HUNTER-GATHERERS IN THE MORRO BAY WATERSHED 3650 YEAR AGO: SETTLEMENT, SUBSISTENCE AND TECHNOLOGY DURING AN ARCHAEOLOGICAL POINT IN TIME

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This study examines ten prehistoric sites from the Morro Bay watershed linked by tight contemporaneity. This provides an excellent opportunity to compare assemblages from sites that were occupied at around the same time. Tight bracketing of dates makes this suite of sites unusual, and the resulting information provides a glimpse at how hunter/gatherer families addressed subsistence and settlement issues during a specific time period. We can use this knowledge to better understand what adaptations were derived from the more distant past and what possible directions the indigenous cultures took later in prehistory.

A settlement pattern or typology was immediately apparent when reviewing these sites. Four distinct settlement types were recognized based on their location and assemblage composition. These types appeared to correspond with the four site types identified by Jon Erlandson (1997) for the Middle Holocene Santa Barbara Channel region (Table 1).

SITE CHRONOLOGY

Radiocarbon dating and, to a lesser extent, obsidian hydration techniques were used to date the Morro Bay watershed archaeological sites, summarized in Figure 1. Site dating was based on rtadiocarbon dating and obsidian hydration results. Measured radiocarbon years were used for comparison since specific information could not be obtained for some of the samples. Despite the absence of calibration results, the dates are still considered to be near the actual date of the sites. Two sites were dated based on obsidian hydration evidence alone, as they are located where organic preservation is poor and no charcoal was available. Some sites contained evidence of additional occupation before and/or after the Middle Holocene. Multi-component sites included SLO-14, SLO-165, SLO-978, SLO-1647 and SLO-2023, which contained artifacts indicating they were occupied primarily during the Middle Holocene but also during earlier and later periods. Current evidence suggests SLO-977, SLO-1212, SLO-1305, SLO-1443, and SLO-1795 were occupied strictly during the Middle Hoilocene time period discussed in this study.

ENVIRONMENTAL SETTING

The Morro Bay watershed contains a wide variety of habitats and vegetation communities. The location of these habitats and the resources they supported were critical in determining locations of settlement types. The habitat associations of study area archaeological sites are listed in Table 2.

Littoral Zone

The watershed ends at the coastline. Most of the shoreline is sandy beach with some offshore reefs. Morro Rock provides a large isolated rocky shore location with fish, shellfish, sea mammals, and shorebirds unique to this area.

Estuary

The estuary is the heart of the watershed around which most resources and human habitation was centered. Numerous plant and animal species are located in and around this body of water. In addition to the estuarine flora and fauna, a wide variety of other habitats surround the estuary.

Dune Scrub, Chaparral and Grassland

Extending over stabilized dunes surrounding the estuary and occurring throughout the watershed in well drained or shallow soils, these vegetation communities provided seeds and tubers as well as

Table 1: Erlandson's settlement model.

Site Type	Characteristics
Primary Villages	Residential bases with relatively permanent structures and features associated with them.
Secondary Villages	Residential bases with evidence of a less intensive occupation, but displayed the wide range of activities found at the Primary village Sites.
Lithic Sites	Occupations dominated by chipped and groundstone tools, including hammers and flake tools. Organic remains, such as bone and shell, are rare or absent altogether.
Temporary Campsites	Brief occupations focussed on resource processing, often of shellfish, located where a narrower range of seasonally abundant resources could be obtained.

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Proceedings of the Society for California Archaeology, Volume 19, 2006, pp. 211-219

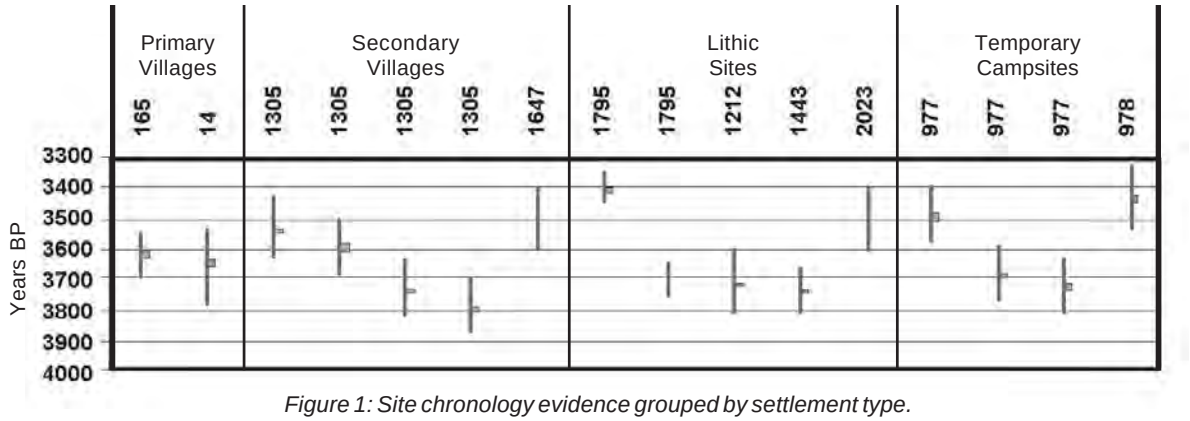


Figure 1: Site chronology evidence grouped by settlement type.

supporting large numbers of deer and rabbit, the top prey species during this period.

Riparian Corridors

Branching throughout the watershed is a network of streams, springs, ponds, marshes and creeks. Besides providing crucial freshwater, they also supported important plant communities, attracted game and provided habitat for turtles, waterfowl and anadromous fish, such as steelhead. Watercourses were also used as trails to move up and down the watershed.

Xeric Communities

A rather unique habitat occurs throughout the watershed. Along serpentine exposures and ridgelines, xeric adapted plants, such as yucca and other succulents, thrive. Many of these plants were important food items and game also frequents these locations. Numerous prehistoric sites have been identified in this setting, including Lithic Sites dating to the period in question.

Uplands

Reaching up to elevations of 2500 feet, the uplands surrounding the watershed provide the last piece to the puzzle of resource distribution. Cypress, pine and manzanita woodland, interspersed with meadows, provided an occasional alternative to lower elevation resources. These areas were also traversed to maintain social and economic ties with the interior.

FOOD RESOURCES

In order to gain a better understanding of the logistical considerations faced by early hunter/gatherers when determining settlement location, food resources must be considered foremost. Food resources around the estuary were the most diverse and abundant in the catchment area. Sea mammals are both year-round residents and seasonal migrants. Waterfowl and shorebirds appeared in dramatic numbers, especially through the winter months. As a nursery for young fish, a staggering number of fish species congregated at the estuary throughout the year. Shellfish adapted to muddy bottom, sandy bottom and rocky substrate could be found in and around the estuary providing a rich and varied addition to the diet.

Terrestrial prey included large game, such as mule deer and tule elk but smaller game, especially cottontail, brush rabbit and jackrabbit consistently played important roles in the overall diet. The proposed small catchment that the human populations utilized favored small game that could reproduce more rapidly and rebound more effectively

Table 2: Habitat associations of study area archaeological sites.

Trinomial	Site Type	Location/Environment	Resource Association	Reference
SLO-165	Primary Village	North edge of Estuary at Creekmouth	Littoral, Estuary, Riparian, Grassland, Chaparral	Jones et al. 1994Mikkelsen et al 1998
SLO-14	Primary Village	South edge of Estuary at large spring	Estuary Dune Scrub, Chaparral, Riparian	Parker 1996
SLO-1305	Secondary Village	Coastal Valley – knoll overlooking Morro Creek	Chaparral, Grassland, Riparian, Xeric	Jones et al. 1994
SLO-1647	Secondary Village	Coastal Valley – knoll overlooking Chorro Creek	Chaparral, Grassland, Riparian, Xeric	Roper et al. 1996
SLO-1795	Lithic Site	Stabilized dunes overlooking south end of estuary	Dune Scrub, Chaparral, Riparian, Estuary	Bertrando 2004
SLO-1212	Lithic Site	Stabilized dunes overlooking south end of estuary	Dune Scrub, Chaparral, Riparian, Estuary	Bertrando 2000
SLO-1443	Lithic Site	Coastal Valley – knoll overlooking Morro Creek	Chaparral, Grassland, Riparian	Jones et al. 1994
SLO-2023	Lithic Site	Coastal Valley – knoll overlooking Chorro Creek	Chaparral, Grassland, Riparian, Xeric	Carpenter et al. 2003
SLO-977	Temporary Camp	Sandspit between ocean and estuary	Littoral, Estuary, Dune Scrub	Dallas 1992
SLO-978	Temporary Camp	Sandspit between ocean and estuary	Littoral, Estuary, Dune Scrub	Gibson 1981

from intensive hunting. Other approaches to enhancing hunting efficiency may have included predation on large carnivores that actively competed for food with the Native Americans. Mountain lion, coyote and grizzly bear were all relatively abundant in the watershed. Although hunting these animals presented risks, the overriding benefits may have outweighed the costs.

Site	Winter	Spring	Summer	Fall
SLO-165 Primary Village	Bird Remains Fish Remains?	Botanical Remains Bird Remains	Botanical Remains Bird Remains Fish Remains	Botanical Remains Bird Remains Fish Remains
SLO-14 Primary Village	No Data	No Data	No Data	No Data
SLO-1305 Secondary Village	Fish Remains	No Data	Fish Remains	No Data
SLO-1647 Secondary Village	No Data	No Data	No Data	No Data
SLO-1443 Lithic Site	No Data	No Data	No Data	No Data
SLO-2023 Lithic Site	No Data	No Data	No Data	No Data
SLO-1212 Lithic Site	No Data	No Data	Groundstone	Groundstone
SLO-1795 Lithic Site	No Data	No Data	Groundstone	Groundstone
SLO-977 Temporary Campsite	No Data	No Data	Fish Remains?	Fish Remains?
SLO-978 Temporary Campsite	No Data	No Data	No Data	No Data

Table 3: Summary of seasonality indicators recovered from study area archaeological sites.

Seasonality indicators are summarixed in Table 3. Implications for plant use at sites include frequent groundstone implements, both millingstones and mortars. While paleobotanical remains are uncommon in Middle Holocene sites in the study area, they have been recovered from a coastal cotext at nearby SLO-165, which predates the time period considered here (Mikkelsen et al. 1998), and SLO-1384, situated along Chorro Creek, which appears to post-date the period considered in this discussion (Farquhar 1995). However, SLO-1384 is immediately adjacent to SLO-2023 (Lithic Site) and produced a diverse array of plants including oak, grey pine, elderberry, yucca, goosefoot, wild cucumber, chia, clover, tarplant, manzanita, needlegrass, fescue grass, native barley and Phacelia that may be indicative of plants exploited at SLO-2023. Again, this assemblage reflects the diversity of local resources and the efforts of the local population to take advantage of this diversity. This is another example of managing and maintaining the productivity of their relatively limited catchment area and territory.

Seasonality indicators for these sites remain poor, although the limited available information supports the overall settlement model (Table 3). Primary Villages were occupied throughout much of the year, Secondary Villages were occupied repeatedly throughout the year, and the Lithic Sites and Temporary Campsites were used at specific times during the year to target seasonally abundant resources.

Technology

The technologies represented at these sites provide an interesting glimpse into life around Morro Bay during the Middle Holocene. Among the findings were:

- All bowls from Lithic Sites were either broken or intentionally "Killed." Often they were also recycled as fire affected rocks
- Notched formal tools or "Spoke Shaves" were standardized in construction, representing formalized shaft production.
- A wide variety of projectile point forms were used during this narrow time period, but no apparent functional relationship can be discerned.
- Asphaltum was used in large amounts in the production of a wide variety of composite tools and was a critical component to the tool kit.
- Large rounded cobbles, consistently of dense material, were recovered with clear evidence of asphaltum wrapping and possible hafting (Figure 2). The function of these items has not been determined.
- Projectile points and late stage lithic debris appear to be spatially separate from ground stone items and large cobble/core tools.

Utilized Flake Tools

A pattern emerges among the utilized flake tools at SLO-1795 (Lithic Site). The average size of the flake tools was standardized across raw material lines (Table 4). In contrast, average raw material size, as denoted in the average debitage weight category, were quite disparate. This indicates that the utilized flake tools were manufactured for specific purposes, despite the low level of effort invested in their manufacture. This may contradict the typical interpretation of these tools being manufactured quickly and inexpensively on an "as needed" basis to perform a wide range of tasks. They may have been built in a standardized form to perform standardized functions.

Projectile Points

Diverse projectile points were found associated with many of the sites in this study. They have been classified as follows: contracting-stemmed, square-stemmed, leaf (or ovate), lanceolate and side-notched. Functional associations with these different point styles have never been well demonstrated. The one notable exception is that it has been suggested that the hafting application for the side-notched is different than the other varieties and is less dependent on adhesives, such as pitch or asphaltum. Following this reasoning, it could be assumed that the side-notched fell out of use as asphaltum became more integrated into tool manufacturing approaches.

Figure 2: Hafted cobbles from SLO-1212.

Figure 3 shows the distribution of different projectile point types at various site types. While diverse point types were common during this period, the contracting-stemmed points consistently dominated. The restriction of large side-notched points to SLO-165 is probably due to that site containing multiple occupations extending back to the Millingstone Period. The absence of side-notched points from the other sites that are more narrowly dated probably indicates that by around 4000 years ago, side-notched points had ceased being used in the Morro Bay Watershed. Again, the predominance of asphaltum at sites such as SLO-997, SLO-1212 and SLO-1795 would support this conclusion.

Table 4: Utilized flake tool metrics by raw material.

Raw Material	Debitage Average Weight	Utilized Flake Tool Average Length	Utilized Flake Tool Average Width	Utilized Flake Tool Average Thickness
Monterey Chert	0.68g	3.0 cm	2.4 cm	0.8 cm
Franciscan Chert	1.58g	3.0 cm	2.4 cm	0.9 cm
Shale	1.25g	3.0 cm	2.3 cm	0.7 cm
Basalt	0.90g	3.8 cm	2.9 cm	1.2 cm

Groundstone

Primary Villages and Secondary Villages contained roughly equal amounts of mortars and millingslabs with millingslabs being slightly more abundant (Figure 4). In contrast, Lithic Sites overwhelmingly contained mortars. Implications for the diet point toward a greater emphasis on fleshy or pulpy plants, such as acorns and bulbs, than the Primary Villages or Secondary Villages alone would suggest. This might mean that Primary Villages were occupied almost year-round and Secondary Villages were occupied in various seasons, as seasonality indicators suggest. Occupation of Lithic Sites was more limited and seasonally oriented. This new evidence of an early effort to collect and process plant foods, such as acorns, at locations that were probably occupied only during the day means that surplus foodstuffs were collected and processed away from the main settlement and brought back as storable foodstuffs. This logistical approach to food collection is a common behavior of chiefdom level societies.

SOCIAL AND SETTLEMENT MODELS

The settlement model forwarded by Erlandson (1997) is logistical. It centers on a main occupation that was tethered to satellite locations devoted to the collection and processing of a specific suite of resources. The Primary Villages were the principal residences occupied throughout the year, although abandoned at intervals for procurement forays by at least a portion of the population. Most social activities took place at these centers and most food processing, tool making and storage were restricted to these occupations.

Table 5 summarizes settlement evidence from the Morro Bay study sites. The Secondary Villages are perhaps the most difficult to describe. They display evidence of a variety of activities and some indication of persistent use. Seasonality indicators, while limited, suggest repeated occupation through more than one season. These sites may have served as temporary central locations for daily forays in areas removed from the Primary Villages. They may have also served as staging areas for more intensive collection activity at Lithic Sites and Temporary Campsites. Their occurrence in the settlement system indicates an additional tier in a simple logistic settlement strategy. The implication may include a need to increase carrying capacity of the territory by expanding the site catchment, a product of population growth. This is supported by the fact that they were always located significant distances from the Primary Villages.

Lithic Sites are somewhat unusual in that a diverse array of activities took place at these locations, but the evidence suggests that occupations were very brief, perhaps no longer than a single day. Activities focused on food procurement and, to a lesser extent, food processing. The remarkable lack of food remains, and the proximity of these sites to Primary Villages or Secondary Villages show that these locations were briefly occupied, perhaps only during the day,

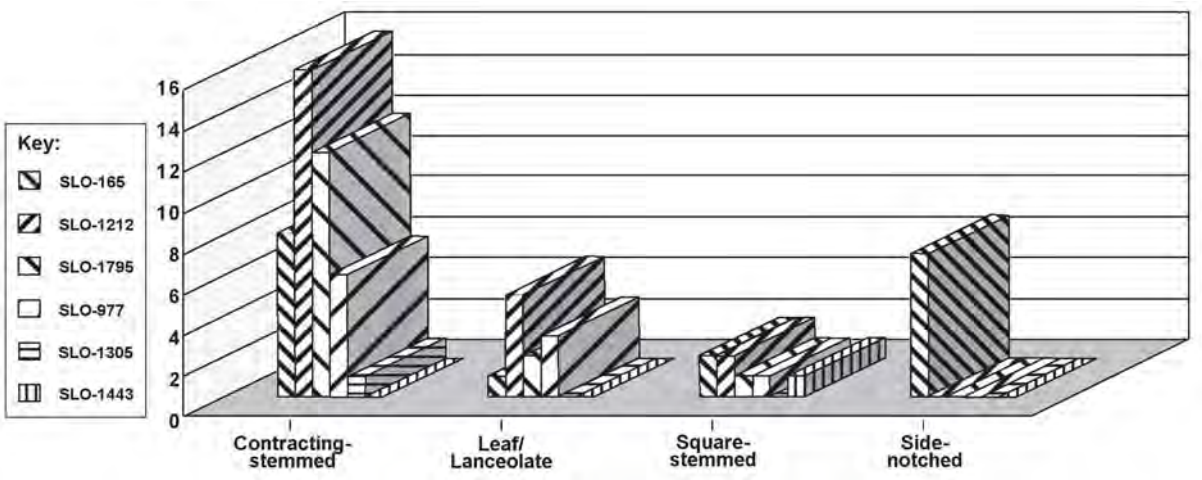


Figure 3: Distribution of projectile point types by settlement type.

and all food resources were removed from the site. The amount of artifactual material indicates that the sites were repeatedly used. The formation of distinct activity areas, divided primarily along gender lines, provides a glimpse into the division of labor of the society. It also implies that the entire population, or a representative sample of the population, used these sites. More specialized logistic mobility involving groups of specialists does not appear to be represented at these sites.

Temporary Campsites were simple intensive resource procurement locations. In the Morro Bay watershed they are represented only by sites on the sandspit where marine resources were actively exploited and asphaltum was collected. Occupations were necessarily brief, as no freshwater was available on the sandspit. They differ from Lithic Sites in that the food resources collected at those locations were consumed largely on site. This may be due to the fact that shellfish and fish could be easily consumed without much preparation, in contrast to certain plants. It may also reflect the fact that these marine resources were not as amenable to storage as were certain plant foods. While Temporary Campsites have only been identified along the sandspit, it is conceivable that other locations were exploited in a similar fashion but have yet to be identified.

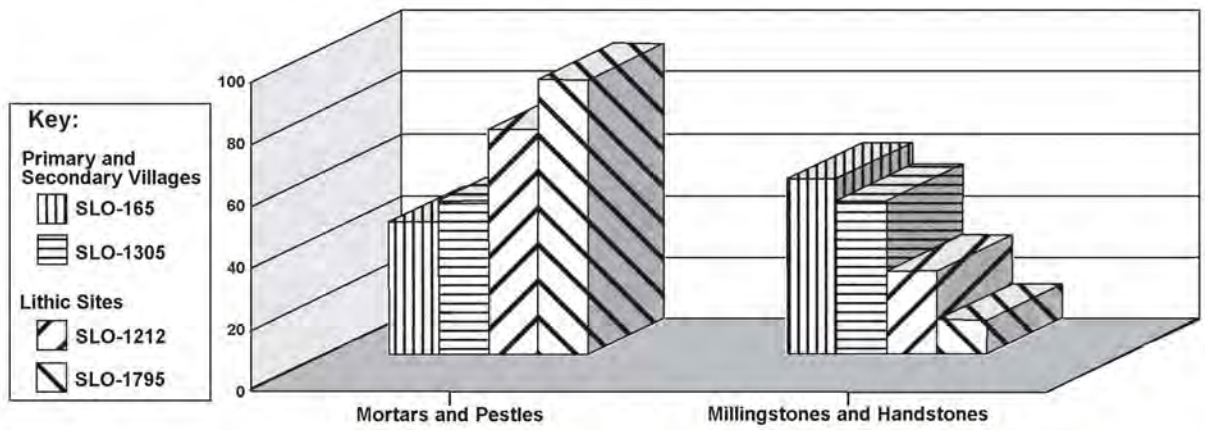
Forager/Collector Question

The examination of contemporaneous Middle Holocene sites in the Morro Bay watershed provides an opportunity to tackle one of the fundamental questions researchers ask when trying to solve questions regarding prehistoric hunter-gatherers; Were they Foragers or Collectors?

This question stems from early work conducted by Binford (1980) who noted that hunter-gatherers tend to follow one of two distinct approaches to resource acquisition. In its most simple terms, the Forager/Collector theory states that in some settings it would be optimal for hunter-gatherers to move to the resource (forager approach), while in other situations it is more beneficial to acquire the resources and move them back to the central occupation (collector approach).

Many factors were involved in determining these approaches, including; types of resources available, period of time in which they were available, how were they distributed over the landscape, what technologies were available to use in resource acquisition and degree of seasonality. To summarize, Collectors would tend to have larger

Figure 4: Distribution of groundstone types by settlement type.



populations, more diverse settlements types, more sophisticated toolkits, be more dependent on storage, develop more social complexity, develop more craft specialization and lean towards sedentism. Applying this model to the Morro Bay watershed 3,500 years ago cannot only establish whether these past populations were Foragers or Collectors but how they applied behaviors associated with these two different strategies.

Settlement, Catchment and Territory

Three models are proposed that each fit the settlement data for the Morro Bay Watershed(Figure 5). The exterior boundaries of the territories were arbitrarily determined by watershed. On the maps, the Primary Villages are depicted by black circles, the Secondary Villages by gray hexagons, the Lithic Sites by white squares and the Temporary Campsites by grey triangles. All three scenarios also assume a collector strategy, however, Each model has its implications and shortcomings. It is assumed that Population increased over time, which had implications to the degree of social complexity achieved by the group.

	Forager-Like Traits	Collector-Like Traits
Primary Villages	None	Task groups left the village to retrieve and return with resources. Later stage processing and consumption of resources occurred.
Secondary Villages	None	Task groups left the village to retrieve and return with resources. Later stage processing and consumption of resources occurred.
Lithic Sites	These sites supported a general population profile including complete social groups. A wide variety of resources were collected and processed that were available in the immediate vicinity.	Food resources were removed to more permanent occupations for consumption. There was an apparent focus on storable resources, such as large game and acorns.
Temporary Camps	These sites supported a general population profile including complete social groups. A wide variety of resources were collected and processed that were available in the immediate vicinity.	Duration of occupation was very limited since no freshwater was available in the vicinity. Specialized activities, such as bulk collection of asphaltum from SLO-977, would indicate transport to larger, more permanent settlements.

Table 5: Settlement evidence from the Morro Bay watershed study area grouped by site type.

In Figure 5A, the three primary watersheds are separated out into three territories. The known sites are presented with obvious gaps in the settlement patterns. One of those gaps may be filled by one of several sites identified in the vicinity of the question marks. This model provides access to the same array of resources and habitats for each of the three territories.

In Figure 5B, three contemporary populations exploited similar resources in three adjacent drainages. The delineation of this territory based on watershed boundaries ensured that each territory had access to a similar array of resources. The central territory extended across the bay to the sandspit to accommodate this habitat. By incorporating similar habitats, inter-group competition for resources would be reduced. The proximity of these territories would imply regular interaction but the size of each individual territory would place significant restrictions on the amount of population growth each territory could support.

In Figure 5C, a single population rotate between the watersheds as resources become over exploited. In this final scenario, the central territory is combined with the southern territory, a single population is hypothesized, and baseline populations could be significantly higher per site. The acreage and resource base for this proposed territory is substantial. This provides each territory with the diversity of site types anticipated during this period. One of the flaws with this model is that the Primary Village is not centrally located in the territory, unnecessarily increasing transportation costs and population movement. The southern Primary Village is re-categorized as a large Secondary Village. The Primary Village in the northern territory would also serve the requirements of a Temporary Campsite, based on its proximity to the estuary and sandy beaches thus fulfilling the requirement in the settlement pattern for a complete complement of site types.

Model 5C best accommodates the existing archaeological data, providing each territory with a complete suite of settlement types. The southern territory, being about three times the size, would support a considerably larger population than the northern territory. Being in such close proximity, it is likely that the northern territory would then be a satellite population politically/socially/economically linked to the southern territory as it is too small to likely achieve independence from its larger neighbor. This model, too, represents a collector strategy. The possibility of a hierarchical territory system and a necessarily complex political system would provide a setting sufficient enough to warrant the development of a more centralized political structure, like a "Chiefdom."

Model 5C considerably increases the catchment area of the population. Furthermore, it sets up a highly complex hierarchy of settlements. The large population and complex settlement system strongly suggests both a collector approach and a "Chiefdom" level political system. The associated larger population and more centralized authority would have led to greater development of specialization including craft specialists and religious specialists. These traits were more commonly associated with the later periods, but may have first emerged during the Middle Holocene.

ADDITIONAL SOCIAL IMPLICATIONS

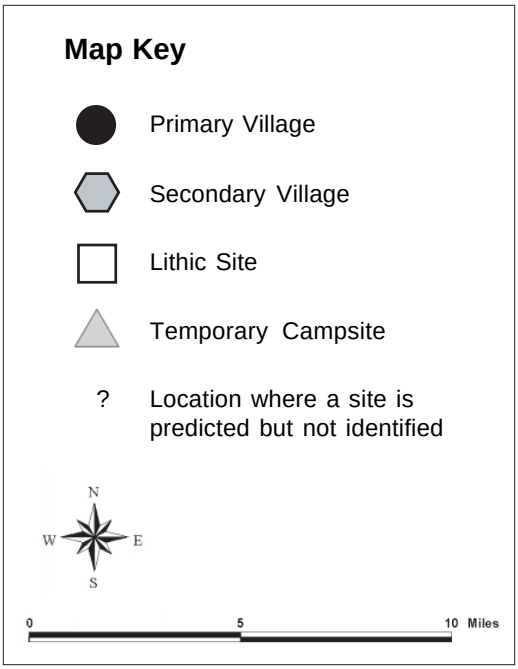
The data collected by this study also provided the opportunity to address other aspects of the culture, such as Craft Specialization, Gender Roles, and Technology.

Figure 5:

A Option 1, three contemporaneous territories.

B Option 2, two contemporaneous territories.

C Option 3, one unified territory.



Craft Specialization

The evidence for craft specialization during this time is slim, especially when compared to later periods. Certainly, individuals dedicated more or less of their own time to the production of specific items but there is no evidence of specialization or production for exchange. Regional evidence of extensive and intensive obsidian exchange, in which the Morro Bay watershed participated, may indicate emergent craft specialization but it appears to have played a small role in the overall economy.

Engendering Studies

Archaeological evidence from SLO-1212 (Lithic Site) indicates that division of labor based on gender was a common practice. Activity areas were spatially segregated into male areas, female areas and integrated areas. Male areas were identified as discrete locations rich in projectile points, late stage lithic debris and utilized flakes. Female areas contained higher frequencies of groundstone, especially mortars, and large cobble/core tools. The communal areas were characterized by a more midden-like soil, food remains and clear evidence of fire production and use.

Technological Innovation Influencing Behaviour

New tools appeared during this period, such as hafted cobbles (Figure 2), whose function is currently unknown but of apparent importance. Old tools vanished, such as large side-notched points which were replaced by an array of new styles. All these changes were tied to the integration of asphaltum into the toolkit, and it is clear that asphaltum was a vital component of the new technologies. Another possible benefit of this material was its use as a water sealant. Baskets caulked with asphaltum and used as water containers are known from the later time periods. However, waterproof containers may have been used in a similar capacity much earlier, which may explain why such water-poor areas as the sandspit and Los Osos dunes became important locations for the first time during the Middle Holocene. The diverse and intensive use of asphaltum clearly separates technological development of the Middle and Late Holocene from the Early Holocene.

CLOSING THOUGHTS

Settlement patterns apparent during the Middle Holocene had an underlying rhythm. Lithic Sites and Temporary Campsites were located in the immediate vicinity of seasonally-abundant food resources. Secondary Villages were situated the greatest distance from Primary Villages, and served as staging areas for collection events of prolonged durations, that is, of long enough duration to make travel costs from the Primary Village too high. Primary Villages occurred in the heart of resource rich locations characterized by the broadest diversity of environmental settings and resources available at the shortest distance. From an economic standpoint, this settlement pattern appears to have been viable.

This strategy also offers up an interesting spin-off of the Forager-Collector Model. The Primary Village anchoring this settlement system is a classic feature of the Collector strategy. The use of Temporary Campsites, where a narrow range of seasonally abundant resources were intensively collected, was also consistent with a Collector strategy. However, the Secondary Villages produced conflicting attributes. They were situated to logistically exploit various resources in a Collector-like fashion but served as centers for Forager-like exploitation of a broad diversity of immediately available resources. Lithic Sites also produced contradictory traits. While they were clearly used for the purpose of collecting and processing foods with the intent to return the foods to the Primary Village, a hallmark of the collector approach, the broad range of activities and clear representation of both sexes and all ages occupying these briefly occupied sites reflects a Forager approach.

The hypothesized small territory, together with repeated and patterned settlement types, offers an intriguing glimpse into Middle Holocene adaptations, a time when new hunting/fishing and plant processing strategies had replaced older Millingstone approaches and emerging social complexity foreshadowed complex cheifdoms commonly associated with the Chumash Late Period. Seasonally and spatially structured resource distributions triggered a demand for scheduling, logistic mobility and a more formalized decision making process in the society. While evidence suggests that all of these processes were in motion at that time, much needs to be learned about the factors influencing this changing direction towards increased social complexity.

Acknowledgements

I would like to thank Pat Mikkelsen and Terry Joslin for their diligence and perseverance in organizing the session that led to this paper. Terry also provided a valuable but thorough review of earlier drafts of this paper. Dustin MacKenzie, Christina Baker and my father, Luther Bertrando all assisted in the fieldwork that resulted in much of the data presented here. Dozens of other archaeologists have also applied their talents in the study area, and I am grateful for their scholarly work and collegial attitudes regarding the sharing of data. While much of the data incorporated into this paper is derived from others, the conclusions, including any inaccuracies (and accuracies, if any) are solely my responsibility.

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