

INVESTIGATION OF THE PARADISE RANCH KNOLL EARTH OVEN SITE, CA-LAN-2464, IN RESPONSE TO SITE DAMAGE RESULTING FROM THE 2006 “DAY” WILDFIRE INCIDENT

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In the Fall of 2006, the “Day Fire” burned within the Angeles and Los Padres National Forests, in eastern Ventura and western Los Angeles counties. During the incident, Forest Service archaeologists discovered inadvertent effects from bulldozer suppression activities to the Paradise Ranch Knoll Earth Oven site (CA-LAN-2464). Archaeological investigations were subsequently undertaken in order to determine the extent of the damage to the site and salvage displaced archaeological materials. This paper reviews the results of those investigations, and demonstrates the efficacy of recovering meaningful scientific data from damaged archaeological contexts.

BACKGROUND

The Day Fire Incident

Between September 4 and October 2, 2006, the “Day Fire” burned approximately 162,702 acres of chaparral and mixed conifer vegetation within the Angeles and Los Padres National Forests, in eastern Ventura and western Los Angeles counties, California. At the time of the Day Fire, a Resource Advisor had been ordered by the Incident Commander, and due caution was exercised in attempting to avoid archaeological sites. However, in the midst of fire suppression activities, the fire progressed too rapidly towards nearby private residences along the Interstate 5 corridor, and containment and contingency firelines were created before coordination could be made to safely permit an archaeologist into the area to manage protection of archaeological sites. When conditions improved during the incident, CA-LAN-2464 was visited by Forest Service archaeologists to check and update the site condition.

Wildfire incidents have potential to damage or destroy irreplaceable cultural resources through effects of the fire, such as direct burning and smoke damage, and secondary effects subsequent to burning, including soil and debris movement caused by storm precipitation. However, fire suppression measures, such as the mass movement of earth during the creation of firelines, often are the primary cause of adverse effects to cultural resources. These processes may alter the context of archaeological remains vital to analysis and interpretation and have potential to completely destroy the resource.

Site Information

The Paradise Ranch Knoll Earth Oven site is located in a narrow saddle at the terminus of a northwest-southeast ridgeline, running off the larger Whitaker Peak landform, situated above the junction of Canton Canyon and Big Oak Flat, at an altitude of 3,070 ft. above mean sea level (Figure 1). The area sits within the administrative boundaries of the Santa Clara-Mojave Rivers Ranger District of the Angeles National Forest, in northwestern Los Angeles County.

LAN-2464 was originally recorded in 1996 as an area of dark carbonized soil with fire-affected rock (FAR) on the surface, indicating the presence of an earth oven, a subsurface feature generally associated with the cooking of yucca. The site was recorded during investigations following a similar wildfire incident, the 1996 “Marple Fire.” In that event, a bulldozer reopened a mechanical fireline along the ridgeline, striking the deposits. During that investigation, it was noted that the dark carbonized soil and FAR were widely scattered on the surface, and that some of the rock had been crushed by bulldozer

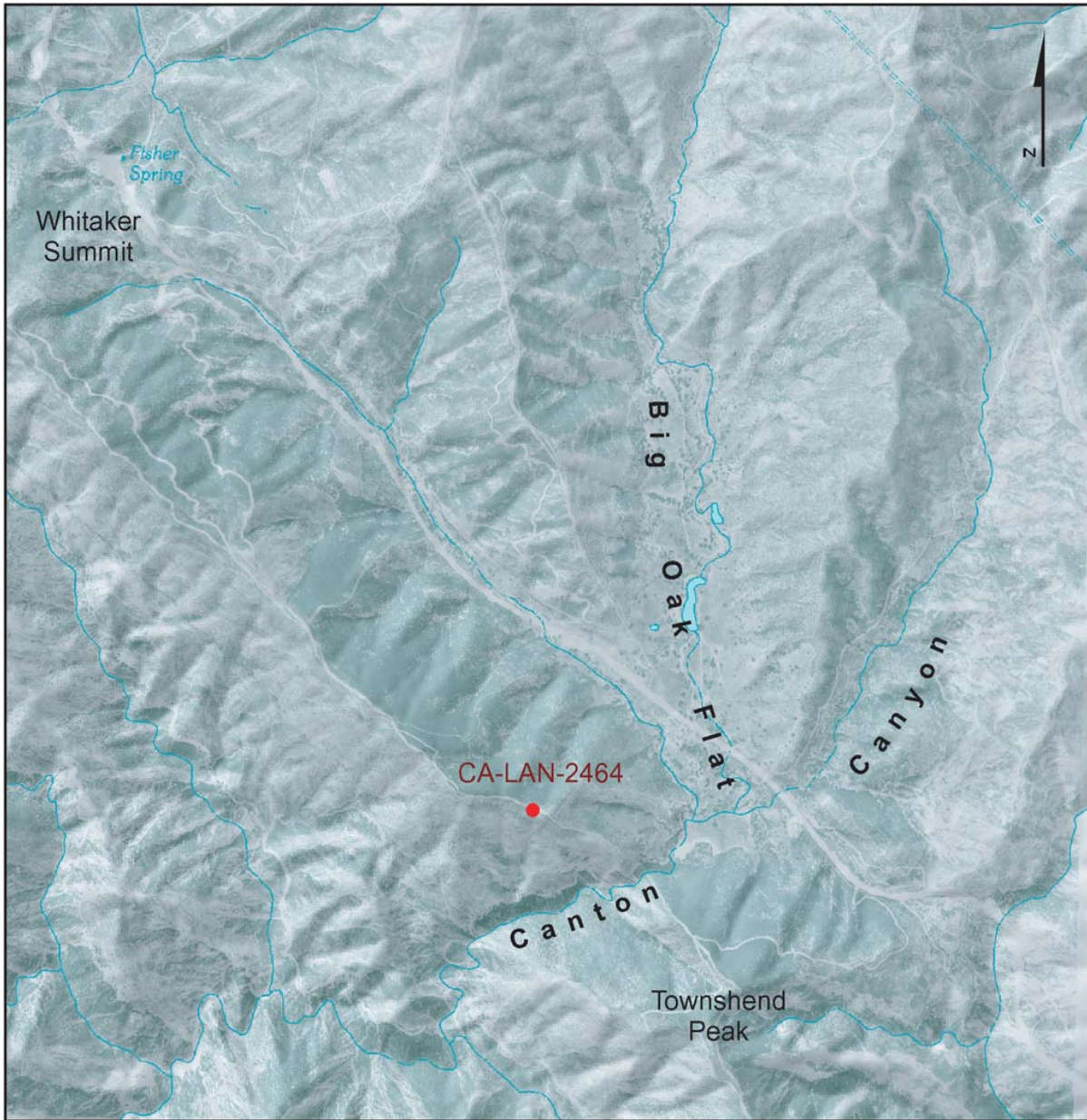


Figure 1. CA-LAN-2464 vicinity map.

tracks. It was estimated at that time that, due to the widespread scattering of deposits, the site only possessed perhaps 10 to 50 percent integrity (Kozach and Milburn 1996).

The site is located in a road loop that had been decommissioned by the Forest, and reopened for the incident (Figure 2). In past fires, that ridge terminus was utilized as the anchor point for suppression lines constructed by heavy equipment along the ridgeline system. The existing mechanized fireline was a product of several separate wildfire events; the landscape is often a determinant of fireline locations, and the same contingent lines are repeatedly opened as part of the emergency responses, based upon known and predicted fire behavior in the vicinity. The site's location on a narrow saddle makes it nearly



Figure 2. CA-LAN-2464 site overview, looking southeast.

unavoidable for suppression activities along that ridge. It was the same contingency fireline system that was reopened during the early operational periods of the Day Fire.

Initial 2006 reconnaissance observed that the mechanized equipment had scraped the site and spread the deposits across the saddle landform. The dozer tracks indicated extensive displacement of fire-affected rock and ashy soil, obscuring the boundaries of the site, which had been largely indistinct (Figure 3). Decision was then made to determine the extent of site damage, by removal of displaced matrix in order to prevent comingling of intact site deposits with material that was out of context.

The data value of subsurface oven deposits directly correlates with their integrity. In general, an oven deposit which lacks integrity yields very little information of value, beyond providing data in a landscape approach. Oven features with intact deposits may yield relatively detailed information regarding the morphology of ovens, firing technology, and subsistence data, through investigation of internal structure and stratigraphy, delineation of horizontal dimensions and vertical extent, and assessment of observable degree of impacts from post-abandonment processes (Milburn 1998a; Wessel and McIntyre 1990). The undertaking served as a twofold opportunity: to repair the damage to the site from the suppression activities, while restoring the site to its pre-incident condition in such a manner that future suppression impacts would not affect the remaining contextual information present within the matrix.

Setting

The Paradise Ranch Knoll Earth Oven site is located within the ethnographic boundaries of the Takic-speaking Tataviam, whose territories ethnographically occupied the Upper Santa Clara River drainage, roughly corresponding with the modern Santa Clarita Valley. Their range covered an area extending from portions of Piru Creek in the west to the frontiers of the Antelope Valley in the modern



Figure 3. CA-LAN-2464, site condition at initial post-fire reconnaissance, looking north.

Agua Dulce-Acton area to the east. The southern boundary is framed by the northern foothills of the San Gabriel and Santa Susanna mountains, and the north appears to have extended beyond Liebre-Sawmill Mountains to the San Andreas Rift Zone and Rancho La Liebre vicinity. These rough territories have been established primarily through a combination of mission records analysis, Spanish accounts, and ethnographic interviews of their neighbors (Caruso 1988; Hudson 1982; King and Blackburn 1978; McIntyre 1979).

LAN-2464 sits in a relative terra incognita, between the greater Piru drainage to the west and the Castaic Creek drainage to the east. Tataviam village sites and placenames in the Piru Creek drainage include *pi'irukuung* (La Esperanza, under Piru Lake), *akavavea* (El Temascal), *etseng* (along Piru, above *akavavea*), *huyung/juyubit* (on Piru Creek, above *etseng*), and *kivung*, (along Piru Creek, above *huyung*). Along Castaic Creek, known sites include *pi'ing* (junction of Castaic Creek and Elizabeth Lake Canyon, now under Castaic Lake), *naqava'atang* (upstream from *pi'ing*), and *tikatsing* and *apatsitsing*, on upper Castaic Creek (Johnson and Earle 1990; King and Blackburn 1978). King (2004:127-128) has used the San Fernando Mission records to further tie some of the placenames to archaeological sites, placing *pinga/piibit* at LAN-324, under the Elderberry Forebay of Castaic Lake. He also indicates that the sites at Oak Flat (LAN-248), and below Knapp Ranch (LAN-433, and LAN-434) are the remains of *moomga*, *cacucuyjabit*, *ajuavit*, and/or *juyubit/huyung*. These identifications are based upon the known names of settlements recruited into San Fernando Mission between 1802 and 1805, and postulated as names of sites in upper Piru, Castaic, and San Francisquito Creeks (Figure 4).

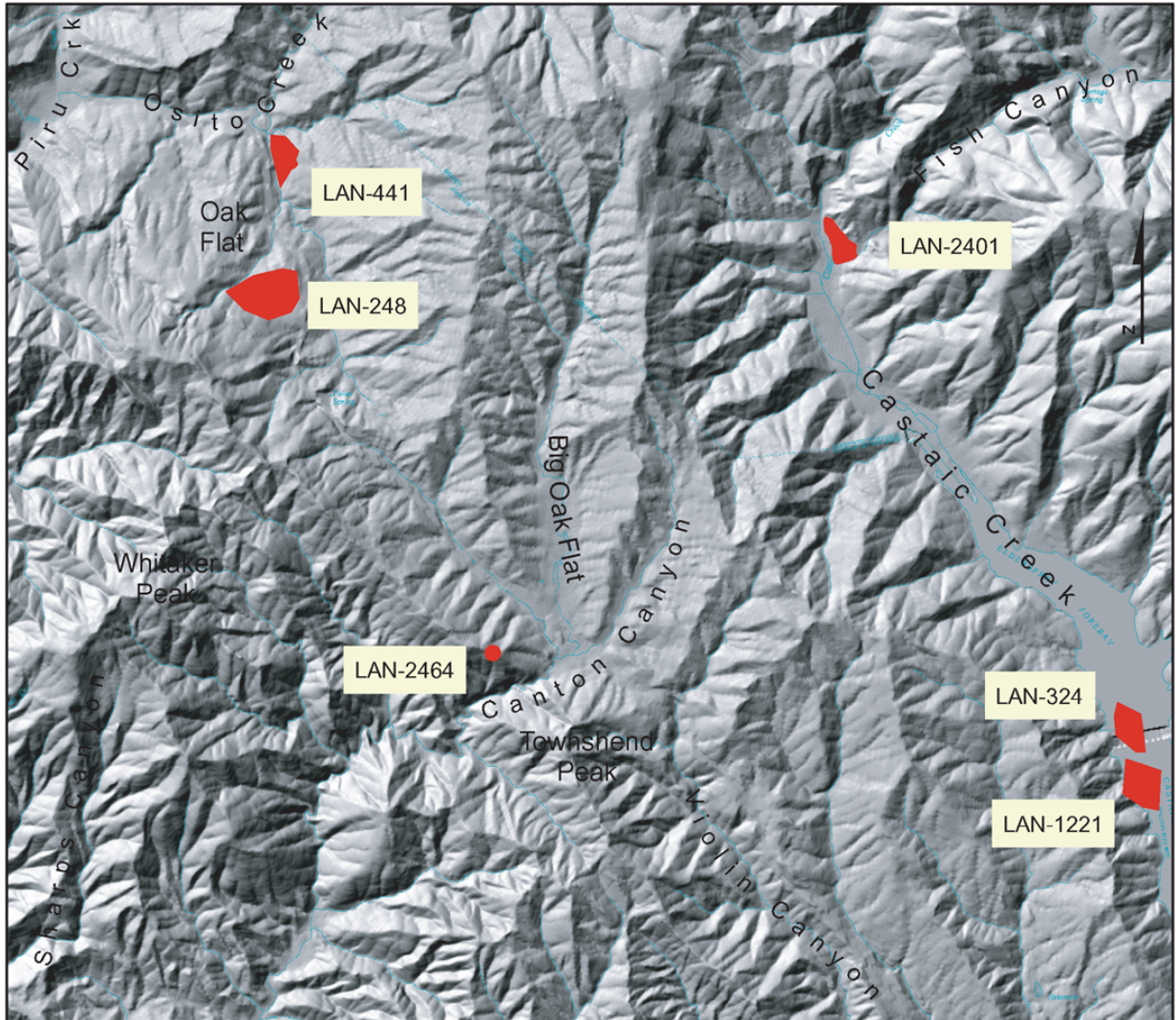


Figure 4. Known large prehistoric sites in the CA-LAN-2464 vicinity.

The core of the Tataviam area is characterized as a transition zone between the Mediterranean coastal chaparral and the arid western Mojave Desert. Along the northern-facing slopes is a hard chaparral community, dominated by California lilac (*Ceanothus* sp.), mountain mahogany (*Cercocarpus ledifolius*), and scrub oak (*Quercus berberidifolia*), with groves of interior live oak (*Quercus wislizeni*) concentrated in sheltered northern exposures. The prevailing southern-facing landscapes are dominated by a soft chaparral plant community, with chamise (*Adenostoma fasciculatum*), buckwheat (*Eriogonum fasciculatum*), black sage (*Salvia mellifera*), and elderberry (*Sambucus mexicana*) (Caruso 1988; King and Blackburn 1978). Although other primary vegetable foods, including acorns (*Quercus* sp.), juniper berries (*Juniperus californica*), islay (*Prunus ilicifolia*), and various seeds, roots, and corms, were of some importance, it is widely regarded that the Tataviam relied more heavily on Yucca (*Y. whipplei*) as a major staple than did neighboring peoples (Caruso 1988; King and Blackburn 1978; McIntyre 1979; Milburn 1998b).

For practical implements, the entire developmental sequence of the yucca plant has uses. The fibers from the leaves were woven for cordage and sandal manufacture, and could be pounded for the

production of a cleansing soap. The flower stalk, when dried, could be used for a hearth for the fire starting kit (Wessel 1986). The blossoms were blanched, parched, or dried, and seeds were also pounded and ground into an edible paste. Generally, however, consumption of yucca entailed processing by roasting over a fire or in an earth oven. The baking of stalks converted the pithy material to a rich molasses-like food and the leafy basal rosette of the plant, which has a consistency similar to artichoke, could also be roasted. This activity would generally occur in the spring to early summer as the plants were in pre-florescence, and contained a considerable amount of stored starch for reproduction. After heating, they apparently could be stored for over a year (Bean and Saubel 1973; King et al. 1974; Wessel 1986).

EARTH OVENS

The basic earth oven feature is a firing pit excavated for purposes of cooking food, using oxygen-reduced heat from hot coals covered by a cap of earth and/or rocks. They have been reported throughout southern California, with specific ethnographic reference among the Chumash, Cahuilla, Kawaiisu, and Kitanemuk (Hudson and Blackburn 1981; King 1993; King et al. 1974; Milburn 2004).

The earth oven feature can be unlined, lined with stone, or in some cases neatly dressed with stone. Earth ovens identified within the Tataviam region have generally been recorded as lenticular firing pits lined with stones, ranging in size from cobbles to small boulders. The placement of these lining stones for the firing platform appears unpatterned, excepting that larger stones are generally situated in the bottom of the pit (Milburn 1998b).

In practice, the oven began as a pit excavated with digging sticks, generally measuring approximately 1 m deep and about 2 m in diameter. Large firewood was compactly placed into the resultant cavity, on the "firing surface," and set alight and allowed to burn to create hot coals. When the oven was thoroughly heated, the fire was raked out and partially covered with stone or dirt to about ground surface level. A small hole or aperture would be left clear in the middle of the pit to retain oxygen, and then the sand or earth tamped down to level, causing flames to shoot out of the hole. The yucca would be placed on the resulting "cooking surface," wrapped or layered in wet green vegetation. The feature was then banked over with an earthen mound, which might initially reach a height of over 1 m, to contain the heat. The mound would partially settle during the roasting process. The food was left to cook in the stored heat in the oven for one to two nights. Subsequently, cooked yucca hearts were extracted for further processing, in which they were dried, ground, and mixed with water to form cakes for storage (Balls 1962; Bean and Saubel 1973; Earle et al. 1995; Hudson and Blackburn 1981; Milburn 1998b; Wessel 1986).

Earth oven features are most likely located along ridgelines, including saddles and spurs, on bench landforms, or on creek terraces in canyon bottoms (Earle et al. 1995; King et al. 1974). Milburn (1998a:47) has distilled the determinant attributes for a typical earth oven landform: 1) an elevation zone containing yucca as part of the plant community; 2) proximity to desired plant foods for ease of collection and transportation to ovens; 3) proximity to stone resources for the construction of the features; 4) suitable well-drained soil matrix for digging the required oven depression; 5) relatively level surface geometry with sufficient size to contain features; 6) ready access to desirable fuelwood materials for the firing of ovens; and 7) location on a ridgeline to facilitate travel and transportation of resources. It is likely that most, if not all, of these characteristics may be found at landforms containing earth oven deposits (Earle et al. 1995; King et al. 1974; Wessel 1986).

While the abundance of yucca in a particular area certainly enhances the likelihood of earth oven sites being present, it is not the sole vegetative determinant of oven site distribution. Other dominant vegetation variables near the oven features in the Tataviam resource area include woody species such as juniper, islay, oaks, pinyon (*Pinus monophylla*), and manzanita (*Arctostaphylos* sp.). While these species are also food producers, there is indication that the wood availability equally served to influence oven distribution, as the firing of the earth oven feature would require a large amount of fuel (King et al. 1974).

Yucca roasting sites may in fact have been sited further away from camp sites to prevent depletion of wood fuel supplies reserved for regular household tasks (Earle et al. 1995).

Date ranges for thermal cooking features in the central Transverse Mountain Ranges run from the Post-Pleistocene (Lake Mohave/ San Dieguito, 7000+ B.P.) to Protohistoric periods, with the large majority falling in the younger range of the spectrum within Tataviam regions, from about 2300 to 200 B.P. (McIntyre 1986; Milburn 2004). In particular, unpatterned stone-lined variants appear to conform to a Middle to Late period context, represented by LAN-1166, in the Rowher Flats vicinity dated to 2000 ± 100 B.P., and LAN-2119, in the Liebre Gulch vicinity dated to 600 ± 50 B.P. (Milburn 1998b; Strudwick and Sturm 1996; Wessel and McIntyre 1990).

THE INVESTIGATION

The objectives for the archaeological investigation in response to the Day Fire suppression damage at LAN-2464 were to 1) expose the archaeological deposit to determine the extent of damage; 2) internally stabilize disturbed deposits to reduce damage from future ground disturbing activities; and 3) salvage and analyze displaced artifactual/ecofactual materials.

Initial post-damage assessment of the site identified the spread of the FAR over a 4-m-diameter area, at indeterminate depth. Personnel subsequently implemented a shallow surface exposure of the site to identify the limits of the damage as well as identify the volume of displaced site material. The exposure uncovered approximately half of the feature, in a six-unit staged grid (Figure 5). The units (standard 1 m²), designated Unit 1 through Unit 6, were set up on an east-west magnetic axis (roughly corresponding with the local orientation of the long axis of the saddle landform), and placed in a portion of the impacted FAR matrix that superficially appeared central to the feature.

Initial Unit 1 exposure led to the discovery of the feature margin in the southeast, manifested as a near-surface concentration of the stratigraphic parent material, which sloped downward as the basal surface of the feature. Unit 1 consisted entirely of a matrix of small FAR (6 to 10 cm in diameter) and ashy soil, reaching an average depth of approximately 18 cm, with a maximum of 24 cm in the northeast.

Unit 2 was exposed following the contours established in Unit 1. The top of the FAR matrix (cobbles ranging from 5 to 20 cm in diameter), was a relatively uniform layer, overlying a continuation of the basal material in Unit 1. The surface undulates in Unit 2, ramping up to the north-northeast.

Unit 3 was placed directly north of Unit 2 to find the opposite margin from Unit 1 (because the basal surface trended shallow at that side). The FAR-ashy matrix was similar, but the underlying basal surface in the unit appeared more thermally altered. The center and north of the unit was dominated by a concentrated circular feature, characterized by an inset accumulation of large (approximately 20 cm+ diameter) rocks, immediately on the basal stratum. The feature extended into the unit walls, and Units 4 and 5 were opened to the west and north in order to trace its extent.

The western two-thirds of Unit 4 indicated the edge of the oven. The eastern one-third was covered in the FAR matrix to approximately 10 cm. Beneath that level lay the central feature, represented by the larger rocks with apparent underlying basal material. In the eastern margin of Unit 4 and western margin of Unit 3, the deep concavity in the center of the rocks sank to approximately 40 cm.

Unit 5 was largely composed of displaced road fill material. In fact, the parent material dominated the northern three-quarters of the unit, which bottomed out at less than 10 cm. The southern one-quarter of the unit contained the margin of both the earth oven and the central feature (to a depth of approximately 15 cm).

Unit 6 was placed directly east of Unit 1, in order to determine the full diameter of the entire oven feature. The basal surface descended from near-surface to almost 20 cm deep in the northwest, providing a good margin for the feature.

In the mechanically spread dark matrix outside the units, trowel scrapes determined the areal extent of the remainder of the feature. The scrapes were markedly discernible as far as presence or



Figure 5. Paradise Ranch Knoll earth oven, excavation plan map.

absence of the FAR matrix, due to strata consistency and color, which indicated the near-surface spatial extents of the feature.

Subsequent to the establishment of the size of the earth oven, the internal composition of the exposed (but intact) central rock feature was examined in order to recover data regarding the age of the site. Unit 3 was bisected on an east-west axis into Unit 3A and Unit 3B to the north and south, respectively. Unit 3A was left intact, and Unit 3B was dismantled to establish a profile (Figure 6).

RESULTS

Stratigraphy

As a discrete earth oven feature (aside from mechanical impacts), differences in sediment consistency and color were distinct. The basal stratum is composed of highly concreted pebble material of

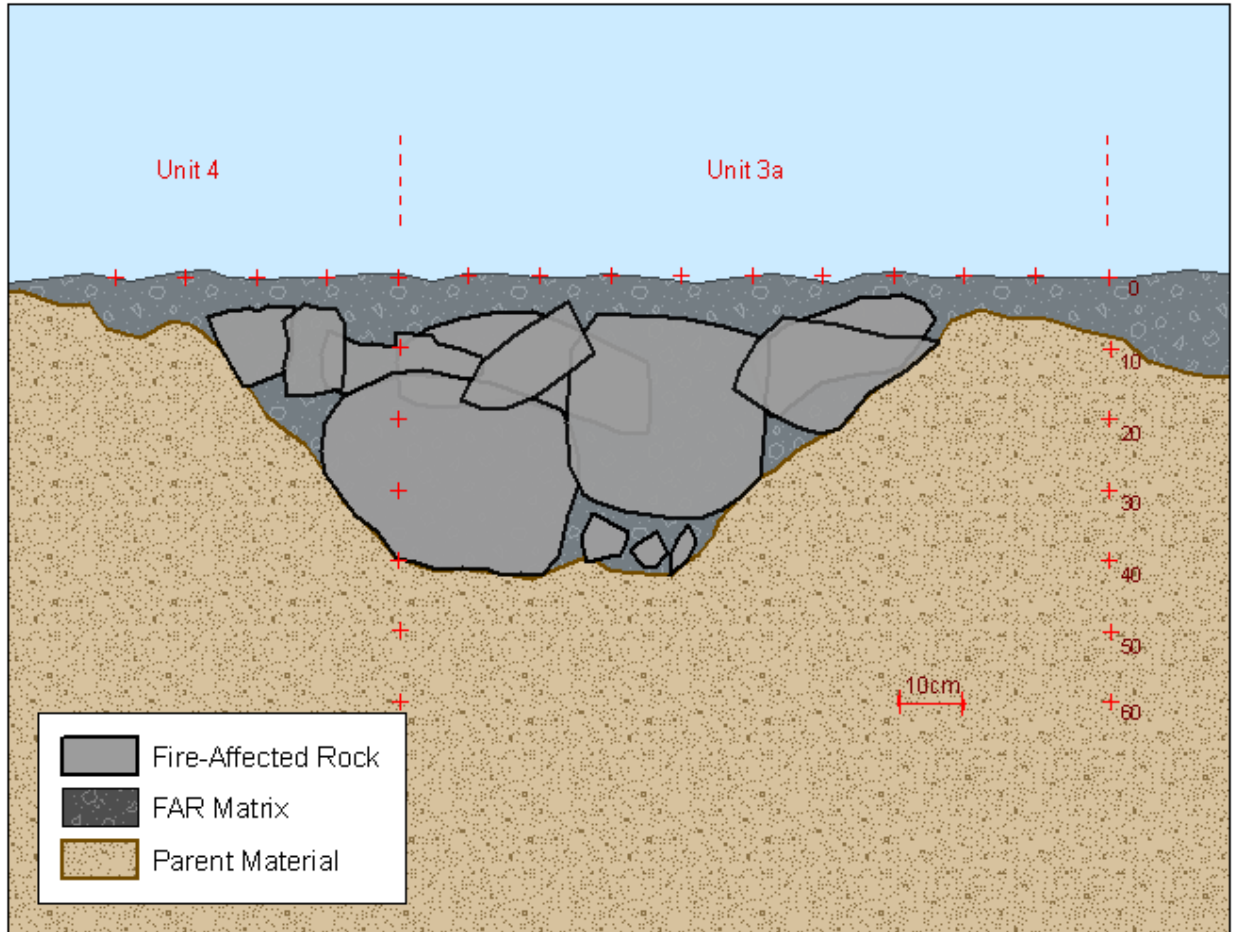


Figure 6. Paradise Ranch Knoll earth oven, central feature profile.

indeterminate thickness, corresponding with the sterile C horizon, characterized as parent material overlying bedrock. It also forms the outlying surface deposits in the saddle landform (which has been graded for the road), and is comingled with the ashy oven soils where the mechanical impacts have taken place. It has a yellowish-brown color (Munsell 10YR 5/6), although where it had been thermally altered, it has oxidized to a mottled red (2.5YR 6/6). Within the oven feature, the surface undulates and is clearly culturally modified, having been dug into during creation of the oven. It surrounds the central rock feature (which was inset into it), and distinctly defined the margins of the entire oven feature. Although the basal stratum is relatively flat outside the extent of the feature, the road surface has been graded, so the prehistoric landform topography remains unclear.

The FAR matrix is composed of relatively small (approximately 5- to 20-cm-diameter) rocks and dark, ashy soil. It has a very dark brown color (Munsell 10YR 2/2), although in its comingled context at surface it grades into a lighter shade (10YR 3/3). The layer, which is the hallmark of a thermal feature, has been markedly displaced. It represents a combination of the cooking platform of the oven and perhaps post-cooking debitage -- the delineation of the two has been lost, due to the surface grading.

The central rock feature is also entirely cultural, and appears as an excavated concavity in the basal stratum, which was then arranged with large rocks (Figure 7). The resulting structure was then used as the primary firing platform of the oven, and the ashy FAR matrix has settled in between the larger



Figure 7. The central feature, post-excavation.

rocks. Around the feature the basal stratum is highly oxidized, suggesting substantial thermal activity. The central feature also has a very dark brown color (Munsell 10YR 2/2).

The Earth Oven Feature

Although the mechanical spread of ashy material covered an area of approximately 4 m in diameter, the feature itself was roughly 2.5 m by 2 m (consistent with ethnographic descriptions), with an observed structure that lends itself to what Milburn (2004:105) classifies as a “Stone-lined Oven” variant, with a concave unpatterned cobble firing basin. It had a discrete firing platform of large rocks/boulders, approximately 1 m in diameter, with an overlying cooking platform (which sits above the actual fire and is identified as the FAR cobble/ashy soil matrix) that has been largely obliterated by mechanical disturbance. The pristine ovens that have been examined in the larger Tataviam area generally rise as a mound above ground surface (indications that the feature may not quite fully settle during the cooking process), and can be almost 1 m deep, but LAN-2464 measured only 10 to 20 cm deep (down to 40 cm in the central firing locus). The mechanical displacement hampers interpretation of the feature, given the fact that the complete ground-level portion (perhaps 20 to 30 cm worth) of the feature had been destroyed, obscuring a true volume of the oven. Nevertheless, based upon what is known and inferred by the oven’s structure, this oven fits confidently within the typology of known dated ovens for the region, and it is consistent with variants available after approximately 2000 B.P. (Milburn 1998b).

Samples Recovered

Generally, prehistoric artifacts are not present in association with isolated oven features (although they are present in larger mixed-use sites), and LAN-2464 appears to be no exception (King et al. 1974).

However, two faunal samples and one macrofloral sample were recovered. A small piece of tooth enamel (mammal, species indeterminate) was recovered from the FAR matrix in Unit 1, and a single small mammal longbone fragment (species indeterminate) was recovered from the mixed ashy soils above the FAR matrix in Unit 2. A partially carbonized manzanita berry was also encountered within the FAR matrix in Unit 2.

Three in situ charcoal samples were recovered: two along the edge of the central feature on the eastern margin of Unit 4, and one at the bottom of the same central feature in Unit 3B at approximately 40 cm. The Unit 3B sample was submitted for radiocarbon dating, using standard Accelerated Mass Spectrometry (AMS), which yielded a conventional radiocarbon age of 1630 ± 40 (Beta-223043; charred material; $^{13}\text{C} = -24.9$ percent) with a calibrated age range of 1600 to 1420 cal B.P. (calibrated at 2σ with INTCAL98), intercept of 1530 B.P./ A.D. 420. The date is certainly within the range of dates returned from other earth ovens in the Angeles National Forest, the site activities indicating a Middle period (3450-950 B.P., per McIntyre 1986) occupation, and consistent with the Milburn (1998b) dates for the stone-lined unpatterned variant.

DISCUSSION

Form and Function

The shape and size of the earth oven at LAN-2464 may indicate some of its functional aspects. Accounting for the fact that the feature has been substantially impacted by mechanical equipment over a number of years, the subsurface stratigraphy indicates a reasonable context has been retained, and there are certain material questions that may be posed by the remains of the feature. For instance, the apparent off-center placement of the central firing locus may be the functional remedy to access problems. The feature may have been deliberately designed so that it could be accessed from two shorter directions without having to negotiate hot FAR matrix, both during cooking and in post-cooking retrieval.

The undulating surface of the basal material noted in Unit 2 may represent other than operational expedience; rather than haphazard excavation, one would think that purposeful care was taken to shape out the cavity of the oven. The dramatic undulation within the portion of the feature may represent another intentional trait. Secondary or differential firing of oven features has been noted (Balls 1962; Milburn 1998b; Strudwick and Sturm 1996). Rather, however, it may be the remains of a subordinate cooking surface; as an oven is smoldering, it may be less labor-intensive to add a "side burner" to an already involved feature, rather than disrupt the existing cooking process. That could manifest as a shallower FAR-filled depression adjacent to the main feature. The presence of faunal materials and the manzanita berry in the oven, away from the central firing platform (but amongst the FAR matrix), supports the hypothesis.

The noted shape may also represent maintenance and/or reuse of the feature. The subsistence cost incurred from the placement, creation, and use of an earth oven lends itself to assumption that the features would not be single-use. A finite number of locations are available across the landscape with the necessary characteristics, so it is logical that prime locations would be reused (Earle et al. 1995; Milburn 1998a). The amount of ash and residue created through use would require periodic maintenance in the form of cleaning out the feature. Maintenance produces its own telltale mark on the surface of the feature as materials are removed wholesale, including scrapings of the basal surface. To the extent that periodic maintenance affects the shape of an oven, reuse may also necessitate lateral relocation across the landform, as materials are removed and cast aside and perhaps dug into at a later period. Certainly, repeated thermal alteration takes a toll on the components of such a feature, which accounts for the large amounts of fragmentary FAR. If so, then perhaps the internal structure observed in an oven represents only a single stage in its lifespan, which may include excavation and re-excavation across the landform.

LAN-2464 is typical of earth oven features in that it is located on a saddle in a ridgeline. The placement of ovens on canyon terraces and ridgeline landforms may indicate the harnessing of local

winds to amplify or hasten the firing process. Slope and valley winds are the product of local conditions of topography, where differential heating and cooling causes air movement. Generalized local wind patterns include upslope (3 to 8 mi. per hour) and upvalley winds (10 to 15 mi. per hour) beginning in late morning, and reaching their peak in the afternoon, as the gradual heating of the landforms cause the warmer air to rise. Conversely, downvalley (5 to 10 mi. per hour) and downslope winds (2 to 5 mi. per hour) begin a few hours after dark, as the cooling air sinks (National Interagency Fire Center [NIFC] 1994).

Broad Spectrum and Seasonality

Within the FAR matrix of LAN-2464, a partially carbonized manzanita berry was recovered. There has not been ethnographic mention of the berries being roasted in ovens, suggesting rather that manzanita (which currently grows on the north-facing side of the same ridgeline) may have been part of the fuelwood, which has also been noted in other oven contexts (King 1993; Puseman and Dexter 2005; Strudwick and Sturm 1996). Taphonomic scenarios aside, the find provides indication of the possible season of use for the feature. Manzanita fruit usually ripens from late February to mid-May, which overlaps the time that yucca matures to the point that it was processed in earth ovens.

The yucca harvest characteristics have been thoroughly discussed in the literature (Bean and Saubel 1973; Earle et al. 1995; Hudson and Blackburn 1981; King and Blackburn 1978; King et al. 1974; Milburn 1998b; Wessel 1986). The yucca basal heart (bola) could theoretically be harvested year-round, but was most desirable in early spring, when it was green, before producing stalks and flowers (which were harvested a little later, depending on weather and altitude, April through early June to mid-July). At the pre-florescent point in its lifecycle, the mature yucca has stored a considerable amount of starch for the energy to flower. The resulting flower stalk may reach 8 ft. in height and produces seeds in a small fruit. Prior to that development, the plant has slowly matured over six to 10 years. A yucca will sprout its flower stalk only once; as the plant finishes the reproductive cycle, it drops its seeds and dies (Powell and Mackie 1966). Within a circumscribed population of yucca, only a selection will be mature enough to flower in a given year, and a thorough harvesting of stalks or even green bolas could locally depress the reproductive rate.

While yucca was certainly an important food item, it should not be overestimated. Diversification of subsistence activities, notes Colson (1979:22), “is probably the most effective device utilized by hunter-gatherers ... for preventing weather vagaries or other adverse conditions from plunging them into famine... Specialization, in the light of human history, is a dangerous phenomenon.” In fact, at Rowher Flats village complex (LAN-856, -857, etc.), Wessel and McIntyre (1986) recorded 51 separate food plants that appear to have part of the Tataviam nutritional regime.

Although spring was devoted to the yucca harvest, clearly other items supplemented the diet. Summer was most likely focused on seed and berry gathering, autumn primarily the acorn and pinyon harvest, and the winter diet drew from food stores, supplemented with game (Earle et al. 1995). Notes McIntyre (1979: 57), the unpredictability of the annual round, in terms of perishability and gatherability, required “precise knowledge of ... availability so as to obtain a maximum resource return as well as to avoid competition from various insects, birds, and animals for these foods.”

Even within earth oven features themselves, material evidence of bulbs, roots, and corms, such as *Lotus procumbens* (California broom), or brodiaea (*Dichelostemma pulchellum*), has been encountered, indicating that these food items also were roasted (Balls 1962; Earle et al. 1995; Hudson and Blackburn 1981; King 1993). There may be indication, moreover, that in certain contexts, the aforementioned species could have been relied upon to fulfill a shortfall of the yucca harvest, perhaps even roasted exclusively in a given oven. Although earth ovens are primarily for roasting vegetal materials, it is not unheard of to add meat to the process, whether by convention or by convenience (Hudson and Blackburn 1981; Strudwick and Sturm 1996). The presence of two small pieces of faunal material suggests that perhaps the contents of earth ovens themselves need to be examined more closely.

The Earth Oven as Part of a Subsistence Strategy

Within the Tataviam area, the settlement patterns and ethnographic information suggest a subsistence strategy organized around a few large villages and multiple satellite seasonal camps and specialized resource procurement and processing sites (Earle et al. 1995; McIntyre 1986). Large Tataviam villages were maximally dispersed in relationship to one another, and seasonally contained perhaps 200 people. Intermediate-size villages of 20 to 60 were dispersed between major centers, and the seasonal camps of 10 to 15 people were interspersed across the landscape. At the time of historic contact, the total Tataviam population was probably less than 1,000, although the Late Period population of Agua Dulce alone may have amounted to some 200 to 300 individuals (King and Blackburn 1978; King et al. 1974). That particular complex consisted of several small habitation clusters of one or two familial units, which when taken together formed a village about Vasquez Rocks. The nearby Escondido Canyon village consisted of a single group of households in a centralized village. Within the primary production catchment of the two major villages at Vasquez and Escondido, there some 30 recorded oven localities, consisting of multi-oven complexes or isolated features (King et al. 1974; Wessel 1986).

As a subsistence strategy is largely a product of resources and a given cultural system, the density and location of these exploitative sites can provide data regarding those factors. The exploitative tasks, organization, and technology are set in large part by the particulars of the resource. The characteristics of an exploited species, including density, distribution, fecundity, seasonality, and biological structure, are major determinants of the costs, potential yields, technology, and social organization of a strategy (Earle 1980). Certainly the densest cluster of oven sites would be the product of ideal physical location and favorable overlapping ecological zones (Earle et al. 1995).

Results from survey, excavation, and ethnobotanical data analyses of the Agua Dulce area indicate that yucca and other utilized natural resources are unevenly distributed throughout, and suggest that the distribution of general production and specialized sites loosely correlates with that patterning (King et al. 1974; Wessel 1986). Extended ridge systems, often with low, sloping spurs or access points from perennial streams, may have served as primary travel routes through much of the upland foothills, with camps located at the interface of ridge systems with access to overlapping zones of yucca, juniper, pinyon, and oak. The small benches or shallow saddles along the ridgelines could all be expected to accommodate numbers of vegetal procurement sites, where foraging parties procured and processed upland plant resources for transport back to the centralized village (Earle et al. 1995; Milburn 1998a).

The occurrence of isolated ovens features, like LAN-2464, may be more indicative of seasonal camps utilized by dispersed collectors, most likely village-based foraging groups on temporary exploitative trips within the extended catchment of the larger village sites (Earle et al. 1995). For basic resource strategies, the expansion of a centralized village into a dispersed resource procurement regime may reflect intensification, whereby the inhabitants incur increased costs in order to maintain their subsistence, reflected in the need to travel farther from the base camp, the need to search longer for a resource, and the need to procure products of smaller size or lower quality (Earle 1980). The occurrence of isolated earth ovens across the landscape may reflect intensive practices by a supra-familial group as part of a regular regime of exploitation (Caruso 1988; McIntyre 1979).

The volume of activities associated with the process indicates substantial time and labor. It is ethnographically noted that two or three families shared a single roasting oven, and that the orientation of the hearts within the oven was organized to accommodate shared removal (Earle et al. 1995). The organization of labor suggests that the yucca harvest might have been a periodic social event that occurred within an intense stretch of time, perhaps only a few instances a year. Earle et al. (1995:3-18) note that gathering and processing activities involved numerous members of both sexes of the local or invited community, and logistically, that would limit viable sites to locations “near a sufficient source of reliable water for daily use (and in some case leaching), fuel for cooking and roasting, parching, or drying, and within easy access for transport of freshly harvested or partially process commodities between the harvesting site and the village to be used over the winter, traded, or consumed.” Hence, it is likely that the

exploitation of a single procurement area necessitated a sufficient density of yucca bolas to be roasted at a given time, to maximize the yield in order to offset the costs incurred.

For yucca/earth oven utilization, although the quality/caloric yield of the end product should be weighed against the presumed benefits of other strategies, the cumulative tasks needed for exploitation suggest a rather costly endeavor. The total cost of a given resource procurement strategy, according to Earle (1980:6-7), is the sum of all the associated costs: technological costs involve the time expended in procuring the raw materials and in manufacturing tools; transportation cost is measured as the time expended in reaching procurement area and in transporting procured resource back to base camp; collection cost is measured as the time expended in procuring the resource once the group is at the procurement area; processing cost is measured as the time expended in preparing the resource for storage and consumption; storage cost is the time expended in constructing storage facilities.

Specific technological costs involve the production of digging sticks for the excavation of the pit, cutting implements and scrapers for removing the hard outer skin of the bolas (basal rosettes), cooking tools (including fire lighting kit and stokers), and perhaps post-cooking processing tools (baskets, platters, molds, mallets, etc.). Transportation costs, assuming that the procurement site is within the catchment of either a centralized village or at least seasonal camp, include travel to and from the procurement site. Unless the cooking time is spent on other activities on-site, there is additional incurred transportation cost to return to harvest the finished yucca from the oven. While it is assumed that the oven is located more or less within the center of the procurement area, collection costs include time locating a sufficient amount of yucca, time to burn off or otherwise remove outside bayonets from the bolas, dig the yucca out, and transport it back to the oven location. Providing the oven is on a saddle or ridgeline, these collecting costs would be incurred on significant slopes. Certainly the largest costs incurred in earth oven use are processing costs. Oven excavation by digging sticks (with perhaps woven baskets for earth movement) in well-drained stony matrix would take multiple person/hours. Rocks must also be obtained for the feature lining and cooking platform, and firewood collected to fill the feature. There are additional costs of fire-building, stamping, and mounding of the earth, as well as pre-processing of the bolas, including scraping off unwanted foliage, gathering the green wrapping materials, and arranging the cooking surface with the yucca. Subsequent to the cooking period, the oven must be dismantled and the yucca extracted. The finished product must then be cooled and further processed for storage by molding and drying it into cakes, and perhaps wrapping it in some form of storage packaging (Earle et al. 1995). As the ethnography mentions, yucca was stored for up to a year, for availability during the lean winter months, and construction of granaries or cache features increases storage costs (King et al. 1974; McIntyre 1986). Specific tasks related to storage include additional excavation of pits, firing of materials in the bottom to ward off vermin, and gathering of stones to create a viable seal.

Storage of foodstuffs is ideal for handling seasonal shortages, given the conditions faced within the Tataviam seasonal round. To that end, the importance of facilities such as ovens in converting vegetation into storable food cannot be overemphasized (Colson 1979; King et al. 1974). In fact, most foragers can rarely provide a surplus to store food for more than a single season, and cannot count on storage to carry them through a series of bad years. Therefore, food storage is planned from harvest to harvest, and two bad years are regarded as a major calamity (Colson 1979). Suggestive along those lines is a remark within the 1769 Pedro Fages account, in which he describes what he refers to as “century plant,” presumably in reference to yucca: “It is juicy, sweet, and of a certain vinous flavor; indeed, a very good wine can be made from it” (Priestley 1937:10). Fages quite possibly, if not an enterprising imbiber, may have tasted some yucca that had “turned” and fermented in its storage.

CONCLUSION

The 2006 Day Fire Incident demonstrates that the potential damage to a heritage resource during wildfire suppression tactics is often times more pronounced than that which occurs from actual burning.

Although the wildfire did not burn across LAN-2464, the mechanical reopening of a preexisting fireline resulted in impacts to the earth oven feature.

Archaeological investigations were undertaken in order to determine the extent of the damage to the site and salvage displaced archaeological materials at the Paradise Ranch Knoll Earth Oven. The investigation included the shallow surface exposure of the site to identify the limits of the damage as well as trace the displaced site material.

Although the limited view afforded by exposure of the remaining structure prevented a complete analysis of the site, the existing oven has proven to have sufficient context to provide data for discussion. Although much of the cooking platform appears to have been impacted, the central firing structure remained intact. Several samples were taken from the deposits, and the information gleaned from exposing the feature gives a fairly decent indication as to what was taking place at the site. The feature appears consistent with other Middle period stone-lined earth ovens found within the central Transverse Ranges. The information gleaned from its exposure provides information for the regional data base for earth oven features and contributes to the body of archaeological data regarding the Tataviam sphere of influence.

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