Processing Economies, Coastal Settlement, and Intensification in Northern San Diego County

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Temporal and spatial variability in the use and manufacture of ground stone tools provides a strong context for understanding adjustments in technological and social organization to the changing role of different foods in northern San Diego County aboriginal societies. A large sample of ground stone implements were analyzed from coastal and inland localities from northern Camp Pendleton, Rancho Park North, San Elijo Lagoon, and Palomar Mountain. The analysis results help address competing hypotheses of coastal settlement variation and explore the possibility of subsistence changes driving settlement patterns.

A regional ground and battered stone analysis from assemblages in northern San Diego County produced several implications regarding aboriginal settlement-subsistence practices. First, ethnohistoric accounts of an acorn-based intensification economy in Luiseño and Kumeyaay territory are not consistent with pre-contact archaeological assemblages. This strongly suggests that the ethnohistoric focus on acorn exploitation was a direct response to post-contact changes in aboriginal landscape perspectives. Second, predominant models of subsistence intensification during the Late Prehistoric are not manifest in the archaeological record. The ground stone analysis revealed changes in settlement-subsistence from the Archaic to Late Prehistoric periods that reflect an extensification of resources and land use patterns. The lack of evidence for acorn intensification and the evidence for resource extensification leave no economic basis for a maritime-based model of coastal settlement-subsistence in northern San Diego County. These conclusions do not account for problems of preservation, including acorn remains and basketry.

Ethnohistoric Accounts of Processing Economies and Technologies

Ground stone assemblages employed by Luiseño and Kumeyaay groups included mortars, pestles, hand stones, and milling stones (Bean and Shipek 1978; Cline 1984; Shipek 1991). Mortars and pestles are reported for grinding and pulverizing many different kinds of resources, primarily including acorns, pinyon, and grass seeds, but also fibrous materials (e.g., yucca, agave), roots, various flowers, berries, and even small animals (Bean and Shipek 1978; Cline 1984; Luomala 1978; Shipek 1991; Sparkman 1908). Interestingly, some shellfish were prepared with processing equipment. Delfina Cuero recalls that a person "had to pound the meat of abalone soft with a rock right away" because of its toughness (Shipek 1991:28).

Ethnohistoric accounts often contradict one another on the purposeful use of grinding tools. For instance, Tom Lucas reports that his mother and grandmother used "the flat, smooth places on the rock [to] grind the acorns or seeds, and the holes were used to hold the grain and for grinding small seeds" (Cline 1984:40), and again that "acorns are ground into meal using a mortar or metate with a small hand stone" (Cline 1984:28). While both mortars and milling stones could be used for grinding small seeds and acorns, the use of mortars (i.e., holes) for holding grain and grinding small seeds is contradictory to other ethnohistoric accounts and common conceptions regarding the processing role of mortars and milling stones. Delfina Cuero recalls that pine nuts and other plant resources were ground on a flat grinding stone and acorns were pounded in a mortar (Shipek 1991:30). The latter is a more widely accepted role of mortars and pestles versus milling stones and hand stones. Sparkman (1908:193) notes that the Luiseño pounded acorns and other seeds with a stone mortar and pestle and that some seeds were ground into flour. Drucker (1937:14) includes stone mortars, hopper mortars, unshaped pestles, and naturally shaped milling stones in a trait list for the Luiseño. Bedrock milling surfaces were present where suitable bedrock outcrops were ubiquitous.

Information on the use of grinding equipment for food processing is biased by two factors. First, some major informants for both Luiseño and Kumeyaay were male (see Cline 1984; Drucker 1937:5). The testimonies of male informants on a (likely) strictly female role of processing limits the reliability of information relating to specific roles of processing tools in that the informants were merely observers, even if they were involved in gathering plant resources to be processed. Second, information regarding processing was gathered after significant changes to aboriginal settlement and subsistence systems had taken place due to Euro-American contact. The unpredictability of residential locations translated into unpredictability in the amount of food that a group or family may have been able to collect (Shipek 1991:32). The elevated risk level of starvation could have conceivably led to the use of processing tools in a variety of tasks for which they were seldom employed, or for which other tools were originally intended. In other words, the use of mortars and pestles for grinding grass seeds, or the use of milling stones and hand stones for processing acorns, could have become more common in an increasingly situational yet intensive processing regime. The same would be true for bedrock mortar and milling slick surfaces. This process may account for the recollection of

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Tom Lucas that flat, smooth surfaces were used to grind acorns and that holes (mortars) were used to store grain for grinding (Cline 1984:40), although a more likely explanation is that Tom Lucas simply did not specify all stages of acorn processing that included mortar and milling slick use.

Available ethnohistory reflects processing strategies that are evolved responses to economic stresses felt in the post-contact era. Euro-American settlement effectively destroyed aboriginal concepts of traditional landscapes. In the greater San Diego area, the rapid expansion of Euro-American people forced Kumeyaay families to constantly move residential camps when they were pushed out of areas (Shipek 1991: 32). As residential mobility became more variable, families found themselves traveling greater distances to gather the necessary amount of food for immediate use and for winter storage. Traditionally used areas for gathering acorns and pine nuts were still revisited to keep up strained social ties and to ensure that there would be enough to eat through the winter (Shipek 1991:28). Food supplements gained from working for Euro-American farmers and ranchers were unreliable. The lack of regularity in available living space resulted in small aggregates of aboriginal families in areas that were less hostile or facilitated aboriginal settlement. These areas were usually on a small piece of property set aside by a rancher for whom the men worked.

The early life of Delfina Cuero provides an illustration of a subsistence economy that was always in flux and dependent on constant gathering and preparation of vegetal resources for the lean winter months. Such a lifeway necessitated a processing strategy that could solve immediate yet intensive processing demands without certainty of returning to the same area at another time. It also demanded a strategy that would allow for maximized seasonal exploitation of larger crops (i.e., acorns and pine nuts) in an efficient manner.

An argument for consistency between ethnohistoric and Late Prehistoric lifeways is based on observations that some mission padres preferred and encouraged aboriginal groups to pursue their traditional subsistence practices (see Bean and Shipek 1978; Luomala 1978). Although this certainly had the effect of helping Native Americans retain knowledge about some subsistence practices and other economic pursuits, their subsequent participation in such activities after becoming tied to mission lands indicates that their settlement and subsistence systems were tethered to the missions. Missionization often mixed Native Americans of distinct culture groups and subgroups, arguably altering pre-contact social networks. With an economy tethered to an artificial landscape (delineation of mission authority into territories), aboriginal economies were not centered on "traditional" seasonal rounds or resource availability. Thus, encouragement by the mission padres to pursue native lifeways likely did little more than maintain knowledge of some economic activities.

Aspects of the ground stone assemblage discussed in ethnohistoric accounts reflect a dynamic and adaptive strategy. Specifically, tools used for processing many different kinds of seeds and nuts included large, unwieldy stones used both as pestles and as hand stones (Figure 1). These items were unshaped, with pestle ends used with enough intensity to blunt the original end shape. Also, medial surfaces between the ends

Figure 1: Maria Lucas from Cline (1984:41).

were used for horizontal grinding in the manner of a hand stone, but not enough to produce even surfaces. The use of large, irregularly shaped cobbles for processing in the absence of shaping demonstrates that these items were intended for immediate intensive processing and that they were not transported between processing locations. The large size of the cobbles would be more efficient in reducing a larger amount of vegetal material in less time than smaller cobbles due to larger functional surface areas and greater mass. These tools were not used expediently, because of the intensity of grinding and pulverizing that they were involved in. Although abundant raw material (especially granite) in both Luiseño and Kumeyaay territory facilitated such a strategy, the importance of these tools is that they were subject to heavy duty use in a relatively short period of time.

In the upland region on the Pauma reservation, a site that is locally known as an historic-era temporary refugium following the effects of Euro-American contact included an abundance of large, globular cobbles that were heavily used as pestles and less intensively as hand stones (Hale 2004). All of these tools were manufactured from locally available cobbles and were blunted on the ends, exhibiting intensive pestle use (Figure 2). Additionally, a suite of six recorded milling features with nearly 60 milling surfaces (including mortars, slicks, and basins) were recorded on site, indicating that processing included both regular and intensive work as well as situational activity (see Hale 2004).

Such a processing strategy as the one implied by the large pestle/hand stone tools is not expected to occur outside of extreme subsistence stress. In situations where settlement was more regular and predictable, it would be expected that resource processing would also be more predictable and less temporally compressed. Processing equitable amounts of material over a longer time span would likely result in the use of smaller pestles or hand stones, which would reduce mass, making them easier to use and resulting in less fatigue over time. Lifting a large, irregular cobble and driving it down to pulverize vegetal material would become tiresome over an extended period of time. Given

more certainty in settlement and more time for processing, less material would have to be processed at any given time, negating the need for such a large tool.

In summary, Spanish contact altered landscape use strategies of aboriginal groups, creating unusual subsistence stress. This necessitated an intensive and unplanned exploitation of acorns and other resources to compensate for potential food shortages arising from altered access to resources. Some evidence of this is the use of large, unwieldy pestles for short-term yet intensive acorn processing. Problems with confirming this interpretation stem mainly from poor preservation (perishable technology, acorn remains, etc.) and biased ethnohistoric accounts (information inferred by recorders; male informants for female roles). The concept that the ethnohistoric record in northern San Diego County is a response to the effects of Spanish contact conflicts with the assumption that it has its roots deep into the Late Prehistoric period. The problems with the ethnohistoric record and implications derived from analyses of processing tools are limited research avenues, and this topic should be explored more thoroughly. Additionally, it may be more productive to explore which aspects of culture may have greater antiquity than others (i.e., social norms vs. economic strategies).

Figure 2: An example of a hand stone-pestle combination tool. Note the irregular shape of the rock and the blunted ends from heavy use.

Prehistoric Processing Economies

Archaic and Late Prehistoric period ground stone assemblages reflect a process of resource extensification and a shift from planned reoccupation of particular locations to planned exploitation of particular resource sets in different provinces. Economic intensification of coastal resources (see Byrd and Reddy 2004) is not manifest archaeologically and was not feasible along the northern San Diego County coast without intensification on inland vegetal resources. Extensification during the Late Prehistoric did not result in an occupational decline on the coast but instead resulted in better integration of resources along the littoral into a broad terrestrial settlement strategy (Hale and Becker 2005).

The following section is a discussion of ground stone analysis results by time period (Archaic and Late Prehistoric) and region in northern San Diego County. Hand stones (or manos) are the focus of this use-wear review for purposes of simplicity and because they are the most ubiquitous ground stone item. For a discussion of the full data sets and a detailed description of the analysis methods, refer to Hale (2005). The data discussed largely derive from work related to the Las Pulgas Corridor project (see Hale and Becker 2005).

Archaic Period Ground Stone Use

Archaic period assemblages are characterized by large aggregations of processing tools. This is a pattern that is common throughout San Diego County and fits partially into the Encinitas Tradition (Warren 1968). Archaic sites tend to be larger in size and fewer in number and do not exhibit high interregional variability in terms of tool use. Archaic ground stone assemblages tend to reflect a combination of highly shaped specimens with exhaustive wear patterns, and non-formalized tools with well developed wear facets, though not exhausted. Overall, the Archaic period ground stone assemblages in northern San Diego County reflect regular, intensive processing as the primary economic focus of site occupation. This conclusion is supported by use wear data.

Hand stones dating to the Archaic period from the Camp Pendleton coast (n = 21) were compared to those from Rancho Park North (n = 42) at the eastern end of Batiquitos Lagoon, and from San Elijo Lagoon (n = 23). The assemblages from Rancho Park North and San Elijo Lagoon were chosen for comparison because they are characterized by two distinct types of sites. Rancho Park North is a very large, complex site that was used as a residential hub and is characteristic of many Encinitas Tradition sites in San Diego County (see Hale 2001). Archaic sites from San Elijo Lagoon, in contrast, are small, limited-use locales that were situated to exploit lagoonal resources.

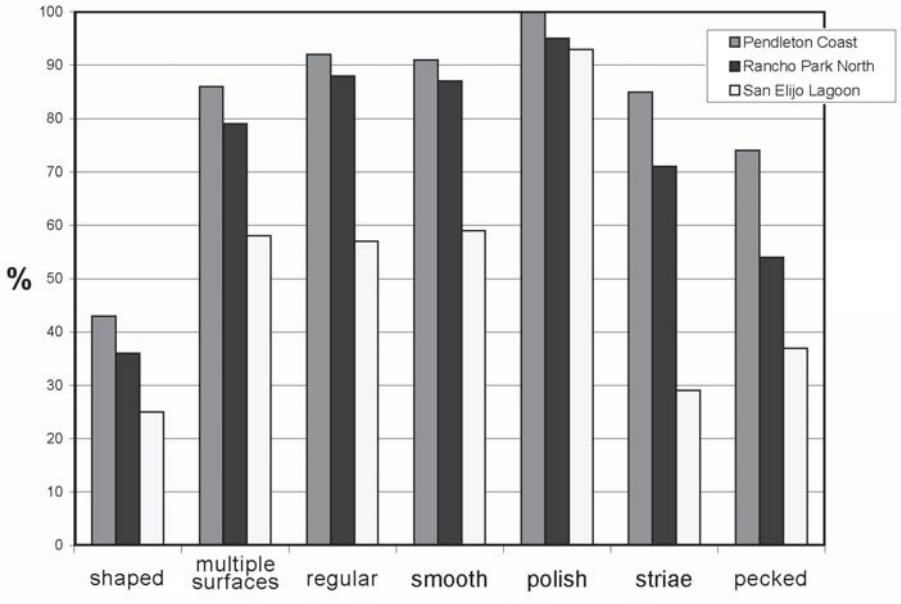
Archaic hand stones from the Camp Pendleton coast and Rancho Park North exhibit striking similarities (see Figure 3). In both instances over a third (43 and 36 percent, respectively) exhibit formal modification that altered more than 70 percent of the exterior surface.

The high occurrence of shaping is also correlated with regular and intensive use wear. Hand stones from these two areas tend to have multiple wear facets that have regular surface shapes, smooth textures, and exhibit polish, striations, and pecking. The latter attribute is indicative of surface rejuvenation. These attributes suggest that hand stones on the Camp Pendleton coast and at Rancho Park North were used regularly and with at least moderate intensity. That more than a third were highly shaped indicates that they were maintained in a tool kit for prolonged periods and likely saw use in multiple locations. Combined with other indicators, these data fit within a pattern of regular site reoccupation where transported tools are discarded and locally available cobbles are commonly reused. This resulted in the accumulation of large amounts of ground stone items. Generally low levels of assemblage diversity indicate that these sites were not sedentary villages but were residential bases that likely consisted of extended or multiple families (see Hale 2001, 2005).

Archaic hand stones from San Elijo Lagoon exhibit much less formalization and use than those from more northern locales. Only a quarter (25 percent) of the hand stones from San Elijo Lagoon were shaped (see Figure 3). Additionally, comparatively low numbers of hand stones exhibited multiple wear facets (58 percent), regular surface shapes (57 percent), smooth textures (59 percent), striations (29 percent), or pecking (37 percent). While polish was present on most surfaces (93 percent), these tools were not used with enough regularity or intensity to accumulate other forms of wear or to justify rejuvenation of surfaces. Hand stones from San Elijo Lagoon were used for processing as a supporting role to other economic endeavors at the sites, such as shellfish collection or gathering of plants.

Analyses of Archaic period hand stones reveal that processing was the primary economic activity of subsistence strategies but that minor variation, as seen at San Elijo Lagoon, indicates that the subsistence regime was flexible enough to accommodate other minor subsistence pursuits when necessary.

Figure 3: Archaic Hand Stone Use-Wear Attributes



Late Prehistoric Period Ground Stone Use

Late Prehistoric sites on Camp Pendleton tend to be smaller in size and more numerous, with the largest settlements occurring along major watercourses or on the coast. Ground stone assemblages parallel this pattern with typically small assemblages in the inland and upland regions and large assemblages on the coast. Unlike Archaic period ground stone, there is strong patterning between coastal ground stone assemblages and those from the inland and upland regions. Ground stone on the coast is much less formalized, and wear patterns are dominated by situational use that results in large aggregates of lightly used tools. Inland and upland ground stone tends to be highly formalized and moderately to intensively used. These differences indicate that processing in inland and upland areas of Camp Pendleton was the primary economic activity, while processing on the coast served a supporting role to other subsistence pursuits during the Late Prehistoric period.

Hand stones from sites on Camp Pendleton derive from the coast (n = 98), inland (n = 34), and upland (n = 17) regions, totaling 149 from 18 sites (see Hale 2005). Analyses of use wear and formalization attributes provide a strong measure of the regional variability in processing activities. First, coastal hand stones from Late Prehistoric sites exhibit very low levels of formalization in that only 22 percent were shaped (Figure 4). Even though 63 percent of the wear facets are smooth and 94 percent polished, only 37 percent were striated and 25 percent were pecked for rejuvenation. These low levels of wear are amplified by the fact that only 43 percent of coastal hand stones contain more than one wear facet per specimen. In context of the overall site assemblages, use wear and formalization patterns indicate that processing was situational, lacking extensive planning. The ubiquitous hand stone-sized cobbles at each site facilitated this pattern by essentially eliminating procurement costs. Such a pattern of use indicates that these large coastal sites were regularly reoccupied but that the primary economic role at each site was not vegetal processing but was focused on gathering along the littoral. Though residential hubs, these sites do not contain enough assemblage diversity to have been sedentary villages (see Hale and Becker 2005).

Hand stones from the inland and upland regions resemble Archaic period hand stones. Most are highly shaped (>51 percent) and have more than one surface (> 83 percent) (see Figure 4). These surfaces tend to be regular in shape and smooth in texture (> 85 percent each), polished (100 percent), and exhibit striations and pecking (> 70 percent each). These attributes indicate that Late Prehistoric hand stone use in inland and upland regions was intensive and planned. Processing was the primary role at these sites which are small and have relatively

diverse assemblages as a whole (see Hale and Becker 2005). The inland and upland assemblages also tend to be associated with bedrock milling features exhibiting a variety of surface types.

Late Prehistoric hand stone use varies from the coast to the inland and upland regions. Coastal hand stones are situational and fit with a supporting role of other economic activities. However, inland and upland hand stones resemble Archaic period assemblages that are highly formalized and reflect a high degree of planned processing and site reoccupation. Late Prehistoric subsistence/ settlement strategies efficiently incorporated the exploitation of all major biotic communities on Camp Pendleton.

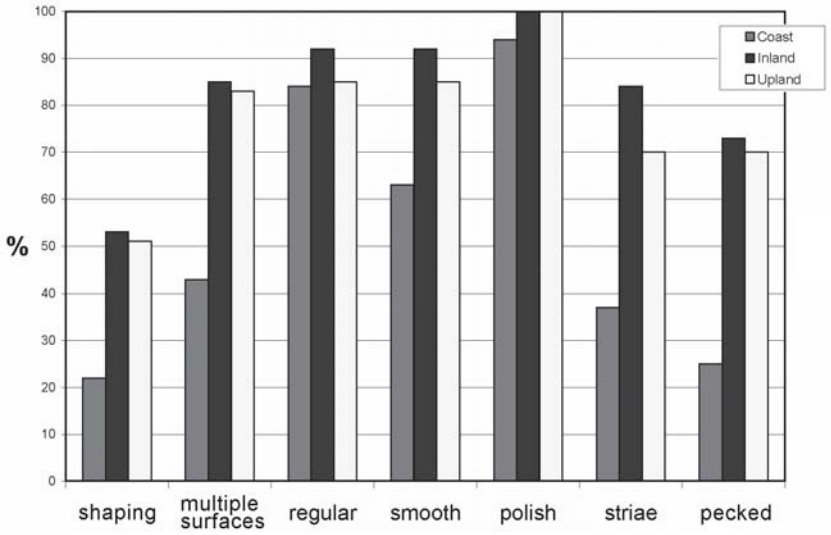


Figure 4: Late Prehistoric Hand Stone Use-Wear Attributes

Economic Changes from the Archaic to the Late Prehistoric Periods on the Coast

Given current debates regarding aboriginal occupation of the northern San Diego County coastline during the Late Prehistoric, coastal ground stone use wear patterns over the last 8,000 years are compared to illuminate economic changes that occurred. Though the review of the data here is a reiteration of the preceding sections, the present comparison is provided for clarification.

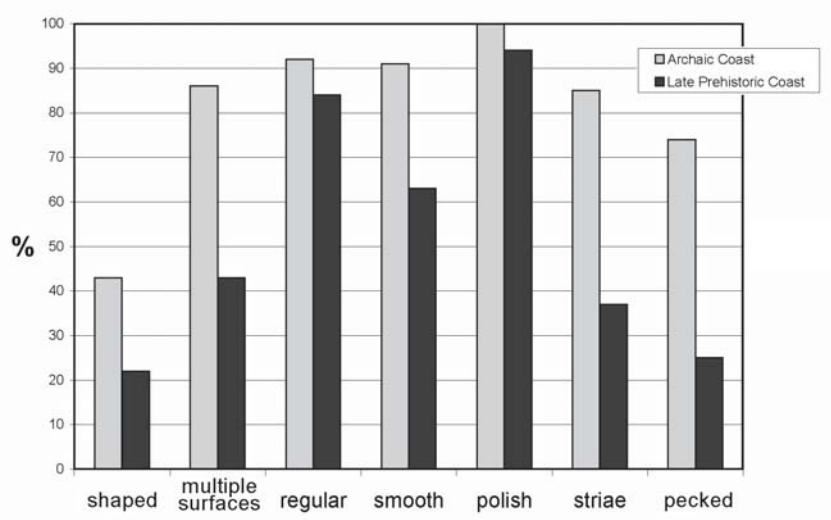
In the current analysis, Archaic hand stones had a relatively high proportion of shaped specimens (43 percent) with multiple wear facets (86 percent) (Figure 5). Surfaces tended to have regular surface shapes and were smooth, polished, striated, and pecked. Conversely, Late Prehistoric coastal hand stones had a low proportion of shaped specimens (22 percent) and less than half (43 percent) had more than one wear facet. The most significant pattern among Late Prehistoric hand stones is the lack of striations and pecking (37 and 25 percent, respectively). Combined with low levels of shaping and the predominance of single wear facet specimens, these attributes indicate that Late Prehistoric coastal hand stones were situationally used for relatively short periods of time compared to Archaic coastal hand stones that indicate prolonged and repeated use.

In the context of other assemblage data, coastal ground stone use during the Archaic fits within a strategy of planned site occupation and tool reuse. Toward the Late Prehistoric, ground stone use indicates that coastal occupation was directed at exploiting specific littoral resources and that processing vegetal materials was of secondary importance. In the broader northern San Diego County region, these changes in the economic focus of coastal occupation reflect a process of extensification where upland, inland, and coastal environments were exploited more efficiently during the Late Prehistoric (see Hale and Becker 2005). This is in contrast to a decrease in foraging efficiency in coastal intensification models, as proposed by Byrd and Reddy (2004).

SUMMARY

Economic intensification in aboriginal societies of northern San Diego County is suggested in the ethnohistoric literature of the Luiseño and the Kumeyaay and in some models of prehistoric settlement-subsistence. Intensive acorn exploitation is the basis of ethnohistoric period aboriginal economies. However, results from the current analysis are not consistent with such a pattern deriving from the Late Prehistoric period. Instead, Late Prehistoric economies are supported by vegetal processing that was regular and planned at upland and inland areas, and more irregular at the coast where vegetal processing supported other gathering activities. The Late Prehistoric regional economic system exploited all environments efficiently with differential resource

Figure 5: Archaic vs Late Prehistoric Ground Stone Use Intensity.



emphasis and probably incorporated larger sites of aggregate families on the coast, and smaller (single family?), more residentially mobile sites on the interior. Prior to the Late Prehistoric, the Archaic period is also characterized by the primacy of vegetal processing, but settlement was probably centered around regular reoccupation of centralized locales by moderate-sized groups (extended or multiple families?). No resource during the Archaic or Late Prehistoric periods appears to have been subject to economic intensification. Because of this finding, it is more likely that the ethnohistoric pattern of intensive acorn exploitation resulted from economic pressures induced after Spanish contact. This is supported by the high degree of economic variability and lack of planning implied by ethnohistoric processing assemblages.

If the process of intensification did occur in San Diego County in prehistoric times, some key data are needed to demonstrate this. The most significant data need includes a robust paleoethnobotanical assemblage of acorn remains. To date, very few acorn remains have been recovered, regardless of exhaustive efforts to track this resource (Reddy 2005). If acorns truly were subject to intensification, acorn remains would be expected to represent a statistically substantial sample of ethnobotanical assemblages. This is also true regarding acorn processing technology. Excluding bedrock mortars, mortars and pestles are far less common in San Diego County ground stone assemblages than milling stones and hand stones from the same temporal components. It is also true that mortars and pestles are often misidentified, a fact that shrinks their archaeological representation even further. Finally, more work needs to be done regarding bedrock milling elements and associated archaeological deposits to better link these ubiquitous features to the archaeological record (see Hale and Becker 2005). Without evidence of any resource sets being subject to intensification in the prehistoric era, the question remains whether intensification was inevitable, as some imply (Byrd and Reddy 2004), or whether it was unlikely to occur in northern San Diego County without non-aboriginal economic influence.

REFERENCES CITED

Bean, Lowell J., and Florence C. Shipek
1978 Luiseño. In *California*, edited by Robert F. Heizer, pp. 550-563. Handbook of North American Indians, Vol. 8, William C. Sturtevant, general editor. Smithsonian Institution, Washington, D.C.

Byrd, Brian F., and S. N. Reddy
2004 Late Holocene Adaptations along the Northern San Diego Coastline: New Perspectives on Old Paradigms. In *Catalysts to Complexity: Late Holocene Societies of the California Coast*, edited by Jon M. Erlandson and Terry L. Jones, pp. 40-62. Perspectives in California Archaeology Vol. 6. University of California, Los Angeles.

Cline, Lora L.
1984 *Just Before Sunset.* J and L Enterprises, Jacumba, California.

Drucker, Philip
1937 Culture Element Distributions: V, Southern California. *Anthropological Records* 1:1-52. University of California, Berkeley.

Hale, Micah J.
2001 Technological Organization of the Milling Stone Pattern in Southern California. Unpublished Master's thesis, Department of Anthropology, California State University, Sacramento.

2004 *Report on Excavations at Charlie's Site, Pauma Valley, California.* Submitted to Pauma Band of Luiseño Indians, California.

2005 Ground Stone Analysis. In *From the Coast to the Inland: Prehistoric Settlement Systems along the Las Pulgas Corridor, Camp Pendleton, California*, by Micah J. Hale and Mark S. Becker. ASM Affiliates, Carlsbad, California. Report submitted to Marine Corps Base Camp Pendleton, California.

Hale, Micah J., and Mark S. Becker
2005 *From the Coast to the Inland: Prehistoric Settlement Systems along the Las Pulgas Corridor, Camp Pendleton, California.* ASM Affiliates, Carlsbad, California. Report submitted to Marine Corps Base Camp Pendleton, California.

Luomala, Katherine
1978 Tipai and Ipai. In *California*, edited by Robert F. Heizer, pp. 592-609. Handbook of the North American Indians, Vol. 8, William C. Sturtevant, general editor. Smithsonian Institution, Washington, D.C.

Reddy, Seetha N.
2005 Paleoethnobotanical Study at SDI-812/H and SDI-10,723. In, *From the Coast to the Inland: Prehistoric Settlement Systems along the Las Pulgas Corridor, Camp Pendleton, California.* Micah Hale and Mark Becker, eds., ASM Affiliates, Carlsbad, California. Report submitted to Marine Corps Base Camp Pendleton, California.

Shipek, Florence C.
1991 *Delfina Cuero: Her Autobiography*. Ballena Press, Menlo Park, California

Sparkman, Philip S.
1908 The Culture of the Luiseño Indians. *University of California Publications in American Archaeology and Ethnology* 8:187-234. Berkeley.

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