. 1994; Gardner et al. 1995; Loveall et al. 1995; Manifold et al. 1995; Spohn et al. 1995). With the exception of CA-KIN-80, none of the sites identified during the Arroyo Pasajero project could be assigned a specific age, although most of the artifacts consisted of ground stone implements, which are commonly associated with cultural assemblages of Holocene age.

Continuous occupation at Tulare Lake over the last 12,000 years has been documented by a number of scholars (e.g., Riddell and Olsen 1969; Moratto 1984:81–82, 186; Fenenga 1991, 1993, 1994, 1995; Wallace and Riddell 1991, 1993; Porcasi 2000). Nevertheless, the precise dating of archaeological components, other than through the presumed ages of projectile point types, has thus far been minimal (but see Fenenga 1993:Table 1). This is largely due to agricultural and other historical disturbances that have disrupted or destroyed most of the stratigraphic relationships and the integrity of archaeological deposits in the Basin. Many of the diagnostic artifacts that once dotted the landscape of the Basin have suffered from widespread, unsystematic collection, with little or no site-specific provenience provided (Wallace 1993). Collectors in the area have reported large numbers of fluted projectile points, as well as other purportedly Paleoindian

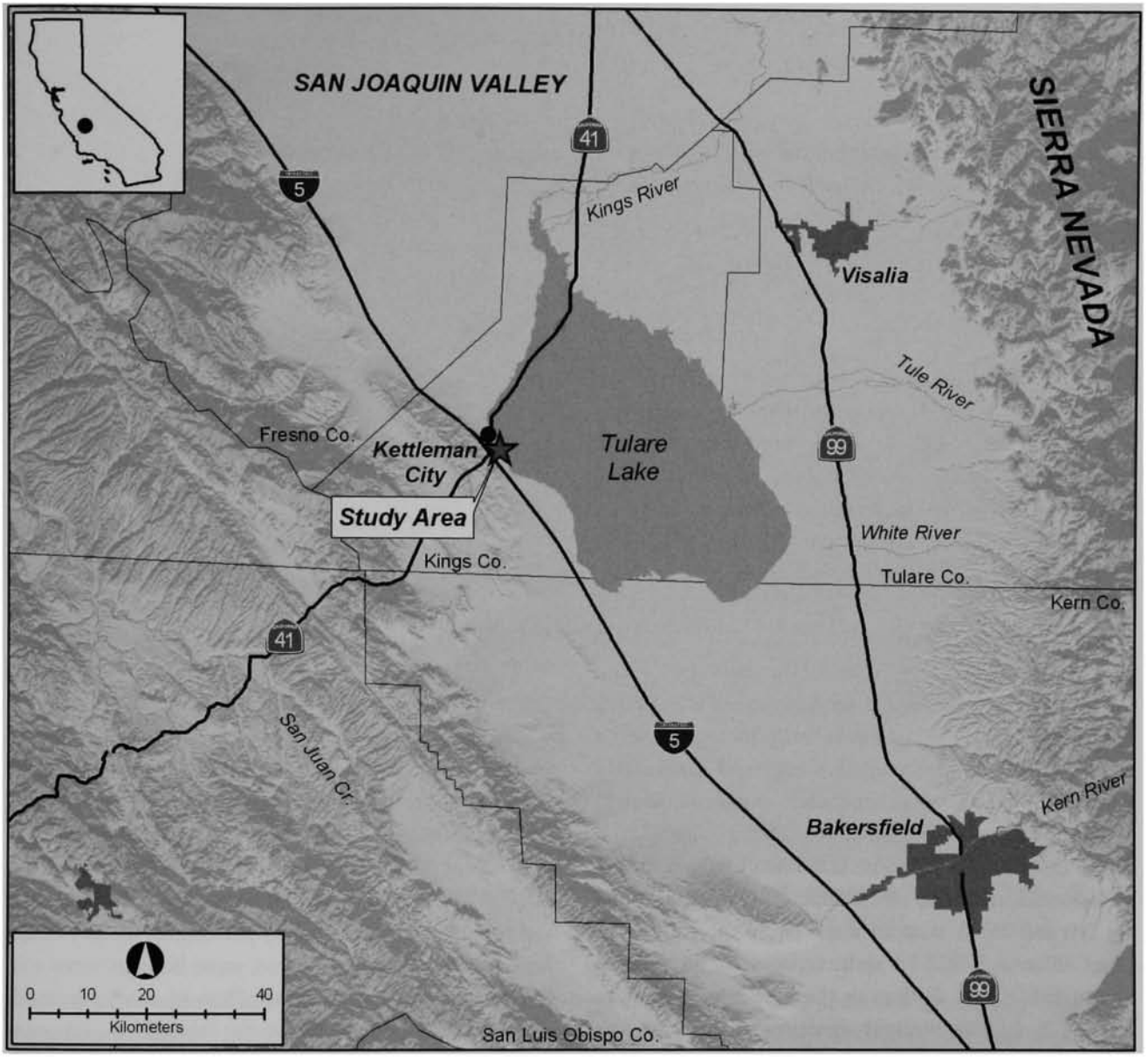

Figure 1. Location of the Study Area. The Tulare Lake shoreline illustrated in this figure was extrapolated from a modern elevation data set and depicts the ca. 195-ft. elevation.

artifacts, from the southwest section of the lake (Riddell and Olsen 1969; Fenenga 1993:25; Wallace 1993:6).

Due to these interpretive problems, one of the primary research goals for CAR during the Arroyo Pasajero project was to attempt to locate intact, subsurface deposits that could illuminate our understanding of the Paleoindian occupation at Tulare Lake. As part of this effort, geologic trenches were placed in various locations in the project area, totaling almost 1,300 linear feet (~396 m.) and ranging from about five to eight feet (~1.5 to 2.4 m.) deep. While no intact cultural deposits were revealed during the trenching operation, several sites were documented, including one (CA-INY-80) with a human bone fragment that was subsequently radiocarbon dated (see below).

CA-KIN-80

Prehistoric site CA-KIN-80 was discovered approximately three-quarters of a mile west of the 190-ft. contour on the

Figure 2. CA-KIN-80 as it appeared in May 2002 (view south).

west side of the highway, at an elevation of 215 ± 10 ft. (Figs. 2 and 3). CA-KIN-80 is the site where the human bone was discovered. The site is situated on the Rambla shoreline, a wavecut shoreline feature evident in the field as a prominent slope (Fig. 4; also see Negrini and Wigand 2003). The Rambla shoreline is defined topographically by a distinct, relatively steep slope observable between the 210 and 230 ft. contour intervals on the Kettleman City, California, USGS 7.5' series topographic quadrangle, although it is less distinct in the area where the site is located. A more obvious signature of the shoreline begins at the eastern end of Kettleman City and extends toward the southeast for ca. two km. until it merges with the northern edge of Dudley Ridge, where the landform on which the well-known Witt Site is located (Riddell and Olsen 1969; Fenenga 1992, 1993). The Rambla shoreline is also prominently displayed on aerial photographs due to its relatively bright signature (Negrini and Wigand 2003:1–6).

CA-KIN-80 was exposed in the wall of a small, north-south oriented irrigation canal along a dirt road. The 2-m. thick sedimentary section in which the site was discovered consisted primarily of a massive, poorly sorted, very-fine grained, olive-colored (5Y 5/3) sand unit with abundant fragments of *Anodonta* shell and charcoal. The uppermost 56 cm. were relatively unconsolidated, containing large, cobble-sized aggregates comprised of sediments similar to that in the rest of the unit. This upper zone was interpreted to be the result of historic tilling, with the large clasts probably being the result of the first plowing (or tillage) of heavy, wet soil. This left much of the original soil structure and composition intact within each soil ped (clast). Any secondary plowing (or tillage) would have produced a finer textured, more homogeneous soil. A continuous 4-cm. thick, medium to coarse-grained, pale olive (5Y 6/3) sand layer ran through the exposure ca. 85 cm. below the surface, suggesting that components of the site found below the till zone were in their original stratigraphic context.

The site consisted of a relatively large midden containing a light, diffuse lithic scatter of chert and jasper debitage, an obsidian biface fragment, a chert 'humpie,'[2] and six fragmentary ground stone implements. Initially, the discovery of the humpie, combined with the elevation of the site, prompted the tentative interpretation of the site as Paleoindian in age (for additional information regarding the significance of humpies, see Sampson 1991; also see below). In addition to the artifacts found at the site, a human bone fragment was also discovered, identified as the proximal phalanx[3] of the left first digit (thumb) of an

Figure 3. Wall of the canal where the human bone was discovered, as the canal appeared in September 2001. Robert Yohe is pointing to the general location where the bone was found.

adult of indeterminate sex. It was found eroding out of the wall of the canal at a depth of about 180 cm. below the surface (see Fig. 2). There were no other human remains recovered at the site and there was no evidence of a burial pit, although such evidence could have been destroyed by construction of the canal. None of the artifacts was directly associated with the human bone, nor could it be determined whether any of the artifacts came from the same level as the bone, as grading for the canal and the road had destroyed much of the stratigraphy.

THE RADIOCARBON DATES

After notifying the Kings County Coroner's Office of the discovery of the bone fragment from CA-KIN-80, CAR received verbal agreement from a local tribal official to radiocarbon date the specimen (via accelerator mass spectrometry [AMS]). The assay returned a result of 4,360 ± 70 RCYBP (cal BP 5,270 to 5,170 at two sigma; Beta-167852). This represents the first human remain from the Tulare Lake Basin to be radiocarbon dated. In a previous study, a human bone from Tulare Lake had been dated by uranium series analysis to 15,802 B.P. (West et al. 1991:1). Little confidence can be placed in that date, however, as uranium series assessments are generally useful only for the period from about 50,000 to 500,000 years ago, and are prone to ambiguous results (e.g., Parkes 1986:102–104).

An *Anodonta* shell fragment from 105 cm. below the surface (75 cm. above the bone fragment) was also AMS dated, yielding an age of 2,880 ± 40 RCYBP (cal BP 3,140 to 2,880 at two sigma; Beta-167851). While no shell

Figure 4a. Photograph of Rambla shoreline feature southeast of CA-KIN-80 (Kettleman Hills in the background).

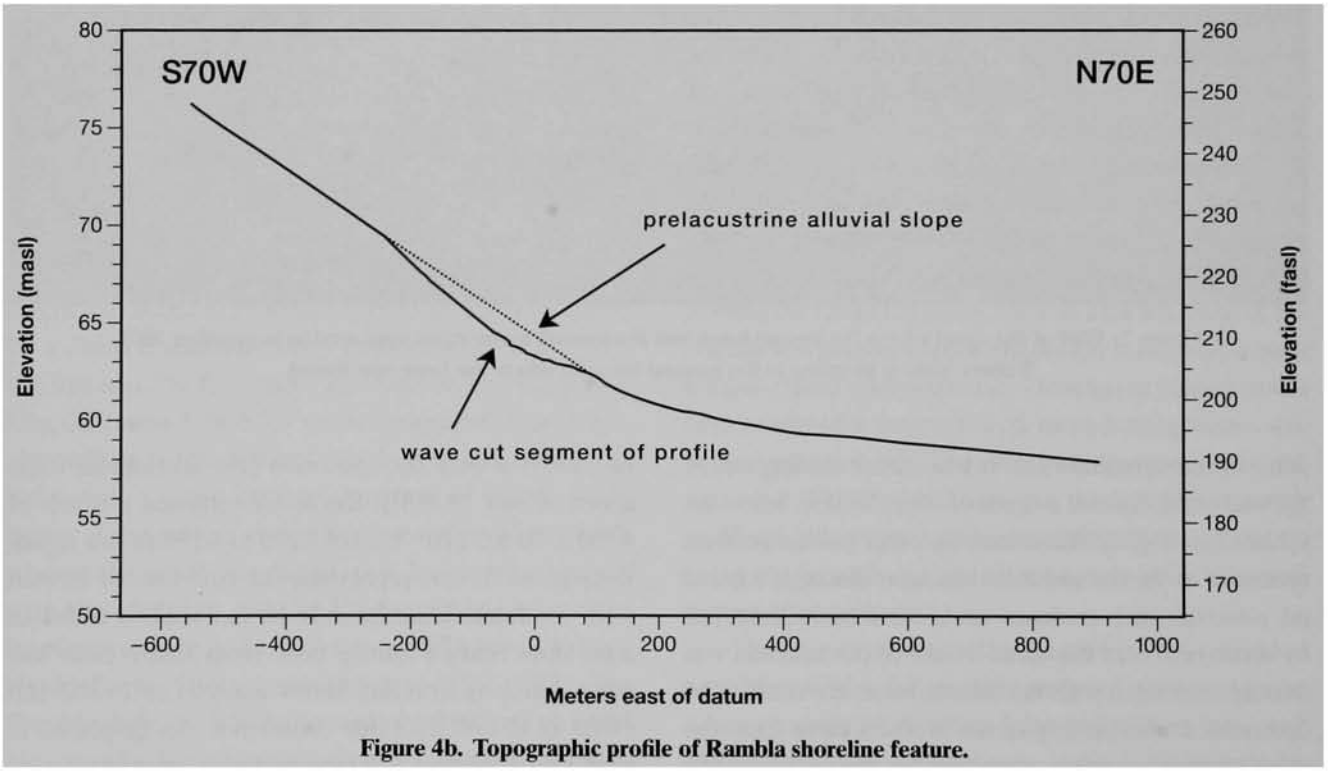

Figure 4b. Topographic profile of Rambla shoreline feature.

correction factor has been established for the Tulare Lake Basin, in the neighboring Buena Vista Lake Basin to the south, a recent study on discrete *Anodonta* shell features at the Manifold site (CA-KER-4220) has provided a correction factor for freshwater shell of –300 years for that basin (Sutton and Orfila 2003). Assuming that this correction factor can be extrapolated to Tulare Lake, it would provide a corrected radiocarbon date on the *Anodonta* shell from CA-KIN-80 of 2,580 ± 40 (cal BP 2,840 to 2,580). This assumption should be viewed with some caution, however, until a correction factor has also been established for Tulare Lake.

THE GEOLOGICAL CONTEXT

The primary focus of the geological component of the Arroyo Passajero Project was to identify the most promising locations for both surface and subsurface evidence of prehistoric human occupation in the project area. To accomplish this goal, efforts were made to locate potential paleoshorelines and paleochannel features through the use of various images of the surface of the earth, and to test the resultant hypotheses by mapping associated geological features in trenches. The results of these efforts, presented in detail in Negrini and Wigand (2003), are summarized below, focusing on the context they provide for the bone date.

As noted above, the CA-KIN-80 site lies within the Rambla shoreline feature that was identified through the mapping efforts. At times, the shoreline is buried by younger alluvial fans protruding eastward out into the Tulare Lake plain from the Kettleman Hills, although nascent development of the shoreline on some of the fans suggests a somewhat complex interplay of stratigraphic relationships between the fans and the shoreline. The identification and dating of high-stand lake deposits in trenches cut into the shoreline feature strongly suggest that Tulare Lake rose to the level of this high stand at least a few times during the past 10,000 years, but was well below this level at the time of the midden occupation suggested by the bone date (e.g., Negrini et al. 2005).

In contrast, analysis of more than eight feet of sediments from a second set of trenches in the project area at a lower elevation (~190-ft.) revealed continuous deposition for the past 5,000 to 6,000 years. Most of this deposition was in a lacustrine setting, although the uppermost 800 years or so of deposits exhibit the coarser grain size and channel features expected of alluvial fans. The projected elevation of Clovis-age deposits in this latter set of trenches is thus well below the 190 ft. mark traditionally associated with Clovis-age occupations in this region.

Combining the results from the set of shoreline trenches and from the lower elevation lake plain trenches, the following context is inferred for Holocene occupations in the Arroyo Passajero project area. First, the middle Holocene occupation associated with the bone date would have been on the prominent landform of the wave-cut shoreline, at the most several hundred meters distant from the lake shore, which maintained a surface elevation of at least 190 ft. throughout this time. Second, the Tulare Lake shoreline in the project area at the time of Clovis occupation must have been well to the west of the present 190 ft. elevation line. Thus, if Clovis-age materials exist in association with the deposits of this shoreline, then they presently lie at least several feet below younger alluvial fan deposits.

DISCUSSION

The maps and photographs that were analyzed as part of this study revealed the presence of at least one alluvial fan extending from the Kettleman Hills to the west of the project area, with the toe of the fan projecting into the project area. This suggested that the fan may postdate the formation of ancient shorelines and paleochannels, thereby concealing them. Further, more mesic environmental conditions during the late Quaternary may have resulted in more permanent stream flow from the Kettleman Hills; thus, the project area near the toe of the fan may have contained a rich ecotone of riparian and lacustrine resources, thereby increasing the likelihood of human occupation, beginning with the Clovis era. These were the justifications for placing the CSUB trenches in the southern part of the project area, as any potentially intact archaeological deposits might also be concealed by the fan.

As a result of this study, it was believed that for the purpose of identifying areas of archaeological sensitivity, the shorelines believed to be buried by the alluvial fans would have provided an almost ideal habitat for human habitation during the Clovis era. It is our belief that the Clovis-age shoreline in this region of Tulare Lake was relatively far to the west of the modern Blakeley Canal, and is now covered by many meters of alluvial sediments. On the other hand, the area abutting the western end of the project area that runs adjacent to the Blakeley Canal along Highway 41 may also contain buried archaeological deposits. At this location, the alluvial fans have deposited a thin layer of silts within the past couple of thousand years, providing a more habitable surface than the muddy sediments found in the northern and easternmost parts of the project area. It is also the area where most of the sites were documented during this study; all were within 100 m. of the 190-ft. contour. It is likely that most of the

archaeological deposits would be restricted to the top ca. 50 cm. of sediment in this region, although agricultural activities have disturbed the context and association of such deposits.

As the trenches did not penetrate into sediments older than a few thousand years, it is possible that humans resided next to a very shallow lake in this region during the Late Pleistocene and Early Holocene. It may be, for instance, that lake sediments of Clovis age could be present in this region at a depth greater than was possible to investigate during this project. Moreover, the likelihood of finding archaeological materials decreases significantly as one moves north of the project area and eastward into the center of the Tulare Lake Basin. Obviously, the center of the basin would be underwater in all but the most arid periods of prehistory.

In the area around CA-KIN-80, the sediments were deposited in an environment favorable for human occupation during those times when Tulare Lake rose near the level of this prominent shoreline. Indeed, the radiocarbon dates from CA-KIN-80 indicate that this area of the Tulare Lake Basin has been a relatively active region for human activity since at least the Middle Holocene. These findings supplement the currently ambiguous data base for sites of this age in the San Joaquin Valley. While a number of sites in the valley are believed to be of Middle Holocene age due to the presence of hundreds of Pinto series projectile points, the few radiometric analyses that have been conducted have provided much later dates (e.g., Fenenga 1994; Siefkin 1999; also see Hartzell 1992; Sutton 1997). On the other hand, the date on the human bone from CA-KIN-80 provides direct evidence for a Middle Holocene occupation of the Tulare Lake Basin, although the scope of that occupation is not at all clear.

However, a few conclusions may be drawn regarding the environmental context of the site. The radiocarbon age of the bone dates to the middle of a time interval of freshwater marsh vegetation expansion that began about 7,000 years ago at Tulare Lake (Davis 1999:Fig. 3). It was a time when the freshwater marsh of the Tulare Lake Basin was apparently at its greatest Holocene extent, just prior to its partial submergence under the expanding lake. It would have been a time of maximal marsh resource availability, probably unparalleled at any time either before or since. Indeed, it may have been the growing marsh that encouraged the largest numbers of ancient Native Americans to enter the basin since Clovis times. The evidence for this period of much wetter conditions, found in the pollen and algae records from the Tulare Lake Basin, mirrors that found in other areas of the West, and has been correlated with the Neoglacial Period (Wigand 1987; Davis 1999; Wigand and Rhode 2002).

CONCLUSIONS

The radiocarbon date on the phalanx discovered during the course of the Arroyo Pasajero project is significant as it represents the only radiometric assay on human bone from the Tulare Lake Basin to date. Although a cultural affiliation cannot be established on the basis of a single bone fragment, the date of the bone provides direct and incontrovertible evidence for a Middle Holocene human occupation of the Tulare Lake Basin, data that are sorely lacking for this region of California. While such an occupation may have been transitory, the presence of Native Americans during a period that appears to correspond to the most extensive marsh and lake expansion in the Tulare Lake Basin is probably not coincidental.

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NOTES

[1]At the time CA-KIN-80 was discovered, the property containing the site was included in the Arroyo Pasajero project area. We subsequently learned that this area had been eliminated from the project. Nevertheless, as we believed at the time that it was in the project area, and since it was in close proximity to it in any case, CA-KIN-80 was included in our investigations for comparative purposes.

[2]Sampson (1991:53) defined humpies as artifacts that are "oblong-shaped, plano-convex in cross-section, and exhibit pointed ends." Since they have been discovered in association with fluted projectile points and other Paleoindian artifacts, they are generally considered to have considerable antiquity (Sampson 1991:57–58).

[3]This bone was erroneously identified as a metacarpal in the original report (Gardner 2003).

REFERENCES

Davis, Owen K.
1999 Pollen Analysis of Tulare Lake, California: Great Basin-like Vegetation in Central California during the Full-glacial and Early Holocene. *Review of Palaeobotany and Palynology* 107:249–257.

Fenenga, Gerrit L.
1991 A Preliminary Examination of Faunal Remains from Early Sites in the Tulare Lake Basin. In *Contributions to Tulare Lake Archaeology I: Background to a Study of Tulare Lake's Archaeological Past*, William J. Wallace and Francis A. Riddell, eds., pp. 11–22. Redondo Beach: Tulare Lake Archaeological Research Group.

1992 *Regional Variability in the Early Prehistory of the American Far West*. Ph.D. dissertation on file at University of California, Berkeley.

1993 Test Excavations at the Witt Site (CA-KIN-32). In *Contributions to Tulare Lake Archaeology II: Finding the Evidence: The Quest for Tulare Lake's Archaeological Past*, William J. Wallace and Francis A. Riddell, eds., pp. 25–38. Redondo Beach: Tulare Lake Archaeological Research Group.

1994 Alternative Interpretations of Late Pleistocene Paleoecology in the Tulare Lake Basin, San Joaquin Valley, California. *Kern County Archaeological Society Journal* 5:105–117.

1995 Man and Pleistocene Fauna at Tulare Lake. Paper presented at the annual meetings of the Society for California Archaeology, Eureka.

Gardner, Jill K.
2003 *Archaeological Assessment of the Arroyo Pasajero Westside Detention Basin with Tulare Lakebed Flood Storage Project, Kings County, California*. Report on file at the Southern San Joaquin Valley Historical Resources Information Center, California State University, Bakersfield.

Gardner, Jill K., Kimberley Pinney, Hubert Switalski, and Athene Mitchell
1995 *Preliminary Archaeological Investigations at the Van Den Enden Site, Tulare Lake, California*. Report on file at the Southern San Joaquin Valley Historical Resources Information Center, California State University, Bakersfield.

Hartzell, Leslie L.
1992 *Hunter-gatherer Adaptive Strategies and Lacustrine Environments in the Buena Vista Lake Basin, Kern County, California*. Ph.D. dissertation on file at University of California, Davis.

Jenkins, Dennis L.
1987 Dating the Pinto Occupation at Rogers Ridge: A Fossil Spring Site in the Mojave Desert, California. *Journal of California and Great Basin Anthropology* 9(2):214–231.

Jennings, Wendy, Jan Lawson, Marion-Rowe Iriart, and Brian T. Woods
1994 *Flooterville: Test Excavations at a Late Pleistocene Site at Tulare Lake*. Report on file at the Southern San Joaquin Valley Historical Resources Information Center, California State University, Bakersfield.

Kaberline, C. M.
1993 *An Analysis of Tulare Lake Pinto Points*. Report on file at the Southern San Joaquin Valley Historical Resources Information Center, California State University, Bakersfield.

Loveall, John, Jim Cassidy, and Ryan Bloching
1995 *Archaeological Investigations at the Mr. Ed Site, Tulare Lake, California*. Report on file at the Southern San Joaquin Valley Historical Resources Information Center, California State University, Bakersfield.

Manifold, Douglas, Patricia Manifold, and Greg Reza
1995 *Archaeological Investigations at the Corral Site, Tulare Lake, California*. Report on file at the Southern San Joaquin Valley Historical Resources Information Center, California State University, Bakersfield.

Moratto, Michael J.
1984 *California Archaeology*. San Diego: Academic Press.

Negrini, Robert M., and Peter E. Wigand
2003 Appendix I: Geologic Investigations of Ancient Shorelines Along the Western Margin of Tulare Lake. In *Archaeological Assessment of the Arroyo Pasajero Westside Detention Basin with Tulare Lakebed Flood Storage Project, Kings County, California*, by Jill K. Gardner. Report on file at the Southern San Joaquin Valley Historical Resources Information Center, California State University, Bakersfield.

Negrini, Robert M., Peter E. Wigand, Sara Draucker, Kenneth Gobalet, Jill K. Gardner, Mark Q. Sutton, and Robert M. Yohe II
2005 The Holocene Lake-Level History of Tulare Lake, California. *Geological Society of America, Abstracts with Program* 37(7):121.

Parkes, P. A.
1986 *Current Scientific Techniques in Archaeology*. New York: St. Martin's Press.

Porcasi, Judith F. (ed.)
2000 Archaeological Investigations at CA-TUL-1613, The Creighton Ranch Site, Tulare County, California. In *Contributions to Tulare Lake Archaeology III*. Redondo Beach: Tulare Lake Archaeological Research Group.

Riddell, Francis A., and William H. Olsen
1969 An Early Man Site in the San Joaquin Valley, California. *American Antiquity* 34(2):121–130.

Sampson, Michael
1991 A Distinctive Flaked-Stone Tool Type from Tulare Lake Basin. In *Contributions to Tulare Lake Archaeology I: Background to a Study of Tulare Lake's Archaeological Past*, William J. Wallace and Francis A. Riddell, eds., pp. 53–60. Redondo Beach: Tulare Lake Archaeological Research Group.

Siefkin, Nelson
1999 *Archaeology of the Redtfeldt Mound (CA-KIN-66), Tulare Basin, California*. Master's thesis on file at California State University, Bakersfield.

Spohn, Summer, Keith Terintino, and Jon Suter
1995 *Further Analyses at the Flooterville Site: A Late Pleistocene Camp on Tulare Lake*. Report on file at the Southern San Joaquin Valley Historical Resources Information Center, California State University, Bakersfield.

Sutton, Mark Q.
1996 The Current Status of Archaeological Research in the Mojave Desert. *Journal of California and Great Basin Anthropology* 18(2):221–257.

1997 A Background for Archaeological Investigations at Buena Vista Lake, Southern San Joaquin Valley, California. *Kern County Archaeological Society Journal* 8:3–21.

Sutton, Mark Q., and Rebecca S. Orfila
2003 A Radiocarbon Correction Factor for Freshwater Shell for the Lower Kern River/Northern Buena Vista Lake Area, Southern San Joaquin Valley, California. *Society for California Archaeology Newsletter* 37(2):23–24.

Tidmore, Robin, Janet Pritchard, Stacey Tisler, and David Schuldies
1994 *Preliminary Archaeological Investigations at the EWE-20 Site, Tulare Lake, California*. Report on file at the Southern San Joaquin Valley Historical Resources Information Center, California State University, Bakersfield.

Vaughn, Sheila J., and Claude N. Warren
1987 Toward a Definition of Pinto Points. *Journal of California and Great Basin Anthropology* 9(2):199–213.

Wallace, William J.
1993 A Lost Opportunity? A Brief History of Archaeological Research in the Tulare Lake Basin. In *Contributions to Tulare Lake Archaeology II: Finding the Evidence: The Quest for Tulare Lake's Archaeological Past*, William J. Wallace and Francis A. Riddell, eds., pp. 1–11. Redondo Beach: Tulare Lake Archaeological Research Group.

Wallace, William J., and Francis A. Riddell (eds.)
1991 *Contributions to Tulare Lake Archaeology I: Background to a Study of Tulare Lake's Archaeological Past*. Redondo Beach: Tulare Lake Archaeological Research Group.

1993 *Contributions to Tulare Lake Archaeology II: Finding the Evidence: The Quest for Tulare Lake's Archaeological Past*. Redondo Beach: Tulare Lake Archaeological Research Group.

Warren, Claude N.
1980 Pinto Points and Problems in Mojave Desert Archaeology. In *Anthropological Papers in Memory of Earl H. Swanson, Jr.*, Lucille B. Harten, Claude N. Warren, and Donald R. Tuohy, eds., pp. 67–76. Pocatello: Idaho Museum of Natural History.

1984 The Desert Region. In *California Archaeology*, by Michael J. Moratto, pp. 339–430. San Diego: Academic Press.

2002 Time, Form, and Variability: Lake Mojave and Pinto Periods in Mojave Desert Prehistory. In *Essays in California Archaeology: A Memorial to Franklin Fenenga*, William J. Wallace and Francis A. Riddell, eds., pp. 129–141. Berkeley: Contributions of the University of California Archaeological Research Facility 60.

Warren, Claude N., and Robert H. Crabtree
1986 Prehistory of the Southwestern Area. In *Handbook of North American Indians, Vol. 11, Great Basin*, Warren L. d'Azevedo, ed., pp. 183–193. Washington, D.C.: Smithsonian Institution.

West, G. James, Owen K. Davis, and William J. Wallace
1991 Fluted Points at Tulare Lake, California: Environmental Background. In *Contributions to Tulare Lake Archaeology I: Background to a Study of Tulare Lake's Archaeological Past*, William J. Wallace and Francis A. Riddell, eds., pp. 1–10. Redondo Beach: Tulare Lake Archaeological Research Group.

Wigand, Peter E.
1987 Diamond Pond, Harney County, Oregon: Vegetation History and Water Table in the Eastern Oregon Desert. *Great Basin Naturalist* 47(3):427–458.

Wigand, Peter E., and David Rhode
2002 Great Basin Vegetation History and Aquatic Systems: The Last 150,000 Years. In *Great Basin Aquatic Systems History*, Robert Hershler, David B. Madsen and Donald R. Currey, eds., pp. 309–367. Washington, D.C.: Smithsonian Institution Press.

Wolfe, Susan, Christine McQueen, and Solveig Thompson
1994 *Preliminary Archaeological Investigations at the Corral Site*. Report on file at the Southern San Joaquin Valley Historical Resources Information Center, California State University, Bakersfield.