

BALLONA ARCHAEOLOGY: A DECADE OF MULTIDISCIPLINARY RESEARCH

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Following 10 years of intensive research, our knowledge of Ballona wetlands, located along Santa Monica Bay, is reviewed and new research questions are defined. Our ongoing research combines archaeological and environmental reconstruction covering more than 6,500 years of human occupation. Comparing the timing of environmental and cultural events produced some surprises that helped us formulate several new research questions. From these questions, two events emerge as critical: (1) the sudden influx of people around 3000 B.P. represented by settlement along the bluff tops, along Centinela Creek, and at the lagoon edge; and (2) the abandonment of the bluff tops and creek edge at around 1000 B.P. Larger issues embedded in these two questions involve the seemingly paradoxical subsistence practices of the bluff-top and creek-edge populations, and their cultural affiliation. Various hypotheses are examined that might account for these events. It is suggested that excavation of the Peck site (CA-LAN-62) is essential to obtain the data necessary for addressing these questions.

The Ballona is a large, low-lying coastal gap along Santa Monica Bay that represents one of the many drowned valleys dotting the length of the California Bight. Now home to the modern communities of Marina del Rey, Westchester, and Playa del Rey, the Ballona once attracted many prehistoric peoples, who established numerous settlements on top of the bluffs to the south, on the edge of the lagoon, and along the banks of the two streams that fed the wetlands, Ballona and Centinela creeks (Figure 1).

Not surprisingly, the area has long been of interest to archaeologists. Many sites were documented by amateurs who collected and excavated extensively in the first half of the twentieth century (Farmer 1936; Lambert 1983; Peck 1947; Thiel 1953). It was not until the 1960s that professional archaeologists were drawn to the Ballona, largely to respond to archaeological sites imperiled by modern development. One of the first major excavations in the region took place in 1961 at the Admiralty site (LAN-47). Led by Keith Johnson, a group of University of California at Los Angeles (UCLA) students and volunteers performed emergency salvage work at this lagoon-edge shell midden, located next to Yacht Basin F in Marina del Rey (Meighan 1961). Later in that decade, more modest excavations were performed by Chester King (1967) at the historical-period Hammack Street site (LAN-194), situated on the eastern edge of the Ballona. By far the largest data recovery effort took place in the 1980s on the tops of the Westchester Bluffs. Led by David Van Horn, more than 3,000 m³ of cultural deposits were excavated and analyzed at five major sites: Hughes (LAN-59), Loyola-Marymount (LAN-61), Del Rey (LAN-63), Bluff (LAN-64), and Berger Street (LAN-206) (Van

Horn 1984, 1987; Van Horn and Murray 1984; 1985; Van Horn and White 1997a).

Since 1989, Statistical Research, Inc. (SRI) has conducted an intensive program combining environmental reconstruction and archaeological investigations (Altschul et al. 1991, 1992, 1998, 1999; Grenda and Altschul 1994; Grenda et al. 1994). Much of this work has been performed in conjunction with the Playa Vista development. As this massive project turns from inventory and testing to data recovery, we believe it useful to present what we have learned and what more we hope to learn about this estuary.

In 1990, Altschul and Ciolek-Torrello (1990; see also Altschul et al. 1993) presented a model of settlement for the Ballona wetlands. We argued that changes in human use of the region were tied directly to the Holocene evolution of the wetlands. When humans first ventured into the region, the Ballona was part of Santa Monica Bay. Their visits were short and confined to the only stable land forms, which at this early date were restricted to the tops of the El Segundo Sand Hills, commonly referred to as the Westchester Bluffs. Over thousands of years the open bay gradually became a closed lagoon. Floral and faunal resources of the Ballona became more attractive to humans, and seasonal settlements were established along the length of the bluff tops. As sediment gradually filled the gap, marshes formed along the edges of the lagoon. Eventually these marshes developed into a resource-rich estuarine environment, and the inhabitants of the Ballona forsook their scattered bluff-top settlements for larger settlements along the edges of the lagoon.

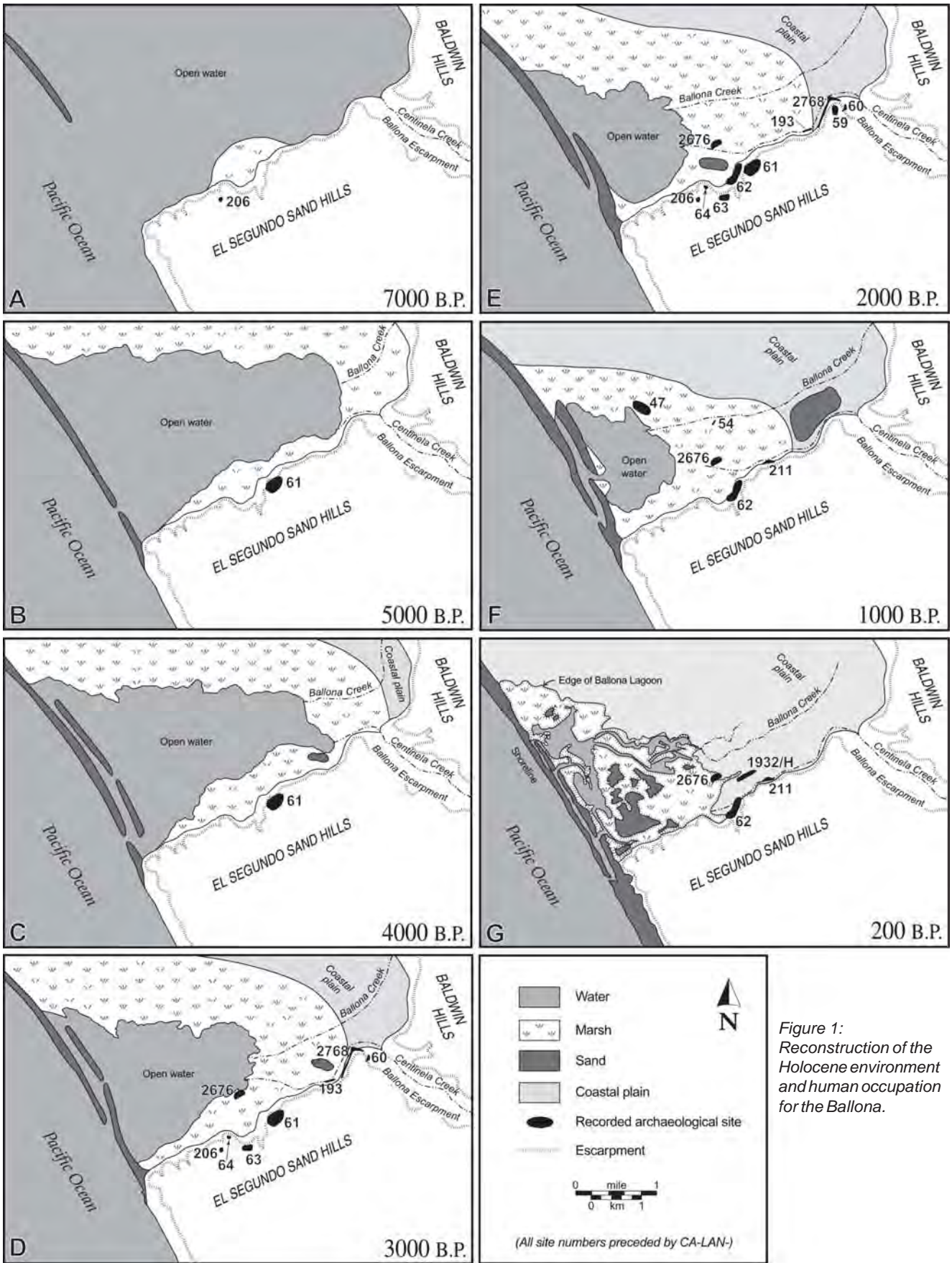


Figure 1: Reconstruction of the Holocene environment and human occupation for the Ballona.

In the course of our work, we have demonstrated that the broad outlines of the model are correct. The timing and nature of environmental and cultural events, however, are quite different from what we expected; we suspect that it is precisely the interplay of these events that determined the course of prehistory in the Ballona. Furthermore, it is impossible even to ask the right questions until the relationship between environmental and cultural change can be discerned. Following the principles of cultural ecology outlined more than 45 years ago, we agree with Steward (1955:41) that “although technology and environment prescribe that certain things must be done in certain ways if they are to be done at all, the extent to which these activities are functionally tied to other aspects of culture is a purely empirical problem.”

Two events emerge as central to our continuing research. The first occurs between around 3000 and 1000 B.P., a time defined as the Middle period. It is at this time that people first establish semipermanent settlements in the Ballona. Using a gradualist approach, we originally suspected that the Middle period was characterized by an open lagoon and a settlement pattern restricted to the bluff tops. We envisaged that population grew in step with the increasing diversity and density of wetland resources. Problems emerged with this conception; the lagoon formed earlier and the Middle period population influx was sudden and widespread, encompassing the banks of Centinela Creek as well as the bluff tops. Furthermore, the faunal collections found on the bluffs and along the creek are quite distinct but counterintuitive to their environmental location. Three hypotheses have emerged to account for the archaeological record: (1) desert peoples migrated to the Ballona, and established an enclave along the coast; (2) two different populations occupied the Ballona during the Middle period; or (3) bluff-top and creek-side occupation was not actually contemporary, occurring either at different times in the Middle period or representing different seasons of occupation.

The second event relates to the abandonment of the bluff tops and upper creek edge around 1000 B.P. at a time when the wetlands were mature and remained attractive to humans. This abandonment, then, does not seem to have an environmental cause. One possibility is that during the Late period, or between 1000 B.P. and the arrival of Europeans, the previously dispersed population of the Ballona aggregated into a village at the edge of the historical-period lagoon. This certainly accords with ethnohistorical accounts (see Bean and Smith 1978). Another hypothesis is that the population remained dispersed as it had been during the Middle period, but that it rearranged itself into relatively small

camps on the lagoon shore. Finally, it is possible that the Ballona was largely abandoned at this time, used only periodically by small groups. A bigger issue embedded in the changing distribution of the population regards their cultural affiliation. Are these the descendants of the Middle period population(s)? Or did the earlier inhabitants return inland, leaving the coast as a no-man’s-land between competing political units?

The answers to these questions lie in several areas that will require additional research. First, we need to understand the Holocene evolution of the Ballona wetlands, and the manner in which the resource base changed throughout the period of human use. Next, we need to explore the nature of the two areas of occupation — the bluff tops and creek edge — during the Middle period, first in relation to each other and then to other coastal and inland regions. Data on site layout, faunal usage, material culture, mortuary practices, and chronology will be crucial here, so that proper comparisons can be made. Finally, data from one site, the Peck site (LAN-62), is central to all arguments. Located at the confluence of Centinela Creek and the historic Ballona Lagoon, the Peck site is the only candidate for a Late period village in the Ballona. It also may contain Middle period and protohistoric components, making it essential for understanding changes in land use, settlement, subsistence, and cultural practices during the critical Middle to Late period transition.

In the balance of this paper we explore these ideas in more depth. We begin with our current understanding of how the Ballona wetlands developed over the last 7,000 years. We then examine the archaeological record, beginning with a sketchy outline of the first occupants of the Ballona and then moving on to the more complete, but poorly understood, remains of the Middle and Late periods.

The Holocene Environment

Paleoenvironmental reconstruction of the Holocene ecosystem in the Ballona is a major goal of the Playa Vista Project (see Altschul et al. 1991). An extensive coring program has provided more than 200 continuous 7.6-cm (3-in) cores for the entire project area. These cores have been used for stratigraphic, chronometric, pollen, mollusk, foraminifera, siliceous microfossil, and ostracode analyses (Boettcher and Kling 1999; Brevik et al. 2000; Davis 1998; Palacios-Fest 1998). Although we are still synthesizing the results, preliminary statements can be offered (see Figure 1). Prior to modern development, the Ballona Lagoon would have been termed an estuarine lagoon

(Davies 1973:152). Whereas a marine lagoon is produced solely by marine action and lies between some sort of barrier feature and the original coastline, an estuarine lagoon is formed when a river discharges into a marine lagoon. As an estuarine lagoon matures, sediments from upstream are continually deposited at the mouths of the rivers. Eventually siltation transforms the lagoon from an open expanse of water into an intricate network of estuarine channels cutting through newly formed marshes and islands.

Estuaries such as that formed in the Ballona are among the most productive ecozones in terms of biomass (Ketchum 1983; Palacios-Fest 2000; Schreiber 1981). The mixture of open lagoon, tidal flats, saltwater and freshwater marshes, and freshwater streams provides a variety of distinct habitats within a restricted space. The availability of oceanic, riverine, and terrestrial plants and animals in proximity to one another makes the Ballona and other estuaries of the southern California Bight some of the most favored locales for human occupation since people arrived in the New World. In the 1870s, the Ballona Lagoon was home to a dense population of fish, water fowl, and sea mammals, and was renowned for its hunting and fishing.

Global sea level rise during the Pleistocene, beginning approximately 18,000 B.P., was the formative factor in the Ballona wetlands. Initially, the inundation of the preexisting shoreline created a bay that extended into the Ballona. By 7000 B.P. the rate of sea level rise began to decrease, and other geologic processes, particularly depositional processes, exerted more influence in shaping the landscape (Orme 1990). In the Ballona, a spit began to migrate southward across the mouth of the coastal inlet at present-day Playa del Rey (see Figure 1a), which by 6200 B.P. had completely closed off the inlet. At this time, the main feature in the Ballona was a small marshy alluvial fan projecting northward into the bay from a large amphitheater-shaped gap eroded into the Westchester Bluffs — a gap now occupied by Lincoln Boulevard. The fan originally formed prior to 16,000 B.P., and its edge maintained a position roughly near the current intersection of Lincoln and Jefferson boulevards until approximately 3000 B.P. The fan, a feature of long-term stability, provided ready access for prehistoric peoples to the lagoon and its resources.

By 5000 B.P. sediments were starting to fill in around the fringes of the inlet, creating marshes that flanked a large lagoon (roughly 5 by 3 km) (see Figure 1b). A sandy area or “island” of higher and better-drained land was present in the marshes near the eastern edge of the lagoon (Brevik et al. 2000:9). As sediment infilling continued, more extensive marshes were created at the expense of the lagoon. By 4000 B.P., the

lagoon had shrunk significantly, and a coastal plain probably began to form at the eastern end of the Ballona (see Figure 1c). This open-water retreat continued steadily for the next 3,000 years, with the lagoon filling in more quickly east to west than north to south because Ballona and Centinela creeks (see Figures 1d-e) both enter the wetlands from the east. Ballona Creek in particular would have carried a relatively high sediment load, especially during times when it captured the flow of the Los Angeles River. By 1000 B.P., the Ballona Lagoon was confined to a small remnant of its former size, with the lagoon edge retreating from the Ballona Escarpment along all or most of its length (see Figure 1f). The lagoon at this time was probably quite shallow, and marshes may have formed along the landward side of the barrier.

The 1861 U.S. Coast Survey map of the Ballona, which serves as the environmental foundation for Figure 1g, depicts a lagoon separated from the ocean by a double barrier and largely filled with sediment. There are several sandy “islands” that are higher and drier than the surrounding marsh. Ballona and Centinela creeks supplied freshwater to the lagoon, and the coastal plain expanded over much of the former lagoon.

Filling of the Ballona Lagoon took approximately 5,000 years; such rapid infilling is not surprising, as lagoons and associated wetlands tend to be short-lived geologic features (Bird 1994; Eisma 1998; Orme 1990). The relatively constant position of the barrier and the shoreline suggests that for about the last 7,000 years, a dynamic equilibrium existed between local tectonic uplift and sea level rise. Such an equilibrium probably prolonged the life of the Ballona Lagoon, as the lagoon was neither inundated by transgressing seawater nor drained by rising landforms (Brevik et al. 2000:11).

The wetlands, however, did witness changes in salinity as the lagoon was alternately dominated by marine or freshwater inputs. Environmental proxies indicate that the Ballona Lagoon was primarily a marine environment prior to about 6200 B.P. Between 6200 and 4000 B.P., the wetlands were mostly dominated by marine influences, interrupted sporadically by several freshwater pulses. After 4000 B.P., freshwater inputs were the primary factors driving the evolution of the wetlands. Combining the stratigraphic with the biological evidence, the barrier across the Ballona was probably complete by about 6200 B.P., but the lagoon was still heavily influenced by tidal action until about 4000 B.P. After that time, the tidal channel(s) were frequently blocked or filled in above sea level, thereby allowing freshwater from Ballona and Centinela creeks to build up behind the barrier and dilute the lagoon’s salinity.

HUMAN RESPONSE TO A CHANGING ENVIRONMENT

The archaeological record demonstrates that humans adapted their settlement and subsistence to changes in the biotic and physiographic character of the Ballona. Humans also adapted to changes in the social environment. These latter shifts are more apparent at times when they appear contrary to prevailing environmental conditions.

The Early Period

The Early period is currently conceived as a 3,500-year temporal span beginning with the stabilization of sea levels about 6500 B.P. and ending with the first dramatic increase in regional human population around 3000 B.P. Human use of the Ballona during the Early period is ephemeral. Although numerous early styles of projectile points (e.g., Lake Mohave), discoidals, and crescents have been collected from the surface of the bluff-top sites (Lambert 1983), only two sites have components dated to the Early period. Both components are from bluff-top sites: one at the Loyola-Marymount site (LAN-61), which returned an uncorrected radiocarbon date on a shell sample of 4710 ± 80 B.P. (Van Horn and Murray 1985), and one at the Berger Street site (LAN-206), which provided an uncorrected shell date of 6750 ± 80 (Freeman 1991; Van Horn and White 1997a).

Based on the paleoenvironmental reconstruction presented above, the Ballona Lagoon in the Early period would have been composed of a large, shallow bay separated from the ocean by shifting sand barriers. Ballona Creek was active during this period, depositing several meters of sediment. Upstream from the lagoon, we would expect extensive areas of poorly developed mud and tidal flats at this early date. The biotic potential of the wetlands would have been limited in the absence of well-developed freshwater marshes and could not have supported intensive occupation of the region. The lowlands, with few dry and stable landforms, would have been unattractive to human settlement. Instead, the few groups that visited the Ballona stayed in the hills overlooking the lagoon. Large, shallow depressions also occur in these hills near the edge of the bluffs. During wet years or in spring, these depressions may have become vernal pools that could have provided a variety of resources to augment those of the lagoon.

Altschul and Grenda (2002) argue that much of the Los Angeles Basin conforms to the reconstruction offered for the Ballona. They contend that the paucity of archaeological sites dating to the Early period in the

Los Angeles Basin, which contrast sharply with the relatively large numbers of Early Holocene sites in the Santa Barbara and San Diego areas, can be explained by a generally inhospitable environment. Although the Ballona data are consistent with this interpretation, more geomorphic investigations from other estuaries in the Los Angeles area are needed to support this contention.

Many questions remain about the Early period in the Ballona. Perhaps the most fundamental concerns the dating of the period. The beginning of the Early period is argued to be around 6500 B.P. This date may reflect the establishment of seasonal camps in the Ballona, but it probably does not represent the initial use of the Ballona. We suspect that the radiocarbon result upon which this date hinges reflects sample selection and is not a good proxy for the initial occupation. Although Van Horn and White (1997a) do not state what type of shell was dated, there is a good chance they used *Chione* sp. Most archaeologists along the coast use *Chione* because the size of the shell allows them to obtain a sample from a single shell, as opposed to combining shell pieces found in various proveniences. Shell analysis from the geomorphic cores at Playa Vista indicate that *Chione* and other estuarine shell species were not established in the Ballona prior to about 6500 B.P. (Steve Shelley, personal communication 2000). Thus, Van Horn and his colleagues may have dated occupations coeval with the origin of the marsh, but not necessarily the first human use of the region. The presence of Lake Mohave points and crescents supports at least ephemeral human use, possibly dating as early as 8500 B.P.

Determining whether the earliest occupants simply visited the bay or established campsites of longer duration will require re-dating the bluff-top deposits. Regardless, by 6500 B.P., when the lagoon began to form, human use of the Ballona was intense enough for middens to develop. Van Horn and White (1997a) argued that the occupants of the Early period component at the Berger Street site (LAN-206) fished and collected shellfish in the nearby estuary. The sparsity of tools and faunal remains in the midden suggested that this component consisted of the remains of short-lived camps, presumably individual occupations that did not last more than a few weeks.

The Berger Street site documents that the original occupants of the Ballona practiced a maritime adaptation similar to contemporary populations of the California Bight (see Erlandson 1994; Erlandson and Colten 1991). The exploitation of near-shore and lagoonal fish and shellfish by small, mobile groups in combination with a material culture common along the

coast suggests that Early period residents of the Ballona participated in a widespread coastal cultural system. These patterns are in sharp contrast to the subsequent components at the Berger Street site, and as we shall see, from other Middle period sites in the Ballona.

The Middle Period

Our original model held that Middle period sites were confined to the bluff tops because stable landforms had not been established in the wetlands at this time (Altschul and Ciolek-Torrello 1990). Clearly, we were wrong. Recent geomorphological evidence suggests that the lagoon shoreline developed around 6300 B.P. and remained relatively constant for the next 4,000 years. Stable alluvial fans were created at the base of the Ballona Escarpment in the vicinity of present-day Lincoln Boulevard and in other localities along Centinela Creek by 5000 B.P. In hindsight, the discovery of a relatively extensive Middle period occupation in the lowlands should not have taken us by surprise, but it did. Since 1998, we have discovered five Middle period sites in the Ballona wetlands (see Figure 1). All but one of these sites are confined to the narrow band between the edge of the escarpment and Centinela Creek. Just as Altschul (1997) has argued that the bluff tops are best conceived as one site or occupation zone, so too the banks of Centinela Creek extending east from LAN-193 to LAN-60, a distance of about 1.5 km, should be considered one occupation zone.

Why had previous archaeologists failed to discover these lowland sites? The answer lies in the modern history of the property. In 1940, Howard Hughes purchased the lowlands, now encompassed by the Playa Vista development, and much of the bluff top (Altschul et al. 1991:84). Initially, Hughes planned to use the area to pursue his motion picture aspirations. With the onset of World War II, however, his plans changed, and the lowland parcel was developed into an industrial complex where military equipment was produced until the end of the Cold War (see Altschul et al. 1991). As part of this development the entire lowland parcel east of Lincoln Boulevard was built up by filling the wetlands with sediment imported largely from outside the property. From our 1990 survey of the Playa Vista project area, it was clear that the surface was a poor indicator of subsurface deposits. Consequently, we devised a different type of discovery technique. This program involved a systematic program of subsurface probing to find sites. The coring program, augmented by construction monitoring, has been responsible for finding and evaluating most archaeological sites found in the Ballona since 1990 (see Altschul et al. 1998, 1999).

The Middle period is the best-documented portion of the prehistoric epoch in the Ballona. Middle period sites are found on the bluff tops (LAN-59, -61, -63, -64, and -206), along Ballona (LAN-54) and Centinela creeks (LAN-60, -193, and -2768), and along the lagoon edge (LAN-62). They range in date from about 3000 to 1000 B.P. (Figure 2).

The relationship between low-lying Middle period sites, their better-known bluff-top counterparts, and the development of the lagoon has emerged as a central research question (see Figure 1d-e). The Middle period occupations on the bluff tops are characterized by certain cultural traits, such as tanged points and cremations, that Van Horn believed to have originated in the Mojave Desert. Although excavations in the lowlands have been insufficient to document these traits, we have found artifacts representing an unusual microlith tradition at both lowland and bluff-top sites. The function of these tools remains elusive. Late period microliths, best known from Santa Cruz Island, tend to be triangular or trapezoidal in cross section and were used as drills in a specialized shell bead-making endeavor (Arnold 1987a, 1987b). By contrast, Middle period microliths from the Ballona are primarily blades, which could have been hafted and used for a variety of functions, including gravers for cutting wood or stone (Van Horn 1987:241). This distinctive microlith technology indicates a shared cultural tradition among Middle period Ballona sites.

Faunal exploitation patterns, however, are quite different between lowland and bluff-top sites. For example, the inhabitants along Centinela Creek and the lagoon edge focused on terrestrial fauna such as rabbit and deer, which make up over 80 percent of the faunal collections from six lowland sites, but tended to ignore fish, which make up less than 10 percent of these collections (Altschul et al. 1999:106-107). By contrast, Middle period inhabitants along the top of the neighboring escarpment focused on lagoon fish, especially sharks and rays (all fish constitute over 80 percent of the faunal collections from six bluff-top sites) and tended to shun terrestrial fauna, which make up a little over 12 percent of these collections. Surprisingly, exploitation of estuarine shellfish was relatively low in both groups of sites. For example, five Middle period bluff-top sites had an average of only 66 specimens per m³ while two riparian sites contained 76 specimens per m³. By contrast, three Late period lagoon-edge sites averaged almost 350 specimens per m³. Shell beads are also lacking from bluff-top and creek-side sites during the Middle Period, although stone beads are common.

Over time, we have developed a number of working hypotheses to integrate the archaeological record with

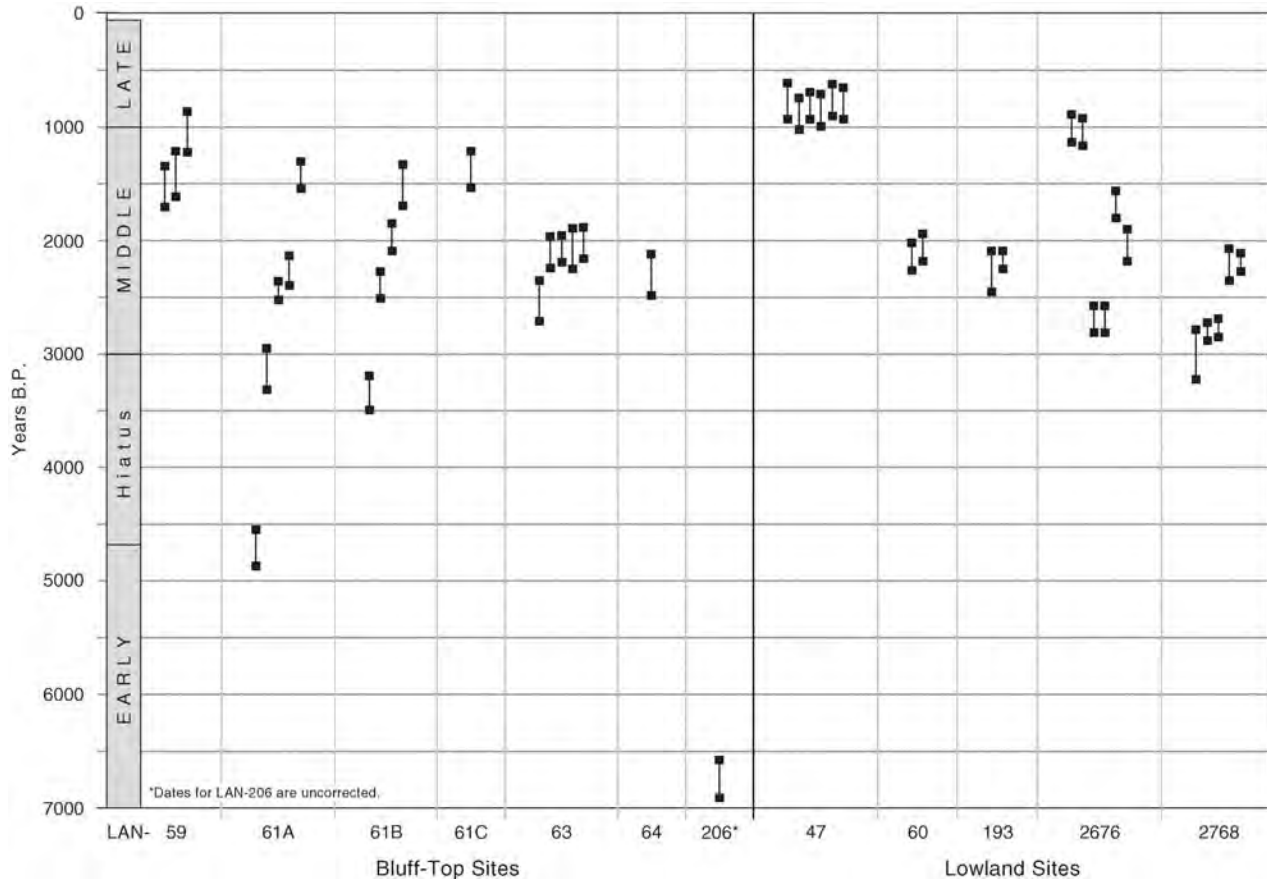


Figure 2: Corrected radiocarbon dates for archaeological sites in the Ballona.

the paleoenvironmental reconstruction. Two hypotheses focus on “traditional” archaeological explanations: chronology and environment. As discussed above, there is a possibility that the Early period in the Ballona has been misdated, and that the beginning of the period should be pushed back from around 6500 B.P. to 8500 B.P. If the bluff-top middens have been misdated because of reliance on estuarine shell samples, then perhaps significant portions of the middens date not to the Middle but to the Early period. A predominantly Early period age for the bluff-top settlements is consistent with a lagoon-focused subsistence strategy. It is during the Early period that the Ballona was characterized by a shallow, open lagoon where rays, sharks, and other fish were abundant. Extensive mud flats, which would have supported estuarine shellfish, were not established until later in the Middle period when the Centinela Creek sites were occupied.

Although accounting for the faunal collections, this explanation fails to be supported by the archaeological record. Early period artifacts have been found on the bluff tops, but they remain few in number. Most have been found by amateurs, with the proveniences open to question. Lambert (1983), for example, illustrates six

Lake Mohave points and three crescents from private collections, reportedly recovered from the Loyola-Marymount site (LAN-61). It is difficult to evaluate whether these artifacts represent a significant occupation or a skewed emphasis on large points and crescents by collectors. A more useful comparison is provided by the systematic excavations performed by Van Horn and Murray (1985), who recovered 153 projectile points at LAN-61. None of the points were typed to styles dating to the Early period, although six crescents and one discoidal were recovered in the excavations. Similar results were reported at the other bluff-top sites, indicating ephemeral Early and Late period use with the predominant occupation taking place in the Middle period (Van Horn 1984, 1987; Van Horn and White 1997a).

A variant of this first explanation would hold that the bluff-top sites date to the early part of the Middle period (ca. 3000–2000 B.P.), whereas those along Centinela Creek date to the latter part of the period (ca. 2000–1000 B.P.). Much like the previous explanation, this one would account for differences in faunal collections by linking the subsistence practices to the evolution of the lagoon. Absolute dates from Middle period sites on the bluff tops and creek edge, however,

do not follow this pattern (see Figure 2). Instead, all the sites appear contemporaneous.

A second explanation focuses on the dynamic character of an estuarine lagoon and suggests that the bluff-top and riparian settlements represent different occupations during the Middle period. Major climatic or tectonic events, such as floods or earthquakes, can have great environmental consequences in an estuary. Floods periodically flush estuaries, removing sediment, cutting new outlet channels, and changing landforms, thereby altering habitats. At times, these events can even change the course of rivers, leaving one estuary to die and another to be reborn. Such an event was recorded in 1815, when at high flood stage, the Los Angeles River was diverted from its present-day course to a more westerly route, being captured by Ballona Creek, and emptying into Santa Monica Bay (Weide 1967). Ten years later, a second major flood returned the river to its original course. During subsequent floods in 1862 and 1884, part of the river's flow was again diverted through Ballona Creek into the lagoon. Such changes in the course of the Los Angeles River occurred many times in prehistory, and undoubtedly had a profound effect upon the Ballona and its residents.

It is possible that the Middle period bluff-top sites represent occupations that occurred when such catastrophic events flooded marshlands and flushed the estuaries, making the lowlands uninhabitable and removing shell beds and other estuary species. During drier periods, when estuarine species were reestablished, residents of the Ballona moved closer to the resources. Although this hypothesis has some appeal, it does not adequately account for the low dependence of Middle period populations on estuarine resources and the stark differences between lowland and bluff-top faunal exploitation patterns. These differences might be reconciled if the sites on the bluffs were dominated by terrestrial species, whereas the sites along Centinela Creek were dominated by riparian species. In that case, one could argue that the Ballona's residents placed their camps near the resources they targeted. Such is not the case, however. Bluff-top sites contain mostly lagoonal resources, which would have been easier to obtain from the creek edge, whereas those sites along the creek edge are characterized by terrestrial species, some of which may have been more plentiful on the bluffs.

In all likelihood the bluff top and creek edge were occupied simultaneously during the Middle period. The shift in settlement between the Early and Middle period is dramatic. The Ballona, which in the Early period had been largely unattractive to human

settlement, hosts an intensive occupation in the Middle period, with settlements all along the lower reach of Centinela Creek and along the entire edge of the Westchester Bluffs. How can we explain this transformation?

One approach is to emphasize mobility. Early hunters and gatherers of the California Bight can be conceived of as small groups that exploited areas rich in resources until those areas were exhausted, at which time they moved on. Middle period sites in the Ballona represent hundreds, if not thousands, of visits by small groups, who established, and then abandoned, campsites in the same general vicinity (see Van Horn 1987). This explanation is appealing because no significant change in population, social organization, or adaptation is needed. Population remains low and dispersed, with the only major difference between the Early and Middle period being with the number of times the Ballona is visited. Visitation and use certainly increased, but such is expected because as the lagoon evolved into an estuarine lagoon its resources would have become increasingly attractive to humans.

One aspect of the mobility explanation is at odds with the archaeological record. Altschul (1997) has noted that the Del Rey site (LAN-63) and presumably other bluff-top sites exhibit strong site structure. For example, the Del Rey site is not composed of homogeneous midden deposits with features randomly dispersed within it, as would be expected from an accretionary formation consisting of hundreds of campsites. Instead, features follow highly structured plans, with hearths surrounded by concentrations of lithic and faunal remains reminiscent of ethnographic accounts of toss circles (see Bartram et al. 1991; Gargett and Hayden 1991; Meehan 1982; Murray 1980; O'Connell et al. 1991) distributed along the bluff edge, and more public and ritualistic features concentrated near the center. Altschul (1997) argues that the Del Rey site is better viewed as a multiseasonal habitation site used by multiple domestic groups rather than a temporary seasonal camp.

Longer and more permanent settlement in the Ballona is certainly expected as the wetlands matured and plants and animals of the region formed an increasing proportion of the residents' diet. A major focus of our research is how productive the estuary would have been at various times in its evolution. By the Late period, the biomass of the Ballona may have supported a permanent resident population of reasonable size. It is unclear if the same was possible during the Middle period. Even so, as the Ballona wetland matured, its economic value increased, and at some point it would have been important to the social

group laying claim to the Ballona not to leave the region unprotected.

To understand Middle period settlement in the Ballona we must resolve the dual issues of mobility and sedentism at the local and regional level. At the local level, we have evidence of seasonal, and perhaps multiseasonal, settlements composed of multiple domestic groups dispersed along the creek edge and on the bluff top. We have developed two working hypotheses to explain this situation. The first is that these settlements represent two distinct populations. For example, the seasonal round of two systems of related domestic units could have overlapped in the Ballona, with each unit using the wetlands at different times of the year. One lineage would have practiced a typical coastal maritime adaptation and settled on the bluffs, whereas the other would have been oriented toward terrestrial resources and settled along Centinela Creek.

The alternative hypothesis is that the sites represent one social unit that resided in the Ballona for part or all of the year. A large social group could have split itself into small domestic units that were spread along the creek and bluff tops. Alternatively, individual domestic groups could have moved back and forth between the bluff tops and the creek as they exhausted local resources. Yet another alternative involves seasonal residence in which occupation of the Ballona was part of a larger seasonal round. Each time the social group visited the Ballona, a decision was made to live either along the creek or on top of the bluffs, depending on the prevailing conditions that year.

Deciding between the alternative explanations presented above requires placing the Ballona into a larger regional context. Was the Ballona used by a coastal foraging group that moved from one estuary to another along the California Bight? Were the residents originally from the desert, and if so, did the sites form the western nexus of an east-west territory designed to provide access to a wide variety of biotic communities and mineral resources? Answers to these questions have been slow to emerge. The presence of Middle period microliths in the Ballona and the absence of comparable artifacts in other contemporary coastal estuaries, such as Newport Bay and Bolsa Chica to the south or Malibu to the north, suggests that this industry did not extend far along the coast. Desert groups, who range over large territories, tend to have relatively simple, versatile, and easily transported tools. Although a microlith industry has not been identified in the Mojave desert, desert groups might be expected to have used small hafted tools like those found in the Ballona. Instead of a coastal affiliation, the Ballona is more likely tied to a

desert-coastal system. Support for this assertion comes in the form of formal tools. Middle period Ballona sites are characterized by the distinctive stemmed Marymount point style, which Van Horn (1990) argues is similar to contemporaneous desert point styles and is distinct from coastal ones. Other common projectile point styles recovered from Middle period contexts in the Ballona include Gypsum Cave and Pinto point types; by contrast, Canalino points are rare.

Such evidence suggests that the Middle period settlement of the Ballona was strongly influenced by contemporary cultural practices in the Mojave Desert. Influence can take many forms, from migration to diffusion. Combining the cultural traits described above with the paucity of shellfish in collections from Middle period riparian and bluff-top sites, the preference of stone over shell for beads, and mortuary practices focused on cremation, leads us to hypothesize that this influence took the form of an actual migration.

A desert-to-coast migration conjures up the long-debated issue of when Takic speakers arrived in coastal California (Koerper 1979; Kroeber 1925; Moratto 1984; True 1966). Traditionally, archaeologists have argued that Takic speakers moved out of the Great Basin and Mojave Desert toward the coast around A.D. 500. These "Shoshonean" groups settled in the Los Angeles Basin and surrounding regions, thereby driving a wedge between indigenous Hokan speakers, the Chumash to the north and the Diegueño to the south. The Takic speaking groups supposedly brought with them a distinct cultural package, highlighted by the bow-and-arrow, cremation, and pottery.

Others have suggested that the Takic intrusion took place much earlier. In perhaps the best articulated argument along these lines, Koerper (1979) points out that changes in material culture of a similar magnitude to those hypothesized to have occurred around A.D. 500 also took place much earlier in the archeological record. More importantly, at the time of Spanish contact, social groups in the California Bight shared many aspects of culture, language, and social organization. To reconcile the similarities in culture with the difference in language families, Koerper forwarded the hypothesis that the Takic migration needs to be pushed back several thousand years.

We suggest that both arguments may be correct. In a different setting, Altschul and his colleagues (1998:17) forwarded this position:

Part of our problem as archaeologists may be that, by focusing on specific events, we have failed to perceive the underlying fluidity of regional relationships. By framing the problem as

an event, we may be blind to the possibility that it was not a migration, but instead, many migrations during a long period of time.

Evidence from the Ballona certainly supports this contention. Van Horn (1990) argues that the Marymount point is part of a bow-and-arrow technology that reached the Ballona through a migration from the desert around A.D. 500. His argument is based on the fact that most Marymount points are arrowpoints and proportionally more were recovered in the upper 60 cm of deposit at bluff-top sites than in the lower part of the midden. This proposed migration, however, cannot be the only one. Most desert traits—material culture, burial and subsistence practices—appear in the archaeological record beginning around 3000 B.P. and persist throughout the Middle period. Indeed, what is striking about Middle period middens in the Ballona is that they lack obvious stratigraphic breaks; they do not exhibit sharp changes in material culture, and they reflect strong continuity in adaptive practices.

The Late Period

The Late period in the Ballona begins at approximately A.D. 1000 and ends with the Portolá expedition in 1769. Only one Late period site, the Admiralty site (LAN-47), has been systematically excavated (Altschul et al. 1992). Limited excavations have been performed a number of times at the Peck site (LAN-62), with the first investigations conducted in 1947 (Peck 1947) and the latest in 1998 (Altschul et al. 1998). Excavations also have taken place in the vicinity of the Peck site at LAN-211 and LAN-2676 (see Altschul et al. 1998). Based solely on surface artifacts, LAN-54 also has been hypothesized to date to the Late period (Altschul et al. 1991).

Not surprisingly, our knowledge of the Late period is limited. The Admiralty site is interpreted as the locus of a series of seasonal camps, located on the shore of the lagoon. Subsistence focused on plants and animals of the marsh and near shore, including shellfish, fish, small mammals, birds, and plant resources; very little indication of pelagic resource use was found. The material culture of the site was typical of coastal middens of this time period, with a strong emphasis on local lithic material. Disc *Olivella* sp. beads were common and stone beads were rare. Burials took the form of inhumations.

The excavations at the Admiralty site informed on material culture and subsistence, but in many ways the study left larger issues surrounding Late period settlement and culture untouched. In particular, issues of settlement population or permanence have not been addressed. For years, we have argued that the key to

understanding these issues resides in the Peck site (see Altschul and Ciolek-Torrello 1990). The Peck site is the most viable candidate for a village (i.e., permanent residence of 100 or more people) in the Ballona (Peck 1947; Van Horn et al. 1983). This site has by far the best-developed midden, and contains a greater diversity and density of artifacts and faunal remains than any other site in the Ballona (Altschul et al. 1998).

If a village was established in the Ballona, then the estuary would fit the prevailing model of Late period settlement in the Los Angeles Basin (e.g., Hudson 1971). This inference is based on ethnohistoric accounts that the Gabrielino lived in settlements of between 150 and 200 individuals at the heads of estuaries and along major creeks (see Bean and Smith 1978; Hudson 1971). Uncritically extending the ethnohistoric record into the past, however, is a dubious practice (see Altschul 1991). The village model is untested with archaeological data. Furthermore, we have argued that a village-based model probably only held for major estuaries, and that minor ones, such as Alamitos Bay and the Ballona, more likely were characterized by a dispersed, *ranchería*-type settlement (see Altschul 1994; Altschul and Grenda 2002).

The key to unlocking the Late period in the Ballona lies in the Peck site. Although limited excavations have been conducted on three separate occasions, we still know very little about the deposit. No one has actually reached the bottom of the midden, and the extent of all excavations has been extremely limited. Much of the problem stems from the burial of the site under 4 m of fill as part of the development of the Hughes Aircraft Company's Culver City plant. Using a bucket auger, we were able to characterize different parts of the site (Altschul et al. 1998). Based primarily on shell beads, we infer that the site was occupied beginning in the Middle period and extending throughout the Late period, perhaps into protohistoric times. We still do not know what type of site is represented, or its developmental history. Two hypotheses have been developed to structure future research. The first postulates that the Peck site represents the same type of site as documented elsewhere in the Ballona: a seasonal or multiseasonal camp site. In the absence of stratified deposits, the Middle period occupation at the Peck site does not appear significantly different from the Late period one. It is possible, then, that the site type and settlement pattern established in the Middle period continued through the Late period. Instead of an aggregated village, the Peck site may represent a favored locale in a dispersed *ranchería* model in which domestic groups lived permanently within the Ballona, but shifted settlement as they exhausted local resources.

If the Peck site does not represent a Late period village, then the Ballona probably witnessed a significant reduction in population between the Middle and Late periods. From Middle period occupations covering much of the length of the bluff tops and banks of Centinela creek, Late period settlement is limited to a small number of discrete sites on the lagoon edge. More difficult to explain than decreasing numbers of sites is the abandonment of the bluff tops and upper Centinela creek. In 1990, we suggested that these areas were abandoned as the wetlands matured and allowed occupation closer to the lagoon edge. The Middle period occupation of the Peck site and lower Centinela Creek demonstrate that these areas were suitable for human occupation much earlier than we supposed. Moreover, paleoenvironmental studies indicate that if anything the riparian areas along the creek and the grasslands on the bluff tops would have been more attractive in the Late period than before.

A declining population in the Ballona during the Late period goes against traditional notions of cultural evolution in the southern California Bight. In general, the trend in southern California coastal areas is for increasing population size and density (Altschul and Grenda 2002). Population increase is often purported to be a causal agent leading to territoriality, village life, and social complexity. As described above, paleoenvironmental studies suggest that biological resources favored by humans would have increased through time as the open bay evolved into an estuarine lagoon. Why would human use of such a valued resource decrease, especially during times when similar resources are being fought over?

One possibility is that changing regional climatic conditions counteracted the effects of a maturing estuarine lagoon. Kennett and Kennett (2000) have presented a high-resolution marine climate temperature reconstruction based on a core from the Santa Barbara Channel. They argue that between around 3000 and 1500 B.P. (1050 B.C.-A.D. 450) water temperatures were relatively warm and stable. These data suggest that for the period of intense Middle period occupation, the coast, and thereby, the Ballona, would have been subject to an increase in precipitation. The subsequent period between about 1500 and 650 B.P. (A.D. 450-1300) was characterized as one of the coldest and most unstable marine intervals of the entire Holocene. On the coast, this period would have witnessed relatively low and quite variable precipitation. If these climatic events at the end of the Middle period were combined with tectonic processes that caused the Los Angeles River to flow south to Long Beach, thereby bypassing the Ballona, it is quite possible that the biomass of the Ballona Lagoon would

have decreased dramatically; in some years, the wetlands would have dried completely. Such climatic fluctuations would also have impacted vernal pools that may have existed on the bluff tops. The increased precipitation of the Middle period would have enhanced the productivity of these pools, while low precipitation at the end of this period would have reduced this resource. Abandonment of the bluff tops and concentration of settlement at the edge of the lagoon can be viewed as a likely outcome of such environmental changes.

Another answer may lie in changes in the social environment. The Ballona lies at the historical boundary of the Chumash and Gabrielino territories. As the Chumash culture evolved into a series of chiefdoms to the north of the Ballona, areas on the fringe of Chumash territory may have been threatened. Similarly, the Ballona may have been susceptible to pressure from more powerful Gabrielino neighbors in the larger estuaries to the south. The long-established east-west nexus between the desert and coast may have provided an easy route out of the Los Angeles Basin. Sandwiched between Chumash chiefdoms at Malibu and powerful Gabrielino groups along the Santa Ana River, no group may have felt strong enough to reestablish permanent settlement in the Ballona.

The alternative working hypothesis is that population in the Ballona did not decline, and settlement shifted from a dispersed, rancheria pattern to an aggregated village at the confluence of Centinela Creek and the Ballona Lagoon. In addition to the Peck site, two other large Late period deposits exist in the immediate vicinity. LAN-211 is located along Centinela Creek about 250 m upstream from the Peck site. LAN-2676 is a similar distance from the Peck site, but to the north, situated on the opposite bank of Centinela Creek and lying on the lagoon shore. Together the three sites may represent distinct loci of a large Late period community. The fact that they are spatially segregated may indicate that social distance, although decreasing, was maintained. The three sites may reflect three social groups on their way to becoming a single social entity. As the size of the social group increased, the need for a political hierarchy may have emerged. Support for distinctions in social position are meager, but intriguing. Of the 67 shell beads recovered from LAN-62 in 1998, 10 were typed as *Olivella* wall disc beads, which King (1974) associates with burials of political leaders.

In short, we are no closer to unraveling the structure and size of Late period occupation of the Ballona than we were in 1990. We have developed two diametrically opposed working hypotheses to account for the dramatic

changes in the archaeological record. Data to test these hypotheses lie in the Peck site, and until archaeologists systematically excavate this deposit, all we can do is speculate.

The Protohistoric and Early Historical Periods

Perhaps the most unexpected archaeological finds of the last decade relate to the protohistoric (A.D. 1769–1800) and early historical (A.D. 1800–1850) periods. These periods have long been controversial in the Ballona. Kroeber (1925) first recorded the Gabrielino placename, Sa'an, for the Ballona. Later Swanton (1952) and Johnston (1962) transformed this placename into a village name, Sa'angna. Archaeologists have searched for a site matching the description of a village, to no avail (see Dillon et al. 1988; King and Singer 1983; Stickel 1988). Of the thousands of cubic meters excavated at bluff-top sites, the only evidence of protohistoric use takes the form of three trade glass beads found at LAN-63 (Van Horn 1987). The most substantial historical period deposit in the Ballona was recovered at the Hammack Street site (LAN-194), where King (1967) found a variety of historical-period artifacts, including Mission ware, cream ware, glass, and iron, as well as cattle and horse bone, dating between 1825 and 1850. King argued that these remains most likely reflect Indian laborers who worked on the Rancho La Ballona, which was established in 1839, or "Indians who were raiding horses and cattle and living in the marshes bordering the lagoon" (King 1967:13).

The lack of archaeological evidence, and the absence of baptismal and death records that might indicate a Gabrielino village in the Ballona, led Johnson (1991) to conclude that Sa'angna is either a Gabrielino placename for the Ballona or the Gabrielino name for a settlement of Indian laborers associated with one of the historical-period ranches in the region. Subsequently, McCawley (1996) reviewed linguistic data and Van Horn and White (1997b) examined ethnohistoric data, both coming to essentially the same conclusion as Johnson.

Recent investigations at Playa Vista have encountered evidence of substantial protohistoric and early historical period use. Mission period shell beads have been recovered at the Peck site and LAN-211 (Altschul et al. 1998; Erickson 1998; Freeman et al. 1987). Similar beads along with two radiocarbon dates from LAN-2676, located at the edge of the lagoon, suggest a portion of this largely Late Prehistoric period midden dates between A.D. 1450 and 1660 (Altschul et al. 1998). Mission period shell beads and glass trade beads have also been encountered at LAN-1932/H, a thin midden deposit located in the marshlands between

Ballona and Centinela creeks. LAN-211 also yielded glass beads in association with butchered bone in more substantial deposits. Dates are not yet available for either LAN-211 or LAN-1932/H.

It remains unclear whether the protohistoric and historical period remains are associated with the elusive settlement of Sa'angna or the later Rancho La Ballona. All the glass beads found in the Ballona postdate 1800, by which time most Indians in the Los Angeles Basin had been relocated to Mission San Gabriel. Robinson (1939), based on conversations with descendants of the Machado family, describes the huts of Indian workers located along Centinela Creek. This report is supported by the *diseño* for this rancho, which shows the locations of settlements along Centinela Creek that were used by Gabrielino ranch workers (Van Horn and White 1997c). These workers, however, should have had access to Mission ware and European artifacts, such as those found by King at the Hammack Street site. Such artifacts, however, are significant by their absence at the Centinela Creek sites.

SUMMARY AND FUTURE DIRECTIONS

Much of our early investigations in the region focused on the question of why people shifted their residences to the lagoon edge in the Late period after over 2,000 years of occupation of the bluff tops. We attributed this shift to a generalized adaptational response to changing local environmental conditions; that is, the transition from an open lagoon to a resource-rich estuary, as well as to demographic pressure (Altschul and Ciolek-Torrello 1990). In the last decade, paleoenvironmental studies have demonstrated that colluvial foot-slopes and small alluvial fans provided stable landforms in and around the wetlands much earlier than expected and archaeological investigations have found substantial Middle period settlements on these geomorphic surfaces at the base of the bluffs. The difference between the estuarine subsistence focus of the bluff-top sites and the more terrestrial subsistence strategy of stream-edge settlements has proved to be especially perplexing, and has forced us to question the dating of the bluff-top occupation. The Middle period is also an intriguing time because we can test notions of migration and adaptation of desert people to the coast. Key questions remain as to whether the Middle to Late period transition represents depopulation of the Ballona by desert people (perhaps a return to the desert), leaving the area open to new populations, or a major aggregation of the indigenous population at the Peck site, and the resulting integration of population into larger proto-Gabrielino culture. Finally, recent discoveries provide the opportunity to study the

protohistoric and post-Mission occupation of the Ballona. Although the nature of this late occupation is not entirely clear as yet, it does reveal an almost continuous record of human occupation in the Ballona over the last 5,000 years.

We close this paper with the research domains that will structure our future work in the Ballona. These are environment and human adaptation, migration, and social organization.

Environment and Human Adaptation

Much remains to be learned about the Holocene evolution of the Ballona wetlands. We are confident in the geomorphic reconstruction of the lagoon, but are less sure about the alluvial history of Ballona and Centinela creeks or the presence of vernal pools on the bluff tops. Further, our understanding of the evolution of biological communities in the region is weak. Pollen, mollusk, foraminifera, siliceous microfossil, and ostracode analyses have documented changes in salinity in the wetlands which can be used as proxies for shifts in plant and animal communities, but similar studies are lacking for the riparian zone or bluff tops.

Two periods stand out as critical for understanding human adaptation in the Ballona: the Middle period and the Middle-Late period transition. Currently, we are perplexed by the paradoxical distribution of faunal remains of the Middle period. Collections in the wetlands are characterized by terrestrial species and those on the bluff tops contain mostly estuarine species. By increasing the temporal resolution of both archaeological and environmental data for this period, we may be able to explain these counterintuitive faunal distributions. For example, it may have been the possible vernal pools, which provided waterfowl and plant resources, that attracted human settlement to the bluff tops. Estuarine resources may have been exploited from temporary camps on the lagoon shore and then brought back to the bluff-top settlements. Alternatively, we may be able to eliminate environmental factors as major driving forces in Ballona culture change. Subsistence practices may have been much more influenced by changes in technology than shifts in lagoonal or bluff-top resources. As Ballona residents changed from desert-adapted to coastal-adapted peoples, we would expect technological innovation as well as realignment of social structure.

Human adaptation in the Ballona cannot be understood solely from local environmental conditions or technological change. Kennett and Kennett's reconstruction suggests that regional climatic conditions, if combined with tectonic processes, could

have severely downgraded resource availability in the Ballona at the end of the Middle period. Less intense use of the wetlands, with settlements placed directly on the lagoon edge, might have occurred, leading to the archaeological record that we observe for the Late period.

We hasten to point out, however, that an unstable Late period climate would only make coastal estuary resources more valuable than they were previously. If tectonic processes did not affect Ballona Creek and it continued to flow into the lagoon in the Late period, then the estuary would have been extremely attractive to humans. Regional abandonment in this case could only be explained through social factors. Aggregation and political centralization also is largely a socially driven process, albeit one that is expected, given regional environmental and social factors.

Migration

An intriguing aspect of Ballona archaeology is the possibility of studying a critical event in southern California prehistory: the Takic migration, or migrations, from the Mojave Desert to the Pacific coast. During the Early period, people using the Ballona appear to have been part of a general coastal hunter-gatherer-fisher adaptation. This adaptation was based on small, mobile groups using a simple technology and remaining in particular coastal areas for short periods before moving on to the next estuary or bay. Middle period settlement presents a sharp contrast to this pattern. Within a relative short period, all habitable portions of the creek edges and bluff tops were settled. Occupations were intense enough for middens to develop, suggesting that, minimally, sites were occupied seasonally on a repeated basis. Cultural practices also changed. Material culture, mortuary practices, and economic activities evidence patterns that appear to emanate from the Mojave Desert and Great Basin. The regional scope of these patterns appears quite limited. The Marymount point, one of the hallmarks of the desert pattern, has been found at a relatively small number of sites extending from Malaga Cove on the south to the Santa Clara River drainage on the north (Van Horn 1990). Although Marymount points have been found throughout much of the Los Angeles Basin, nowhere outside the Ballona has a suite of desert cultural practices been documented for an entire settlement system. The most likely explanation of the archaeological record in the Ballona is that it represents a migration of a desert population to the coast around 3000 B.P. The groups may have been preadapted to evolving coastal wetland environments, such as the Ballona. With a subsistence strategy geared toward pluvial lakes, they arrived in the Ballona to find a

shallow lagoon that was similar in many ways to the lacustrine environments they had left. An east-west oriented cultural system may have developed that facilitated movements of people and technology between the desert and coast for the next 2,000 years.

We have taken the documentation of the Middle period in the Ballona to be one of our primary objectives. Although migration is often used as a causal agent in explanations, documented cases in the archaeological record are rare. This is particularly the case among hunters and gatherers, who leave little in the archaeological record to signal such events (see Madsen and Rhode 1994). Although discussing migration to the east, Sutton's (1994:134) conclusions apply as well to the California coast.

The western Mojave Desert, in the southwestern Great Basin, is a prime candidate for the homeland of Numic populations prior to their expansion across the Great Basin. As such, the Mojave Desert should contain the archaeological record for the initial arrival of Northern Uto-Aztecan, the divergence of NUA into its proto-families, the movement of Hopic to the Southwest, and the divergence and expansion of both Takic and Numic. In spite of the potential, the known record of the Mojave is meager and difficult to interpret.

The Ballona, by contrast, appears to contain intact deposits that document a 2,000-year link between populations in the Mojave Desert and Pacific coast. Exploring this record may provide answers to a myriad of theoretical and regional questions. For example, how large were the territories of Middle period hunter-gatherer groups? How often did these groups use different portions of this territory? How did they defend their territory, and how was access to specific resources maintained? As coastal wetlands became increasingly attractive and the pluvial lakes of the desert began to dry, did territories shrink and movement become unidirectional?

Social Organization

The changes in social organization that occurred from the Middle through the historical periods is vital to understanding local culture history and regional cultural dynamics. Various conceptions of society have been offered for the Middle period. All attempt to reconcile the paradox of finding extremely large and thick midden sites that span the entire bluff top and creek edge with traditional models of early hunter-gatherers of the California Bight as small, mobile groups. Thus far, models have largely avoided questions of the type of social organization best suited for these groups and how that organization evolved over time. The lack of interest among archaeologists is

puzzling, given the rich ethnohistoric and ethnographic literature (e.g., Harrington 1933, 1942; Johnston 1962; Kroeber 1925; McCawley 1996; Strong 1929).

The Los Angeles Basin may provide an intriguing example of the evolution from lineage to clan organization. The transformation from localized lineages to clans was first discussed by Steward (1955). He argued that in areas characterized by low productivity, social groups are small and mobile, and organized at either the family or band level. As food supply increases either through changes in technology or environment, human populations increase in size and density. Society splits into either larger bands and lineages occupying the same territory, more small groups each occupying less space, or multi-lineage villages in which former localized groups live together. Multi-lineage villages increase in size if war or migration forces them to accept dislocated bands and lineages, or if population growth continues unabated and lineages cannot split off from their parent villages. Clans will form in these aggregations of unilateral groups if possession of a group name, common ceremonies, or other processes create intergroup solidarity and prevent a loss of kinship recognition in succeeding generations. Transformation to a clan-based system is complete when political autonomy transfers from the localized lineage to a larger group.

Although developed to explain cultural evolution in the American Southwest, Steward's argument may be useful for explaining aspects of Ballona archeology. We suspect that prior to the Middle period, the Ballona was visited by bands who exploited the resources of the developing wetlands with relatively simple technology that they used in exploiting inland wetlands. Low productivity precluded these groups from establishing camps of long duration. At the onset of the Middle period, one or more bands originating in the desert moved into the Ballona. As the wetlands evolved, more bands from the desert moved into the region. Throughout the Middle period, these bands probably kept their autonomy by dispersing around the edges of the creeks and lagoon, and on the bluff tops. Population was kept at levels below the carrying capacity by bands moving back and forth to the desert. By the onset of the Late period, the wetlands had matured so that a permanent, aggregated population could be supported. Tribal dislocation may have been a prime factor in aggregation. The switch from multilineage settlement with a desert-coast cultural affiliation to a clan-based, coastally oriented society may have occurred in concert with the development of political centralization and social stratification associated with the protohistoric and ethnohistoric tribes of the region.

Data needed to test this formulation will be found in the material culture, site structure, mortuary practices, and faunal collections of the numerous sites that exist in the Ballona. Our data recovery efforts will by necessity focus on those sites that lie in the path of development. Success in interpreting Ballona archaeology, however, will require us to place these materials in their proper context. Archaeological investigations will have to be comparative in nature, and will require us to reexamine collections recovered by previous investigators. The success of Ballona archaeology in the next decade will be measured by how well we meet the challenge of designing field and analytical strategies for the sites in the wetlands and integrating the results with new insights obtained from old collections from the bluff tops.

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