VOLUME I

THE MOSS LANDING HILL SITE

A TECHNICAL REPORT ON ARCHAEOLOGICAL STUDIES AT CA-MNT-234 IN 1991 and 1997-1998

by

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CHAPTER V

SITE STRUCTURE AND CHRONOLOGICAL COMPONENTS

This chapter describes the complex structure of Moss Landing Hill and the approach used to break the site down into temporal components for study of changes in the past. Sections discuss the geomorphic structure of the hill, the information used to assign time periods to the sediment packages (radiocarbon, artifact cross-dating, obsidian hydration), assignment of specific excavation proveniences to temporal components, distribution of the site's most ubiquitous cultural constituents, and a description of features. The final section summarizes the variety of loci that make up the known portion of CA-Mnt-234.

MOSS LANDING HILL STRUCTURE

Moss Landing Hill consists of a number of sand layers. Some are highly cemented, others are loose and easily eroded. The complexity of the hill's geomorphological structure was revealed through examination of stepped backhoe-trench sidewalls, excavation unit sidewalls, archaeological auger holes, soil-engineering auger holes, and finally, through witnessing the wholesale removal of the western portion of the hill. It is clear from these examinations that the hill's upper layers, above 24 ft (7.32 m) amsl, are a hodge-podge of buried rolling hills covered with variously stabilized creeping dunes.

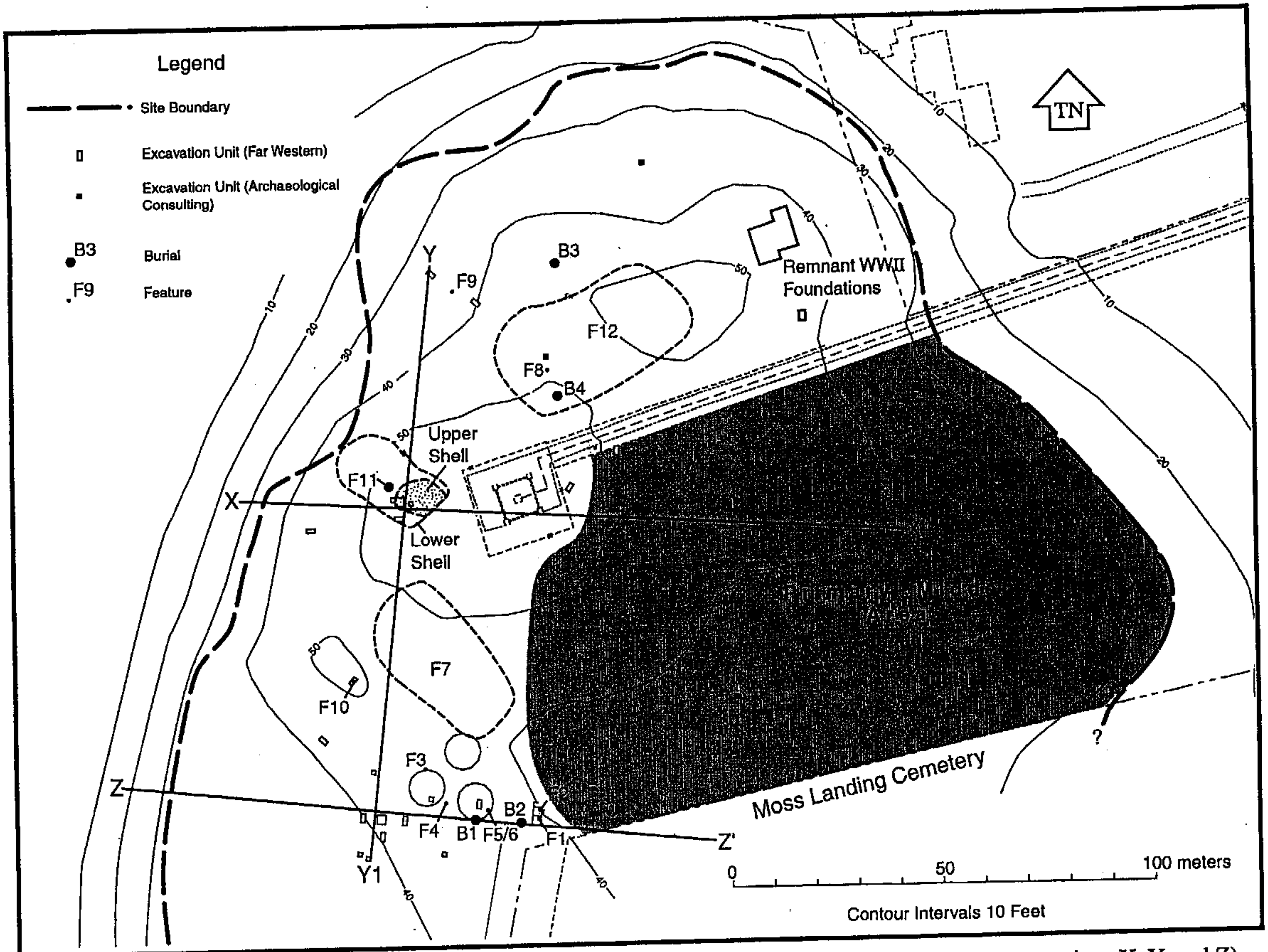
Five successive geomorphic strata characterize the sediment packages that we re-examined on Moss Landing Hill; all are above 17 feet in elevation. We number the strata, I-V, from bottom to top. Geomorphic strata with some soil development are subdivided into an upper "a" element and a lower "c" element. Older sediments do underlie our five geomorphic strata. Rutherford & Chekene Consulting Engineers (1995) notes that a series of distinct interbedded sands and clays of a fluvial or estuarine depositional environment lie below 17 feet, with blue clay deposits below sea level. The strata below 17 feet are not discussed here as they are not relevant to the cultural materials on the hill.

Below we present brief descriptions of our five strata, together with evidence that establishes their general age. These discussions will be aided by reference to Map 11 and three cross-sections of the hill, figures 3, 4, and 5.

Geomorphic Stratum I — Buried Red Sand Terrace

Geomorphic Stratum I consists of a remnant terrace of *fine to coarse-grained red sands* in lenses graded by particle size, fairly compact, but lacking visible clay or silt binding. This terrace was encountered at 24-25 ft amsl by auger bores in four dispersed areas: Trench C-North, Excavation Unit CC-4, Excavation Unit N0/E10 (Area A), and Excavation Unit N4/E45 (Area A). The terrace tilts almost imperceptively upward to the west.

Contact with overlying sediments was usually abrupt. Those sediments were clean yellow sands in some places, clay-saturated cemented sands in other places (see Figure 4). There was no indication that the Geomorphic Stratum I surface was ever exposed long enough to begin developing a soil horizon. Munsell chart color readings for these buried sands are 5 YR 5/6 to 7.5 YR 5/7 (dry), which amounts to a reddish color when contrasted to the overlaying yellow or brown sediments. In places this layer also exhibits black stains of manganese/iron (5 YR 2/1 [dry]). Geomorphic Stratum I did not contain cultural material, and therefore no attempt was made to date it.



Map 11. Cross sections, features, and burial locations at CA-Mnt-234 (see Figures 3, 4, and 5for cross-sections X, Y, and Z).

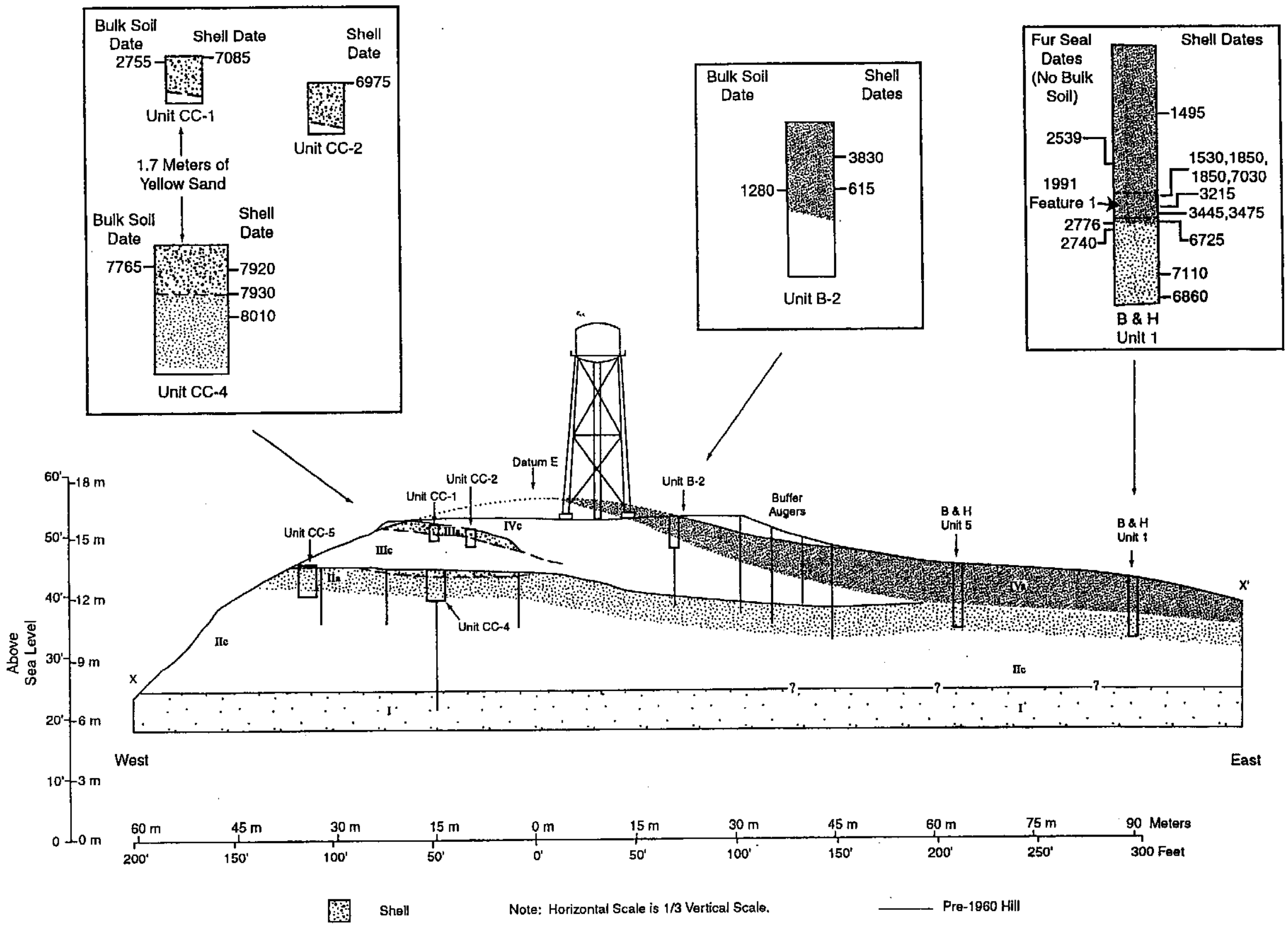
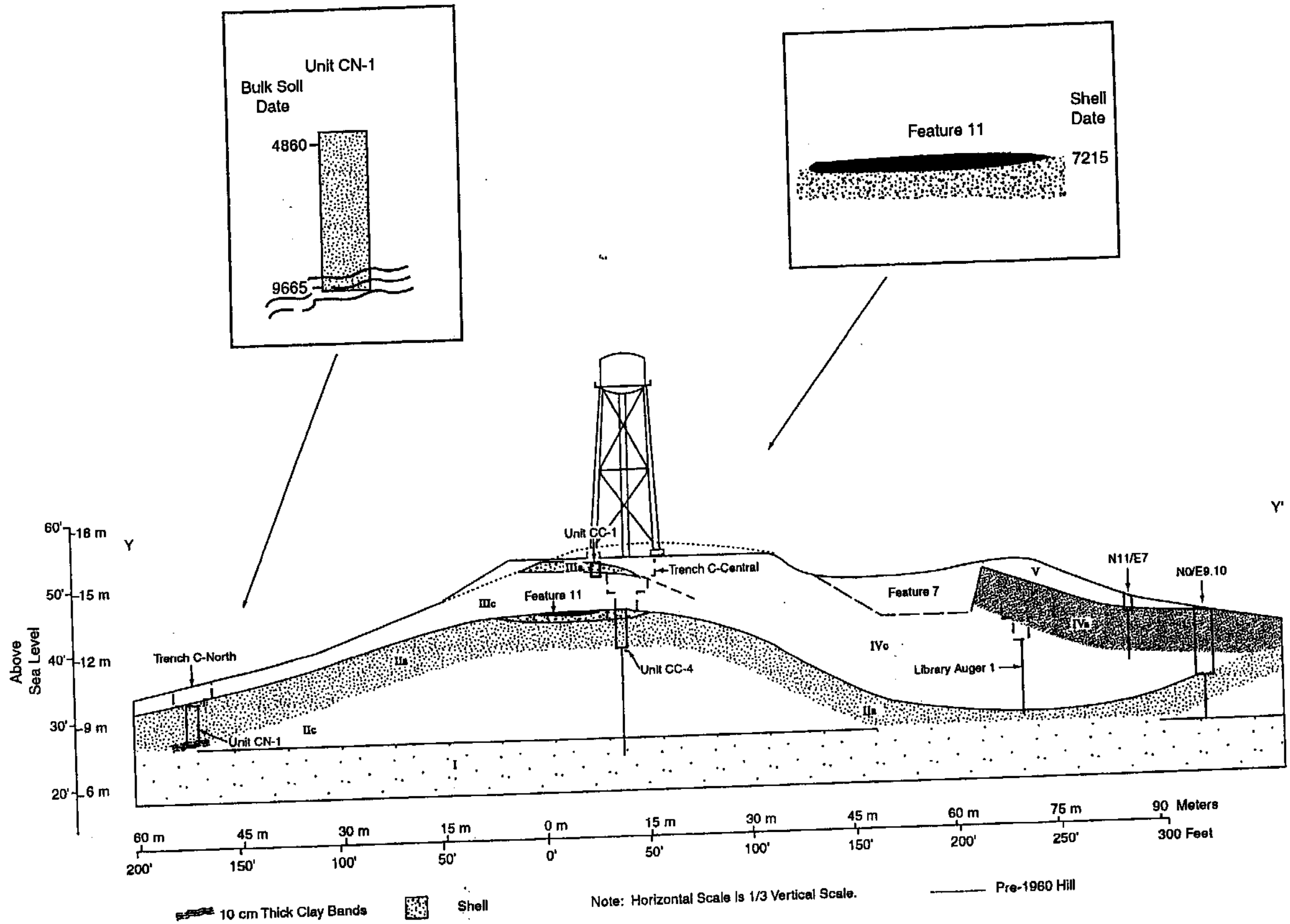


Figure 3. Moss Landing Hill cross-section X-X', west-to-east showing geomorphic strata I-IV and relevant data recovery locations (see Map 11 for plan view).



ure 4. Moss Landing Hill cross-section Y-Y', generally north-to-south showing geomorphic strata I-V and relevant data recovery locations (see Map11 for plan view).

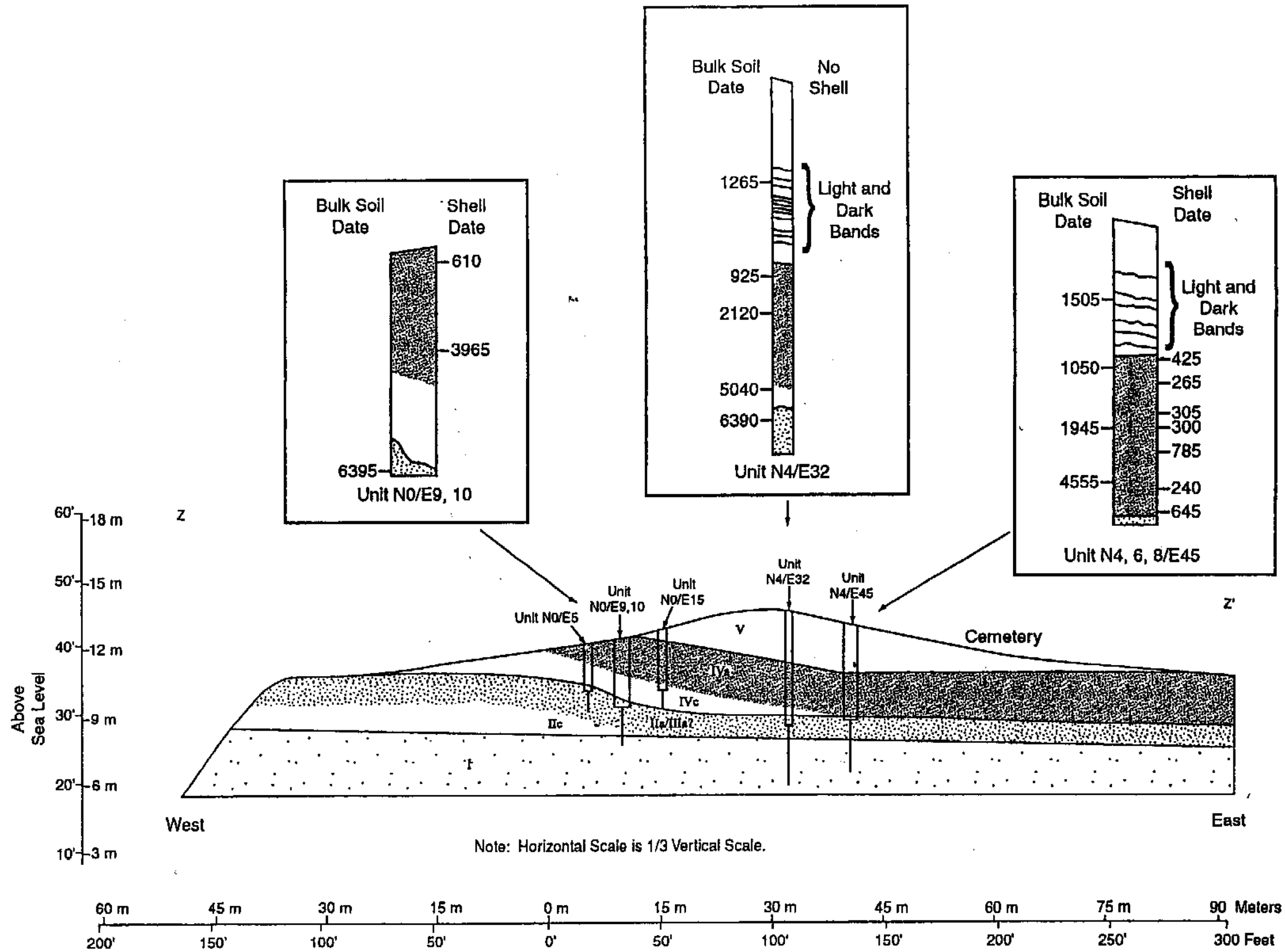


Figure 5. Moss Landing hill cross-section Z-Z', west-to-east showing geomorphic strata I-V and relevant data recovery locations (see Map11 for plan view).

Geomorphic Stratum II — Buried Brown Paleosol-Capped Dunes

Geomorphic Stratum II consists of a buried, stable dune field perched on the Stratum I terrace (Figures 3, 4, 5). The dune field has a a silt-cemented upper element, labeled IIa (1.5-2.0 m thick), which transitions down into a yellow sand lower element, labeled IIc (0-3.6 m thick). This stratum was clearly evident at the western end of the hill where its darker IIa element was sandwiched between yellow sands of Stratum IIIc and above, the yellow sand substrate, IIc, below. In the field we referred to this stratum as the Brown Paleosol. Its surface in a backhoe trench exposure is illustrated in the photograph in Figure 6. Excavation units CC-4 and 5 and CN-1 and 2 were placed into Stratum IIa in Area C.

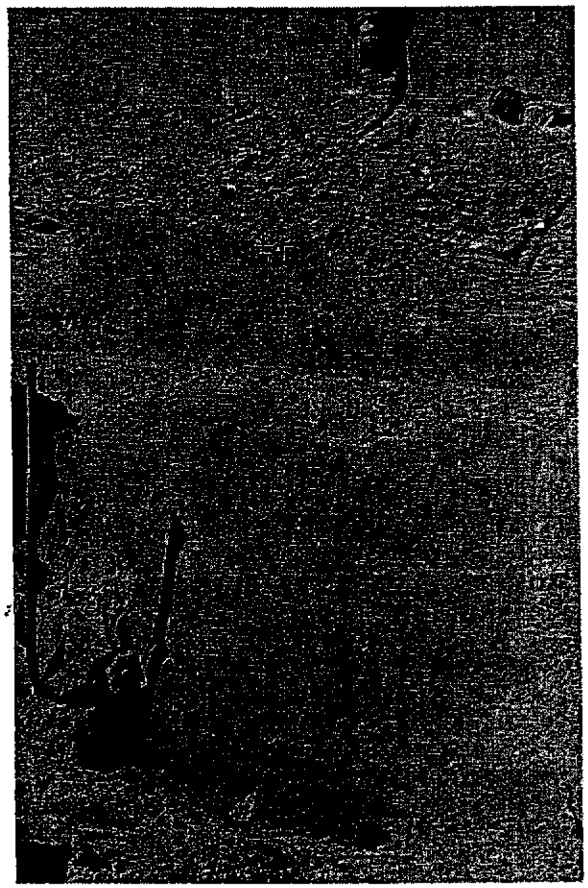


Figure 6. Photograph showing geomorphic strata IIIa, IIIc, and IIa from top to bottom, on the north sidewall backhoe trench C-North.

The upper element, IIa, consists of *silt and clay-coated, medium-grained sands* bound into a strongly cemented brown matrix (10 YR or 9 YR 5/3, 5/4 [dry]). The underlying element, IIc, consists of *clean yellow-brown, medium-grained sands* (10 YR 6/4,7/4 [dry]). Fine clay lamellae (1-2 cm thick) appear in seemingly random locations, in element IIa as well as IIc. In one location where the brown IIa element rests directly upon the red sands of Stratum I, thick clay bands occur (each up to 10 cm thick) in a 50-cm thick belt at the Stratum I/II contact (bottom of excavation Unit CN-1, see Figure 4). A bulk sediment radiocarbon date of 9665 B.P. [cal] was obtained from that thick clay band at the geomorphic Stratum I/Stratum IIa contact. The date indicates a time that organic materials were settling at the Stratum I/II contact, and may indicate that Stratum II is itself a very late Pleistocene or Early Holocene deposition.

The surface of geomorphic Stratum IIa was an exposed hill top used by people 7,900-8,000 [cal] years ago, as evidenced by three radiocarbon dates from shell in excavation Unit CC-4 (see Figure 3). Shell from a whale bone/shell feature collected during hill top grading just to the north of Unit CC-4 was dated to a later 7215 B.P. [cal] (see Figure 4). On the other hand, an older date of 8400 B.P. [cal] was obtained from a thin (1-3 cm thick) band of charcoal that ran along the surface of geomorphic Stratum IIa where it was exposed during building pad leveling beneath the hill top water tower location (Figure 7). That band seems to have been residue of an old grass or brush fire that ran over sands that were just beginning to bury the hill top as geomorphic Stratum IIIc, (see below). Those sands should have covered the shell heap that dates to 8000-7900 B.P.[cal], and the fire should therefore date to post 7900 B.P. The discrepancy between the deepest shell and the seemingly overlaying charcoal band suggests that further work is needed to adjust oceanic and local reservoir effects of shell dates.

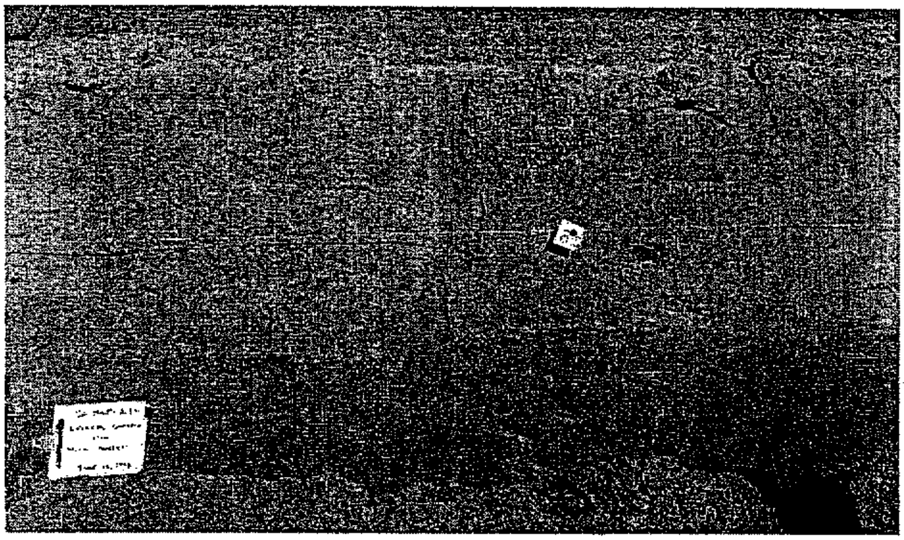


Figure 7. Photograph of the narrow charcoal-infused sand layer (Charcaol dated to 8400±30 B.P. [cal]) exposed along a grader cut at 42' amsl at the stratum IIIc/IIa boundary.

Geomorphic Stratum III — Initial Middle Holocene Sands

Geomorphic Stratum III overlies Stratum II in the west-central portion of the hill as a distinct sediment package of IIIc yellow sands with a brown silty sand upper IIIa element (Figures 3 and 4). The upper element consisted of *silt and clay-coated, medium-grained sands* in a cemented brown matrix (10 YR or 9 YR 4.5/3, 5/3 [dry]), which graded down into the underlying IIIc element of *clean yellow-brown, medium-grained sand* (10 YR 6/4, 7/4 [dry]). Stratum III sediments formed a dark silt-loam A horizon where they were exposed during the Twentieth-century on the northwest face of the hill (see Figure 4, north slope).

Upper geomorphic Stratum IIIa was first recognized as a very dense shell heap (40-70 cm thick) in the western area of the hill, separated from the underlying Stratum IIa shell lens by 1.7 meters of steeply banded yellow sands (Figure 8), the top of which had been clipped off by hill top leveling in 1960 (see Figure 3). Shells from the Stratum IIIa exposure were dated to 7085 and 6975 B.P. [cal]. Shells dating to this time period (7110, 7030, 6860, and 6725 B.P. [cal]) had also been recovered in 1991 in the primary midden in excavation Unit BH-1 in the brown sediments below 210 cm. In the western area, geomorphic Stratum III is a very steep hill of sand sitting on the Stratum IIa surface and rising to the northwest. In th east under the Primary Midden, however, it seems to be level. The IIIa brown paleosol surface is not continuous between the two dated areas; in most places Stratum III sands are directly overlain by sands of the succeeding Stratum IV.

Perhaps most startling is evidence that the two meter deep sand dune of geomorphic Stratum III in the western portion of the site may have built up over as short a period as 100 years, between 7215 and 7085 B.P. [cal]. Such a short time period for the sudden dune movement is indicated if the Feature 11 shell date of 7215 B.P., recovered during building pad grading without precise provenience, is accepted. Otherwise, it is certain that the dune movement occurred within the relatively short span of 800 years between 7900 and 7100 B.P. [cal] (Figure 8, see also Figure 6).

Figure 8. Photograph of the stratum IIIa shell lens, exposed in the east sidewall of Unit CC-3 following a wind storm.

Geomorphic Stratum IV — Middle and Late Holocene Dunes with Midden

Geomorphic Stratum IV consists of dunes with an upper IVa element of *charcoal-stained sands* and a lower Stratum IVc element of *clean yellow sands*. These dunes have accumulated since the 7110-6725 B.P. [cal] Stratum IIIa deposition (see figures 3, 4, and 5). The upper IVa element is midden; its sands contain not only charcoal but also shell, animal and fish bone, and small flakes of discarded tool stone, th residue of a variety of human activities. Where these sands have been stained by numerous fires they we almost black (10YR 2/1), but in most places they were very dark brown (10YR 3/2). In some areas the IVa midden gradually transitioned down into IVc yellow sands (10YR 6/4, 7/4). In other areas the stained sediments mixed directly with the older Stratum IIa and/or Stratum IIIa sediments. Stratum IV sediments formed a loamy A soil horizon where they are exposed at the surface.

Marine shell from Stratum IV contexts provide a range of Late Holocene radiocarbon dates over the past 4,000 years. Bulk soil dates, while not accurate for any single event, indicate a degree of stratigraphic stability and accumulation over time, as they are consistently older in the deepest sediments, and younger in the shallower sediments.

Geomorphic Stratum V — Recently Active Dunes

Geomorphic Stratum V consists of very recent dunes that overlie the midden of Stratum IV sediments (Figure 9). These active dunes, which are almost devoid of cultural material, reach 2.2 m thick in Area A (see Figure 5). They form domes elongated generally northwest-southeast, with the wind. The wind-deposited materials have been laid down in alternating bands of clean yellow sands (10 YR 6/4) and slightly darker sands (10 YR 5/6), 8-15 cm thick. This phenomenon seems to be the result of occasional wind events that erode and redeposit the northwest face of the hill, carrying up first the surface organic materials, then the underlying yellow sands. On the basis of extensive screened excavation at Unit N4/E45, we can say that the Stratum V dunes are essentially devoid of cultural materials.

Summary of Hill Geomorphic History

Moss Landing Hill is a complex geomorphic feature. It is gradually being worn away on the west by the Salinas River channel and on the east by the Moro Cojo channel. It is underlain by a remnant Pleistocene terrace (Stratum I) which supports the remnant rolling hills of a relict stabilized dune field (Stratum II), perhaps of late Pleistocene age. Stratum II in turn is covered by a more recent initial Middle Holocene surface (Stratum III) and they in turn are covered by a Middle Holocene/Late Holocene stable dune field infused with charcoal and cultural residue up to two meters deep (Stratum IV). In some local areas of the site Stratum IV is in turn covered by Terminal Holocene/Historic dunes (Stratum V).

Moss Landing Hill is clearly a remnant of a ridge that extended farther west within the last few thousand years. The original extent of the hill to the west cannot now be determined. It may have reached several hundred yards out, and may have contributed a southern edge to an estuary that was configured much differently than the present area of the Salinas River mouth (see Map 5).

DATA FOR COMPONENT DATING

In this section, evidence is presented for a four-component occupation of CA-Mnt-234: Millingstone Period, Early Period, Middle Period, and Late Period. This model supports Breschini and Haversat's initial model of site occupation; our only major change is the addition of a Late Period component. Breschini and Haversat's (1995a) temporal reconstruction brought together the classic lines of archaeological dating evidence in building their case: radiocarbon dating (20 dates on marine shell), artifact cross-dating (shell artifacts), and obsidian hydration dating (36 usable hydration readings).

The 1997-1998 data recovery excavations have generated an additional 41 new radiocarbon dates and 75 additional usable obsidian hydration readings. They did not result in recovery of any additional shell artifacts useful for cross-dating purposes. In this section we present and analyze the radiocarbon, artifact cross-dating, and obsidian hydration information gathered from 1991 onward.

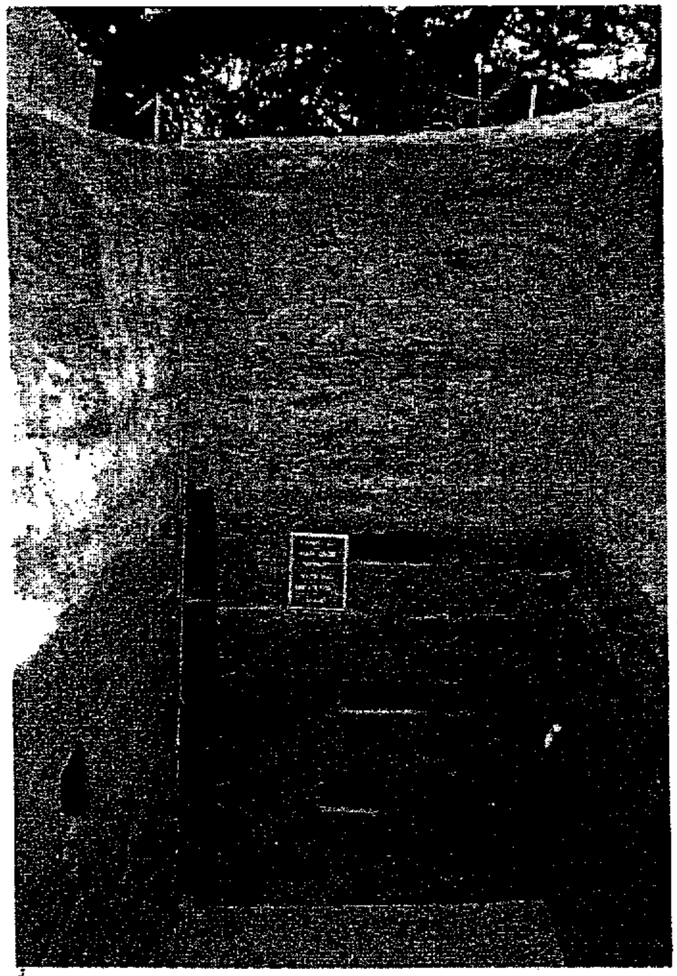


Figure 9. Photograph looking south into excavation Unit N4/E45, showing geomorphic stratum IV, banded dune sands overlaying dark sandy midden of geomorphic stratum IV.

Radiocarbon Data

Shell radiocarbon dates provide the strongest evidence for periods of site use at CA-Mnt-234. Breschini and Haversat (1995a:85) thoroughly dated the column of Unit BH-1 in the Primary Midden using dates from marine shell samples processed by Beta Analytic. When possible, their samples consisted of single pieces of shell. Altogether they processed 20 samples for their 1995 report. Far Western developed another 17 shell dates, mainly in areas A and C, also relying upon Beta Analytic for processing. Far Western also received two radiocarbon dates from charcoal and 22 radiocarbon dates from bulk sediment humic acids. More recently, Archaeological Consulting had Beta Analytic run two more shell dates, both from *Olivella* shell G1 saucer beads. Details on all 63 radiocarbon samples are found in Appendix A. Finally, another three radiocarbon dates from CA-Mnt-234 have been obtained from fur seal bone by University of California, Santa Cruz graduate student Rob Burton (processed by Lawrence Livermore Laboratory; nos. 46, 63, and 94); those three dates will be cited, but details regarding them are not found in Appendix A.

Figure 10 shows the temporal distribution of calibrated marine shell radiocarbon intercepts from the 1991 and 1997-98 excavations; radiocarbon intercepts in key locations are also illustrated on Figures 3, 4, and 5. All radiocarbon dates have been calibrated using Beta Analytic's 1998 recalibration program. Calibration for marine shell samples include a local reservoir correction of +325 ± 35 years for all but two samples. The latter, two G1 shell beads submitted by Archaeological Consulting, were run with a +225 year local reservoir correction. On Figure 10 the shell dates are arrayed from left to right in a way which supports the component definitions that we will present in the final section of this chapter.

The 22 bulk sediment radiocarbon date distributions are not portrayed graphically on Figure 10, although some are shown on Figures 3, 4, and 5. Bulk sediment dates were taken despite major drawbacks in interpreting their results. The humic acids dated by this method are likely to be a combination of materials mixed together from original deposition levels several meters above and below a given sample location. Organic materials are constantly being moved by rodents, insects, and earthworms, affecting the dates of all bulk soil samples.

Despite these drawbacks we initially felt constrained to use these samples to understand the general temporal nature of Area A units where shell was found in only tiny quantities. The bulk sediment dates did prove useful to us as we worked to understand site stratigraphy across wide areas. Bulk sediment dates extracted from highly cemented brown sediments (without cultural constituents) at the bottom of two Area A units, dating to 6395 and 6390 B.P., indicate that all Area A cultural materials post-date the 6500-8100 year old cultural materials found at the base of the Primary Midden and in Area C (see Figures 3, 4, and 5). Furthermore, the essential stratigraphic superposition of Area A midden sediments is illustrated by the orderly array of older to younger bulk soil dates from lower to upper midden levels in two Area A units (see Figure 5).

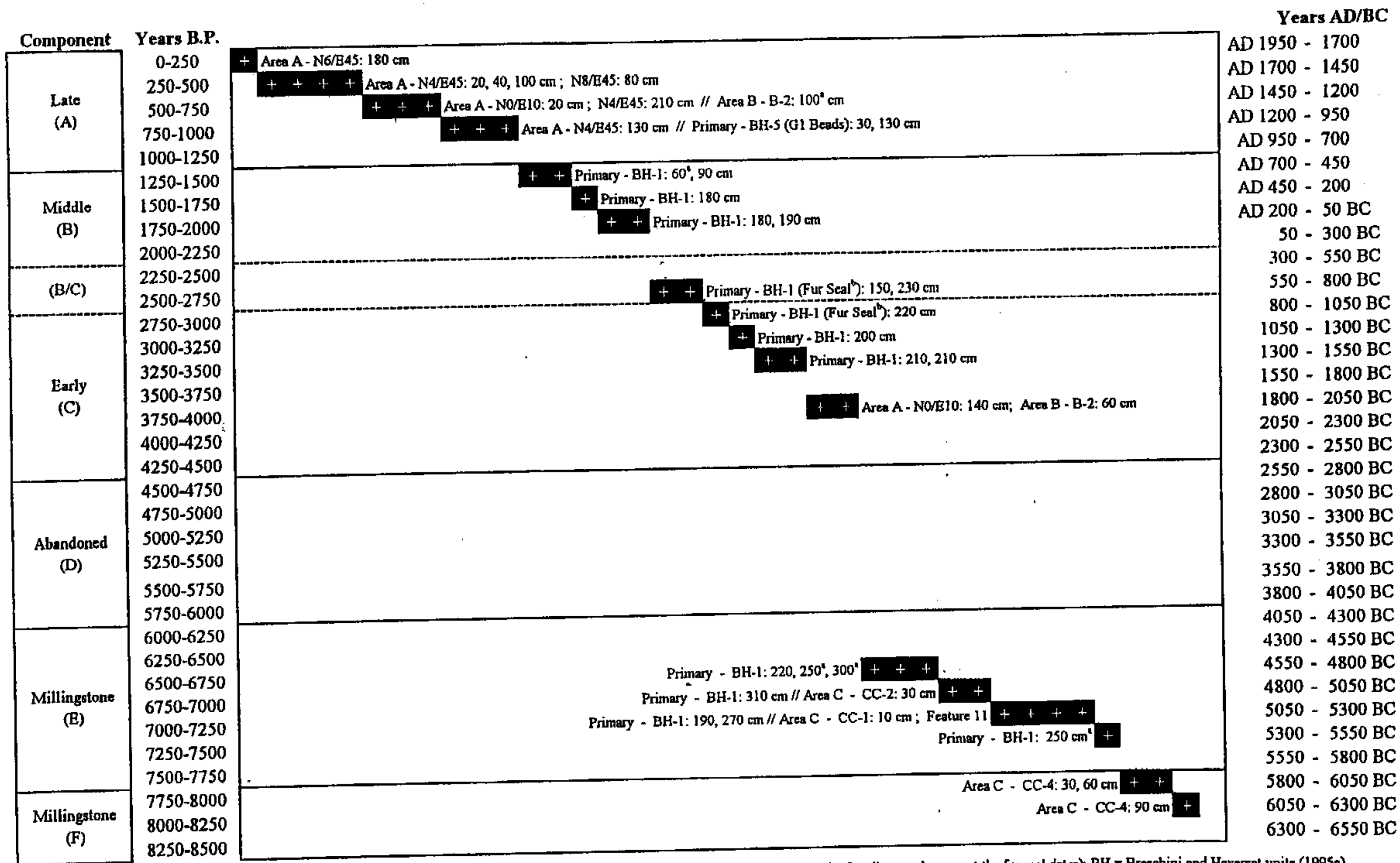
Obsidian Sourcing and Hydration

For this study we use obsidian hydration information for large scale comparative dating of various locations across site CA-Mnt-234. Obsidian hydration studies take advantage of the fact that hydronium ions replace sodium ions in glass matrixes, resulting in a discolored "hydration" band that reaches deeper and deeper inward from freshly exposed glass surfaces over time. In general, obsidian surfaces with hydration band depths of under two microns have been exposed for only a few hundred years, while surfaces with hydration band depths greater than six microns are many thousands of years old.

Since the early 1980s, Monterey Bay Area archaeologists have applied empirically derived hydration rates to characterize the year of creation of specific pieces of shaped obsidian (cf. Breschini and Haversat 1995a:9; Dietz et al. 1988:127-136). Since hydration rates vary between the many chemically diverse obsidian sources, separate obsidian hydration rates have been developed for each source. However, hydration rates may also vary with differences in regional climates, and with differences in microclimatic environments within a single site. Hydration studies try to take into account regional climate differences, but the effect of regional climate and on-site microclimate variation remains poorly understood. Thus obsidian hydration studies remain a controversial tool in site dating.

Sources of Obsidian at CA-Mnt-234

Source-specific rates are a necessary prerequisite for even the most broad-brush hydration dating. Napa Valley obsidian predominates at CA-Mnt-234 (53 %), with Casa Diablo obsidian representing the other large portion (32%) of the 120 source-identified pieces from the site (Table 3). Altogether, obsidian from six source locations are represented at CA-Mnt-234 (see also Appendix C):



+ = Single radiocarbon intercept (see Appendix A for full provenience, materials, and dating results for all examples except the fur seal dates); BH = Breschini and Haversat units (1995a).

Note: [a] = Shell date based on two combined shells, all others shown here are based on a single shell (five shell dates from multiple shell are not shown);

[b] = processed by Lawrence Livermore Laboratory: all others by Beta Analytic.

Figure 10. Temporal ordering of 37 calibrated shell and bone radiocarbon intercepts from CA-Mnt-234.