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The Santa Clara Valley archaeobotanical record spans the central California Early, Middle, and Late periods. Sites CA-SCL-12, -478, -674, and -919 have robust assemblages of plant remains from distinct periods which are used here to evaluate alternative models of plant use in interior and bayshore settings. The interior model is a better fit for the Santa Clara Valley, even for the near-shore site SCL-12. The existence in the South Bay of poorer and more difficult to access aquatic faunal resources appears to explain the greater focus on plant foods there than in the East and North Bay.

MORE THAN 1,000 FLOTATION SAMPLES comprise the current archaeobotanical data on dietary plant remains around San Francisco Bay. By examining dietary plant remains recovered from 111 samples from sites CA-SCL-12, -478, -674, and -919, remains that span a period of 3,000 years, trends in dietary plant use can be predicted in the Santa Clara Valley. With an NISP of more than 22,000, there is sufficient data to confidently compare changes in dietary plant use in the Santa Clara sites with trends in sites found along San Francisco Bay.

BAYSHORE AND INTERIOR MODELS

Recent archaeobotanical research in central California has highlighted two divergent models of the evolution of plant use that can be tested against the trajectory of use of dietary plants in the Santa Clara Valley, immediately south of San Francisco Bay. The temporal scheme utilized here is the updated version of Scheme D of the Central California Taxonomic System, following Groza (2002), Milliken and Schwitalla (2009), and Groza et al. (2011). Temporal periods are divided into Early (5,000–2,450 years before present), Early/Middle Transition and Middle (with a combined range of 2,450–930 B.P.), and the Middle/Late Transition and Late Prehistoric (930–180 B.P.).

In the interior reaches of the greater San Francisco Bay area, the southern North Coast Ranges, and the

Sacramento Valley, Early period sites exhibit generalized plant use characterized by a relatively balanced use of plants, notably nuts and berries, with a lesser use of small seeds. Intensification of acorn use is seen in interior Middle Period central California sites, followed by a more intensive use of small seeds of annuals and grasses in the Late Period, in order to maintain denser and more sedentary populations in constricted group territories (Wohlgemuth 1996, 2004). Alternatively, shell mounds along the north and east shoreline of San Francisco Bay show a similar generalized use of plants during the Early Period, but with the advent of intensive shellfish use around 2,800 cal B.P., the amount of plant-food debris found drops dramatically, suggesting a decreased use of plants. Although shellfish data have not been compiled to show the advent of intensive shellfish collection in the North and East Bay regions, there is good evidence of this in two key localities. CA-MRN-67 has a broad stratigraphic change from the Stratum II “Bone Midden” with minimal shell to the Stratum III “Shell Midden.” The second example is found at Emeryville, with the change at 2,800 B.P. marking the beginning of occupation of CA-ALA-309, the largest shell midden in the San Francisco Bay Area (Wohlgemuth 2014). In the North Bay and in some areas of the East Bay, plant use rebounded in the last 1,000 years, with marked increases in acorn debris, while plant foods remained relatively unimportant in other East Bay localities, notably at the

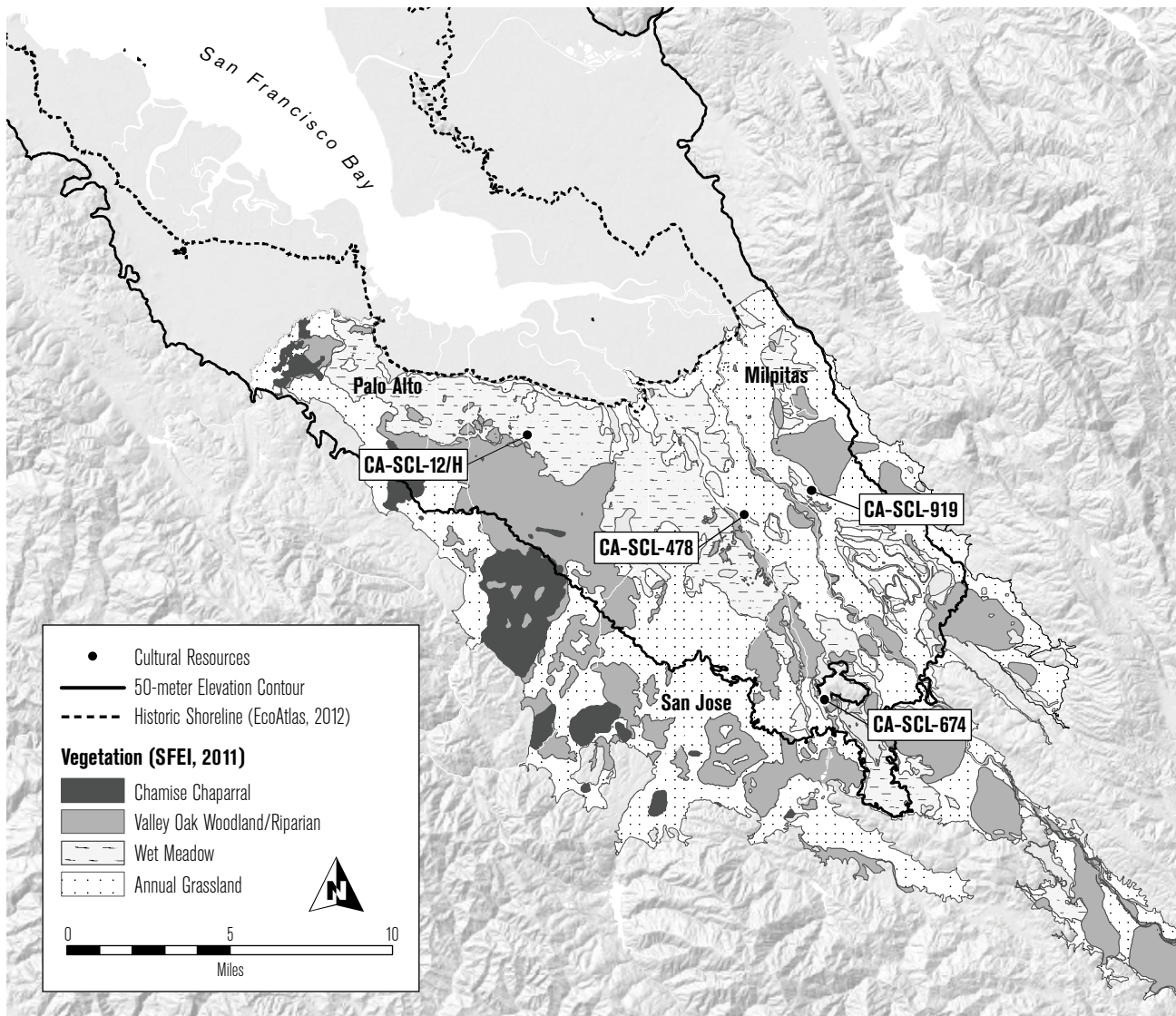


Figure 1. Vegetation map.

Emeryville Shellmound (Wohlgemuth 2014). Whereas the North and East Bay shorelines are adjacent to mussel and oyster beds and areas rich in small schooling fish, these more attractive marine resources were mostly lacking in the South Bay, where low-ranked horn shell (*Cerithidea* spp.) dominates shellfish assemblages, particularly in Late Period sites (Whitaker and Byrd 2014). With poorer access to productive shellfish beds and nutrient-dense marine resources due to the extensive saline wetlands and mudflats along the South Bay shore, we can expect that plant use in the Santa Clara Valley would resemble the interior trajectory of plant use over time.

Four archaeological sites located in the Santa Clara Valley have each produced a robust assemblage of plant

remains that collectively span most of the last 3,300 years, providing reliable samples dating to the Early, Middle, and Late periods. All are occupation sites with middens, features, and human remains, although Late Period SCL-919 is a smaller and less intensively occupied site. SCL-12, the Ynigo Mound, with discrete Early and Middle Period component areas, is located 2 kilometers from the shoreline and had access to oak woodland, wet meadows, coastal marsh land, and estuaries (Byrd and Berg 2009; Popper 1995). SCL-478, with habitats including riparian corridors, grassland prairie, and oak savanna (Popper 2002), is located 22 kilometers from the bay shore. This site and SCL-674, 30 kilometers from the shore and with access to a similar mix of habitats that

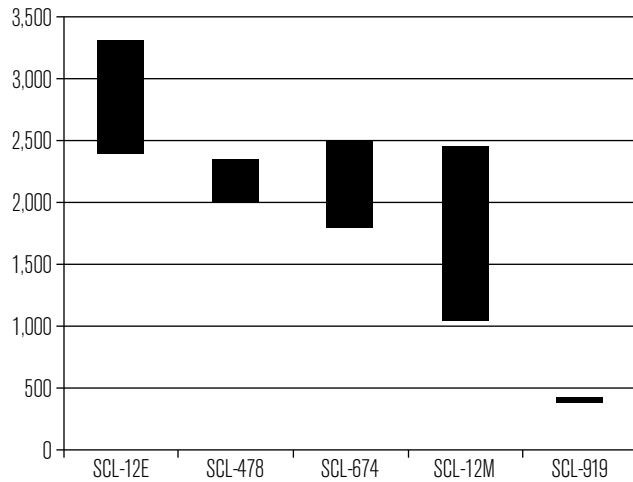


Figure 2. Radiocarbon date range (cal B.P.).

also included foothill communities, provide additional data for the Middle Period (Wohlgemuth 2007). Late Period site SCL-919 is located 10 kilometers from the shoreline and has a habitat similar to SCL-478, with marsh land, wet meadows, oak woodland, willow groves, and riparian areas (Kaijankoski 2013). While there are minor differences in habitat between the four sites (Fig. 1), all of them had access to productive oak stands and open grasslands or meadows. Habitat differences between sites therefore seem unimportant, although SCL-674, the farthest inland site, had more small seeds from drier settings than the other sites.

DATA SET AND ANALYTICAL APPROACH

The sites used for comparative analysis date from 3,300–2,400 cal B.P. for the Early Period, a range of 2,500 to 1,050 cal B.P. for the Middle Period, and 440–380 cal B.P. for the Late Period site (Fig. 2). Some 33 samples totaling 329 liters of sediment were analyzed from the Early Period component of SCL-12, a combined total of 56 samples and 262.3 liters of sediment from the Middle Period sites, and 30 samples comprising 155 liters of sediment from the Late Period, providing sufficient data sets to evaluate chronological changes in plant resource use in the pre-contact Santa Clara Valley (Table 1).

Acorn intensification has been quantitatively measured by increases in the proportion of acorn nutshell versus total dietary nutshell, and by the ratio of acorn nutshell (by weight) to the total density of small

Table 1
DATA SUMMARY OF SANTA CLARA VALLEY SITES

| | SCL-12E | SCL-478 | SCL-674 | SCL-12M | SCL-919 |
|---------------------------|---------|---------|---------|---------|---------|
| Acorn Percentage | 61% | 67% | 85% | 100% | 83% |
| Acorn: Small Seed | 0.39 | 0.38 | 4.82 | 6.67 | 0.23 |
| NISP | 3,435 | 1,472* | 3,451 | 240* | 13,820 |
| Number of Samples | 33 | 24 | 22 | 10 | 30 |
| Kilometers from Shoreline | 2 | 22 | 30 | 2 | 10 |

*Only small seed NISP Available.

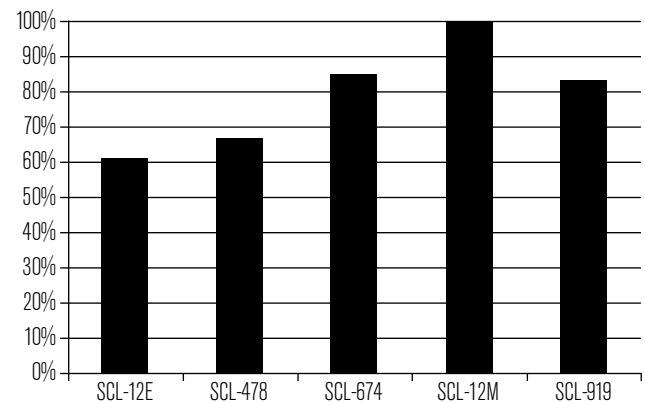


Figure 3. Acorn proportion of dietary nutshell for Santa Clara Valley archaeological sites.

seeds identified to genus, all expressed as densities per liter of sediment. Prior research in central California shows that assemblages of plant remains in Early Period sites contain a broad spectrum of seeds and nutshell, with a relatively low proportion of acorn in the dietary nutshell and low acorn:small seed ratios, whereas Middle Period sites display an increase in the relative abundance of acorn compared to other nutshell and in the acorn:small seed ratio. Late Period interior sites show continued high acorn proportions but a substantial drop in the acorn:small seed ratio, signaling an intensified use of small seeds as well as a heavy reliance on acorns (Wohlgemuth 1996, 2004).

SANTA CLARA VALLEY ARCHAEOBOTANICAL DATA

In the Early Period at SCL-12, acorn [*Quercus* spp.] was an important food, but only one of a diverse set of nuts consumed (Fig. 3). The relatively low proportion of acorn to total dietary nutshell is unique to the SCL-12

Early Period in the Santa Clara Valley sites. Islay [*Prunus ilicifolia*], buckeye [*Aesculus californica*], grey pine [*Pinus sabiniana*], and bay [*Umbellularia californica*] were relatively common among dietary nuts recovered from SCL-12 Early Period samples, and all are located in distant patches 5 to 15 kilometers to the west. The assemblage of the Middle Period component of SCL-12, however, yielded only local acorn debris, probably reflecting decreased group territory size and loss of access to foothill habitats. An identical pattern of extensive use of distant nuts at Early Period CA-ALA-312, followed by a Middle Period retraction at adjacent CA-ALA-309 to more proximate acorn, is also found in Emeryville (Wohlgemuth 2013).

The shift in focus to acorns in the Middle Period component at SCL-12 is also consistent with the acorn intensification seen in interior central California sites. A high acorn proportion is found at Middle Period SCL-478 and SCL-674. As SCL-478 samples were sorted only to the 1.0-millimeter grade for nutshell, while other sites were systematically sorted to the 0.7-millimeter grade, acorn proportion is surely underestimated at SCL-478. This is because the only other identified nutshell at SCL-478 is bay nut, which is more durable and is found less in the 0.7-millimeter grade than more friable acorn nutshell. The percentage of acorn to other dietary nutshell for Late Period SCL-919 is similar to those of the Middle Period sites, showing the relative lack of nut diversity and the clear reliance on acorns.

The Early component of SCL-12 has a very low acorn:small seeds ratio of 0.38 compared to its Middle Period counterpart, where it increases dramatically to 6.7, showing a Middle Period increase in acorn use without a concomitant rise in the use of small seeds (Fig. 4). This is paralleled by a similarly high acorn:small seed ratio at SCL-674. Since nutshell was only sorted to the 1.0-millimeter grade at SCL-478, the ratio would be substantially higher than the SCL-12 Early Period value. Conversely, the SCL-674 acorn:small seed ratio is somewhat inflated due to sorting small seeds only to 0.7-millimeter grade. Collectively, however, there still appears to be good evidence of an intensified use of acorn with respect to small seeds during the Middle Period compared to the Early Period at SCL-12. The substantial drop in the ratio at SCL-919 corresponds to findings at other interior Late Period central California

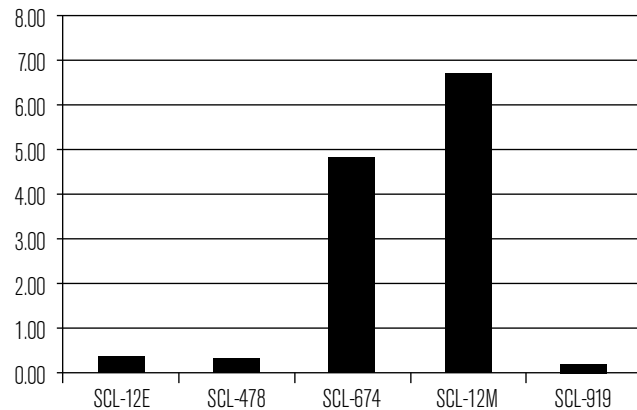


Figure 4. Acorn to small seed ratio for Santa Clara Valley archaeological sites.

sites, representing a shift of plant resource focus to include both small seeds and acorns. Santa Clara Valley sites show the same sequence of initial generalized seed and nut use that is supplemented by an acorn dominant diet, and that culminates with small-seed intensification in addition to an intensive use of acorns, to presumably provide for progressively larger and more sedentary populations.

DISCUSSION

Archaeobotanical data from a 3,300-year sequence in the Santa Clara Valley show that the interior pattern of a stepwise intensification of acorns followed by small seeds fits far better than the model of Middle Period plant de-emphasis from the North and East Bay shoreline. The interior model of changes in plant use and intensification is reflected in the Santa Clara sites and archaeobotanical data, starting from the Early Period more generalized diet of seeds and nutshell to the Middle Period sites with a significantly increased use of acorn with respect to both small seeds and other dietary nutshell. The Late Period site shows low-ranked small seed intensification. This is not surprising given the interior location of most sites sampled and the poorer marine habitat of the South Bay. But even at near-shore site SCL-12, the Early to Middle Period shift matches the sequence of interior central California. The SCL-12 Middle Period component parallels the interior Middle Period sites of SCL-478 and -674, with no evidence of the plant use decline seen at CA-MRN-67 and Emeryville.

The reliance on plants throughout the sequence is consistent with findings from human bone isotopic studies

that show a focus on terrestrial plant foods by people living in the Santa Clara Valley that is unparalleled in central California. Isotopic data collected from the South Bay reflect a diet of plant foods with trophic levels similar to those of herbivorous animals, which contrasts with the high marine-based diet that is suggested by isotopic studies from the North and East Bay (Bartelink 2014; Bartelink and Beasley 2016). More research is needed to not only validate the archaeobotanical patterns found to date, but also to integrate macrofloral data with other subsistence data and non-subsistence information to account for the distinctive patterns in the South Bay.

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