THE USE OF FIRED CLAY DAUB FROM CA-ORA-269 IN THE IDENTIFICATION OF PREHISTORIC DWELLING CONSTRUCTION METHODS, SAN JOAQUIN HILLS, ORANGE COUNTY, CALIFORNIA

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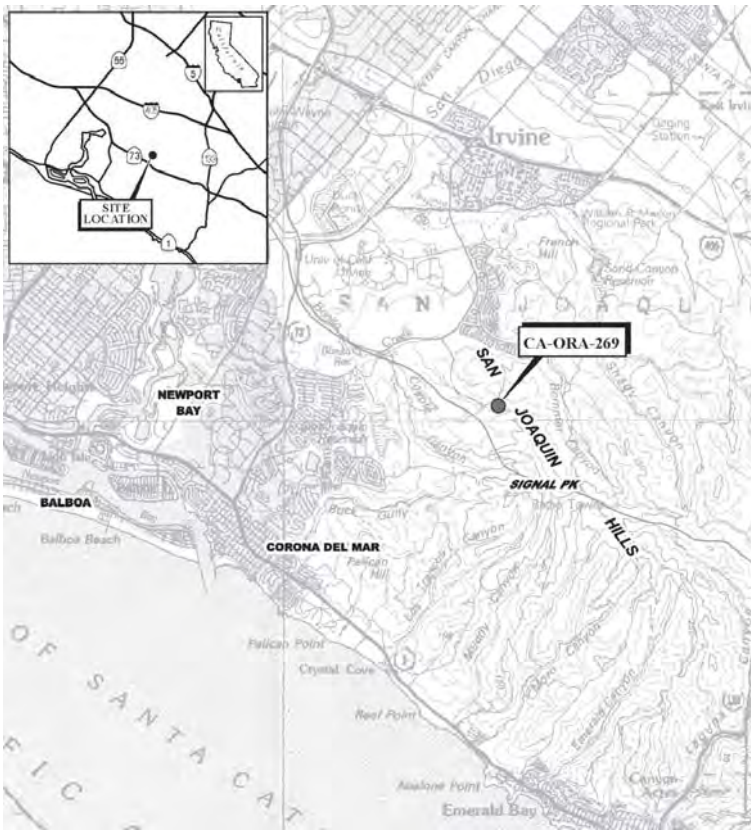
The principal type of prehistoric dwelling in southern California was wattle-and-daub. This type of dwelling was made by first constructing a circular, dome-shaped pole framework. Wattle, or bundles of woven sticks or reeds, was placed upon this framework. The wattle was then packed with daub, which was clay or mud, to weatherproof the dwelling. When the structure burned, the daub was fired and became hardened, similar to fired pottery. Although daub is rarely identified on archaeological sites because it is similar in color and texture to local sediment, waterscreening and laboratory sorting of excavated material substantially increases its recovery. Excavation of ORA-269 in the San Joaquin Hills near Upper Newport Bay resulted in the recovery of daub with impressions of vegetation and sometimes human fingerprints. Fingerprints indicate that it was applied by hand. Stick or pole impressions in daub sometimes exhibit a measurable curvature indicating that two general stick diameters were preferred. Thus, the presence of daub not only indicates that prehistoric structures were present, but its characteristics can be used to identify construction methods.

This report presents data on fired daub, or fired clay, from the prehistoric rockshelter ORA-269, located in the San Joaquin Hills of coastal southern California (Figure 1). Prehistoric house construction in southern California is called wattle-and-daub. Wattle is the bundles of woven reeds or sticks that have been placed upon a pole framework during construction. Daub is clay or mud that has been packed onto a wattle structure for increased protection from the elements and vermin. When the structures burned accidentally or by design, the daub, like pottery, was fired by the burning wood and became hardened. Although not as durable as pottery, because the structure fire was a lower temperature than pottery firing temperature, daub still remains relatively unchanged for long periods of time. Daub can retain the impressions of the twigs, sticks, and poles upon which it was originally impressed. Occasionally human fingerprints will be found, attesting to the method by which the daub was applied to the structure. The attributes of daub are reviewed in this paper with the goal of identifying those characteristics that will yield information concerning methods of prehistoric house construction.

ORA-269

This is a rockshelter habitation site located in the northwestern portion of the San Joaquin Hills at an elevation of 178-192 m (Figure 1). Signal Peak, the highest point in the San Joaquin Hills at 355 m, is located 1.8 km south-southeast of the site. At 5.6 km, the site is equidistant from the closest points on both Upper Newport Bay and the coast. The site is located within a small unnamed tributary of Bonita Creek, and includes a small but dependable spring. The site is located in the

Figure 1: CA-ORA-269 site location.



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southernmost portion of Gabrielino territory, just north of Juaneño territory.

The face of the rockshelter at ORA-269 is a large south-southeast-facing sandstone bedrock outcrop with an overhang that measures just less than 13 m across and recesses 2.5-4.0 m deep (Figure 2). The habitable portion of the shelter is the westernmost two-thirds, while the eastern portion of the shelter affords less protection and was used less, judging from the sparseness of the midden deposit at the east end. When excavated, the shelter overhang provided 1.0-2.4 m of clearance and allowed adequate room for movement. Based on the shelter dripline, the covered portion of the shelter encompasses a surface area of 34.7 m^2. Had a thatched frame structure been placed across the opening, it would have produced a very roomy shelter.

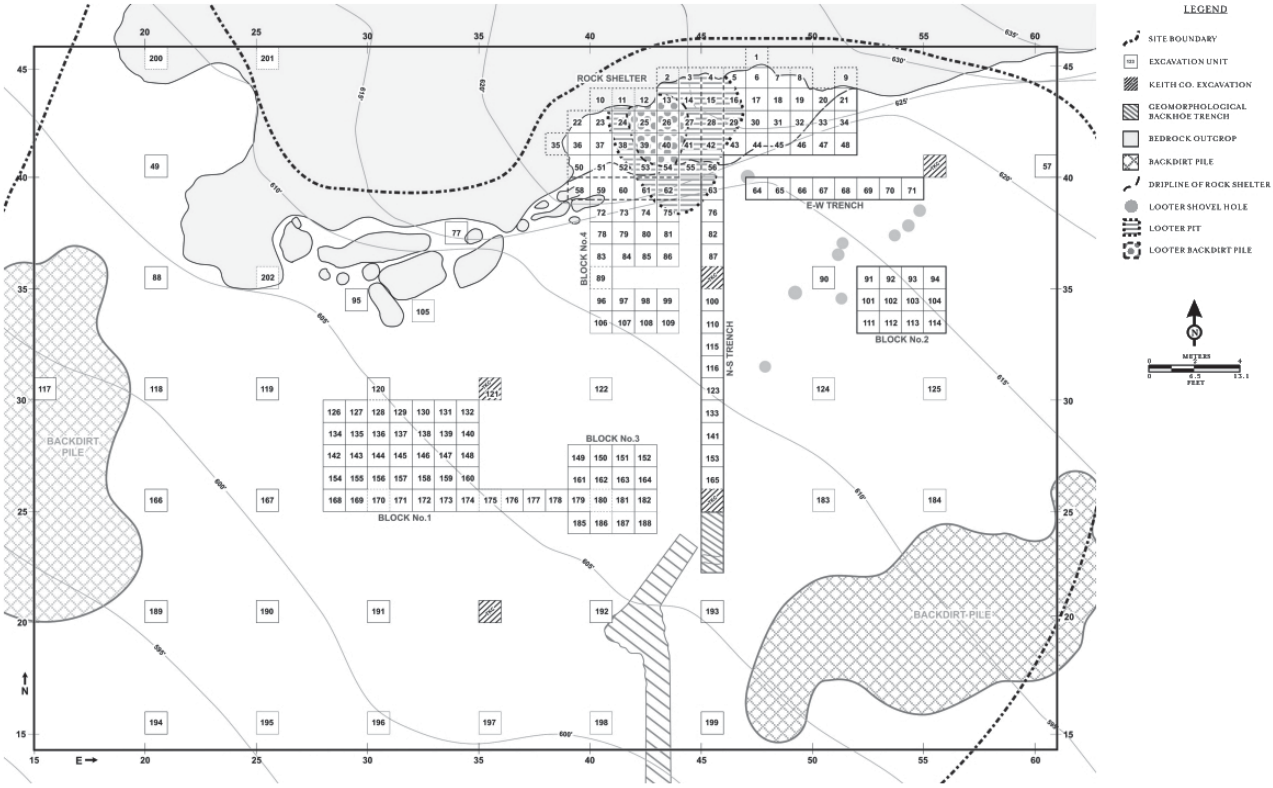
The midden deposit at the site extends downslope and southwest over 40 m from the shelter opening and consists of a very dark grey midden with large quantities of visible marine shell, fire-affected rock, and numerous artifacts. The deposit encompasses approximately 1,800 m^2, although the densest portion of the deposit is approximately 800 m^2.

All excavated sediment was first dry-screened through 3-mm mesh screen, and the residual was water-screened, dried, and sorted in lab. Although 200 1x1 m units were excavated, this report is based on the results of analysis of 43 systematic grid units placed at 5.0 m intervals across the site. The purpose of focusing analysis on grid units was to obtain data for contour density maps to graphically represent artifact and ecofact distribution across the site.

Thirty-three radiocarbon dates were obtained from the site. Thirty-two of the dates are marine shell, including two shell artifacts, and one date is from a carbonized "corm" or bulb from the lily family. Thirty of the dates are from Units 25, 51, and 180. Both shell artifacts, an *Olivella* bead and a punched *Argopecten* shell, are from Unit 180. The *Olivella* bead, at 350-360 cm, is the deepest artifact from the site, while the punched *Argopecten* shell, at 240-250 cm, is the deepest punched *Argopecten* shell from the site, and one of the deepest artifacts found at ORA-269.

Calibrated, two-sigma (95 percent probability) radiocarbon dates from ORA-269 fall in the range 860 B.C.-A.D. 1800. A total of 23 dates (70 percent) are from the Late Prehistoric Period, post A.D. 500, with two (6 percent) bordering on the early portion of the late period, and eight (24 percent) falling within the late portion of the Intermediate Period, 3000 B.C.-A.D. 500. There appear to be three broad periods of site occupation. These three dated periods fall ca. 850-400 B.C., ca. 100 B.C.-A.D. 700 and ca. A.D. 1000-1850.

Figure 2: CA-ORA-269 site map.



With the exception of two *Polinices reclusianus* (Recluz' moon snail) dates, there are two undated periods: ca. 400-100 B.C. and ca. 700-1000 A.D. It is thought that the site was occupied periodically over time beginning about 850 B.C. and ending about A.D. 1800. No early historic artifacts, such as glass trade beads, were found, indicating that the site was inhabited only prehistorically.

Native American Structures in Southern California

Prehistoric house structures in southern California were usually circular in shape. Non-circular structures in southern California are rare, and when described, it is not clear what they are (Ross 1970:84-90; Winterbourne 1940:10-18). House structures were built by first constructing a dome-shaped framework of larger sycamore and willow poles that supported smaller poles and sticks. These were overlain with wattle, woven mats of sticks or reeds. Daub, or clay, was pressed, or "daubed," by hand into the wattle, especially around the base of the structure. This was done in order to reduce drafts, to reduce the inflow of water, and to limit the access of insects and other vermin into the structure. As a construction technique, wattle-and-daub is known from archaeological contexts other than just southern California. A wattle-and-daub wall dating to the Classic Period, A.D. 1100-1300, from the Anasazi pueblo of Betatakin in northern Arizona, is depicted in Figure 3 (McGregor 1977:328).

One of the earliest references to aboriginal dwellings was made by Father Juan Crespí at Plano Trabuco in late July of 1769 (Palou 1926:126). On his northward journey as part of the first European land expedition led by Captain Gaspar de Portolá through what is now coastal southern California, Fr. Crespí referred to "houses made of willows." Prior to September of 1769 while in the Santa Barbara area on the same expedition, the project engineer, Miguel Costansó, described natives dwelling "in villages whose houses are of a spherical form in the shape of half an orange, covered with rushes. They are up to 20 varas[1] in diameter. Each house contains three or four families. The hearth is in the middle, and in the top of the house they leave a vent or chimney to give exit for the smoke" (Brandes 1970:91).

More than 20 years later, José Longinos Martínez (1961:59) described the dwellings in the San Juan Capistrano region, stating that several poles were joined together at the top of a house "forming a pyramid like a bell tent." Upon this framework, various materials, particularly reeds and rushes, were woven in the manner of mat manufacture (Longinos Martínez 1961:59).

The aboriginal house of southern California was also described as a "pit house," or a subterranean or earth-covered house (Waterman 1925:466-67). Waterman based his description on early unpublished data from Kroeber. When Kroeber published his data, he reported that the Gabrielino house was constructed of tule mats on a framework of poles (Kroeber 1925:628). Dwelling size and shape were not identified by Kroeber, but he added that in the hills and on the islands, thatch of other materials may have been used.

Driver (1967:118) reports that in California, the most common type of house was made with a framework of poles bent and tied together, over which a thatch of grass, tules, or other plant material was placed, the thatch being held in place by horizontal poles on the outside. McCawley (1996:29) also describes a similar construction technique specifically for Gabrielino houses, citing Reid (1968) in stating that their houses were of sticks covered with mats made of long, broad, sword-shaped leaves. The Gabrielino house was said to

Figure 3: Early photograph showing wattle -and-daub wall construction at Anasazi Pueblo of Betatakin in Northern Arizona (adapted from McGregor 1977:328).

be quite large and spacious, often able to hold 50 people (Bean and Smith 1978:542; Johnston 1962). March is described as the preferred month for house building because willow bark was green and could be made into cord for lashing (Rose 1959:55 in McCawley 1996:29). Framework poles were described as being either sycamore or willow.

Tule mats are said to have covered the pole framework and the doorway (Harrington 1933:110), and a layer of thatch, consisting of wild alfalfa, fern, or carrizo 15-30 cm thick, was also added (Bean and Smith 1978:542; McCawley 1996:29). Since alfalfa was introduced historically, it is possible that historic use of wild alfalfa is described by McCawley (1996:29). Harrington (1933:110) adds that a door could also be a pole framework filled in with woven green twigs. Bundles of tule were lashed to the upright wooden poles of the doorway. A painting of Mission San Gabriel by artist Ferdinand Deppe in 1832 (Bean and Smith 1978:543; McCawley 1996:Plate 4) shows a traditional Gabrielino dwelling near the mission. While the dwelling appears to be thatched in the illustration, it is not clear from the painting if the structure is wattle-and-daub.

Father Gerónimo Boscana lived with the Juaneño natives at Mission San Juan Capistrano from 1812 to 1826 and recorded many of their activities and beliefs (Bright 1978:iii). According to Boscana (1933:31) fragments of a black rock called *tosaut*, from a small island near the beach, were used as trowels with which they smoothed their mud walls. Harrington (1933:145-146) notes that a mud coating was applied to both the inside and outside of the wall of an adobe house with what he calls a wooden "float," some 10 cm wide by 25 cm long. He states that a two-by-four, a piece of slate, chalk rock, or basalt rock with a smooth surface could also be used for the same purpose. The Indian name for a smoothing stone is *taakic*, and round stones or pebbles, often from the beach, were used to smooth pottery vessels (Harrington 1933:146).

When a Juaneño couple was married, songs were sung to the couple. One of the verses sung to the betrothed was "I go to my home, that is shaded with willow" (Boscana 1933:53).

Archeological evidence of circular, domed, willow-pole-and-tule or coarse grass thatch, mud-banked houses 3.7-6.1 m in diameter is described by D. B. Rogers (1929:370-371) for the Canaliño, the most recent prehistoric ancestors of the ethnohistorically recorded Chumash who inhabited the Santa Barbara area (see also Moratto 1984:124). The pole framework of their dwellings was made of willow set in postholes around the outside of the circular floor and was lashed together at the top to form a hemisphere (Figure 4). A series of perpendicular poles were then lashed to encircle the upright framework (Rogers 1929:371). Prior to the Canaliño in the Santa Barbara area, people of the Oak Grove Culture, a Milling Stone Period precursor, also constructed circular huts 4-5 m in diameter that were "partially subterranean," buried 60-110 cm deep (Rogers 1929:180, 344). This progressive shift toward larger-diameter dwellings is consistent with what is known about prehistoric house structures through time along central and southern coastal California (Ciolek-Torrello 1998:212-217, 222). The depth of the house pit also appears to have become shallower through time, except on San Nicolas Island, where the most recent dwellings exhibit pit depths of as much as 1.2 m (Rogers 1993:20). Thus, while dwelling diameter increased over time, pit depth, in general, decreased.

On the northern Channel island of Santa Rosa, sea grass is described as thatch for a prehistoric circular dwelling 5.5 m in diameter constructed of ironwood and whale bone poles (Rogers 1929:331-332). On the southern Channel island of Santa Catalina, circular dwellings with postholes set around the circumference are also known from prehistoric contexts (Rosenthal et al. 1988; personal observation). Prehistoric dwellings on San Clemente Island are also circular in shape and semi-subterranean (Huey 1992:57). Huey states that the primary difference between prehistoric structures on the mainland and those on the Channel islands is construction material (Huey 1992:21, 57). Wood was used on the mainland, while whale bone or a combination of whale bone and wood was used on the islands. Kroeber (1925:634) also mentions the use of whale bone for aboriginal dwellings on San Nicolas Island, but states that the structures were covered either by sea lion skins or wattled with brush or rushes. Malcolm Rogers reported progressive changes over time for house dwellings on San Nicolas Island. Writing about investigations in 1930, Rogers (1993:20) states that early houses on San Nicolas Island were circular pits 2-3 m in diameter and 30-60 cm deep. He describes later dwellings as large as 9-12 m within pits 120 cm deep. Whale bone and brush dwellings used by the 'Lone Woman of San Nicolas Island' are described by Schwartz (2003:3) as being windbreaks measuring about 2 m diameter and less than this in height. Schwartz believes that these dwellings were merely wind-breaks. He believes that more permanent dwellings would have been covered with seal skin (Schwartz 2003:9).

On San Clemente Island, two circular basin-shaped dwellings are known from SCLI-1215 (Nursery Site). One of these was radiocarbon dated to 3750 ± 35 B.P.

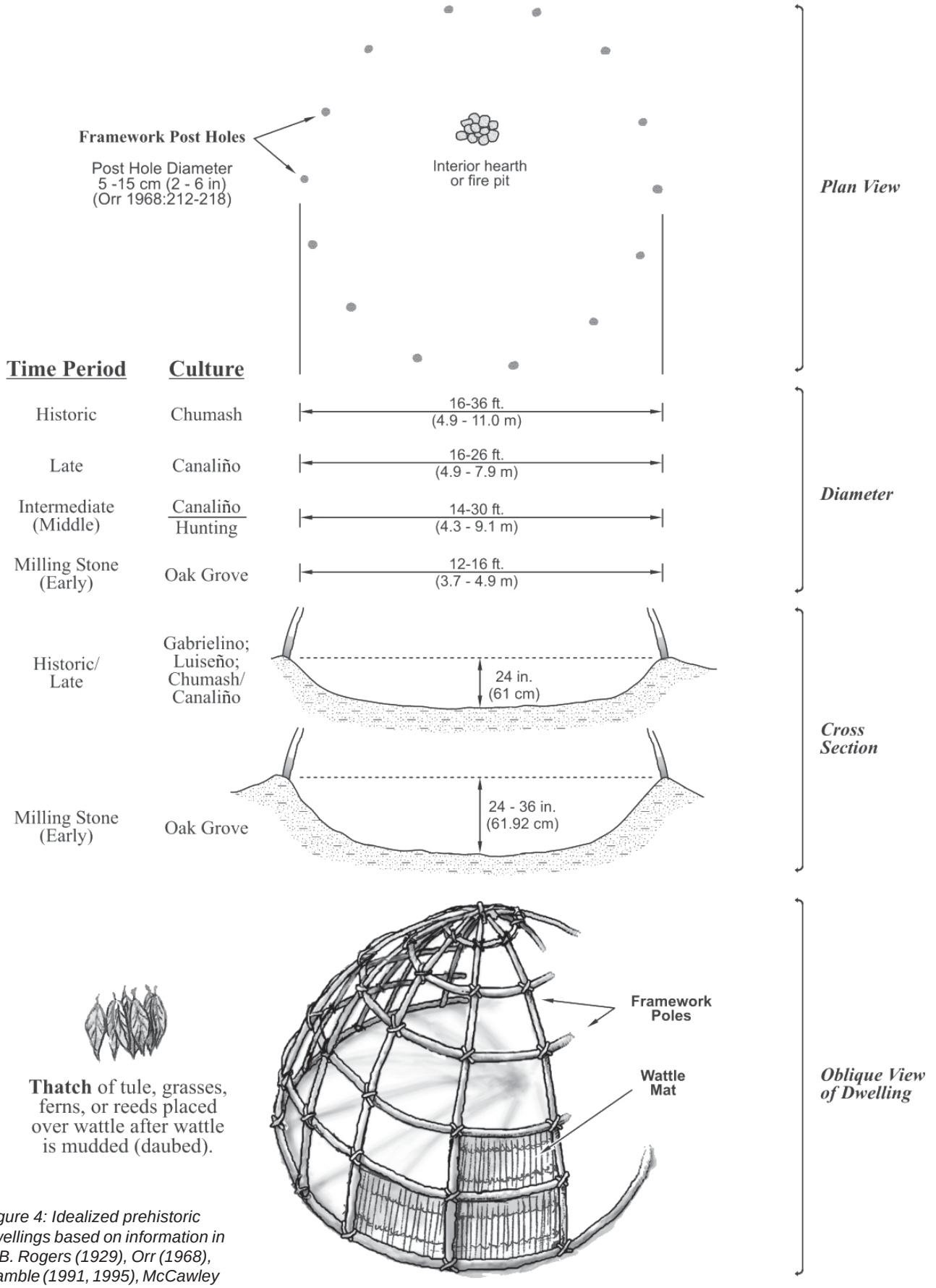


Figure 4: Idealized prehistoric dwellings based on information in D.B. Rogers (1929), Orr (1968), Gamble (1991, 1995), McCawley (1996), and Ciolek-Torrello (1998).

(Salls et al. 1993:189). Carbonized wood from a burial outside a second house floor at SCLI-1215 was dated to 5495 ± 45 B.P. Furthermore, the presence of *Olivella* Grooved Rectangle beads dated ca. 4300-5200 B.P. (Howard and Raab 1993) also suggests that one of the circular pithouses is over 5,000 years old (Salls et al. 1993:190). Another circular house floor (Whale House) from Skull Gulch on Santa Rosa Island was dated to 1230 ± 60 B.P. (Orr 1968:215). Yet another early radiocarbon dated circular house floor comes from SCRI-333 on Santa Cruz Island (Salls et al. 1993:190) where shell on the floor dates the dwelling to 3700 ± 70 B.P. (Breschini et al. 1992:56). This indicates that prehistoric dwellings were circular in outline far back into prehistory. It also suggests that dwelling diameter increased through time.

Kroeber (1925:809) states that "the Chumash threw the earth...up against the walls for a few feet." Packing dirt around the periphery of a dwelling may have been more common than is described in the literature. The Plains Indians are known to have excavated a little earth from the center of their "tipi" and piled it around the edges of the lodging (Waterman 1925:465). This is not commonly described for southern California structures, although it is possible that it commonly occurred but was merely not mentioned. At Tejon, just north of the Los Angeles Basin, a photograph of a rectangular dwelling with shingle roof and cobble stone fireplace taken by Edward S. Curtis about 1924 clearly shows the characteristic wattle-and-daub construction and sediment packed around the outside base of the structure (Blackburn and Bean 1978:565). Historic additions to the prehistoric wattle-and-daub construction technique include a rectilinear rather than circular floor plan, wooden shingles, and a cobble fireplace.

As for the native groups living in the vicinity of Newport Bay, near which ORA-269 is located, McCawley (1996:29) states that they are thought to have followed the Luiseño practice of first excavating a 60-cm deep hole the diameter of the house and then building the wood and rush structure over the hole. This constitutes a semi-subterranean house. A photograph of a semi-subterranean house from the late 1880s is known from the Mohave who inhabited the region of California just west of the Colorado River (Smith 1977:9). A photograph of a rectangular Mohave dwelling from the 1880s exhibits packed sediment at the base along the front wall of the structure (Smith 1977:3).

Unlike Gabrielino houses, permanent Luiseño houses were earth-covered (Kroeber 1925:654-655). Like Gabrielino houses, they were built over an excavation approximately 60 cm deep. Kroeber (1925:654-655) states that the Luiseño house resembles the earth house of the Wintun, Maidu, and Miwok, although the geographically intermediary Gabrielino and Yokuts did not construct earth-covered habitations. Photographs of circular earth-covered sweat houses and ceremonial houses are known from northern and central California (P. Johnson 1978:357, 358; Levy 1978:408; Riddell 1978:373), and photos of incomplete structures showing the poles used in construction are also known from these areas (J. Johnson 1978:367; P. Johnson 1978:355; Wallace 1978:451).

Semi-subterranean sweat lodges, or "temescals," covered with earth were also commonly constructed in California (Driver 1967:118), specifically by the Gabrielino (Kroeber 1925:628; McCawley 1996:30), although there are no known photographs of the Gabrielino structures. Kroeber (1925:628) describes the Gabrielino sweat house as small. The sweat house would probably not have been built close to a living area, but this is unknown. It is possible, since the sweat lodge was primarily a male facility (Hudson and Blackburn 1986:39), that it was set apart from other dwellings (Ciolek-Torrello 1998:195). A photograph of an earth-covered Luiseño sweat house does exist (Bean and Shipek 1978:554; McCawley 1996:31). The Luiseño sweat lodge, according to Kroeber (1925:655), was similar to the earth-covered Luiseño house, except that it was smaller, elliptical, with an entrance along one of the longer sides, and supported by two forked posts connected by a ridge log.

Information on differences between Chumash houses and sweat lodges provided by Gamble (1995:58) indicates that sweat lodges contain between two and four large interior posts rather than the series of posts that were placed around the perimeter of a house. Sweat lodges were also covered with earth; contain evidence of a large, central fireplace; exhibit either a small doorway or no doorway; have a noticeable lack of domestic debris (especially female-related artifacts); contain a mud-plastered floor; and often exhibit a raised interior rim (Gamble 1995:58). As part of the construction of houses, dirt was placed around the outside perimeter so that water would not enter when it rained (Gamble 1995:56; Hudson and Blackburn 1983:331).

Fired clay daub was created when a structure burned. Temescals are known to have hearths or fire pits (Ciolek-Torrello 1998:214; Rogers 1929). Dwellings also had interior hearths, although they were smaller and contained quantities of fire-affected rock (Ciolek-Torrello 1998:214; Orr 1968:215). Hearths were reported as located near the center of the dwellings (Brandes 1970:91) but have also been found

at the entrance to the dwellings (Clemmer 1962; Macko 1983; Salls et al. 1993). Interior hearths could have accidentally caused a structure to burn. Also, the purposeful burning of dwellings to rid them of vermin likely occurred when the dwelling and village were vacated. Prescribed prehistoric burning of natural vegetation is thought to have occurred to increase productivity (Hammett 1991; Timbrook et al. 1982:175; see also Popper 2003:14).

Wattle-and-daub construction is described as the construction technique for Chumash sweat lodges (Hudson and Blackburn 1986:33) and also for small structures used to cure fish and meat (Ciolek-Torrello 1998:197). Furthermore, there are several other coastal settlement structures, such as the male puberty hut, the menstrual hut, a childbirth hut (Hudson and Blackburn 1986:44-47), and a ceremonial enclosure (Boscana 1933:37; Kroeber 1925:628) for which little information is known other than that, like the sweat lodge, these structures were relatively isolated and removed from habitation structures.

Kroeber (1925:628) reports that Gabrielino religious gatherings took place in an open air ceremonial enclosure called a *yoba* (*yobare*, *yobagnar*). Each village contained one *yoba*, constructed in a circular outline of willows inserted among willow stakes (Bean and Smith 1978:542). A similar "temple" structure was constructed by the Juaneño, as reported by Boscana (1933:37), who describes an enclosure called a *vanquech* erected by command of the god Chinigchinich. This is also termed a *wankech* (Kroeber 1925:639). The Juaneño *vanquech* was an unroofed, open-air structure erected in the center of the village, contiguous with the dwelling of the chief, and was:

> an enclosure four or five yards in circumference, not exactly round, but inclining to an oval. This they divided by drawing a line through the centre, and built another, consisting of branches of trees, and mats to the height of about six feet, outside of which, in the other division, they formed another, of small stakes of wood driven into the ground. This was called the gate, or entrance, to the *vanquech*. Inside of this, and close to the largest stakes, was placed a figure of Chinigchinich, elevated upon a kind of hurdle. This is the edifice of the *vanquech* [Boscana 1933:37].

Harrington (1933:155) describes the "hurdle" as a framework. The Juaneño *vanquech* appears to consist of fences made of brush and woven matting, probably similar to what was used in house construction. Whether this structure was daubed is unknown.

This unroofed ceremonial enclosure is also described for the Luiseño, where it was called a *wamkish*, and was found as far north as the Yokuts (Kroeber 1925:628, 655). The Diegueño called it a *himak*, and as stated earlier, the Gabrielino called it a *yoba* (Kroeber 1925:628). Kroeber believes that this type of ceremonial enclosure shows a similarity with structures throughout the Shoshonean Plateau, and may have an ultimate connection with the Sun Dance lodge of the Plains, although in California it is definitely associated with toloache and mourning ceremonies. Native groups of the Colorado River area, the Mohave, for instance, did not use this type of structure. Where this structure is known to occur, there is no description of mud plastering on it.

Summary

The introduction of European culture in the late 1700s to what is now southern California slowly changed the native domicile in this region. The aboriginal dwelling was originally a domed sycamore or willow pole framework covered with wattle and thatch. Usually circular in outline, it was constructed over an excavated pit up to 60 cm deep, making it semi-subterranean. Over time, the prehistoric dwelling increased in diameter, and with the exception of house pits on San Nicolas Island, pit depth decreased. Dirt was packed around the outside base of the structure, and the wattle sides of the structure were daubed with mud. On the mainland, thatch of reed, grass, leaves, tule, fern, and historically alfalfa, was placed over the mudded daub. On the islands, surf grass, or the skin of the seal or sea lion was used as thatch. On many prehistoric sites, structures burned either by accident or design. Based on photographs taken from the late 1800s through the early 1900s, fewer dwellings were semi-subterranean over time. Although still constructed using a pole framework covered with thatch, historic dwellings were often rectangular rather than circular in outline. Daubing the structures was conducted less often, and packing sediment around the base occurred less frequently. Roofs were sometimes shingled, and stone fireplaces were even constructed as time progressed. Doors became pieces of saw-cut wood, rather than the aboriginal tule mats. Introduced constructions such as the beehive oven were also built adjacent to the house. These changes in construction show prehistoric methods that were slowly modernizing.

Preceding descriptions of prehistoric structures do not differentiate between plastering of daub on houses, sweat lodges, or other structures, and often do not describe plastering of mud at all. The fact that sweat lodges were covered with earth does not preclude the use of daub on houses or other structures. Mud was definitely plastered on the floor of sweat lodges (Gamble 1995:58). Thus, the presence of fired daub

with vegetation or pole impressions does not by itself suggest a specific structure. Nonetheless, daub is evidence of the existence of a prehistoric structure. Daub is also evidence that the structure burned.

Thus, the significance of daub is twofold. First, it identifies the presence of a wattle-and-daub structure that burned either by accident or by design. Secondly, daub retains the impressions of the item upon which it was plastered; this distinguishes daub from fired mud that plastered sweat lodge floors. Daub retains the impressions of vegetation, including the posts and reeds used to build the structures. Rarely, daub retains impressions of human fingerprints, identifying that plastering was done by hand.

Daub at Archaeological Sites in Southern California

Daub is created when prehistoric structures are plastered with mud. Much like pottery, the daub is made durable and long-lasting in a fire. When the structure burned, the daub was fired. Much like pottery, the baked clay holds its shape, retaining impressions made in it while it was moist. Although not as durable as pottery, which is baked at a higher temperature for a longer length of time, daub is found in abundance in the vicinity of prehistoric wattle-and-daub structures where it originated. Daub has been found in small quantities on a number of sites in southern California

Central California

Daub is a common element of many prehistoric sites in the Central Valley (Phil Hines, personal communication 2004). It is thought to be the result of burned structures and has been observed during excavation of prehistoric villages along the Fresno River (Gerritt Fenenga, personal communication 2004). Similarly, daub was also reported from permanent winter village sites in the Sierra foothills, while the temporary, seasonal sites were not said to contain daub.

San Diego County

Several fragments of daub were found at the Intermediate Period La Jollan campsite SDI-12510/H in San Marcos (Strudwick et al. 1994:2-11). Three small daub fragments with vegetation impressions were found at SDI-10,156/1299/H, the ethnographically recorded Luiseño village of Topamai on the east bank of the Santa Margarita River near the Rancho Santa Margarita y Las Flores adobe ranch house (Strudwick et al. 1996). Radiocarbon evidence indicates the site was occupied as long ago as 5755-5285 cal B.C. (Beta 84875; Strudwick 1996:29). The three pieces of daub were found in an area of the site conspicuously lacking clay, indicating that the clay was brought to the location where it was found archaeologically.

Orange County

In San Clemente, near the Orange-San Diego county border, three daub fragments with reed stalk impressions were found at the Intermediate to Late Prehistoric Period Marblehead Site, ORA-504 (Cameron et al. 1985:56-57; Scientific Resource Surveys 1980:125; Strudwick 1998:40). Also in San Clemente, 12 pieces of daub, some with reed and grass stalk impressions, were found at the Late Period village site of ORA-907 (Cooley and Carrico 2002). Another 14 pieces of daub were found at nearby site ORA-910A, a Late Prehistoric Period hunting camp (Gross et al. 1989:171).

At Putuidem (ORA-855), an ethnohistorically recorded Juaneño village site near Mission San Juan Capistrano, 17 pieces of daub were found, some with vegetal imprints (Koerper et al. 1988:153; Koerper and Mason 2000:Sect. 7, pp. 16-17). These pieces were stated to exhibit "clear evidence of having been molded to some sort of branch, reed, rush, or similar plant part" (Koerper and Mason 2000:Sect. 7, pp. 17).

Another 54 pieces of daub were reported from the Christ College Site (ORA-378) located on the western edge of the San Joaquin Hills (Koerper 1995:6-172). These were described as the remnants of daub from a wattle-and-daub structure. On the west side of Newport Bay, daub was found at ORA-116 (Grenda et al. 1998). At Bonita Mesa Site IV (ORA-134), located midway between upper Newport Bay and ORA-269, a single piece of daub containing a stick-like impression was found during excavation (Chace et al. 1967:12). Later excavation in the vicinity did not report finding daub (Drover and Peterson 2000).

Closer still to ORA-269, fragments of daub have been identified on two major Newport Coast/San Joaquin Hills area projects: Muddy Canyon and the Newport Coast Archaeological Project (NCAP). Both projects occurred because of proposed development that would eventually result in site destruction, the same factor that initiated excavation at ORA-269.

Muddy Canyon. Five archaeological sites in Muddy Canyon contain daub: ORA-932, ORA-1405, ORA-1407, ORA-1413, and ORA-1597 (Sawyer 2004). Most of the Muddy Canyon sites date to the Late Period (Macko 1998:151), although ORA-1597 was dated to the Intermediate Period with a corrected radiocarbon date of 2420 ± 110 cal B.P. (Sawyer 2004).

Newport Coast Archaeological Project (NCAP). NCAP, completed along the southwestern and western end of the San Joaquin Hills, includes 12 sites with small quantities of daub: ORA-232, ORA-246, ORA-662, ORA-667, ORA-671, ORA-672, ORA-673, ORA-674, ORA-676, ORA-1204, ORA-1208, and ORA-1295. The Late Period site of ORA-662 (Pelican Hill) was reported to contain 63 pieces of daub, many with smooth concavities (Mason et al. 1993:165). Area 13, a locus of ORA-662, also contains two pieces of daub (Mason, Brechbiel, Singer, Peterson, Klug, Bonner, Morgan, and Gibson 1992:60). Another site near Pelican Hill, ORA-1295, also contains a small quantity of daub (Mason, Peterson, Brechbiel, Singer, Langenwalter, and Morgan 1991:45). The three Late Period French Flat sites, ORA-232, ORA-671, and ORA-672, contain a total of 15 pieces of daub, many with concave cross sections and smooth interiors (Mason, Brechbiel, Singer, Peterson, Klug, Bonner, Morgan, and Gibson 1992:64, 111, 147). Three small Late Period rockshelters, ORA-674, ORA-676, and ORA-1204, also contained small quantities of daub, as did ORA-246, ORA-1208, ORA-667, and ORA-673 (Mason, Brechbiel, Peterson, Singer, Bonner, Klug, Morgan, and Gibson 1992:69; Mason Brechbiel, Peterson, Singer, Langenwalter, and Gibson 1991:62, 75, 100; Mason, Brechbiel, Singer, Bonner, Gibson, Peterson, and Morgan 1992:80; Mason, Peterson, Brechbiel, Singer, Bonner, Morgan, and Gibson 1992:52, 69).

Summary

With the exception of NCAP and the Muddy Canyon archaeological projects, few prehistoric sites in southern California are known to contain daub. Undoubtedly, daub exists to a greater extent and its absence is notable. On many sites, daub may be the only remaining indication that a prehistoric structure once existed. Barring identification of a structure on a site, such as the basin-shaped house impressions identified using soil resistivity at ORA-116 (Grenda et al. 1998:37-54), the presence of daub may be the only means by which to infer the existence of structures.

Daub From CA-ORA-269

Distribution

A total of 789.9 g of daub comes from 32 of 43 systematic grid units at ORA-269. Daub was found from the 0-10 cm level to the 370-380 cm level in Unit 180. Daub quantities vary from as little as .3 g in Unit 192 to as much as 120.4 g in Unit 122. Daub from ORA-269 is fragmentary; few pieces measure greater than 2.0 cm. Units 100, 122, and 180 each contain more than 100 g of daub. However, these are also three deep units, and one expects a deeper unit to contain more material than a shallower unit.

A contour density map of average daub weight per level (Figure 5) lessens the effects of deep units when considering daub weight. It is clear that the center of this density map is the central portion of the site directly south of the western portion of the rockshelter. In this area, Units 100 and 122 contain an average of more than 7.0 g of daub per level. However, the distance of what is the center of the densest daub

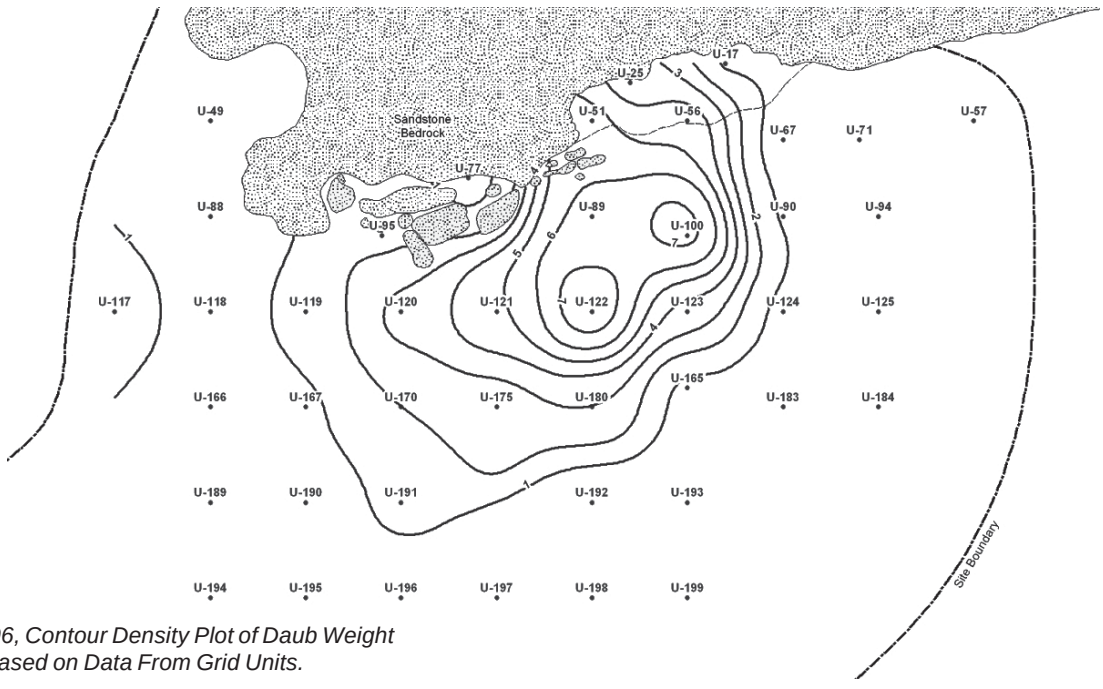


Figure 5: CA-ORA-296, Contour Density Plot of Daub Weight in Grams Per Level Based on Data From Grid Units.

distribution is 3-13 m from the front of the shelter. This is closer to the shelter than had total daub weight per unit been considered, rather than average daub weight per level. Unit 51, within the western portion of the rockshelter, contains more than 5 g of daub per level.

Based on the density of daub, it is likely that a structure existed in front of the western portion of the shelter within the triangular area represented by Units 89, 100 and 122 (Figure 5). A slightly higher density of daub exists in Units 100 and 122 than in Unit 89. It is possible that as many as three dwellings once stood on this portion of the site, as there is ample room for three huts measuring as large as 4 m diameter. However, no subsurface indications of prehistoric structures were identified during excavation.

A wattle-and-daub windbreak may have been constructed against the front of the west side of the shelter, although there are no visible alterations to the sandstone rock overhang. Daub density is slightly greater within the western portion of the shelter than it is outside the center of the shelter just 5 m east. A decomposing wattle-and-daub structure leaning against the mouth of the rockshelter would have decomposed downslope to the southwest. However, if the rockshelter was cleaned out periodically, downslope may have been north, into the shelter. After the shelter filled with debris, downslope would have been away from the shelter, to the southwest. Increased density of daub near Units 100 and 122 suggests that structures may have existed outside and away from the shelter, since this area, especially near Unit 100, is at the same elevation as the west side of the shelter. Unless purposefully thrown to the southeast, debris from the west side of the shelter would not have naturally moved eastward. However, the rapid decrease in the quantity of other cultural material to the east in the shelter, and outside the eastern portion of the shelter, suggests that debris was not discarded to either the southeast or east.

Some type of wattle-and-daub structure was located near the western portion of the shelter. This is thought to be so since an abandoned structure would decompose where it stood and in a downslope direction. Also, if the rockshelter was used or inhabited, then it would have been cleaned out occasionally and refuse would have been redeposited outside the shelter, where it would have eventually moved downslope. The fact that a relatively high density of daub exists within the western part of the shelter suggests that some sort of daubed structure existed near the western shelter opening.

Fingerprints

Despite its small size, a valuable characteristic of daub is its tendency to contain impressions of material on which it was packed. Many daub fragments exhibit various types of impressions, primarily vegetation, and rarely, fragments of human fingerprints. Fingerprints are the rarest of the impressions identified in daub from ORA-269.

A total of 12 pieces of daub contain portions of visible human fingerprints or skin imprints. Some of the better examples are depicted in Figure 6A. One of these (Cat. No. 269-2203) appears to be an impression of skin from an area of the hand near the knuckles where triangular wrinkles exist. These impressions suggest that daub was plastered by hand and not exclusively with a smoothing stone, *taakic* (Harrington 1933:146), or black *tosaut* rock from an island near the beach (Boscana 1933:31).

Vegetal Impressions

The majority of imprints on the daub from ORA-269 are of vegetation. Some pieces appear to have been packed over irregular pieces of vegetation such as small sticks or twigs (Figure 6B)[2]. Some of the impressions are smooth and cylindrical, suggesting the daub hardened around a stick or pole. The quality and size of many of the smooth, cylindrical daub impressions was sufficient to measure their diameter. A total of 164 pieces of daub contained a measurable curvature, or sufficient curvature by which to identify the original diameter of the stick or pole on which the daub was impressed.

Curvature measurement was completed using a series of circle templates to estimate the original stick or pole diameter (Figure 6B). If the daub was too fragmented or the curvature too irregular in shape, then a match was not possible and the daub did not contain a measurable curvature. If the daub contained a sufficient portion of the original stick or pole curvature, approximately 6.4 mm of curvature, then a relatively accurate approximation of the stick or pole diameter was possible. On similarly sized pieces of daub, the larger the pole diameter, the more difficult the measurement, and, of course, the less accurate the estimation of pole diameter. More accurate pole diameter estimations were possible with larger pieces of daub, or with pieces containing greater portions of the impressed curvature.

Smaller diameters, from 3 mm to 10 mm, were estimated in increments of one-sixteenth of an inch (1.5 mm). Above 13 mm, gradations were by one-eighth inch (3 mm). Exact determinations were almost never possible, but visual determination between two diameter choices was possible in almost every case. Thus, for each piece of daub containing a measurable curvature impression, two curve diameters were

Figure 6: (A) Daub with human fingerprint and skin impressions; (B) Daub with vegetal impressions and with concave curvature placed against circle representing stick or pole cross-section.

recorded. The recording sheet contains columns between individual diameters, rather than one for each diameter. Each column identifies a measurement between two diameters, such as -¾ inch (15.9-19.0 mm), or ¾- inch (19.0-22.2 mm). Each measurement is thus a choice between two diameters, and produces one result.

A total of 164 measurable curvatures were identified from the 789.9 g of daub at ORA-269. Diameters as great as 41-44 mm and as small as 3 mm were identified on the daub. Only three curvatures greater than 31.8 mm diameter were identified, 1.8 percent of all measurements. Graphically, all curvature diameters (n = 164) are depicted in Figure 7, which presents measured daub curvature diameters by quantity.

Figure 7 is a bimodal curve, the two modes being the <3.2-4.8 mm columns and the 12.7-28.6 mm columns. A total of 110 curvatures (67.1 percent) measure 12.7-28.6 mm, while 26 curvatures (15.9 percent) measure <3.2-4.8 mm. A gradual rise from the 9.5-12.7 mm column (n = 6) leads to a peak at the 19.0-22.2 mm column (n = 29). Impressively, the columns on either side of the 19.0-22.2 mm column, 15.9-19.0 mm and 22.2-25.4 mm, each contain 26 curvatures. The graph declines rapidly above 25.4 mm. Thus, curvatures with measurements approximately 13-29 mm in diameter were most commonly represented by the daub recovered at ORA-269, followed secondarily by much smaller twig curvatures in the <3.2-4.8 mm inch columns. The smaller curvatures of <3.2-4.8 mm diameter indicate that twigs and brush were mixed with mud prior to applying the daub mixture to wattle, which was made of sticks with the larger 12.7-28.6 mm diameters. Harrington (1933:110) mentions that a door can be a pole framework filled in with woven green twigs. Twigs were mixed with mud most likely because when the daub dries, it shrinks and cracks and the twigs helped keep it in place. In the same way, straw is added to adobe bricks for strength.

There are two possible reasons why sticks measuring 13-29 mm were preferred for wattle. The first is that it was a conscious decision by the natives to select this stick diameter. The second reason is that this was the stick diameter available. Hypothetically, the simplest way to identify this apparent preference is to identify the species of plant impressed in the daub. Because of the small size of the impression, and because the majority of impressions are smooth and have no characteristic variation, identification of a single plant species is difficult.

The Jepson Manual of Plants (Hickman 1993:1308) divides rushes and reeds into three basic categories: *Typha* (cattail), *Scirpus* (bulrush), and *Juncus* (rush). No mention is made of stem diameter for these groups. *Typha* is described as having cylindric and solid stems, *Scirpus* as having stems that are triangular or cylindrical, and *Juncus* as having stems that are cylindrical or flat (Hickman 1993:1308). All of the aforementioned rushes and reeds can exhibit round stem cross sections; thus, any of them could be represented on the daub used for house building. In fact, measurement of 30 arbitrarily chosen *Typha* and *Juncus* stems within a riparian area on the Tustin Plain north of ORA-269 shows that both measure predominantly 13-26 mm. However, stems were sheathed and "grassy," and not smooth as suggested by almost all of the concave daub curvatures.

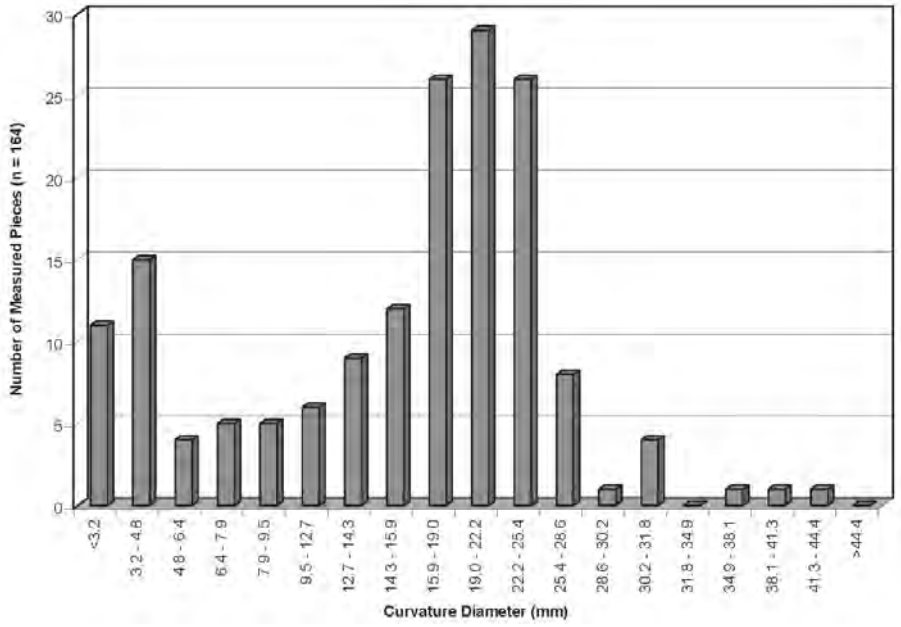


Figure 7: Measured daub curvature diameter by frequency.

It is more likely that rushes and reeds would have been used as thatch to lay over the pole framework, rather than as a weak wattle material onto which mud was packed. Macrobotanical analysis of flotation samples identified small quantities of carbonized *Scirpus* from ORA-269 (Popper 2003:8, Table 11). *Typha* and *Juncus* were not identified.

Willow was not measured for this study, but 31 species of willow (*Salix* spp.) are distributed throughout California from the Alpine zone to the coast, invariably along water (Schoenherr 1992:154). Willow can be a thin-diameter single shoot when young, and can also grow into trees with much larger trunks and branches. Willow is also much stronger than the grass-like rushes or reeds, and importantly, young willow exhibits smooth stems. The fact that willow grows much larger than 29 mm in diameter indicates that plant stem diameters estimated to be in excess of 32 mm are probably willow. Additionally, western sycamore (*Platanus racemosa*) and poplar/willow (*Populus/Salix*) were two wood taxa identified from macrobotanical analysis of soil samples from the site (Popper 2003:5-6).

Although unproven, it is likely that the wattle impressions identified on daub at ORA-269 are a species of willow, *Salix* spp., with stems purposefully chosen primarily in the 13-29 mm diameter range. This hypothesized use of willow matches archaeological and ethnographic literature identifying willow for house construction (McCawley 1996:29; Palou 1926:126; Rogers 1929:371; Rose 1959:55), for construction of ceremonial enclosures such as the Gabrielino *yoba* (Bean and Smith 1978:542), and also described in verse and sung to newly married Juaneño couples (Boscana (1933:53).

Summary

Prehistoric structures in southern California were usually constructed using a circular framework of larger sycamore and willow poles supporting smaller poles and sticks overlain with wattle. Daub, or clay mud mixed with twigs less than 5 mm diameter, was pressed, or "daubed," into the wattle-covered pole framework. Sediment was also piled around the base of the structure. On the mainland, thatch, made of reed, grass, leaves, tule, fern, and historically, alfalfa, was also added. Sea grass and the skin of seal or sea lion was used on the Channel Islands. This was done to reduce drafts, to reduce the inflow of water, and to limit the access of insects and other vermin to the structure. Much like pottery when fired, the daub was made durable when the structure burned.

On archaeological sites, daub is found in the vicinity of prehistoric wattle-and-daub structures. At ORA-269, daub is found in greatest abundance just outside the western front of the rockshelter. Based on the density of the daub at the site, it is possible that a wattle-and-daub framework was placed up against the western side of the rockshelter for protection. It is also possible that from one to three small wattle-and-daub dwellings existed outside the rockshelter, although no subsurface evidence of their existence was found during excavation.

Daub from ORA-269 contains impressions from vegetation and from human fingerprints, impressions made during construction of the structure. Vegetal impressions include portions of cylindrically shaped concavities from twigs, sticks, and poles. It is possible to estimate the diameter of the item on which the daub was impressed with a reasonable degree of accuracy by comparing it to a series of circle templates of known diameter.

At ORA-269 a total of 789.9 g of daub comes from 32 of 43 systematic grid units. Daub was found from the 0-10 cm levels in most units to as deep as 370-380 cm in Unit 180. The daub is fragmentary and few pieces measure greater than 2.0 cm. A total of 164 measurable curvatures ranging from 3.2 to 44.4 mm were identified. The majority, 67.1 percent (n = 110), measure 12.7-28.6 mm in diameter, suggesting either that this diameter stem was what was available or that it was specifically chosen for building structures. A secondary grouping of curvatures, 15.9 percent (n = 26), measuring <3.2-4.8 mm diameter indicates that twigs were mixed into the mud before it was daubed onto the wattle structure. It is thought that twigs were added for strength in the same way that straw is added to adobe brick. When the daub dried, it shrank and cracked. Twigs helped hold the daub in place.

Thirty arbitrarily chosen local *Typha* (cattail) and *Juncus* (rush) stems both measure primarily 13-26 mm. However, the stems were sheathed and "grassy," and not smooth as are the concave curvatures impressed on the daub from ORA-269. Willow (*Salix*) shoots are not only smooth but have small stem diameters when young and also much larger stem diameters as they grow larger. Western sycamore (*Platanus racemosa*), poplar/willow (*Populus/Salix*), and small quantities of bulrush *(Scirpus*) were identified during macrobotanical analysis of soil samples from ORA-269. It is likely that the wattle impressions identified on daub at ORA-269 are a species of willow, with stems purposefully chosen primarily in the 13-29 mm diameter range for their relative strength. This matches archaeological

evidence and ethnographically recorded descriptions of willow for use in house building in the coastal southern California region.

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Endnotes

[1] A *vara*, or Spanish yard, measures 85 cm (Avina 1932:19; Shumway 1993:10).

[2] The gradation of twig to stick to pole is one of increasing diameter, and also to some extent straightness and length. To my knowledge there is no definition of when a twig becomes a stick, or when a stick becomes a pole, or for that matter when a pole becomes a log. For purposes of this discussion, the terms stick and pole are used interchangeably. Twigs are the smallest of the curvature measurements.

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