ARCHAEOLOGICAL TESTING AT THE CALLO DEL OSO SITE, 41NU2, NUECES COUNTY, TEXAS

by

Robert A. Ricklis

Prepared for

Naismith Engineering, Inc.

Under Texas Antiquities Permit No. 1727

Coastal Archaeological Research, Inc.
Corpus Christi, Texas

1997

ABSTRACT

Archaeological testing was conducted at the Callo del Oso Site, 41NU2, during September and October, 1996. This site, situated primarily on a clay dune on the west shoreline of Oso Bay, has been known since the early years of this century as a prehistoric occupation site and a major prehistoric burial site. The primary goal of this work was to determine if significant prehistoric occupation components and/or prehistoric Native American burials were present within the right-of-way of proposed construction planned for road widening at Spur 3, Ennis Joslin Road, Corpus Christi. Two basic procedures were employed in the testing. First, 30 sediment cores were extracted using a 2-inch split spoon coring device. Sediment profiles within the cores were recorded, which permitted a general reconstruction of the sedimentary geology of the site. Second, a series of 20 test units was excavated using a gradeall. This procedure permitted identification of prehistoric cultural features, and provided unit wall profiles which aided in further defining the stratigraphic nature of the site. Cultural debris was found to be confined almost exclusively to thin soil horizons within the clay dunes or to the base of cumulic soils developed behind the clay dune.

Findings included scattered faunal remains and a small number of artifacts. An intact prehistoric burial was found in Test Unit 5, in the southern part of the site within the right-of-way on the east side of Ennis Joslin Road. Also found in this unit was an intact human ulna, believed to be displaced from another burial near, but outside the limits of, Test Unit 5. A single human molar was found in a cultural zone in Test Unit 1, also in the south part of the site, near the east side of Ennis Joslin Road. These findings suggest that additional burials may be present within the bounds of proposed road expansion. Human remains were not found in other test units, but limited access to properties at the time of testing precludes a confident conclusion that other areas of the site within the construction right-of-way are devoid of burials.

Prehistoric occupation debris was generally not abundant within cultural zones. However, sufficient faunal materials were recovered with which to make certain inferences concerning resource use and seasonality of fishing. The few artifacts recovered include items of stone, shell and a single artifact of modified bone. On the basis of the limited quantities of faunal materials and artifacts, it is concluded that occupation at the site was light, in contrast to the use of the local as a major cemetery.

Five radiocarbon dates place the occupation components within the Archaic stage, between ca. 4500 and 1300 years b.p. No Late Prehistoric materials were found.

On the basis of the findings, it is recommended that limited mitigation and additional testing should be conducted prior to construction in order to locate and protect prehistoric human remains which may be present; this work should focus on the southern area of the site, where human remains were encountered during testing. Archaeological monitoring is recommended during planned road construction, in order to preclude damage to human remains which may escape detection during testing and mitigation. No additional investigation of zones containing occupation (non-burial) materials is recommended, due to the sparse amount of cultural debris present. However, it is recommended that additional samples for radiocarbon dating be extracted during mitigation in order to better define the history of occupation at the site.

TABLE OF CONTENTS

LIST OF FIGURES

LIST OF TABLES

ACKNOWLEDGMENTS

The efforts of many individuals contributed to the successful completion of the 1997 archaeological testing at the Callo del Oso site. The Scope of Work which guided the fieldwork was prepared by personnel with Archeology Studies Program of the Division of Environmental Affairs, Texas Department of Transportation (TxDoT), Austin. TxDoT archaeologists Nancy Kenmotsu, John Clark, Ann Irwin and Al McGraw took an active interest in the fieldwork, offering helpful input at various points and traveling from Austin to visit the site during testing. Paula Sayles and David Potter of the regional TxDoT office, Corpus Christi, were helpful in facilitating logistics of the project; Dave Potter was most helpful in providing barrier fencing for our excavation units. G. Lain Ellis of the Division of Antiquities Protection, Texas Historical Commission (THC), visited the site and reviewed the draft version of this report for THC; his thoughtful comments are appreciated.

Personnel of Naismith Engineering, Inc., Corpus Christi, particularly David E. Sullivan, were most helpful throughout the course of the work, coordinating with TxDoT, and with the City of Corpus Christi for use of machinery, as well as arranging with the firm of PSI, Inc., for a truck-mounted coring rig to be on site during the initial stage of fieldwork. Dave Sullivan, Project Coordinator for Naismith Engineering, provided detailed maps of the project area, facilitated access to properties, and skillfully brought coherence to an effort involving archaeologists, engineers and State and City agencies and personnel. Terry Smith and Joe Grennan of Naismith Engineering were on site during the fieldwork, coordinating the coring operation, identifying precise locations of property lines and right-of-way boundaries and confirming access to properties.

Various personnel of the City of Corpus Christi were indispensible during fieldwork. Ogilvie Geriche, City Street Department, provided the gradeall machine with operator which was used to excavate test units in the hard clay soils. Pablo Rodriguez, City Gas Department, located and flagged existing gas lines. Wes McKinzie, Manager of the Oso Waster Water Treatment Plant, provided secure overnight storage space for archaeological tools and equipment. Pete Garza trucked water onto the site for water screening, and Pablo Blanco, Joe Garcia, Marcelo Longoria and Manuel Gonzales provided traffic control along Ennis Joslin Road and Alameda Street, which was essential for the safe and timely completion of the fieldwork.

The field crew for Coastal Archaeological Research, Inc. was comprised of David Driver, Luke Huston, Victoria McCoy, Jennifer McWilliams, Todd Pitezel, Jenny Savage, and Greg Sundborg. Without exception, these individuals worked together as a highly capable and congenial team, and their efforts are sincerely appreciated. David Driver lent his considerable expertise to recording coring logs and drafting excellent plan and profile drawings. Jennifer McWilliams served ably as project photographer. Luke Huston assisted in the laboratory, cleaning, cataloging and bagging artifacts and faunal specimens.

Robert A. Ricklis, Ph.D.,
Principal Investigator
Corpus Christi, April, 1997

CHAPTER 1

BACKGROUND DISCUSSION: THE SITE, GOALS OF TESTING, AND ENVIRONMENTAL AND ARCHAEOLOGICAL BACKGROUND

The Site

The Callo del Oso Site, designated by the trinomial 41NU2, has been known as a prehistoric Native American occupation and burial locus since the turn of the century. The site, within the city limits of Corpus Christi, is situated within a clay dune which parallels the northwest shoreline of Oso Bay for approximately one-half mile, extending from near the Corpus Christi Bay shoreline near the intersection of Ocean Drive and Alameda Street southwestward to the edge of the drainage of False Oso Creek (see Figures 1 and 2). The clay dune attains an elevation above mean sea level of just over 15 feet. The shoreward edge of the dune has been subjected to considerble erosion in the past, though this slope is now partly stabilized by fill and vegetation. Below the dune are extensive mud flats which doubtless have characterized this part of the Oso Bay shoreline for several millenia, since extensive mud flats are the requisite sediment source for clay dune development.

At the time of its discovery, the site was outside the built-up area of Corpus Christi, but is now largely covered by residential homes and yards and, along its western margin, by Ennis Joslin Road and Alameda Street. A number of vacant lots remain, some of which are presently covered by modern fill consisting of variable mixtures of soil, gravel and broken bits of concrete. Mesquite trees and short grasses now grow in the vacant lots.

The site has been generally recognized as an unusually extensive and dense aboriginal cemetery (e.g., Hester 1980). According to notes made by George C. Martin (on file, Texas Archeological Research Laboratory [TARL]), a Mr. Martin Pearse claimed to have observed the bones of as many as 5,000 human skeletons exposed by erosion during the hurricane of 1900. While this number is almost certainly an exaggeration, there is no doubt that a remarkable number of burials were exposed at this time. During the 1920s and 1930s, digging by various individuals and by the University of Texas resulted in the recovery of the remains of at least 173 individuals (Martin's notes, TARL). The University of Texas excavation, under the direction of A. T. Jackson, was situated at the approximate mid-point of the site (see Figure 3). The remains of at least 93 individuals were found within an area approximately 50 feet square. Generally speaking, bones were in fair condition, and skeletons were flexed, though some graves apparently contained disarticulated bones of additional individuals. Burials were generally found at shallow depths (about 25 inches below surface) though it was noted that this was in part due to previous erosion of the clay dune surface). Artifacts were found with burials only sporadically (A. T. Jackson, unpublished notes on file, TARL). Additional burials have been reported by locale observers as having been exposed during excavation of home foundations along the length of the clay dune, and by incidental road work and commerical construction at the north end of the site (Alex Cox and Kim Cox, pers. comm, 1996; see Figure 3).

Despite the large quantity of skeletal material which has been removed from the site over the years, only limited information has been obtained about the physical and bioarchaeological aspects of the human remains. A series of skulls was studied by Woodbury and Woodbury, who believed that marked robusticity indicated a distinctive physical type (Woodbury and Woodbury 1935; Neumann 1952). In a more recent study, Jackson, Boone and Henneberg reported evidence for what they believed was endemic treponematosis in 24 percent of observed individuals, and suggested that the presence of this disease in this relatively large portion of the sample indicated at least part-time or seasonal aggregation of population (Jackson et al. 1986).

In addition to recording observations on burials, Jackson also noted the presence of "camp debris" in the forms of both localized clusters of whelk and other shell and subsurface "midden"

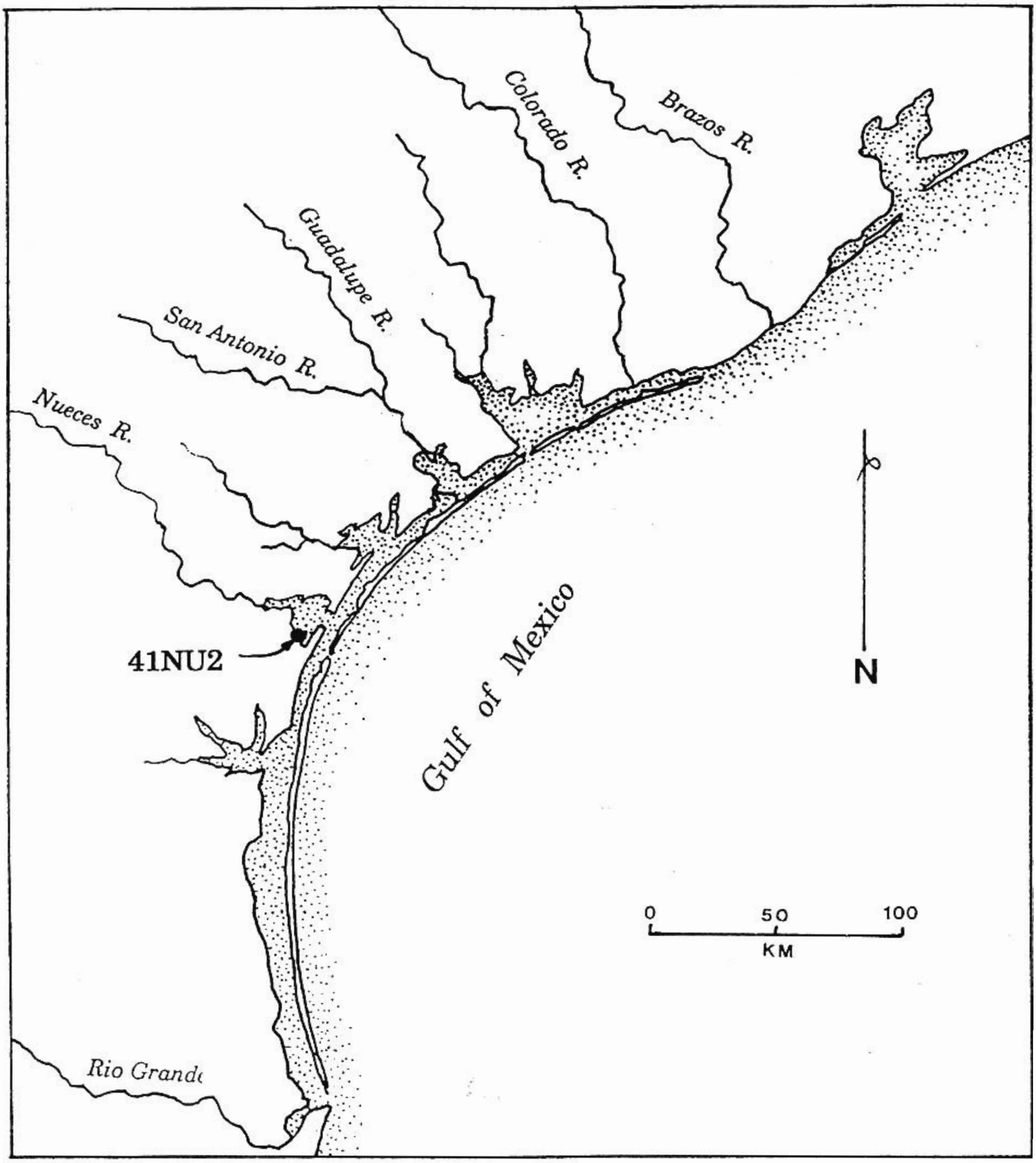

Figure 1. Map of the Texas coast showing location of the Callo del Oso Site, 41NU2.

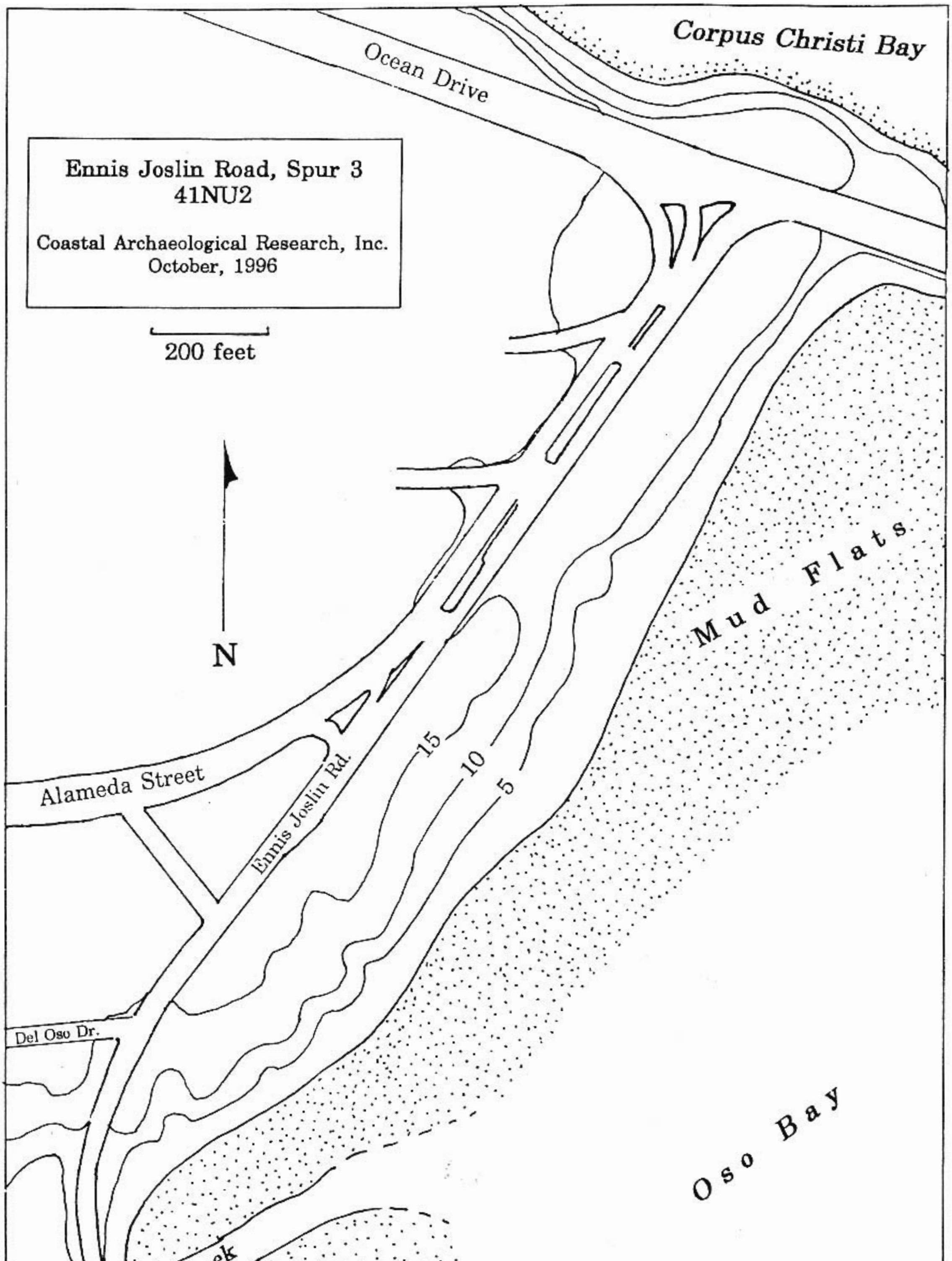

Figure 2. Map of the Callo del Oso Site, 41NU2. Note extensive mud flats along shore of Oso Bay, sediment source for clay dune development, and Creek (Falso Oso Cr.) immediately south of site.

strata encountered during excavation or noted in erosional cuts within the clay dune sediments. Artifacts observed by both Martin and Jackson to be in association with debris deposits included chert flakes, a few projectile points (both arrow points and dart points), and potsherds, which were said to be scarce (notes of Martin and Jackson, TARL files). Martin's notes contain several illustrations of flaked stone projectile points from the site, and presently defined types (Suhm and Jelks 1962; Turner and Hester 1993) include Morhiss, Matamoros, Catan, Perdiz and Starr, thus indicating both Late Archaic and Late Prehistoric occupations.

Goals of the 1996 Testing

Several goals were established for testing at 41NU2 in a Scope of Work (SoW) prepared by personnel of the Archeology Studies Program, Environmental Affairs Division, Texas Department of Transportation, Austin. The SoW was in response to the perceived need to define the nature and extent of archaeological deposits at the site which would be impacted by road widening of Ennis Joslin Road, Spur 3, and Alameda Street. The following seven objectives were articulated in the SoW:

1. Determine the depth of the cultural deposits in the current right-of-way on both sides of the present road, with the purpose of projecting to the areas where access is not available.
2. Determine the extent of disturbance to the cultural deposits.
3. Determine the north/south limits of the site as it exists within the right-of-way.
4. Attempt to determine whether burials are present in the portions of the site to be affected by construction.
5. Attempt to determine whether cultural features are present and whether stratigraphically separable components are present.
6. Determine if materials are present that will support appropriate special studies.
7. Develop a conservative data recovery plan to take advantage of the linear configuration of the right-of-way. The plan should conisder regional questions as developed for the southern coastal corridor recently published by the Texas Historical Commission (Mercado-Allinger et al. 1996).

Environmental Background

Climate

The climate of the Corpus Christi area is nearly subtropical, with hot summers and generally mild winters. However, between 15 and 20 polar cold fronts usually move into the area during the months of December through February, when temperatures often fall below freezing. These fronts often arrive in rapid succession, so that the winter months tend to be marked by cool or cold temperatures for periods lasting up to several weeks.

Average precipitation on the central Texas coast is around 40 inches at the northeastern edge of the central Texas coast area around Matagorda Bay, and decreases clinally to the south, so that the Baffin Bay area receives only about 28 inches per year (Orton 1969). Throughout the region, high evapotransporation rates produce precipitation deficits. Rainfall is generally highest during the late summer through early fall, with secondary peaks in mid summer and late winter. Periods of drought have occurred historically, and these can have measurable effects on the distributions of various plant communities (Drawe et al. 1978), as well as on the range of estuarine shellfish species due to increases in bay/lagoon salinities.

Geology and Holocene Sea Level Rise

The central coast of Texas is part of the broad Gulf Coastal Plain (Fenneman 1938), a nearly flat physiographic unit that rises gradually from the coast to the interior. The surface

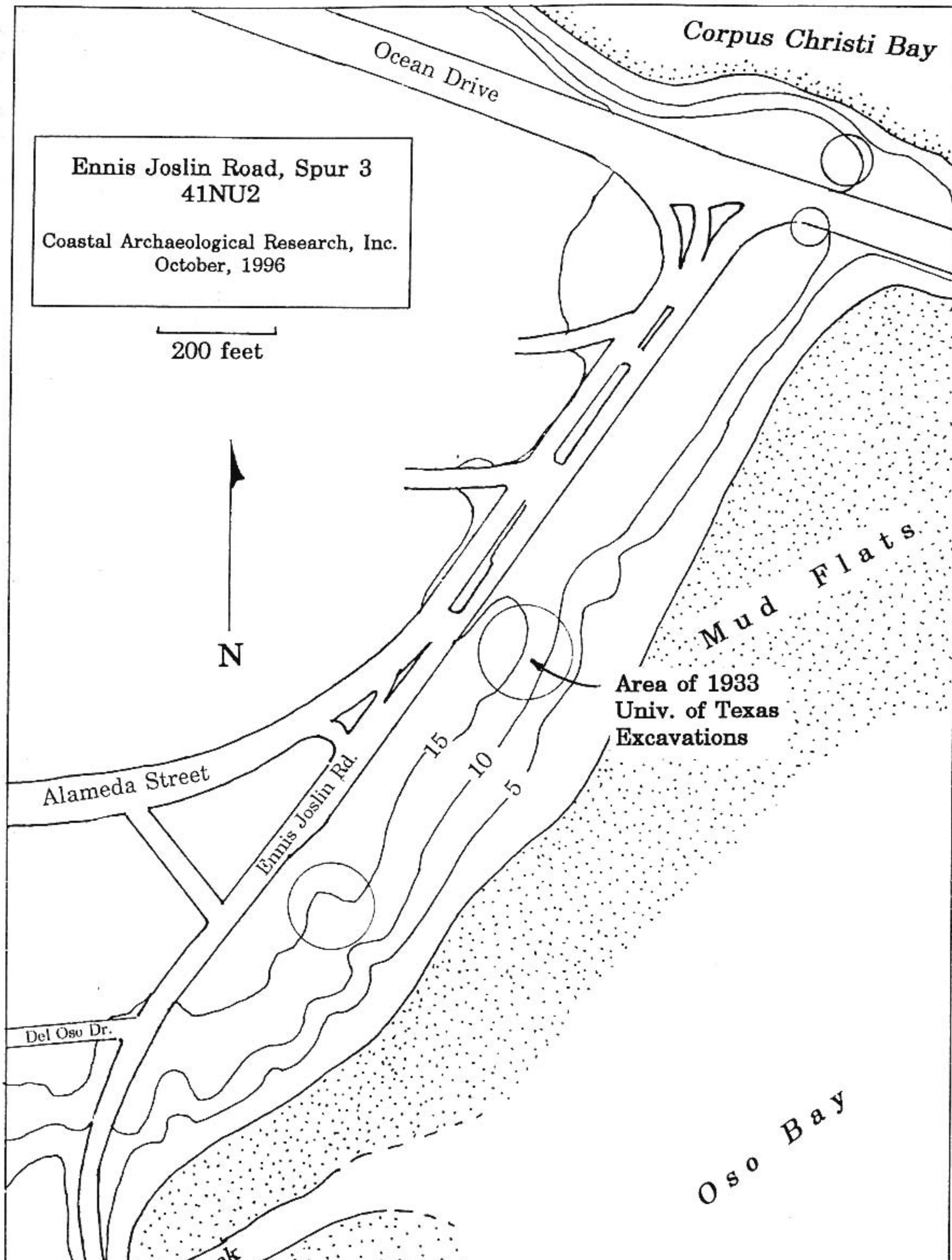

Figure 3. Map of 41NU2 showing locations of areas (encircled) said by local informants to have yielded burials; note location of 1933 excavation by the University of Texas.

geology consists of sandy clays and clayey sands deposited by major fluvial and fluvial-deltaic systems during Pleistocene interglacial periods. There is a general macrostratigraphic pattern of gradual downdip toward the coast, so that progressively older formations are exposed at the surface as one moves inland. The most recent is the Beaumont Formation, a thick accumulation of clays and fine sands that constitutes the geologic foundation of the present coastline (Brown et al. 1976; McGowen et al. 1976; Solis 1981).

During the last glacial maximum, ca. 20,000 years b.p. (before present), coastal rivers downcut deeply into the older fluvial-deltaic deposits of the Beaumont Formation, creating a series of deep valleys along the coast. At this time, much of the global water supply was captured in polar and continental ice sheets, and sea level was some 100 meters lower than today. The Gulf shoreline was about 200 kilometers east-southeast of the modern coastline. With the global warming attending the end of the Pleistocene, sea level began to rise rapidly, and ultimately the coastal river valleys were inundated to become the embayments of the modern Texas coast (Shepard and Moore 1960; Behrens 1963; Wilkinson and Byrne 1977; Morton and McGowen 1980).

While geologic interpretations of Holocene sea level rise on the Texas coast vary in detail, all posit a rapid rise after 20,000-18,000 b.p. and slowed but uneven rates of rise after ca. 9000 b.p. (Curray 1960; Nelson and Bray 1970; Frazier 1974; Paine 1991). Sea level stillstands, minor regressions or markedly slowed rates of rise are indicated by submerged paleoshorelines on the continental shelf, and radiocarbon dating of now-submerged shell deposits and marsh peats permits approximate chronological reconstructions of the varying rates of Holocene sea level rise and marine transgression.

A globally-coherent eustatic sea level rise of 100 meters or more accompanied reductions in ice volume during the full-glacial to interglacial (holocene) transition (Fairbanks 1989; Matthews 1990), but discussions of the exact nature of eustatic change are characterized by two schools of thought (Kidson 1982). Some suggest a smooth, continuous rise, and others a step-wise model. However, interpretations of the former result from curve fitting, since wastage of ice sheets was by no means a smooth, continuous process (Ruddiman and Duplessy, 1985). Hughes (1987) and Anderson and Thomas (1991) suggest that step-wise changes resulted from ice sheet ablation coupled with episodic collapse of the marine-based margins of northern hemisphere and/or Antarctic ice masses.

For the Gulf of Mexico, deltas located at the shelf edge, at present depths of 100-120 meters, are perhaps the best indicators of full-glacial lowstand shorelines at ca. 20,000 b.p. (Suter and Berryhill 1985; Suter 1987). A number of older studies (e.g. Curray 1960; Nelson and Bray 1970; Frazier 1974) propose relative sea level curves for the post full-glacial period for the northwestern Gulf of Mexico, based on uncorrected and uncalibrated radiocarbon ages from mollusks or plant macrofossils in now submerged stratigraphic contexts, some of which consist of shore-parallel sandbodies interpreted as former shorelines. Each displays the general rising trend that accompanied wastage of continental ice sheets, with sea level at -80 meters or more prior to ca. 17,000 b.p., rapid transgression during the latest Pleistocene, slower transgression during the early to middle Holocene, and highstand conditions during the late Holocene. Details differ, but each worker proposed a general step-wise model for post-glacial sea level rise (see Figure 5).

Three sets of recent, independently-collected data support a step-wise model for post-glacial relative sea level rise in the Gulf of Mexico. Seismic reflection and vibracore studies by Anderson and coworkers (Anderson and Thomas 1991; Anderson et al. 1992; Thomas and Anderson 1994) show that incised valley fills of the Trinity River on the now-submerged shelf consist of periods of bay-head delta progradation punctuated by flooding surfaces that demarcate periods of delta overstepping and significant landward translation of the shoreline within the valley due to rapid sea level rise. Although details of radiocarbon dating are not presented, they suggest that flooding surfaces formed ca. 9000, 7000, and 4000 b.p., roughly the same time as episodic high rates of sea level rise advocated by Frazier (1974). Their reconstructed sea level positions are slightly different, however, because shore-parallel sand bodies used by Frazier (1974) were argued to have been reworked in the landward direction, and therefore overestimated sea level at the time indicated by radiocarbon ages on associated shells. Paine (1991) examined cores from the Copano Bay fill which display alternating periods of fluvial and estuarine deposition. Abrupt fluvial to estuarine transitions, and by inference rapid transgressions, were correlated to Frazier's (1974) sea level curve, and suggested to have occurred ca. 10,000, 7000, and 5000-3500 b.p.

Paine (1991) also examined prospects for a middle to late Holocene sea level highstand, noting a number of possible geomorphic indicators, including: (a) inactive estuary tributaries filled to levels above the modern high tide range with marsh sediments; (b) emergent, relict flood-tidal deltas that may have been abandoned as sea level fell from a highstand position and the tidal pass was closed; and (c) inactive clay-dune complexes adjacent to relict tidal flats. Detailed investigations were undertaken at a tidal flat/clay-dune complex along the southern margins of Copano Bay in association with investigations at the Swan Lake archaeological site (41AS16). Corrected and calibrated radiocarbon ages suggest the clay-dune was active from ca. 5300-2600 b.p., whereas elevation of the tidal flat suggested relative sea level was between 60-90 cm higher than present at that time. Uninterrupted growth of a nearby clay dune adjacent to a lower elevation, active tidal flat from ca. 2300 b.p. to present suggests sea level has been relatively stable since then.

The Process of Clay Dune Formation

Clay dunes are topographically distinctive features found along the mainland shores of the Texas coast from Copano Bay south to the Rio Grande Delta area (Price 1933, 1963; Brown et al. 1976; Brown et al. 1977). The dunes are made up of innumerable lenses of silty and fine-sandy clay deposited as windborne sediments along the margins of bays and lagoons where shorelines consist of mud flats which are frequently inundated with saline water; it is these flats which provide the sediment source for dune construction. Clay dunes are invariably elongated in plan, and are found immediately adjacent to shorelines. Because of the way in which the dunes form, they never extend leeward of shorelines for more than short distances.

According to Price (1963), clay dunes form along coastal shorelines in semi-arid regions where mud flats are alternately flooded and subaerially exposed. When the flats are exposed and dry, they crust over, and with time the crusts break down into sand-sized aggregates comprised of fine sand or silt, clay particles, and evaporite salts. The salts play a key role in that they increase the moisture-holding and moisture-releasing capacity of the clay, resulting in expansion and contraction of the mud which aids in the breakdown of the crust into the small aggregates which are borne leeward to form the dunes.

Clay dunes do not migrate leeward due to the fact that once the sediment aggregates are deposited adjacent to the shoreline, re-moistening of the sediment particles by rainfall or even dew causes clay particles to cohere and thus become resistant to further eolian displacement (Price 1963). Thus clay dunes tend to be stable landscape features and do not take on the varied forms found in sand dunes. The salt component within the sediments tends to leach out with time, leaving behind consolidated silty or sandy clays and allowing normal soil development to occur on dune surfaces during periods when the dune has been cut off from introduction of fresh wind-borne sediments. Clay dunes along the Texas coast have distinctive stratigraphic profiles in which dark, organic-rich bands of soil are separated by light-colored zones representing periods of relatively rapid sediment accumulation.

Biotic Resources

The Callo del Oso Site is in an ecotonal location, between the estuarine environment of Oso and Corpus Christi Bays on the one hand, and coastal prairies which once covered the level uplands of the coastal littoral on the other. As a result, prehistoric peoples who occupied site had direct access to a varied set of estuarine and terrestrial resources.

Estuarine Resources

Estuaries are among the most biotically productive of environments, rivaled only by the tropical rainforests (Odum 1971; Whittaker 1975), due to high photosynthetic primary productivity in low-turbidity, shallow waters, as well as influx of nutrients through riverine discharge, and organic detrital nutirents from shoreline marsh plant communities. In the bays and lagoons of the central Texas coast, abundant phytoplanktonic life, consisting mainly of diatoms, forms the basis for a rich food chain which supports the various molluscan and fish species which were economically important in prehistory and are still harvested today. Long-term sedimentation of bays and lagoons, through the agencies of wave action and riverine discharge, has created the shoreline shallows which support extensive salt marshes and grassflats. These shallow-water environments provide protective habitats for primary and secondary consumer populations, including economically important fish species such as black drum, redfish, and spotted seatrout.

The bays and lagoons behind the Texas coast barrier islands have historically yielded rich harvests of economically useful fish and shellfish. The presence on archaeological sites of large quantities of shells of rangia, oyster, scallop, whelk and other molluscs, as well as bones of fishes, indicates that these resources were important in prehistoric economies as well.

The various species of shellfish represented in archaeological deposits reflect different environmental zones within the estuaries, largely because species are adapted to different salinity regimes. Rangia clams, including *Rangia cuneata* and *Rangia flexuosa*, are brackish-water bivalves which live in inland bay margins and the lower riverine estuaries in waters with salinities generally less than 10 parts per thousand (ppt) (La Salle and de la Cruz 1985). Oysters (*Crassostrea virginica*) and other bivalves such as bay scallop (*Argopectin irradians*), quahog (*Mercenaria campechensis*) and cross-barred venus (*Chione cancellata*) thrive in intermediate salinities between approximately 10 and 30 ppt (Andrews 1977). The various gastropods found in the Corpus Christi Bay estuary include lightning whelk (*Busycon perversum*), banded tulip shell (*Fasciolaria illium*), pear whelk (*Busycon spiratum*), shark eye (*Polinices duplicatus*) and Florida horse conch (*Pleuroploca gigantea*) all live in relatively high salinities (approx. 25-40 ppt) in more marine-influenced bay and lagoon areas (Andrews 1977).

Although a wide range of fish species inhabits the waters of the Texas coast, archaeological investigations at a number of sites along the central coast (e.g. Story 1968; Prewitt et al 1987; Zimmermann et al. 1988; Ricklis 1988, 1990, 1993) have indicated that most of the fish biomass procured by prehistoric people came from the same several species which have been the basis of the modern fishing industry. The relatively short list of key economic species includes black drum (*Pogonias cromis*), redfish (*Sciaenops ocellata*), spotted seatrout (*Cynoscion nebulosus*), sheepshead (*Archosargus probatocephalus*) and Atlantic croaker (*Micropogon undulatus*). Also found archaeologically, though usually not in great abundance, are the remains of the sea catfish (*Arius felis*) and the gaftopsail catfish (*Bagre marinus*). The various species can be identified in archaeological contexts on the basis of diagnostic bone elements and otoliths.

Terrestrial Resources

Flora

Terrestrial flora on the central Texas coast are grouped according to several major associations whose distributions depend on variables of moisture and soil type. In sandy areas along the mainland shoreline are oak mottes. Several species are found, though the live oak (*Quercus virginiana*), which yields edible acorns each fall, is by far the most common (Jones 1983). A variety of salt-tolerant plants grows on the barrier islands and in marshy areas along bay/lagoon margins and in the deltaic areas around river mouths. On river floodplains, upstream of estuarine salt marshes, is dense arboreal vegetation. Common trees include hackberry (*Celtis laevigata*), anacua (*Ehretia anacua*), huisache, elm (*Ulma laevigata)*, and pecan (*Carya illinoiensis*). Vines of the mustang grape (*Vitis mustangensis*) frequently drape tree limbs. The larger trees form partial canopies, under which are shrub understories of smaller live oaks and mesquite (*Prosopis glandulosa*). Short to medium grasses and shade-tolerant forbs form the ground cover (Drawe et al. 1978; Jones 1983).

An extensive coastal prairie covered the level uplands between stream drainages in early historic times. Prior to Euroamerican settlement and attendant land-use patterns, the landscape was a grassland with scattered areas of oak savanna on sandier soils. Since the middle of the nineteenth century, thornbrush such as mesquite and hackberry have expanded greatly at the expense of the grassland plant communities (Bogusch 1952, Johnston 1963).

Clay dunes are found on the leeward shores of bays and lagoons along the Texas coast from Copano Bay southward to the Rio Grande delta area. These geomorphic features generally support mesquite trees and a variety of short grasses.

Fauna

A varied fauna is supported by the marshlands, riparian floodplains and uplands of the Texas coastal zone. Reptiles include aquatic and terrestrial turtles, lizards, snakes and, in fresh and brackish riverine areas, the American alligator. Species of migratory birds that frequent the area include a variety of ducks, geese, and the sandhill and whooping crane. Along bay and lagoon margins are brown pelican (*Pelecanus occidentalis*), the little blue heron (*Florida caerulea*), and the great blue heron (*Ardea herodias*). A variety of gulls and terns frequent beaches, and inland are found numerous avian species, including the wild turkey (*Meleagris gallopavo*).

Smaller mammals include rodents (mice, rats, pocket gophers) and rabbits (cottontail and jackrabbit). The collared peccary, or javelina (*Dicotyles tajacu*), has apparently been expanding its range northward during historic times, and may not have been abundant prehistorically (Shew et al. 1981). The black bear *(Ursus americanus*), wolf (*canus lupus*), and puma (*Felis concolor)* are extinct in south Texas today, but were present in early historic times. Carnivores still extant include the bobcat (*Lynx rufus*), gray fox (*Urocyon cineroargenteus*), coyote (*Canis latrans*), raccoon (*Procyon lotor*) and opossum (*Didelphis marsupialis*) (Shew et al. 1981).

The most economically important mammals in aboriginal adaptations were the white-tailed deer (*Odocoileus virginianus*) and the american buffalo or bison (*Bison bison*). Deer are still abundant in the region, while the buffalo was probably being displaced by spanish cattle herds by as early as the latter half of the eighteenth century (Ricklis 1990:542-545). Bison may not have been present during the entire span of prehistoric human occupation of the central coast region. According to a model proposed by Dillehay (1974), bison presence in Texas alternated with periods of absence over the last 10,000 years, and the final appearance of the animal in most of Texas occurred around A.D. 1200-1300, after a period of absence lasting nearly a thousand years. Subsequent research has tended to support Dillehay's model, though bison may simply have been less abundant in some areas during the periods of "absence" (Creel et al. 1990). On and near the coastal prairies, there does appear to have been a late prehistoric appearance of bison beginning around A.D. 1250 or 1300, in keeping with Dillehay's hypothesized final period of presence (Black 1986; Ricklis 1989; 1992; Huebner 1991).

The Archaeological Context

Early Archaeological Research in the Central Texas Coast Region

The first systematic, documented investigations consisted largely of extensive surface surveys carried out in the 1920s and 1930s by two amateur archaeologists, George Martin (1930, 1931) and Wendell Potter (1930). These men documented numerous sites in the region, mainly along the shorelines of Corpus Christi and Copano Bays. In 1935, E. B. Sayles published *An Archeological Survey of Texas*, which included an overview of the prehistoric cultural remains along the coast and made a first attempt at placing artifacts within a regional chronology. Sayles formulated two broad periods, a pre-ceramic Oso Phase and a subsequent ceramic period Rockport Phase. The earlier period was characterized mainly by a wide variety of relatively large and heavy stone projectile points, or dart points, while the Rockport Phase was marked by the appearance of pottery and small, thin, and light stone arrowpoints.

Several important sites were investigated during the 1930s and early 1940s by crews from the University of Texas, with funding provided by the Works Progress Administration. As noted above, A. T. Jackson conducted excavations at 41NU2. Additionally, Jackson worked at the Webb Island Site, 41NU1, one of several habitation sites on small islands in Upper Laguna Madre, just offshore from Encinal Peninsula. In the early 1940s, William E. Duffen directed work at three sites on the Copano Bay shoreline; the Kent-Crane (41AS3) and Johnson (41AS1) sites were dense shell middens of mainly pre-ceramic age, and the Live Oak Point Site (41AS2) produced components of both the pre-ceramic and ceramic periods.

During the 1940s and 1950s, T. N. Campbell of The University of Texas analyzed the collections from these sites and related the material finds to intra-site contexts, to the extent possible with available data. Campbell published the results of his analyses in a series of articles which became the basis for subsequent archaeological classification of aboriginal material culture from the central Texas coast (Campbell 1947, 1952, 1956, 1957, 1960).

Campbell defined two broad chronological periods of aboriginal occupation of the area. The earlier of these was the Aransas Focus, defined largely on the basis of materials from the Johnson and Kent-Crane Sites. This was assigned to the Archaic Stage, a very broadly conceptualized cultural pattern in North American prehistory which pre-dated the introduction of ceramics and the bow and arrow, and which involved a pre- or non-agricultural subsistence base (Ritchie 1932; Willey and Phillips 1958). Diagnostic materials of the Aransas Focus were a variety of stemmed, notched and unstemmed flaked stone dart points, bone tools, and a suite of shell tools including conch shell adzes and gouges, perforated oyster shells (which Campbell suggested were netweights), bi-pointed whelk shell spires or columellae, edge-flaked sunray venus clamshell knives or scrapers, and whelk shell hammers. The later Rockport Focus, thought to be directly ancestral to the region's historically documented Karankawa Indians (Campbell 1960), was identified on the basis of sandy paste pottery, often decorated and/or coated with asphaltum (a natural tar), and several styles of arrowpoints. Since the pertinent sites had all been investigated prior to the development of radiocarbon dating, the chronology was a strictly relative one, and the actual ages of the two periods remained unknown. Based on faunal materials recovered from sites of both the Aransas and Rockport Foci, Campbell concluded that aboriginal subsistence economy involved the exploitation of both aquatic and terrestrial food resources.

Burial sites in the region vary in size, and may pertain largely to the late Archaic and Late Prehistoric periods. Prehistoric cemeteries have been documented at 41NU37 and 41NU29 on Oso Creek (Mercado-Allinger 1985; Hester 1980), and probably are largely late Archaic in age. As is the case with 41NU2, both of these sites are on clay dunes. At 41NU37, a number of burials were documented during the late 1980s; most were flexed primary interments, and some contained freshwater mussel shell pendants and dart points among the bones which appeared to have been the cause of death (Cox and De France, in prep.). Prehistoric cemeteries on Nueces Bay and the lower Nueces River include a sizeable cluster of interments at 41SP154, where Ensor dart points found in association with disturbed burials suggest at late Archaic age. At 41NU276 on the upland margin overlooking the Nueces River delta, a cluster of prehistoric burials some 10 meters in diameter was exposed and largely destroyed by mechanical soil removal (Ricklis 1995b). A few kilometers upstream, a cemetery with an estimated 50 burials, 41NU173, was partially excavated; a Scallorn type arrowpoint embedded in the bones of one flexed individual suggests an age in the early part of the Late Prehistoric period (Mokry 1979). Unfortunately, little controlled excavation has been conducted on the prehistoric burial sites in the region, so that little is known about the chronology of cemetery use or burial patterns which could shed light on the characteristics of mortuary patterns.

Recent Investigations: Regional Cultural Chronology and Archaeological Taxonomy

Over the last ten years, much new information has been gathered which begins to shed light on the absolute time frame involved in prehistoric occupation of the central Texas coast. Relevant to the present discussion, the new data include information on site stratigraphic sequences, the temporal positions of time-diagnostic artifact types, and most importantly, an exponential increase in the number of available radiocarbon dates from more or less well-defined archaeological contexts. These recent findings are most effectively presented here in the form of a broad cultural chronology based on (a) radiocarbon-dated site components, (b) kinds of material remains associated with those components, and (c) kinds of subsistence remains, which reflect something of the nature of cultural adaptations through time. An overview of the current status of archaeological knowledge in the region may be found in Ricklis 1995a.

The Paleo-Indian Stage

The first universally accepted cultural presence in North America is generally referred to as Paleo-Indian. The term serves to identify a wide range of sites, artifacts and associated materials from across the entire continent (and indeed into South America). Generally, the Paleo-Indian is dated to between ca. 12,000 and 9,000 years ago, and is characterized by a variety of rather large, well-made stone dart or spear point types, various other lithic tools and, sometimes, associations with now extinct species of Pleistocene mammals, the hunting of which formed a more or less significant subsistence activity.

The Paleo-Indian Stage is evidenced along the Texas coast only by surface finds of diagnostic point types (e.g. Hester 1980a,b), and intact, subsurface archaeological deposits of the period have yet to be found and investigated. There is, as yet, no evidence to show that Paleo-Indian peoples exploited coastal food resources, and if such exists it is likely to now be submerged, since sea level was considerably lower than at present, and the shoreline was 50 to as much as 200 kilometers seaward of its present location.

The Archaic Stage

As alluded to above, the term Archaic is a very general term in American archaeology which refers to a broad-based, hunting and plant gathering (and in places fishing) adaptation (Ritchie 1932; Willey and Phillips 1958). In broadest terms, the Archaic preceded the introduction and/or development of horticulture or agriculture, ceramics and the bow and arrow. Recently acquired data for the central Texas coast indicates that an Archaic kind of adaptation lasted at least 6,500 years, beginning by ca. 7500 years before present (b.p.) and continuing to around 900 b.p. (see Figure 4).

The concept of the Aransas Focus or Complex, originally intended to define a temporally and spatially discrete Archaic cultural expression (Campbell 1947), is not employed here. The data now available indicate that some of the supposedly diagnostic shell tool forms of the Aransas Focus were in use far too long to be considered time markers for a definable cultural manifestation, and the temporal range of coastal adaptation in the region is now known to have been too long to be subsumed under a generic Aransas concept (the term has generally been used as synonymous with pre-ceramic coastal occupation; cf. Shafer and Bond 1985; Steel and Mokry 1985). In any case, the nature of human adaptations during the Archaic on the central Texas coast can be best

Figure 4. Generalized archaeological chronology for the central coast of Texas (after data in Ricklis 1995a).

YEAR S B.P.	Phase/Period	Diagnostic Artifacts	Adaptive Patterns
	Hist. Karankawa		
1000	Late Prehistoric (Rockpoort Phase)	Pottery, arrowpoints, end scrapers, bifacial knives, bone and shell tools	Seasonal population aggregation at major fishing camps; spring-summer hunting
2000	Late Archaic	Various dart points, shell and bone tools including conch shell adzes, hammers, etc.	Intensive fishing and shellfish gathering, hunting and plant gathering
3000			
4000			
5000	Early Archaic II	Bell/Andice and triangular dart points, perforated oyster shells, edge-flaked sunray clam shell	Shellfish gathering, limited fishing, hunting and gathering
6000			
7000	Early Archaic I	Edge-flaked sunray clamshell, dart points	Shellfish gathering, hunting and gathering
8000			
9000-12000	Paleo-Indian		Hunting and gathering

understood by reference to fundamental human ecological principles and environmental change, and static conceptualizations such as phases or foci tend to mask the dynamics of actual processes (see discussions in Ricklis 1990, 1993, 1995a; Ricklis and Cox 1991).

The Early Archaic, Ca. 7500-4200 B.P.

The earliest evidence for human coastal adaptation in the Corpus Christi area comes from sites around Nueces Bay, where radiocarbon dates on oyster shell fall at around 7500-6800 b.p. (Ricklis and Cox 1991; Ricklis 1993, 1996). No "time-diagnostic" lithic artifacts were found in association with these early components, though flakes and cores of chert were present. Importantly, however, edge-flaked sunray venus clamshell knives or scrapers were recovered at 41SP153, indicating that this shell tool form has great time depth in the region. The presence of abundant oyster shells indicates that this mollusc was being gathered as a food resource, and further shows that an exploitable estuarine resource base was already in place by the latter part of the eight millennium b.p. Faunal bone was completely absent in the oldest strata at all sites of the period, probably the result of complete decay. Also virtually absent are fish otoliths (concretions found in fish skulls which apparently aided in balance; e.g. Casteel 1974), which suggests that fish in fact were not an important food resource at this time; since otoliths are highly resistant to decay in the kinds of soils found at these sites, their absence probably does reflect a very limited or even non-existent economic role for fishing.

For the period between ca. 5900 and 4200 b.p., there are considerably more data. Sites are more numerous, and there are more radiocarbon dates and more artifacts than at the earlier site components. In general, it is possible to hypothesize that more people were living along the shoreline and exploiting its resources, though preservational factors could have contributed to the increased number of sites. However, a good deal more data on artifactual and ecofactual assemblages are needed from sites of this time period before variability in adpative patterns can be modeled.

The Late Archaic

Currently available information strongly suggests a hiatus, or at least a significant reduction in shoreline occupation, between ca. 4200 and 3000 b.p. Because geologic evidence suggests rapid sea level rise and a possible highstand prior to establishment of modern sea level at ca. 3000 b.p. (Thomas and Anderson 1994; Paine 1991), it has been suggested that inundation of ecologically critical marshes and bay/lagoon shallows reduced primary productivity, creating an estuarine environment which did not attract intensive human occupation (see discussions in Ricklis and Cox 1991; Ricklis 1993, 1995a, b). Thus the period traditionally referred to as the Middle Archaic in Texas (e.g., Prewitt 1981. 1985) may have seen relatively little use of the shoreline zone by prehistoric peoples.

By contrast, many Late Archaic sites in the Corpus Christi area have been dated to after ca. 3000 b.p. (Ricklis 1993). Although there is considerable variability in the size and thickness of cultural deposits, some sites have thicker deposits and a greater density of artifacts than any of the Early Archaic sites explored to date. Several types of lithic dart points generally recognized as diagnostic of the Late Archaic have been found on dated sites in the area (41SP120, 41SP177, 41SP43); these include the Kent, Godley, Marcos, Ensor, Matamoros and Catan types (see Suhm and Jelks 1962; Turner and Hester 1993). Shell tools tend to be abundant, particularly at sites at the seaward ends of the bay systems, where moderate- to high-salinity sunray venus and whelk would have been most readily available as raw material. The main bulk of the shell midden at the Kent-Crane Site, which apparently dates to after ca. 2700 b.p. (Cox and Smith 1989; Ricklis and Cox 1991), has yielded, as noted above, numerous shell tools. At 41SP43 and 41SP120 on Ingleside Cove, numerous edge-flaked sunray venus clamshell tools, perforated oysters, whelk hammers, bi-pointed whelk columellae and several conch shell adzes have been found in Late

Archaic deposits dated to between ca. 1800 and 950 b.p. The first pottery in the region may have appeared by the end of the Late Archaic, perhaps sometime between ca. A.D. 500 and 1050 (Ricklis 1990; Ricklis and Cox 1991).

During the Late Archaic, a dichotomy appears in archaeological sites, with dense, fairly thick shell middens at seaward sites such as Kent-Crane, 41SP43, 41SP120 and 41CL3, standing in contrast to thinner shell deposits toward more inland bayhead riverine estuary areas (Ricklis 1995a). Artifact densities are relatively high at the former group of sites, though they do vary within sites (cf. Ricklis 1990, 1993, 1996). At White's Point, thin Late Archaic middens have been documented at 41SP136, 41SP153, and 41SP149, with respective radiocarbon age ranges of 2340-2155 b.p., 1749-1816 b.p. and 1296-1407 b.p., placing these sites contemporaneous with Late Archaic occupations at Kent-Crane and Ingleside Cove. These and other Late Archaic sites along the lower reaches of central coast rivers (Ricklis 1990) produce only small quantities of artifacts, suggesting that they may have been short-term campsites. In contrast, the more seaward sites, with thicker and denser shell deposits and more abundant artifacts, were more intensively and/or frequently used locations, and may have been seasonal base camps at which relatively large populations aggregated to exploit exceptionally productive resource zones.

Faunal bone is generally well-preserved in Late Archaic site components. The dense middens such as Kent-Crane, 41SP43, 41SP120 and 41CL3 produce bones of mainly of fish and deer, often in profusion, with only scant representation of smaller mammals and shoreline bird species. The more inland shoreline sites also yield fish and deer remains, though not in comparable quantities or densities, again suggesting less intense occupation, perhaps by smaller numbers of people than congregated at more seaward locations. To date, however, faunal samples from these more inland sites are very limited, and more faunal data are needed before dietary patterns can be reconstructed in any detail.

The Late Prehistoric

The term Late Prehistoric refers to the final period of cultural prehistory, and has been employed widely in Texas archaeology (Hester 1975, 1980b; Black 1986; Highley 1986; Ricklis and Collins 1995). On the central coast, the period is marked by the appearance of arrowpoints, small unifacial chert end scrapers, cylindrical flaked chert drills or perforators, a prismatic blade-core chert-knapping technology, and abundant sandy paste pottery, frequently coated and/or decorated with distinctive designs in asphaltum. Tools and occasional simple ornaments of bone and shell, as well as well as ceramic smoking pipes, are reported from Late Prehistoric contexts (Story 1968; Ricklis 1990, 1992a, 1992b, 1995a).

The best known Late Prehistoric archaeological culture in the region is the Rockport Phase, for which diagnostic artifacts are Perdiz arrowpoints, unifacial end scrapers, prismatic blades, thin bifacially flaked knives, and the regionally unique sandy paste Rockport ware pottery. The term "phase" has generally come to replace "focus" as more in keeping with updated archaeological chronology in Texas and in North America in general (e.g., Prewitt et al. 1987; Ricklis 1990; Weinstein 1992). In contrast to the situation with the Archaic, the phase concept is applicable here, since the artifact assemblage is clearly defined in both time and space. The most common arrowpoint type, Perdiz, is well-dated throughout much of Texas to between ca. A.D. 1250/1300 and 1700 and this serves to place the Rockport Phase within this chronological time frame. Radiocarbon dates on a Rockport Phase site in Refugio County, 41RF21, fall into the early end of the time range, suggesting that the phase emerged by A.D. 1250-1300 (Ricklis 1989, 1990). The highly diagnostic Rockport ware pottery is found between Matagorda and Baffin Bays (Suhm and Jelks 1962; Fritz 1974), and is restricted to a rather narrow zone (about 40 km wide) along the coastline (Ricklis 1990). The Rockport Phase is largely if not entirely the archaeological correlate of the Karankawan Indian tribes documented on the central Texas coast in historic times.

A considerable body of data exist with which to begin a reconstruction of the nature of human adaptation to the central coast environment during the Rockport Phase (Ricklis 1988, 1992a, 1995a, 1996). The dichotomy in site types already suggested for the Late Archaic appears to be quite clear during the Late Prehistoric. Two kinds of site have been identified to date. Group 1 sites are large, relatively thick and dense midden deposits located at what must have been optimal shoreline fishing locales. Artifacts are abundant on these sites, as are faunal remains; fish remains are found in profusion. By contrast, Group 2 sites are small and thin cultural deposits located near bayheads and on upland margins bordering the lower reaches of streams. Faunal remains at Group 2 sites consist mostly bones of deer and bison, with fish and shellfish remains only sparsely represented. The two kinds of site thus are interpreted to represent two different aspects of coastal adaptation, with Group 1 site occupations involving intensive fishing activities, and Group 2 site occupations based primarily on the hunting of large game. There also appears to be a seasonal dichotomy in the use of the two kinds of sites, since seasonality analyses on shellfish (rangia, oyster) and fish otoliths suggest that Group 1 sites were most intensively occupied in the fall through very early spring and that Group 2 sites were occupied from mid-spring into summer.

CHAPTER 2

TESTING PROCEDURES AND RESULTS

In accord with the Scope of Work for testing prepared by the Texas Department of Transportation, the testing at 41NU2 involved two procedures. The first consisted of 30 sediment cores extracted using a 2-inch split spoon, truck-mounted coring rig. All cores were taken to a depth sufficient to reach the Pleistocene clay of the Beaumont formation which underlies the clay dune sediments. After extraction, each core was examined in the field and the color and texture of sedimentary strata or lenses was recorded on printed data sheets. All possible cultural inclusions (e.g, shell fragments, burned clay nodules, charcoal) were noted, as well as any perceptible modern disturbances.

The second procedure involved the excavation of 20 test units, each measuring approximately 1.5 by 2.2 meters. Because of the very hard and dense nature of the clay sediments, hand excavation would have been so laborious and time-consuming as to be impractical. Thus, excavation was accomplished, for the most part, with a gradeall equiped with a five-foot-wide, strait-edged bucket. The gradeall was found to be very suitable, since (a) it was possible to remove sediment in cuts as little as about 2 cm thick, and (b) the strait-edged bucket made clean cuts in which even subtle variations in the excavation floor were readily visible. With this technique, the units were excavated to a depth of five feet, at which point field personnel entered the unit to clean walls of the unit in preparation for profile drawings and photographs. If the base of the clay dune had not been reached at the five-foot depth-- the maximum depth for safe entry by personnel-- excavation was continued with the gradeall. By careful use of the machinery, it was possible to create a reasonably clean wall profile below the five-foot depth for accurate completion of the unit profile drawings. Since no cultural features or zones were encountered below the five-foot level, it was unnecessary for personnel to re-enter the units.

It was found that sedimentary strata containing prehistoric cultural materials could be easily identified. Cultural materials were encountered almost exclusively within dark brown, organically enriched soil horizons within the clay dune sediments. Archaeologically relevant soils were recognized by inclusions of burned clay nodules, shell fragments, faunal bone fragments and bits or flecks of wood charcoal. In the case of some soil horizons, such materials were so sparse that the sedimentary matrix was simply removed with the gradeall and dumped within a general backdirt pile, though any observed traces of human occupation were recorded in field notes. Where cultural debris was somewhat more abundant, all sediment matrix from the relevant soil horizon was water screened through 1/4-inch wire mesh; a total of approximately 5.6 cubic meters of soil was thus screened in the field. Additionally, samples were retained for fine-mesh water screening in the laboratory. Where the culturally relevant zone was relatively thin (less than 15 cm), the zone was treated as a single unit of vertical provenience. Initially, where a thicker cultural zone was present, proveniences were maintained in approximtely 10-cm increments within the zone. However, it became apparent that, in general, insufficient diagnostic materials or artifacts and faunal bone in general were present to provide meaningful arbitrary analytical units, and most zones were treated as single unit of provenience. During in-the-field sreening, all whole shells and umbo fragments, faunal materials and artifacts were bagged according to provenience and kept for cleaning and analysis.

The Cores

The primary goal of the coring was to obtain a reasonably reliable picture of the stratigraphy of sediments within the right-of-way, as a basis for reconstructing the geologic history of site formation as well as to provide information on the extent and depths of cultural zones which would facilitate decisions about where to place the test units. The locations of the 30 sediment cores are indicated in Figure 5. It will be seen that these locations tend to cluster spatially, a result of the fact that access for testing was unavailable in many of the residential lots within the project right-of-way. Nonetheless, a useful overall idea of the geologic structure of the site was obtained.

Figures 6-9 illustrate the sediment profiles obtained in the various cores, grouped according to spatial locations. The various colors of sedimentary strata are readily observable (indicated according to Munsell color codes in the legend, Figure 6). All sediments are silty clays. Several informative points are revealed by the kinds of sediment profiles found in each area; these can be summarized as follows:

1. The group of cores clustering at the southern end of the project area (nos. 1-4, 6-8), shown in Figure 6) consistently exhibits a typical clay dune stratigraphy, with thin, more or less dark-colored, organically enriched soil horizons separated by light-colored zones of fine sand or silty clay. It is interesting and significant to note that a uniform stratigraphy accross the area is not indicated. Rather, soil horizons tend to be horizontally localized, suggesting a complex history of clay dune formation, perhaps involving localized erosional events in which pre-existing sediments were partly removed prior to subsequent eolian deposition of new material.

2. A second group of cores (Figure 7) also shows, in part, characteriztic clay dune stratigraphy (nos. 25-28). Fewer soil horizons are apparent here than in the south end of the project area, perhaps due to fewer episodes of rapid sediment deposition in this area, which was at the back (leeward) side of the clay dune. Cores 29 and 30 exhibit a markedly different sediment profile consisting, with the exception of a surface layer of modern disturbed overburden, of a homogeneous dark brown silty cumulic Holocene soil resting directly upon dense, light-colored silty clay of the Pleistocene Beaumont Formation. These two cores thus show a soil profile typical of the prairie upland margins overlooking bays in the area (see Blum et al. 1995), beyond the inland margin of clay dune formation.

3. The third group of cores (nos. 9-16, Figure 8) is entirely beyond the inland clay dune margin, since all cores exhibit a characteristic upland prarie soil profile, with (excepting modern surface overburden) an essentially homogeneous dark brown, organic-rich silty cumulic Holocene soil lying unconformably on Beaumont silty clay. The soil thins toward the north, though it is not clear to what extent this is the result of variation in the natural depositional rates or is rather indicative of modern landscaping.

4. The final group of cores (17-20, 22, 23) is located at the north end of the project area where Alameda Street intersects with Ocean Drive (Figure 9). All cores in this area showed the presence of modern fill, usually in the form of redeposited soil; in some cases, multiple layers of fill were observed. Underlying the overburden, three distinct kinds of sediment profiles were observed in this area. Cores 17 and 18, the closest to the Oso Bay shoreline, showed the typical clay dune stratigraphy, with alternating light and dark zones of silty clays. To the east, cores 19, 20 and 22 exhibited thick (approx. 1.5 meters) deposits of black, very heavily organic-rich clayey silt, interpreted as pond sediments with, in some cases, inclusive lenses or strata of light-colored fine grained eolian sediments. Finally, core 23 showed the characteristic upland prairie soil profile, with a dark brown cumulic silty soil resting unconformably on Beaumont clay.

Based on these findings, a generalized reconstruction of the geologic structure of the project area can be made. It is clear that the clay dune is a narrow feature which parallels the Oso Bay shoreline and extends leeward only as far as Ennis Joslin Road and Alameda Streets. All cores west of the roads penetrated upland prarie Holocene silty soils which rested directly on Pleistocene clay. Near the middle of the project area, Cores 29 and 30 showed the same upland soil profile, indicating that the inland margin of the clay dune is actually slightly east of the road in this area.

The cores in the north end of the project area show the inland margin of the clay dune approximately in the center line of Alameda Street. The thick black soil behind the dune indicates the former existence of a small pond, as is often the case in the topographic low points behind clay dunes. Surrounding the pond leeward of the clay dune were upland prairies, as indicated by the

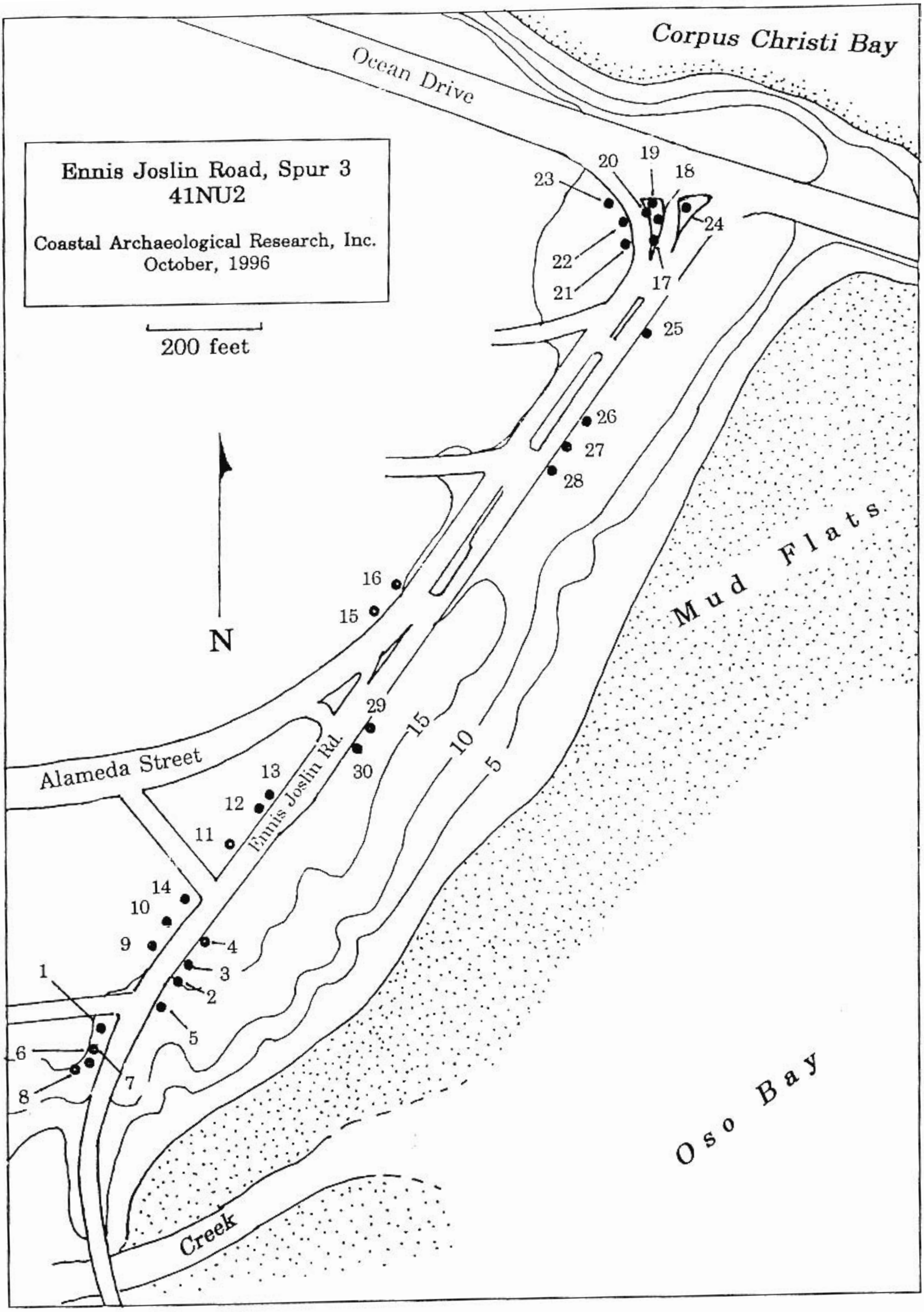

Figure 5. Map of 41NU2, showing locations of cores.

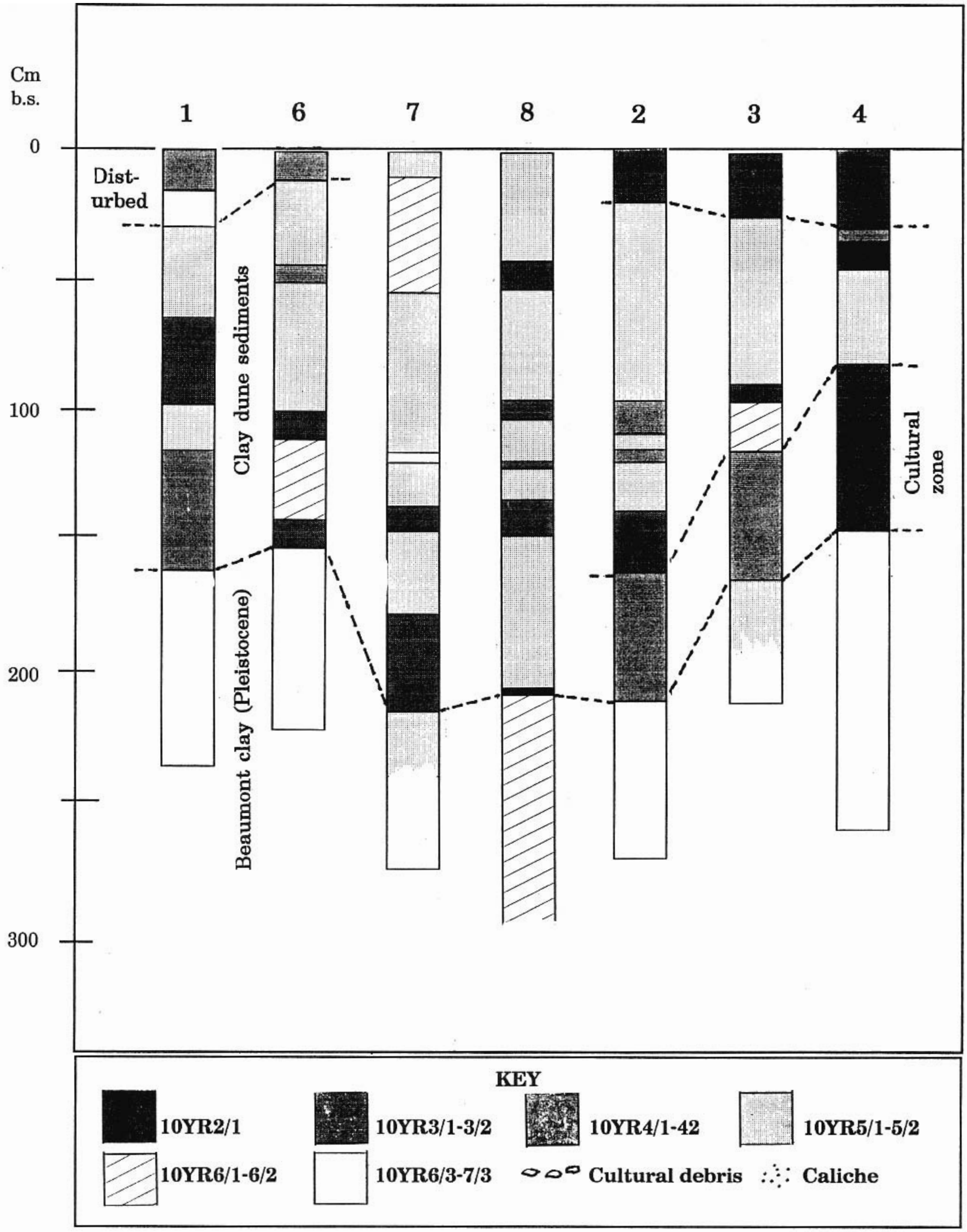

Figure 6. Core sediment profiles, south end of 41NU2, with Munsell colors shown in legend.

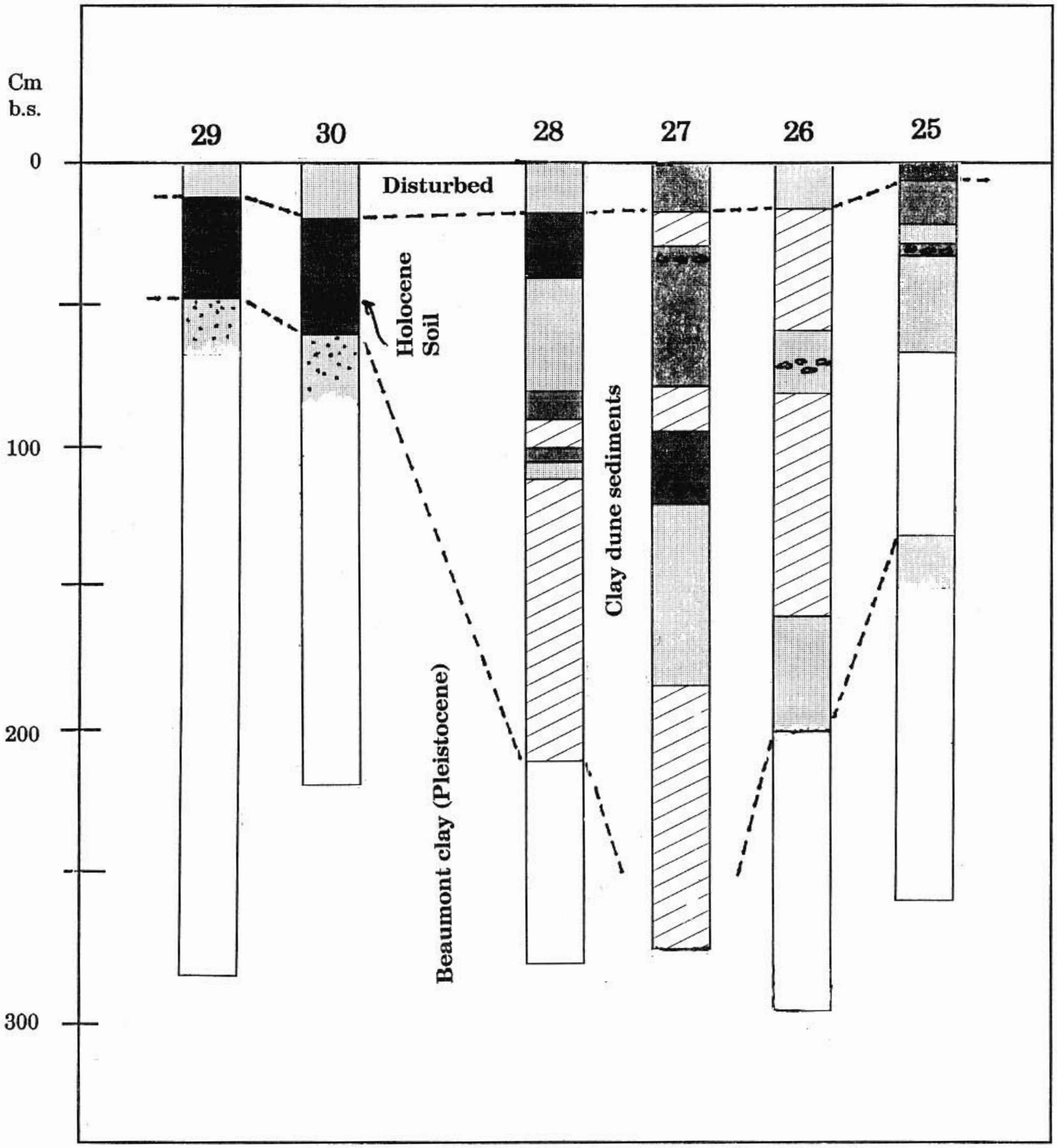

Figure 7. Core sediment profiles along east side of Alameda Street, north part of 41NU2. Note distinct difference in stratigraphy between upland prairie soil profile (nos. 29, 30) and clay dune (nos. 25-28).

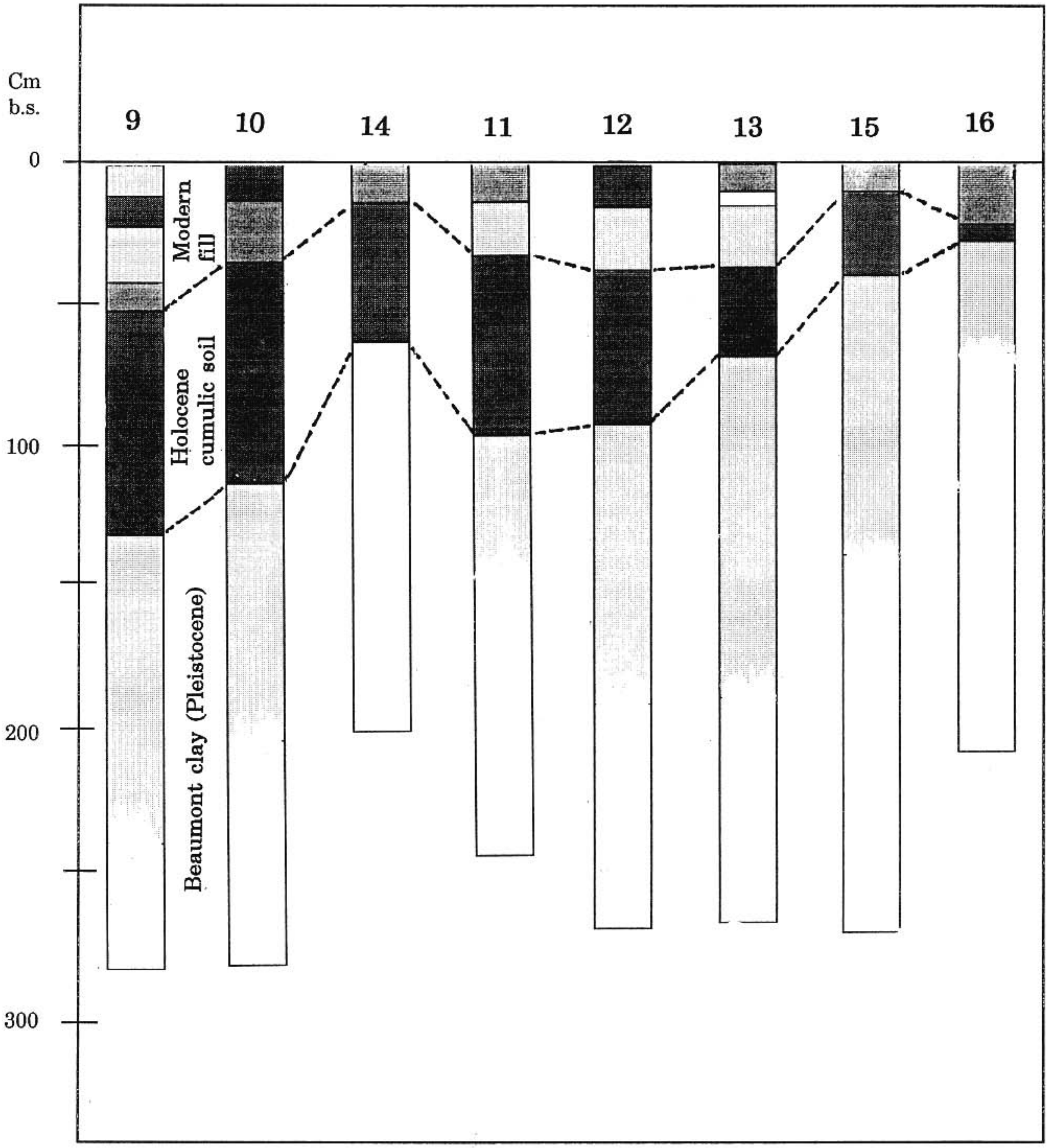

Figure 8. Core sediment profiles along west side of Alameda Street and Ennis Joslin Road. Note that all of these cores show typical upland soil profile as opposed to complex clay dune stratigraphy.

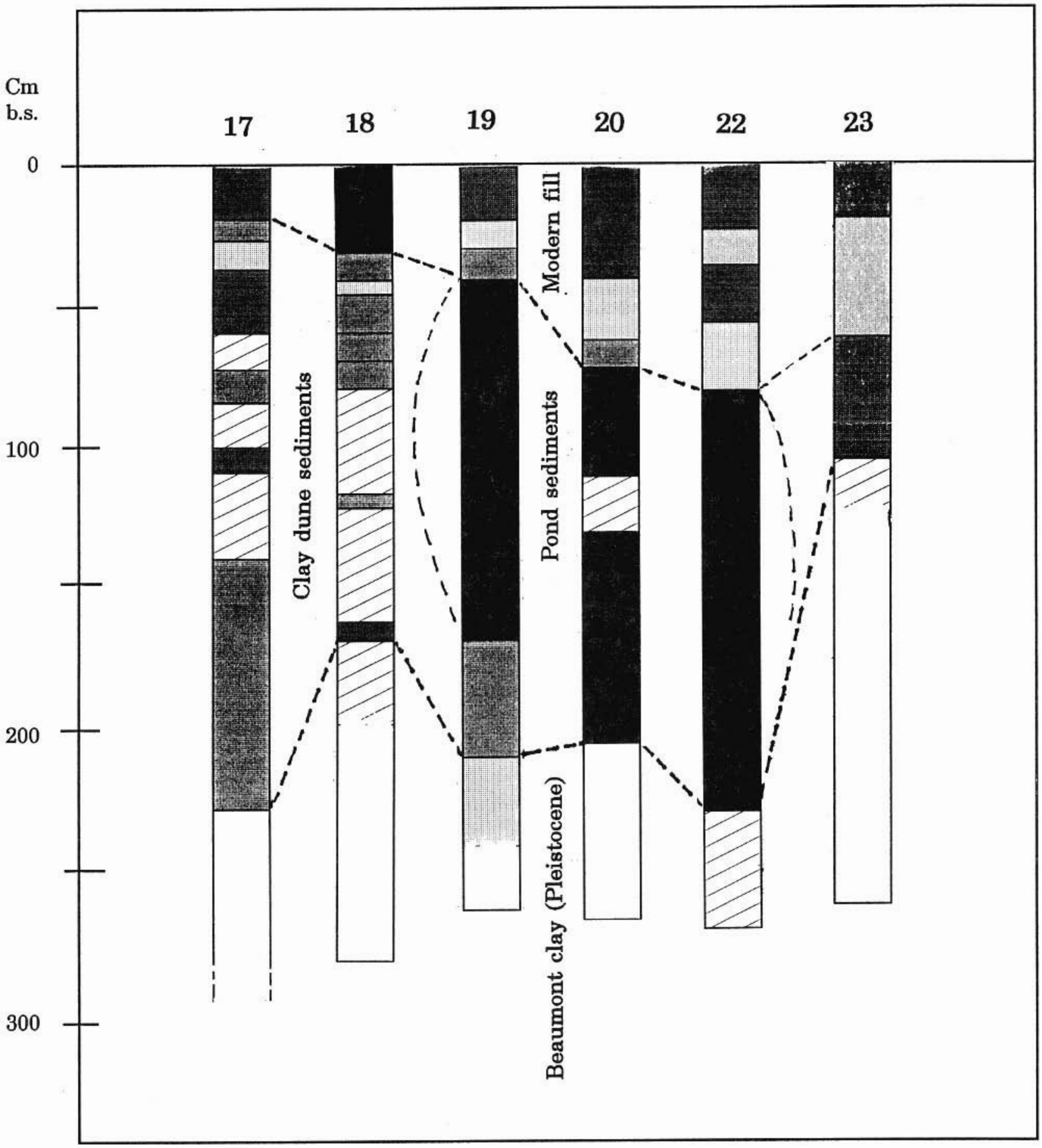

Figure 9. Core sediment profiles at north end of 41NU2. Note three distinct types of stratigraphy: Complex clay dune stratigraphy in Cores 17 and 18, pond sediments in Cores 19, 20 and 22, and upland soil profile (with modern fill on top) in Core 23.

soil profile in Core 23 and the cores along the west side of the project area. Figure 10 shows a schematic geological cross section of the north end of the project area based upon the core data.

The Test Units

The locations of the 20 test units are indicated in Figure 11. As was the case with the cores, limited access to residential lots conditioned the placement of these excavations, so that they tend to be spatially clustered.

In terms of geologic stratigraphy, the findings in the test units are congruent with those in the cores. Test units in the southern end of the project area (nos. 1-7) invariably showed clay dune sediment profiles. The single unit on the west side of Ennis Joslin Road, no. 20, showed a characteristic upland soil profile, with a homogeneous Holocene silty soil resting unconformably on Pleistocne clay of the Beaumont Formation. At the north end of the project area, Test Unit 18 contained the thick black pond sediments found in Cores 19, 22 and 23, while Test Unit 19 to the east revealed a clay dune stratigraphy, in keeping with the core data which showed the back edge of the dune to be approximately in the center line of Alameda Street. Finally, Test Units 8-10 and 16, all next to the eastern edge of Ennis Joslin and Alameda, revealed upland soil profiles, indicating that they were located just inland of the back edge of the clay dune.

Prehistoric cultural debris was found in 13 of the Test Units (nos. 1, 2, 4-7, 10, 13-17 and 20). As noted above, virtually all cultural debris was found within dark soil horizons in the clay dune sediments, except in the case of Test Units 8-10, 16 and 20 where shell fragments, burned clay nodules and occasional faunal bone fragments were mostly within the base of silty Holocene cumulic upland soil. In no instance was cultural debris dense. Shell debris and faunal bone did not approach the density found in true shell midden deposits, and artifacts were very scarce.

Representative Descriptions of Selected Test Units

The kinds and quantities of materials found in the test units are discussed in the next chapter. Here, several selected test units are described in order to give representative picture of stratigraphic variability across the site. A summary of the presence/absence and depths of soil zones containing cultural debris, and the kinds of materials present in these and other test units, may be found in Table 1.

Test Unit 2 (Figure 12)

This unit was located at the south end of the project area on level ground immediately west of the drainage ditch along the west side of Ennis Joslin Road. The top 20 cm or so consisted of a brown silty clay (Munsell color 10YR5/2) soil. As may be seen in Figure 12, five relatively dark-colored soil horizons were present, separated by light-colored organic silty clay. At a depth of 155 cm below ground surface, a dense, light-colored (10YR6/2) silty clay containing small caliche (calcium carbonate) nodules was encountered; this is believed to be the top of the Pleistocene Beaumont Formation. The thickest of the dark soil zones (10-20 cm thick) ranged in depth from 58-80 cm. This zone contained sparse cultural debris in the forms of scattered shell and faunal bone fragments and a few small chert flakes; cultural materials were restricted to this zone.

Test Unit 5 (Figure 13)

Located within the right of way on the east side of Ennis Joslin Road near the 15-foot contour line, this unit contained cultural debris as well as prehistoric human skeletal remains. Under approximately 20 cm of disturbed soil containing road gravel was found a characteristic clay dune statigraphy, with three distinct dark-colored soil horizons separated by zones of lighter-

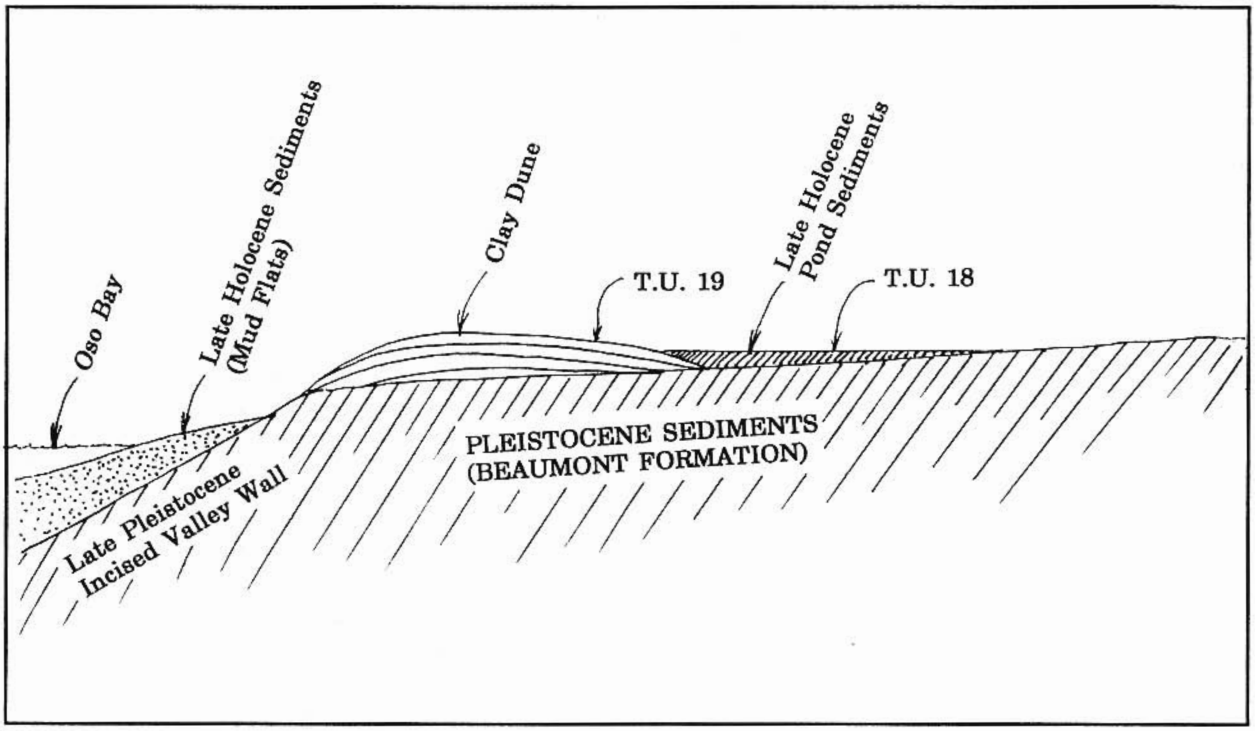

Figure 10. Schematic geologic cross-section of north end of 41NU2, based on data from cores and test units.

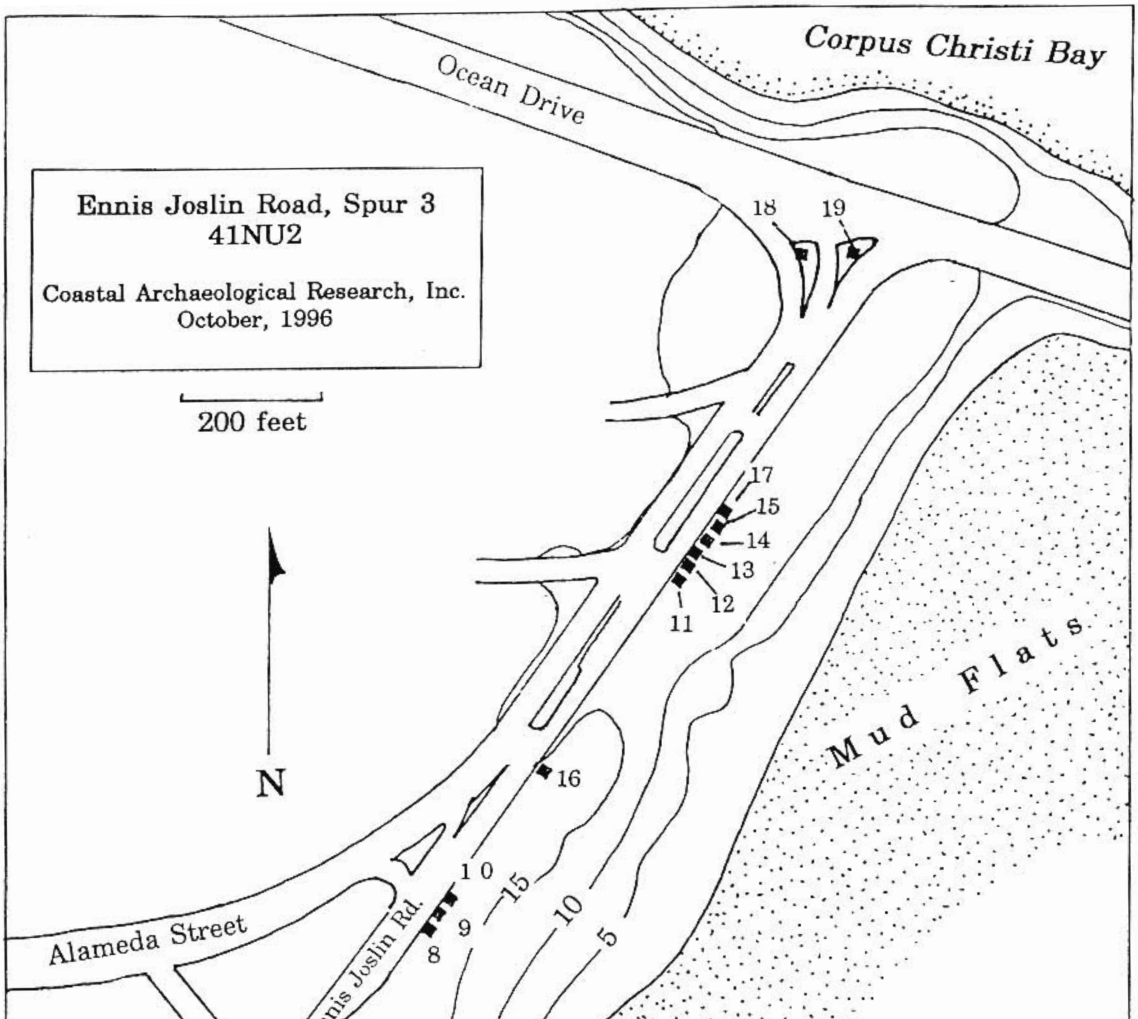

Figure 11. Map of 41NU2, showing locations of test units.

Table 1. Depths of soil horizons in Test Units with observed cultural materials (S=shell; FB=faunal bone; D=chert debitage; BCN= burned clay nodules; C=charcoal)

Test Unit	Depth of Zones*	Thickness	Cultural Materials Observed	Screened?
1	Fea. 1, 50-55 cm 120-135 cm	5 cm 15 cm	S, disturbed soil Sparse S, FB	No Yes
2	57-75 cm	15 cm	Sparse S, FB, D	Yes
3	No cultural zones	----	----	----
4	130-150 cm	20 cm	FB, S	Yes
5	90-100 cm 130-160 cm	5-8 cm 30 cm	C, very sparse S FB, BCN, S, D	No Yes
6	100-130 cm	25 cm	FB, S, BCN, D, dart point	Yes
7	90-130 cm	40 cm	FB, S BCN, D	Yes
8	No cultural zones	-----	Extremely sparse S at base of cumulic soil	No
9	No cultural zones	-----	Extremely sparse S at base of cumulic soil	No
10	80-100 cm	15 -20 cm	1otolith, sparse S, D at base of cumulic soil	Yes
11	60-70 cm	5 cm	Very sparse S	No
12	100-115 cm	10 cm	Very sparse S	No
13	70-75 cm 110-130 cm	5 cm 15 cm	C FB, BCN, D, otoliths	No Yes
14	100-125 cm	20 cm	FB, S, BCN, D, otoliths, sandstone	Yes
15	80-100 cm	15 cm	FB, S, BCN, D, bone pin, otoliths	Yes
16	No cultural zones	---	---	No
17	90-100 cm	5-8 cm	Fea. 5 (whelk), sparse FB, crab claw fragments	Yes
18	No cultural zones	---	---	No
19	No cultural zones	---	---	No
20	65-85 cm	15 cm	FB, S, BCN, D at base of soil	Yes

Note: Depth ranges of zones are usually greater than actual zone thicknesses, reflecting undulation/dipping of zones.

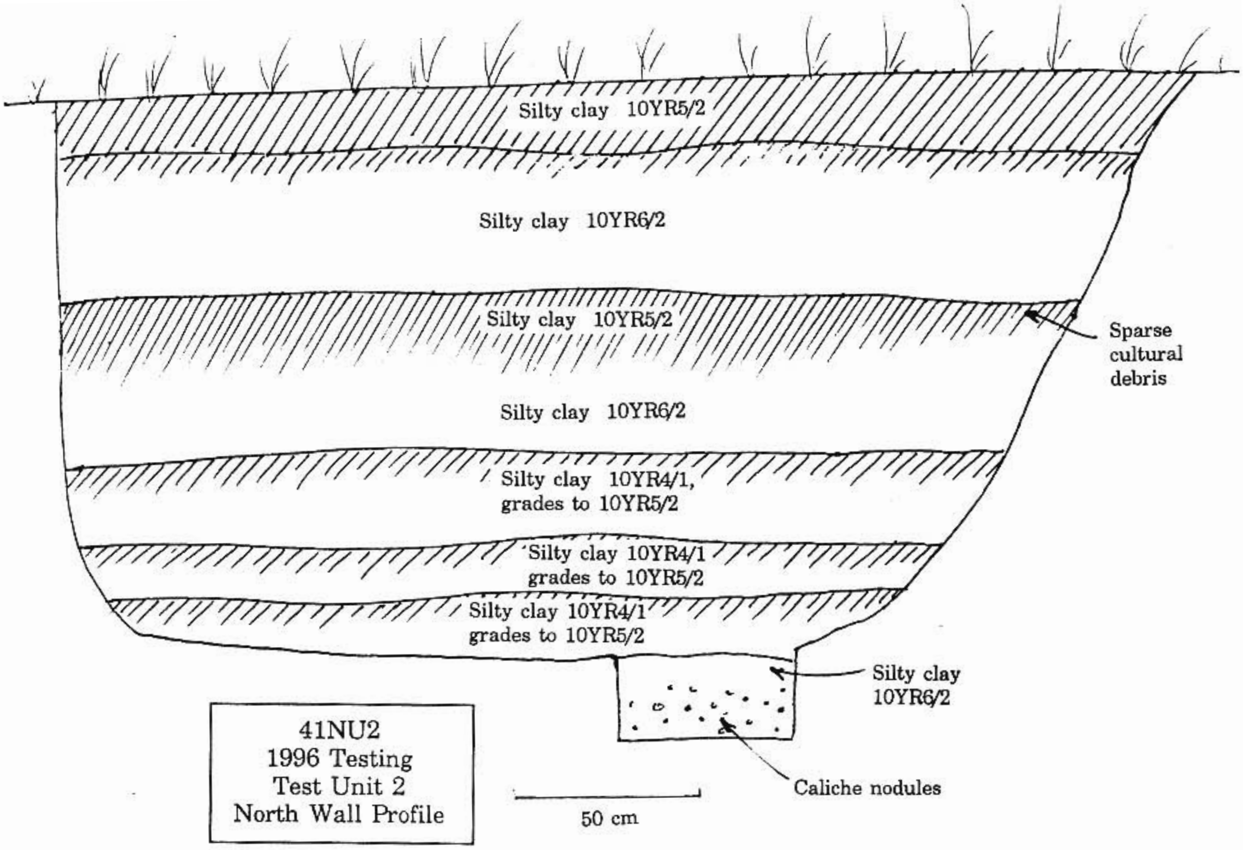

Figure 12. Profile of north wall of Test Unit 2.

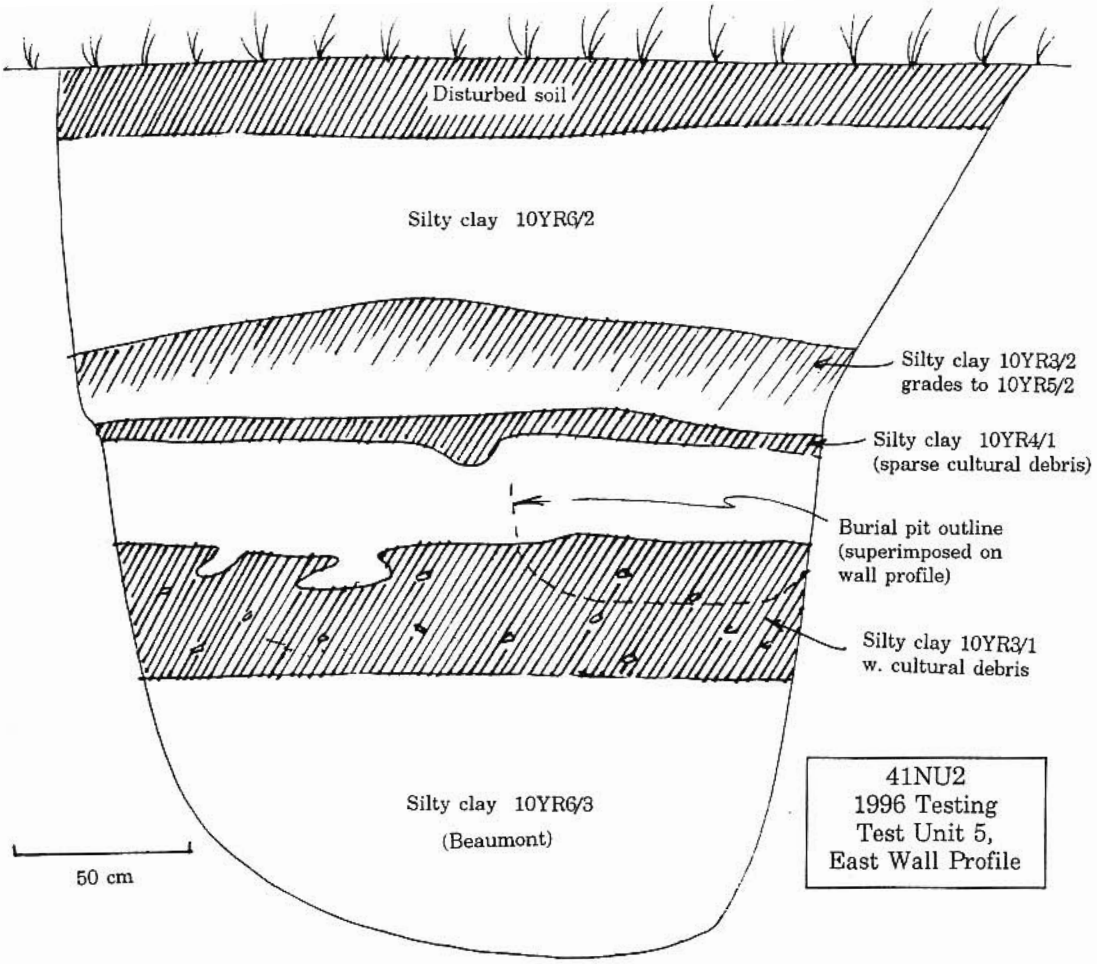

Figure 13. Profile of east wall of Test Unit 5. Note that burial pit intrudes into cultural zone at base of clay dune deposit.

colored eolian silty clay (see Figure 13). At a depth 170 cm below surface, dense, light-colored silty clay of the Beaumont Formation was reached. The two lower soil horizons contained cultural debris. The upper of these was relatively thin (5-10 cm thick), and debris was extremely sparse, consisting only of charcoal flecks, a few small burned clay nodules and shell fragments. The lower soil was considerably thicker (approximately 25-30 cm thick), and contained a much greater density of debris consisting of burned clay and caliched nodules, shells and shell fragments of various estuarine species, and bones of various fish and terrestrial fauna. All of the excavated matrix from this zone was water screened in the field, and a sample was fine water screened in the laboratory.

Human skeletal remains in Test Unit 5 consisted of a complete burial resting at approximately 130-150 cm below ground surface, and a complete human ulna representing a different individual found against the north wall of the unit at a depth of 139 cm. These remains and associated materials are described and disucssed further on.

Test Unit 7 (Figure 14)

Test Unit 7 was also located within the right-of-way on the east side of Ennis Joslin Road, some 20 meters north of Test Unit 5. The stratigraphy in this unit was similar to that in Unit 5, except for a thicker and more complex disturbed zone consisting of redeposited silty clay soil over a layer of modern fill (soil with road shell and gravel). Beneath the disturbed zone was a light (10YR6/2) silty clay corresponding to the silty clay zone of the same color found beneath the thinner disturbed soil in Test Unit 5. Under the light silty clay was found a 10-15-cm thick, dark-colored (10YR3/2) silty clay soil horizon with very sparse cultural debris (a few small faunal bone fragments); this zone probably corresponds to the upper and thinner of the two cultural zones in Test Unit 5. This thin soil graded into a light (10YR5/2) silty clay, under which was a thick (50-cm) zone of dark (10YR3/1 silty clay soil containing relatively abundant cultural debris in the forms of shells and shell fragments, numerous nodules of burned clay and burned caliche, four chert flakes, a fragment of edge-flaked sunray venus clam shell, and faunal bone fragments. By far the greatest density of debris was within the upper 30 cm of the zone (90-120 cm below ground surface), the excavated soil from which was water-screened by 10-cm vertical increments. This zone rested unconformably on Beaumont sediment, a dense, light-colored (10YR6/3) silty clay containing small caliche nodules. The thickness, contents, color, texture and stratigraphic position of the lower cultural zone suggest that it corrletes with the lower cultural zone in Test Unit 5. Similar zones containing cultural debris were found immediately above the Beaumont clay in nearby Test Units 4 and 7, suggesting a continuous cultural zone within this area.

Test Unit 10 (Figure 15)

This unit exhibited an upland prairie soil profile. Under an approximately 10-20 cm-thick overburden of disturbed soil containing modern glass fragments was an essentially homogeneous silt-clay cumulic soil, approximately 80-90 cm thick, consistently dark in color but grading from a dark brown (10YR3/2) to a dark gray. Cultural materials were observed in the bottom 15-20 cm of this soil, which was water screened in the field. The screening yielded shells, burned clay/caliche nodules, a chert flake, a piece of sandstone, and sparse faunal materials. The soil rested unconformably on a dense, lighter-colored (10YR5/2) silty clay of the Beaumont Formation.

Test Unit 14 (Figures 16 and 17)

Test Unit 14 was located immediately adjacent to the proposed right-of-way on the east side of Alameda Street toward the north end of the project area. This unit exhibited a rather complex clay dune stratigraphy, as did other test units in this area (i.e., Test Units 12, 13, 15, 17). The unit was excavated to a depth of 150 cm, revealing six distinct soil horizons, including a

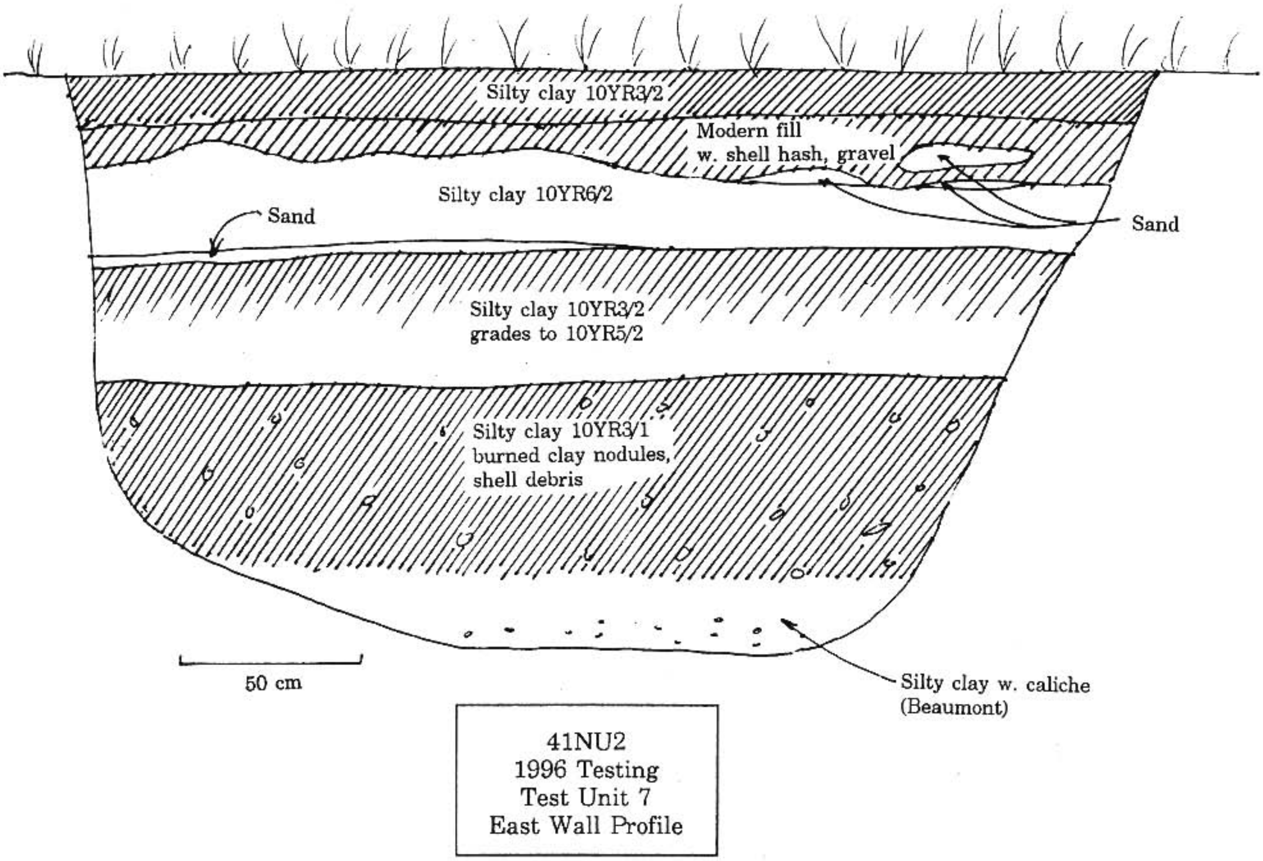

Figure 14. Profile of east wall of Test Unit 7.

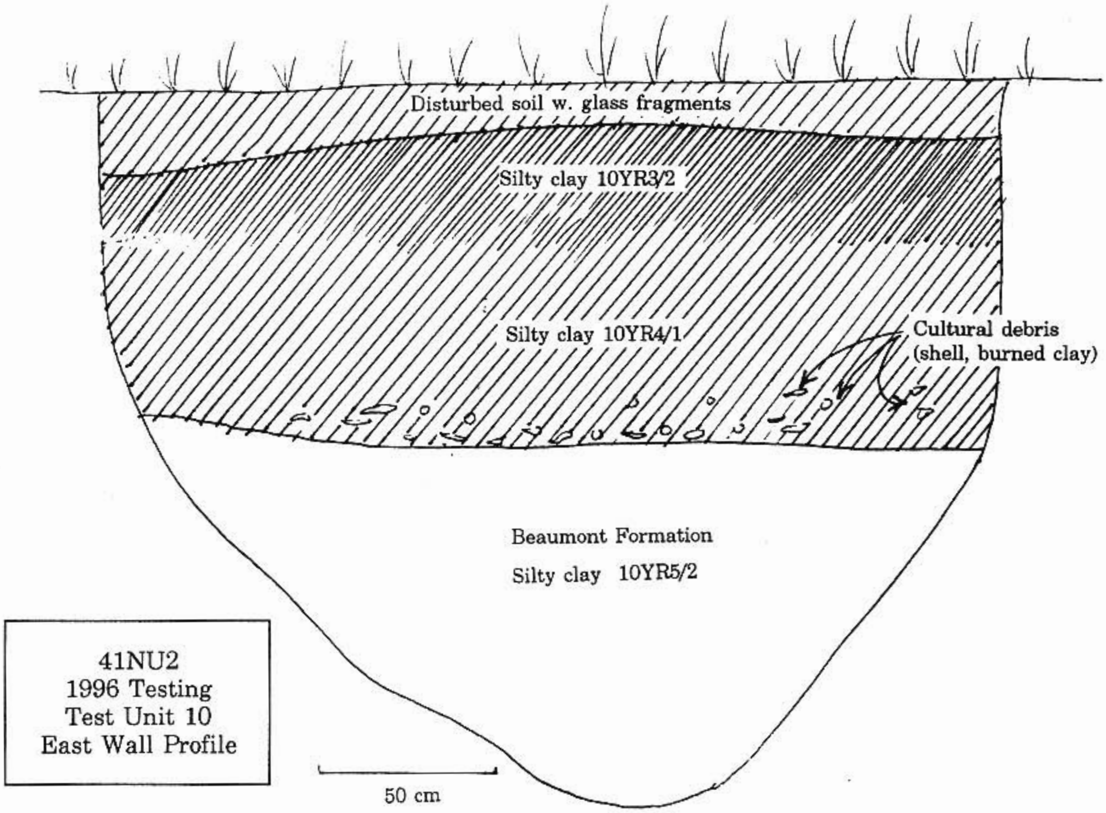

Figure 15. Profile of east wall of Test Unit 10. Note that scattered cultural materials rest in base of cumulic silty clay upland soil.

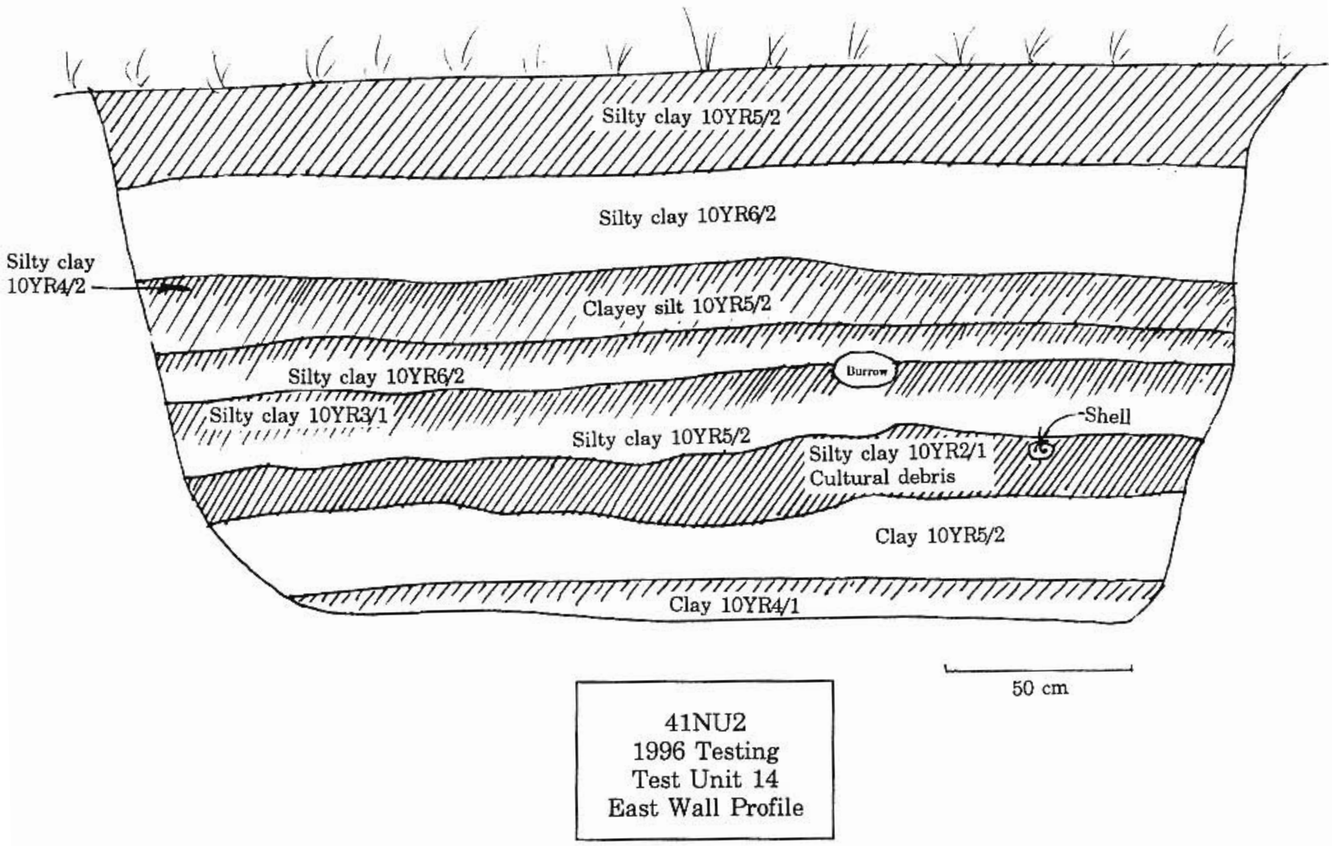

Figure 16. Profile of east wall of Test Unit 14.

Figure 17. David Driver drawing profile of east wall of Test Unit 14. Note shells in dark soil horizon in adjoining south wall of unit.

grayish brown silty clay topsoil, alternating with light-colored silty clay eolian sediments. Although the unit did not reach the underlying Pleistocene clay of the Beaumont Formation, it is confidently believed, based on nearby core data and test unit stratigraphies, that the lowest stratum in Test Unit 14, a dark gray soil horizon, was near the base of the clay dune.

Cultural materials were found in some abundance within a black soil, 15-20 cm thick, the top of which was encountered at 100 cm below the surface. This soil was water screened in the field, and yielded burned clay/caliche nodules, shells and shell fragments, faunal bone, a relatively large number of fish otoliths, a sandstone fragment and a fragment of edge-flaked sunray venus clam shell.

Test Unit 17 (Figure 18)

This unit was located next to the right-of-way on the east side of Alameda Street, a short distance north of Test Unit 14 (see Figure 18). A thick layer of disturbed soil containing fragments of concrete and road gravel extended from the surface to a depth of as much as 60 cm. This was directly underlain by clay dune sediments. Four distinct soil horizons were found, again alternating with light-colored eolian silty clay strata, including two thin lenses of light gray fine sand at depths of 90 and 110 cm below surface. Two thin soil horizons, each 5-10 cm thick, contained cultural materials; all sediments from these zones were water screened. The upper of

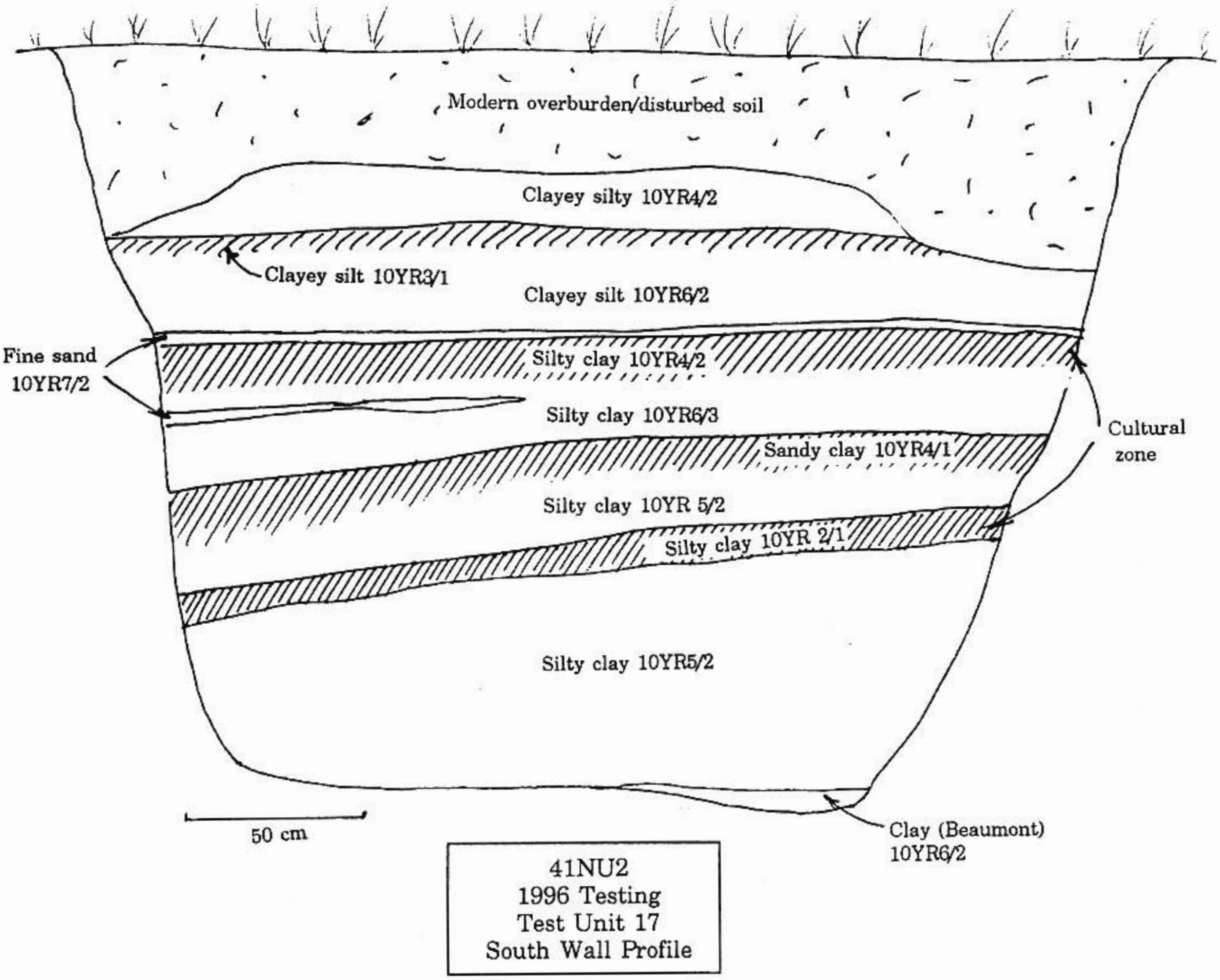

Figure 18. Profile of south wall of Test Unit 17.

these, found between 90 and 100 cm below surface, contained a small concentration of whelk (*Busycon perversum*) shells, numerous crab claw fragments, and a few associated faunal bone fragments. The lower cultural zone, which dipped slightly downward from south to north (see Figure 18), was encountered between 145 and 160 cm below the surface. Materials from this zone include whole and fragmentary shells, burned clay nodules, faunal bone fragments and fish otoliths.

Test Unit 18 (Figures 19)

Located at the north end of the project area within a median at the intersection of Alameda Street and Ocean Drive, the stratigraphy in this unit consisted of two layers of modern soil fill over an essentially homogeneous black (10YR2/1), highly organic-rich silt-clay pond sediment. The stratigraphy here was thus very similar to that in nearby cores (nos. 19, 20 and 22), further supporting the conclusion, mentioned above, that a pond once existed at this location behind the clay dune. No cultural materials were present in this test unit.

Test Unit 19 (Figures 20 and 21)

This unit, located some 30 meters to the east of Test Unit 19, exhibited a clear clay dune stratigraphy. Under a layer of modern fill soil appoximately 40 cm thick were eight dark silty clay soil horizons ranging in thickness from approximately 20 cm to as little as 3-5 cm, alternating with light-colored silt-clay eolian sediments. A dense, fine sandy clay of the Beaumont formation was reached at a depth of 200 cm below the surface. No cultural materials were found in this test unit.

Test Unit 20 (Figure 22)

This unit was located in the southern part of the project area, adjacent to the right-of-way on the west side of Ennis Joslin Road. In keeping with the findings in most cores on the east side of Ennis Joslin Road, the stratigraphy here was typical of the upland prairie rather than a clay dune, with a homogeneous brown (10YR4/2) silty clay cumulic soil resting unconformably on a gray (10YR5/1 grading to 10YR6/2) dense silty clay of the Beaumont Formation.

The lowest 10-20 cm of the cumulic soil contained cultural debris in the forms of burned clay nodules, shell and scattered faunal bone fragments and five chert flakes. A concentration of burned clay nodules was observed within this zone in the west wall of the unit. This may represent a small hearth, and was designated Feature 6 (described below).

Features

A total of six anomalies were designated as features in the field. Upon careful exposure with small hand tools, only two of these, Features 5 and 6 proved to be true features. The others turned out to be either relatively large, isolated faunal bone fragments (Features 2 3, and 4), or in the case of Feature 1, a concentration of shell which probably resulted from modern soil disturbance.

Feature 1

This consisted of a dense deposit of whole and fragmentary sunray venus (*Macrocallista nimbosa*) clam shell fragments, found within Test Unit 1 near the southwest corner of the intersection of Ennis Joslin Road and Del Oso Drive. The shells, weighing a total of 1,073 grams, were concentrated within an approximately 100 x 60 cm area near the south wall of the unit at a depth ranging between 50 and 55 cm below surface. Because sunray venus shell is commonly

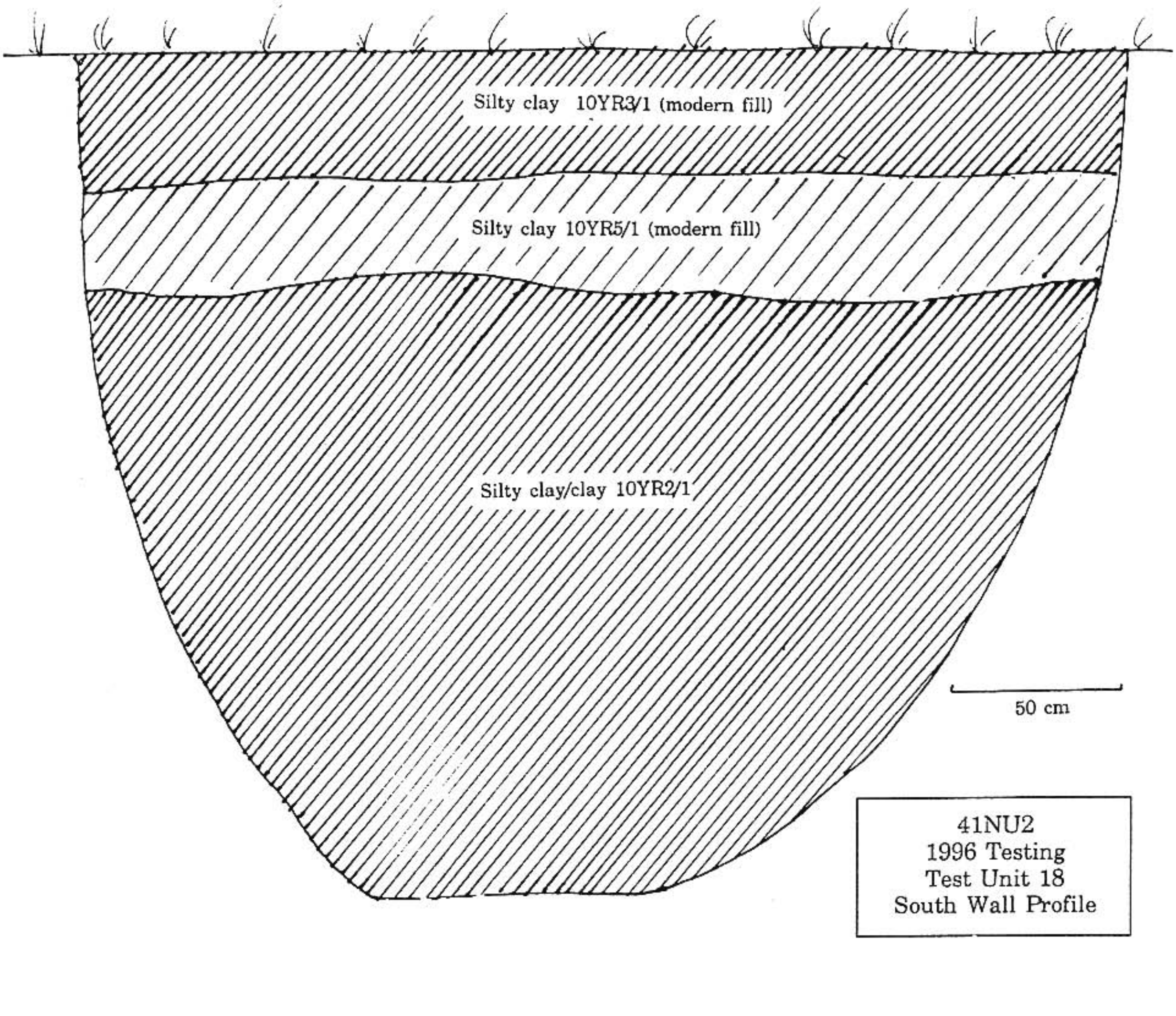

Figure 19. Profile of south wall of Test Unit 18. Note thick black pond sediments.

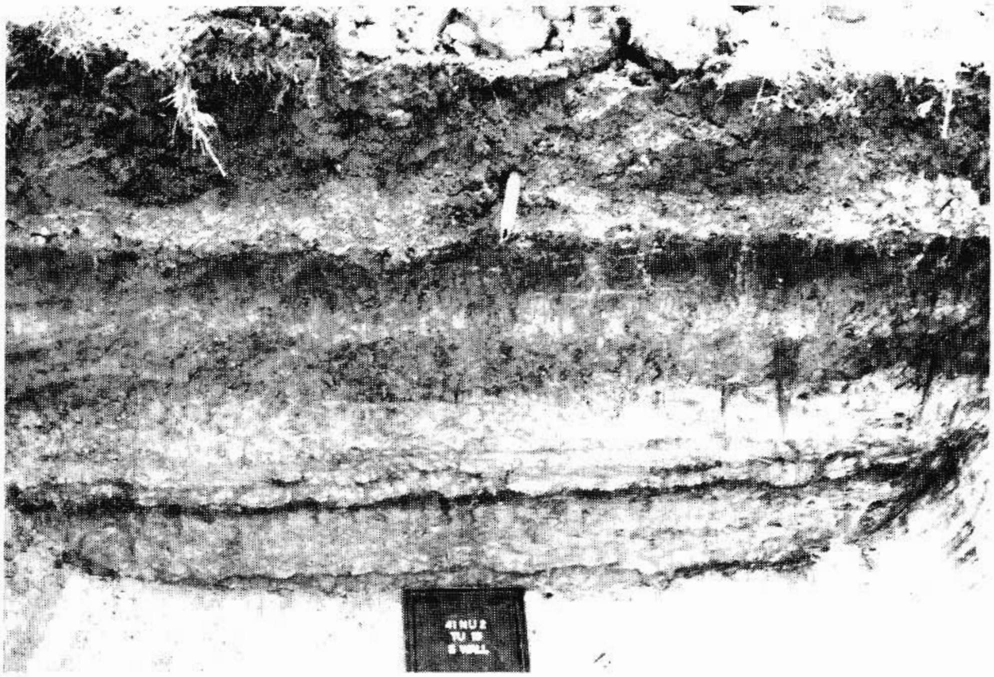

Figure 20. South wall of Test Unit 19, showing characteristic clay dune stratigraphy, with dark soil horizons alternating with light-colored sediments.

associated with prehistoric occupation sites, this was initially thought to represent a concentration of prehistoric food refuse. However, hand excavation in and around the shell concentration, and in general in the test unit, revealed numerous fragments of modern concrete slabs and glass fragments; one concrete fragment was found resting immediately under the shell concentration. It was concluded, therefore, that the shells were deposited in a highly disturbed context, probably the result of modern earth-moving activities.

Feature 2

This "feature" consisted of a fragment of mammal longbone broken and in poor condition, approximately 14 cm in length, resting at a depth of 120 cm below surface in Test Unit 6. The bone does not appear to be human, though species identification is uncertain due to the poor and highly fragmented condition. The bone rested, along with six oyster shells, in a light-colored silty clay eolian sediment. A feature designation was given, but subsequent exposure with small hand tools failed to show evidence that these materials were more than a small and isolated occurence of faunal materials.

Feature 3

This consisted of a relatively large deer longbone fragment found also within Test Unit 6

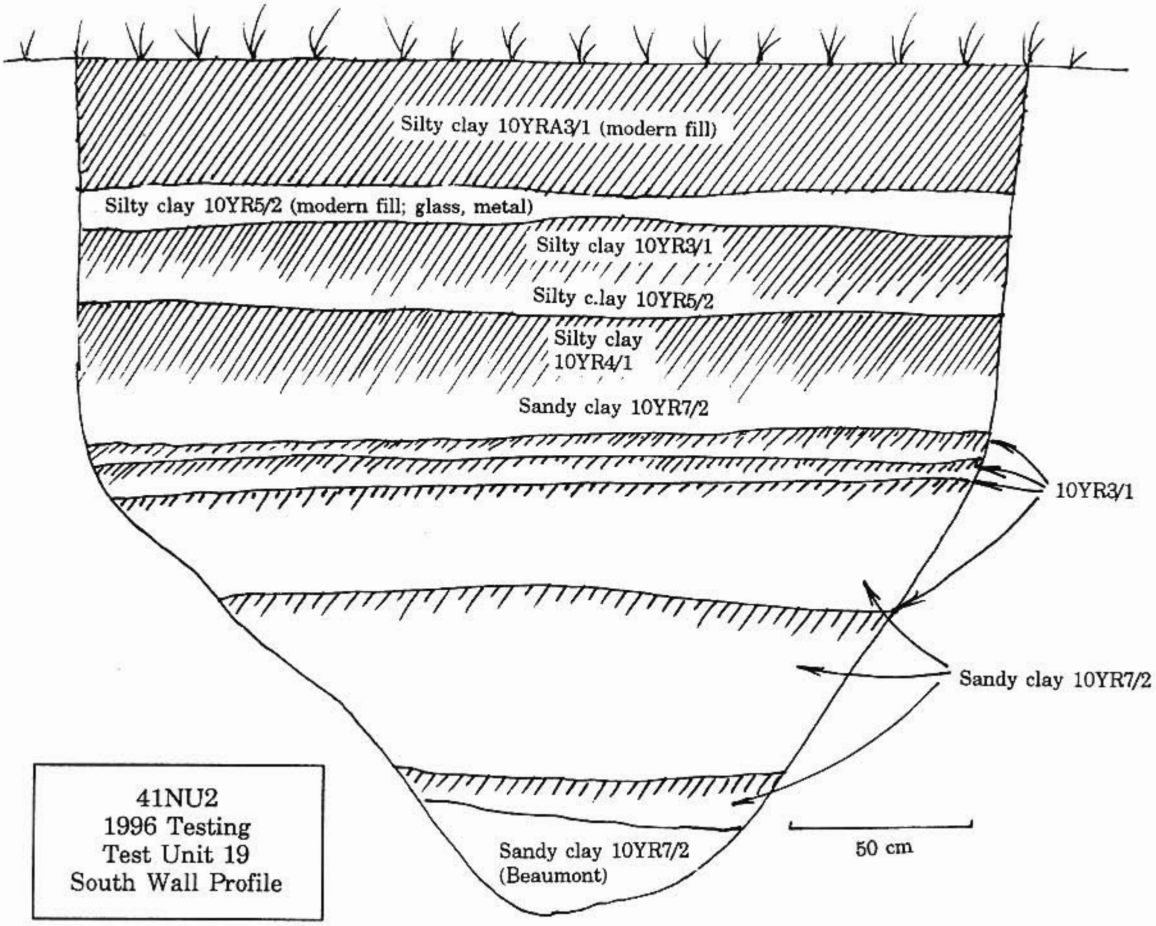

Figure 21. Profile of south wall of Test Unit 19.

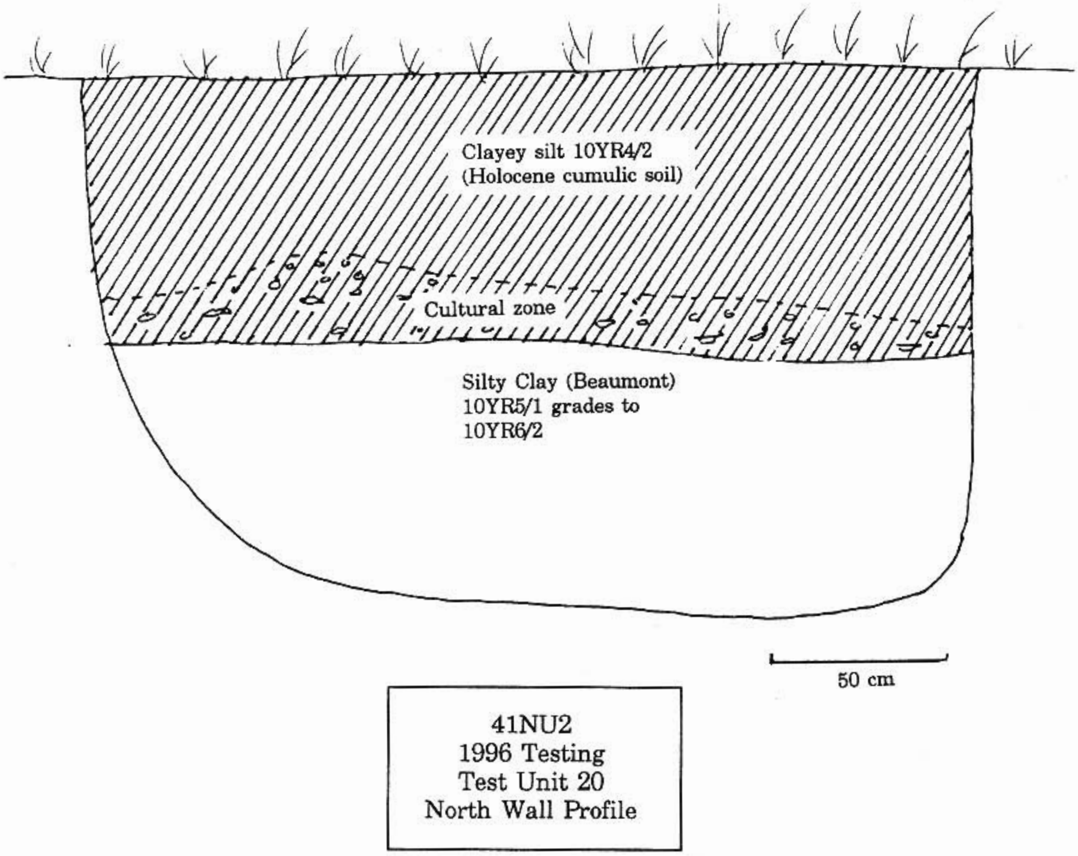

Figure 22. Profile of north wall of Test Unit 20. Note that cultural materials occur in base of upland eolian cumulic soil, which rests unconformably on Beaumont (Pleistocene) clay.

at the same depth as "Feature" 3. Erring on the side of caution, this was given a feature designation upon initial exposure, but hand excavation failed to reveal additional associated material.

Feature 4

This was an approximately 10-cm-long section of mammal longbone resting at 85 centimeters below the surface in Test Unit 9, within dark gray eolian sediment. Due to very poor preservation and highly fragmented conditions, the species is unidentifiable.

Feature 5, Whelk Shell Concentration (Figure 23)

This feature consisted of a distinct concentration of small- to medium-sized, mostly whole shells of lightning whelk (*Busycon perversum*), resting on the surface of a thin soil horizon at a depth of 70-80 cm below ground surface in Test Unit 17. The 10-cm depth range of the feature reflects slight undulation of the buried soil surface on which the shells rested; the actual thickness of the shell deposit was about five centimeters. The shells were concentrated in the western 100 cm of the test unit, with a scatter of specimens beyond the margins of the concentration (see Figure 23). Whole shells generally ranged between seven and 10 cm in length. Although whelk shells from cultural deposits in the region often exhibit artificial perforations in the body whorl sections-- so-called "kill holes", this was not the case here. A total of 162 whole shells, 21 columella fragments, and 37 body whorl fragments were associated with the feature.

Other cultural debris found within or around the feature included sparse remains of a number of faunal taxa, but no artifacts. In addition to the whelk shells, molluskan remains consisted of one whole and three fragmentary quahog (*Mercenaria campichensis*) shells, 10 fragments of Atlantic cockle (*Laevicardium robustum*) shell, seven cross-barred venus (*Chione cancellata*) shells, five ponderous ark (*Noetia ponderosa*) shells, and seven umbo/whole and 28 valve fragments of sunray venus clamshell (*Macrocallista nimbosa*). The feature and immediately surrounding soil contained 144 crab claw fragments, the highest density observed at the site. Faunal bone was notably scarce, consisting of two fragments of deer bone and seven fish otoliths (1 redfish, 4 spotted seatrout and 2 saltwater catfish).

Feature 5 was not completely exposed, since it appeared to extend beyond the edges of the test unit, into the north and west walls. However, the fact that it was restricted to the west end of the unit suggests that it is a localized feature rather than an extensive stratum of shell debris. In this regard, it is similar to localized clusters of whelk shell noted in areas exposed by erosion during the 1933 investigations at the site (A. T. Jackson, n.d., on file at TARL). Presumably, Feature 5 and other such shell concentrations represent discard of conch shells related to episodes of procurement and food consumption.

Feature 6, Possible Hearth (Figure 24)

Feature 6 was a relatively dense cluster of small (1-2.5 cm in diameter) burned clay nodules and scattered small bits of charcoal observed in the west wall of Test Unit 20 as the end of the unit was cleaned with trowels in preparation for profile drawing and photography. The feature rested within the upland silty clay cumulic soil, within the 10-20 cm-thick zone of cultural material at the bottom of the soil and immediately above the unconformably contact with the basal Beaumont clay. The feature may be a hearth remnant, though it did not have either clear edges or a discernable basin shape in profile. The cluster of burned clay nodules had an oblong shape in profile, and a thickness of 22 cm. The horizontal dimension was indeterminate because the feature extended beyond the limits of the test unit; that portion visible extended from the south

Figure 23. Feature 5, concentration of whelk (*Busycon perversum*) shells in Test Unit 17. Looking west.

unit wall into the unit a distance of 46 cm.

Human Skeletal Remains in Test Unit 5

As noted above, prehistoric human skeletal materials were encountered in Test Unit 5, all at depths between 130 and 150 cm below surface. Except for an isolated human molar in Test Unit 1, these are the only human remains found during the 1996 testing. These remains consisted of an intact burial and an isolated human ulna which, for reasons discussed below, probably was displaced from another burial near but outside the confines of Test Unit 5.

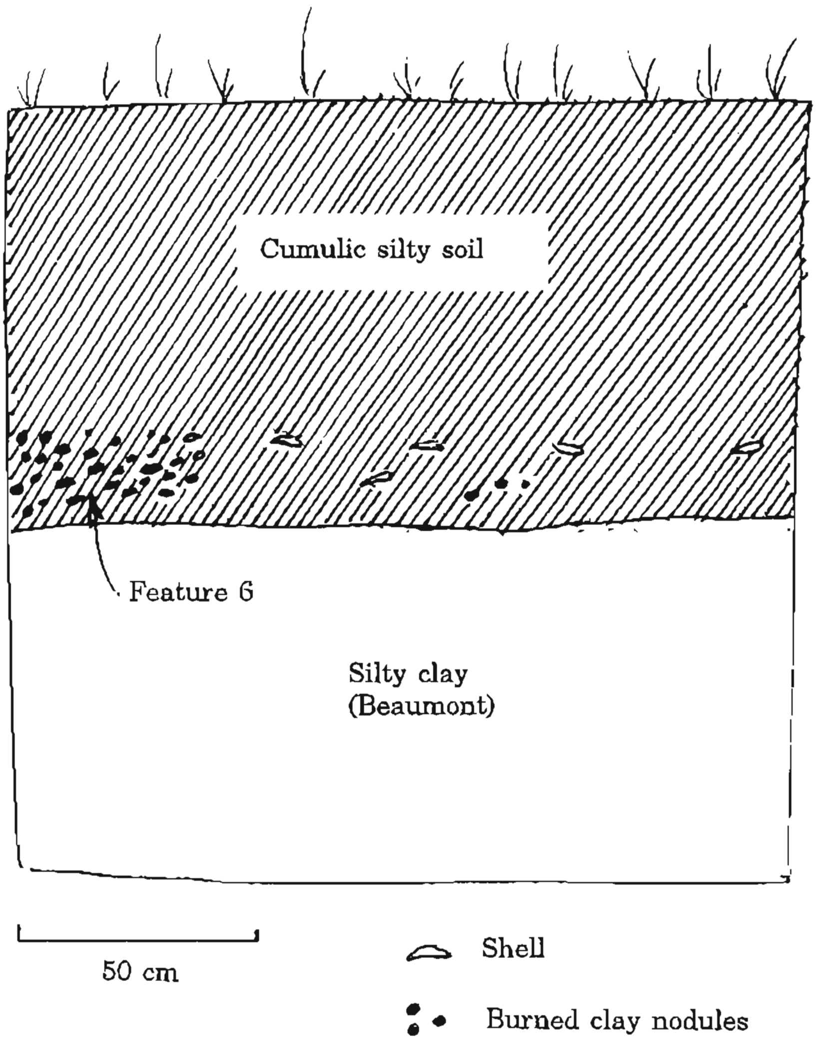

Figure 24. Profile of west wall of Test Unit 20, showing concentration of burned clay nodules, Feature 6, in base of cumulic soil.

The Burial (Figures 25-27)

As gradeall excavation proceeded in Test Unit 5, a fragment of bone was exposed in situ at a depth of 130 cm, within light-colored silty clay sediment. Since one of the primary objectives of the testing was to locate and document prehistoric mortuary remains, any bone (other than obviously very small faunal bone fragments) encountered as thin soil increments were removed was considered a potential indicator that a burial was present. In this case, a small portion of longbone was exposed by the gradeall, and hand excavation with trowels, small hand-held bamboo picks and brushes revealed a human femur and other associated bones. Additionally, it was noted that the bones rested within a patch of brown soil within the light sediment matrix; this proved to mark the outlines of a burial pit measuring approximately 90 cm north-south by 60 cm east-west.

Once the presence of a burial was confirmed, the pit outline was cleaned, mapped and photographed. Excavation then involved careful hand work, so that bones and associated grave materials could be exposed in situ for further documentation. Where possible, excavation followed the pit outline, though the edges of the grave pit were found to be somewhat unclear on the west edge.

At the request of TxDot (Austin) personnel, immediately upon removal from the ground, the bones and associated grave inclusions were transported to the Corpus Christi Museum of Science and History for temporary curation, in order to preclude any possible perception of disrespectful treatment. For the same reason, no analysis of the bones was permitted prior the time of this writing. Thus, the following discussion can rely only on the very limited observations which could be made in the field.

The layout of the bones may be seen in Figure 25. The fully exposed skeleton was found to be that of an adult female, resting on the right side, with the head oriented to the south. Interestingly, the leg bones (femurs, tibiae and fibulae) were separated from the otherwise fully articulated skeleton, and placed on top of the torso. The two femurs were clearly reversed, so that the proximal end of one was toward the feet. The leg bones thus had either been removed from the body prior to burial and defleshed, or perhaps the body had been placed on a scaffold or some kind of charnel house where partial decay and disarticulation of the bones had taken place. Eventual cleaning and careful examination of these bones may reveal cut marks which would serve as a clue as to the sequence of events which led to the unusual position of the leg bones. Suffice it to say at this time that these bones do appear, on the basis of general size and the absence of any other leg bones in the grave, to pertain to the same individual as the rest of the skeleton within the burial.

Aside from the disarticulated leg bones, the position of the body is typical of tightly flexed burials, with the articulated feet resting close to the pelvis. The left arm was bent at the elbow, with the hand in front of the abdomen. The right arm was apparently also bent at the elbow, with the hand near the face.

The bones, including the skull, were in good condition. The identification of the skeleton as pertaining to an adult female is based on the following field observations:

1. Partly closed cranial sutures, completely fused longbone epiphyses, and considerable tooth wear indicated that the individual was an adult. Cranial sutures were still clearly visible, and tooth wear, while marked, was not as advanced as in some other specimens from the Texas coast, suggesting that the individual was not of highly advanced age.

2. That this individual was a female is suggested by the general impression of small size (though time in the field did not permit measurement of individual bone elements), a rather small mastoid process and generally gracile facial bones, a relatively wide pelvic notch and observable parturition pits on both right and left pelvic bones.

Additional materials and observations which provide hints at the nature of the interment within a ritual context are:

1. The skeleton appeared to be surrounded by small- to medium-sized shells of the gastropod species lightning whelk (*Busycon perversum*) (N=13) and Florida horse conch (*Pleuropoca gigantea*) (N=1). Subsequent excavation and screening of the cultural zone into which the grave pit intruded failed to show a comparble density of gastropod shells, indicating that these shells were in fact placed within the grave at the time of burial. The shells in fact tended to occur near the edge of the grave, just inside the discernable grave pit outline. Several of the graves excavated at the site in 1933 also contained gastropod shells (Jackson, field notes), so it is apparent that some ritual or ideological significance was ascribed to gastropod shells.

2. A bi-pointed whelk columella, similar to the specimen illustrated in Figure 29, was found near the top of the skull. The ends of this specimen appear to be artificially pointed (though, as is generally the case on Texas coast sites, surficial weathering precludes identification

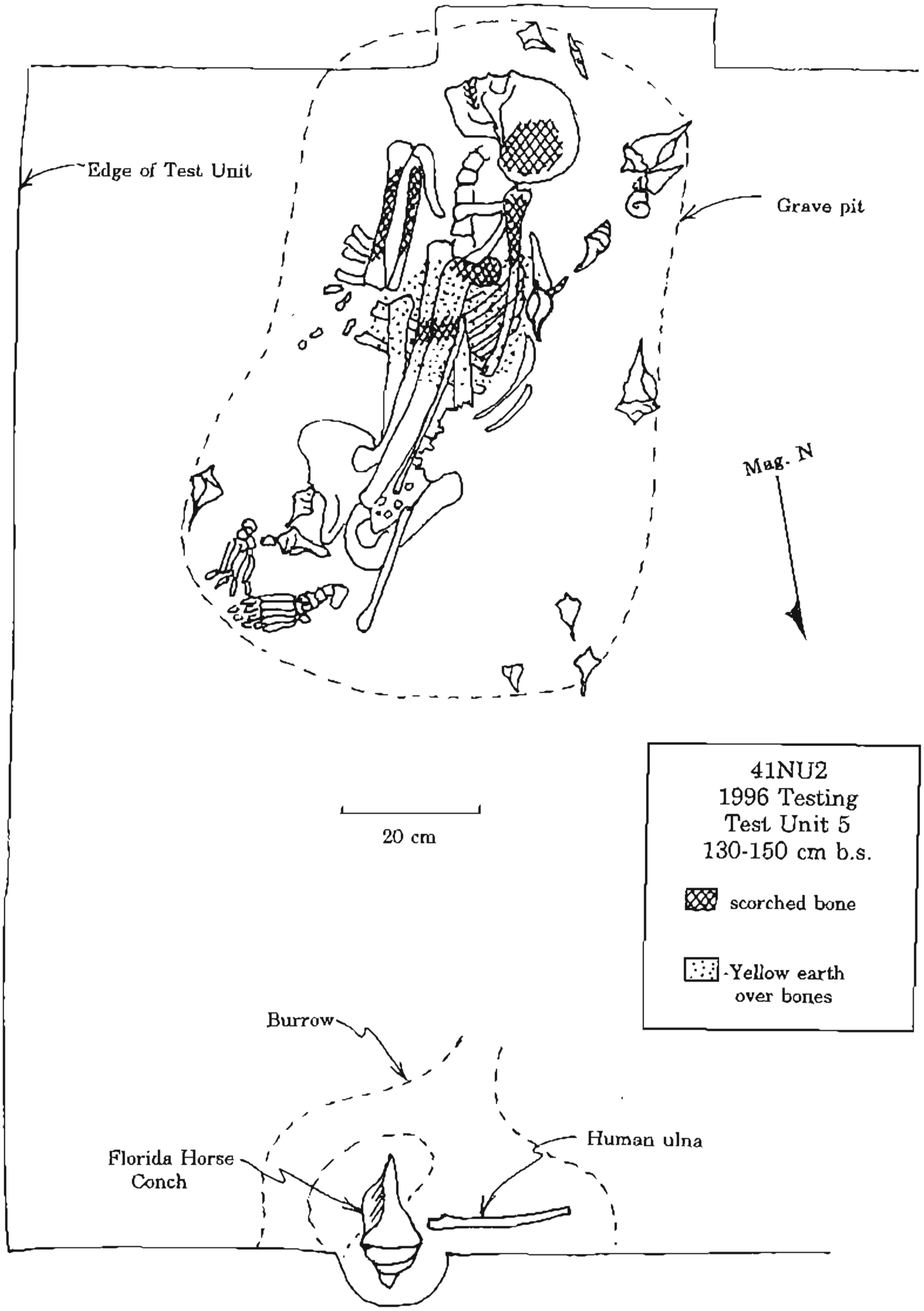

Figure 25. Plan view of Test Unit 5, 130-150 cm below surface, showing burial and isolated human ulna and large Florida horse conch in burrow.

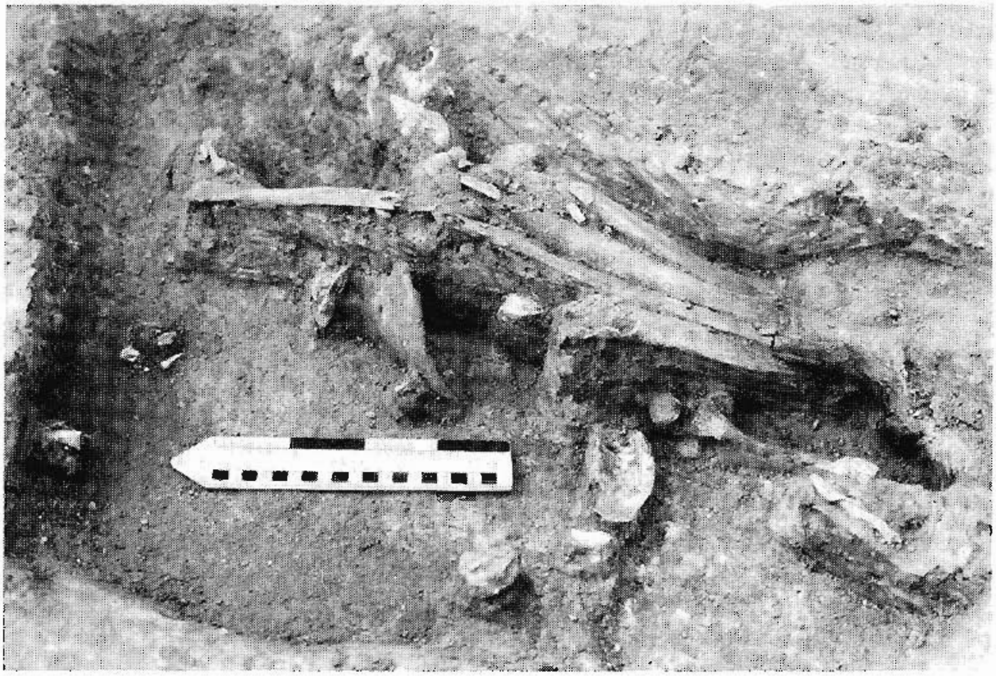

Figure 26. Initial exposure of longbones in burial, Test Unit 5.

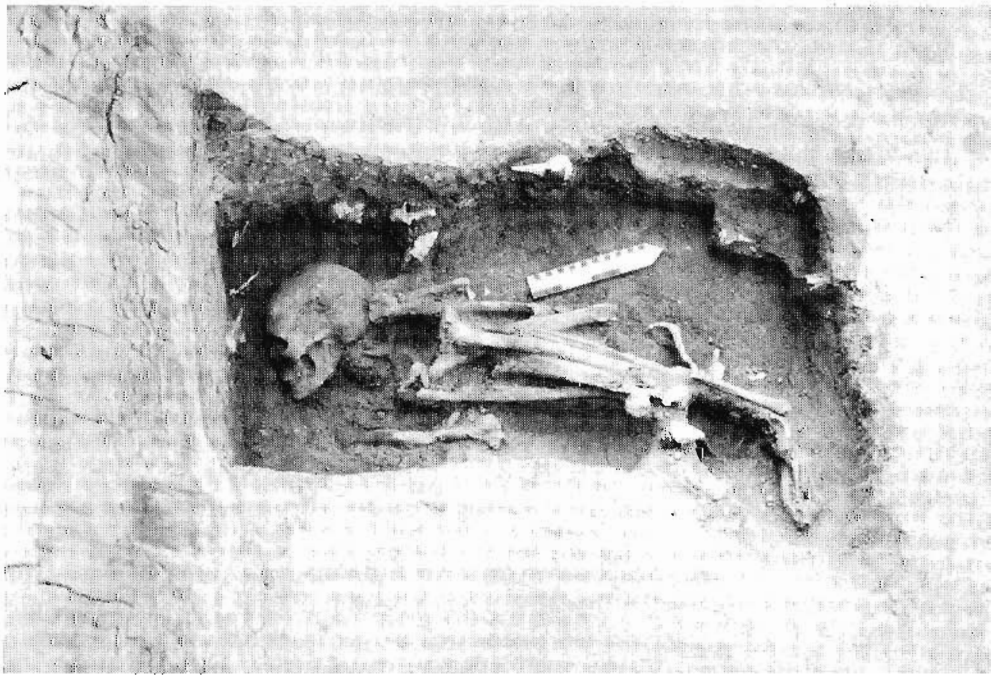

Figure 27. Burial in Test Unit 5, exposed. Note that longbones were placed on top of lower torso; also note gastropod shells within grave pit, and bi-pointed whelk columella near top of skull.

of manufacturing or use wear). Similar specimens are frequently found in midden debris on central Texas coast sites (e.g., Story 1968; Prewitt et al. 1987; Ricklis 1995). The function(s) of these artifacts is unclear, though the location of the present specimen suggests that it could have served as a hair pin. The presence of numerous similar specimens in midden debris would not seem to support this interpretation, but it is entirely possible that these artifacts had multiple uses.

3. Approximately two liters of yellow (10YR7/6) sandy sediment was found in a more or less homogenous mass resting on the upper torso of the individual. This material appears to be an intentional placement within the grave, and presumably had some kind of magio-religious significance within the context of mortuary ritual. It may be relevant to note that red and yellow ochres have been found within prehistoric graves at other Texas coast sites (e.g., Campbell 1952; Aten 1976; Ricklis 1994). While the yellow sand is definitely not powdered ochre, it may have served an analogous, albeit unclear, ritual function.

4. A small fire was built on or immediately above the skeleton, presumably during ritual attending burial. This is indictated by the fact that a number of articulated bones, namely, part of the skull, the proximal left humerous and nearby leg longbone sections, were scorched to a dark gray to black color (Figure 25. Small bits of wood charcoal were found among the bones in this part of the grave, and these doubtless are remnants of the fuel used for the fire. A sample of this charcoal was submitted for radiocarbon assay and produced a corrected and calibrated 1-sigma age range of 2856-2762 b.p.

Isolated Human Ulna

An intact human ulna was found adjacent to the north wall of Test Unit 5 (Figure 25). The bone rested at a slight incline, so that the proximal end and distal ends were, respectively, at depths of 139 and 130 cm below ground surface. This specimen exhibited incomplete fusion of the distal epiphysis, indicating immediately that it pertained to a different individual than represented in the nearby burial. The bone rested within a discernable rodent disturbance, suggested that it was displaced from a nearby burial located beyond the walls of Test Unit 5.

A large Florida horse conch, 230 mm in length, rested approximately 10 cm to the east of the ulna. This specimen also was found within the same rodent disturbance which contained the ulna, suggesting a similar origin and thus the possibility that this is a grave inclusion similar to the gastropod shells found with the intact burial. This interpretation is probably bolstered by the fact that the shell is complete, and much larger than all other specimens of the species found at the site within deposits of occupation debris.

Special Studies

Radiocarbon Assays and Chronology of Site Use

A total of five radiocarbon assays was run on organic materials from cutlural deposits at 41NU2. Four samples consisted of mollusk shell from debris deposits within soil horizons; the fifth assay was run on a small amount of charcoal collected from the burned area within the grave pit in Test Unit 5. The assay results are presented in Table 2, which shows the uncorrected ages, corrections for the 13C/12C ratio, and 1- and 2-sigma calibrated age ranges in years b.p. and in calendar years.

An atmoshperic (tree-ring) calibration (Stuiver and Reimer 1993) is employed for all five samples. The use of this calibration, rather than a marine calibration, is believed to be appropriate on the basis of paired shell and charcoal samples as well as typological associations from other sites in the Corpus Christi Bay area (Ricklis 1993, 1995a). The atmoshperic calibration essentially mimics the results which would be obtained using a mixed marine-atmospheric calibration in which

Table 2. Radiocarbon Data, 41NU2.

Sample Provenience	Lab No.	Sample Material	Radiocarbon Age	Age Corrected for 13C/12C*	Calibrated Age Ranges
T.U. 5, 130-150 cm	Beta-099304	Oyster shell	3580 +/-60 BP	3990 +/-70 BP	1-Sigma: 4527 (4422)4359 BP BC 2577 (2473)2409 2-Sigma: 4804(4422)4238 BP BC 2854(2473)2288
T.U. 20, 65-85 cm	Beta-099303	Quahog shell	2750 +/-70 BP	3160 +/-70 BP	1 Sigma: 3461(3368)32704BP BC 1511(1419)1324 2-Sigma: 3541(3368)3211 BC 1591(1419)1261
T.U. 14, 100-125 cm	Beta-099302	Whelk shell	1630 +/-60 BP	2040 +/-60 BP	1-Sigma: 2053(1985)1897 BP BC 103 (36) AD 53 2-Sigma: 2140 (1985)1839 BC 190(36) AD 111
T.U. 17, Fea. 5	Beta-099301	Whelk shell	1000 +/-60 BP	1410 +/-60 BP	1-Sigma: 1341(1299)1282 BP AD 609((651)668 2-Sigma: 1403(1299)1193 BP AD 547(651)757
T.U. 5, Burial	Beta-099305	Wood charcoal	2740 +/-50 BP	2720 +/-50 BP	1-Sigma: 2856(2786)2762 BP BC 907(837)813 2-Sigma: 2927(2786)2749 BC 978(837)800

* Correction factor on shell ages is estimated by Beta Analytic, Inc. at 410 years, based on numerous samples from other sites; this estimate is in agreement with other samples from the central Texas coast (see Ricklis 1995a).

only a minor proportion of marine influence is assumed.

The oldest calibrated age range of 4527-4359 (2577-2409 B.C.), from T.U. 5, pertains to the lowest cultural zone found in Test Units 4-7 on in the southern part of the site along the east side of Ennis Joslin Road. Based on the similar depths and stratigraphic position immediately above the Pleistocene Beaumont Formation, this appears to be a continuous cultural horizon in this area.

The 1-sigma calibrated age range of 3461-3270 b.p. (1511-1324 B.C.), on quahog shells from Test Unit 20, provides a time range for the accumulation of cultural debris at the unconformable contact between the Beaumont Formation and the overlying cumulic upland prairie soil. The age range of 2053-1897 (103 B.C.-A.D. 53) from the cultural zone in Test Unit 14 provides provides a time range for what is again probably a continuous horizon encountered at similar depths in Test Units 11-15 and 17 in the northern part of the site. Finally, the age range of 1341-1282 b.p. (A.D. 609-668) on whelk shells from feature 5 in Test Unit 17, places the thin cultural zone containing the shells toward the end of the Archaic period, which appears on the basis of available information to terminate around A.D. 1000 (cf. Ricklis 1995a).

The calibrated age range on the burial in Test Unit 5 of 2856-2762 b.p. (907-813 B.C.) can be confidently assumed to date the interment, since the assayed charcoal was clearly associated with a small fire built directly over the body and within the grave pit. As already noted, however, dates from other burials at the site would be required in order to evaluate whether or not cemetery use was primarily at about this time.

Fish Otolith Seasonality

As noted above, a relative concentration of marine fish otoliths was found in Test Units 13-15 and 17. The most abundantly represented species is black drum. In order to determine the seasaonality of fishing at the site, or at least for that part of the site represented by the cultural horizon in these units, a sample of 30 black drum otoliths was analyzed for seasonality of death (i.e., season of procurement).

It is well established that the annual growth cycle of many fish species is recorded in the otolith as observable growth increments, with narrow opaque bands representing winter growth cessation and wider transluscent bands representing rapid sping through fall growth (e.g., Beckmann et al. 1988). Consequently, otoliths have been widely employed in archaeological seasonality studies on the Texas coast and elsewhere (e.g., Smith 1984; Prewitt 1987; Ricklis 1988, 1996; Stringer 1995). The procedure employed in the analysis involved cross-sectioning each otolith, polishing the cross-sectioned surface, and examining the cross-section under a 20X binocular microscope. If the narrow winter growth interruption band was located on the outer edge of the specimen, a winter death was recorded. Where the warm-weather transluscent band had attained less than 1/3 its expectable width (based on the width of the previous complete annulus), a spring death was recorded. Summer and Fall deaths were assumed to be indicated, respectively, by growth of the transluscent band between 1/3 and 2/3 or more than 2/3 of the expectable width (see Ricklis 1996, Appendix A for more detailed discussion of methodology and related issues of otolith seasonality analysis).

The results of the analysis are shown in Table 3. The otoliths overwhelmingly fall into the winter and spring seasons, which account for 92.4% of the total. This suggests that drum were caught primarily during the spawning season which, for this species, is the winter-early spring (Simmons and Breuer 1962; Sutter et al. 1986), when adult fish tend to concentrate in vegetated shallows.

Fine-Screen Samples

Thirteen samples of soil were extracted from cultural zones for fine screening in the laboratory. Each sample consisted of approximately four litres of soil. In the lab, these were

Table 3. Seasonality data, black drum (*Pogonias cromis*) otoliths, Test Unit 15 (80-100 cm), 41NU2.

Specimen No.	Age (Growth Year)	Estimated Season of Death
1	8	Spring
2	9	Early Spring
3	6	Spring
4	7-8	Winter-Spring
5	?	?
6	6	Early Spring
7	5	Winter
8	9	Winter
9	7	Winter
10	4	Winter
11	4	Winter
12	6	Spring
13	8	Winter
14	?	?
15	9	Winter
16	?	?
17	5	Winter
18	5	Spring
19	9	Spring
20	6	Spring
21	9	Spring-Summer
22	3	Winter
23	5	Spring
24	5	Winter
25	?	?
26	8	Winter
27	5	Winter
28	4	Fall-Winter
29	4	Winter-Spring
30	5	Spring

Winter- 12 (46.2%*)
Winter-Spring- 2 (7.7%)
Early Spring- 2 (7.7%)
Spring- 8 (30.8%)
Spring-Summer- 1 (3.8%)
Fall-Winter- 1 (3.8%)

* Percentages based on 26 specimens for which seasonality determination was possible; 4 specimens were indeterminate due to unclear or uneven growth increments.

water screened through 1/16-inch mesh. The primary goal was to determine whether preserved macrobotanical remains were present. Although small bits of wood charcoal were present in all samples, no other form of carbonized plant material was present. Other materials recovered through this process included burned clay and caliche nodules, land snails, shell fragments, very small fragments of bone, crab clay fragments and six fish otoliths (all from Test Unit 17, 145-165 cm depth). These findings are quantified by provenience in Table 4.

Table 4. Fine Screen Materials, by Provenience, 41NU2.

Provenience	Burned Clay Nodules	Burned Caliche	Land Snails* R	Land Snails* H	Land Snails* P	Estuarine Mollusk Shell and shell frags.	Crab Claw Fragments	Small Bone Fragments	Fish Otoliths	Wood Charcoal
TU 5, Burial fill	30	14					1	20		X**
TU 6, 110-117 cm	21					3		1		X
TU 6, 117-130 cm	15					14		6		X
TU 7, 90-100 cm	17					7		2		X
TU 7, 100-110 cm	20					1		2		X
TU 7, 110-120 cm	24	1				1		1		X
TU 7, 120-130 cm	22	1				2				X
TU 10, 80-100 cm	14					11				X
TU 13, 120-135 cm	0					5	1	3		X
TU 14, 100-110 cm	0					1				X
TU 14, 110-120 cm	1	1		1		5				X
TU 17, 90-100 cm	0	1	17	5	8	13	18	6		X
TU 17, 145-165 cm	1		1		2	5	1	18	6	X

* *Rabdotus, sp.* (R), *Helicina sp.* (H), *Polygyra sp.* (P)

** X indicates presence of small bit/flecks of wood charcoal

CHAPTER 3

ARTIFACTS AND FAUNAL REMAINS

Artifacts

Artifacts were notably few within the cultural deposits tested at 41NU2. Exclusive of numerous small nodules of burned clay or caliche and 13 small pieces of pumice, water screening of a total of approximately 5.6 cubic meters of soils containing cultural debris produced only 48 artifacts, of which the majority (35, or 68.6%) are chert flakes. Other lithics consist of the basal fragment of a stemmed dart point and five thin pieces of sandstone. Shell artifacts include four fragments of edge-flaked sunray venus clamshell, a complete quahog shell with a flaked/utilized ventral margin, a bi-pointed whelk columella, and a perforated oyster shell. The distal end of a bone pin with a simple engraved geometric design is the only bone artifact recovered. Aside from the many burned clay nodules found in the cultural zones, the only fired clay object is a small nodule with grass impressions; this may be a piece of clay daub, though the grass impressions may simply be unintentional.

This small sample of material offers little opportunity for identifying temporal change in artifact assemblages over time. As discussed below, the single dart point cannot be assigned to any known typological group, and the few artifacts of shell are of types known to occur throughout the Archaic and Late Prehistoric cultural sequence on the central Texas coast. The various artifacts are described below. Proveniences are indicted in Table 5.

Lithics

Dart Point Fragment (Figure 28)

This specimen, made of light brown, fine-grained chert, came from the cultural zone in Test Unit 6, at a depth below surface of between 110 and 117 cm. This is a basal (proximal) stem fragment. The thinned base is straight, and the stem edges are slightly expanded. The fragment is 20 mm long, and the width of the stem is 18 mm. Maximum thickness is 5 mm. Though the point appears to have been broken above the stem, the configuration of the shoulders is obscured by reworking of the break. The specimen cannot be assigned to any known type.

Chert Flakes

As noted above, only 35 chert flakes were recovered during testing. The small size of the sample can be attributed in part to limited use of chert for tools in an area devoid of raw material (see Ricklis and Cox 1993), as well as to the paucity of artifacts in general. Five (14%) of the flakes are primary or cortex flakes, nine (26%) are secondary cortex flakes, and 21 (60%) are tertiary flakes. All are small, the largest specimen is a cortex flake measuring 23 mm in length.

Sandstone Fragments

Three fragments of fine-to-medium grained sandstone were recovered. While none show discernable artificial modification, all are relatively thin and flat and may have served as abrading stones. If this was the case, it is not surprising that use wear cannot be identified, since the surfaces of the rather soft stone would presumably have readily weathered if exposed to the elements for any length of time. In any case, sandstone is not native to the geologic sediments at the site, and these pieces were almost certainly brought on to the site by prehistoric occupants.

Table 5. Artifacts by proveniences, 41NU2.

Test Units, Zone Depth Ranges	Dart Point	Chert Flakes* P	S	T	Sandstone Pieces	Flaked sunray	Whelk Columellae	Ground Whelk	Perf. Oyster	Bone Pin	Daub
T.U. 1, 120-135 cm						1					
T.U. 2, 57-75 cm				4							
T.U. 5, 130-160 cm				1							
T.U. 6, 100-130 cm	1			1					1		
T.U. 7, 90-100 cm			1	3		2	1				
T.U. 10, 80-100 cm				1	3						
T.U. 13, 110-130 cm			1	2	1			1			
T.U. 14, 100-125 cm			6	5	1	1					
T.U. 15, 80-100 cm			1	2						1	1
T.U. 17, 90-100 cm				1							
145-165 cm				1							
T.U. 20, 65-85 cm		5				1					

* P= primary flakes, S = secondary flakes, T= tertiary flakes.

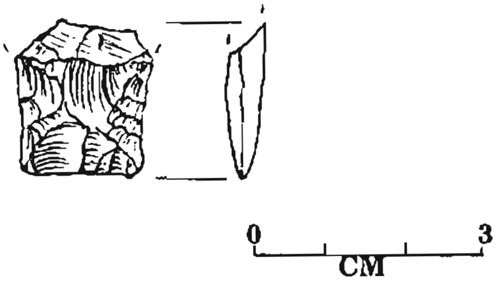

Figure 28. Dart point stem fragment, Test Unit 6, 41NU2.

The proveniences and measurements of the specimens, according to length, width and thickness (L, W, and T) are as follows:

Test Unit 10, 80-100 cm: L, 38 mm; W 33 mm; T, 8 mm
Test Unit 13, 130 cm: L, 54 mm; W, 39 mm; T, 9 mm
Test Unit 14, 110-125 cm: L, 20 mm; W, 18 mm, T, 5 mm

Pumice

A total of 13 small, round-to-oval pieces of water-worn pumice were recovered. None show signs of use wear, and any possible function is unclear. Modified pumice fragments, probably used as abrading stones, have been found in archaeological context on the Texas coast (e.g. Ricklis 1994), and these small pieces may have been brought onto the site to be similarly used. They are probably too large/heavy to have been naturally blown onto the site by the same eolian processes which deposited the fine grained silt-clay sediments of the clay dune.

Shell Artifacts (Figure 29)

The seven shell artifacts are all of forms reported from other sites in the central Texas coast area. The paucity of shell tools at 41NU2 is somewhat surprising, considering the scarcity of flaked stone tools and the fact that shell was often used in the region as a surrogate tool material where stone was scarce (Ricklis and Cox 1993). Considering the small combined samples of both shell and stone artifacts at the site, it would appear that occupation was rather sporadic and involved only limited on-site production and/or use of tools, at least in those areas which were tested.

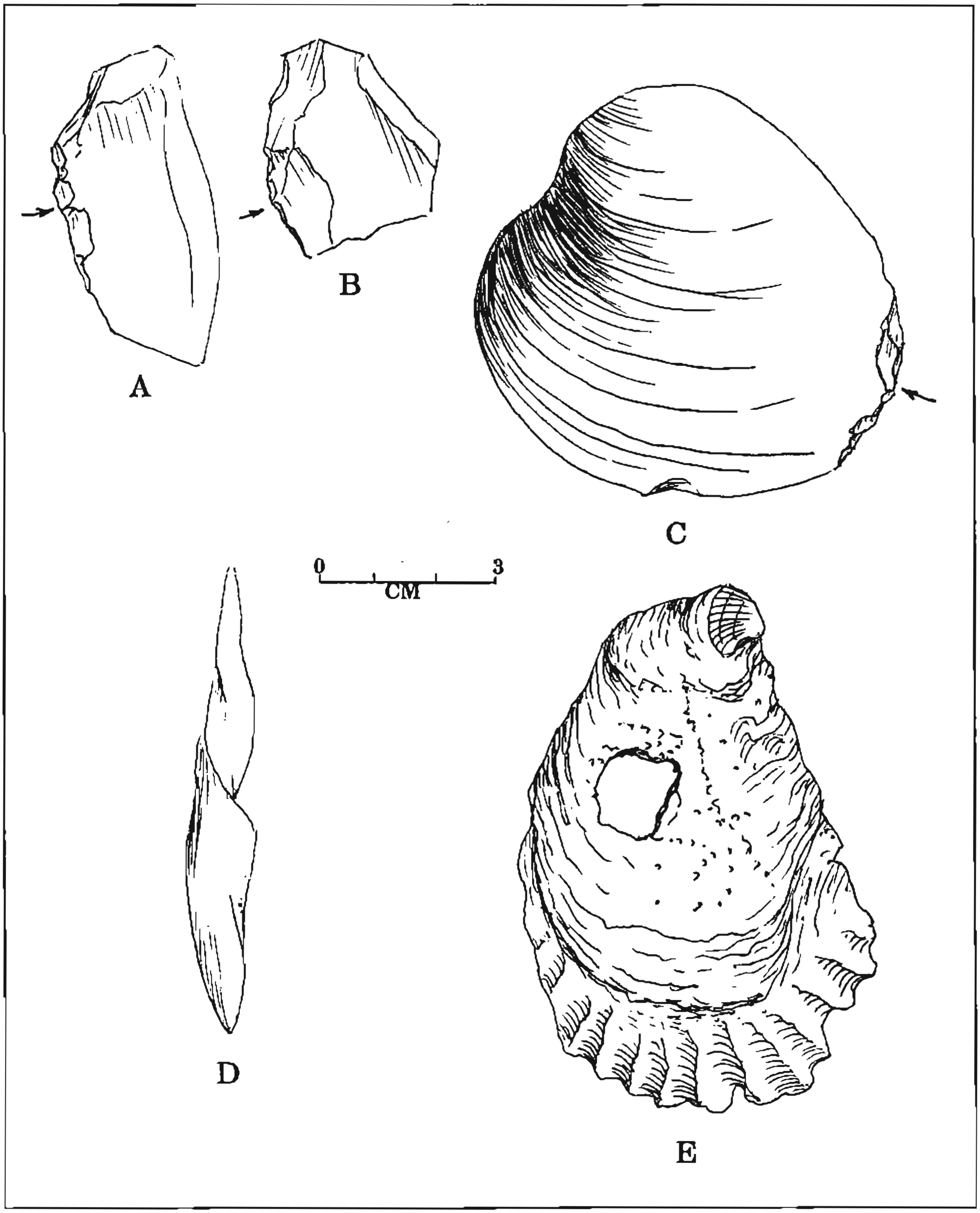

Figure 29. Shell artifacts, 41NU2. A,B, edge-flaked sunray venus clam shell fragments; C, edge-flaked quahog shell; D, bi-pointed whelk columella; E, perforated oyster shell. Arrows point to flaked edges on A-C.

Edge-flaked Sunray Venus Clamshell Fragments (Figure 29, A and B)

The four edge-flaked sunray fragments represent a common tool type in the region (e.g., Campbell 1960; Steele and Mokry 1985; Steele 1988; Ricklis 1996), one which was in use from early Archaic times ca. 7,000 b.p. through the Late Prehistoric period (Ricklis and Cox 1993; Ricklis 1995a). Presumably these tools were used for scraping and/or cutting tasks.

Edge-flaked Quahog Shell (Figure 29, C)

This specimen, from the base of the Holocene cumulic soil in Test Unit 20, is a complete quahog valve, 69 mm in length, showing distinct edge-flaking on the exterior of one end. Although the thick and stout shells of quahog seemingly would have provided durable tool material, worked quahog has not been commonly reported from the region. Two specimens form 41SP120 on Ingleside Cove on the northeastern shore of Corpus Christi Bay are the only other specimens reported from the immediate area.

Bi-pointed Whelk Columella (Figure 29, D)

Bi-pointed columellae of small to medium-sized whelks (Busycon perversum) have been widely reported from sites in the region (e.g., Campbell 1947, 1952; Story 1968; Lisk 1987; Ricklis 1995a). However, the function(s) are unclear. Some specimens may have been used as perforators, other perhaps served as spear or projectile points. As suggested above, the presence of a similar specimen near the top of the skull in the burial in Test Unit 5 suggests that some specimens may have served as hair pins. The specimen from Test Unit 7, 110-120 cm below surface, has a length of 77 mm.

Perforated Oyster Shell (Figure 29, E)

These are common items on shoreline sites in the central coast region, and have been suggested to have served as netweights (Campbell 1958). A similar function has been suggested for specimens of perforated oyster and other bivalve shells from southwest Florida, an inference supported by the discovery in that region of specimens still attached to preserved netting (Marquardt 1992:212). On the Texas coast, perforatored oyster shells were in use by early Archaic times, at least by the sixth millennium b.p. (Ricklis 1995a), and have been found in abundance in late Archaic and Late Prehistoric contexts (e.g., Campbell 1952; Story 1968; Steele 1988; Ricklis 1995a, 1996). The specimen from 41NU2 was found in Test Unit 6 at a depth range of 113-130 cm. The shell measures 89 mm in length, and the roughly circular perforation is 14 mm in diameter.

Engraved Bone Pin (Figure 30)

This is the distal, pointed end of a pin or perforator, found in Test Unit 15 in the 15-cm-thick cultural zone which ranged in depth between 80 and 100 cm. Made from medium-to-large mammal bone, the fragment is 45 mm long. Maximum thickness is 7 mm, and width was at least 13 mm. Three parallel, oblique lines are cut into the bone on each face of the artifact. This specimen resembles other pointed bone artifacts with simple parallel or opposed engraved-line geometric designs from Late Archaic contexts in the region such as Kent-Crane on Copano Bay, 41AS3 (Campbell 1952) and 41SP120 (Ricklis 1996) and Mustang Lake, 41CL3, on San Antonio Bay (Rickis 1995a).

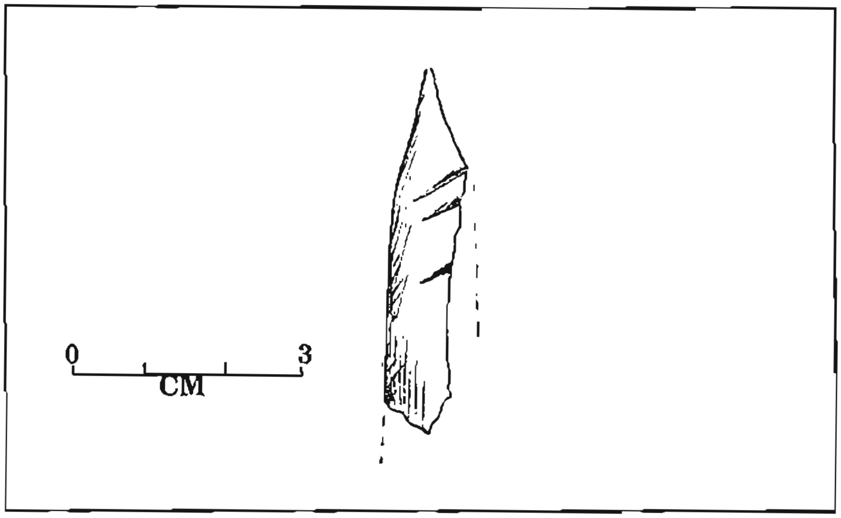

Figure 30. Bone pin with parallel oblique engraved lines, Test Unit 15, 41NU2.

Burned Clay and Caliche Nodules: Densities, Intra-site Distribution and Some Functional Considerations

Several thousand small (approx. 1-5 cm in length) nodules of burned clay and caliche were recovered from the cultural zones in the test units. The burned clay nodules were far more abundant that the burned caliche, both across the site and within individual soil horizons within specific test units; the total weight of all burned clay nodules is 11,759.0 grams, while that of burned caliche is 1,613.7 grams. The respective weights of burned clay and burned caliche in the test unit are shown in Table 6).

The burned clay nodules range in color from bright orange to tan to black, reflecting both oxidizing and reducing firing atmospheres. Generally, they are quite hard, indicating fairly intensive firings. The hardened, limestone-like caliche nodules are believed to have been burned on the basis of occasional pinkish tinges, which probably reflect exposure to heat in an oxidizing atmosphere.

Burned clay nodules are commonly found, sometimes in profusion, on prehistoric archaeological sites in the Corpus Christi and Oso Bay areas, as well as in the Baffin Bay area to the south (e.g., Hester 1969; Patterson and Ford 1974; Smith n.d.; Ricklis 1993). They are assumed to have been related to fires and/or cooking activities, but their exact function or functions remains to be determined with certainty. Although it is possible that in some cases burned clay nodules were simply a unintentional by-product of building fires on/in naturally occuring clayey sediments, there is reason to believe that, at least in many cases, they were intentionally made for use in cooking activities. For example, at 41SP120 on Ingleside Cove, burned clay nodules were found in Archaic deposits within a fine sand matrix; clearly, in such a context, they could not been accidently produced by burning of the sediment matrix. Interestingly,

Table 6. Weights (in grams) of burned clay and burned caliche nodules, Lower Cultural Zone, by Test Units, 41NU2 .

Test Unit	Burned Clay	Burned Caliche	Total Weight
T.U. 1	533.6	33.5	567.1
T.U. 4	138.6	9.4	148.0
T.U. 5	2,327.3	48.4	2,375.7
T.U. 6	2,459.4	183.1	2,642.5
T.U. 7	3,670.0	1,318.0	4,988.0
T.U. 10	1,274.0	0	1,274.0
T.U. 13	24.6	0	24.6
T.U. 14	1.2	0	1.2
T.U. 15	19.1	7.1	26.2
T.U. 17	17.2	1.6	18.8
T.U. 20	1,274.0	12.6	1,286.6

burned clay nodules at 41SP120 occur overwhelmingly within pre-ceramic stratigraphic components, being notably scarce in Late Prehistoric, pottery-bearing components (Ricklis, in preparation). Similarly, at 41NU267 overlooking the south shore of Nueces Bay, both burned clay and caliche nodules were found within a fine sand matrix almost exclusively in the lower (Archaic) levels; the upper 40 cm of the deposit, believed on the basis of the presence of chert prismatic blades and bison bone to pertain to the Late Prehistoric, yielded only a single burned clay nodule (Ricklis 1995b:73). The mutually exclusive occurence of burned clay nodules and pottery strongly suggests that the clay nodules served a function which became obsolete with the introduction of ceramic technology. Inferentially, burned clay nodules were prepared for use as surrogate boiling stones, a cooking technology which was probably replaced by the more efficient use of pottery.

Whatever the precise function of burned clay nodules at 41NU2, it was probably duplicated by the caliche nodules, since the two materials basically co-vary in density across the site, as measured by the weights in the various cultural zones within test units. This is apparent in the data presented in Table 6, and is shown graphically in Figure 31. Certainly, the caliche nodules are not native to the local geologic sediments, and had to have been brought onto the site, suggesting a specific function, perhaps as hearth and/or boiling stones.

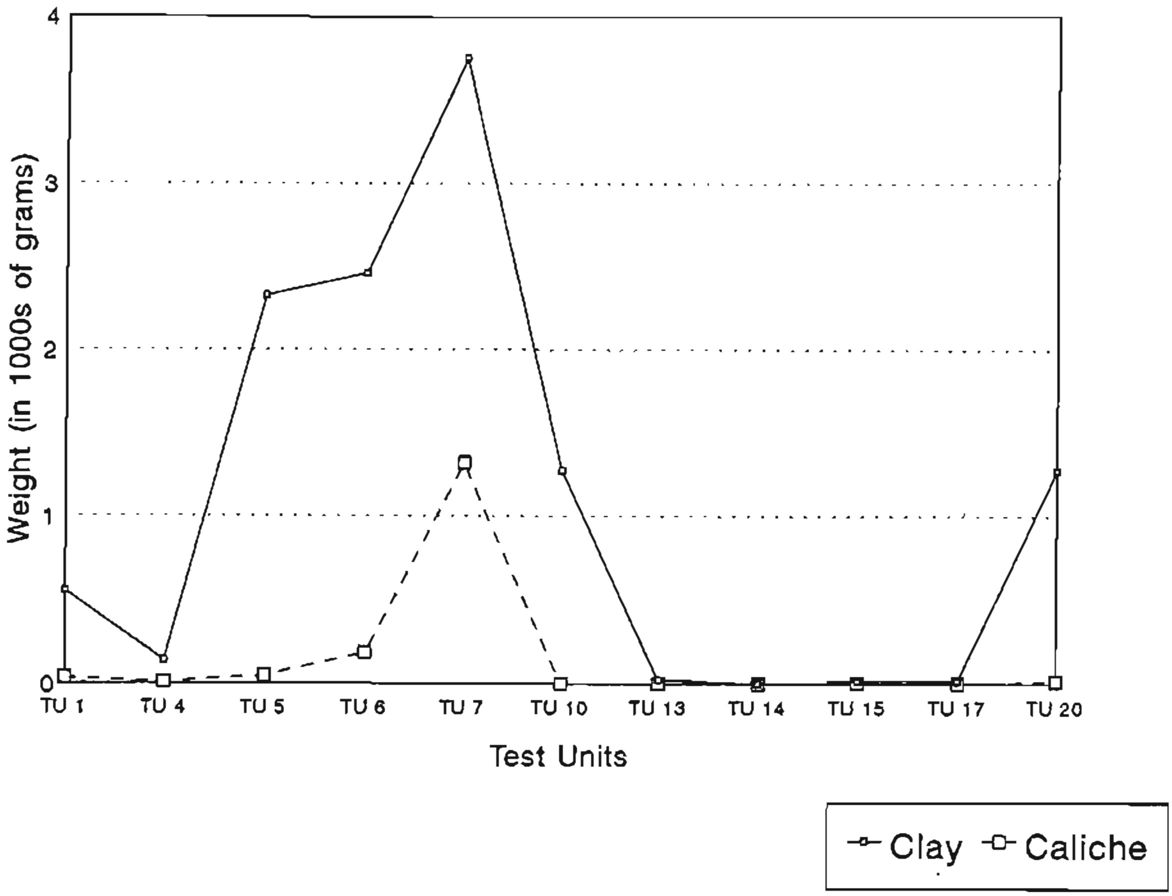

Figure 31. Graph showing weights of burned clay and burned caliche nodules from cultural zones in various test units, 41NU2.

Faunal Remains

During the course of the test unit excavations, the water screening operation resulted in the recovery of 3,779 faunal specimens. This total is comprised of 312 bone elements (including 146 fish bone elements), 311 fish otoliths, and 3,156 whole and fragmentary shells of estuarine mollusks (1,859 bivalves and 1,297 gastropods).

The proveniences of the faunal specimens are shown in Table 7. As can be seen in Table 7, prehistoric use of faunal resources involved procurement of a variety of terrestrial and estuarine species. The mammalian sample is dominated by bone elements of white-tailed deer (*Odocoileus virginianus*). Other mammals identified are bobcat (*Lynx rufus*), dog or fox, hispid cotton rat (*Sigmodon hispidus*), and squirrel (species unidentified). Birds are sparsely represented by vertebrae and longbone fragments of unidentified small- to medium-sized individuals. Reptiles are

Table 7. Faunal elements by taxa, cultural zones in Test Units, 41NU2. Zones are those soil horizons which were water screened in the field, as listed in Table 1.

TAXA	T.U.1	T.U.2	T.U.4	T.U.5	T.U.6	T.U.7	T.U.10	T.U.13	T.U.14	T.U.15	T.U.17 U	T.U.17 L	T.U.20
Mammals													
Canid (dog or fox)													
Canine tooth				1									
Molar													
Bobcat *(Lynx rufus)*													
Humerus													
Deer *(Odocoileus virginianus)*													
Skull frag.				1								1	
Teeth				4	9				1				
Mandible	1								1				
Vertebrae						1							
Rib frag.										2			
Humerus				1									
Tibia				2									
Femur			1	1									
Ulna				1									
Radius				1									
Metepodial										1			
Carpals/ tarsals			4								1		
Phalange										1			1
Longbone frags.		1	3	22		3		1	19	2	1	1	16
Hispid cotton rat *(Sigmodon hispidus)*	4				3								
Mandible				1									
Femur				1									
Squirrel (sp?)													
Humerus				1									

Table 7, continued.

TAXA	T.U.1	T.U.2	T.U.4	T.U.5	T.U.6	T.U.7	T.U.IO	T.U.I3	T.U.14	T.U.15	T.U.17 U	T.U.17 L	T.U.20
Unidentified small-medium-sized													
mammals												2	
Vertebrae													1
Phalange					1								
Longbone frags.	6												
Bird													
Vertebrae				3									
Longbone frags.	1	4		1		1				2			1
Reptile													
Hardshell turtle													
Vertebra													
Carapace/ plastron frags.	1		2	3	1					1			1
Snake (sp. unident.)													
Vertebrae	1			7	2	6				1			
Fish													
Black drum (*Pogonias cromis*)													
Mandible frags.				2	2	1			2				
Otoliths	2		1	1		2	1	6	26	88		13	1
Redfish (*Sciaenops ocellatus)*													
Otoliths				1	2				6	11	1	1	1
Spotted seatrout (*Cynoscion nebulosus)*		3											
Otoliths				2	3			10	20	21	4	10	
Atlantic croaker (*Micropogon undulatus)*													
Otoliths								3	24	20		9	

Table 7, continued.

TAXA	T.U.1	T.U.2	T.U.4	T.U.5	T.U.6	T.U.7	T.U.10	T.U.13	T.U.14	T.U.15	T.U.17 U	T.U.17 L	T.U.20
Fish (cont.)													
Saltwater catfish *(Bagre marinus/ Aureus felis)*													
Otoliths	2		2			1		2	9	3	2	3	
Gar (*Lepisostens sp.)*													
Scales				1									
Bone elements (species undiffer-entiated)													
Vetebrae	2	2	2	17	16	4		4	16	7		2	
Vertebral spines	1		4	1	5	5		11	7	13		5	5
Gill plates	1					2							
Fin spines									1	6			
Crab													
Claw fragments	3		1		1	1		3	11	10	144	1	1
Estuarine Molluscs													
Bivalves													
Oyster (Crassost-rea virginica)													
Whole/umbos	7		2	113	104	51	13	5	28	6	2	13	21
Fragments	14		7	116	56	66	15	15	32	9	1	21	23
Sunray venus (Macrocallisa nimbosa)													
Whole/umnbos	3	56	10	29	4	2	2		6	8	7	9	13
Fragments	16		86	68	20	9	5		24	20	28	54	45

TAXA	T.U.1	T.U.2	T.U.4	T.U.5	T.U.6	T.U.7	T.U.10	T.U.13	T.U.14	T.U.15	T.U.17 U	T.U.17 L	T.U.20
Bivalves (cont.)													
Bay scallop *(Argopectin irradians)*													
Whole/umbos	6				6	6	6	1	51				50
Fragments	6		2	7	11	10	6	2	23				82
Quahog *(Mercenaria campechensis)*													
Whole/umbos		1		14	4	1	2	3	1	1	1	2	20
Fragments	5	2	8	67	26	13	16	7	10	8	3	2	69
Atlantic cockle *(Levicardium robustum)*													
Whole/umbos & fragments				14	3	3		3	5	11	10	1	1
Cross-barred venus *(Chione cancellata)*													
Whole/umbo							1				7		
Ponderous ark *(Noetia ponderosa)*				2	1				1		5		5
Gastopods													
Lightning whelk *(Busycon perversum)*													
Whole		6	8	19	46	16	4	11	64	24	162	20	30
Columellae	3	1	14	29	79	66	10	27	82	30	21	33	27
Whorl frag.	3	8	22	18	29	27		22	35	19	37	50	21
Pear whelk *(Busycon spiratum)*													
Whole									1			1	
Columellae						2							
Whorl frag.													

Table 7, concluded.

TAXA	T.U.1	T.U.2	T.U.4	T.U.5	T.U.6	T.U.7	T.U.10	T.U.13	T.U.14	T.U.15	T.U.17 U	T.U.17 L	T.U.20
Gastropods (cont.)													
Banded tulip													
(Fasciolaria lillium)													
Whole	1				6						5	2	
Columellae	2				3	10		3	6				4
Whorl frag.													
Florida horse conch													
(Pleuroploca gigant..)										2			
Whole				5	4	2		3	1	3		3	
Columellae					27	12		1	2			2	2
Whorl frag.					10		1	1	1			2	4
Shark eye *(Polinices*										2			
duplicatus)			1	3	2	8		3	3		4	3	

Fish are represented by vertebrae, fin spines and otoliths. Species identified are black drum, redfish (or red drum), spotted sea trout, Atlantic croaker, and saltwater catfish.

A total of 3,142 shell specimens was recovered during water screening in the field. This sample includes 1,855 bivalves (oyster, scallop, quahog, sunray venus, Atlantic cockle, cross-barred venus and ponderous ark) and 1,287 gastropods (lightning whelk, Florida horse conch, banded tulip, pear whelk, and shark eye).

While shell specimens thus account numerically for most of the faunal remains, it is should be emphasized that shell densities encountered at 41NU2 were nowhere comparable to those found in true shell midden sites on the central Texas coast. This contrast can be approximately but fairly reliably quantified. The total volume of soil from cultural zones water screened during the testing yielded 3,142 shell specimens, or an average of 561 specimens per cubic meter of soil matrix. By contrast, a total of 40,176 shells were recovered from 2.6 cubic meters of shell midden desposit at the Mustang Lake site on San Antonio Bay (Ricklis 1995a, 1996), for an average of 15,452 specimens per cubic meter. At 41SP120 on the northeastern shore of Corpus Christi Bay, approximately 2.2 cubic meters of a Late Archaic shell midden deposit excavated in the "North Block" area produced 12,015 shells, for an average of 5,461 specimens per cubic meter. Thus the density of shell debris within such major shell middens is some 10 to 30 times as great as that found at 41NU2.

While the faunal samples from any given stratigraphic unit are too limited for meaningful quantification of biomass or minimum numbers of individuals represented, it is clear that prehistoric meat diet at the site involved a combination of terrestrial mammals, mainly deer, fish and estuarine shellfish. A reliable quantification of the relative importance of the various food resources would require larger samples from discrete occupational components, as represented by individual stratigraphic units.

Some Patterns in the Horizontal Distribution of Faunal Remains at 41NU2

There are certain differences in the quantities of molluskan and fish remains across the site worth noting here. The first relevant data set involves a shift in the proportional representation of medium-salinity vs. high-salinity shellfish species. The second involves markedly different proportions of fish cranial remains (as represented by otoliths) and post-cranial fish bone.

Proportional Representation of Bivalves vs. Gastropods

Both bivalves and gastropods are well represented in the shell samples recovered during water screening of soils from cultural zones in the test units. However, as may be seen in Table 8, the percentages of bivalves vs. gastropods shows an overall increase from south to north along the length of the site. This trend is shown graphically in Figure 32.

Since all bivalve and gastropod species found at 41NU2 are known to have been commonly exploited as food resources by prehistoric peoples on the central Texas coast (cf. Story 1968; Prewitt et al. 1987; Steele 1988; Ricklis 1996), variable representations of different species probably can be taken to reflect corresponding differences in estuarine environments within the catchment area of sites. For example, excavations at a series of roughly contemporaneous Archaic sites along the shores of Nueces and Corpus Christi Bays have shown a clinal shift from low-salinity bivalves to moderate- and high-salinity species at the seaward end of the estuary (Ricklis 1995b). This trend correlates with expectable average salinity gradients, since lowest salinities would have been in the river-influenced area near the Nueces River delta and highest salinities would have existed where marine inflence was greatest near the mouth of Corpus Christi Bay.

In the present case, the south-to-north trend from a predominance of moderate-salinity bivalves to a predominance of high-salinity gastropods may reflect localized differences in the average salinities of the estuarine waters in nearby Oso Bay. That is, bivalves predominate at the south end of the site, where adjacent shoreline shallows would have tended to have relatively low

Table 8. Counts and percentages of bivalves vs. gastropods by Test Unit, 41NU2.

Test Unit	Total Number of Shells, all Species	Bivalves	Gastropods
T.U. 1	66*	57 (86%)	9 (14%)
T.U. 4	160	115 (72%)	45 (28%)
T.U. 5	552	478 (87%)	74 (13%)
T.U. 6	441	235 (53%)	206 (47%)
T.U. 7	304	161 (53%)	143 (47%)
T.U. 10	81	66 (81%)	15 (19%)
T.U. 13	107	36 (34%)	71 (66%)
T.U. 14	376	181 (48%)	195 (52%)
T.U. 15	143	63 (44%)	80 (56%)
T.U. 17	217**	102 (47%)	115 (53%)
T.U. 20	417	329 (79%)	88 (21%)

* Excludes numerous sunray venus shells, Feature 1, in disturbed context.
** Includes only shells from lower cultural zone in this test unit.

salinity due to freshwater discharge from False Oso Creek. At the north end of the site, the higher-salinity gastropods comprise the majority of shellfish remains, reflecting increased distance from that freshwater source.

It is possible that the shift in shellfish species reflects diachronic change in overall bay salinity rather than a synchronic or spatial salinity gradient, since the shells from the north end of the site come from a stratum dated to 1341-1282 b.p. and most from the the south end are older (4527-4359 b.p. for the cultural zone in T.U.s 4-7 and 3461-3270 for T.U. 20). However, given what is currently known about the evolution of the estuarine environment, it is expectable that general salinity levels would have decreased through time, rather than increased, as would be indicated by a temporal shift from bivalves to gastropods. As discussed in Chapter 1, with stabilization of sea level at or near modern stillstand by ca. 3000 b.p., the modern barrier island chain began to develop, thus reducing marine influence in the Corpus Christi Bay estuary system, a process which should have resulted in general decreases in salinity levels. That this was in fact

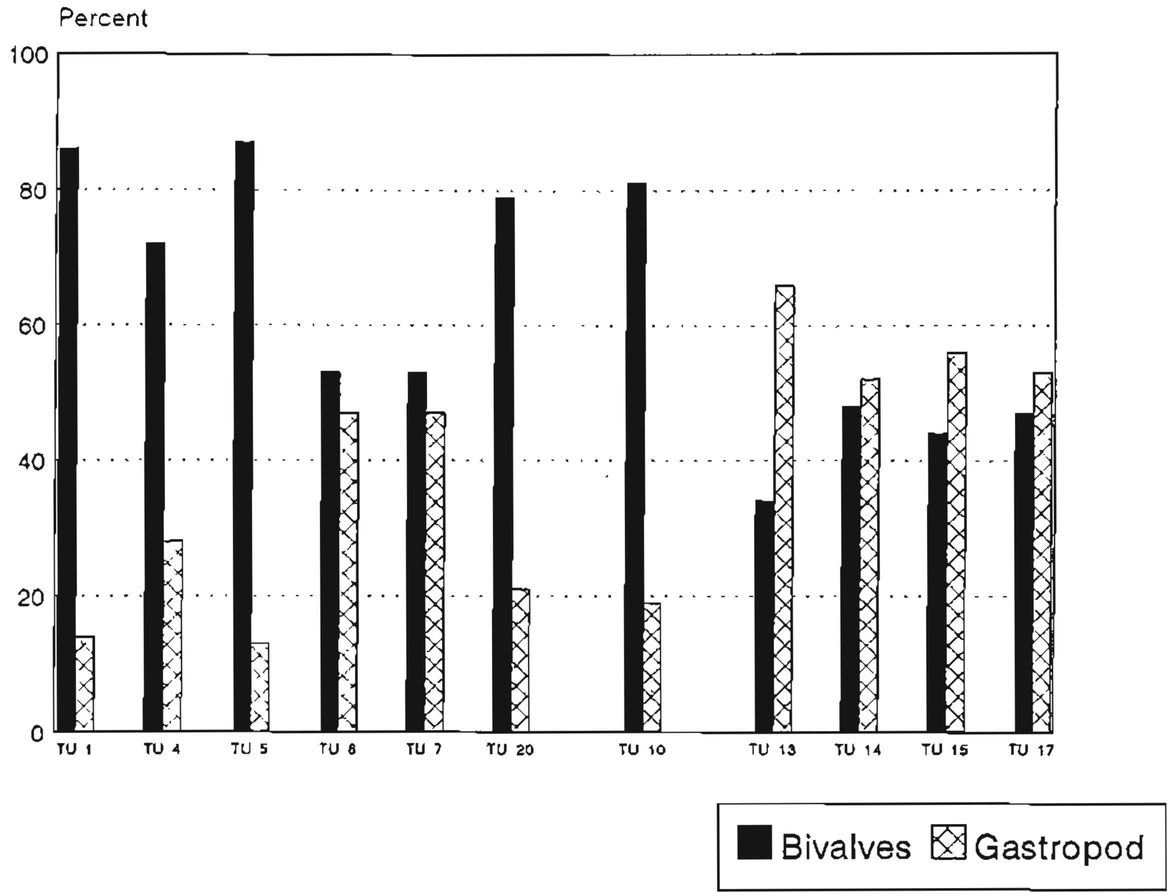

Figure 32. Graph showing percentages of bivalves vs. gastropods in cultural zones in various test units, 41NU2.

the case is suggested by progressive replacement of moderate salinity bivalves by low-salinity *Rangia cuneata* in stratigraphic sequences at sites near the head of Nueces Bay (Ricklis 1993, 1995b). With presently available information, then, it can tentatively be concluded that the spatial variability in shell species at 41NU2 does reflect localized environmental variables. It follows that molluskan resources tended to be processed, consumed, and the shells discarded, within close proximity to the loci of procurement.

Ratios of Cranial to Post-Cranial Fish Remains

Fish bones were found in all test units which contained cultural material. Generally, however, they were not abundant, consisting of the larger and more durable bone elements such as vertebrae, fin spines, mandibles and gill plates, as well as otoliths. While it is possible that the smallest/thinnest fish bones (e.g., ribs, cranial elements) have not been preserved, the general

Table 9. Numbers of fish otoliths and post-cranial fish bone elements, and ratio of otoliths to post-cranial elements in test units, 41NU2.

	TU 4	TU.5	TU 6	TU 7	TU 20	TU 13	TU 14	TU 15	TU 17
Otoliths	3	6	7	1	2	21	77	144	36
Post-cranial elements	6	18	21	9	5	15	24	26	7
Ratio of otoliths to post-cranial elements	.5:1	.33:1	.33:1	.1:1	.4:1	1.4:1	3.2:1	5.5:1	5.1:1

condition of the recovered bones appears to be good, suggesting reasonably uniform preservation of larger elements across the site. All otoliths were in excellent condition, indicating that there should be no preservational bias in the representation of these elements.

As may be seen in Table 7, by far the greatest number of otoliths was recovered in the lowest cultural zone encountered in Test Units 13, 14, 15 and 17 toward the north end of the site. Other cultural zones in other areas produced few otoliths. However, there was not a correspondingly significant difference between areas in the quantities of post-cranial fish elements (vertebrae, fin spines). This fact is reflected in the markedly different ratios of crania, as represented by otoliths, and post-cranial elements across the site, as shown in Table 9 and Figure 33. Thus, cranial and post-cranial fish remains are not evenly distributed; even within the area of Test Units 13-14 and 17, otolith concentration tends to be localized in Units 14 and 15. In combination, the spatial variability in the absolute numbers of otoliths and the ratio of otoliths to post cranial bone elements suggests a corresponding differential deposition of fish crania across the site. While little is known either archaeologically or ethnohistorically concerning aboriginal fish processing techniques on the central coast, it is possible that heads were removed after procurement as a means of facilitating drying and/or smoking of bodies. If this were the case, it can be expected that otoliths, the most durable of cranial elements, would be spatially clustered at or near the processing locus. The density of otoliths in the area of Test Units 13-15 and 17 may thus represent a localized area of fish processing.

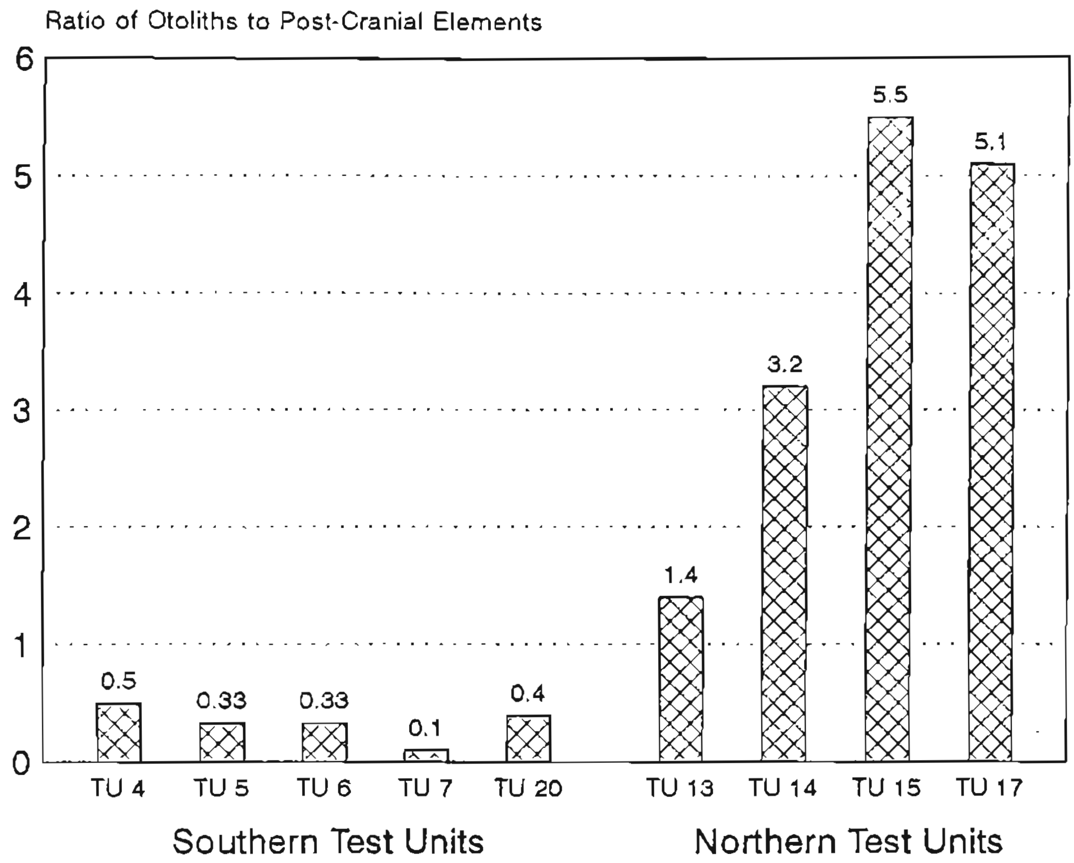

Figure 33. Graph showing ratios of fish otoliths to fish post-cranial bone elements in cultural zones in various test units, 41NU2.

CHAPTER 4

CONCLUSIONS AND RECOMMENDATIONS

The Nature of Prehistoric Occupation at 41NU2

The results of the 1996 testing at 41NU2, though limited, permit some significant conclusions concerning site formation processes, human ecology, and chronology of occupation. All of the findings made during the testing pertain to the Archaic. Despite careful watch during screening of cultural zone matrices, not a single Late Prehistoric potsherd was found. A few arrowpoints were noted by George Martin from surface contexts, but potsherds were said to be few (Martin, notes on file, TARL), further suggesting a limited use of the site during the Late Prehistoric period.

The earliest radiocarbon age range, 4523-4355 (corrected and calibrated at 1-sigma), comes from shell in the lower cultural zone, which ranged in depth from 130 to 160 cm and lay directly on dense silty clay of the Beaumont Formation. This radiocarbon assay provides a minimum age for the clay dune, suggesting that it began to accumulate by ca. 4500 b.p. The cultural zone at the base of the upland cumulic soil in Test Unit 20 dates (corrected and calibrated at 1-sigma) to 3455-3270 b.p. In the northern part of the site, the lowest cultural zone in Test Unit 14 yielded a corrected and calibrated age range of 2053-1897 b.p., and the upper cultural zone in Test Unit 17 produced an age range of 1311-1282 b.p. In sum, the radiocarbon dates on occupation at the site range from the latter part of the early Archaic, ca. 4500 b.p. to the late Archaic, ca. 1300 b.p. (cf. Ricklis 1995a). Associated charcoal in the burial in Test Unit 5 places that interment at 2856-2762 b.p. Whether this reflects the general time period of cemetery use at 41NU2 site can only be determined by radiocarbon assays on other burials at the site.

As noted repeatedly in the preceding pages, prehistoric occupation debris was restricted to discrete, dark-colored soil zones within clay dune sediments, or was encountered at the base of late Holocene silty clay cumulic soil at or near the unconformable contact with the underlying Beaumont Formation of Pleistocene age. The fact that, in the clay dune, virtually all cultural debris was within the dark soil horizons strongly suggests accumulation on prehistoric surfaces which were sufficiently stable to allow for introduction of significant amounts of organic material through prolonged periods of plant growth and decay. The minimal organic staining of the light-colored intervening silt-clay eolian sediments suggests relatively rapid rates of deposition, with the result that little occupation debris was incorporated into these zones. Assuming this to be the case, occupation of the site must generally have been fairly infrequent/non-intensive, so that only surfaces stable for relatively long periods of time saw appreciable accumulation of debris.

The latter inference is supported by the general paucity of artifacts and faunal remains within the discernable cultural zones. Only a single lithic tool, a dart point fragment, was recovered, and chert flakes number only 35. While the dearth of lithics can be partly attributed to the absence of locally available stone, the added scarcity of shell tools strongly suggests relatively little tool production, use and discard at the site, at least within the areas available for testing. Shell debris, though the most abundant class of material, was, as discussed above, quite sparse in comparison with the densities documented at other shoreline sites in the central coast region. Similarly, faunal bone was found only as a scatters within cultural horizons.

It can be concluded, then, that 41NU2 did not see particularly intensive occupation, at least in those parts of the site which were tested. It is relevant to note here that exploratory trenches and observations of erosional profiles made during the 1933 fieldwork also failed to reveal evidence of intensive occupation (A. T Jackson, ms. on file, TARL, pp. 103-105). As in the case of our 1996 testing, discernable cultural zones were fairly thin (5-9 inches thick) and within dark-colored soil horizons. No artifacts were reported from these zones, and, judging by photographs (Jackson n.d. p. 105), shell debris was not concentrated. In sum, the available information suggests that, in general, dense accumulations of occupational debris do not characterize the archaeological deposits at the site. If relatively dense deposits exist, they must be rather small and localized.

The faunal remains recovered in 1996 suggest a mixed subsistence base, with contributions coming from both terrestrial fauna and estuarine food resources, though small sample sizes preclude meaningful quantification of the signicance of different taxa as dietary components. As noted, shellfish remains are relatively sparse, as are fish remains, with the exception of the relatively high density of otoliths in the area of Test Units 14-15 and 17. As also discussed, the density of otoliths in that area may be more a reflection of localized processing of fish rather than an overall intensive procurement of fish. Seasonality analysis of otoliths of the most abundant fish species (black drum) from this area indicate a focus on winter-early spring procurement, perhaps in response to seasonal concentrations of fish during spawning.

In sum, the findings at 41NU2 suggest that the site was not a major focal point for occupation. Presumably, other loci in the surrounding area better provided the kind of predictably concentrated resource base which could more or less reliably support sizeable groups for extended periods within acceptable levels of risk. Various late Archaic shoreline sites in the region, such as Mustang Lake (41CL3), Kent-Crane (41AS3) and 41SP43 and 41SP120 on Ingleside Cove, are extensive, with relatively thick, dense shell midden deposits containing relatively abundant artifacts. Such sites were clearly focal points of recurrent occupation, probably by sizeable groups (see Ricklis 1996), in contrast to the situation seemingly indicated for 41NU2.

The large shoreline shell middens are at least partly contemporaneous with 41NU2, since they pertain to the late Archaic, after ca. 3,000 b.p. (Ricklis 1995a). Thus, the relatively light occupation at 41NU2 probably should not be ascribed to either a low regional population density or to an adaptive system which involved only short-term occupation of shoreline zones by small groups. Indeed, if Jackson, Boone and Henneberg (1986) are correct, the high incidence of endemic treponematosis in the burial population from 41NU2 points to a least part-time aggregation of people into fairly large groups.

The relatively light occupation of the site is in striking contrast to its use as a major cemetery, suggesting that the importance of a given locale as a residential campsite was not necessarily congruent with its significance as a place for burial and attendant mortuary ritual. It is perhaps relevant in this regard that the several documented larger prehistoric cemetery locales in the surrounding area are generally not found on, or in close proximity to, known camp sites containing thick or dense midden deposits. For example, at 41NU276, located on the upland margin overlooking the southeast shore of Nueces Bay, a discrete prehistoric cemetery was found in association with little camp debris, and nearby sites were consistently characterized by thin and/or sparse midden deposits with low artifact yields (see Ricklis 1995b). At the Berryman site (41NU173), overlooking the lower Nueces River floodplain, a discrete cemetery of early Late Prehistoric age was on a topographic high point with only scattered occupation debris (Mokry, 1979), and no large, dense archaeological deposits have been documented in that area. At 41SP154 in the White's Point area overlooking the north shore of Nueces Bay, recent machine activity exposed what appears to be an extensive cemetery of late Archaic age (judging by the presence of Ensor dart points in apparent association with the disturbed burials; Ricklis field notes, 1994). Extensive reconnaisance as well as subsurface testing at this site and the surrounding area failed to locate large, thick or artifact-rich deposits; all known archaeological sites in the White's Point area are characterized by thin middens with low artifact densities (Ricklis 1993). Finally, on Oso Creek, some 12 km inland from 41NU2, a large prehistoric cemetery, 41NU37, lies within a clay dune containing only sparse occupational debris which is mostly of Late Prehistoric age (i.e, arrowpoints and potsherds; Mercado-Allinger 1985; Ricklis 1996:90).

It is also notable that, while a few burials have been documented at major campsites such as Kent-Crane and Johnson (Campbell 1947, 1952), no major cemeteries have been reported to date in direct association with large, intensively occupied shoreline sites. This suggests that prehistoric peoples in the the area maintained a fairly clear distinction between locations used frequently as domestic camps and those reserved for burial of the dead. Inferably, locations for interment of the dead and mortuary ritual were precincts whose special function was ascribed within a supra-mundane belief system which attributed special significance to specific points on the landscape.

Recommendations

Based upon the large number of prehistoric burials exposed over the years at 41NU2, the site can be considered a highly significant cultural resource eligible for placment on the National Register of Historic Places. Our limited 1996 findings indicate that additional burials may be present within or along the right of way of proposed road construction. The burials excavated in the 1930s were located at the approximate north-south center point of the site, at about the 15-foot contour. The fact that the burial and the displaced human ulna in Test Unit 5 were found very near the 15-foot contour suggests the possibility that additional burials could lie within the clay dune sediments at or near this elevation. Additionally, a human tooth was found in Test Unit 1, also near the 15-foot contour line; this specimen could be displaced from a burial in that area. On the basis of this information, the southern part of the site along the east side of Ennis Joslin road and on the west side of Ennis Joslin immediately south of Del Oso Drive should be regarded as a high-priority area which may contain additional burials.

North of Del Oso Drive on the west side of Ennis Joslin Road, our coring and testing indicate an upland landform rather than clay dune sediments. Since all known burials from the site have been found within the clay dune, burials are probably less likely to lie west of the road.

Despite fairly intensive testing on the east side of Alameda Street near the north end of the site (the area of test units 11-15, 17), no burials were encountered, suggesting an absence or at least a dearth of human remains in this area. Nonetheless, the possibility that burials may lie within/adjacent to the right-of-way to the north and south of this area cannot be ruled out.

One of the critical factors to be kept in mind in making any recommendations for additional archaeological work at 41NU2 is that only limited access to properties within/adjacent to the proposed right-of-way was available at the time of our testing (essentially, access was not available in those areas along the east side of the roadway in which test units were not clustered). Given the information provided by the testing, and the the factor of limited access for our investigations, the following recommendations are offered for mitigation of impacts of proposed road construction:

1. The virtually consistent sparseness of cultural debris in the various soil horizons suggests that proposed road construction will not impact significant prehistoric occupation (i.e., non-cemetery) components. The scarcity of artifacts and general low density of faunal remains in the cultural zones suggests that additional time and resources devoted to excavation in such strata will provide only minimal additional information concerning prehistoric ecology or on-site behavioral patterns which would not justify the cost of further excavation and attendant laboratory analysis.

2. Because of the importance of locating prehistoric burials which might be impacted by contruction, the following mitigation efforts are suggested:

a. As already mentioned, the presence of human remains in Test Units 1 and 5 makes the area east of Ennis Joslin Road northward to the point at which Ennis Joslin widens south of Test Unit 8, and the area west of Ennis Joslin from the intersection of Del Oso Drive (to the 10-foot contour), a high-priority area for further investigation to locate additional human remains. It is recommended that the area within the right-of-way between Del Oso Drive and Test Unit 2, and the area between Test Unit 4 northward past Test Unit 7 be excavated to deterimine if additional burials area present. Such excavation should be accomplished with the same technique used to dig the test units, namely, by removing thin (approx 5-cm) cuts with a gradeall. This approach has been shown to be both effective and non-destructive to human skeletal material. If addtional burials are encountered within these areas, they should be carefully excavated by hand and fully documented.

b. Further testing is recommended within the right-of-way on the east side of Ennis Joslin road, along the stretch between Test Unit 7 and Test Unit 8. This area was not available for testing in 1996 and, because it lies above the 15-foot contour, the presence of additional burials therein should be considered a possibility. It is recommended that such test units be excavated in the same way as were those dug in 1996. However, because the corings and test units already excavated have provided a reasonably good picture of the geomorphic and stratigraphic nature of the site, detailed recording of stratigraphic profiles in field notes and photographs is unnecessary. In order to maximize confidence that the presence/absence of burial clusters in this area has been reliably established, it is recommended that test units be spaced at intervals of no more than 10 meters.

c. In addition to these strategies, it is recommended that actual construction within the bounds of 41NU2 be monitored by a qualified professional archaeologist, and that provisions be made during the course of the monitoring to have an archaeological field crew available for immediate hand excavation, documentation and removal of any human remains observed.

It is believed that the above procedures will serve to reliably locate and protect human remains which lie within the propsed right-of-way where it crosses 41NU2. In addition to these field procedures, it is recommended that:

1. All materials be prepared for curation. Arrangements should be made in consultation with appropriate Native American groups for proper treatment of human remains, and to the extent posssible, scientific analysis, in preparation for either permanent curation or possible repatriation.

2. It can be expected that during mitigation within the high-priority area, additional (non-burial) cultural zones will be encountered. While detailed investigations of these are not recommended, intact features, if present, should be hand excavated and documented using appropriate archaeological techniques. If localized debris deposits are encountered which appear to be particularly productive of artifacts and/or faunal remains, such that significant new information on prehistoric adaptation can be obtained, the matrix from such deposits should be water-screened in the field and appropriate collections made for laboratory analysis.

3. It is highly recommended that additional samples for radiocarbon dating be procured during this work, both from charcoal and/or shell samples from within discrete cultural zones in wall profiles or within features (if found) and from organic materials such as shell and/or charcoal found in clear association with burials. In this way, the presently sketchy cultural history of the site can be more fully reconstructed.

4. Upon completion of the fieldwork and appropriate labwork, a complete report should be prepared of the findings. If additional human remains are encountered, these should be analyzed and reported to the fullest extent possible. It is further suggested that this report incorporate a description/discussion of human remains previously excavated at the site, along with related observations on mortuary practices, in as detailed a manner as is possible using field notes on file at TARL. This, in conjunction with the additional recommended fieldwork and radiocarbon dating, can be expected to provide significant information on prehistoric Native American occupation and mortuary patterns at this important site.

REFERENCES CITED

Anderson, J. B. and Thomas, M. A. (1991) Marine Ice Sheet Decoupling as a Mechanism for Rapid Episodic Sea Level Change: The Record of Such Events and their Influence on Sedimentation. *Sedimentary Geology* 70:87-104.

Anderson, J. B., Thomas, M. A., Siringin, F. P., and Smyth, W. C. (1992) Quaternary Evolution of the Texas Coast and Shelf. In: C. H. Fletcher III and J. F. Wehmiller (eds.) *Quaternary Coasts of the United States: Marine and Lacustrine Systems*. Special Publication 48, Society for Sedimentary Geology. Tulsa. Pp. 253-265.

Andrews, J. (1977) *Shells and Shores of Texas*. The Elma Dill Russell Spencer Foundation Series No. 5. University of Texas Press. Austin and London.

Aten, L. E. (1976) Descriptions of Boys School and Other Galveston Bay Area Mortuary Data. In: L. E. Aten, C. K Chandler, A. B. Weselowski and R. M. Malina, *Excavations at the Harris County Boys School Cemetery*. Texas Archeological Society Special Publication.

Bekmann, D. W., Render, J. M. and Wilson, C. A. (1988) *The Age and Growth of Black Drum in Louisiana Gulf of Mexico Waters*. Coastal Fisheries Institute, Center for Wetlands Resrouces, Louisiana State University. Baton Rouge.

Behrens, E. W. (1963) Buried Pleistocene River Valleys in Aransas and Baffin Bays, Texas. *Publications of the Marine Science Institute, University of Texas* 9:7-18.

Black, S. L. (1986) *The Clemente and Herminia Hinojosa Site, 41JW8: A Toyah Horizon Campsite in Southern Texas*. Center for Archaeological Research, The University of Texas at San Antonio, Special Report No. 18.

Bogusch, E. R. (1952) Brush Invasion in the Rio Grande Plain of Texas. Texas Journal of Science 4(1):85-91.

Brown, L. F., Brewton, J. L., McGowen, J. H., Evans, T. J., Fisher, W. L., and Groat, C. G. (1976) *Environmental Geologic Atlas of the Texas Coastal Zone - Corpus Christi Area*. Austin, Texas. Bureau of Economic Geology, University of Texas at Austin.

Byrne, J. R. (1975). Holocene Depositional History of Lavaca Bay, Central Texas Coast. Ph.D. dissertation, Department of Geology, The University of Texas at Austin.

Campbell, T. N. (1947). The Johnson Site: Type Site of the Aransas Focus of the Texas Coast. *Bulletin of the Texas Archeological and Paleontological Society* 18:40-75.

Campbell, T. N. (1952). The Kent-Crane Site: A Shell Midden on the Texas Coast. *Bulletin of the Texas Archeological Society* 23:39-77.

Campbell, T. N. (1956). Archeological Materials from Five Islands in the Laguna Madre, Texas Coast. *Bulletin of the Texas Archeological Society* 27:7-46.

Campbell, T. N. (1958). Archeological Remains from the Live Oak Point Site, Aransas County. *Texas Journal of Science* 10(4):423-442.

Campbell, T. N. (1960). Archeology of the Central and Southern Sections of the Texas Coast. *Bulletin of the Texas Archeological Society* 29 (for 1958):145-175.

Casteel, R. (1976) *Fish Remains in Archaeology and Paleoenvironmental Studies*. Academic Press.

Cox, K. A., and De France, S. (in prep.). Ms. summarizing findings at 41NU37, Nueces County, Texas.

Cox, K. A. and Smith, H. A. (1989) Kent-Crane Revisted. *La Tierra, Journal of the Southern Texas Archaeological Association* 15(3):24-38.

Creel, D, Scott, R. R., Collins, M. B. (1989) A Faunal Record from West Central Texas and its Bearing on Late Holocene Bison Population Changes in the Southern Plains. *Plains Anthropologist* 35(127):55-69.

Curray, J. R. (1960). Sediments and History of Holocene Transgression, Continental Shelf, Northwest Gulf of Mexico. In: F.P. Shepard, F. B. Phleger, T. H. Van Andel (eds.) *Recent Sediments Northwest Gulf of Mexico*. American Association of Petroleum Geologists, Tulsa. Pp. 221-226.

Dillehay, T. D. (1974). Late Quaternary Bison Population Changes on the Southern Plains. *Plains Anthropologist* 19:180-196.

Drawe, D. L., A. D. Chamrad and T. W. Box (1978) *Plant Communities of the Welder Wildlife Refuge*. Contribution No. 5, Series B. Rob and Bessie Welder Wildlife Foundation, Sinton, Texas.

Fairbanks, R. G.(1989) A 17,000 Year Glacio-Eustatic Sea-Level Record: Influence of Glacial Melting Rates on the Younger Dryas Rvent and Deep Ocean Circulation. *Nature* 342:637-642.

Fenneman, N. M. (1938). *Physiography of the Eastern United States*. McGraw-Hill. New York.

Frazier, D. E. (1974) *Depositional Episodes: Their Relationship to the Quaternary Framework in the Northwestern Portion of the Gulf Basin*. Geological Circular 74. Bureau of Economic Geology, The University of Texas at Austin. Austin, Tx.

Fritz, G. (1975). *Matagorda Bay Area, Texas: A Survey of the Archeological and Historical Resources*. Texas Archeological Survey, The University of Texas at Austin, Research Report No. 45.

Hester, T. R. (1969) *Archeological Investigations in Kenedy and Kleberg Counties, Texas*. State Building Commission Archeological Program, Report 15. Austin.

Hester, T. R. (1980a). *Digging Into South Texas Prehistory: A Guide for Amateur Archaeologists*. Corona Publishing Co., San Antonio.

Hester, T. R. (1980b). A Survey of Paleo-Indian Archaeological Remains along the Texas Coast. In: *Papers on the Archaeology of the Texas Coast*, L. Highley and T. R. Hester, editors. Center for Archaeological Research, The University of Texas at San Antonio, Special Report No. 11. Pp. 1-12.

Highley, C. L. (1986) *Archaeological Investigations at 41LK201, Choke Canyon Reservoir, Southern Texas*. Center for Archaeological Research, The University of Texas at San Antonio, Choke Canyon Series 11.

Huebner, J. A. (1991) Late Prehistoric Bison Populations in Central and Southern Texas. *Plains Anthropologist* 36(137):343-358.

Jackson, A. T. (n.d.) Excavations of the Callo del Oso Burial Site at Mouth of False Oso Creek 8 Miles South of Corpus Christi in Nueces County, Texas. Unpulished ms. on file, Texas Archeological Research Laboratory, The University of Texas at Austin.

Jackson, B. J., Boone, J. L. annd Henneberg, M. (1986) Possible Cases of Endemic Treponematosis in a Prehistoric Hunter-Gatherer Population on the Texas Coast. *Bulletin of the Texas Archeological Society* 55:183-192.

Johnston, M. C. (1963) Past and Present Grasslands of Southern Texas and Northeastern Mexico. *Ecology* 44(3):456-466.

Jones, F. B. (1983). *The Flora of the Texas Coastal Bend.* Welder Wildlife Foundation, Sinton Texas.

LaSalle, M. W. and A. A. de la Cruz (1985) *Common Rangia.* Biological Report 82, Fish and Wildlife Service, U. S. Department of the Interior.

Matthews, R. K. (1990) Quaternary Sea-Level Change. In: Revelle, R. B. (ed.) *Sea-Level Change.* National Academy Press. Washington, D. C. Pp. 88-103.

McGowen, J. H., Evans, T. J., Groat, C. G., and Fisher, W. L. (1977) *Environmental Geologic Atlas of the Texas Coastal Zone, Kingsville Area.* Bureau of Economic Geology, The University of Texas at Austin.

McGowen, J. H., C. V. Procter, Jr., T. J. Evans, W. L. Fisher, and C. G. Groat (1976). *Environmental Geologic Atlas of the Texas Coastal Zone: Port Lavaca Area.* Bureau of Economic Geology, The University of Texas at Austin.

Marquardt, W. H. (1992) Shell Artifacts from the Caloosahatchee Area. In: Marquardt, W. H., editor, *Culture and Environment in the Domain of the Calusa.* Monograph No. 1, Institute of Archaeology and Paleoenvironmental Studies, University of Florida, Gainesville. Pp. 191-228.

Martin, G. C. (1930) Two Sites on the Callo del Oso, Nueces County, Texas. *Bulletin of the Texas Archeological and Paleontological Society* 2:7-17.

Martin, G. C. (1931) Texas Coastal Pottery. *Bulletin of the Texas Archeological and Paleontological* Society 3:53-56.

Martin, G. C. (n.d.) Unpublished notes on the Callo de Oso Burial Site. On file, Texas Archeological Research Laboratory, The University of Texas at Austin.

Mercado-Allinger, P. A. (1985) Oso Dune Site (41NU37). National Register of Historic Places Inventory, Nomination Form. On file, Texas Archeological Research Laboratory, The University of Texas at Austin.

Mokry, E. R., Jr. (1979) Preliminary Notes on Limited Excavations at Site 41NU173, Nueces County, Texas. Ms. on file, Texas Archeological Research Laboratory, The University of Texas at Austin.

Morton, R. A. and McGowan, J. A. (1980) *Modern Depositional Environments of the Texas Coast.* Guidebook 20. Bureau of Economic Geology, The University of Texas at Austin.

Nelson, H. F. and E. E. Bray (1970) Stratigraphy and History of the Holocene Sediments in the Sabine-High Island Area, Gulf of Mexico. pp. 48-77. In: J.P. Morgan and R.H. Shaver, (eds.) *Deltaic Sedimentation, Modern and Ancient.* Society of Economic Paleontologists and Mineralogists Special Publication No. 15.

Neumann, G. K. (1952) *Archeology and Race in the American Indian.* In: J. B. Griffin, editor, Archeology of Eastern United States. University of Chicago Press. Chicago.

Odum, E. P. (1971). *Fundamentals of Ecology.* W. B. Saunders Co.,

Orton, R. (1969) *Map of Texas Showing Normal Precipitation Deficiency in Inches.* U. S. Department of Commerce, Environmental Sciences Administration, Weather Bureau. Austin.

Paine, J. G. (1991) *Late Quaternary Depositional Units, Sea Level, and Vertical Movement Along the Central Texas Coast.* Unpublished Ph. D. Dissertation, University of Texas at Austin. Austin, Texas.

Patterson, E. P. and Ford, M. M. (1974) *Oso Creek Flood Control Project Area, Nueces County, Texas: A Report on the Archeological and Historical Resources.* Texas Archeological Survey, The University of Texas at Austin, Research Report 35.

Potter, W. H. (1930) Ornamentation on the Pottery of the Texas Coastal Tribes. *Bulletin of the Texas Archeological and Paleontological Society* 2:41-44.

Prewitt, E. R. (1981) Cultural Chronology in Central Texas. *Bulletin of the Texas Archeological Society* 52:65-89.

Prewitt, E. R. (1985) From Circleville to Toyah: Comments on Central Texas Chronology. *Bulletin of the Texas Archeological Society* 54(for 1983):201-238.

Prewitt, E. R. (1987) Observations on Seasonality of Selected Fish Remains from 41AS16. In: Prewitt, E. R., Lisk, S. V., and Howard, M. A. *National Register Assessments of the Swan Lake Site, 41AS16, on Copano Bay, Aransas County, Texas.* Reports of Investigations 56, Prewitt and Associates, Inc. Austin. Pp. 259-268.

Prewitt, Elton R., Susan V. Lisk and Margaret A. Howard (1987) *National Register Assessments of the Swan Lake Site, 41AS16, on Copano Bay, Aransas County, Texas.* Prewitt and Associates, Reports of Investigations No. 56, Austin.

Price, W. A. (1933) Role of Diastrophism in Topography of the Corpus Christi Area, South Texas. *Bulletin of the American Association of Petroleum Geologists.* v. 17, pp. 907-962.

Price, W. A. (1963) Pysiochemical and Environmental Factors in Clay Dune Genesis. *Journal of Sedimentary Petrology* 33:766-778.

Ricklis, R. A. (1988) Archeological Investigations at the McKinzie Site (41NU221), Nueces County, Texas: Description and Contextual Interpretations. *Bulletin of the Texas Archeological Society 58*(for 1987):1-76.

Ricklis, R. A. (1989) Preliminary Observations on a Late Prehistoric Bison Processing Site (41RF21) on the Central Part of the Texas Coastal Plain. *Texas Archeology* 33(2):12-13.

Ricklis, R. A. (1990) *A Historical Cultural Ecology of the Karankawan Indians of the Central Texas Coast: A Case Study in the Roots of Adaptive Change.* Ph.D. dissertation, The University of Texas at Austin.

Ricklis, R. A. (1992) The Spread of a Late Prehistoric Bison Hunting Complex: Evidence from the South-Central Coastal Prairie of Texas. *Plains Anthropologist* 37(140):261-273.

Ricklis, R. A. (1993) *A Model of Holocene Environmental and Human Adaptive Change on the Central Texas Coast: Geoarchaeological Investigations at White's Point, Nueces Bay, and Surrounding Area.* Coastal Archaeological Studies Inc. Corpus Christi, Texas.

Ricklis, R. A. (1994) *Aboriginal Life and Culture on the Upper Texas Coast: Archaeology at the Mitchell Ridge Site, 41GV66, Galveston Island.* Coastal Archaeological Research, Inc. Corpus Christi.

Ricklis, R. A. (1995a) Prehistoric Occupation of the Central and Lower Texas Coast: A Regional Overview. *Bulletin of the Texas Archeological Society* 66.

Ricklis, R. A. (1995b) *Environmental and Human Adaptive Change on the Nueces Bay Shoreline: Phase I Archaeological Data Recovery at Koch Refining Company Middle Plant, Nueces County, Texas.* Coastal Archaeological Research, Inc. Corpus Christi, Texas.

Ricklis, R. A. (1996) *The Karankawa Indians of Texas: An Ecological Study of Cultural Tradition and Change.* University of Texas Press. Austin.

Ricklis, R. A. and Collins, M. B. (1995) *Archaic and Late Prehistoric Human Ecology in the Middle Onion Creek Valley, Hays County, Texas.* Studies in Archeology 19, Texas Archeological Research Laboratory, The University of Texas at Austin.

Ricklis, R. A. and Cox, K. A. (1991) Toward a Chronology of Adaptive Change During the Archaic of the Texas Coastal Bend Area. *La Tierra* 18(2):13-31.

Ricklis, R. A. and Cox, K. A. (1993) Examining Lithic Technological Organization as a Dynamic Cultural Subsystem: The Advantages of an Explicitly Spatial Approach. *American Antiquity* 58(3):444-461.

Ruddiman, W. F. and Duplessey, J. -C. (1985) Conference on the Last Deglaciation: Timing and Mechanism. *Quaternary Research.* v. 23, pp. 1-17.

Sayles, E. B. (1935) *An Archaeological Survey of Texas.* Medallion Papers 17, Gila Pueblo. Globe, Arizona.

Shafer, H. J. and C. Bond (1985) An Archeological Review of the Central Texas Coast. *Bulletin of the Texas Archeological Society* 54(for 1983):271-285.

Shepard, F. P. and D. G. Moore (1960) Bays of the Central Texas Coast. In: F. P. Shepard, F. B. Phleger and T. H. van Andel (eds.) *Recent Sediments, Northwest Gulf of Mexico.* American Association of Petroleum Geologists. Pp. 117-152.

Shew, D. M., R. H. Baumann T. H. Fritts and L. S. Dunn (1981) *Texas Barrier Islands Region Ecological Characterization: Environmental Synthesis Papers.* Biological Services Program, Fish and Wildlife Service, U. S. Department of the Interior. Washington, D. C.

Simmons, E. G. and J. P. Breuer (1962) A Study of Redfish Sciaenops ocellata Linnaeus and Black Drum (Pogonias cromis Linnaeus. *Publications of the Marine Science Institute, The University of Texas* 5.

Smith, H. A. (1983) Determination of Seasonality in Archaeological Sites through Examination of Fish Otoliths. *Journal of Field Archaeology* 10:498-500.

Solis, R. F., I (1981) *Upper Tertiary and Quaternary Depositional Systems, Central Coastal Plain, Texas: Geology of the Coastal Aquifer and Potential Liquid-Waste Repositories.* Bureau of Economic Geology, The University of Texas at Austin, Report of Investigations No. 108.

Steele, D. G. and E. R. Mokry, Jr. (1985) Archeological Investigations of Seven Prehistoric Sites Along Oso Creek, Nueces County, Texas. *Bulletin of the Texas Archeological Society* 54 (for 1983:287-308.

Story, D. A. (1968) *Archeological Investigations at Two Central Gulf Coast Sites.* State Building Commission, Archeological Program, Report No. 13. Austin.

Stringer, G. L. (1995) Analysis of Teleostean Otoliths from Three Shell Midden Sites (41CH252, 41CH357, and 41LB84) from the Wallisville Lake Area in Chambers and Liberty Counties, Texas. In: Ensor, H. G., editor, *Archeological Testing at Four Shell Midden Sites, Wallisville Lake Project Area, Chambers and Liberty Counties, Texas.* Geo-Marine, Inc., Plano, Texas. Pp. F-3 - F-14.

Stuiver, Minze and Reimer, P. J. (1993) Radiocarbon Calibration Program, Quaternary Isotope Lab, University of Washington. *Radiocarbon* 35:215-230.

Suhm, D. A. and E. B. Jelks (1962) *Handbook of Texas Archeology: Type Descriptions.* Texas Archeological Society Special Publication No. 1 and Texas Memorial Museum Bulletin No. 4.

Suter, J. R. (1987) Fluvial Systems. In: Berryhill, H. L. (ed.) *Late Quaternary Facies and Structure, Northern Gulf of Mexico - Interpretations from Seismic Data.* AAPG Studies in Geology 23. Pp. 81-129.

Suter, J. R. and Berryhill, H. L. (1985) Late Quaternary Shelf-Margin Deltas, Northwest Gulf of Mexico. *Bulletin of the American Association of Petroleum Geologists* 69:77-91.

Sutter, F. C., R. S. Waller and T. D. McIlwain (1986) *Black Drum.* Species Profiles: Life Histories and Environmental Requirements of Coastal Fisheries and Invertebrates (Gulf of Mexico). Fish and Wildlife Service, U.S. Department of the Interior, and Coastal Ecology Group, Waterways Experiment Station, U.S. Army Corps of Engineers.

Swift, D. J. (1975) Barrier Island Genesis: Evidence from the Middle Atlantic Shelf of North America. *Sedimentary Geology* 14:1-43.

Thomas, M. A. and Anderson, J. B. (1994) Sea-level controls onf facies architecture of the Trinity / Sabine incised-valley system, Texas Continental Shelf. In: Dalrymple, R. W., Zaitlin, B. A., and Boyd, R. (eds.) *Incised-Valley Systems: Origins and Sedimentary Sequences.* SEPM Special Publication 51. Pp. 63-82.

Turner, E. and T. R. Hester (1985) *Stone Artifacts of the Texas Indians.* Second Edition. Gulf Publishing Company. Houston.

Weinstein, R. A. (1992) *Archaeology and Paleogeography of the Lower Guadalupe River/San Antonio Bay Region: Cultural Resource Investigations Along the Channel to Victoria, Calhoun and Victoria Counties, Texas.* Coastal Environments, Inc. Baton Rouge, Louisiana.

Whittaker, R. H. (1975) *Communities and Ecosystems* (2nd Edition) MacMillan, New York.

Wilkinson, B. H. (1975) Matagorda Island, Texas: The Evolution of a Gulf Coast Barrier Complex. *Bulletin of the Geological Society of America* 86:959-967.

Willey, G. R. and P. Phillips (1958) *Method and Theory in American Archaeology.* University of Chicago Press.

Woodbury, G. and Woodbury, E. (1935) *Prehistoric Skeletal Remains from the Texas Coast. Lancaster Press*. Lancaster, Pennsylvania.

Zimmerman, L. S., D. G. Steele and J. D. Meyer (1988) A Visual Key for the Identification of Otoliths. *Bulletin of the Texas Archeological Society* 58 (for 1987):175-200.