Archeology in Yosemite National Park:
The Wawona Testing Project

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ABSTRACT

The Wawona Testing Project evaluated three potential sewage development locations and examined some other sites to produce general information on Wawona prehistory. Systematic surface collections and/or test excavations were conducted at five sites. Two of these were relatively large and important prehistoric sites for the Wawona valley. Most of the material recovered relates to the late prehistoric occupation, the Mariposa Complex, or protohistoric Miwok. There is also evidence of occupation during the Crane Flat Complex, probably before A.D. 500. Analysis of the obsidian tools and debitage revealed that an important activity at the Wawona sites was the working of obsidian bifaces, probably obtained by trade from the Great Basin groups across the Sierra to the east. This was a longstanding tradition in Wawona prehistory, evidenced by the similarity of material at all the sites studied, and from the latest to the earliest levels. Historic material relating to the early settlement of Wawona and the development of the Sierran tourist industry was also analyzed. The intensive analysis of a small amount of excavated material proved effective in producing new information on Wawona's past, and in aiding management decisions.
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Chapter 1
INTRODUCTION

Before describing the Wawona Testing Project, I should say a few words about why it was done, and the way I have written about it. The National Park Service, and similar institutions help to preserve a variety of things, including natural wonders, a diversity of living creatures, and what the jargon of the day chooses to call cultural resources. These last are the works of other humans, and if some of the essence of humanity is to know ourselves, in the individual and in the multitude, then the understanding of past lives has a place in our own. The curiosity in most of us is reflected in the popularity both of parks like Mesa Verde, and of the ravings of the ancient-spacemen crowd. Where we can, we have a responsibility to protect and interpret the evidence of past lives.

New sewage treatment facilities are necessary at Wawona to protect the river; to protect the cultural resources it was necessary to test and choose between alternate locations. Probably most of the archeological work done on public lands now is similar—a very small amount of excavation is intended to provide sufficient information not only for management decisions, but also to answer the questions archeologists and the interested public would like to ask.

The emphasis in this project has been on an intensive analysis of a rather small amount of material. The descriptive sections of this report are long, and doubtless laborious to some, for several reasons. It is necessary to report fully on small projects like this. There is no hope of comparing and tying them together into a useful interpretive whole if only a few items are minimally described. Any excavation removes the artifacts from the context which gives them interpretive value. The longer the time between excavation and report, the more is forgotten. Once artifacts have been analyzed and packed away, there is little chance that another worker will unpack them and reanalyze them in light of new ideas unless they are of unusual interest. It is my hope that if future excavation is done in Wawona the analysis already performed will provide useful comparative data for the next worker, as this report has relied on information collected by others. Therefore the
descriptions are detailed, and the criteria for interpretations such as
dates and functions of artifacts are laid out so that my conclusions can
be evaluated by others. This is also important if such reports are to
be read by non-archeologists. I have tried to minimize the more obtuse
archeological jargon and explain some of the lines of reasoning so that
this report will be of use to more than a handful of colleagues inter­
ested in the esoterica of prehistoric obsidian tools in the Yosemite
region. In trying to reach this kind of balance, some stumbles are in­
evitable but not, I trust, overwhelming.

A few notes on the presentation of certain standard data are in
order. The numbering system by which the sites are referred to was
adopted by the University of California Archeological Survey in 1948.
The prefix 4 or CA stands for California, the three-letter abbreviation
represents the county, and the numbers are consecutively assigned within
each county. The Wawona sites are in Mariposa County (Mrp), and some
other Yosemite sites are in Tuolumne County (Tuo). Locations that have
not been entered in the California system are labeled with a field num­
ber (e.g., YOSE 80A-2).

Some measurements are given in both English and metric systems. In
such cases, they are given first as measured or cited elsewhere, fol­
lowed by the translation in parentheses.

Archeological dates should always be given in terms of BC/AD, to
avoid the confusion of a floating "present" implied by BP in some con­
texts. However, C14 dates are usually given in uncorrected form as BP
dates, indicating years before present (arbitrarily set at 1950) accord­
ing to one of several half-lifes for C14. The ± factor indicates sta­
tistical error within one standard deviation on each side of the date,
so for 1000 ± 50 BP there is statistically a 66 percent chance that the
real date is between 950 and 1050 BP. A translation of this date into
AD 950 is considered sufficiently accurate for most discussions. Var­i­
ous calibrations can be used to correct C14 years in translating them
into real elapsed time, but this was not done to any of the dates cited
in this report.

The maps presented in this report are slightly more vague about
site locations than archeological maps should be. This is one example
of how the modern necessities of preservation are hindering future research. Sites are being destroyed not only by development and construction, but also by hordes of the ignorant, careless, or greedy, who knowingly or unknowingly destroy sites by collecting artifacts, thus removing them from the context which makes them meaningful and allows us to interpret the sites. The sites at Wawona are not very rich, and contain no spectacular artifacts, but all have probably been damaged to some extent already. Thus the site map for the Wawona Valley shows only sites relevant to the report, and interested scholars will need to request unpublished information from the Western Archeological and Conservation Center.

It remains to thank many people who contributed to this report. Two unsung multitudes are the people of the past who unwittingly left us an interesting puzzle to untangle and an unwritten testament of their lives, and the scholars, cited and uncited, whose work led to my own.

Keith Anderson and Don Morris of the Western Archeological and Conservation Center oversaw this project, and Steven Danziger helped in the field. Malcolm Holser, Jerry Parker, Kevin Parker, and Michael Ramirez were an interested and hardworking crew. Lisa Huckell, Tom Origer, Lee Sappington, Faith Duncan, Patrick Vaughn, and George Carter provided technical analyses. Phil Chase and Brigid Sullivan did the illustrations. JoAnne Miller and Vonna Lou Mason typed manuscripts.

Les James, Jay Johnson, and Julia Parker of the American Indian Council of Mariposa County were helpful, and the Council is to be commended for its determination to protect archeological sites in Yosemite. The National Park Service staff in Yosemite and Wawona provided facilities and information. Many other people helped with information and comments, including Mike Adams, James Bard, Mark Baumler, Colin Busby, Scott Carpenter, John Clonts, Lee Fratt, Al Gordon, Kathy Kamp, Roger Kelly, Julia Parker, Shirley Sargent, and George Teague.
Chapter 2
GENERAL BACKGROUND

Project Rationale

The Wawona Testing Project was part of the planning for construction of new sewage facilities in the Wawona Valley. The present pond and spray field is inadequate to handle the increasing tourist and residential waste, and is environmentally unsatisfactory as it occasionally releases waste into the Merced River.

Accordingly, this project was initiated to evaluate the cultural resources in the Wawona Valley, specifically at three potential locations for sewage plant construction. A major goal was locating and describing archeological sites on these three locations, evaluating their significance and potential for research contribution, and suggesting the necessary steps for protection or recovery of significant material.

The prehistory of the Wawona Valley was known only through survey of surface sites (Bennyhoff 1952, 1956; Napton et al. 1974). As a result of this work, the Wawona Valley Archeological District has been determined eligible for nomination to the National Register of Historic Places (Hammack and Anderson 1978). An additional goal of this testing project was to efficiently collect a sample of material which would allow comparisons with surrounding areas, and provide some general information on the prehistory of Wawona. To this end, some sites not directly affected by the proposed development were investigated.

Only a small fraction of each site was sampled in order to minimize both expense and disturbance of the sites. The analysis of the material recovered has been stressed. This limited excavation has provided the necessary information about the extent and nature of these sites, and intensive analysis of the materials has produced new information on the cultural activities of the prehistoric inhabitants. This has made possible a realistic evaluation of the further research potential of these sites and set directions for future investigations.
Environmental Background

Wawona is an open valley at an elevation of 4,000 feet (1,219 meters) on the south fork of the Merced River, on the southern edge of Yosemite National Park (Map 1).

The Sierra Nevada mountain range runs north-south for some 360 miles, along the California-Nevada border. It is formed by a tilted granite block, dissected by glaciation and river canyons. The western slope into California's central valley is relatively gentle; the eastern slope drops abruptly into the Great Basin.

Yosemite National Park occupies a wide transect across the mountains, including within it most of the east-west range of environmental and geological variability. The park includes elevations from 1,800 feet (550 meters) near El Portal to 13,000 feet (3,950 meters) along the mountain crest. It includes major drainages of the Tuolumne and Merced Rivers.

The park crosses five life-zones, the Upper Sonoran, Transitional, Canadian, Hudsonian, and Alpine (Jepson 1925). The Upper Sonoran Life-Zone at altitudes below 4,000 feet is characterized by plant communities of oak-grassland and chapparal. For the ethnographic Miwok Indians in the Yosemite region, this was the most productive and populated life-zone, but it is represented in Yosemite only by the Merced Canyon around El Portal. The Transition Life-Zone is from about 4,000 feet to 6,000 feet in the Yosemite area. It is characterized by open forests, with ponderosa or yellow pine the dominant tree. There are also cedar, fir, and other conifers, and several oaks, including the productive black oak, a preferred food species. Although less rich than the Upper Sonoran Life-Zone, the Transition Life-Zone also contained resources useful to the Miwok. Most of the major sites recorded in Yosemite are in this life-zone, and the large valleys such as Yosemite and Wawona have mostly Transition plants, with some Upper Sonoran species. Riparian and meadow vegetation is also found in these valleys.

The three higher life-zones contain mostly conifer forests passing to alpine meadows above tree line. These zones were less productive of plant foods, and would have been occupied mostly in the course of hunting and trading.
Map 1. Project location, important sites, and geographical features mentioned in text.
1. El Portal 2. Crane Flat, 4-Mrp-105 3. Tamarack Flat, 4-Mrp-97 4. Yosemite Valley
  c. Mt. Hicks d. Queen e. Mono Craters f. Mono Glass Mt. g. Casa Diablo h. Fish Springs
The Wawona Valley is open, lacking the steep glaciated cliffs of Yosemite Valley. It is also smaller and narrower. The south fork of the Merced River runs generally east to west through the valley, and there is an extensive meadow. This has partly been kept open by its use as pasture, and it is difficult to say how much of the valley floor was forested in prehistoric times. Where the valley is narrow, the forest extends from the slopes to the river edge.

The bedrock is granite, which outcrops frequently on slopes and along the river.

Methods

The personnel for the Wawona Testing Project consisted of myself and four local crew members. None of the crew was experienced in archaeology, but the archeology was simple and the project small, so I was able to supervise all aspects of the work. Steve Danziger, the archeological circuit rider for Yosemite, was able to assist us part of the time.

The general procedure at each site was as follows: the entire crew walked over the site, examining the surface to get a general idea of the site's extent and density. Using this information, and the boundaries set in 1974 (Napton et al. 1974), the area to be dealt with was chosen. The site was mapped either by transit and stadia rod, or by compass and tape. Major topographic and cultural features were mapped, and a surface sampling scheme chosen. On sites where the preliminary walk-over indicated few artifacts, no surface sample was made. At 4-Mrp-343 and 4-Mrp-8, where there was substantial surface material, the sites were grided in 10 x 10-meter units and a random sample of approximately 20 percent of these was collected.

Excavation units (labeled EU in the following text) were selectively located to give information on the extent and content of cultural deposits. Our purpose was to examine a variety of areas within each site, and to test areas where no cultural material was evident on the surface. All excavation units were 1 meter wide by 2 meters long, excavated with shovel and trowel into sterile soil. Units where little cultural material was expected were excavated in 10-centimeter levels; units dug in
midden or other contexts likely to have artifacts were excavated in arbitrary 5-centimeter levels, using one corner of the unit as a datum, or in natural stratigraphic units where visible. All soil from all excavation units was screened through 1/8-inch mesh to recover small artifacts.

Samples for flotation and pollen analysis were collected from each 5-centimeter level of one midden unit at 4-Mrp-170, 4-Mrp-343, and 4-Mrp-8. Samples from each level of EU 5 at 4-Mrp-170 and EU 15 at 4-Mrp-343 were washed through 1/16-inch mesh in the river to test the value of wet-screening for recovering very small artifacts. This proved not very informative, and no wet-screening was done at 4-Mrp-8.

Following the fieldwork, all material was processed at the Western Archeological and Conservation Center. At the request of the American Indian Council of Mariposa County, all artifacts will be packed, sorted by context, and returned to the Yosemite Museum for curation. The field notes, maps, photographs, and artifact data sheets will be kept at the Western Archeological and Conservation Center.
Chapter 3
THE SITES: DESCRIPTION AND OPERATIONS

4-Mrp-170

Site 4-Mrp-170 was recorded by Bennyhoff (1952) and relocated by Napton in 1974 (Napton et al. 1974). Bennyhoff recorded as the site only a small area 70 x 100 feet (21 x 30 meters) where some midden survives. Napton greatly expanded the site boundaries, to an area some 61 meters by 305 meters, apparently because obsidian flakes were found in this additional area. I chose to follow Napton's boundaries in testing the site, and included the historic material in the slaughterhouse area as well as the prehistoric midden.

The site runs along the south bank of the South Fork of the Merced River (Maps 2 and 3). The midden area is directly on the bank. The entire site area has been greatly disturbed. The Wawona meadow served as a pasture for the Wawona Hotel farms from the mid-19th century until the 1930's (Sargent 1979). The slaughterhouse area was associated with the production of meat for the hotel. The present structure was built in 1929, and the foundation of an earlier structure was recorded during this project. There were fences and tracks associated with this area. The present golf course was opened in 1918, and overlaps some of the site area. The present sewage pond was built to the west of the site in 1971, and a tank and fence in 1976. The midden area has been disturbed by an access road across its southern portion, and a pumphouse to the east. The slaughterhouse area has been used as a dump and a borrow pit. Nevertheless, a portion of midden some 15 by 20 meters in area survives, as well as the old slaughterhouse foundations and some of the associated bone dump deposits.

The natural vegetation of the site has been much altered. There are remnants of mature pine forest, with a few large oaks along the river bank. There is tall grass in the slaughterhouse area, and golf-course turf covers the southeastern part of the site.

It was originally planned to collect a sample of approximately 20 percent of the site surface. After a few 10 by 10-meter units had been collected, surface collection was ended, as most of the site was under
Map 2. Wawona Valley and site locations.
Map 3. 4-Mrp-170 Site Map.
golf course turf, high grass, deep pine needle litter, or dirt roads. The surface collection was not useful in defining either the site boundaries or the surface artifact assemblage. After work at the site was formally finished, a disturbed dump area was discovered in high growth at the western end. This was labeled Surface Unit X, and a collection of diagnostic glass fragments was made.

The site was tested by a series of 1 x 2-meter excavation units. EU 1 tested the area near the slaughterhouse foundations where there was a surface scatter of bone and glass. EU 5 was to sample the surviving midden; units 2 and 4 were in areas of forest remnant where the soil was relatively undisturbed. Unit 3 was on the edge of the golf course. No units were excavated in the area to the east of the midden remnant, although it was included within Napton's site boundaries, as it was heavily disturbed by roads and golf course, and no surface material was evident.

In addition to the excavation units, a series of auger holes was used to test the area around the midden covered by the golf course, and the less disturbed areas east of the midden. The auger tests found only a few flakes in brown soil which contrasted with the darker soil of the midden, showing that the midden area is confined to the bank of the river, north of the present dirt road. A few obsidian flakes were found in each of the excavation units, and there were occasional flakes on the surface. There may have been light occupation over the whole site area, but the prehistoric material is definitely concentrated in the relatively small midden area tested by EU 5.

All the excavation units were dug in 10-centimeter levels except EU 5 which was dug in 5-centimeter levels. All soil was screened. Samples of soil were collected from each level of EU 5 for flotation and pollen analysis, and a bucket of soil from each level was washed through 1/16-inch mesh. The material recovered will be discussed in detail later.

**YOSE 80A-1**

This area was considered for sewage facility development. Although it had been checked before and nothing found, a walk-over with the full crew noted a few obsidian flakes on the surface, so it was decided that
further testing was necessary.

YOSE 80A-1 is a flat area at the foot of the mountain slope north of the river and the Wawona road (Maps 2 and 4). This flat is heavily forested with mature ponderosa pine and some cedar. There are some relatively open areas with grass and deep pine needle litter under the trees. The site has been disturbed somewhat by tree cutting, especially on the eastern edge.

The site was defined as an area about 100 meters x 70 meters, essentially the whole of the flat. The surface scatter was so sparse that no systematic surface collection was attempted. Seven 1 x 2-meter units were excavated in 10-centimeter levels. In addition, a 10-meter grid was laid out and auger holes dug at grid intersections. The auger sample was not completed due to time limitations. The soil encountered in all the excavation units and auger holes was a pale brown sandy loam, apparently sterile except for occasional obsidian flakes. EU 1 produced six steatite disc beads. On the slope, about 30 meters up from the flat, was a boulder with five mortar cups, and a pestle. The site evidently received light prehistoric use, but archeological evidence is scarce.

YOSE 80A-2

This area was tested as a possible sewage plant location, and was the last area tested during this project. YOSE 80A-2 is a large open field with a gentle slope rising to the southeast (Maps 2 and 5). It is bounded on the northwest by the dirt road, and on the southeast by the Washburn ditch and pine forest, and on the west by a stream bank. There are a few large oaks; the rest of the area appears to have been cleared.

A walk-over of the area produced only one obsidian flake; YOSE 80A-2 is not in a favorable location for prehistoric occupation. There were scatters of 20th century trash. Due to the lack of surface material and shortage of time, only two excavation units were dug. Unit 1 was dug near where the obsidian flake was found but yielded no artifacts at all. Unit 2 produced a large number of wire nails and some glass. The area of YOSE 80A-2 is probably the site of the Sierra Lodge, built in 1920, but there is very little to show for it.
Map 5. YOSE 80A-2 Site Map.
Site 4-Mrp-343 was recorded for the first time in 1974 (Napton et al. 1974). It was included in this project because of the possibility that a nearby spray field would be expanded to the detriment of the site.

The site is on a north-facing terrace on the slope south of the South Fork of the Merced River (Maps 2 and 6). It is about 100 meters south of the river, and about 30 meters above it. The site is wooded, with ponderosa pine dominant and fir, cedar, and oak also common. There are a number of large, old trees, but also large, dense stands of young pine and cedar. The ground cover is variable, from almost nothing where small drainages are cut into the soil, to grassy patches in open areas, to heavy litter under the trees. There are some shrubs around the numerous bedrock outcrops including manzanita and kit-kit-dizze. There is little evidence of recent disturbance.

Because of the uneven topography and vegetation, the site was mapped and gridded by compass and tape instead of by transit. An area approximately 90 x 70 meters was considered as the site, based on surface obsidian scatters and Napton's boundaries. This area was gridded in 10-meter units, and twelve 10 x 10-meter surface units were randomly selected for collection to give a sample of approximately 20 percent of the site surface.

Eighteen excavation units were dug. In eleven of these, EU 3 - EU 13, we only cleared and screened the duff covering the large area of BRM 1. The other seven were selected to examine different areas of the site. All units were excavated in 5-centimeter arbitrary levels, and all soil was screened through 1/8-inch mesh. The large midden area associated with BRM 1 was mostly surface-collected as Surface Unit 1, and two excavation units were dug into it. From EU 14 in this midden area samples were collected from each 5-cm level for flotation and pollen analysis, and half a bucket of soil from each level was wet screened through 1/16-inch mesh. All the observed bedrock mortars were drawn, but only BRM 1 was cleared of duff.

Site 4-Mrp-343 is a large and interesting site. The material recovered is described in following sections.
Map 6. 4-Mrp-343 Site Map.
4-Mrp-330

This site was not expected to be disturbed by sewage facility development, but was tested in order to recover some information from a badly damaged and eroding site. Site 4-Mrp-330 is a remnant of midden on the edge of the river (Map 2), in an area which has been mostly quarried away by use as a gravel borrow pit. There is a single bedrock mortar cup on a boulder in the river. Napton (Napton et al. 1974) recorded this site, at which time they found obsidian flakes eroding out of the midden remnant. None were observed in 1980. A single 1 x 2-meter excavation unit was dug to a depth of 35 cm, which extended through dark midden soil into river-laid gravel and cobbles. Only four obsidian flakes were recovered. There is not much left of whatever site occupied the area around 4-Mrp-330.

4-Mrp-169

On visiting this site, only a bedrock mortar was observed. The midden reported by Napton (Napton et al. 1974) was not evident. No further work was done.

4-Mrp-8

Bennyhoff (1952) recorded this site in a cursory way, noting rare obsidian flakes and a large bedrock mortar area. Napton (Napton et al. 1974) relocated this site, noting numerous flakes, and 10 pestles in situ. The pestles were no longer there in 1980. Site 4-Mrp-8 is a flat area along the north bank of the south fork of the Merced River. The site is open, with only a few large oak and pine trees. The site has considerable long grass cover, which becomes a lush meadow in the lower, moister area east of the site.

Site 4-Mrp-8 is the largest in Wawona (Maps 2 and 7). Although it was not expected that the proposed sewage development would affect the site, it was felt that 4-Mrp-8 offered the best chance of a deep midden with a long occupation sequence. As it is near developed areas and subject to considerable traffic, and has been disturbed by trails,
historic occupation, and park development, it was decided to sample the
surface material to protect it from further attrition, and excavate one
or two units to provide a better knowledge of local prehistory and this
important site while causing minimal further disturbance.

In accordance with these goals, the site was mapped as an area
approximately 100 meters x 100 meters, and gridded in 10-meter units
using a transit. A 20 percent sample of 10 x 10-meter surface units was
randomly selected and all artifacts therein collected. Two areas of
midden were tested by 1 x 2-meter excavation units. EU 1 reopened an
old sewage line trench, and EU 2 extended from this into undisturbed
midden. EU 3 reached sterile sand at a depth of 90 centimeters, testing
the midden associated with the BRM area.

The material recovered from 4-Mrp-8 is discussed in following
sections.
Background History of Wawona

The history of Wawona has been told in detail by Shirley Sargent (1979) in whose work much of the following information was found. Bunnell's *Discovery of the Yosemite* (Bunnell 1892) describes the early Anglo incursions, and Russell's *One Hundred Years in Yosemite* (Russell 1947) summarizes the development of Yosemite National Park as a whole. The following outline of Wawona history is limited to the major developments and the events of special relevance to the sites involved in this project. It is based mostly on secondary sources, but many other valuable primary documents are preserved in the Yosemite Research Library, and by interested locals such as Shirley Sargent.

Before the gold rush of 1849, the Sierra Nevada was relatively undisturbed. The Spanish raided into the foothills when Indians captured horses and sheltered fugitives from the missions, but had little interest in the mountains, not realizing that they contained gold (Moratto 1972:60-61).

Fur trappers in the 1820's to the 1840's penetrated farther into the Sierra, and Jedediah Smith crossed the mountains by way of the Stanislaus River valley in 1827 (Moratto 1972:61).

Joseph Walker in 1833 led a party of explorers across the mountains and apparently discovered Yosemite Valley, although he did not enter it. (Russell 1942:58). Early American settlers crossed the Sierra by passes north and south of Yosemite.

After the discovery of gold in 1848, gold seekers swarmed across the known passes, or arrived by ship, and towns such as Sonora, Big Oak Flat, and Mariposa sprang up in the hills west of Yosemite. As everywhere in California, the Indians were driven out of their lands or destroyed, and the Anglos were quick to retaliate for any threat or attack on themselves.

In this stormy atmosphere on the fringes of the hill towns, traders such as James Savage exploited both the miners and the Indians. Savage seems to have had considerable influence with the foothill Indians.
(Bunnell 1892; Russell 1947), but with these groups under considerable pressure, trouble was inevitable. Early in 1850, Savage's first trading post was attacked by Yosemite Indians (Bunnell 1892:36). He established two other posts farther from Yosemite but in December of 1850 a number of trading posts, including both of Savage's, were attacked, and several people killed. A volunteer posse organized by the Mariposa County sheriff skirmished with the Indians in the mountains.

In February of 1851, the Mariposa battalion of volunteers was formed under the command of James Savage. A government commission attempted to make peace and put the Indians on a reservation, and spoke with some of the leaders. The Yosemite group of Miwok and some other mountain groups refused to retreat, hoping to stand off the invaders in their mountains. The Mariposa Battalion was assigned the job of subduing them.

Savage and his command entered the mountains, and reached the south fork of the Merced River "about a mile below what is now known as Clarks, or Wah-wo-na" (Bunnell 1892:39). Here they left their horses, and proceeded on foot to surprise a village which surrendered and was burned without resistance. This village is probably one of the sites in the Wawona area, but Bunnell's description, although an eyewitness account, was written years after the event and locational information is very vague. He says "There was a very passable trail for horses leading down the right bank of the river, but it was overlooked on the left bank by the Indian village, which was situated on a high point at a curve in the river that commanded an extensive view up and down (Bunnell 1892:40). The right bank is later (Bunnell 1892:44) said to have a south-westerly exposure, which could make it the north bank. The expedition followed the left bank, at times wading, and then apparently climbed a ridge, "a run of a mile or more," to overlook the village. This description could fit the location of 4-Mrp-343 (Map 2), if the expedition is seen as coming from the east. More likely they came from the west, from "below" (downstream?) Wawona, in which case the left bank would be the north side of the river and 4-Mrp-217, a site on the terrace above 4-Mrp-8 could be the village then occupied. Sargent (1979:12) identifies the area of Camp A. E. Wood, the present campground west of 4-Mrp-343 and in the flat across the river, as the spot where the
Nuchu band of Miwok surrendered. There are sites in this area (Napton et al. 1974) but none seem to fit Bunnell's description. To add to the difficulties, Bunnell later states that there was a "plateau" on an "elevated table" "nearly opposite" the village (Bunnell 1892:43). The prominent meadow of Wawona is not mentioned at all. These last facts may indicate that the village destroyed by Savage was not actually in the Wawona Valley, but elsewhere along the Merced. In any case, I do not feel that we can identify any of the presently known sites with Bunnell's account.

The Mariposa Battalion went on, and were the first Anglos to enter Yosemite Valley. Chief Tenaya and 72 members of his band surrendered and the Battalion burned the food stores in the valley in an attempt to force out others. Tenaya and his people escaped, but a second expedition later recaptured them and they were removed to the Fresno River Reservation. After several months they were allowed to return to Yosemite, but there was further trouble with the Anglos in 1852. In 1853 the Paiutes killed Tenaya and some others and the Awanichis, the Yosemite band of Miwok, were scattered (Bunnell 1892; Russell 1947; Moratto 1972).

Bunnell and other members of the early expeditions into Yosemite were greatly impressed by the valley. In 1853 and 1855 prospecting parties explored the area, and James Hutching described the valley in the Mariposa Gazette (Russell 1947:50). The usual route from Mariposa to Yosemite passed through Wawona. Several of the early visitors were quick to exploit the potential of the Yosemite region for drawing settlers, miners and sightseers. Milton and Houston Mann built a toll trail from Mariposa to Yosemite in 1856-1857. On this trail at what is now called Wawona, Galen Clark built a cabin in 1857 (Sargent 1979:12). There is a spring with sequoia trees planted by Clark at the west end of the meadow, up the slope above the present golf course and 4-Mrp-170. This is locally considered to be his first cabin site. He moved to the other side of the meadow, near the present hotel location "probably before 1858" (Sargent 1979:13). Travelers along the Mann trail were lodged and fed at "Clark's Station."

A number of settlers moved into the Yosemite Valley, and several hotels were built to cater to visitors. There was a growing sentiment
that Yosemite should be preserved as public land. Senator John Conness of California introduced a bill in Washington, signed by President Lincoln in 1864, which made a state park of Yosemite and the Mariposa Grove of redwoods. In 1866 Galen Clark was chosen as guardian of the new park. This position was a drain on Clark's energies, and he first leased Clark's Station in 1868 and 1869, and then took a partner to run it in 1870. Meanwhile, Clark and various associates struggled to finance the construction of a good stage road from Mariposa to Yosemite by way of Wawona and the Mariposa Grove (Russell 1947:147-150; Sargent 1979:13-16).

In 1874 stage roads to Yosemite were completed along the two northern routes, from Coulterville and Big Oak Flat. They drew away much of the traffic from the less comfortable southern route, and this was the final blow to the enterprise of Clark and his partner Moore. They sold out to the firm of Washburn, Coffman, and Chapman for $1,000 and some $20,000 in debts (Sargent 1979:14-16).

Henry Washburn was already a notable figure in the Yosemite transportation business; now he became the dominant figure in the development of Wawona. He began by pushing the stage road to completion in 1875, building the covered bridge across the South Fork of the Merced, and revitalizing the inn, which was now called the Big Tree Station. In 1876 he and his partners added the "Long White" building, which still stands, to the Big Tree Station complex. In November of 1878 a fire destroyed everything except the stables and the "Long White" building. Washburn and John Bruce, his partner of the time, promptly built a fine new two-story building which is the present Wawona Hotel. It was finished in 1879, and U. S. Grant and Rutherford B. Hayes were two of the first prominent visitors. By 1882, the hotel was officially "Wawona," an Indian word meaning big tree (Sargent 1979:33-48).

The unprotected portions of the Yosemite region were being despoiled by settlers, sheep herders, and lumber companies. Starting in the 1870's, John Muir and others began lobbying for the preservation of more of this unique area. This campaign was successful, and in 1890 an area even larger than at present was set aside as Yosemite National Park, surrounding the Yosemite Valley and the Mariposa Grove, which remained state land. The national park was administered by the U.S.
Army, which set up headquarters at Wawona, actually outside the boundaries of both state and national parks. This headquarters was at Camp A. E. Wood, named after the first military superintendent, in the area of the present Wawona campground. From 1891 to 1913, the military ran Yosemite National Park, mapping, building trails, and running out the sheep herders. In 1905, California returned the State Grant of 1864 to the nation, and the Yosemite Valley and Mariposa Grove became part of the national park, so the Army moved its headquarters from Wawona to Yosemite.

During the 1880's and 1890's the Wawona establishment continued to expand. More buildings were added to the hotel complex. Stella Lake, a small artificial lake upstream from the hotel, was built to supply ice and recreation. A fish hatchery was built in 1891 along the river between 4-Mrp-170 and 4-Mrp-343. In a 1932 photograph (Sprinkel and Ackles 1932), the hatchery appears as a substantial building with a stone foundation and a wooden superstructure, but I was unable to locate remains.

In 1900 the first automobile reached Wawona, and Henry Washburn was convinced that here was the wave of the future. Before he could do much towards motor transport, he died at the age of 66 in 1902. Although the leading Washburn was gone, his brother Edward and others of the family and associates continued to run the hotel. Clarence Washburn, son of John, a third brother, became a manager of the hotel and was responsible for some of the changes in the 1900's. An electric power plant was installed in 1908, run by water from the Washburn ditch (Sargent 1979: 53-58), which had been built as a water supply early in 1871 (Sargent: personal communication).

In 1914 the road from Wawona to Yosemite was opened to automobile traffic, and civilian rangers replaced the Army in the park. The automobile age brought changes to Wawona. A new "annex" and a swimming pool were added at the hotel, and in 1918 the golf course was opened. Most of the extensive Wawona meadow remained pasture. The Wawona establishment was a working ranch as well as a hotel, and much of the food served at the hotel was grown on its land. The present slaughterhouse, now a tool shed on 4-Mrp-170 at the end of the golf course, processed the hotel's cows and sheep. This structure was built in 1929 (Sprinkel and
Ackles 1932), and Sargent (1979:61) quotes Clarence Washburn recording the building of a "new" slaughterhouse in 1920, which implies that an older structure was replaced. This should be the foundation present on the site, and probably the earlier one was also nearby.

In the 1920's the Wawona Hotel had some nearby competitors. Jack Minesini established the Sierra Lodge in 1920. This was a sizable complex, apparently on the site discussed below as YOSE 80A-2. The Sierra Lodge competed with Wawona for customers, and built a well near the Washburn ditch, causing conflict over water. It closed as a hotel in the '20's, and was run by Sara Scroggs as a summer youth camp for some years. The National Park Service acquired the property in the 1940's and removed the buildings (Sargent 1979:65-68).

The present road, running along the edge of the meadow and in front of the hotel, was built between 1929 and 1932. The depression hurt the Wawona Hotel's business, and for some years the Yosemite Park and Curry Company, and the National Park Service negotiated to buy out the Wawona Hotel Company. In 1932, 8,785 acres of the Wawona Basin were added to the Yosemite National Park. Of that, 2,665 acres had belonged to the Wawona Hotel Company. The Yosemite Park and Curry Company at the same time purchased the buildings and operating rights. The intent had been to continue running the hotel in its traditional manner, but shortly after the purchase, the park ended the ranch part of the operation, the pastures reverted to meadow, and the vegetable and animal raising ceased (Sargent 1979:67-70).

During the 1930's and 1940's many of the old structures that had once served the hotel were destroyed. The barn and stables now standing west of 4-Mrp-8 were built in 1932 (Sprinkel and Aickles 1932). In 1955 a flood breached Stella Lake and the Washburn ditch, and damaged the covered bridge which had to be drawn up on the north bank of the river and repaired. Starting in 1964 a number of historic structures were moved to Wawona and arranged as a "pioneer village" near the barn west of 4-Mrp-8. A basic sewage system laid out in the 1930's was expanded in the 1970's by the addition of a pond and tank near the golf course and a spray field near 4-Mrp-343. This is the last of the major events affecting the sites in this report. As tourist traffic inevitably increases, historic and prehistoric sites will no doubt be further affected.
Historic Artifacts: General Information

The following section contains general information and definitions for the major classes of historic artifacts recovered during this project. The artifacts themselves are described in the discussions of specific sites. The general information is presented in the hope that it will be of general use, and so that the conclusions based on historic material may be evaluated by others.

Glass

The dating of glass objects is based on knowledge of manufacturing techniques that leave their marks on the glass, and identification of the marks of makers, distributors, and contents. Most of the glass recovered at Wawona is bottle glass, and the discussion following will relate mostly to bottles.

The dating of bottles by technological features has been discussed in considerable detail by others (Armstrong and Schulz 1980; Jones 1971a, 1971b; Lorrain 1968; Newman 1970; Toulouse 1968, 1969b). Accordingly, I will give only the briefest of outlines, emphasizing aspects relevant to the Wawona material.

Until the early 19th century, most glass was free-blown. The technique of blowing the glass into a mold to give it a consistent form became increasingly popular, until by the mid-19th century most bottles were mold-blown. Molds changed through time, and different types can be identified by the placement of seams on the bottle, where glass was forced between sections of the mold. The finish, or top, of the bottle is datable too, as we know when different methods of closing bottles were developed and more approximately when they went out of style. Early finishes were simple, crudely made by hand. After the 1850's a finishing tool was used on most bottles, leaving uniform finishes. In 1881 the first semi-automatic bottle making machine was invented, and in 1903 the Owens automatic bottle machine was patented, revolutionizing the glass container industry.

What follows is a brief discussion of the chronologically significant features recognized on the Wawona material. All dates are subject to certain problems. Bottles are frequently reused for the same or oth-
er products, especially in the 19th century. Many of the dates for new techniques are based on patent information and some techniques were used before patenting, or did not become commercially available until after the patent date. New techniques did not immediately replace older. Much of our information is subject to refinement by future research. With these warnings in mind, collections of discarded glass may be used to suggest a rough date for the context in which they are found. Because of these difficulties, I thought it best to explicitly present the information and assumptions used in dating Wawona material.

**Pressed Glass.** 1827-present. The pressing mold machine was invented in 1827 (Lorrain 1968).

**Snap Case.** ca 1845-1920. A device for holding a bottle while finishing it that replaced the pontil, and eliminated the pontil mark, on the bases of bottles. A date frequently given for the invention of the snap case is 1857 (Lorrain 1968) or 1855 (Newman 1970), but it seems the snap case and other similar devices were in use in the 1840's (Armstrong and Shulz 1980). This too was replaced by machine techniques.

**Lipping Tool or Finishing Tool.** ca 1850-1920. This tool forms a relatively even and symmetrical finish, often with horizontal striations. It was introduced before 1850 (Lorrain 1968) and used until replaced by machine-made finishes, starting after 1903 in some glass factories. A reasonable range is ca 1850-1920.

**Post Bottom Mold.** The defining marks of this mold type are described by Toulouse (1969b:581) as a circular seam symmetrically placed on the bottom of the bottle coincident with, or slightly larger than, the bottom contact area on which the bottle stands, and joined to the side seams. Toulouse gives no useable dates, simply stating that the technique was old by the time of Mason's jar patent in 1858, and was more favored for hand-blowing molds.

**Cup Bottom Mold.** Of this Toulouse (1969b:583) says "the lowest bottle seam is a circle around the heel at or just below the tangent of the heel radius and the side wall." Again this is not well dated, but is "the more common machine mold type."

**Cup-post Bottom Mold.** 19th century-1920? Fratt (personal communication) defines a third mold configuration combining the marks of both the above as the "cup-post bottom mold." Of the 454 whole beer bottles
recovered by the Tucson Urban Renewal Project, 247 had cup-post bottom mold bases, and of these only one was machine made (Fratt: personal communication).

**Turn Mold or Paste-mold. ca 1870-1920.** Some bottles were rotated within the mold as they were blown. This eliminated mold seam marks, required a circular horizontal cross-section, prevented the use of embossed lettering, and frequently left horizontal striations on the body of the bottle. "Turn mold bottles became popular in the US beginning in the 1870's and were produced possibly as late as the 1910's-20's (Toulouse 1969b:532)."

**"Lightning Stopper." 1875-ca 1920 (-present).** "Lightning" was the trade name given by Henry W. Putnam to an exterior plug stopper with a wire leverage system to hold it on firmly. Putnam patented several forms of this device between 1878 and 1880. Charles de Quillfeldt had patented a stopper on the same principles in 1875 (Riley 1958:99), and there were a number of similar competing devices in the 1800's. Because they were more expensive than Hutchinson type stoppers, Lightning type stoppers were mostly used for beer and ale (Riley 1958:98); however, they could be applied to almost any type of bottle finish. They were eventually squeezed out of the market by the crown cap, and it is probably safe to assume that Lightning-capped beverage bottles in the United States pre-date World War I. Nevertheless, they are still made; imported "Grolsch" beer from Holland available in Tucson grocery stores in 1981 is sealed with a porcelain Lightning-type stopper.

**Hutchinson Stopper. 1879-ca 1912.** This was a rubber gasket stopper held inside the bottle neck by a wire spring. It was patented in 1879, widely used and imitated through the 1800's, discontinued by Hutchinson 1912 (Riley 1958:98).

**Crown Cap. 1892-present.** William Painter developed this familiar closure in 1889-1891 and it was patented in 1892. It required a special finish on the bottles, and a special machine to cap them, so it was quite a while before the crown cap won out over its earlier competitors. "Substantial use of the new closure by soda-water bottlers did not get started until about 1897. By 1902-03, less than 20 bottling plants in the New York City area were using the new crown" (Riley 1958:102). The crown cap has been the most important beverage bottle closure for many
years. In the Tucson stores now (1981) it is giving way to aluminum
twist caps on most soft drink bottles, while still surviving on beer
bottles.

**Semi-automatic Bottle Machine.** 1881-present?; bottles 1902-present? These machines (and the Owens machine below) leave essentially identical mold marks. The identifying features are seams running around the top of the finish (Toulouse 1969b:585) and "ghost" seams on the sides resulting from the consecutive use of a blank mold and a final finish mold (Toulouse 1969b:586). Of numerous semi-automatic machines, only one seems to leave a mark specifically identifiable with that machine. Toulouse (1969b:583) describes a machine-made "valve" mark, a circular indented groove. This is elsewhere identified (Toulouse 1971:302) as the mark of a Miller machine, an improved semi-automatic introduced in the early 1900's (Davis 1949:210). The early semi-automatic machines were first used for jars and did not produce many bottles until after 1902 (Fratt: personal communication; Scoville 1978:178) or 1908 (Schulz et al. 1980:6; David 1949:214). I am unable to say with certainty that semi-automatic machines are used today. They certainly survived at least through the Second World War, judging by the information on various glass companies given in Toulouse (1971). Jones (1971) states that some are still used in England.

**Owens Automatic Bottle Machine.** 1903-present. Owens patented his fully automatic bottle machine in 1903. The mold marks produced by this machine are identical to those of the various semi-automatic machines with the exception of a soft, eccentric, irregular round scar on the base of the bottle. This is the "cut-off" scar, produced by a suction feeder when the molten glass in the first or blank mold is severed from the glass remaining in the pot (Toulouse 1969b:582). The automatic feeder is what made Owen's machine fully automatic; the semi-automatic machines were fed by hand. To add to the confusion, it seems that many semi-automatic machines after about 1914 were fitted with various feeders, making them too fully automatic (Davis 1949:210).

Machine-made bottles are a good example of why dates based on bottle technology are necessarily loose. The Owens machine was patented in 1903. In 1906, there were eight Owens machines and about 168 semi-automatic machines operating in the United States. By 1916 the ratio
was still only 187 to 459 (Davis 1949:214). Toulouse (1971:30-33, 264-268), in discussing major bottle companies such as Illinois Glass Co. and American Bottling Company, makes it plain that bottles were made by Owens machines, semi-automatic machines, and hand-blowing sometimes side-by-side in the same factories well into the 1900's and up to 1925 at least. Machines were expensive and took a long time to catch on.


Color. The glass recovered from Wawona was in many colors. Most offer little chronological or other information. Clear glass was most common. "Clear" as used here indicates only that the glass was not intentionally given an artificial color. Most of the clear glass from Wawona is light greenish or bluish.

"Flint" glass (or "lead" glass) is the clear colorless glass common today, and this colorlessness usually required the addition of manganese dioxide or silenium to offset the green or blue caused by iron. Modern techniques have reduced the need for decolorizers (Toulouse 1969a:534). Various colorless glasses have been used for centuries, becoming more and more popular after the Civil War.

"Sun-turned amethyst" was originally clear glass, changed to a purplish color by the action of the sun on the manganese decoloriser. Manganese dioxide came from Germany and the supply was cut off during World War I at which time glass makers switched to silenium and never switched back (Toulouse 1969a:534). Sun-turned amethyst glass is thus probably post-Civil War and pre-World War I.

"Amber glass was made by adding some form of carbon as a reducing agent, together with some form of sulphur" (Toulouse 1969a:532). Amber glass was considered to protect beer and other drinks from the effects of light, and has been made at least since the first half of the 19th century.

Black glass is actually a very dark green which appears black in reflected light. Also used for alcoholic beverages, black glass has been made in the United States since the first half of the 19th century. Jones (1971b:11) remarks that "refined examples" can still be bought, but concedes a decline at the end of the 19th century. Newman (1970:74) gives black glass dates of 1815-1885, and it seems that there was proba-
bly little black glass made in the United States after the last years of the 19th century.

Olive green as used here refers to a bright clear green, like that of modern Seven-Up bottles. Blue glass refers to an intentionally bright deep blue, still seen on some ointment jars, and frequently used for ointment and medicine containers in the past. Opal glass, otherwise known as milk glass, is translucent white glass, most common in small jars, and pressed and other decorative wares. For these last three colors, olive green, blue, and opal, I have not been able to find reliable information on dates of introduction. All three colors are presently made.

Makers' Marks. Glass containers are often embossed with the mark of the company that manufactured them, and sometimes with the name of the products they contain or the distributor who handles them. With sufficient research many companies and their marks can be precisely dated. In this project, time limits have forced me to restrict my research to secondary sources and some of my identifications are incomplete. The major source of information is Toulouses' Bottle Makers and Their Marks (Toulouse 1971).

The last few pages express a preoccupation with dating. There are a number of reasons. It is the type of information most readily obtainable from glass containers, especially fragmented ones. We are interested in the occupational history of the sites: who was there and when? This is interesting information for its own sake, but is also necessary for management concerns where a project such as this is expected to evaluate the age and historical significance of a site.

The glass can provide more than just chronological data. We can say something about what the bottles originally contained, based on the type of bottle and embossed labels. Bottle finish types were fairly standardized and give a rough idea of the contents for which the bottle was intended (but not necessarily used). The identifications in this report are from Putnam (1965), which is an unattributed reprint of an Illinois Glass Company catalogue ca 1903 (Fratt: personal communication), and from Herskovitz (1978) and Switzer (1974). Because the Wawona sample is small and comes from dump contexts, mostly mixed, I have not tried to do much with the information on contents. In a larger
sample with better context it might also be possible to discuss, through identification of makers' marks, commercial connections, and their changes over time.

Ceramics

The ceramics from Wawona are fairly homogeneous and not very informative, so I will not deal with them at length. The paste or body varies according to the material used and the temperature of firing, and may be used to divide 19th century commercial ceramics into four major groups. Porcelain is translucent and has a hard, nonabsorbent vitreous paste. Stoneware is opaque, hard, only slightly if at all absorbent, and usually not very white. Stoneware most often appears as crockery. Earthenware has a relatively soft, porous, and opaque paste. Whiteware is opaque, hard or even vitreous, and white or creamish with a granular fracture. Following Teague (1980:73) I use whiteware as a generic term including Ironstone and other tradenamed wares such as Stone China and semi-porcelain. The definitions above are taken primarily from Teague (1980); also Herskovitz (1978), Spargo (1926), and Shenk and Teague (1975). The available literature is chaotic; some workers would use what I term whiteware as a subdivision of earthenware or white earthenware. All the definitions are loose, containing much variation and gradation. "Hard" and "soft" are particularly subjective and relative.

There is only a little stoneware and porcelain from Wawona; the whitewares are by far the most common ceramic type. Whitewares are of little use in dating unless they have makers' marks, since they arrived in the first decade of the 19th century (Noel Hume 1969:130-31) and have been with us ever since.

Ammunition

The history of firearm ammunition has been thoroughly traced by Logan (1948) and will not be dealt with here. Only five metal cartridge cases were recovered from Wawona, all on 4-Mrp-8. Metal cartridges have four basic parts: a case, a primer, powder, and a bullet. In a rimfire cartridge, the primer is placed around the inside rim of the cartridge case; in a center-fire cartridge, the priming is in the center. In either case, the blow of the hammer or firing pin indents the metal and
explodes the primer, which ignites the powder to propel the bullet.

Caliber is an expression of bullet diameter in hundredths of an inch; e.g., a .44 caliber bullet is supposed to be forty-four one-hundredths of an inch in diameter. In actual practice a bullet may have a diameter two- or three-hundredths different from its stated caliber, and cases vary even more. A second figure after the caliber, as in .56-50 may be used to refer to the grains of powder commonly used in a particular cartridge. The base of the cartridge may be stamped with the caliber, the manufacturer, or other information. This is the headstamp.

Cans

Fontana and Greenleaf (1962) give a fairly thorough discussion of the development of canning and tinned iron cans. Tin cans (actually tin-coated iron or steel) were developed about 1810, at which time the cans were handmade, with overlapping and heavily soldered seams. The can was filled through an opening an inch or two in diameter left in the top. A cap was soldered over the hole and the contents were cooked in the can. Steam was vented through a small hole which was sealed with a drop of solder after the cooking process. This type of can, called the hole-in-top or hole-and-cap can, was produced throughout the 19th century and was machine-made by the 1880's. The modern crimped seam or double seam cans with single piece tops and no vent holes were developed around 1900 and shortly thereafter replaced the old hole-in-top type can.

The flat sardine can shape was early used for meat and fish. The first ones were three-piece cans with soldered seams, but by 1880 the base and body were drawn in one piece. Modern double-seamed sardine cans apparently did not appear in the United States until 1918 (Fontana and Greenleaf 1962:72).

Along with cans there were can openers. A number of patent devices for cutting open cans were in use in the 19th century. The scored strip-and-key opener familiar to any corned beef eater was invented in 1865 (Fontana and Greenleaf 1962:71). The church key opener came out with the first flat-top beer cans in 1935 (Lady 1976). Flat top beverage cans to be opened with a church key have now (1981) been almost entirely replaced by various aluminum pull-top and pop-top type openings.
Some cans have embossed labels, and different sizes and shapes rapidly became standard for different foods. Teague (1980) discusses this at length.

Nails

Nails can be dated by technological changes reflected in their forms. Nails provide only rather loose chronological information and should only be considered as assemblages, never singly (Nelson 1968).

The development of nail technology can be summarized as follows (Nelson 1968; Fontana and Greenleaf 1962; Teague 1980):

1. Antiquity to AD 1800: Handwrought Nails. Handmade wrought nails tend to be uneven in shank and head, and the rectangular shank tapers on all four sides to the point. Handwrought nails were used for some purposes until at least 1850 (Fontana and Greenleaf 1962:54), long after they had been superseded by cut nails.

2. 1790-1830: Early Cut Nails. This period saw the development of numerous machines for producing cut nails from iron plates. The earliest cut nails were headed by hammer. Later, water-powered machines were developed to head them automatically. Both the hand-hammered and the early machine-headed nails tend to have uneven heads.

3. 1830-1890: Cut Nails Predominate. The shanks of cut nails are parallel on two sides, and taper on two sides. Once the machinery was perfected, nails could be produced with uniform square heads and even shanks, and cut nails after 1830 are virtually indistinguishable from those produced today.

4. 1890 - Present: Wire Nails. Wire nails were invented in France around 1830 and introduced to the United States by 1855 (Fontana and Greenleaf 1962:54). They did not really begin to compete with the cut nail until the 1880's. By 1895 wire nails, essentially the same as those of today, had conquered the market. (For a more extensive treatment of nail chronology, see Fontana and Greenleaf 1962; Nelson 1968).

Both wire and cut nails are produced in a number of different sizes, labeled by "d" (pennyweight), and in many different forms. The pennyweight designations have at least two explanations, one being that ideally the pennyweight of a nail equaled the number of pounds per 1000 nails (Fontana and Greenleaf 1962:55), the other that it was at some
time the price of 100 nails of that size (Nelson 1968). Whatever the origin, this system became standardized by length rather than by weight or price, apparently by the 1400's (Nelson 1968).

The lengths given later in Table 9 (page 59) for different pennyweights are taken from the Sears Roebuck and Co. catalogue for 1897, which advertised wire nails, but correspond to the illustrations of square nails in the Russell and Erwin Manufacturing Co. American Hardware catalogue of 1865. Although the pennyweight/length system seems fairly standardized, Fontana and Greenleaf (1962:56) indicate that different forms of square cut nails sometimes had different lengths for the same pennyweight. In the assemblages from Wawona, there was a certain amount of variability among nails which were clearly of the same pennyweight, and the 2d and 16d square cut nails were consistently longer than the 1 inch and $3\frac{3}{4}$ inches expected.

There are numerous different forms of square cut nails, and of wire nails. Fontana and Greenleaf (1962:57-60) describe common cut, fencing, casing, brad, finishing, fine blued, barrel, clinch, roofing, channel, copper, basket, and chair as different forms of cut nails. Catalogues such as Russel and Erwin (1865) show other named forms. These are all distinguished by such attributes as head size, length of beveling on shank, rectangular or square point, and material. These distinctions of form appear to be variable, are often minute, and are frequently difficult to recognize in archeological specimens.

As the names of the different forms imply, each was intended for a specific task. Naturally enough, different sizes of nails were also used in different situations. Usage varied from builder to builder, and nails can best be looked at as rough functional groups of sizes (Teague 1980).

4-Mrp-170 Historic Material

Historic artifacts were observed over most of the surface of 4-Mrp-170. The golf course which impinges on 4-Mrp-170 can itself be considered a historic artifact. Opened in 1918, it was the first mountain golf course in California (Sargent 1979). The western end of the site yielded two assemblages of historic material associated with the Wawona
Hotel and the developing tourist industry in Wawona.

Surface Unit X

Surface Unit X was discovered after formal work on 4-Mrp-170 had been finished. It was a large scatter of broken glass with some pieces of ceramic and bone, west of the slaughterhouse area, in undergrowth near the river. The artifacts appeared to be from a disturbed dump area. There was evidence of old digging, and some of the broken bottles had been sorted and stacked. No whole bottles were observed; they have probably all been removed by the bottle hunters. A selective collection of diagnostic pieces, mostly finishes and bases, was made to date the dump.

The material collected from area X consists of 18 bottle finishes, nine bottle bases, one bottle neck and shoulder, two drinking glass bases, and four pieces of whiteware, as follows:

Bottle Finishes (see Fig. 1)

Fig. 1a. Dark green glass-1, clear glass-2, flint glass-1. This sort of finish is often found on bottles intended for wine and other liquors (Putnam 1965). These four specimens were all made with a finishing tool (ca 1850-ca 1920) and the flint glass finish comes from a turn molded bottle (ca 1870-ca 1920).

Fig 1b. Dark green glass-1. This finish is called a champagne finish by Herskovitz (1978:5), and occurs on champagne, wine, and other liquor bottles (Putnam 1965). This one was made with a finishing tool (ca 1850-ca 1920).

Fig. 1c. Clear glass-1. This too occurs on wine and liquor bottles (Putnam 1965), and our specimen is finished with a finishing tool (ca 1850-ca 1920).

Fig. 1d. Sun-turned amethyst-1. This is the finish on screw-top brandy bottles in the ca 1903 Illinois glass catalogue (Putnam 1965: 140). It also occurs on other flasks and bottles, including those for ketchup (Putnam 1965:195). It is machine-made and poorly fire-polished. Thus it should date after 1903 and, because of the discolored glass, before World War I.

Fig. 1e. Amber glass-1. This is a beer bottle finish, although
Fig. 1. Glass bottle finishes from Wawona sites.
frequently used for other beverages (Putnam 1965). A Lightning stopper was often used with this finish, especially for effervescent drinks. Our specimen was made with a finishing tool (ca 1850-ca 1920).

Fig. 1f. Dark green glass-1. Another type of liquor finish (Putnam 1965), this specimen is made with a finishing tool (ca 1850-ca 1920).

Fig. 1g. Clear glass-2. Both specimens of this liquor finish, common on brandy bottles (Putnam 1965), are worked with a finishing tool (ca 1850-ca 1920).

Fig. 1h. Amber glass-1. This finish looks something like a crown finish but isn't. It is probably a finish for beer and other liquor, to be closed with a cork. A finishing tool was used (ca 1850-ca 1920).

Fig. 1i. Amber glass-1, Clear glass-2. This crown finish was patented in 1892 especially for use with carbonated beverages. All three specimens were made with a finishing tool, so the combined date range should be 1892-ca 1920.

Fig. 1j. Sunturned amethyst glass-1. The most common finish on patent medicine bottles, this specimen was made with a lipping tool, and should date ca 1850-World War I.

Fig. 1k. Olive green glass-1. This color of glass and type of finish was common in containers for olives, pickles, and preserves (Putnam 1965). This example was rather roughly handmade, so probably dates as before about 1920.

Fig. 1l. Flint glass-1. This is a machine-made milk bottle finish. Milk bottles with paper lids were introduced in 1889 (Munsey 1970) and lasted at least to the early 1960's in my memory.

Bases

1. Round with kick-up. Clear glass-1, sun-turned amethyst-1. The clear piece was turn molded (ca 1870-ca 1920). Kick-ups are most common on bottles for wine and related liquor.

2. Round, post bottom mold. Clear glass-1. The post bottom mold is most frequent on pre-machine bottles (Toulouse 1969:578). This specimen has an embossed "NB" in a circle (Fig. 2b). Toulouse (1971:377) gives this as the 1903-1937 mark of the North British Bottle Manu-
Fig. 2. Embossed glass bottle bases and whiteware makers' marks from Wawona sites.

42
facturing Company of Shettleston, Scotland. Lee Fratt (personal communication), who has worked with a large collection of 19th century material from the Tucson Urban Renewal Project, suggests that this is more likely a beer bottle from the North Baltimore Bottle Company.

3. Round, cup-post bottom mold. Clear glass-3. Fratt (personal communication), from experience with 454 whole beer bottles from the Tucson Urban Renewal Project, feels that these are pint-size "export" beer bottles. One is embossed "AB," the others A. B. Co. (Fig. 2d, e). The first mark is assigned by Toulouse (1971:26) to the Adolphus Busch Glass Manufacturing Company ca 1904-1907. Part of the Busch operation was taken over by the American Bottle Company, who used the second mark from 1905-1916 (Toulouse 1971:30). Both these glass companies were associated with the brewing industry in Illinois.

4. Oval. Sunturned amethyst-1. The mold marks are indefinite. In form this base looks like the Oval Cummings or Picnic-type whiskey flasks pictured in Putnam (1965). There is no maker's mark, but the discolored glass places this piece probably before World War I.

5. Elongated octagonal. Clear-1. There are no good mold marks on this piece. The form resembles that called an octagonal pepper/spice by Herskovitz (1978:4).

6. Round. Opal glass-1. Of thick white glass, this fragment is embossed with a small cow's head and (IM)PERIAL (CHEE)SE (Fig. 2c).

7. Drinking glass bases. Flint glass-2. One of these is a thick round tumbler base, the other a thin flat base from a round drinking glass.

Neck and Shoulder. Clear glass-1. The finish is broken, but was made with a finishing tool which obliterated the two mold marks on the upper part of the neck. Around the shoulder it is embossed WORCESTER-SHIRE SAUCE and running vertically up the side (LEA AND PERRIN)NS.

Ceramics

Only four pieces of whiteware were collected as identifiable, from two saucers, a butter dish (?), and a plate. The first three are decorated with underglaze transfer prints in green, two variations of a floral design. The maker's mark on one identifies the design as "New-
port," and the maker as John Maddock and Sons, England (Fig. 2). The other piece bears a different mark of the same firm in blue underglaze transfer print (Fig. 2). The design is identified as "Rector," a stylized leafy motif. Above the maker's mark is the name of the distributor for whom the batch was made "(Natha)n Dohrman Co. (San) Francisco." Godden (1964:406) dates both marks as "ca 1896+.

Interpretations

If we assume that this dump is fairly homogeneous, as it appeared to be in the field, we can assign a fairly precise date to it. Almost all the bottles are handmade (pre-1920) with the exception of two out of the 18 finishes. There are four pieces of sun-turned amethyst glass, which should be before World War I. One of these is a machine-made finish, which thus should be made after 1903. The identifiable makers' marks date 1903-1937, 1904-1907, and 1905-1916. The ceramic marks should be shortly after 1896. Thus the dump as a whole was probably deposited after 1903 and before the First World War, probably closer to 1903 when only a very few bottles were machine-made.

The two whiteware marks and patterns found here represent almost the only sort of decorated ceramics from Wawona, not only in this dump but elsewhere on 4-Mrp-170 and also from the surface of 4-Mrp-8. They also occur in two dumps from Yosemite Valley, which are probably related to the hotels there. While there is no secure evidence, it is probable that the dump at 4-Mrp-170 contains kitchen garbage from the Wawona Hotel. The nature of the material, mostly beverage and food bottles and tableware, the proximity of the hotel, and the known use of this land for hotel animals and meat processing is consistent with this possibility.

Slaughterhouse Area and Excavation Unit 1

On the western edge of 4-Mrp-170 stands a frame building with a high concrete foundation. Now used as a storage shed for lawn mowers and other golf course equipment, it was built in 1929 as a slaughterhouse for the Wawona Hotel (Sprinkel and Ackles 1932). A 1932 photograph in the Yosemite Museum shows it with a chute, which has since been removed, but there is still a projecting beam for a block and tackle.
This structure replaced an earlier slaughterhouse nearby, which apparently had been built in 1920 to replace a still earlier one (Sargent 1979:61).

Near the present slaughterhouse is a foundation consisting of loose stones in a rough rectangle divided into two square rooms. The whole is about 9 meters long x 4 meters wide. There is only one discontinuous course visible and the foundation has been disturbed, probably by driving a bulldozer over it some years ago when a large depression was formed to the south by the removal of soil for the golf course (Al Gordon: personal communication). Al Gordon identified this foundation as the site of the old slaughterhouse.

All around the foundation the ground is covered with bits of calcified bone and some badly weathered unburned pieces. There are also some glass, ceramic, and metal artifacts, mostly burned. EU 1 was dug near the slaughterhouse foundation to evaluate this area of refuse.

Excavation Unit 1. EU 1, in the area of the old slaughterhouse (Map 3) uncovered evidence of garbage disposal, but of a different sort from that in Surface Unit X. This unit, the first opened, was excavated in 10-centimeter levels. There was much burnt bone throughout, and between 20 cm - 40 cm depth a thick layer of unburnt, poorly preserved bone discarded by the slaughterhouse. Mixed with this were numerous pieces of glass, ceramic, and metal.

Most of the material from EU 1 is undatable, but enough is datable to give us an idea of the age of the dump.

Level 1: 0-10 cm depth. This level contained a crown cap and four machine-made crown finishes, including two from amber beer bottles, a recent Seven-Up bottle, and an almost complete Bireley's (orange drink) bottle. Both soft drink bottles have applied color labeling and are thus more recent than 1934. The base of the Bireley's bottle is embossed with the mark used by Glass Containers, Inc. since 1945 (Toulouse 1971:220) (Fig. 2f). Two other machine-made bases were recovered, an amber beer bottle with the mark of Maywood Glass Company "ca 1958" (Toulouse 1971:357) and a flint glass whiskey flask embossed "Half Pint" on the heel, and with the mark used by the Owens Illinois Glass Co. since 1954 (Toulouse 1971:403) (Fig. 2g, h). There was also a piece of sun-turned amethyst glass, and newspaper fragments dated July 2, 1957.
Level 2: 10-20 cm depth. There were nine crown caps in this level, parts of the same Seven-Up bottle as in level 1, and parts of the first and a second Bireley's bottle, and of the whiskey flask. The other datable glass was a small blue glass machine-made ointment jar with the mark (Fig. 1a) used by the Maryland Glass Corporation since 1916 (Toulouse 1971:339), a piece of an opal glass Mason jar lid liner, and three pieces of sun-turned amethyst bottle glass. There were more ceramics than in the first 10 centimeters (Table 1), including a piece of the familiar "Newport" pattern.

<table>
<thead>
<tr>
<th>Level</th>
<th>Depth</th>
<th>Metal</th>
<th>Glass</th>
<th>Ceramic</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>0-10 cm</td>
<td>19</td>
<td>134</td>
<td>3</td>
</tr>
<tr>
<td>2</td>
<td>10-20 cm</td>
<td>100</td>
<td>125</td>
<td>24</td>
</tr>
<tr>
<td>3</td>
<td>20-30 cm</td>
<td>9</td>
<td>62</td>
<td>63</td>
</tr>
<tr>
<td>4</td>
<td>30-40 cm</td>
<td>22</td>
<td>30</td>
<td>25</td>
</tr>
<tr>
<td>5</td>
<td>40-50 cm</td>
<td>1</td>
<td>1</td>
<td>1</td>
</tr>
</tbody>
</table>

Table 1
ARTIFACT DISTRIBUTION, EU 1, 4-Mrp-170

Level 3: 20-30 cm depth. From this level comes another piece of the second Bireley's bottle, and a flint glass bottle base with the mark of a Miller's semi-automatic bottle machine. It is embossed "Van Thomas Co.," a name that does not appear in Toulouse (1971) and may be a product or distributor rather than a glass company (Fig. 2i). Among the ceramics there are two pieces of the "Rector" pattern and one partial "Newport" mark, both by John Maddock and Sons of England.

Level 4: 30-40 cm depth. This level contained a crown cap and a melted crown finish, a small, uneven flint glass bottle base, and a fragment of a sun-turned amethyst medicine bottle panel embossed "... ILY...ONTA...."

Level 5: 40-50 cm depth. This level was essentially sterile.

The stratigraphy and the artifacts indicate two periods of use. The upper two levels are loose to firm loam with much organic material, glass, and burnt bone. Ash occurs throughout and in distinct lenses. Several of the artifacts in these levels date from the 1950's; most of the rest could also be that recent. The few items that are certainly earlier, i.e., the sun-turned amethyst glass and the "Newport" pattern
whiteware, are all small and easily subject to disturbance. There are visible, active rodent holes as deep as 30 cm below the present surface. In spite of the large amount of ash present, few of the artifacts show the effects of fire. Glass and metal artifacts (mostly nails and wire) are more numerous than ceramic (Table 1).

At the top of level 3 there is a layer of fine sandy loam that partially covers the stratum below. It is mostly sterile, and shows some bedding, thus it is probably water laid sand in a small drainage channel. Under this are the third and fourth levels containing the bones. There are few datable artifacts in the third and fourth levels, but the assemblage is different, including many more ceramic artifacts. The metal is far more corroded than that from the upper levels, and many of the ceramic and glass pieces are burned or melted. The presence of the "Newport" and "Rector" pattern whiteware may link this material to that from the surface dump material previously described.

Bone From EU 1

The bone from this unit follows the stratigraphic pattern of the artifacts. Table 2 shows the unidentifiable fragments by level. While burnt bone is common throughout the unit, unburnt bone is mostly confined to the 3rd and 4th levels.

<table>
<thead>
<tr>
<th>LEVEL</th>
<th>BURNT</th>
<th>UNBURNT</th>
</tr>
</thead>
<tbody>
<tr>
<td>0-10 cm</td>
<td>150</td>
<td>1</td>
</tr>
<tr>
<td>10-20 cm</td>
<td>620</td>
<td>12</td>
</tr>
<tr>
<td>20-30 cm</td>
<td>725</td>
<td>83</td>
</tr>
<tr>
<td>30-40 cm</td>
<td>404</td>
<td>308</td>
</tr>
<tr>
<td>40-50 cm</td>
<td>26</td>
<td>4</td>
</tr>
</tbody>
</table>

The unburnt bone was in poor condition, exceedingly friable, and often softer than the surrounding soil. The burnt bone was usually reduced to very small fragments, mostly of long-bone shafts. In spite of this, a total of 297 identifiable bones and bone fragments were collected. Because of the condition of the bone, fragile bones are
probably under-represented in the collection. While the unburnt bone is limited in stratigraphic extent, the burnt bone occurs throughout. There is a stratigraphic and temporal division at about 20 cm depth. Only 10 pieces of identifiable bone were recovered above 20 cm depth, all burnt but one. Two of these are cow, the rest sheep. These are excluded from the following analysis. It is assumed for the purpose of this analysis that in spite of some probable disturbance, the burnt (14 pieces) and unburnt (271) bones from 20-40 cm depth belong together.

Table 3 shows the number of bones identified as cow, sheep, pig, and small ungulate. The small ungulate category includes bones which may be sheep, goat, deer, or pig, but cannot be definitely identified by species. The articular parts of most major bones can usually be identified (Lawrence 1951; Hildebrand 1955). As only three bones were definitely pig, and no deer were identified, the small ungulate bones have been considered as sheep in the anatomical breakdown to follow.

Table 3

<table>
<thead>
<tr>
<th>SPECIES</th>
<th>NUMBER OF BONE FRAGMENTS</th>
</tr>
</thead>
<tbody>
<tr>
<td>Cow</td>
<td>78</td>
</tr>
<tr>
<td>Sheep</td>
<td>134</td>
</tr>
<tr>
<td>Pig</td>
<td>3</td>
</tr>
<tr>
<td>Small Ungulate</td>
<td>72</td>
</tr>
</tbody>
</table>

Table 4 shows the number of different bones from sheep, cow, and pig. Archaeologists commonly calculate the minimum number of individuals present in a collection of bones. The simplest method is to use the most common bone. For sheep there are four lower left third molars, plus a left mandible with a third molar, so at least five individual sheep must have unwillingly donated their bones to this collection. If we use the metapodials, we have a total of 25 bones; two metacarpals and 23 pieces that are either metacarpal (forelimb) or metatarsal (hindlimb) bones. Any one sheep has only four metapodials, thus at least six individuals are represented. The cow bones could all have come from one cow except that there are 13 incisor teeth (a cow has eight) and two


<table>
<thead>
<tr>
<th>FEET</th>
<th>HIND</th>
<th>HEAD</th>
<th>TEETH</th>
<th>FOREQUARTER</th>
<th>HINDQUARTER</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>SHEEP</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Fore</td>
<td>HIND</td>
<td>HEAD</td>
<td>TEETH</td>
<td>FOREQUARTER</td>
<td>HINDQUARTER</td>
</tr>
<tr>
<td>Carpal</td>
<td>5</td>
<td>Tarsal</td>
<td>18</td>
<td>Skull</td>
<td>13</td>
</tr>
<tr>
<td>Metacarpal</td>
<td>2</td>
<td>Metatarsal</td>
<td>0</td>
<td>Mandible</td>
<td>9</td>
</tr>
<tr>
<td>Metapodial</td>
<td>23</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Sesamoid</td>
<td>2</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>1st or 2nd Phalanx</td>
<td>13</td>
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<td></td>
<td></td>
</tr>
<tr>
<td>1st Phalanx</td>
<td>21</td>
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<tr>
<td>2nd Phalanx</td>
<td>16</td>
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</tr>
<tr>
<td>3rd Phalanx</td>
<td>6</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Subtotal</td>
<td>106</td>
<td>22</td>
<td>56</td>
<td>17</td>
<td>5</td>
</tr>
<tr>
<td>Total</td>
<td>206</td>
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<td></td>
<td></td>
<td></td>
</tr>
<tr>
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<td></td>
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<td></td>
<td>COW</td>
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<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Fore</td>
<td>HIND</td>
<td>HEAD</td>
<td>TEETH</td>
<td>FOREQUARTER</td>
<td>HINDQUARTER</td>
</tr>
<tr>
<td>Carpal</td>
<td>5</td>
<td>Tarsal</td>
<td>2</td>
<td>Skull</td>
<td>2</td>
</tr>
<tr>
<td>Metacarpal</td>
<td>1</td>
<td>Metatarsal</td>
<td>0</td>
<td>Mandible</td>
<td>1</td>
</tr>
<tr>
<td>Metapodial</td>
<td>2</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Sesamoid</td>
<td>6</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>1st Phalanx</td>
<td>2</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>2nd Phalanx</td>
<td>2</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>3rd Phalanx</td>
<td>3</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Subtotal</td>
<td>23</td>
<td>3</td>
<td>39</td>
<td>8</td>
<td>1</td>
</tr>
<tr>
<td>Total</td>
<td>74 (plus 4 cut pieces of humerus or femur)</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>PIG</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Fore</td>
<td>HIND</td>
<td>HEAD</td>
<td>TEETH</td>
<td>FOREQUARTER</td>
<td>HINDQUARTER</td>
</tr>
<tr>
<td>Carpal</td>
<td>2</td>
<td>Tarsal</td>
<td>0</td>
<td>Skull</td>
<td>0</td>
</tr>
<tr>
<td>Total</td>
<td>3</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
left unciform (forefoot) bones. With such a small sample of the site we cannot use this information for much except to suggest that more sheep than cows were butchered here.

The majority of the bones, both cow and sheep, are from the head and feet. This is to be expected from a slaughterhouse context. The head and feet, not considered valuable food parts, were discarded on the spot; the forequarter and hindquarter parts, the major meat-bearing portions of the carcass, were further processed, and taken away to be cooked and eaten. Most of these bones must have been discarded elsewhere. Interestingly, there are almost no bones from the hindquarter, the best meat. This may indicate that the hindquarters and forequarters were being processed, distributed, or consumed differently.

There are only a few bones that show the types of final cut produced. There are four pieces of cow humerus or femur which have been sawn across in sections about 1/2-inch thick. These are round steak (if femur) or chuck steak (if humerus). A cow's lumbar vertebra has been split vertically and sawn transversely to produce a T-bone steak. One sawn pelvis fragment represents a mutton chop from the sirloin area. The saw marks are indistinct on the poorly preserved bone, but seem to show the irregular striations of a hand saw skillfully wielded to produce even, parallel sided cuts (Clonts: personal communication).

Only two butchering marks resulting from the initial cutting up of the carcass were found. An axis vertebra had been sawn vertically through the proximal articulation, probably in detaching the head. The end of one beef rib has deep knife cuts, probably from splitting the sternum. Other butchering marks were not found, due in part to the poor condition of the bone.

We can say a little more about the kind of meat produced here. The ages at which the epiphyses, or articular ends of different bones fuse are known for domestic animals (Chaplin 1971; Silver 1969). Payne (1973) has described the eruption and wear patterns on sheep mandibles, which may be used to approximately age skeletal specimens. Table 5 shows the sheep bones from 4-Mrp-170 which allowed an estimate of the sheep's age at death. Commercially, mutton is from sheep more than 12-18 months old (Ashbrook 1955). Carcasses may be classified as lamb or mutton depending on whether or not the metacarpal epiphyses have
fused to the shaft, which occurs starting around 14 months (Selke: personal communication). From Table 5 we can see that sheep of all ages were slaughtered at this site; probably both mutton and lamb appeared on the menu at the Wawona Hotel.

Working with historical material we sometimes have the opportunity to compare archeological results to memories and written records, and see how different sources complement each other. In the early days the Wawona Hotel establishment produced much of its own food. Photographs from the late 1800's show the meadow fenced for pasture, and barns and other outbuildings served cattle, sheep, and horses (Sargent 1979). Sargent (1979:41) quotes a contemporary description. "Wawona was famous for its food. It had its own garden from which all vegetables came; they killed their own meat; they fished out of the rivers. Milk came from their own cows, and in game season, there was quail on toast and venison. A typical Wawona breakfast consisted of fruit in season, beefsteak, ham and eggs, trout, hot cakes, and cornbread with homemade preserves. This was not to give a diner his choice, but to be eaten in its entirety. The rate for room and board was $4.00 per day."

Al Gordon (personal communication) identified the stones near EU 1 as the old slaughterhouse foundation. His father, Ed Gordon, ran the slaughterhouse and the hog farm which was near it. The hogs were fed offal from the slaughterhouse, and garbage from the hotel. Al Gordon remembers that the old slaughterhouse was removed in 1929 or 1930, and

Table 5
BONE DATA FROM EXCAVATION UNIT 1, 4-Mrp-170, 20-40 cm
SHEEP BONE AGE IDENTIFICATION

<table>
<thead>
<tr>
<th>BONE</th>
<th>FUSED</th>
<th>UNFUSED</th>
<th>AGE OF FUSING</th>
</tr>
</thead>
<tbody>
<tr>
<td>Metapodials (Distal Epiphysis)</td>
<td>2</td>
<td>10</td>
<td>14-28 months</td>
</tr>
<tr>
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<td>18-24 months</td>
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<tr>
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<tr>
<td>Mandible</td>
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the government inventory (Sprinkel and Ackles 1932) states that the present structure was built in 1929. It probably went out of use as a slaughterhouse when the government took over in the 1930's. The artifacts associated with the bones do not give a good date, but the presence of "Newport" and "Rector" pattern ceramics may mean that the deposit was formed around the turn of the century, in which case it may belong to the first of three slaughterhouses in the area. A deposit representing rubbish disposal in the 1950's overlies this.

Although the Wawona Hotel apparently sometimes served game, no evidence was found for this. The lack of pig bone is puzzling. Hogs may have been processed elsewhere, or the bones deposited at a time when no swine were kept, or the small sample represented by a single unit may have biased the analysis.

Conclusions

The area recorded by Napton (Napton et al. 1974) as a prehistoric site, 4-Mrp-170, has been greatly affected by use in the historic period connected with the Wawona Hotel. The use of this part of the meadow as pasture for the hotel stock was replaced in 1918 by use as a golf course for the hotel patrons, but the meat processing facilities remained important until the 1930's. The archeological work has recovered evidence of the slaughterhouse meat processing and waste disposal, and of a dump for refuse probably from the hotel. These tell us something about the past of mountain resorts and the developing tourist industry in the Sierra Nevada.

4-Mrp-8 Historic Material

The historic material collected from 4-Mrp-8 came mostly from the twenty 10 x 10-meter surface units, randomly selected as a sample of approximately 20 percent of the site surface. The whole site area was covered with rubbish, and the artifacts will be described together. Most of the material appears to be randomly distributed as a result of casual dumping, but a few significant patterns may be pointed out.
Table 6 shows the distribution of major artifact classes by surface unit. Disregarding the prehistoric lithic artifacts, 65 percent of the historic material is glass. The glass artifacts, in particular, give evidence of the heavy traffic on this site over the years. Everything is broken, and usually into quite small pieces. Even the bottle bases and finishes, the toughest parts, are all fragmentary except for one base and one finish (out of 13 and 10 specimens, respectively). Both of these are from Surface Unit 18, a unit on the sloping bank of the river, where there is little traffic and where the material is protected by lying among cobbles. The broken pieces elsewhere frequently have crushed, battered, and flaked edges and numerous scratches on their surfaces.

<table>
<thead>
<tr>
<th>UNIT</th>
<th>GLASS</th>
<th>CERAMIC</th>
<th>METAL</th>
<th>LITHIC</th>
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<td>20</td>
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<td>4</td>
</tr>
</tbody>
</table>

Total  
753  
262  
145  
1,078 / 2,238  
34%  
12%  
6%  
48% / 100%

A brief description of the more identifiable material follows:
Bottle Finishes. The 10 finishes described below were all made with a finishing tool. The numbers refer to Fig. 1 and previous descriptions in the section on 4-Mrp-170.

Fig. 1a. This is a liquor finish, previously described. One fragment in dark green glass was recovered. Fig. 1e. Three amber glass specimens of this beer and liquor finish were found, of which two have a rounder profile than that illustrated. Fig. 1i. This is the common crown finish, of which one amber glass specimen was found. Fig. 1j. One sun-turned amethyst example of a patent-medicine type finish was found.

Four other finishes were recovered in so fragmentary a condition that it is difficult to say what they were. A black glass and an amber glass specimen both have at least one bead and are probably liquor finishes. The other two fragments are of clear and sun-turned amethyst glass. In addition to these finishes, three crown caps were found.

Bottle Bases. There are six base fragments from round amber glass liquor bottles. Three are from cup-bottom molds, two from post bottom molds, and one is indeterminable. The post bottom mold bases are embossed, one with an illegible fragment, and the other with a partial maker's mark reading 3....MIL. "MIL" like this occurs as part of the work of William Franzan and Son on beer bottles from the Tucson Urban Renewal Project (Fratt: personal communication). This company operated in Milwaukee from 1900-1929 according to Toulouse (1971:537), who gives a mark which uses "MILW" and differs from some of those assigned to this company by Fratt.

There are three oval bases, all of sun-turned amethyst glass, and all apparently from small oval liquor flasks of the Cummings or Picnic type (Putnam 1965). One appears to have been made in a two-part mold, another has a faint embossed "9."

Two fragments of turn-molded liquor bottles with kick-up bases were recovered, one in dark green glass, the other in black glass.

Three other bases were found, all embossed. One is a fragment of a flat base, bearing an embossed "B," while a similar fragment is embossed "(REGI)STERED." The first is clear glass, the second flint. Three fragments of a single round flat machine-made flint glass base have the mark of the Owens Illinois Glass Company, and a "3" in the date posi-
tion, indicating 1933, 1943, or 1953 as the year of production.

**Bottle Body Fragments.** Most of the glass was from bottle bodies and is not very informative. Five pieces of glass bottle bodies with embossing were found. All were of clear glass, and so fragmentary that I could not identify them. A single piece of olive green glass with red and white applied color labeling comes from a Seven-Up bottle.

**Jars.** Parts of two identifiable jars were found, and of one closure. From Surface Unit 11 came eight pieces of a fruit jar in sun-turned amethyst glass. It was machine-made, with a finish designed for a Lightning-type closure. Fruit jars were successfully made by semi-automatic machines at least as early as 1894 (Toulouse 1969:389). Also in this unit were two pieces of an opal glass liner for a Mason-type screw lid, embossed with a diamond mark used by Diamond Glass Company since 1924 (Toulouse 1971:550). The other jar is a machine-made flint glass fruit jar with a continuous thread finish to seal on a bead. This is the kind developed about 1915 (Toulouse 1969a:394) and still current.

**Pressed Glass.** Only three pieces of pressed glass were recovered, all of sun-turned amethyst glass. One is a piece of a handle, perhaps to a pitcher, the second is part of the base of a small bowl, and the last is a very heavy fluted base of something like a large punch bowl. This material has little chronological significance other than being of pre-World War I glass. It does, however, represent tableware, rather than the containers for food and beverages represented by most of the glass.

**Dating.** Table 7 shows the glass assemblage broken down by unit and color. Two definitely early types of glass, the black glass and the sun-turned amethyst glass, form over 20 percent of the total glass. The surprising thing about the surface collection from 4-Mrp-8 is that taken as a whole, it looks relatively early. Many pieces show early technology, such as turn molding and finishing tool marks. None of the finishes, and only one of the bottle bases found was machine made.

Only two pieces of glass must date after 1930, the Seven-Up bottle, with applied color labeling, and the Owens Illinois Glass Company mark of 1933, 1943 or 1953. Some of the undatable glass is surely recent, but there is remarkably little visible contamination of an assemblage that appears to be late 19th and early 20th century in age.
Ceramics

Table 6 shows the distribution of ceramic artifacts on the surface of 4-Mrp-8. Most of the ceramic material was unidentifiable whiteware. There were 12 pieces of American or European porcelain identifiable by its bright white color, and 14 pieces of oriental import porcelain which has a greenish or bluish tint. Of this last, two decorated vessels were represented by small fragments, both with hand painted underglaze designs, one in blue, one in grayish green. The rest of the porcelain was undecorated.

The white ware is almost all undecorated. The forms represented are cups, plates, and saucers, in several shapes and sizes. The decorated ware includes at least four patterns of underglaze transfer prints. There are two represented only by fragments of unidentifiable makers' marks in black. One reads "ROY(AL)"; a word added to many marks after the middle of the 19th century (Godden 1964:11). Two pieces from Surface Unit 11 are of the "Rector" pattern described earlier, and nine pieces of a saucer from Surface Unit 14 are of the "Newport" pattern. The only other decorated pieces are 20 fragments of a single plate from Surface Unit 8, all with handpainted overglaze decoration in a small polychrome floral design.

There is a single piece of a tabular ceramic electrical insulator, and one fragment of a lead glazed stoneware crock.

Cans

Cans have been discussed generally in an earlier section. Because the sample is small and the deposit is probably the result of casual dumping that cannot be linked to any particular structure or event, the sizes and forms of the cans cannot be used to discuss eating habits in Wawona. Table 8 suffices to describe the cans from 4-Mrp-8.

Nails

Nails should only be analyzed as assemblages, and the most useful information is gained by comparing different assemblages. Accordingly, nails from three different proveniences, including a site to be described later, are dealt with in this section.

The surface material from 4-Mrp-8 includes nails from 19 of the 20
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<th>Unit</th>
<th>Total</th>
<th>Black</th>
<th>Dark Green</th>
<th>Olive Green</th>
<th>Amber</th>
<th>Clear</th>
<th>Sun-Turned Amethyst</th>
<th>Flint</th>
<th>Window</th>
<th>Opal</th>
<th>Blue</th>
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Table 8
CANS FROM SITE 4-Mrp-8

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<th>SURFACE UNIT</th>
<th>DESCRIPTION</th>
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<tr>
<td>2</td>
<td>Two 3-piece soldered sardine cans, cut open (before ca 1880)</td>
</tr>
<tr>
<td>3</td>
<td>One unidentifiable fragment</td>
</tr>
<tr>
<td>10</td>
<td>One hole-in-top can (before ca 1900), one beer can with multiple &quot;church-key&quot; openings (after 1935), one unidentifiable fragment</td>
</tr>
<tr>
<td>11</td>
<td>Three tops cut from hole-in-top cans, one crimped seam can (after ca 1900), three cut can bottoms, four lids to baking soda type cans</td>
</tr>
<tr>
<td>12</td>
<td>Two unidentifiable fragments</td>
</tr>
<tr>
<td>13</td>
<td>Two tops and one hole-in-top can, one beer can with &quot;church-key&quot; opening, four fragments</td>
</tr>
<tr>
<td>14</td>
<td>Two tops cut from hole-in-top cans, two tops cut from crimped-seam cans</td>
</tr>
<tr>
<td>15</td>
<td>One soldered sardine can, one unidentifiable fragment</td>
</tr>
<tr>
<td>16</td>
<td>One crimped seam sardine can embossed &quot;Novege&quot; (after 1918), one unidentifiable fragment</td>
</tr>
<tr>
<td>17</td>
<td>Two fragments</td>
</tr>
<tr>
<td>18</td>
<td>One fragment</td>
</tr>
<tr>
<td>19</td>
<td>Two hole-in-top cans</td>
</tr>
</tbody>
</table>

surface units. Feature 1 in EU 2 at 4-Mrp-8 is a hearth, which will be described more fully below. EU 2 at YOSE-80A-2, which will also be dealt with below, is probably on or near the site of the Sierra Lodge, built in the 1920's.

Table 9 summarizes the cut and wire nails from these different proveniences.

Among the square cut nails from Wawona, I was able to identify a single 10d brad, by its strongly beveled sides, small head and rectangular point (Fontana and Greenleaf 1962:58). All the other square cut nails appear to be "common cut" except for two tacks. Common cut nails are the most common form of square cut nail, and have large heads, a rectangular cross section at the point, and somewhat beveled shanks. Of the wire nails from YOSE 80A-2, 29 percent were finishing nails.

As for chronological information, the nail assemblages seem to fol-
Table 9
NAILS FROM THREE PROVENIENCES IN WAWONA

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<thead>
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<th>Class</th>
<th>Penny-Weight</th>
<th>Length</th>
<th>4-MRP-8 Feature 1</th>
<th>Yose 80A-2 Feature 1</th>
<th>4-MRP-8 Surface</th>
<th>4-MRP-8 Surface</th>
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<tr>
<td></td>
<td></td>
<td></td>
<td>Square Wire</td>
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<td>Square Wire</td>
<td>Square Wire</td>
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<tr>
<td>D</td>
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<td>50d</td>
<td>5-1/2&quot;</td>
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<td></td>
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<tr>
<td></td>
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<td>A</td>
<td>5d</td>
<td>1-3/4&quot;</td>
<td>12</td>
<td></td>
<td>16 c (1)</td>
<td>1</td>
</tr>
<tr>
<td></td>
<td>4d</td>
<td>1-1/2&quot;</td>
<td>20</td>
<td></td>
<td>4</td>
<td>1</td>
</tr>
<tr>
<td></td>
<td>3d</td>
<td>1-1/4&quot;</td>
<td>13</td>
<td></td>
<td>4 d (1)</td>
<td></td>
</tr>
<tr>
<td></td>
<td>2d</td>
<td>1&quot;</td>
<td>17 e</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Tack</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Totals</td>
<td></td>
<td></td>
<td>162 f (1)</td>
<td>373 (152)</td>
<td>46 g (22)</td>
<td></td>
</tr>
</tbody>
</table>

( ) - brads and finishing nails, wire and square, in addition to ordinary nail count, not used in figuring percentages in Fig. 3.

a - sizes and pennyweights taken from Sears and Roebuck (1897).
b - 2 square cut 6d nails also recovered.
c - The 4d wire nails are of heavier guage than the 5d or 6d.
d - square cut 2d nails are all a bit too long, may be a different type of nail.
e - Square cut tacks, one 3/4", one 1/2".
f - of which 76 (46.6%) were broken.
g - of which 20 (43.9%) were broken.
The expected pattern. Nails from the 1920’s should be mostly wire nails, and only two square nails were found at YOSE 80A-2. These may be earlier nails, or more likely represent the occasional use of square nails which continues to the present for flooring and other purposes.

A hearth which contains only square nails, as at 4-Mrp-8, should date earlier than 1890. The fact that the nails from this hearth tended to break when bent or clinched, and that 46.6 percent of the specimens are broken, may be significant. Early cut nails tended to break when clinched, until about 1871 when manufacturers began to anneal them so that they would bend without breaking (Fontana and Greenleaf 1962:53). These authors go so far as to say "any cut nail which has been ruptured in bending is probably pre-1879." This cannot be quite true as the 1865 Russell and Erwin hardware catalogue illustrates, among other cut nails, six sizes of "clinch nails" which are portrayed not merely bent, but rolled like snails, presumably to advertise their clinchability.

The surface material from 4-Mrp-8 includes both square and wire nails, but mostly square nails. The sample is small, but it probably indicates that greater construction and dumping activity occurred on the site in the late 1800s than after the turn of the century. This interpretation is consistent with the other evidence on the site.

Figure 3 shows the relative percentages of four function-related size groups of nails from three proveniences. The two assemblages with a large enough sample of nails, Feature 1 of EU 2 at 4-Mrp-8, and EU 2 at YOSE-80A-2, contrast somewhat in the distribution of nails among these groups. The assemblage of square nails from the hearth at 4-Mrp-8 includes a much higher percentage (39 percent) of small nails than the assemblage of wire nails from YOSE 80A-2 (5.3 percent).

The differences between the two nail assemblages may reflect differences in construction over time. Most of the early buildings in Wawona were log structures, where nails would be mostly used for roofing and finishing. By the 1920's, frame structures relying on larger nails were more frequent. The only published photograph of the Sierra Lodge which I have seen (Sargent 1979:68) shows a group of frame buildings. Whether or not YOSE 80A-2 is the site of the Sierra Lodge, the differences in the square nail assemblage from 4-Mrp-8 and the wire nail assemblage from YOSE 80A-2 may reflect differences between log and frame construction.
Fig. 3. Nails from three proveniences: percentages of four function-related size groups.

a. 2d-5d—roofing, lathing, finishing.

b. 6d-10d—utility carpentry, siding, flooring, light framing, interior fitting.

c. 12d-16d—light framing, stud wall construction.

d. 20d-larger—heavy framing.
Five cartridge cases were recovered from site 4-Mrp-8, as follows:

1. New Haven Arms Company .44 caliber rimfire cartridge, for Henry Repeating Rifle. The New Haven Arms Company was reorganized as the Winchester Repeating Arms Company in 1866, and the .44 Henry rifle was the predecessor of the Winchester line of lever-action repeating rifles. The Henry Patent Repeating Rifle was patented in 1860 and saw some use in the Civil War, although the U.S. government never adopted it as the official military arm (Williamson 1952). Some Colt revolvers were chambered for this cartridge, but the double firing pin mark on our specimen shows it to have been fired in a Henry rifle. This cartridge was made from 1860 to about 1934 (Barnes 1965:280). The raised H in a circle headstamp is apparently early, and was followed by a plain stamped "H" still used on Winchester rimfire cartridges (Logan 1948: 66).

2. Maker unknown, .50 to .56 caliber rimfire cartridge. This specimen has no headstamp and no firing pin mark. It appears to have been exploded in a fire, so accurate measurement and identification is impossible. It is larger than the .44 caliber, in the range of .50 to .56 caliber, and between 2 and 3 cm long (.8 - 1.2 inches). It could be any of several obsolete rimfire cartridges, including .50 Remington Navy, .56-50 Spencer, .56-.52 Spencer, .54 Ballard or .56-.56 Spencer. These were all military cartridges beginning 1862-1865 (Logan 1948:70-72). This specimen is most likely one of the Spencer cartridges, used in the Spencer repeating rifle (and a few other arms) which saw action in the Civil War and was carried by some of the Western frontier regiments. Many of these guns were made, and they were much used in the west after the military abandoned them shortly after the Civil War. At least the .56-50 and the .56-52 Spencer cartridges were listed in ammunition catalogues up to about 1920 (Barnes 1965:281).

3. Maker unknown, .44 caliber centerfire cartridge. This cartridge case has no headstamp, but should be a cartridge for the .44 Smith and Wesson American or Army single action revolver, manufactured starting in 1870. The U.S. Army used this weapon between 1871 and 1873. This cartridge was loaded commercially until about 1940 (Barnes 1965: 166).
4. Maker unknown, .45 caliber centerfire cartridge. This is the .45 Colt cartridge, which was introduced by Colt in 1873 for the single-action revolver used by the U.S. Army from 1875 to 1892 (Barnes 1965:172). This specimen has no headstamp, but fits the length of 1⅛ inch given by Logan (1948:139) for this cartridge. It was still commercially available in 1963 (Barnes 1965:172).

5. United States Cartridge Co. .22 caliber rimfire cartridge. The headstamp of "US" is that of the United States Cartridge Co., which operated from 1870-1936 (Teague and Shenk 1977:148). This specimen is of the .22 Long and .22 Long Rifle size and lacks the crimp which Barnes (1965:274) feels appeared around 1900. The .22 Long was developed around 1871, and the .22 Long Rifle, which uses the same size cartridge case, appeared in 1887. Innumerable guns have been chambered for these rounds.

The cartridges from 4-Mrp-8 are all from relatively common weapons, probably civilian. The U.S. Army, which administered Yosemite Park for 23 years, arrived in 1891, at which time only the .45 Colt was an official military side-arm. Poachers were a problem in the early days of the park, and "it was not until 1896 that a determined effort was made to keep firearms out of the park at any time of the year" (Russell 1947:158). All four cartridges are well weathered and two of them are of distinct early types, so it is probable that they date to the pre-1900 days when the park was more a wilderness.

The proveniences of these cartridge cases are:

1. 4-MRP-8 Surface Unit 13
2. 4-MRP-8 Surface Unit 6
3. 4-MRP-8 Surface Unit 15
4. 4-MRP-8 Surface Unit 16
5. 4-MRP-8 EU 3, 0-5 cm depth.

Beside the five cartridge cases, one blunt steel target arrowhead was recovered from Surface Unit 6.

Miscellaneous Historic Artifacts

A variety of small artifacts were recovered that do not fit into the categories of artifacts described above. Table 10 lists these artifacts by provenience.
<table>
<thead>
<tr>
<th>SURFACE UNIT</th>
<th>DESCRIPTION</th>
</tr>
</thead>
<tbody>
<tr>
<td>6</td>
<td>2 metal buttons, Levi type</td>
</tr>
<tr>
<td>8</td>
<td>Crown cap</td>
</tr>
<tr>
<td>11</td>
<td>Crown cap; lead top to toothpaste tube, embossed &quot;Colgate and Co. New York&quot;; shoelace eyelet; pocket-watch face; 2 metal strips; opal glass plano-convex disc, diameter 8 mm; old rubber tire fragment; 2 unidentified pieces of rubber</td>
</tr>
<tr>
<td>12</td>
<td>Piece of wire; 1873 dime; doorknob</td>
</tr>
<tr>
<td>13</td>
<td>Lightbulb base; metal strip</td>
</tr>
<tr>
<td>14</td>
<td>Metal button, Levi type; lock plate from small padlock or trunk; 2 pieces lead foil seal</td>
</tr>
<tr>
<td>15</td>
<td>Small jackknife blade; metal button, 4 holes; riveted metal strip; piece of wire</td>
</tr>
<tr>
<td>16</td>
<td>2 metal strips, one with eyes; metal grommet ring; plastic comb fragment; crown cap</td>
</tr>
<tr>
<td>17</td>
<td>Opal glass button, 4-hole shirt size</td>
</tr>
<tr>
<td>18</td>
<td>Leather harness scrap with 2 rivets</td>
</tr>
<tr>
<td>19</td>
<td>Decorated suspender buckle cover; fragment of golf ball</td>
</tr>
</tbody>
</table>

A few of the items in Table 10 are worthy of a closer look. The small opal glass disc, flat on one side and slightly convex on the other is enigmatic. It resembles a game piece but is really too small. The watch face is nonferrous metal, and very battered. It has a separate circle for a second hand, but shows no sign of paint or enamel and so may be a more interior piece, rather than a face.

The 1873 dime is rather worn and scratched, and has been pierced. The hole obliterated any mint mark that it may have had. As it was pierced for use as an ornament, this dime most likely represents post-contact Miwok jewelry.

The doorknob, badly broken, is of a marbled brown ceramic material. The exterior has a high polish. It resembles those illustrated in the Russell and Erwin (1865) catalogue, and labeled "Mineral," but I am not certain of this identification.
Hearth

Most of the historic artifacts from 4-MRP-8 were collected from the surface units. Three 1 x 2-meter excavation units were dug, all of which contained some historic material. EU 1 reopened an old sewer trench, and both wire and square nails were recovered from this disturbed context, along with some undatable glass fragments. EU 3 contained a few undatable glass and ceramic fragments and both wire and square nails, mostly in the upper 10 centimeters.

EU 2, adjoining excavation Unit 1, sampled an area of prehistoric midden. There was a very distinct hearth (feature 1) full of white ash which contrasted vividly with the surrounding black midden soil. The hearth appeared to be dug into the midden, although some apparent midden overlapped one edge. The hearth is indisputably historic, and this overlap is probably the result of disturbance, also evidenced by patches of black earth in the hearth and white ash in the midden, probably marking rodent tunnels. Nails and burnt bone, apparently from the hearth, were distributed in the surrounding midden, and the hearth contained a few flakes of obsidian. It is not impossible that a historic Miwok occupation on the site continued to accumulate black midden material above the hearth, but there should have been no extensive occupation of this site for more than a few years after 1851.

The large assemblage of exclusively square nails from Feature 1, described above, indicate a date after Anglo discovery of the valley in 1851, and probably before 1890.

The artifacts in the hearth also included a glass shirt button with four holes, and the bowl of a large spoon. Both of these had been in the fire. Only nails actually found in the hearth have been described in detail, but the surrounding soil contained another 151 square cut nails, some of which were stained with white ash, a few pieces of undatable glass, and one fragment of a sun-turned amethyst glass fruit jar lid. Two hundred and sixty-nine small fragments of burnt bone were recovered from Feature 1. Only one piece was precisely identifiable, a fragment of metapodial shaft from a deer. Most of the rest was from deer or sheep sized mammals, and a few pieces were anatomically identifiable as long bone, rib, vertebrae, and incisor tooth roots. A single piece of limb or rib was so small it must have come from a rodent or small rabbit.
Taken as a whole, Feature 1 probably represents a hearth or campfire fueled by scrap lumber with nails in it, and used to dispose of food refuse. The nails indicate a 19th century date, although it is possible that old lumber could have been burned. The hearth most likely results from the desultory occupation of 4-Mrp-8 by surviving Miwok and workers associated with the Wawona Hotel, late in the 1800's.

Discussion

As the above descriptions show, there is remarkably little recent trash on the surface of 4-Mrp-8. The bulk of the material pre-dates World War I. Remembering that this site is located near the center of tourist traffic in Wawona and near the major National Park Service installations, and is the most walked-over site studied by this project, it is surprising that so much recognizably old material has survived and that so little recent litter has been deposited.

The 20 percent surface sample taken in this project serves to document a few patterns in the distribution of the artifacts. Table 6 shows the densities of historic artifacts in surface units shown in Map 7. Some of the variations may be due to difficulties in collecting certain units. Surface Units 1, 2, and 3 are near the present road and may have been somewhat disturbed; they are also farthest from the areas that seem to have been most active in the past. Units 1, 2, 3, 4, 5, 9, 17, and 18 had thick grass cover which hid the ground, and few historic artifacts. However, Table 6, which shows lithic artifacts as well as historic, indicates large numbers of lithic artifacts collected even from some of the units with heavy ground cover.

The site is divided by a long depression running northeast to southwest (Map 7). Al Gordon told me that this is the line of the old road which crossed the river on the covered bridge. A map prepared in 1932 confirms this (Sprinkel and Ackles 1932). The low artifact density of units 7 and 9 may be an effect of this old road. The existing trails shown on the site map are of unknown age.

The 1932 inventory and map (Sprinkel and Ackles 1932) does not show any structures on the site at that time. The barn to the northwest had been built earlier that year, and two cabins are shown well to the east of the site area. According to Al Gordon (personal communication),
there were at one time a couple of shacks inhabited by Indian woodcutters, one near the present corrals and one at the eastern end of the meadow. There are no foundations to be seen today, but units 11 and 14 have more window glass and ceramic tableware than any other units. Unit 11 contained five bottle finish fragments, pieces of five amber beer bottle bases, and pieces of an oval liquor flask base and a green kicked-up wine bottle base. All of these were described above, and should date to before 1920. The hearth in EU 2 may relate to habitations in this area, and there may be other buried features. The artifacts from Unit 11, and also 13, 14, and 16, could represent dumps or the destruction refuse associated with a woodcutter's shack or other impermanent structure. There is no firm evidence for this however, so it could simply be a relatively concentrated dumping area within the larger scatter of rubbish all over 4-Mrp-8.

The prehistoric occupation of 4-Mrp-8 will be discussed later. Sargent (1979:30) says there was an Indian camp of shacks and traditional structures on the far side of the river from the hotel in the 1800's. Site 8 is quite likely the site involved, but again there is little evidence. The hearth with bone and square nails in EU 2, the pierced dime, and the glass bead from EU 1 are at least the kind of remains such a settlement would produce.

**YOSE 80A-2: Historic Material**

This was the last area tested by the project. There was little surface evidence of interesting material. The Washburn ditch, built in 1871 to supply water to the Wawona Hotel, runs along the southeast edge of the site, just inside the pine forest (Map 5). There are a few scatters of 20th century trash on the surface, and a rock alignment near the woods. This site was identified by Al Gordon as the location of the Sierra Lodge, built in 1920, and removed by the park in the 1940's.

Although the Sierra Lodge was a substantial complex, boasting several large frame buildings, there is very little evidence remaining. Some of the trash scatters which include nails and window glass probably represent building debris, and the rock alignment may have been a garden or trail border. There are no visible foundations.
Two 1 x 2-meter units were excavated. EU 1 was completely sterile. EU 2 was in one of the trash scatters, and the artifacts were mostly building debris. They consisted of 156 pieces of window glass; 28 pieces of bottle glass, mostly lead glass, but including a few pieces of amber, green, and sun-turned amethyst glass and fragments of a Mason jar liner, a few bits of whiteware, two ceramic insulators, a few pieces of ceramic drain pipe, and a door spring, plus almost 400 wire nails. The nails have been discussed above, where they are compared to nails from 4-Mrp-8. Much of the material had been burned, and while there is not much that is datable, it is all consistent with what we know about the Sierra Lodge.
Chapter 5
PREHISTORIC MATERIAL

Prehistoric Background

The Sierra Nevada region is a large, ecologically diverse area. The cultures found in the Sierra show considerable homogeneity over a large area, and exhibit relationships with the California culture area to the west, and the Great Basin cultures to the east. Accordingly, a brief summary will be given of the archeological sequences and material in surrounding regions.

Central California

Early work in the Sacramento-San Joaquin Delta region led to the definition of three cultural "horizons" (Heizer and Fenenga 1939; Beardsley 1948, 1954). Although there is variation from site to site, relevant traits of the horizons may be summarized as follows:

Early Horizon. Sites are concentrated in the Cosumnes-Mokelumne area. Much of the information has come from burials which are usually extended and oriented to the west, frequently with numerous artifacts. Projectile points are large and heavy, and only about half are of obsidian. Point forms include leaf-shaped, lanceolate, concave based, and a variety of stemmed forms. The grinding tools are manos and metates, and some portable mortars. Burial goods include a variety of distinctive Haliotis and Olivella shell bead types, shell mosaics, elongated "charm-stones" perforated at one end, slate pendants, quartz crystals, and rectangular stone palettes. Burials and goods are sometimes stained with red ochre. Bone artifacts are relatively rare, but cannon bone daggers, needles, and awls are found. It is assumed that the subsistence was based on hunting, fishing, and gathering, without the emphasis on acorns that characterized later cultures.

Middle Horizon. Sites are found throughout the Central Valley. Burials are a major source of information, and are usually flexed. Westerly orientation is common, but not invariable, and less than half of the burials have grave goods. Ochre staining is common, and burials are often covered with cairns. There are rare cremations, usually with
artifacts. Burials with embedded projectile points are not uncommon. Points are still large and heavy, and of similar types. Some of the large points have very fine diagonal "ribbon flaking." The points presumably tipped darts to be used with atlatls, and atlatl weights are occasionally found. There are numerous types of Olivella and Haliotis beads, and short bird bone beads. Bone artifacts are more common, including flakers, atlatl spurs, basketry awls, "strigils," fish spear barbs and other forms. There are occasional baked clay objects. Portable mortars and pestles are characteristic. It is assumed that the emphasis on acorn exploitation began to develop during this horizon.

**Late Horizon.** Sites occur throughout central California. Both burials and cremations are found. Burials are usually flexed and about half are westerly oriented. Artifacts are sometimes burned. Projectile points are small and the use of the bow and arrow is inferred. In some areas the points are deeply serrated, and small side-notched points are common in late sites. The bead assemblage is particularly distinguished by a proliferation of Haliotis ornament types, and by clam shell and steatite disc beads which appear very late. There are also tubular and discoidal magnesite beads, and at the very end of the sequence, glass beads and other objects of European origin. The portable mortars are shaped and flat bottomed, and used with cylindrical pestles. Baked clay objects are common in some areas. The subsistence presumably focused on acorn exploitation, with hunting, fishing, and gathering of other plant foods.

I have recited this sequence in some detail because it is the basic reference to which material elsewhere in California has been compared. The dating of these horizons is uncertain, and recent work has both refined and complicated the picture given. Heizer (1958) used a series of radiocarbon dates from different sites to date the three horizons. From three dates from the Blossom site, he set the end of the Early Horizon at about 2000 BC. The Middle Horizon lasted from 2000 BC until AD 300, which date was extrapolated from a date of AD 725 (1225± 200 BP) for an early Late Horizon site. The Late Horizon then began around AD 300 and lasted until historic times. However, these dates are now in question. Ragir (1972) has concluded that the Blossom site (4-SJo-68) is actually the oldest known of the Windmiller (Early Horizon) sites, instead of the
youngest as Heizer thought. The University Village site (Gerow and Force 1968) may represent an early culture developing along the coast while the Windmiller culture occupied the interior. On the basis of C14 dates and bead typology, it seems to be earlier than Middle Horizon components, but it is more different from Windmiller Early Horizon components than are the Middle Horizon materials. Gerow and Force (1968:12) suggest that their Early Bay type culture coexisted with the Windmiller type culture between 1500 and 1000 BC and thereafter converged.

Elsasser (1978) considered both these cultures to be regional variants within the Early Horizon. The Windmiller type would be slightly older, and the Early Horizon as a whole would terminate around 1000 BC.

Southern San Joaquin Valley

The San Joaquin Valley south of the Central California region discussed above is little known. Recent work on the eastern edge of the Diablo range, on the west side of the San Joaquin Valley in Merced County has outlined a sequence of archeological cultures from four excavated sites (Olsen and Payen 1969; Pritchard 1970). As described by Olsen and Payen (1969:39-42) the sequence is from late to early as follows:

Panoche Complex. This is the protohistoric occupation, presumably Yokut. There are small side-notched projectile points, not fitting any of Baumhoff and Byrnes (1958) Desert Side-notched subtypes but doubtless related, and other small points, some of obsidian. Numerous, large, well-chipped flake scrapers are distinctive. There is an extensive bone industry, including awls, scapula grass cutters, and bird bone tubes and beads. Steatite ear spools, rare vessels, and shaft straighteners occur. There is a variety of mortar and pestle forms, including bedrock mortars, and a few manos and metates. There are a number of diagnostic bead forms, including clam shell and steatite disc beads. Some pottery is known. Both cremation and primary flexed burial were used in definite cemetery areas. There are small circular dwellings and large circular assembly houses. An acorn oriented adaptation is indicated, and the artifacts show relationships to the south and to the Sacramento-San Joaquin Delta region. Based on the artifacts, a date of 1500-1850 is used.

Gonzaga Complex. This late prehistoric occupation is mostly known
from grave goods accompanying extended and flexed burials. A variety of bead types are the most diagnostic artifacts. Few projectile points are known; they seem to be larger than in the Panoche Complex. Large bowl mortars and shaped pestles were used, and manos and slab metates were more important than later. The burial complex and shell industry is seen as having close links to the early (Phase I) Late Horizon in the Delta Region.

**Pacheco Complex A and B.** The Pacheco A Complex includes diagnostic shell beads related to the Middle Horizon of Central California. The projectile points are large and heavy, often stemmed or side-notched. Only a few are obsidian. Projectile point form and material indicate a coastal derivation, as do a few other artifacts. The bone industry includes perforated canine teeth, bird bone whistles, awls, and scapula grass cutters. Steatite is not evident. Grinding tools are abundant, including a variety of mortar and pestle forms, and frequent manos and slab metates. It is suggested that this period represents an incursion of coastal people. The Pacheco B complex is suggested on the basis of a very few artifacts. These include beads and points which suggest a relationship to the Central California Early Horizon.

**Positas Complex.** This is from the basal deposit at 4-Mer-S94, and is also poorly represented. There are perforated flat cobbles, flake scrapers, shaped mortars and pestles, and manos and slab metates. No points are securely assigned to this complex, and it is presently weakly defined.

These complexes are at present undated. The few C14 dates obtained were unacceptable to the excavators, as they proved much later than the postulated typological relations would indicate.

**Owens Valley**

Ethnographically, the Owens Valley region of the Great Basin was known to have cultural and trading ties with the Sierra tribes. Most of the obsidian used in the Sierra Nevada comes from Owens Valley sources, and the trade in obsidian was probably a major factor influencing the continuity of projectile point types found from the Great Basin across the Sierras and into Central California.

The cultural sequences used in the Great Basin rely heavily on pro-
jectile point typology. The most complete sequence is from the Rose Spring Site (4-Iny-372), a deeply stratified site on the western edge of the Owens Valley. Lanning (1963) proposed five phases of occupation based on point types, with dates estimated from other Great Basin and California sites, as follows:

2. Late Rose Spring Phase. Cottonwood Triangular, Rose Spring Corner-notched, Eastgate Expanding Stem points. AD 500 – AD 1300.
4. Early Rose Spring Phase. Humboldt Concave Base A points. 1500 BC – 500 BC.
5. Little Lake Phase. Pinto, Lake Mohave points (no points were actually found at Rose Spring). 3000 BC – 1500 BC.

Pottery occurs only in the Cottonwood Phase. The mano and metate were apparently in use since Early Rose Spring times, but pestles appear later, probably in Late Rose Spring times, and were presumably used in nearby bedrock mortars, as portable mortars were not found in the Owens Valley. The dates used by Lanning have been generally supported by a few C14 dates from the site itself, and later work elsewhere in the Great Basin (Clewlow, Heizer, and Berger 1970).

The Rose Spring site is interpreted as a habitation site with an emphasis on obsidian tool manufacture and hunting. The nature of the site was similar throughout its occupation. Trade with the California cultures to the west is indicated as early as the Middle Rose Springs level by shell beads of Middle Horizon type associated with burials.

**Northern Sierra Nevada**

In the area around Lake Tahoe, Heizer and Elsasser (1953) defined two complexes. The earlier, the Martis Complex, was seen as a high altitude adaptation emphasizing hunting and seed gathering. Projectile points of this complex are heavy; leaf-shaped, shouldered, and large side-notched types predominate. Most of the points are of basalt and other materials rather than obsidian. These are considered dart points, and some stone atlatl weights further support this idea. The mano and
metate were the main grinding tools, but there are also some pestles and portable mortars.

The King's Beach Complex is equated with the protohistoric Washo, and characterized by small points including the Desert Side-notched type, made of obsidian or chert. The bedrock mortar is the most important grinding tool.

Later work by Elasser (1960) expanded on this sequence, especially the Martis Complex, showing that it was not confined to the high altitudes, but was more characteristic of the Transition Zone. Some of the Martis points show Great Basin connections. Elston (1971) suggests a beginning date of around 1000 BC for the Martis Complex, based on a CI4 date and Great Basin point typology, and replacement of the Martis Complex by the King's Beach Complex about AD 500. Moratto (1971, 1972) suggests that material from 4-Tuo-300 in the New Don Pedro Reservoir region represents a survival of the Martis Complex until as late as AD 1000. Martis-like traits here include large leaf-shaped and side-notched points of non-obsidian materials, large flake scrapers, manos, metates and portable mortars, and an atlatl weight.

Elston (1971) also presents evidence for an occupation of the Lake Tahoe region before the Martis Complex. This he calls the Spooner Complex, characterized by Humbolt Concave Base and Pinto points. The Spooner Complex is rather hypothetical, and may represent sporadic use of the Sierra by Great Basin groups.

Southern Sierra Nevada

The Yosemite region, which is discussed separately, is the most intensively studied area of the southern Sierra other than a number of projects at lower elevations. Other high Sierra studies have included Lathrap and Shutler's (1955) work in Vermillion Valley, and Hindes' (1962) survey and testing in the Huntington Lake region. This last project indicated cultures comparable to those in Yosemite, but less well defined, and with Owens Valley type pottery in the latest period.

In the southern Sierra foothills, much recent work has been necessitated by the destruction of entire valley systems as dams are constructed. Rather than attempt to cover all of these, I will briefly summarize the findings in the Buchanan Reservoir region reported by
Moratto (1972). These sites are representative of the sort of material involved, and are close to the Yosemite region. Moratto's study is an especially good one, including evidence from an unusually large number of sites with considerable well controlled excavation and a careful synthesis of the material.

The Buchanan Reservoir is in the valley of the Chowchilla River, at an elevation of 600 feet. Like Yosemite, it was in the territory of the Southern Sierra Miwok. Twenty-seven sites were sampled, some intensively. Reports include Henn (1969), King (1968), and Moratto (1968, 1969, 1970, 1972). The summation following is condensed from Moratto (1972).

Based on stratigraphy and the analysis of artifacts, Moratto (1972: 159-164) defined three phases of prehistoric occupation in the Chowchilla River Basin.

**Chowchilla Phase 300 BC-AD 300.** The projectile points from this earliest phase are large and heavy. The most diagnostic forms are Elko Eared, large stemmed and side-notched forms, large bifaces, and the "Eared Concave Base" points, which usually have fine parallel diagonal pressure flaking. The Elko Side-notched, Sierra Concave Base, and Pinto Sloping Shoulder point types are also found. Obsidian is the most common material. These points presumably armed atlatl darts, and atlatl weights and spurs are found. There are numerous small obsidian flake tools, which persist throughout all three phases, and heavy core choppers. Portable cobble mortars are found, and cylindrical pestles and the bedrock mortar and/or cobble pestles may have been in use by AD 200 or 300. Slab metates were used with one-hand manos, which are usually bifacial and rectangular, but unifacial cobble manos are also found. The bone industry includes fish-spear guides, antler tool handles, abundant awls, and spatulates. The ornaments include numerous *Olivella* and *Haliotis* and Limpet shell types, and small, roughly ground stone beads. The dead were buried, usually extended or semi-extended, with flexed burials increasingly popular after about AD 200. Grave goods are usually included, sometimes ceremonially "killed," and red ochre is commonly used in burial contexts. The nonrandom distribution of grave goods, including some richly furnished child burials, may be evidence of a non-egalitarian society with ascribed social distinctions. Settlements are restricted to the bank of the Chowchilla River, with an economic empha-
sis on hunting and fishing, acorns being less important than later. A beginning date is set at about 300 BC, based on C14 dates around AD 110 – AD 260 on well-established sites. There is no evidence of earlier occupation of the region.

**Raymond Phase, AD 300-AD 1500.** The projectile points of this middle phase are of moderate to light weight, less than 5 grams. The Rose Spring and Eastgate series points predominate. Elko Eared and Sierra Concave Base points decline, and the Desert Side-notched point appears late in this phase. The use of bow and arrow is inferred from the appearance of small points around AD 600. Small obsidian flake tools and heavy choppers of other materials continue in use. Bedrock mortars and cobble pestles are extensively used, while the slab metate remains important with manos mostly oval or unshaped, and bifacial. *Haliotis* beads virtually disappear, and do not recur, while *Olivella* beads are less abundant. There are small ground stone cylinders and "spindles" and ear plugs. Burials are usually flexed, with extended burial surviving until about AD 500. Grave goods are rare and burials are commonly covered with a cairn. No new sites were established during this phase, and those previously occupied seem to have experienced cycles of abandonment and reoccupation. A number of the burials give evidence of violent death. The economy had shifted to an emphasis on acorns with hunting still important. Dates from AD 685 to AD 1445 are associated with flexed inhumations, Rose Spring Corner-notched points, and other Raymond Phase traits but the sequence and duration of occupations at the various sites is not well understood.

**Madera Phase, AD 1500-AD 1850.** This is the ancestral Miwok occupation. The use of the bow and arrow is inferred from small, light projectile points and arrowshaft straighteners. The points are mostly obsidian, and the Desert Side-notched and Cottonwood Triangular types are most popular, but Eastgate Expanding Stem and Rose Spring Corner-notched points survive in reduced numbers. Small obsidian flake tools continue. Bedrock mortars and cobble pestles are the most important grinding tools, but manos and metates continue unchanged from the Raymond Phase. There is an extensive steatite industry, including vessels, shaft straighteners, tobacco pipes, ear plugs, pendants and beads. The steatite disc beads are diagnostic, and there are also a few *Olivella*
beads and rare clam shell disc beads. Other ornaments include ground stone cylinders, "spindles," earplugs, and polished rings. There are bird bone beads and bone awls. There are rare occurrences of brownware pottery, very late and apparently imported. Artifacts of Euro-American manufacture occur in two components. Primary flexed burial was preferred, but cremation of high status individuals in dance houses was introduced around 1600 or 1700. Large circular semi-subterranean houses with earthen floors and wattle and daub superstructures are comparable to historic Miwok dance houses, and small circular houses with slightly excavated floors and central firepits were used as dwellings. A settlement pattern develops of large central villages along the Chowchilla River, with smaller villages on the tributaries, and the population expands considerably after AD 1500 or 1600. The economy should be similar to that of the ethnographic Miwok. The chronology is based on typological comparisons with other well-dated assemblages, and three C14 dates from AD 1665 to 1765.

The Buchanan Reservoir sequence is particularly comparable to the Yosemite region because of its geographic proximity, the similarity of the artifacts, and the fact that in recent times it was within the territory of the same aboriginal group. The sequence from Buchanan is based on far more extensive work and a much better sample of the archaeological material than is that from the Yosemite region.

Yosemite Region

Archeological research in the Sierra Nevada did not really begin until the 1950's, with the work of Heizer and Elsasser in the Lake Tahoe region (Heizer and Elsasser 1953), and Bennyhoff and Grosscup in Yosemite (Bennyhoff 1952, 1956). Prior to that time, there was a good deal of ethnographic work with the Miwok and other Sierran tribes, some of direct archeological interest such as Merriam (1917), Beatty (1933), and Barrett and Gifford (1933). In addition, various short notices concerning Yosemite antiquities were published (Harnden 1908; Douglass 1936; Johnston 1937; Caywood 1954). Between 1940 and 1950, R. McIntyre, the Park Naturalist, recorded over 100 sites in his spare time (Napton 1978).

In the summers of 1952, 1953, and 1954, James Bennyhoff and associ-
ates ran three small survey and testing projects in the park (Bennyhoff 1952, 1956). Some 401 sites were located and recorded in most of the major areas of the park. Limited test excavations were conducted at four sites. While the coverage of the park was by no means complete, and the excavations very limited, this work provided basic information on the nature of the archeological material in the park and the distribution and chronology of aboriginal occupation.

**Mariposa Complex.** Bennyhoff established a sequence of three "complexes" in the Yosemite region (Bennyhoff 1956). The latest, and best evidenced, he called the Mariposa Complex, which represents the protohistoric ancestors of the Southern and Central Miwok. The primary diagnostic trait of this complex is the use of small (Class A) projectile points weighing less than 1 gram. These are presumed to be arrow points. The most common forms are side-notched points with concave or notched bases, and simple concave-based triangles. These are now referred to, respectively, as the Desert Side-notched and Cottonwood Triangular types. Small shouldered or tanged points with expanding bases are also common.

The bedrock mortar and cobble pestle are ubiquitous and presumably reflect an emphasis on acorns and seeds. Steatite vessels, disc beads, and clamshell disc beads are diagnostic of this complex. There are long parallel-sided drills with expanding bases. The most common artifact is the flake scraper; and flake knives, blades, choppers, and hammerstones occur, but none of these is diagnostic. Manos and metates were apparently not used, except as a rare late introduction from the east. Pictographs probably belong to this period, and the dead were probably cremated as in ethnographic times.

The Mariposa Complex lasted until the 1850's. The beginning date is uncertain, but Bennyhoff proposed AD 1200, based on the assumption that the Desert Side-notched type of point moved east from the southwest where it appears around AD 900 to reach the Sacramento Delta region around 1600.

**Tamarack Complex.** The Tamarack Complex is the least well defined of Bennyhoff's sequence. The diagnostic trait is the use of projectile points weighing between 1 and 3.5 grams, presumably arrow points. Obsidian is the most common point material, and the most common forms
are shouldered or tanged with expanding bases. These correspond in part to the Rose Spring and Eastgate series of point types used by later workers.

The type site, 4-Mrp-97, had only a single Desert Side-notched point on the surface, so it is assumed that the bedrock mortars there are part of the earlier complex. Flake scrapers are common, but less so than in the Mariposa Complex assemblages, and flake knives and a short triangular drill are also assigned to the Tamarack Complex.

Bennyhoff found that his Class B points (1-3.5 gm) occurred stratigraphically above the heavier and earlier Class C points at 4-Mrp-97, and below the late Class A points at 4-Mrp-105. At 4-Mrp-97 there was only a single Class A point, the Desert Side-notched point mentioned above. Although samples from all sites were small, Bennyhoff considered this sufficient evidence to tentatively define a distinct Tamarack Complex. As similar points appear in the Sacramento Valley at the beginning of the Late Horizon, he suggested dates of from around AD 500 to AD 1200.

Crane Flat Complex. The Crane Flat Complex is the earliest definable cultural assemblage in the Yosemite region. The diagnostic traits are projectile points weighing more than 3.5 grams, the mano and portable slab metate, and possibly heavy, nonobsidian core scrapers. The points are mostly of obsidian, but other materials were used more often than in later complexes. The most common point forms are long concave-based, leaf-shaped, shouldered and stemmed with indented bases, and shouldered with expanding stems. These are presumed to be points for darts used with a spear thrower.

Bedrock mortars and cobble pestles do not seem to be associated with this complex, and the mano and metate were used instead. Flake scrapers are less abundant than later, and blades, choppers, and hammerstones are found.

Bennyhoff was unable to date this complex. He suggested a terminal date of AD 500, and felt that the emphasis on obsidian could indicate that the Crane Flat Complex is not as old as the Pinto or Martis Complexes with related point types.

In the 1960's, Robert Fitzwater conducted salvage excavations at 4-Mrp-181 at El Portal, 4-Mrp-105 at Crane Flat, and 4-Tuo-236 at Hodgdon.

The excavations at El Portal (Fitzwater 1962) revealed up to 60 inches (152 cm) of midden and 23 burials. There was some visible stratification of the midden into an upper dark midden member, and a lower brown sand member. The separation was indistinct; for analysis upper, transition, and lower divisions were used. Site 4-Mrp-181 was a large site, with 46 bedrock mortars on it and another 44 nearby. The elevation is about 1,800 feet, and this was probably a permanent village, in contrast to those at higher elevations. There was a greater diversity of artifacts here than at other Yosemite sites, probably a function of intensity and length of occupation, although the burials and bone and shell items found in El Portal do not seem to be preserved in higher altitude sites.

Fitzwater distinguished two periods of prehistoric occupation. The later period corresponded to Bennyhoff's Mariposa Complex, to which was added the rare occurrence of Owens Valley Brownware pottery.

Fitzwater objected to the use of projectile point weight as the criterion for defining the Tamarack Complex, and preferred a two-stage sequence. In following Bennyhoff's Crane Flat Complex definition, Fitzwater emphasized the importance of nonobsidian artifacts, large core tools, large projectile points, especially concave-based forms, and the use of the mano and metate instead of the bedrock mortar. The excavations at El Portal allowed him to add shell ornaments and bone tools including atlatl spurs, "strigils," awls, and hairpins to the Crane Flat Complex assemblage. There were also flexed burials, often with red ochre or burial goods and covered by cairns. In the artifacts generally, and especially in the burials, Fitzwater saw the influence of the Middle Horizon of the Central Valley.

Fitzwater also excavated extensively at 4-Mrp-105, where Bennyhoff had defined the Crane Flat Complex (Fitzwater 1968a). Here he again identified Mariposa Complex and Crane Flat Complex components, for which the best temporal markers seemed to be, respectively, the Desert Side-notched points and the shouldered and stemmed forms with indented bases, elsewhere referred to as Pinto points. The most important result of this excavation was three radiocarbon dates from one excavation pit. Unfortunately, they are not adequately discussed. They do not appear to
have come from any well defined cultural feature, the material is not specified, and the associations are not clearly stated.

If we piece together the information on the relevant unit (22C), it looks like this (from Fitzwater 1968a:288, 290, 296-7):

<table>
<thead>
<tr>
<th>Level</th>
<th>C14</th>
<th>Artifacts</th>
</tr>
</thead>
<tbody>
<tr>
<td>0-6&quot;</td>
<td></td>
<td>1 Type Q (=Desert Side-notched)</td>
</tr>
<tr>
<td>6-12&quot;</td>
<td></td>
<td></td>
</tr>
<tr>
<td>12-18&quot;</td>
<td></td>
<td></td>
</tr>
<tr>
<td>18-24&quot;</td>
<td>950 ± 70 BP</td>
<td>1 Type Y (=Eastgate Split Stem)</td>
</tr>
<tr>
<td>24-30&quot;</td>
<td></td>
<td>metate</td>
</tr>
<tr>
<td>30-36&quot;</td>
<td></td>
<td>metate</td>
</tr>
<tr>
<td>36-42&quot;</td>
<td>1580 ± 80 BP</td>
<td>mano</td>
</tr>
<tr>
<td>42-48&quot;</td>
<td></td>
<td>metate</td>
</tr>
<tr>
<td>48-54&quot;</td>
<td>2040 ± 100 BP</td>
<td></td>
</tr>
<tr>
<td>54-60&quot;</td>
<td></td>
<td>1 Type T (=Pinto)</td>
</tr>
</tbody>
</table>

On the basis of this information, Fitzwater assigned a date of 950 ± 70 BP to the Desert Side-notched and Cottonwood Triangular point types and set the beginning of the Mariposa Complex at AD 1000. The Crane Flat Complex was seen as beginning around 500 BC, and he continued to reject a separate Tamarack Complex.

Fitzwater's data do not entirely support his conclusions. There is no evidence that the Desert Side-notched and Cottonwood Triangular point types are as old as 950 ± 70 BP. The point in closest association with that date is of the Eastgate Split Stem type, one of Bennyhoff's Class B, Tamarack Complex points. Fitzwater does not give distributional data for artifacts at Crane Flat, but from the depth and weight data given for points from El Portal (Fitzwater 1962:258-274), it is apparent that the distribution of points Bennyhoff would have called Class B is biased toward the middle levels of the site. It does seem that the middle weight points of Bennyhoff's Class B, which include most examples of the Rose Spring and Eastgate types, can serve as temporal markers. They are not as temporally distinct as the Desert Side-notched and Cottonwood Triangular types, but are generally indicative of a period earlier than
that of the Desert Side-notched and Cottonwood Triangular points, and
later than that of the heavy types such as the concave-based and Pinto
forms. This is consistently true for Bennyhoff's sites, and El Portal.
It is also in accord with the temporal position of Rose Spring and East-
gate type points from the Rose Spring Site, (Lanning 1963; Clelowl, Hei-
zter, and Berger 1970), and the sequence Moratto (1972) has defined in
the Buchanan region. Therefore, it seems best to retain the Tamarack
Complex as part of the Yosemite sequence, admitting that it is not yet
well defined.

In the Yosemite area, and the Sierra generally, there is no evi-
dence of rapid change or sudden replacement of one prehistoric tool type
by another. The definition of complexes is thus somewhat arbitrary, and
some traits should be expected to overlap as they increase or die out at
different rates. It is at least possible that further research will
discover other material culture traits that distinguish a middle period
in the Sierra. For instance, if shell artifacts were well preserved in
Sierra sites, it would perhaps be possible to relate them to the rela-
tively well established sequences of shell bead types elsewhere in
California.

Rasson (1966) excavated part of Ahwahnee, 4-Mrp-56, now beneath the
Yosemite Valley Visitor Center. This proved to be a disturbed site,
with primarily Mariposa Complex materials, and a few artifacts which
could be associated with Tamarack and Crane Flat occupation.

In 1974 and 1975 a series of surveys were conducted in some of the
major valleys, drainages, and trail systems in Yosemite National Park
(Napton et al. 1974; Napton and Greathouse 1976). Numerous sites were
inventoried, but no substantive conclusions were produced.

Since that time a number of National Park Service archeological
clearances have resulted in the discovery of a few more sites, and
checked many locations without sites. There have been a few small tests
done in the course of mitigation (e.g., Mayberry 1979), and two burials
were recorded (Birkby 1973; Lajeunesse 1979; Danziger 1980). Both
burials were accidentally discovered in Yosemite Valley. Both were
flexed and without associated cultural material, but the good preserva-
tion of the second one argued for a recent date (Lajeunesse 1979).
Napton (1978) has written an overview of the archeological resources,
emphasizing the impact of park use on archeological sites and the possibilities for protection. Moratto (1980) is preparing a general research design for the park.

In the light of present information from surrounding regions, especially the Chowchilla River basin, some general aspects of Sierran prehistory as reflected in the Yosemite region can be summarized. Both widespread homogeneity and regional individuality can be observed. This is not surprising in California which ethnographically showed widespread continuities, yet at the same time included more different linguistic groups than any other area of comparable size.

Much has been said about projectile points, and more is to follow. There is a consistent development from large points associated with atlatl weights and spurs to medium-weight points, to small points associated with arrowshaft straighteners and ethnographic use of the bow and arrow. This is a consistent trend over the entire continent, not merely the Great Basin and California. The times of change are not necessarily sharply defined, nor simultaneous over whole regions. Some, like Fitzwater, object to the use of points as markers for cultural change, but they are certainly as valid as beads or burial styles.

The projectile points from the Sierra show a continuing relationship with the Great Basin. Further west into California other influences are recognized, but some types, such as the Desert Side-notched point, are distributed even to the Pacific coast.

Trade between California and Great Basin groups over the Sierra Nevada developed early. The movement of obsidian into the western Sierra from Great Basin sources may have stimulated the spread of point types. Other goods, only a few of which are now traceable archeologically, moved in both directions. A plain utilitarian pottery, Owens Valley Brownware, infiltrated the Southern Sierra from the east in late protohistoric times, barely reaching the Yosemite area. Beads from the coast are found in Great Basin sites as early as 4000-5000 BC (Leonard Rockshelter; Bennyhoff and Heizer 1958).

As one moves west out of the Sierra, and north toward the Delta, similarities to the Central California cultures increase, visible in burials, beads and other ornaments, and eventually even projectile points. In the Sierran region, the earlier cultures such as the Crane
Flat Complex and the Chowchilla Phase show the most visible relationships to the Early and Middle Horizons of Central California.

The Sierra Nevada seems to have been occupied relatively late, with dates so far of ca 90 BC (Crane Flat Complex, Fitzwater 1968), and ca AD 110 (Chowchilla Phase, Moratto 1972) for the Southern Sierra. The Martis Complex farther north may have earlier origins. Moratto (1972) suggests that the early settlers represent an expansion of Cosunmnes (Middle Horizon) related cultures eastward into the Sierras, made possible by Middle Horizon emphasis on acorns, the major food resource in the Sierra Nevada.

There is recent evidence of earlier occupation or at least use by groups with Great Basin affinities (Elston 1971; Moratto 1980), perhaps by 5000 BC or earlier. The Leonard Rockshelter beads also indicate early trans-Sierran contacts. The Martis Complex in the Northern Sierra seems to represent a fairly extensive occupation beginning around 1000 BC, with a probable emphasis on hunting and seed-gathering.

The Crane Flat Complex and related Sierran cultures show a combination of elements from both sides of the mountains; Great Basin related projectile points occur with Californian ornaments, burial traditions, and the mortar and pestle. They may represent a blending of the Great Basin economy based on hunting and seed-gathering with the developing California economy based on acorns. The Sierra region continued to accept influences from east and west, while diverging from both to form a distinctive adaptation based on the vast acorn resources, and spanning the length and breadth of the Sierra Nevada.

**Miwok Ethnography**

The interpretation of archeological material is based on a knowledge of how similar items fit into the lives of living people. There are many ethnographic accounts of California Indians which can be used to interpret the archeological remains of their predecessors.

Yosemite is in the area occupied in historic times by the Sierra Miwok. Accordingly, a brief outline of Miwok ethnography is presented. It is well to remember that what we know of the Miwok was all recorded after European civilization had pushed back the aboriginal culture, dec-
imating the population by disease and murder, and forcing substantial changes in their way of life. Nevertheless, there are basic similarities in the adaptation to their world, and continuities of material culture which make it fairly certain that the late prehistoric Mariposa Complex or Madera Phase people were the ancestors of the historic Miwok, and which encourage us to extend our interpretations even farther back in time.

A number of early ethnographers worked with the Miwok, among them Kroeber, Merriam, and Barrett. The following description is drawn, where not otherwise specified, from the summaries by Kroeber (1925) and Levy (1978) and Barrett and Gifford's (1933) extensive work on material culture.

Speakers of Miwok, a Utian language, are spread from the Sierra west to the Coast. Broadbent and Callaghan (1960) make linguistic subdivisions as follows:

A. Eastern Division
   1. Sierra
      la. Southern Sierra
      lb. Central Sierra
      lc. Northern Sierra
   2. Plains
   3. Saclan (Bay)

B. Western Division
   1. Coast
      la. Bodega
      lb. Marin
   2. Lake

There are some cultural as well as linguistic differences. Only the Eastern Division, and especially the Sierra Miwok groups which are culturally homogeneous, are of concern in this paper. The Central and Northern Sierra dialects are similar to each other and the Plains dialect, while the Southern Sierra dialect is distinct.

The Northern Sierra Miwok territory included the drainages of the Mokelumne and Calaveras Rivers, the Central Sierra Miwok lived around the Stanislaus and Tuolumne drainages, and the Southern Sierra Miwok inhabited the drainages of the Merced River and adjacent smaller
streams. These territories lacked well-defined boundaries, and there was certainly mixing of adjacent populations, and even some mixing with neighboring tribes such as the Yokut to the south. The two groups of most importance in the Yosemite region were the Central Sierra Miwok and the Southern Sierra Miwok in whose territory were the Wawona and Yosemite Valleys.

Politically a Miwok would have claimed allegiance not to the tribe as a whole, but to a more localized group which may be called a tribelet (Levy 1978). Each tribelet occupied its own territory, with small villages centered around a principal village with an assembly house and chiefly residence. Each village was headquarters for a partilineage, of which the chiefly patriline was the most important.

The tribelet chief inherited his position from his father, and served as advisor, spokesman, and arbitrator for his tribelet. He had some responsibility for managing local resources and scheduling hunting and gathering activities, and dealing with neighboring tribelets. He generally had more shell money and other wealth than anyone else. A number of young unmarried men served the chief as hunters and were lodged and fed by him. Elective "speakers" served as subchiefs in their own villages, and hereditary "messengers" ran errands for the chief and announced ceremonial occasions. Miwok society thus was not egalitarian, and some positions were inherited.

Besides the lineages in their villages, the other important division was the moiety. Lineages belonged to either the land or the water moiety, each with associated totemic animal symbols. The moieties were social and sometimes ceremonial divisions, and supposed to be exogamous, although marriages within a moiety were not forbidden.

Gifford (1926) felt that Miwok religion included elements of the Bird Cult from the south, and a reduced form of the northern God-impersonating Cult. This last involved sacred dances in which costumed dancers represented Kuksuyu and other spirits. The important ceremonies took place in the assembly houses of chiefly villages. A number of specialized shamans practiced magical medicine, and occasionally malignant sorcery.

Historically, the dead were usually cremated. Goods and houses were also destroyed during funerals, and annual "crys" were held at major villages to commemorate the year's dead (Moratto 1972).
The relationships of tribelets to each other, and with non-Miwok neighbors, varied from hostility to friendship. The Miwok fought with bows and spears. Most of the fighting was in the form of disorganized raids as a result of disputes over resources, witchcraft, and murder.

Friendship, or at least neutrality, was presumably more common than conflict. There was extensive trade among the Miwok and between them and their neighbors. Much of the trade brought in materials not available to the Miwok in the foothills and mountains on the west side of the Sierra Nevada. Thus they obtained obsidian, salt, buffalo robes, dried fish, pinon nuts, and edible Mono Lake fly pupae from the east, and shell beads and dogs from the west. In exchange they exported items available in Miwok territory, acorns, manzanita berries, and probably steatite, and served as middlemen between east and west. A wide range of manufactured products were traded in all directions, including bows and arrows, baskets, hides and rabbit skin blankets, and ornaments.

The subsistence economy and material culture of the Miwok has been described in detail by Barrett and Gifford (1933). I will discuss here only some major features of archeological relevance. Some specific items are further mentioned in discussion of the artifacts from Wawona.

The Miwok, like many California Indians, depended heavily upon the acorn for their subsistence. Acorns produce plentifully and are easily gathered but require fairly laborious processing (Barrett and Gifford 1933; Gifford 1951). In brief, the acorns were collected when they dropped in fall, and after drying were cracked with a hammer or the teeth and shelled. The meats were pounded to flour in a bedrock mortar. The flour was placed in a basket or a leaf-lined basin of sand and leached by pouring water through it. This process was essential to remove the bitter tannins, and required some time. The flour was then cooked by "stone-boiling," dropping heated rocks into a basket of acorn flour and water to make a soup or a mush, incredibly glutinous and almost tasteless. It could also be baked in an earth oven or on a hot rock to make a cake. Acorn mush was the staple food over much of California.

The Miwok exploited a variety of other plant foods, of which Barrett and Gifford give an extensive list. Buckeyes were treated much like acorns, but only eaten when the acorn harvest was poor. A number
of seeds were parched, ground, and eaten as dry flour or mush. Barrett and Gifford were able to identify 11 bulbs and corms, which were eaten, and 21 species of greens, which were eaten raw or cooked. Berries were also collected, but the only one of importance was the manzanita, which was pulverized to make a cider.

Deer were the major meat source, and were captured by trapping, netting, and stalking with bow and arrow. Some of the Miwok hunted antelope and elk in the plains. The rabbit was next after deer in importance. They were driven into nets and clubbed. Squirrels were shot. Bear, beaver, and various birds were also eaten. Along major rivers, salmon and trout were important foods. Fish were netted, speared, and poisoned, but apparently not hooked. Some insects were eaten, including grasshoppers, yellow-jacket larvae, and various caterpillars.

The Miwok subsistence had a number of implications. Acorns are relatively reliable and plentiful, and can be successfully stored for over a year. An acorn-based economy allowed relatively permanent villages in some areas, and sizable populations. Baumhoff (1963) estimates populations of 2,130 and 2,727 for the Central and Southern Sierra Miwok. The total population for the Eastern Division of the Miwok might have been around 19,500 (Levy 1978). Kroeber (1925), on the other hand, estimates far fewer Plains Miwok, and arrives at an Eastern Division total of around 9,000. In either case, some idea of the impact of imported disease on native populations may be gained from the 1910 census which reported 670 surviving Miwok, only half full-blooded (Kroeber 1925:445).

Most of the plants used by the Miwok were native to the Upper Sonoran Life Zone, and the largest villages and densest settlement was in this zone. Villages here would be in permanent locations, and occupied most of the year. While there was probably some permanent population in the Transition Zone, areas such as Yosemite and Wawona, and higher elevation sites, were mostly occupied in the summer when some of the foothill population moved into the mountains to follow the deer herds, trade with the Paiute from the east, escape the summer heat, and collect resources not available at lower altitudes.

The Miwok built several kinds of structures. The assembly house
has already been mentioned. This was the most substantial structure. It was 40 or 50 feet in diameter, dug three or four feet into the ground, and covered by a conical roof of beams supported by four central posts and covered with brush and earth. There was a central fireplace, a side entrance, and a hollow log foot drum over a resonating pit. In the summer, a smaller surface structure of brush was used.

A structure similar to the assembly house but smaller was sometimes built by men of importance as a winter residence. The usual dwelling was a conical structure covered with tule mats or brush. In the mountains, this was a cone of bark slabs from large conifers, leaned together and overlapping. These impermanent structures were apparently not built over a pit, and would leave little archeological trace, except for features. A shallow central fireplace provided heat and light, and some cooking was also done in an earth oven, a pit about a foot deep and a foot across.

In addition to dwellings, there were brush shades and sweathouses. The sweathouses were small, conical, earth-roofed pit-houses, and sweating was by fire only, not steam.

Prehistoric Artifacts

The prehistoric remains from Wawona are quite similar from site to site, and because only a small sample was taken from each of several sites, it is best to discuss the artifacts mostly as a single assemblage. Following this, the sites will be compared and individually evaluated.

Projectile Points

As used here, the term "projectile point" refers to bifacially worked stone tools with generally sharp points and cutting edges, usually symmetrical, and of an appropriate size for hafting onto a spear or arrowshaft. Some functional interpretations are implied; similar tools are known to have been used by living peoples as arrowheads and spear points. There is no guarantee that all of the tools labeled projectile points by the archeologist actually served such a function, but they form a class which can be used for description and comparison.
In the Great Basin a number of named projectile point types are distinguished (e.g. Heizer and Hester 1978). Previous work has found these types to be consistent in form and occurrence, and the named types imply certain temporal spans, geographic ranges, and cultural associations. The projectile points in California, and especially in the Sierra, are less well known. Some types are at least related to Great Basin types and can be evaluated in light of our knowledge of these, while others have not yet been found in enough different contexts for us to understand their ranges of variation and placement in space and time.

Bennyhoff (1956) organized the projectile points from his work in the Yosemite region into three major classes by weight: Class A, 1 gram or less; Class B, 1.1-3.5 grams, and Class C more than 3.5 grams. He felt that these weight classes were stratigraphically significant. Following the ideas of Fenenga (1953), they were also felt to have functional significance, the large points being hafted to atlatl darts used by earlier cultures, while the small, light points tipped arrows (see also Thomas 1978). Each class contained many different forms, but Bennyhoff felt that for most there was too little known to warrant the use of a type name, and simply numbered different forms within his weight classes.

Bennyhoff's weight classes are not especially useful in analyzing the Wawona material. All of the complete points found are of the small, light types in his Class A, and all of the large points whose form and size can be estimated from the fragments recovered would have weighed more than 3.5 grams. The artifact tables do show that large points and fragments tend to occur at greater depth than small points and fragments.

Desert Side-notched. Almost all of the small points are roughly triangular in outline. The Desert Side-notched type (Bennyhoff and Byrne 1959) has side notches and various base forms, usually concave. All the complete specimens are shown in Figure 4a. As can be seen there is a great deal of variation. Baumhoff and Byrne (1959) have divided their Desert Side-notched type into four subtypes with regional significance. Figure 4a, b, and c are good examples of their widespread general subtype, and Figure 4d fits their Sierra subtype, distinguished by the basal notch and more limited in distribution. The others vary
considerably from the published examples (Figs. 4e-j). Some of these points are very regularly flaked, others are carelessly made, lopsided, and irregular. Most of them were made on thin flakes, and still have remnants of the original flake surface which was not completely removed by the secondary flaking. I replicated about a dozen of these points using obsidian from the Mono Lake region and antler pressure flakers. Even the best of these points requires no more than 20 minutes labor, and the majority could be produced in a few minutes by even the least skillful worker.

Small, thin, Desert Side-notched points are easy to break, both in manufacture and in use. Figure 4k illustrates a kind of snap that frequently occurs in manufacture. Figure 4-l is most likely also a fragment of a Desert Side-notched point broken in manufacture. This piece has been reworked along the break line, and both edges are ground smooth and round.

Three fragments were found that could be identified as the basal corners of Desert Side-notched points (Figure 4m). These break off easily during manufacture, but are also about what one would expect to find if the deer dodged and the hunter brought back his shaft for a new arrowhead. The points in figures 4c and g have a single flake running down the point from where the tip used to be. This is sometimes called an impact flute, and is frequently produced when a stone projectile point hits something hard such as a rock or a tree, if the archer missed, or a bone if he didn't. This evidence implies that one of the activities at these sites was hunting, and damaged arrows were brought back to have the broken points replaced with others made on the spot.

Baumhoff and Byrne (1959) discussed the chronological implications of Desert Side-notched points at length. From the data then available, they concluded that the Desert Side-notched point spread westward and northward from the Great Basin and the Southwest and was thus earlier in the Sierra Nevada than in central California, where it appears slightly earlier than Phase II of the Late Horizon, which begins around AD 1500. They estimate a beginning data in the south and central Sierra Nevada around AD 1350 for their general subtype of the Desert Side-notched point, and feel that the Sierra subtype begins to appear about 100 years later. Bennyhoff (1956) and Fitzwater (1968a, 1968b) consider the
Fig. 4. Projectile points. Desert Side-notched: a. 4-Mrp-343, EU2, 15-20 cm. b. 343, SU1. c. 170, EU5, 5-10 cm. d. 343, EU14, 0-5 cm. e. 170, EU5, 10-15 cm. f. 170, EU5, 0-5 cm. g. 343, EU2, 15-20 cm. h. 343, EU2, 15-20 cm. i. 343, EU14, 5-10 cm. j. 8, EU2, no provenience. k. 170, EU5, 0-5 cm. l. 343, EU14, 5-10 cm. m. 343, EU2, 40-45 cm. Cottonwood Triangular: n. 343, EU2, 15-20 cm. o. 343, EU4, BRM1. Rose Spring Corner-notched: p. 343, EU2, 20-25 cm. Elko Corner-notched: q. 343, EU16, 55-60 cm. Pinto: r. 343, EU2, 30 cm. Concave-based: s. 8, SU1. t. 343, EU16, 20-25 cm. Large Side-notched: u. 170, midden surface. Biface fragments: v. 8, EU3, 65-70 cm. w. 8, SU10. x. 8, EU3, 45-50 cm. y. 8, EU3, 60-65 cm. z. 8, EU3, 50-55 cm.
Desert Side-notched point to be a defining trait of the Mariposa Complex. Bennyhoff (1956) estimated a beginning date of AD 1200 for the Mariposa Complex. Fitzwater prefers to begin the Mariposa Complex around AD 1000, based on a C14 date of 950 ± 70 BP from the Crane Flat site 4-Mrp-105 (Fitzwater 1968a). The reasons why this date cannot be applied to Desert Side-notched points have been discussed above. The C14 dates obtained by Moratto (1972) for Buchanan Reservoir material associated with Desert Side-notched points are all later than Baumhoff and Byrnes' AD 1350 estimate, so for the moment the available evidence indicates that this is substantially correct for the Yosemite region.

While the beginning date for the Desert Side-notched point in the Yosemite area is thus uncertain, there is no question that it represents late occupations and was still in use in historic times. Heizer and Hester (1978) cite dates in the 18th and 17th centuries for Great Basin sites with Desert Side-notched points. One of these, from the Pyramid Lake site in Nevada, is a C14 date on an arrowshaft armed with a Desert Side-notched point. For the historic Miwok, Barret and Gifford (1933: Plate 59) show an arrow with an obsidian point of this type from Calaveras County.

Desert Side-notched points were found at all three of the major sites investigated in Wawona.

**Cottonwood Triangular.** Two other small points (Figures 4n and o) and a fragment can be classed as Cottonwood Triangular points as defined by Lanning (1963). The two examples figured are of the poorest workmanship. Figure 4n is a thin flake with the barest minimum of trimming to shape it and 4o is sadly lopsided. The range of Great Basin dates cited by Heizer and Hester (1978) is essentially the same as for the Desert Side-notched point, and the two types frequently occur together both archeologically and ethnographically. From the illustrations and descriptions in Lanning (1963), Bennyhoff (1956), Clewlow (1967), Heizer and Hester (1978), and the specimens recovered at Wawona, it is evident that there is great variability within the Desert Side-notched and Cottonwood Triangular types, and they are very similar in form. Clewlow (1967) has suggested the possibility that the Cottonwood Triangular type is an unnotched version of the Desert Side-notched type, with some differences in geographic distribution. There seems in fact to be a
complex of small triangular arrowheads dating from AD 1000-1300 to historic times in California, with wide variation in the presence or absence of serration, side-notching, and in the form of the base which has some temporal and/or geographical significance. The unnotched form (Cottonwood Triangular) is more common in assemblages from the east side of the Sierra Nevada than in the Yosemite region and west.

**Rose Spring Corner-notched.** Figure 4p illustrates the single example of a small, corner-notched projectile point. It is poorly made on a biface thinning flake with minimum retouch to shape. In outline it resembles the Rose Spring Corner-notched type (Lanning 1963; Heizer and Hester 1978), although the illustrations in these works show much better made points.

Bennyhoff's (1956) Type A-11 is comparable to our specimen (which weighs 1.05 gm)—also his A7 and A10. These forms co-occur with Desert Side-notched points at Crane Flat in Yosemite. Similar but heavier forms are expected to be earlier. The specimen illustrated is from Excavation Unit 2 at 4-Mrp-343, where it occurred just below three Desert Side-notched points (Table 12).

The Rose Spring and related Eastgate series of point types are smallish points, and fall into either Bennyhoff's Class A or B. The Class B points, including these types, are characteristic of the Tamarack Complex in Yosemite and other middle to late prehistoric assemblages, such as the Raymond Phase at Buchanan. Heizer and Hester (1978) suggest that the Rose Spring series was most important from about AD 600 to AD 1100, having been introduced somewhat earlier, and surviving to historic times.

The specimen from 4-Mrp-343 is small, and there is no visible stratification separating it from the Desert Side-notched points. Moreover, it is only a single specimen. It does not necessarily imply a Tamarack Complex occupation of Wawona, although that is not ruled out.

Only fragments of large points were recovered, and of these there were only five from which the original form of the point could be estimated for comparison with points from previous work.

**Elko Corner-notched.** Figure 4q shows the base of a point which compares very nicely to published examples of the Elko Corner-notched type (O'Connell 1967; Clelowlow 1967; Heizer and Hester 1978). This spec-
imen is very flat and thin, unusually well made with fine pressure flaking. Heizer and Hester (1978) have compiled C14 dates associated with Elko series points, and suggest a Great Basin time span of ca 2000 BC to AD 1080. However, they also present data indicating that Elko series points may begin as early as 6000 BC and last to AD 1350. The Elko Corner-notched (and other Elko series points) are mostly Great Basin points, but do occur in small numbers in Southern Sierra sites (Moratto 1972; Bennyhoff 1956:Type C13; Fitzwater 1962) and in the northern Martis Complex sites (Elston 1971). Present evidence indicates that this is a relatively early point type, and the specimen figured was recovered from the 55-60 cm level of EU 16 in 4-Mrp-343.

**Pinto.** The base shown in Fig. 4r, is thick and weathered. The beginning of a shoulder seems to be indicated just below the break. This point resembles points of the Pinto series. Heizer and Hester (1978) date the Pinto series early in the Great Basin, ca 3000 BC to 700 BC. However, Moratto (1972) found two points in the Buchanan area of the Sierra foothills which he calls Pinto Sloping Shoulder points. They come from deposits probably dating to AD 500-800, and he feels their resemblance to the early Great Basin points is probably fortuitous (Moratto 1972:262). The specimen from Wawona resembles the two points illustrated by Moratto (1972:Plate IIk, 1), and also Bennyhoff's (1956) Types C11 and B8. Fitzwater (1968a, Type T) considers this type to be diagnostic of the Crane Flat Complex. It does seem to be an early point in this area, and the Wawona specimen came from 4-Mrp-343 in EU 2, where at a depth of 30 cm it was below the occurrence of Desert Side-notched points in the same unit. The break on this point is much fresher than the flaked surface, which appears more weathered than other tools from these sites. This may indicate reuse of an old point.

**Concave-based.** Two base fragments of concave-based points were found, one (Fig. 4s) on the surface of 4-Mrp-8, the other (Fig. 4t) from the 20-25 cm level of EU 16 at 4-Mrp-343. The first of these is an ugly thing which would have been a stumpy rounded triangle with a concave base. It shows evidence of percussion flaking and irregular pressure finishing, and seems to have been shattered on impacting something hard. The second is the concave base of a well made lanceolate form finished by careful pressure flaking. I have referred to both as concave-based.
points because the typological literature on such forms is confused. Both are within the bounds of what has been called the Humbolt Concave-based type in the Great Basin and California (Heizer and Hester 1978; Muto, Mehringer, and Warren 1976; Clewlow 1967). Heizer and Hester (1978) support a time range for Humbolt points similar to that of the Pinto series points, and cite C14 dates from 3920 BC to 1100 BC, while suggesting that the actual range may be both earlier and later. Green (1975) prefers to restrict the Humbolt label in the Great Basin to very fine points with parallel oblique pressure flaking, dating as far back as ca 7600 BC.

Moratto (1972) classes both the crude and the well made concave based points from the Buchanan Reservoir area in California as a new type, the Sierra Concave-based. He feels the Humbolt Concave-based point is restricted to the Great Basin, and smaller than the Sierra Concave-based type, although his smaller examples of Sierra Concave-based points "correspond to the descriptions of the Humbolt Concave-based type" (Moratto 1972:258). Heizer and Hester (1978) consider the California Sierra and San Joaquin Valley concave-based points as members of their Humbolt type.

Ragir (1972) reports concave-based points (her Type 3b) from central California which resemble Fig. 4s and the less refined Humbolt points. These are from Windmiller Phase sites which she dates between about 3000 and 1000 BC (Ragir 1972:123,267). At site 4-Mad-159 in the Buchanan Reservoir area Sierra Concave-based points occur in strata with C14 dates of AD 150 and AD 260 (Moratto 1972:258, 423). There is, thus, a range of dates for concave-based point forms in California. It would probably be possible to distinguish more than one type of concave-based point in California, with different temporal and spatial distributions, if variations in form and flaking technology were considered in detail. Until this is done, we can say only that large concave-based forms appear to be relatively early, and in the Yosemite region should relate to Bennyhoff's Crane Flat Complex.

It is often arguable whether large points such as these were intended for use as knives or as points on darts and spears. There is evidence that at least some of the large concave-based forms were indeed projectile points; two skeletons excavated by Moratto (1972) have the fatal Sierra Concave-based points still embedded in skull and spine.
Large Side-notched. The point shown in Fig. 4u was found on the surface of the midden area on site 4-Mrp-170. It is flatly biconvex in cross section, and shows evidence of percussion and pressure work. The surface illustrated is neatly flaked, the other face not so well. The surfaces and break are weathered, contrasting with some fresh flake scars along the edges, probably damage from traffic on the golf course.

This point would have been large and broad, with convex edges, shallow notches, and an expanding stem. In form it is comparable to Moratto's (1972) Sierra Side-notched type. It also resembles some examples of Bennyhoff's (1956) C9 type from Yosemite, and nonobsidian points of the Martis Complex of the Central and Northern Sierra (Heizer and Elsasser 1953:Type 4d). All of these occur in early contexts, in excess of 1,000 years old.

The specimen illustrated is better worked than similar points illustrated elsewhere. The visible weathering of its surface may argue some antiquity.

Other biface fragments. Figs. 4v, w, x, y, and z show selected fragments of points or large bifaces, typical of what are called in Tables 11-18 (pages 101-106) large biface fragments. The tips shown (v, w) are thick and crudely flaked. The base (x) was impact shattered. Fig. 4y shows a wedge from the edge of a large thick point made of quartz crystal, the only point fragment found not made of obsidian. The wedge in Fig. 4z is obsidian and from a biface at least twice as wide as the wedge is long. This and other small wedges, and the waste flakes discussed below, indicate the production of larger bifaces than any recovered by this project.

Drills and Gravers

Two pieces that can be called drills were recovered at Wawona (Figs. 5a, b). Fig. 5a is a small section of the blade of a well made chert drill. Small flake scars and rounding of the edge show use. Fig. 5b is an obsidian drill made with rough bifacial work on a fragment of a flat flake. It too shows wear from use. The last piece, Fig. 5c, I have called a graver. It is a chert flake with steep unifacial retouch forming a point. There is some wear along the edges and the tip, but only on the retouched face, not on both faces as there should be if it had been used as a drill with a rotary motion.
Fig. 5. Retouched tools. Drills: a. 4-Mrp-343, EU2, 35-40 cm. b. 343, EU15, 15-20 cm. Graver: c. 8, EU3, 40-45 cm. Simple Scrapers: d. 8, EU3, 75-80 cm. e. 343, EU2, 25-30 cm. f. 8, EU2, 0-5 cm. g. 8, EU3, 60-65 cm. Complex Scrapers: h. 8, EU3, 65-70 cm. i. 8, EU3, 60-65 cm. j. 343, EU18, 0-5 cm. k. 343, SU6. Serrated Flake: l. 8, EU3, 5-10 cm. Retouched Quartz Crystal: m. 8, EU3, 20-25 cm. Retouched Cobble Flake: n. 343, EU18, 30-35 cm. Edge-Ground Flake: o. 170, EU2, 20-30 cm.
Tools of these sorts have been little studied in California, and we can only guess at their function. They could have been used in drilling and incising any of a number of materials: wood, bone, antler, steatite, or shell, for instance. From the southern Sierra Nevada comparable tools are illustrated by Bennyhoff (1956), Moratto (1972), and Bellinger (1974).

Scrapers

The most common tool type from all the excavations at Wawona was the scraper. From excavation contexts, 71.7 percent of the tools fall into this category. The term implies a scraping function which is not necessarily what they were used for. What "scraper" usually means is a tool retouched with short steep flakes, most often unifacially. As for actual use, these tools are suitable for smoothing and planing wood, antler, or bone, scraping hide, or cutting soft materials. The retouch gives a slightly duller, but steeper and stronger edge. Most of the scrapers from Wawona are small flakes with short, irregular, retouched edges. Most of the retouch is very casual and can, in fact, be produced by use as well as by intentional pressure working. Scraping the edge of an obsidian flake once or twice across a piece of bone or antler will duplicate the majority of scrapers from Wawona. Scrapers are often divided into convex, concave, convergent, pointed, and other categories by shape (eg. Bellinger 1974; Bennyhoff 1956). There is no good evidence from our area that different forms of these simple flake scrapers have any temporal or functional significance. Such tools were probably made, used, and discarded with little more thought than a smoker gives his matches. Accordingly, I have only subdivided the scrapers into three categories, two of size and a third for scrapers that show more than minimum retouching, either to a definite form such as notches, or on more than one edge (Tables 11-18).

Figs. 5d, e, f, and g are examples of simple scrapers, the first three small (less than 2 cm), the fourth large (more than 2 cm). The next two (Figs. 5h, i) are typical complex scrapers, with well developed retouch, and worked on more than one edge. Most of the complex scrapers were made on flakes larger than 2 cm long. Figs. 5j and k are also complex scrapers. The first is made on a piece of a thick obsidian
flake which has had some bifacial work along the edges. The second is on a thick flake of reddish fine-grained quartzite. The artifact tables (Tables 11-18) show the distribution of these three categories of scraper.

Other Flaked Stone Tools

Fig. 5-1 shows a small obsidian flake which has been given serrated edges. It is too wide and thin to be a projectile point fragment.

Fig. 5m is a quartz crystal, notched, and with some bifacial flaking.

Fig. 5n shows a large flake of silicified limestone which has been worked to a point. Most of the retouch is on the interior side of the flake, but there is some bifacial retouch as well.

Fig. 5o shows an obsidian flake, one edge of which has been ground until it is completely dull and rounded. This piece is very like the point shown in Fig. 4-1, which has both edges ground in the same way. Patrick Vaughan of the University of Pennsylvania examined these two tools microscopically at 280x and compared them to some obsidian flakes which I had used experimentally. The wear is similar to that produced in grooving a piece of sandstone, although the experimental flake had striations which were lacking on the archeological specimen. Tools used in cutting steatite are not ground down in this way. Patrick Vaughan concluded, on the basis of this and his own experiments, that these tools were used to work a hard, gritty material, probably a fine-grained stone although shell remains an untested alternative.

Utilized Flakes

Flakes that show damage along their edges in the form of small, irregularly spaced flakes, usually off both faces, are often termed "utilized flakes." The damage is interpreted as wear from use, and indeed cutting, scraping, and sawing with flakes will produce edge damage of this sort. However, the sharp, fragile edges of flakes are easily damaged by a variety of nonintentional and natural forces, such as striking the core or the ground when struck, trampling by men and animals, erosion and motion of the soil, and excavation and transport by the archeologist. Obsidian, which produces extremely sharp edges and is
Table 11
ARThFACt DISTRIBUTION, 4-MRP-170, EU 5

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KEY: tf = Tip fragment
uf = Unidentifiable bifacally worked fragment
DSN = Desert Side-notched
BTF = Biface thinning flakes
mf = Middle fragment
## Table 12

**ARTIFACT DISTRIBUTION, 4-MRP-343, EU 2**

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**KEY:**
- DSN = Desert side-notched
- tf = Tip fragment
- ef = Edge fragment
- CT = Cottonwood Triangular
- bf = Base fragment
- w = Wedge
- P = Pinto
- DRL = Drill
- RSCN = Rose Spring Corner-notched
- uf = Unidentifiable bifacially worked fragment
- BTF = Biface thinning flakes
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</table>

**KEY:**
- tf = Tip fragment
- bf = Base fragment
- uf = Unidentifiable bifacially worked fragment
- BTF = Biface thinning flakes
- E = Elko
- CB = Concave-based
- ef = Edge fragment
- w = Wedge
Table 14
ARTIFACT DISTRIBUTION, 4-MRP-8, EU 3

<table>
<thead>
<tr>
<th>4-MRP-8 EU3</th>
<th>POINTS AND BIFACES</th>
<th>SCRAPERS</th>
<th>TOTAL TOOLS</th>
<th>FLAKES</th>
</tr>
</thead>
<tbody>
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<td>bf, w</td>
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<td>95-105</td>
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</table>

KEY: tf = Tip fragment; ef = Edge fragment; bf = Base fragment; w = Wedge; uf = Unidentifiable bifacially worked fragment; DRL = Drill; BTF = Biface thinning flakes; mf = Middle fragment
### Table 15
**ARTIFACT DISTRIBUTION, 4-MRP-343, EU 14**

<table>
<thead>
<tr>
<th>4-MRP-343 EU14</th>
<th>POINTS AND BIFACES</th>
<th>SCRAPERS</th>
<th>TOTAL TOOLS</th>
<th>FLAKES</th>
</tr>
</thead>
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<td>2</td>
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<tr>
<td>25-30</td>
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</tr>
</tbody>
</table>

**KEY:**
- DSN = Desert Side-notched
- CT = Cottonwood Triangular
- mf = Middle fragment
- bf = Base fragment
- ef = Edge fragment
- w = Wedge
- uf = Unidentifiable bifacially worked fragment

### Table 16
**ARTIFACT DISTRIBUTION, 4-MRP-343, EU 15**

<table>
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<th>4-MRP-343 EU15</th>
<th>POINTS AND BIFACES</th>
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<th>TOTAL TOOLS</th>
<th>FLAKES</th>
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<td>&gt;2 cm</td>
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**KEY:**
- DRL = Drill
### Table 17

**ARTIFACT DISTRIBUTION, 4-MRP-343, EU 18**

<table>
<thead>
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<th>4-MRP-343 EU18</th>
<th>POINTS AND BIFACES</th>
<th>SCRAPERS</th>
<th>TOTAL TOOLS</th>
<th>FLAKES</th>
<th>NONOBSIDIAN</th>
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Unfinished

**KEY:** uf = Unidentifiable bifacially worked fragment; tf = Tip fragment; bf = Base fragment

### Table 18

**ARTIFACT DISTRIBUTION, 4-MRP-8, EU 2**

<table>
<thead>
<tr>
<th>4-MRP-8 EU2</th>
<th>POINTS AND BIFACES</th>
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<th>FLAKES</th>
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</tr>
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</table>

**KEY:** DSN = Desert Side-notched

uf = Unidentifiable bifacially worked fragment
brittle material, is even more subject to such damage than flint or other common lithic raw materials. My own experience with the pile of waste flakes where I knap is that most of the flakes develop damaged edges; this must be the result of trampling as I use very few. Many of the flakes from Wawona have damaged edges, but I have not attempted to classify or quantify them. Damaged edges are an indicator of prehistoric and recent conditions affecting the artifacts, but unless one is ready to invest the labor necessary for a microscopic study of edge-wear, it is best not to describe edge-damaged obsidian flakes as utilized.

Flakes

The majority of the artifacts collected at Wawona were unretouched obsidian flakes, the waste product from making stone tools. These are frequently ignored by archeologists but at Wawona they provide information vital to our understanding of the sites.

All soil was screened through a 1/8-inch mesh, and this resulted in the recovery of large numbers of small flakes. Detailed analysis of the flakes was confined to the four most productive excavation units, EU 5 at 4-Mrp-170, EU 2 and EU 16 at 4-Mrp-343, and EU 3 at 4-Mrp-8. Flakes were sorted into three size categories, using the longest dimension of each flake. Flakes larger than 1 cm in maximum dimension were subdivided as biface thinning flakes or other, and features such as cortex and the platform were examined. The artifact tables, Tables 11-18, show in more detail some of the data discussed in summary form here.

Several features of the stone tool industry at Wawona are outstanding even before detailed analysis. Almost all the material is obsidian, the flakes and tools are small, there are almost no flakes with cortex, and most of the pieces are biface thinning flakes. These characteristics are consistent between sites and throughout whatever time span these sites represent.

Material. Over 10,000 flakes were excavated from the four units studied in detail (Tables 11-14). Only 53 of these were not obsidian. From the same units, 207 tools were recovered. Four of these, or 1.9 percent, were not obsidian. Of all the flaked stone tools collected in the whole project, surface and excavation, only six were of materials
other than obsidian. These have been described above. Most of the nonobsidian pieces were flakes of local cobbles of various fine-grained igneous and metamorphic rocks. None of these cobble flakes had been worked into tools, and some of them may be no more than the accidental products of using cobbles for hammering and pounding. Other materials represented by only a few pieces each were red and white quartzite, a black silicified limestone, quartz crystal, gray and brown cherts, and a very fine white chert or chalcedony.

The obsidian varies in color and quality. It is mostly black, ranging from opaque to translucent. There are some practically clear flakes. The quality varies from very fine and homogeneous to rather grainy, and some flakes have small pumice inclusions. There was no apparent preference for any particular kind of obsidian. Only seven very small flakes of red obsidian and one scraper were found. This may reflect a choice on the part of the tool makers as obsidian frequently occurs in both red and black in the same outcrop, and both colors are readily available in outcrops exposed at present on the east side of the Sierra Nevada. According to Barrett and Gifford (1933:256), the Miwok described obsidian as coming in red and white as well as black, but preferred to use black obsidian.

There is no naturally occurring obsidian in Yosemite or the rest of the Sierra Nevada. All the obsidian found there had to be imported from the edge of the Great Basin on the eastern side of the mountains, or from sources near the coast on the west. So far, mostly obsidian from east of the Sierra has been documented.

The obsidian trade in California is well documented, both archeologically and ethnographically. The Miwok received both raw obsidian and finished points from the Paiute in historic times (Clark 1904:22-23; Curtis 1924:131, cited by Moratto 1972:244). Barrett and Gifford (1933:256) state that obsidian came to the Miwok "from the mountains," or from "a high mountain called Kilili" (Barrett and Gifford 1933:218). The informant here seems to be from the Central Miwok in the foothills. The Central and Southern Sierra Miwok traded extensively with the Mono Lake Paiute, from whose territory the obsidian came. Foothill groups probably received obsidian from tribelets who lived higher in the mountains, and had contact with eastern tribes.
There are too many archeological cases of eastern obsidian in sites west of the Sierra Nevada to mention them all here. I will discuss only a few from south and west of Yosemite.

Jackson (1971) analyzed 112 obsidian specimens from sites in the Don Pedro Reservoir area in the foothills west of the Yosemite region. The Miwok and late prehistoric groups here used mostly obsidian from the Bodie Hills source area (Map 1). Seventy-five of the pieces sampled came from Bodie Hills, followed by 18 from Casa Diablo, eight from Mount Hicks, seven unidentified, three from Mono Glass Mountain, and a single piece from Mount Konocti. The Bodie Hills source area was ethnographically within the territory of the Washo (Kroeber 1925; Ericson 1977) or the Mono Lake Paiute (Jack 1976).

Moratto (1972) analyzed a small sample of obsidian artifacts from sites in the Buchanan region south of Wawona. All but two of the 19 points analyzed came from the Casa Diablo source. The points included early and late types from a variety of contexts. The sample is extremely small, but probably indicates that the Casa Diablo source was the most important obsidian source for the Miwok and earlier groups in the Buchanan region. Jack (1976:192) reports that of 95 specimens "from Southern Sierra Miwok sites in the Yosemite area" the sources are Casa Diablo, 66.3 percent; Queen, 3.2 percent; Mono Glass Mountain/Mono Craters, 3.2 percent; Bodie Hills, 16.9 percent; and Mount Hicks, 6.3 percent.

These three sets of data suggest that the different Sierran and foothill groups tended to obtain their obsidian from the nearest source. The Wawona area is between two major trails which cross the Sierra (Davis 1961). One of these comes from the Mono Lake area where the obsidian sources cluster, and passes somewhat north of Wawona; the other complex runs south of Wawona to the area south of Mono Lake and appears to connect with the Mono Lake Complex.

An X-ray florescence source analysis is being performed on a sample of 73 flakes from Wawona by Lee Sappington of the University of Idaho. Hydration measurements on the same material have been made by T. Origer of Sonoma State University. The results of these studies will be presented in a second paper.

At present we cannot identify with any confidence the sources of
the obsidian used in Wawona. A few specimens were identified as from the Bodie Hills source area (Sappington: personal communication), and it is probable that much of the material came from there.

Size. All the flakes and tools were relatively small. The use of 1/8-inch mesh greatly increased the number of flakes recovered, especially the small ones, but the largest flakes were less than 5 cm long. Only 24.9 percent of the 10,421 flakes excavated in the four richest units were larger than 1 cm in maximum dimension, and only 167 flakes, or 1.6 percent, were larger than 2 cm. These figures would be increased somewhat if we added the tools, which were almost all made on flakes larger than 1 cm.

Measurements of thickness were not made, but few flakes were as thick as 5 mm. This is to be expected in an assemblage mostly made up of biface thinning flakes.

Cortex. The presence or absence of cortex was recorded only for flakes larger than 1 cm in maximum dimension. Only 3.5 percent of those from the four units analysed showed cortex on the exterior surface. The low frequency of cortex indicates that the natural surface of the obsidian pieces brought to Wawona had already been removed by previous flaking. This was probably done at the quarry site, and served to reduce the weight of a load which had to be carried on foot over miles of mountain.

There is little comparable data from sites in the region, but Payson Sheets (1973) reports a similar low incidence (1.8 percent) for a site in the Badger Flat area of Fresno County. The debitage from this site seems comparable to the Wawona material in other respects as well. In contrast to this, a sample from a quarry area at Bodie Hills shows that at least 50 percent of the flakes have cortex (Singer and Ericson 1977:Table 2).

A single test pit at 4-Mrp-56 in Yosemite Valley produced 331 obsidian flakes of which 220, or 66 percent, have cortex (Mayberry 1979). This is particularly interesting because it indicates that the obsidian industry in the Yosemite Valley may have been quite different from that at Wawona.

Biface Thinning Flakes. The biface thinning flake is a specialized kind of flake which is the characteristic product of biface manufacture.
Compared to other kinds of flake, they tend to be thin and flat, and to expand in width from a small platform. The platform is directly on the edge of the biface and is usually prepared by faceting and trimming and often abrasion. Much biface work is done with a hammer of antler, bone, or wood rather than stone. The softer hammer is better for removing long, flat, thin flakes. Many biface thinning flakes, especially those produced with a soft hammer, have a "lip" on the interior of the flake where the platform cracked. Biface thinning flakes often bear on their exterior surface the scars of similar flakes removed earlier, especially if they come from late in the process of making a biface.

All flakes larger than 1 cm in maximum dimension from the four units selected for analysis were sorted into "biface thinning flake" and "other" categories. The criteria used for the biface thinning flake category were that the flake (or flake fragment) should be thin, relatively flat, and with three or more scars on the exterior; if a platform were present, it should be of the biface type, prepared or lipped. The "other" category included a few angular pieces and flakes with platforms that showed a distinct cone and point of impact on a flat platform. These pieces are indicative of working cores with hard hammers to produce flakes, although they may also result from early stages of biface manufacture. Very few of them were found. The "other" category also included a large number of flake fragments with less than three scars on the exterior surface. Many of these probably are, in fact, flakes from biface production. The biface thinning flake category is, thus, biased toward whole flakes, or flakes from later stages of biface production, and can be considered a measure of the minimum proportion of biface thinning flakes in the assemblage.

Of the flakes larger than 1 cm, 79.3 percent fell into the category of biface thinning flakes. This high measure of biface production was also evident in the smaller flakes. Using the flakes less than 1 cm in maximum dimension from EU 3 at site 4-Mrp-8, the relatively thick, angular fragments were sorted out. These comprised only 3.5 percent of the small flakes; the rest were thin flat flakes and flake fragments most likely resulting from biface manufacture. Many of these are pressure flakes, produced in the last stage of manufacturing a refined biface such as a projectile point.
Continuity in Time and Space. I have throughout discussed the Wawona material as a single assemblage. The analysis justified this. Over what should be a span of considerable time, the types of projectile points changed, but the obsidian tool industry remained almost exclusively oriented toward the production of bifaces and the manufacture of small tools from the waste product, biface thinning flakes.

The indices shown in Table 19 serve to compare the four analyzed units. In some respects, notably percentages of large flakes, biface thinning flakes, and tools, EU 5 at 4-Mrp-170 and EU 2 at 4-Mrp-343 resemble one another and contrast with the other two units, which are strikingly similar to each other. However, I have no explanation for this, and it does not seem to reflect temporal differences. The obsidian hydration measurements indicate that EU 16 from 4-Mrp-343 is generally later than EU 3 at 4-Mrp-8 (Origer: personal communication). In an attempt to test temporal variation in the absence of visible stratification, the four units were subdivided into upper and lower levels, and similar indices produced for the subunits. The upper levels of EU 5 at 4-Mrp-170 and EU 2 at 4-Mrp-343 contained Desert Side-notched points. There were none of these late time-markers in the other two units, and 20 cm was arbitrarily chosen as the boundary for subunits. There are no large and consistent differences between subdivisions of the units with late points and those without, or between the upper and lower subdivisions of any of the units. There are possibly trends toward a slight decrease in large flakes and biface thinning flakes from early (lower) to later (upper) subunits, and a faint increase in the proportion of tools. I hesitate to attach much importance to these trends, and prefer to emphasize the generally consistent nature of the industry.

Nature of the Industry. As we have seen, the obsidian industry at Wawona was heavily weighted toward biface production. The lack of cortex, the numerous biface thinning flakes with multiple flake scars on their exterior surfaces, and the large number of small biface flakes indicate that the bifaces worked on in Wawona were already somewhat refined when they arrived at the sites. At an earlier stage in working these bifaces, they would have produced generally larger flakes with more frequent cortex and fewer exterior scars.
<table>
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<tr>
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<th>4-MRP-343 EU16</th>
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<td>.58%</td>
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<td>.29%</td>
<td>.51%</td>
</tr>
<tr>
<td>Cortex &gt;1 cm</td>
<td>7.7%</td>
<td>4.0%</td>
<td>3.1%</td>
<td>3.4%</td>
<td>3.5%</td>
</tr>
<tr>
<td>flakes &gt;1 cm</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Flakes &gt;1 cm N</td>
<td>13.4%</td>
<td>18.8%</td>
<td>28.8%</td>
<td>26.5%</td>
<td>24.9%</td>
</tr>
<tr>
<td>Flakes &gt;2 cm N</td>
<td>.38%</td>
<td>.75%</td>
<td>3.12%</td>
<td>1.63%</td>
<td>1.6%</td>
</tr>
<tr>
<td>BTF &gt;1 cm</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Flakes &gt;1 cm</td>
<td>57.7%</td>
<td>68.4%</td>
<td>77.1%</td>
<td>82.6%</td>
<td>79.7%</td>
</tr>
<tr>
<td>Tools*</td>
<td>.115</td>
<td>.209</td>
<td>.058</td>
<td>.056</td>
<td>.072</td>
</tr>
<tr>
<td>Flakes &gt;1 cm</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Tools*</td>
<td>.015</td>
<td>.039</td>
<td>.017</td>
<td>.015</td>
<td>.018</td>
</tr>
<tr>
<td>0-15 15-55</td>
<td>1.75%</td>
<td>0.19%</td>
<td>.9%</td>
<td>2.12%</td>
<td>1.18%</td>
</tr>
<tr>
<td>Cortex &gt;1 cm</td>
<td>6.7%</td>
<td>9.1%</td>
<td>4.7%</td>
<td>3.4%</td>
<td>3.8%</td>
</tr>
<tr>
<td>flakes &gt;1 cm</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Flakes &gt;1 cm N</td>
<td>13.1%</td>
<td>13.7%</td>
<td>20.2%</td>
<td>17.7%</td>
<td>28.2%</td>
</tr>
<tr>
<td>Flakes &gt;2 cm N</td>
<td>.22%</td>
<td>.62%</td>
<td>1.13%</td>
<td>.45%</td>
<td>2.66%</td>
</tr>
<tr>
<td>BTF &gt;1 cm</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Flakes &gt;1 cm</td>
<td>48.3%</td>
<td>70.5%</td>
<td>71.0%</td>
<td>66.1%</td>
<td>72.6%</td>
</tr>
<tr>
<td>Tools*</td>
<td>.167</td>
<td>.114</td>
<td>.271</td>
<td>.153</td>
<td>.066</td>
</tr>
<tr>
<td>Flakes &gt;1 cm</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
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<tr>
<td>Tools*</td>
<td>.022</td>
<td>.016</td>
<td>.055</td>
<td>.027</td>
<td>.019</td>
</tr>
</tbody>
</table>

**KEY:** * = Not shown as percent because numerator is not a subset of denominator; BTF = Biface thinning flakes.
The small tools used at Wawona were almost all made from the waste products of this biface industry, the biface thinning flakes. This is readily visible on the scrapers, and on the less well made small points such as Figs. 4n and p.

The industry characteristic of Wawona may have differed from that at other sites in the Yosemite region. Unfortunately, none of the earlier excavations published data on the flaking waste.

Rasson (1966) recovered three cores from 4-Mrp-56 in Yosemite Valley. These are worked obsidian nodules from which numerous flakes have been struck. The core illustrated is angular and seems to have had flakes removed from several directions. The flakes removed from such a core would be larger and thicker than the typical biface thinning flake. The flakes with cortex which Mayberry (1979) excavated from this site also indicate a difference between Wawona and Yosemite.

Closer to the source of obsidian, the inhabitants of Yosemite may have been using obsidian that was in the form of larger, less refined pieces than the bifaces worked in Wawona. Flakes from cores would have served for tools just as well as biface thinning flakes. However, there are indications of a biface industry in the form of large points and bifaces (discussed below) from El Portal and Crane Flat.

**Biface Industry**

The evidence of stratigraphy, artifact associations, and obsidian hydration dating indicate that the biface industry at Wawona was a long-standing tradition, lasting up to the protohistoric, or even contact period. The evidence is less clear when we attempt to describe the kind of biface being worked.

The flakes, while small, indicate some rather large bifaces. A flake 2 cm long had to have been removed from a biface at least 2 cm wide, and probably wider.

To produce a standard for comparison, I made three points of obsidian. The first was a Desert Side-notched point made from a biface thinning flake and comparable to Fig. 4a. The second was a lanceolate point, made from a large flake by pressure flaking alone. The flake was 7.0 cm by 3.0 cm by 0.7 cm, and the finished point was 6.5 cm by 2.5 cm by 0.7 cm. The third point was a corner-notched form reduced from a
large flake by both soft hammer percussion and pressure flaking. The flake was 8 cm by 6.5 cm by 1.5 cm, and the finished point was 6.4 cm by 3.2 cm by 0.7 cm. These two points are within the size range represented by the Elko Corner-notched and concave-based points in Figs. 4q and t. All the flaking tools used in these experiments were antler, and the obsidian was from the Mono Glass Mountain source area. All the debris was screened through 1/8-inch mesh to approximate archeological recovery, and the flakes that remained are presented in Table 20 for comparison to the archeological assemblage.

<table>
<thead>
<tr>
<th>Table 20</th>
<th>FLAKES PRODUCED IN MAKING EXPERIMENTAL POINTS</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>N</td>
</tr>
<tr>
<td>Experimental DSN</td>
<td>23</td>
</tr>
<tr>
<td>Experimental Point 2</td>
<td>345</td>
</tr>
</tbody>
</table>

KEY: BTF = Biface thinning flakes

Some general comments on this experiment are necessary. Three points made by one knapper do not constitute much of a sample and can only serve as general guides. The flake count should be considered inflated in comparison to archeological assemblages produced in the manufacture of similar points. If they had been screened out of the soil, perhaps as many as half of the small flakes would not have been found, regardless of other factors which remove flakes from the archeological record.

Having noted these limitations, we can still use the replicated material to illustrate some points about the archeological assemblage. Production of Desert Side-notched points could not be the source of biface thinning flakes larger than 1 cm. Nevertheless, these points are found in the upper levels with almost as great a proportion of biface thinning flakes as occur in the lower levels. Therefore, the people
occupying the sites in late times were making larger bifaces which were not found.

The third experimental point produced flakes similar to those found archeologically. The percent of flakes larger than 2 cm (2.9 percent) is within the range of the archeological samples. It appears that production of the large, early points could account for much of the biface waste in the earlier part of the Wawona occupation. However, none of the flakes produced experimentally was over 3 cm in maximum dimension, and most in the greater than 2 cm group were closer to 2 cm. The archeological flakes in the greater than 2 cm size group average larger, and there are some complete biface thinning flakes more than 4 cm long. Flakes this size could represent bifaces in an early stage of manufacture, which ultimately became large points, or large bifaces which were a finished product in themselves.

Any knapper, no matter how skillful, breaks things from time to time. Large obsidian bifaces are easy to break in manufacture, and with so much being done, we might expect to find numerous biface fragments. Actually there are only a few pieces which probably come from bifaces larger than the large points. The best of these is a fragment which I call a wedge (Fig. 4z). These occur occasionally when a biface is shattered by a bad blow in knapping or by being dropped. The one illustrated gives a partial cross section of the biface, which was at least twice as wide as the wedge is long. This means the biface was at least 5 cm wide and .8 cm thick at the time it was broken. The flaking on the wedge shows that the biface was fairly refined, well flaked, and even, but not finished by pressure flaking. There are five similar but smaller wedges.

The columns labeled "large points and bifaces" in Tables 11-18 contain mostly fragments which probably came from pieces no larger than the large points. Other than the wedges, there are no fragments which definitely came from larger bifaces. The wedges and other fragments are too small to be reworked into new tools. Larger fragments do not seem to have been discarded and were probably kept for reworking. The large scraper shown in Fig. 5j is thick and shows some bifacial retouch. It may be a reworked fragment of a biface broken at an early stage of manufacture. A few of the pieces classed as untypeable point and biface

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fragments may also have been reworked bits of large bifaces. In Wawona, where obsidian had to be traded for or carried many miles over mountains, it must have been a valuable commodity. It is not surprising that large pieces were not discarded.

To sum up, the archeological evidence at Wawona shows a long tradition of biface manufacture. The points from the late levels of the site do not represent this industry at all, and the larger, earlier points from deeper levels may be only one of the products of a large biface industry. Although none have been found in Wawona, there are large bifaces known from this region of California which may fit with the evidence of biface production in Wawona.

Fitzwater (1962) reports two large bifaces from El Portal, one of which was in association with a burial. From his illustrations, this last seems to be broken, and both are broad, leaf-shaped forms showing percussion work. From Crane Flat (Fitzwater 1968a), he recovered five bifaces more than 9 cm long. As he describes them, they are triangular or leaf-shaped, worked by percussion. Two appear unfinished, but all show use chipping along the edges. One is of chert, the others obsidian.

From the Buchanan Reservoir area, in ethnographic Miwok territory but south and west of Wawona and lower in the foothills, Moratto (1972) reports large bifaces, mostly from burial contexts. One burial from site 4-Mad-159 contained two lanceolate bifaces, each more than 20 cm long. From the illustrations (Moratto 1972:Plate VIC, D), these bifaces appear to have been worked by percussion and finely finished by pressure flaking. In form and technology they bear a great resemblance to some of the Sierra Concave-based points from the same area.

Moratto (1972:417) gives three C14 dates for this site, from AD 110 to AD 260 (1840 BP ± 95, 1800 BP ± 95, 1690 BP ± 155). Ten pieces of obsidian from this site were all from the Casa Diablo source area. These bifaces would be suitable for use as knives or spear points, but most of them appear to be unused burial offerings. Moratto also notes prehistoric frugality with obsidian; almost all the large points are found whole only in graves and are mostly represented elsewhere by fragments too small to rework.

North of Wawona, at least two caches of large bifaces have been
found in Yosemite National Park. The museum at Yosemite has about 100 specimens from a cache that apparently contained over 200 bifaces and fragments when it was discovered by a hiker near a trail in Glen Aulin. Another cache was found in Pate Valley by Boy Scouts some years earlier; only six specimens of this one survive. The material from these caches is presently being analyzed for publication by Great Basin Associates (G.B.A.). James Bard and Colin Busby of G.B.A. and Roger Kelly kindly provided me with information and documents concerning this material, although I was not able to see it myself.

The Glen Aulin bifaces are all more than 5 cm long, and some are more than 10 cm long. Most of them are narrow, thin, and flat. They are well worked with careful soft hammer percussion, and only a few show partial pressure finishing. In fact, they appear to be exactly what we might expect at Wawona. Some of the Glen Aulin bifaces have been sourced and found to originate from the Casa Diablo source area, while the Pate Valley pieces are from Bodie Hills (Bard: personal communication). Hydration measurements have not yet been made, and the caches are not otherwise datable. The location of the Glen Aulin cache essentially on the surface at the base of a tree suggests that it is not very ancient.

We are probably seeing several points along a route which took material from the obsidian source to distant consumers. At the obsidian quarries bifaces were roughed out. This first stage of work removed the cortex, reduced the weight, and weeded out flawed pieces. The Glen Aulin bifaces and some of the Bodie Hill quarry specimens (Singer and Ericson 1977) are actually fairly refined; so much of what may be considered the middle stages of work may have been done at the quarry.

Bifaces in a more or less refined form were then traded or carried across the Sierran passes, where an occasional trader or knapper hid his stock and failed to come back.

At sites such as those in Wawona, and a smaller site in the Badger Flat area (Sheets 1973), fairly refined bifaces, lacking cortex and rather large, were further processed. The end product could have been either finished bifaces, or refined pieces ready for the finishing touches and resembling some of those from Glen Aulin. Only the waste flakes and pieces broken in use or manufacture into fragments too small
for use were left behind. Eventually the bifaces were traded or carried into the foothills. They may already have been finished, or they may have been finished by the final consumer. Analysis of waste flakes from the foothill and valley sites could show which. The large points and bifaces were used in the chase, in war, and as burial offerings, the obsidian hoarded and re-worked so that only a few points come whole to the hands of the archeologist.

Trade Systems

I have chosen throughout the discussion above to describe the movement of obsidian while being vague about the mechanisms for that movement. The Miwok could have obtained obsidian either by trade, or by expeditions to the sources. Ericson (1977a) terms these two possibilities the exchange system model and the direct access model. For the Late Horizon in California prehistory, he favors an exchange system based on egalitarian exchange between trade partners (Ericson 1977a, 1977b). Ericson seems to prefer an exchange system to direct access because the former is more efficient in terms of energy expenditure measured by human travel distance. His model is an oversimplification ignoring costs (in terms of energy expenditure or other measures) of any items traded for obsidian, and the fact that other considerations may outweigh efficiency.

Assuming that direct access may be more costly or less efficient than trade, it may still be preferred in obsidian procurement as allowing greater choice and selection of material for the users' purposes, or because of social or ceremonial considerations.

As far as the ethnographic record goes, the California Indians seem to have obtained obsidian by both exchange and direct access, sometimes over considerable distances. Some of the Pomo traveled 50 miles to the Clear Lake obsidian source, asking permission from but not paying the local Pomo group (Heizer and Treganza 1944:299). The Wintu and other groups made a two- or three-day trip each summer to the Glass Mountain source (Heizer and Treganza 1944:303). On the other hand, several tribes are known to have received obsidian through short range trade with neighbors (Davis 1961).
The Southern Miwok of the Yosemite Region and the Central Miwok of the foothills had an extensive trade with their neighbors across the mountains, the Eastern Mono or Mono Lake Paiute, who controlled the obsidian sources around Mono Lake. "Trade between Miwok and Mono friends was a matter of reciprocal gifts, between Miwok and Mono strangers a matter of bargaining" (Barrett and Gifford 1933:256). Various foods were commonly traded, and obsidian also came down from the mountains, usually in the form of arrow points but sometimes as raw material (Barrett and Gifford 1933:256).

While it is not recorded that the Miwok traveled to the obsidian sources across the mountains, they may have done so. They did journey to the coast for shell, at least after the coming of the Spanish (Barrett and Gifford 1933:256). Moreover, the Yosemite Miwok at least had close ties with the Mono. Chief Tenaya seems to have been at least partly Mono, and his band took refuge with the Mono after being driven out of Yosemite (Bunnell 1892:292). Thus for the Miwok an exchange system involving obsidian is definitely recorded and was probably in existence prehistorically, but direct access cannot be ruled out.

We can only speculate about who among the prehistoric inhabitants of Wawona was actually procuring and working the obsidian. Ethnographic accounts of stone-working in California all indicate that it was a male activity. Many of the accounts mention specialists who made bows and arrows for trade to others. Among the Miwok, Barrett and Gifford (1933:219) say "arrows were made by a specialist. Others bought their arrows from him paying in beads. No property marks or other decorations were used on arrows." This is in reference to the making and fletching of the shaft, and may or may not apply to flaking the arrowhead. It is unlikely that the specialists mentioned were full-time artisans. More likely they were just better than average at a craft everyone knew, and made extra tools for trade.

The flake assemblage from all the sites so far studied in Wawona is consistent. It is suggested below, based on ethnographic information, that the late settlements in Wawona represent the summer camps of a tribelet and follow the usual pattern of small related villages centered around the chiefly village. If this is the case, implying at least partly contemporaneous sites, then it is probable that the obsidian was
not worked by specialists, at least not entirely.

The similarity of the waste flakes at all the sites may indicate that each man, or at least many of them, from each different camp, traded for his own supply of obsidian in the form of bifaces, and worked it into finished bifaces and necessary tools at his own camp. This would also be consistent with the wide range of workmanship shown by the projectile points. I hasten to emphasize the speculative nature of this model, and it remains to be seen whether similar patterns exist in other sites in Wawona and elsewhere.

Steatite

The Indians of California used steatite, or soapstone, for vessels and ornaments. At Wawona, steatite was found in the form of bowl sherds, beads, and three unidentified fragments. Table 21 lists these steatite objects with their proveniences and dimensions.

Most of the steatite is gray, but some is reddish or greenish. It probably came from quarries in the foothills. Barrett and Gifford (1933:211) record one Miwok steatite quarry near the present town of Tuolumne; there were certainly others. Steatite trade is recorded ethnographically among the Yokut (Davis 1961), and doubtless the Miwok traded steatite as well.

The use of steatite seems to be a late development in this part of California. In Yosemite, steatite bowls and beads are associated with Bennyhoff's Mariposa Complex material (Bennyhoff 1956). In the Buchanan Reservoir area, numerous bowls and sherds were recovered in stratigraphic contexts that "clearly indicate that steatite vessels belong to the late prehistoric period" (Moratto 1972:322). However, Fitzwater (1962, 1968a) has a few pieces of steatite, apparently ornaments, from Crane Flat which come from lower levels and which he assigns to the Crane Flat Complex. Only one of the six steatite artifacts from Crane Flat is described, and it is impossible to evaluate his statement that they are early. It is possible that there was some early use of steatite ornaments, but bowls and disc beads are consistently late.

The steatite vessels known from the Miwok area are shallow and globular bowls and cooking pots, and plates and dishes (Bennyhoff 1956; Moratto 1972). Although most cooking was done by stone-boiling in
Table 21
STEATITE ARTIFACTS FROM WAWONA SITES

<table>
<thead>
<tr>
<th>PROVENIENCE</th>
<th>DIMENSIONS</th>
<th>REMARKS</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>BOWLS</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>4-MRP-8</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Grid 7E4S surface</td>
<td>10 cm x 7 cm x</td>
<td>Rim, with shaft</td>
</tr>
<tr>
<td></td>
<td>2.9-.8 cm</td>
<td>straightener</td>
</tr>
<tr>
<td>4-MRP-343</td>
<td></td>
<td></td>
</tr>
<tr>
<td>EU2 15-20 cm</td>
<td>3.5 cm x 2 cm x .5 cm</td>
<td>Rim</td>
</tr>
<tr>
<td>EU14 15-20 cm</td>
<td>5 cm x 3 cm x 1 cm</td>
<td>Carbonized incrustation</td>
</tr>
<tr>
<td>SU6</td>
<td>3 cm x 3 cm x .8 cm</td>
<td>Red steatite</td>
</tr>
<tr>
<td><strong>SHAFT STRAIGHTENER</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>4-MRP-8</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Surface</td>
<td>Above</td>
<td>Above</td>
</tr>
<tr>
<td><strong>BEADS</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>4-MRP-8</td>
<td></td>
<td></td>
</tr>
<tr>
<td>EU1 disturbed</td>
<td>5.5 mm x 1.5 mm</td>
<td>Large hole</td>
</tr>
<tr>
<td>EU2 20-25 cm in Feature 1</td>
<td>9.0 mm x 1.3 mm</td>
<td>Broken, rough surfaces</td>
</tr>
<tr>
<td>EU2 10-15 cm</td>
<td>8.4 mm x 1.2-3.0 mm</td>
<td>Uneven thickness</td>
</tr>
<tr>
<td>EU3 15-20 cm</td>
<td>8.9 mm x 1.5 mm</td>
<td>1 rough surface</td>
</tr>
<tr>
<td>SU15</td>
<td>9.5 mm x 2.2 mm</td>
<td>Green steatite</td>
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<td>4-MRP-170</td>
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<td></td>
</tr>
<tr>
<td>EU5 0-5 cm</td>
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<td>Broken</td>
</tr>
<tr>
<td><strong>YOSE 80A-1</strong></td>
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<td></td>
</tr>
<tr>
<td>EU1 10-20 cm</td>
<td>6.8 mm x 2.5 mm</td>
<td>Broken, 1 rough surface</td>
</tr>
<tr>
<td>&quot; &quot;</td>
<td>6.7 mm x 2.6 mm</td>
<td></td>
</tr>
<tr>
<td>&quot; &quot;</td>
<td>6.1 mm x 1.0 mm</td>
<td></td>
</tr>
<tr>
<td>&quot; &quot;</td>
<td>9.0 mm x 4.0-2.6 mm</td>
<td>Uneven</td>
</tr>
<tr>
<td>&quot; 20-30 cm</td>
<td>7.0 mm x 2.2 mm</td>
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</tr>
<tr>
<td>&quot; 50-60 cm</td>
<td>7.6 mm x 3.5 mm</td>
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</tr>
<tr>
<td>EU5 30-40 cm</td>
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</tr>
<tr>
<td><strong>MISCELLANEOUS</strong></td>
<td></td>
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</tr>
<tr>
<td>4-MRP-8</td>
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<td></td>
</tr>
<tr>
<td>EU3 50-55 cm</td>
<td>2.6 cm x .5 cm x .3 cm</td>
<td>Pendant fragment?</td>
</tr>
<tr>
<td>EU3 35-40 cm</td>
<td>1.4 cm x .6 cm x .3 cm</td>
<td>Worked?</td>
</tr>
<tr>
<td>4-MRP-343</td>
<td></td>
<td></td>
</tr>
<tr>
<td>EU14 5-10 cm</td>
<td>.7 cm x .5 cm x .2 cm</td>
<td>Unworked</td>
</tr>
</tbody>
</table>
baskets, steatite pots could be set directly on a fire (Barrett and Gifford 1933:211). Steatite holds heat well, and the stones for stone-boiling were sometimes steatite, although I know of no archeological examples.

Sherds from four steatite bowls were found on the Wawona sites. The three pieces from 4-Mrp-343 are from small bowls. The thinnest was finely worked; the others are uneven but smooth.

One of these fragments has a carbonized incrustation adhering to the inner surface. There was not enough material to have it analyzed chemically. It appears to be burnt seed paste and is visually comparable to an experimental sample of carbonized acorn mush. Although we can't say for sure, it probably is acorn gruel which is very glutinous and would stick and burn quite readily in a stone pot.

On the surface of 4-Mrp-8, near the river bank, was found a rim sherd from a large bowl. A long enough section of rim was left to estimate the original diameter at about 20 centimeters. This vessel was thick and fairly even, the walls tapering to a straight rounded rim. The exterior shows scars and gouges. Both interior and exterior surfaces are uneven but the interior surface is smoothed, probably from use.

On the exterior of this sherd is a polished groove which would once have been an arrowshaft straightener. This is the form of arrow straightener which Kroeber (1925:530) feels is typical of southern California, and associated with the use of cane arrows which were straightened in the groove after heating the stone. The ethnographic Miwok arrows reported by Barrett and Gifford (1933:217-219) had shafts of elder or other wood. These were also straightened by heat, and although Barrett and Gifford do not mention shaft straighteners, they may well have been used.

Flat steatite disc beads are common in Miwok area sites. They are a late time-marker associated with the Mariposa Complex (Bennyhoff 1956). In the Buchanan Reservoir area, steatite disc beads are associated with cremations, Desert Side-notched and Cottonwood Triangular points, and clam shell disc beads, all indicative of protohistoric times. There are beads from contexts with three C14 dates in the 17th and 18th centuries, and no beads from contexts earlier than about AD
1500. On the basis of this evidence Moratto (1972:348-350) concludes that steatite disc beads were introduced in the 16th century.

The steatite beads from Wawona exhibit a range of sizes. The holes are consistently about 2 mm in diameter, and appear to be conically drilled. Some of the beads are uneven in thickness, and the thin specimens with rough surfaces probably result from a bead splitting along a plane in the steatite and may not have been so thin originally. All the beads are of grayish or greenish steatite, with the exception of the bead from the surface of 4-Mrp-8, which is a brilliant jade green. This bead is more carefully made than most, very even and smooth, with a slightly large hole showing wear at the edges from the string.

What is probably a pendant fragment was recovered from EU 3 at 4-Mrp-8. It is badly broken but seems to have been a long, flattened, pointed, or bipointed shape. The measurements indicate present length and original width and thickness.

Two other pieces of steatite are so small that it is difficult to see whether or not they were worked. They are probably chips from broken vessels.

Other Ornaments

From 4-Mrp-8, Surface Unit 3, was recovered a fragment of a ground stone rod or cylinder. The diameter was 0.5 cm, and the length of the fragment is 0.9 cm. The material is a fine-grained metamorphic rock. This artifact appears similar to ground stone cylinders and "spindles" described by Moratto (1972:310), some of which were made of andalusite crystals.

The other three ornaments are of European manufacture. From EU 2 at 4-Mrp-343, a glass bead was recovered from the 20-25 cm level in the midden. It is a short, smooth cylinder of white glass, 3.0 mm long, with a diameter of 3.7 mm, and a hole approximately 1 mm in diameter. There is no evidence of Anglo occupation of this site, so this bead seems to belong to the Miwok occupation in association with Desert Side-notched points. A mass of "small, white glass trade beads" melted into the bottom of a glass bottle from 4-Mrp-92 in Yosemite valley probably represents a cremation offering (Bennyhoff 1956:52) and may be similar to this specimen.
A glass bead was also found at 4-Mrp-8 in EU 1 in the disturbed context of a sewer trench. It is a dark iridescent blue, 6.9 mm long and 2.0 mm in diameter, faintly faceted to produce a hexagonal cross section. Because of the disturbed context and Anglo occupation of 4-Mrp-8, it cannot be definitely associated with the Miwok.

A pierced 1873 dime from Surface Unit 12 at 4-Mrp-8 has been described with the historic artifacts. Because it was pierced to hang as an ornament, it probably relates to the surviving Miwok after the Anglos had invaded the Yosemite area.

Ground Stone

This section includes all stone artifacts not made of flaked stone. They have been shaped in some cases by grinding, in others by pecking, and the form by which these artifacts were recognized was given them more by wear during use than by intentional shaping. Table 22 lists these artifacts by provenience.

Table 22
GROUND STONE ARTIFACTS FROM WAWONA SITES

<table>
<thead>
<tr>
<th>PROVENIENCE</th>
<th>DESCRIPTION</th>
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<tr>
<td>4-Mrp-343</td>
<td></td>
</tr>
<tr>
<td>EU1 15-20 cm</td>
<td>Pestle, granite cobble, fragment, battered end</td>
</tr>
<tr>
<td>EU8 in mortar hole</td>
<td>Pestle, granite cobble, small fragment</td>
</tr>
<tr>
<td>EU2 25-30 cm</td>
<td>Mano, granite cobble, small fragment</td>
</tr>
<tr>
<td>EU2 Feature 1 45 cm</td>
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<td>EU2 Feature 1 50 cm</td>
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</tr>
<tr>
<td>EU5 5-10 cm</td>
<td>Mano, granite cobble, complete</td>
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<tr>
<td>4-Mrp-343</td>
<td></td>
</tr>
<tr>
<td>EU2 Surface</td>
<td>Hammerstone, small granite cobble</td>
</tr>
<tr>
<td>EU2 25-30 cm</td>
<td>Hammerstone, small polished cobble</td>
</tr>
</tbody>
</table>
**Bedrock Mortars.** Bedrock mortars are associated with acorn processing. The number and depth of bedrock mortars at a site relates in some way to the population and length of occupation of a site. Bedrock mortar numbers for the Wawona sites are given in the discussions of specific sites in a later section. Bennyhoff (1956) uses the number of mortar holes to classify sites. Sites without bedrock mortars are classed as camp sites. Sites with one to seven mortar holes are called house sites, those with eight to 19 small villages, and those with 20 or more large villages. This is a rather crude and arbitrary measure, but Bennyhoff does use it to discuss site distribution at different altitudes, showing that large sites mostly occur in the Transition Life Zone up to about 6,500 feet, and bedrock mortars were not found in Yosemite above 8,000 feet.

There are some difficulties in using mortar holes as a measure of site size. Counting the holes is somewhat subjective, and the accumulation of leaf litter often obscures mortar holes. A survey will seldom find as many holes as an intensive project on a single site. The discrepancy between the counts made by Bennyhoff (1956), Napton (Napton et al. 1974), and myself on sites 4-Mrp-8 and 4-Mrp-343 will be discussed below.

Mortar hole number and size are functions of length of occupation, number of people, availability of rock, type of food processed, and probably other variables. None of these relationships are presently quantifiable. Julia Parker (personal communication), who processes large quantities of acorn meal for demonstrations and home use, was unable to give me any estimate of how fast a mortar hole might wear. She said she always used previously existing mortars and had not noticed any increase in size or depth. She felt wear should be slow, as one tries to avoid adding stone flour to the acorn meal by striking the pestle against the mortar. Nor is it certain at what depth a mortar is abandoned. Mrs. Parker suggested that it is hard to remove meal from deep holes, and that deep mortars are better for grinding such things as manzanita berries. Barrett and Gifford (1933:143, 208) report the same, stating that a mortar hole was generally abandoned at a depth of about 5 inches. Mortar holes observed in Wawona ranged from barely visible depressions to 17 centimeters (6.5 inches) deep. Bennyhoff (1956)
reports mortar holes up to 11 inches (28 centimeters) deep. It is evident that bedrock mortars were being used in some way which we do not know about.

In spite of these difficulties, there is some utility in publishing at least the number of mortar holes on a site. It is standard data in California and allows at least a very rough comparison of relative site sizes.

The use of mortar and pestle seems to have some temporal significance. Bennyhoff (1956) associates bedrock mortars with the Tamarack and Mariposa Complex sites, but not with his earlier Crane Flat Complex. He thus estimates a starting date of ca AD 500. Moratto (1972:330) found bedrock mortars and pestles at Buchanan sites occupied mostly in the first four or five centuries AD, and suggests that acorn gathering peoples using portable mortars settled in the foothills about 200-100 BC and had begun to use bedrock mortars by AD 200-300.

Pestles. The pestles associated with bedrock mortars in the Sierra Nevada are generally crude, most often a rough granite block or cobble, with an elongated end or handy corner. Only the wear on them makes them identifiable as artifacts. In Wawona such pestles were observed at YOSE 80A-1 and 4-Mrp-343, where there were a number of pestles and cobbles below BRM 1. Napton et al. (1974) report 10 pestles in situ or associated with the bedrock mortar area of 4-Mrp-8, but these were not observed in 1980.

Only two pestles were recovered in excavation, both from 4-Mrp-343. That from EU 1 is the end of an elongated cobble with a very battered end. The piece from EU 8 is a small fragment of a cobble with no visible wear, but is probably a pestle fragment as it was found in a bedrock mortar cup.

Manos and Metates. Bennyhoff (1956) found manos and metates mostly in the deeper levels of his Yosemite sites in association with large "Class C" points. He therefore assigned these tools to the Crane Flat Complex, before AD 500. They also occur mostly in early context in El Portal and Crane Flat (Fitzwater 1962, 1968a). Barrett and Gifford (1944:209) report that the Miwok probably borrowed the use of the metate from the eastern tribes and used the edge of a cobble pestle instead of a special mano.
The early excavations and ethnographic information indicated that the mano and metate were the early grinding tools associated with an emphasis on small seed collecting. Later they were replaced by the bedrock mortar and cobble pestle, indicating a change to acorn-based subsistence. It is now evident that the different tools do not necessarily indicate a dichotomy between seed processing and acorn processing. Moreover, the mano and metate are found in all periods at Buchanan Reservoir sites, although early shaped manos were replaced by simple cobble manos. Thus, it is not advisable to interpret the simple presence of manos or metates as evidence of early occupation.

Four granite cobbles from Wawona were recognized as manos by the presence of flattened ground surfaces. As granite cobbles were quite common in the natural soil, especially at 4-Mrp-8 and 4-Mrp-170, it is quite possible that some cobbles which received only a little use as grinding tools were not worn enough to be recognized. Glacial and river polish also produce mano-like forms.

The manos are of undetermined age. The mano from 4-Mrp-170, the best of the lot, was found in the 5-10 cm level in association with Desert Side-notched points. The mano fragments from 4-Mrp-343 were all below the levels with late points. Two were from a feature which seemed to be a dump of cooking stones, and could have been either on an early past surface, or in a pit dug down from a later surface.

Hammerstones. Two small stream-polished cobbles with battered ends were excavated from 4-Mrp-343. These could have served for a variety of hammering or pecking purposes.

Organic Material

Organic material preserved in archeological sites provides a variety of information about the artifacts, dietary habits, and environment of prehistoric man. An effort was made to recover organic material from the Wawona sites for its information content, and in order to plan further work at sites in Yosemite. It was hoped that artifacts and food remains would be found in the course of excavation, and that flotation and wet-screening would recover any remains of small fauna or plant foods. A preliminary pollen analysis was performed to test the value of
further work, with pollen as an indicator of environmental change in this region.

Bone and Shell

No artifacts of organic material were recovered. Bone and shell artifacts are to be expected in California sites, and have been excavated from Miwok sites in El Portal (Fitzwater 1962), the Don Pedro and Buchanan Reservoir areas (Moratto 1971, 1972), and elsewhere. However, the only shell beads recorded for mountain sites in Yosemite are in a private collection from Pate Valley (Bennyhoff 1956:52). None of the excavated mountain sites has bone tools or even well preserved bone. The El Portal sites are at an altitude of about 1,800 feet, and the Buchanan and Don Pedro Reservoir sites are from about 200 to 900 feet, and at these altitudes burials, faunal remains, and shell and bone artifacts are common. Most of the sites in Yosemite are above 2,000 feet, and at these higher sites, bone and shell are rarely found.

Small sites, most of which were only seasonally occupied, might not be expected to have a wide range of artifacts, especially ornamental items of valuable material such as shell. However, the bone awls and flaking tools found at lower sites should also occur in Yosemite, and there ought to be faunal remains.

The difference is probably in the preservation of these materials. At Wawona, the bone from the slaughterhouse, which should not be more than 100 years old, was already very soft and friable in EU 1. On the surface of the site, it was chalky and fragmented. The pieces which had been calcined, however, were in excellent condition, although fragmented. This is a common phenomenon in archeological sites.

In the midden areas, there was a good deal of bone, presumably the refuse of meals. It was all in the form of tiny calcined bits. Most of it appeared to be from long bone shafts of large mammals, probably deer, and a few pieces were recognizable as small ungulate, probably deer.

I am not entirely able to explain the poor preservation of unburned bone. Generally speaking, bone does not preserve well in well-drained soils derived from acid igneous rocks, as those at Wawona should be, or in any acid soil (Chaplin 1971:16). George Carter of the Western Archeological and Conservation Center performed pH analyses by the saturated
paste extract method on four midden samples, one from 4-Mrp-170 EU 5, and from the 5-10 cm, 35-40 cm, and 65-70 cm levels of EU 3 at 4-Mrp-8. The pH of these samples ranged from 7.50 to 7.86, or slightly basic. This is somewhat more alkaline than the usual range of 6.0-7.0 (slightly acid to neutral) obtained for both midden and native soils in the El Portal (1,800 feet) and Foresta/Big Meadow (4,300 feet) areas by Hewitt (1976). From this it seems that the midden soils at Wawona are less acid than might be expected, and certainly not acid enough to explain the poor preservation of bone.

Botanical Remains by Lisa Huckell

Introduction. Three of the six sites tested during the Wawona project were sampled for archeobotanical remains: 4-Mrp-8, 4-Mrp-170, and 4-Mrp-343. Thirty-three lots of materials were analysed, which consisted of flotation samples, macrofossils encountered during excavation, and a single small sample of carbonized organic residue found adhering to a soapstone vessel sherd. The samples were submitted for analysis in order to address basic questions concerning the presence of culture-related plant remains, the condition of preserved materials, and the identification of economically significant plant remains that could more specifically indicate the nature of Miwok subsistence activities at the sites. This information was intended to help assess the value of future archeobotanical investigations in Yosemite.

Methods. The processing of the 26 flotation samples followed the procedure described by Bohrer and Adams (1977:37). All samples were weighed and measured for volume prior to immersion; the samples had been collected by weight in the field and ranged in size between 0.5 kg and 2.0 kg. Volumes fell between 600 ml and 1,800 ml. These data are presented in Tables 24-26. The resulting light fraction was then sorted by means of a binocular dissecting microscope, with all potentially identifiable plant parts set aside. With two exceptions, 100 percent of the fraction was examined; the remaining samples came from surface or near surface proveniences and contained large quantities of forest litter and very little carbonized material. Therefore, a 50 percent sample was analyzed. Only those seeds or plant parts that were carbonized were retained for further analysis. Uncarbonized prehistoric material should
not have been preserved and, barring the occurrence of uncarbonized cul-
tigens or unusual manifestations of unburned seeds such as exceptional
concentrations, it is extremely difficult to distinguish modern from
prehistoric seeds (Minnis 1981:147).

Analysis included the use of seed identification manuals (Martin
and Barkley 1961; U.S. Forest Service 1974) to ascertain initial iden-
tities, followed by the use of comparative materials in the author's
collection to confirm the assigned identities. Two sources of informa-
tion on components of the flora in Yosemite Valley were also consulted
(Hall and Hall 1912; Heady and Zinke 1978), while more general informa-
tion was obtained from *A California Flora* (Munz and Keck 1959). In the
case of the organic residue sample, modern comparative samples of car-
bonized acorn meal and mush were prepared in an attempt to identify the
substance. Identified specimens were placed in protective plastic boxes
and will be added to the research collections of the Western Archeologi-
cal and Conservation Center, where they will be available for additional
study.

**Results.** With few exceptions, the flotation materials from all
three sites proved to consist largely of modern uncarbonized forest lit-
ter, with the most common items being rootlets, bark fragments, pine
needles, incense cedar leaves, pine needle dwarf shoots, pine cone bract
fragments, a few staminate oak catkins, pieces of pine nut shell, pitch
droplets, and bits of lichen. Evidence for animal activity was present
in most samples, and included insect exoskeletal fragments, fecal pel-
lets, pupa cases, tiny transparent eggs, and numerous small black
spheres that appeared to be fecal pellets. Some uncharred seeds were
also found in a few of the samples, notably manzanita (*Arctostaphylos
sp.*) and miners' lettuce (*Montia perfoliata*). Numerous small obsidian
flakes were also encountered in most of the samples as well.

Results of the analysis proved to be sparse. Four taxa were iden-
tified, of which three could be identified to the generic level, while
the fourth could be identified only as far as the subfamily. A fifth
plant has been tentatively identified and is included as well. They are
presented in Table 23.
Table 23
TAXA IDENTIFIED FROM WAWONA SITES

Pinaceae
  Pinus sp.

Ericaceae
  Arctostaphylos sp.

Caprifoliaceae
  Sambucus sp.

Lauraceae
  cf. Umbellularia californica (Hook. & Arn.) Nutt.

Gramineae

The general nature of these results devolves from the overall poor condition of the specimens, many of which had experienced severe surface erosion, which had effectively masked or destroyed important diagnostic features. The results of the analysis are presented by site in Tables 24, 25, and 26.

Pinus sp. – Pine. Pine remains were recovered from all three sites; in fact, pine plant remains along with some charcoal constituted the entire plant assemblage from 4-Mrp-343 (Table 25). The remains fell into one of three categories: needle fragments, dwarf or spur shoots (the small lateral branches bearing the fascicles of needles), and pine cone bracts.

At least seven species of pine are known to grow in the Yosemite Valley (Hall and Hall 1912), several of which were used by the Miwok (Barrett and Gifford 1933:149-151). The flavorful seeds were eagerly collected for food while the central pith of the green cones was also consumed. The cones were often harvested just before they opened and were then broken up to release the nuts inside. The needles were used for such purposes as thatching, bedding, and flooring, as well as to ignite over pine cones to burn off the pitch prior to extracting the nuts.

Based on the small volume of recovered pine materials, their modest economic values and the abundance of pine trees in the vicinities of all three sites, it is most likely that these specimens are naturally deposited forest litter that has been burned as part of a forest fire or as an inadvertent inclusion in the midden. It is impossible to be certain
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<th>SEEDS</th>
<th>ELDERBERRY</th>
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<th>PINES</th>
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<td></td>
</tr>
<tr>
<td>10-15 cm</td>
<td>1</td>
<td>4</td>
<td>5</td>
<td></td>
</tr>
<tr>
<td>WT = 1.0 kg</td>
<td>VOL = 1,000 ml</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>15-20 cm</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td></td>
</tr>
<tr>
<td>WT = 1.0 kg</td>
<td>VOL = 950 ml</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>25-30 cm</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td></td>
</tr>
<tr>
<td>WT = 1.0 kg</td>
<td>VOL = 1,000 ml</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>30-35 cm</td>
<td>7</td>
<td>7</td>
<td></td>
<td></td>
</tr>
<tr>
<td>WT = 1.0 kg</td>
<td>VOL = 950 ml</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>TOTAL</strong></td>
<td><strong>1</strong></td>
<td><strong>5</strong></td>
<td><strong>36</strong></td>
<td><strong>42</strong></td>
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Table 26
CARBONIZED PLANT REMAINS FROM 4-MRP-8
EXCAVATION UNIT 3

<table>
<thead>
<tr>
<th>LEVEL</th>
<th>MANZANITA NUTLETS</th>
<th>GRAMINEAE FLORETS</th>
<th>PINE NEEDLES</th>
<th>NEEDLE FASCICLES</th>
<th>CHARCOAL</th>
<th>TOTAL</th>
</tr>
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<tbody>
<tr>
<td>0-5 cm</td>
<td>1</td>
<td>1</td>
<td>20</td>
<td>22</td>
<td></td>
<td></td>
</tr>
<tr>
<td>WT = 1.75 kg</td>
<td>VOL = 1,450 ml</td>
<td></td>
<td></td>
<td></td>
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<tr>
<td>10-15 cm</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>8</td>
<td>8</td>
</tr>
<tr>
<td>WT = 2.0 kg</td>
<td>VOL = 1,550 ml</td>
<td></td>
<td></td>
<td></td>
<td></td>
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<tr>
<td>20-25 cm</td>
<td></td>
<td></td>
<td>2</td>
<td>22</td>
<td>24</td>
<td></td>
</tr>
<tr>
<td>WT = 2.0 kg</td>
<td>VOL = 1,500 ml</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>30-35 cm</td>
<td></td>
<td></td>
<td>1</td>
<td>10</td>
<td>11</td>
<td></td>
</tr>
<tr>
<td>WT = 2.0 kg</td>
<td>VOL = 1,400 ml</td>
<td></td>
<td></td>
<td></td>
<td></td>
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</tr>
<tr>
<td>40-45 cm</td>
<td></td>
<td></td>
<td>2</td>
<td>5</td>
<td>7</td>
<td></td>
</tr>
<tr>
<td>WT = 2.0 kg</td>
<td>VOL = 1,500 ml</td>
<td></td>
<td></td>
<td></td>
<td></td>
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</tr>
<tr>
<td>50-55 cm</td>
<td></td>
<td></td>
<td>3</td>
<td>1</td>
<td>3</td>
<td>7</td>
</tr>
<tr>
<td>WT = 2.0 kg</td>
<td>VOL = 1,800 ml</td>
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<td></td>
<td></td>
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<tr>
<td>60-65 cm</td>
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<td></td>
<td>1</td>
<td></td>
<td>1</td>
<td></td>
</tr>
<tr>
<td>WT = 2.0 kg</td>
<td>VOL = 1,400 ml</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>70-75 cm</td>
<td></td>
<td></td>
<td>3</td>
<td></td>
<td>3</td>
<td></td>
</tr>
<tr>
<td>WT = 1.50 kg</td>
<td>VOL = 1,400 ml</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>80-85 cm</td>
<td></td>
<td></td>
<td>2</td>
<td></td>
<td>2</td>
<td></td>
</tr>
<tr>
<td>WT = 2.0 kg</td>
<td>VOL = 1,600 ml</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>85-90 cm</td>
<td></td>
<td></td>
<td>1</td>
<td></td>
<td>12</td>
<td>13</td>
</tr>
<tr>
<td>WT = 2.0 kg</td>
<td>VOL = 1,400 ml</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>85-95 cm (gravel)</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>0</td>
<td></td>
</tr>
<tr>
<td>WT = 1.75 kg</td>
<td>VOL = 900 ml</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>TOTAL</td>
<td>13</td>
<td>1</td>
<td>2</td>
<td>2</td>
<td>80</td>
<td>98</td>
</tr>
</tbody>
</table>
of the materials' origins.

**Arctostaphylos** sp. - Manzanita. Manzanita nutlets were recovered from 4-Mrp-8 and 4-Mrp-170. However, according to the brief vegetational descriptions provided by Napton et al. (1974), manzanita is not present in the immediate area surrounding the two sites. This absence might be explained at least for 4-Mrp-170 by its location along a golf course where the shrubby growth may have been greatly reduced or eliminated to facilitate the recovery of errant golf shots hit into what would otherwise be a very formidable rough. Another explanation might be that the berries could have been brought in by birds, animals, or the human occupants of the sites.

The nutlets were found distributed virtually throughout the fill of the test excavation. This could reflect bioturbated midden fill, or it might indicate the long-term presence of manzanita at the sites up until relatively recent times. What is needed to help solve this problem are nonsite samples from the same area which would demonstrate how manzanita occurs in definite noncultural deposits.

The nutlets were generally either intact or broken into large fragments. Several of the wedge-shaped nutlets were still cemented to each other, with some still maintaining the solid ball shape that they form within the fruit. Most had experienced some degree of surface alteration through erosion.

Manzanita was one of the more popular plants exploited by California Indian groups, since a refreshing beverage could be prepared from the small, mealy fruits (Chestnut 1902:375-78; Mead 1972:19-24). Of the many species of the plant occurring in the state, most were employed either to make "manzanita cider" or were eaten raw or in powdered form. The Miwoks used five species of the plant (Barrett and Gifford 1933:161-162; Mead 1972:21-3). Preparation for cider involved the optional boiling of the fruits, followed by the reduction of the berries to a coarse meal by grinding. The meal was then placed in baskets, and water was poured through it into a container until all the flavor was leached out. The beverage was then ready for consumption. The berries were also chewed for the flavor, but were not swallowed because of the many seeds.

Based on the ethnographic data regarding preparation procedures, it seems unlikely that the archeological specimens from the Wawona sites
represent cultural activity. This conclusion is based on the small number of nutlets recovered and the relatively intact condition of the seeds. No quantities of small fragments which could have been interpreted as grinding residue were recognized.

**Sambucus sp. - Elderberry.** Seven elderberry seeds were recovered from 4-Mrp-170. Several species of this genus are found in the Yosemite area, all of which produce edible berries. The Miwok always cooked the berries of *S. glauca* Nutt. prior to consuming them. Often the fruits were dried and stored for winter (Barrett and Gifford 1933:172). There is no way to be certain of the means by which the seeds were left at the site. There may be a tree nearby, or they may have been transported, as the berries are relished by birds and animals as well as man.

**Gramineae - Grasses.** Florets of a small grass belonging to the subfamily Festucoideae were found at 4-Mrp-8 and 4-Mrp-170. All of the specimens were damaged and eroded to the point that they could not be identified any further. Many species of grasses are abundant in the area; without modern comparative samples of grasses from the sites, it is impossible to speculate on the grass's identity. The seeds of some grasses were utilized as a food source by the Miwok, including some post-European contact species that were rapidly integrated into the tribal subsistence pattern (Barrett and Gifford 1933:152).

**cf. Umbellularia californica - California Laurel.** Three small fragments of what are probably California Laurel nut shells were found at 4-Mrp-170. The plant, which is frequently found in the Yosemite Valley, bears olive-like fruits, the nuts of which were commonly eaten after being roasted by the Miwok (Barrett and Gifford 1933:163).

**Charcoal.** Small bits of carbonized wood were found in most of the samples. All were too small and eroded to permit further identification. Since none of the flotation samples were obtained from hearths, cooking pits, or other cultural situations in which fire was involved, it is likely that they are the products of naturally occurring sporadic fires.

**Unidentified Organic Substance.** A single fragment of a soapstone vessel was found at 4-Mrp-343 that contained a thin organic incrustation on the interior surface. It was recovered from EU 14 at a depth of 15 to 20 cm. The sherd itself measures roughly 2.95 cm by 4.7 cm, with
approximately 60 percent of the interior surface covered with the organic material. The layer is a thin one, never exceeding 1.0 mm in thickness. The material appears to be of a fine texture, and is homogeneous in consistency, without lumps or variably sized particles. It is completely carbonized.

The substance appears to be a product of cooking in the vessel that was left in it at the time it broke and was discarded. Unfortunately, the small size of the sample, the lack of any morphological clues, and the charred condition (which precludes chemical identification tests) all make it impossible to arrive at an identification.

However, the dependence of California aboriginal groups on seeds as a crucial dietary mainstay is well-documented (Barrett and Gifford 1933:151). In particular, the acorn constituted the major vegetal staple in the aboriginal economy (Gifford 1951; Baumhoff 1963). Preparation methods for most seeds followed the same basic procedure of cracking the seeds, if needed, winnowing the chaff out, parching the seeds with hot coals, and then grinding them into meal or flour by means of stone mortars and pestles. The resulting product was then either eaten as dry meal, was mixed with water and drunk, or was cooked as mush or gruel (Barrett and Gifford 1933:152). Acorns and buckeyes required an additional step in the process, that of leaching out bitter, harmful substances from the kernels or meal.

It seems likely that the residue-bearing sherd contained remnants of a seed mush. Given the universal usage of acorns in the Miwok diet, and the fact that acorn meal was always cooked prior to consumption, samples of acorn mush and carbonized acorn mush were prepared by Whittaker from nuts collected during the fieldwork phase on the chance that the residue might match that of the sherd. However, the results were inconclusive, as no structural features common to the two samples could be seen. As a result, the answer to the identity of the residue must await more sophisticated laboratory techniques.

Discussion and Conclusions. The modest results presented in this study are a product of several factors, some of which deserve mention. One is the well-known problem of preservation in open sites. Perishable materials, particularly fragile botanical remains, are especially vulnerable to decomposition in the unprotected, exposed environment that
characterizes open sites, a condition which leaves behind an impover­ished and frequently misleading archeobotanical record. All three of the Wawona sites from which flotation samples were taken are open sites. An example is offered by 4-Mrp-8, a site that contains at least 51 bed­rock mortars, an indication that the site was the location of numerous repeated episodes of large-scale acorn processing activities. Yet the flotation samples from the midden deposit provide no clues that acorns were utilized at the site at all. Although sampling bias may be re­flected here, the results from all three sites suggest that preservation problems do exist.

A related problem involves local environmental factors that enhance the deterioration of organic materials. As the botanical remains were sorted during analysis, it was immediately apparent that they displayed an exceptionally high degree of surface corrosion; few of the specimens exhibited crisp diagnostic characters. A preliminary analysis conducted on three pollen samples revealed a similar corroded condition of the pollen grains as well as a rapid diminution of the pollen concentration as depth was increased (Duncan: personal communication). It was also discovered that bone preserves poorly in Wawona soils, with the surviv­ing specimens displaying the same eroded surface condition found on the botanical remains (Whittaker: personal communication). This situation suggests that the midden soils may contain an unusually high concentra­tion of acids, bases, or other caustic chemical. However, the pH tests described earlier do not allow us to identify the destructive agent(s).

This brings up the next factor affecting the study results, that of differential preservation. The variety of plant foods incorporated into the aboriginal diet included many forms that could not be expected to survive even under optimal preservation conditions. Such things as greens, corms, and tubers are seldom encountered in the archeological record, a situation that creates an inherent sampling bias in any attempt to reconstruct prehistoric subsistance patterns. In the case of the Wawona samples, the available data are reduced even more by such agencies as harsh soil, insect and microorganism predation, and climatic effects on soils and their contents. With the possible exception of the grass florets, the surviving macrofossils from the Wawona sites tend to
be indurated, highly resistant forms, like nutshells or leathery cone bracts. More fragile forms appear unable to persist. This would also probably include remnants of certain food preparation techniques such as hull fragments from shelled acorns and the crushed seeds winnowed from manzanita berry flour, in which the remains are made even more susceptible to rapid deterioration.

Additional complicating factors affect the interpretation of the results obtained. The carbonized condition is the standard criterion by which potential cultural materials are segregated from noncultural material. However, it is frequently difficult to be certain of the source of the carbonizing fire, particularly in chaparral or forested areas such as Wawona, where natural fires are a frequent and integral component of the vegetational cycle. Although the samples were taken from midden fill, in the absence of strongly associated cultural features this cannot be considered strong proof that carbonization was culturally induced.

The problem of sampling is a critical one that lies at the heart of retrieving useful data. Several informative and highly useful discussions of the issue have been presented (Spector 1970; Bohrer and Adams 1977). Efforts must be made in the future to locate secure cultural contexts such as hearths, floors, or vessel contents from which to obtain samples with sound associations. An adjunct of any sampling strategy should be the acquisition of comparative samples from nonsite locations close to the areas under investigation. This material would greatly assist in the resolution of such issues as the natural occurrence of various seed types, their frequencies, their vertical distribution, specific local variations in preservation of organic remains, the degree and kinds of bioturbation taking place in the area, and much more. Samples of this kind would be extremely useful in dealing with the Wawona samples, as they could provide information on the presence of manzanita in the areas around 4-Mrp-8 and 4-Mrp-170, could assist in determining whether the relatively high macrofossil yield and the higher variety of edible species at 4-Mrp-170 is a natural or cultural manifestation, etc.

As the preceding discussion indicates, several problems must be confronted by those who would study botanical macrofossils from the
Wawona Valley. Although plant remains are present in the midden samples, it remains to be seen to what degree they represent Miwok subsistence activities. With cautious use and careful sampling, future archaeobotanical analyses may be able to make a worthwhile contribution to the culture history of the Wawona Valley.

Pollen Analysis

The pollen analysis was performed by Faith Duncan of the University of Arizona Department of Geosciences Paleoecology Laboratory. Site 4-Mrp-8, EU 3, was chosen as the most likely to provide a sample column representing a long occupation. Samples were taken from the northeast corner of the unit, as each successive level was excavated. Three samples from different depths were submitted for analysis.

Preparations for analysis were begun by weighing 30 grams of dry sediment for extraction, wetting down the samples with distilled water, and adding the Fagus exotic for purposes of tabulation. The sediments were treated with 10 percent and 50 percent HCl to remove carbonates, followed by two 49 percent HF treatments to remove silicates. After 48 hours of HF treatment, the samples were washed and a drop of each was suspended in distilled water to make up three temporary slides. Upon microscopic examination of the slides, a decision was made to continue extraction of the samples with 30 percent nitric acid, an acetolysis procedure, and 10 percent KOH. The samples were washed until the decantant was clear, and then the remaining material was vialled with equal amounts of glycerol for mounting.

Slide preparations, including a Safranin O stain, were made up for each level, and at least one slide was totally counted from each level in an attempt to obtain a 200 grain count.

The results of the counting and identification are summarized in Table 27.

The pollen concentration decreased rapidly with depth. Grains from the lower two levels showed considerably more corrosion than the upper level sample.

As preservation in the lower levels was poor, further analysis was not performed. If preservation is as poor in other sites in Wawona, it will not be easy to assemble a quantified pollen column which would
Table 27
POLLEN ANALYSIS, SITE 4-MRP-8
EXCAVATION UNIT 3

<table>
<thead>
<tr>
<th>Layer</th>
<th>Pollen Concentration</th>
<th>Pollen Preservation</th>
</tr>
</thead>
<tbody>
<tr>
<td>10-15 cm: 153,226 grains/gram sediment</td>
<td>concentration good</td>
<td>preservation adequate</td>
</tr>
<tr>
<td>Pinus (pine)</td>
<td>50.45%</td>
<td></td>
</tr>
<tr>
<td>Pine bladders</td>
<td>24.3%</td>
<td></td>
</tr>
<tr>
<td>Juniper</td>
<td>2.75%</td>
<td></td>
</tr>
<tr>
<td>Quercus (oak)</td>
<td>5.0%</td>
<td></td>
</tr>
<tr>
<td>Malvaceae (mallow family)</td>
<td>0.9%</td>
<td></td>
</tr>
<tr>
<td>Composites, high spine (sunflower family)</td>
<td>6.4%</td>
<td></td>
</tr>
<tr>
<td>Cheno-ams (goosefoot and amaranth families)</td>
<td>1.4%</td>
<td></td>
</tr>
<tr>
<td>Gramineae (grasses)</td>
<td>1.8%</td>
<td></td>
</tr>
<tr>
<td>Ambrosia (ragweed)</td>
<td>0.9%</td>
<td></td>
</tr>
<tr>
<td>Leguminosae (legume family)</td>
<td>1.4%</td>
<td></td>
</tr>
<tr>
<td>Artemesia (sage)</td>
<td>0.46%</td>
<td></td>
</tr>
<tr>
<td>Polygonaceae (buckwheat family)</td>
<td>0.46%</td>
<td></td>
</tr>
<tr>
<td>Ranunculaceae (Rannunculus family)</td>
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<td></td>
</tr>
<tr>
<td>Unknown</td>
<td>0.46%</td>
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<tr>
<td>Unidentifiable due to poor preservation</td>
<td>1.4%</td>
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</tbody>
</table>

<table>
<thead>
<tr>
<th>Layer</th>
<th>Pollen Concentration</th>
<th>Pollen Preservation</th>
</tr>
</thead>
<tbody>
<tr>
<td>40-45 cm: 13,650 grains/gram sediments</td>
<td>concentration poor--too low to count</td>
<td></td>
</tr>
<tr>
<td>Pine bladders</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Composites, high spine</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Gramineae</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Quercus</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Malvaceae</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Cheno-ams</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Ambrosia</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Unknown</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Layer</th>
<th>Pollen Concentration</th>
<th>Pollen Preservation</th>
</tr>
</thead>
<tbody>
<tr>
<td>80-85 cm: 3,069 grains/gram sediment</td>
<td>concentration poor--too low to count</td>
<td></td>
</tr>
<tr>
<td>Pine bladders</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Composites, high spine</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Malvaceae</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Quercus</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Gramineae</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Alnus (alder)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Gilia (gilia)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Unknown</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
allow changes in the environment to be traced. The pollen identified confirms the presence of the vegetation we would expect in the recent past, essentially the same as at present. There is no reason to assume that this pollen results from anything other than the normal rain of wind-carried pollen on a site's surface.

**Prehistoric Material: The Sites**

The assemblage of prehistoric artifacts recovered at the Wawona sites has been described above. Let us now briefly discuss the sites themselves and what we can conclude concerning them.

**4-Mrp-170**

Five 1 x 2-meter units were excavated at this site (Map 3). Each contained at least a few flakes of obsidian. There are occasional flakes on the surface over a large area, about 270 meters x 120 meters. Light use of the entire area, probably for a long time, is indicated. This is probably true for Wawona as a whole, and isolated flakes can be found throughout the Wawona Valley.

The aboriginal occupation centered around sites, usually near water and bedrock outcrops, where use was relatively intensive, and habitations and refuse disposal left a denser litter of discarded tools and organic matter that eventually formed a midden area of artifacts and darkened soil. At 4-Mrp-170 only a small area of midden remains, and EU 5, dug into this midden, was the only unit to encounter substantial amounts of flaking waste. This midden area appears to be confined to an area of about 300 square meters between the river bank and the dirt road at the edge of the golf course. The road and golf course may have removed some of the midden, but auger holes in this area encountered, under golf course turf, the pale brown sandy loam with occasional obsidian flakes that was found in nonmidden areas of all sites tested, and it seemed that disturbance was not deep.

Two 10 x 10-meter surface units were collected across this midden area, but only a few flakes and one projectile point base were found. Table 11 shows the artifact distribution by 5-cm level for EU 5. The midden was not particularly rich in flaking waste. The soil was a very
dark gray, fine, sandy loam, with much organic material in it. This is the characteristic midden soil in this area. There were many cobbles and much organic disturbance in the form of rodent holes and frequent roots. The midden soil extended to a depth of 35-40 cm. There were no clear stratigraphic subdivisions, but the lower half of the midden was mixed with yellower sands from the sterile soil below. Below 40 cm depth there were still some flakes, but the soil was yellowish brown, sandy loam with numerous roots and cobble to boulder-sized rocks. This is probably the natural subsoil of the area, and appears to be glacial material reworked by the river.

The midden at 4-Mrp-170 is shallow, and most of the datable material recovered is late. Five Desert Side-notched points and fragments were found, and only one point (on the surface) of a possibly earlier type (Fig. 4u). A steatite disc bead should also be late, and a mano is indeterminate. There were no indications of structures or features.

In addition to the usual excavation procedures, samples were taken for pollen and flotation analysis, and a bucket of soil from each 5 cm level was washed through 1/16-inch mesh in the nearby river. The water-screened material was not very informative and has not been analyzed in detail. A number of tiny obsidian flakes, down to about 1 mm in maximum dimension, was recovered. These confirm that obsidian was actually worked at this site and not just brought in as tools and large flakes, but the small flakes recovered by the 1/8-inch mesh indicate this as well. A few carbonized manzanita seeds recovered by water-screening did show that there was some promise in flotation. The carbonized material from the flotation samples has been discussed above.

The site at 4-Mrp-170 lacks bedrock mortars and in Bennyhoff's (1956) terms would be a "campsite." It is in a favorable location near water and other resources such as oak and manzanita. It could have been a camp for the gathering of such foods and hunting. There may have been years when the only use Wawona received was short visits to exploit its resources, or to camp and work obsidian along the route to and from the sources. If there were more permanent occupations in the Wawona Valley the Miwok may have split up into small groups, with some of those in outlying camps using the bedrock mortars and other facilities of the larger sites. The accumulation of a midden indicates some length and intensity of occupation.
YOSE 80A-1

This site does not appear to have been intensively occupied. Seven excavation units and a series of auger holes (Map 4) all encountered a uniform, pale brown, sandy loam typical of the forest soil in Wawona. A few flakes were found in every unit, but no concentration and no sign of an organically stained midden deposit. The six steatite disc beads in EU 1 could indicate some special use of the site, perhaps a cremation, but more likely are no more than a broken necklace. On the slope above the flat, there is a bedrock outcrop with five mortar holes and a pestle, but the deepest of these holes was 3 cm, and two were barely visible. This site seems to have seen only light and sporadic use late in the prehistoric sequence.

YOSE 80A-2

This site was not in a favorable location for prehistoric occupation, being far from the river and without bedrock outcrops (Maps 2, 5). It would have been densely forested before clearing. Only two artifacts were observed, an obsidian flake and an obsidian scraper. The scraper was in the area of litter tested by EU 2, and being large and well made, might have been collected by a tourist at the Sierra Lodge.

4-Mrp-343

This large and important site is on a terrace on the wooded slope well above the river (Maps 2, 6). Napton (Napton et al. 1974) estimated more than 27 mortar holes here in three groups. In our more intensive coverage, we located six groups of mortars, with a total of at least 91 holes. When cleared, the large outcrop at BRM 1 revealed 56 mortar holes. There was one at BRM 2, 21 at BRM 3, one at BRM 4, 10 at BRM 5, and two at BRM 6. As the count now stands, 4-Mrp-343 has more bedrock mortars than have been counted for any other site in Wawona. In Bennyhoff's terms (1956), any site with more than 20 mortar holes is a "large village." We can certainly take the large number of mortars and the extensive, well-developed midden at 4-Mrp-343 as indications that this site was occupied for some time by a relatively large number of people. However, we cannot accurately estimate the number of people or the length of their stay, and there is some difficulty even in comparing
different sites. Bedrock mortar counts are somewhat subjective; note the difference between the numbers given by Napton, Bennyhoff, and myself here and at 4-Mrp-8. This is partly influenced by the type of work done on a site. Surveys will seldom locate all the mortar holes on a site covered with pine needle litter. Clearing BRM 1 more than doubled previous estimates of the number of mortars, and as this was the only BRM group that was thoroughly cleared, there are probably yet more mortars at 4-Mrp-343. The point of this discussion is that while 343 is a relatively large site for Wawona by any measure, a number of other sites, reported only by surveys and appearing somewhat smaller, may in fact prove to be equally large and interesting upon closer investigation.

Table 28 details the artifact inventory for the surface collections from 4-Mrp-343. In conjunction with the site map (Map 6), it gives some idea of the variation in artifact density over the site.

<table>
<thead>
<tr>
<th>UNIT NO.</th>
<th>POINTS AND BIFACES</th>
<th>SCRAPERS</th>
<th>FLAKES</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Small DSN, uf</td>
<td>ef, uf, uf</td>
<td>&lt; 2 cm 4</td>
</tr>
<tr>
<td>1</td>
<td>1</td>
<td>24</td>
<td></td>
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<tr>
<td>2</td>
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<td>4</td>
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<tr>
<td>4</td>
<td>1</td>
<td>14</td>
<td></td>
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<tr>
<td>5</td>
<td>7</td>
<td>17</td>
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<tr>
<td>6</td>
<td>9</td>
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<td>17</td>
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<tr>
<td>10</td>
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<tr>
<td>11</td>
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<td></td>
</tr>
<tr>
<td>12</td>
<td>112</td>
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<td></td>
</tr>
<tr>
<td>Totals</td>
<td>3</td>
<td>3</td>
<td>8</td>
</tr>
</tbody>
</table>

Total Tools 37  Tools/Flakes = .071  Scrapers/Tools = 83.8 %

KEY: DSN = Desert Side-notched; ef = Edge fragment;  uf = Unidentifiable bifacially worked fragment
Map 8 shows SU 1 and EU's 2-14 on BRM 1 and in the surrounding midden. The surface artifacts were plotted, but no significant patterns were revealed except a cluster of 40 large flakes. These were of different obsidians and did not represent a flaking work area. The cluster may result from Miwok activity, but is more likely the work of a recent artifact hunter.

Tables 12, 13, 15, 16, and 17 show artifacts by level for most of the excavation units from 4-Mrp-343. EU 3-13 were actually 1 x 2-meter units on top of BRM 1, where the cover of leaf litter, silt, and moss up to several centimeters thick was removed and screened. There were a few flakes in each unit and a Cottonwood Triangular point in one. It is not possible to say whether this material represents debris scattered over the surface of the mortar rock during the site's occupation, or material that washed onto the rock from the midden upslope during the accumulation of a couple of centimeters of dark silt and a thick pad of moss. The deep cover over the bedrock mortars indicates that the site has been abandoned for some time. We already know that it should have been abandoned shortly after 1851 if not before, but the condition of BRM 1 also implies that the site is not much visited by tourists. Napton (1974) states that "the site is within an area reputed to be a former arboretum." There is no sign of such use on the site, and it may be that because of its isolated location, 4-Mrp-343 has been the least disturbed of the Wawona sites.

Two units were excavated in the large midden area associated with BRM 1. This was the largest extent of midden and the densest surface scatter of artifacts. EU 2 was dug on the edge of a depressed area, a possible house pit. No evidence of any structure was found, and the depression appeared to be natural. The stratigraphy was much like that of 4-Mrp-170, with 15 to 20 cm of dark midden soil, a mixed zone about 15 cm deep, and the yellowish, sandy subsoil. Site 4-Mrp-343 lacked the cobbles found at 170, but contained numerous roots and animal burrows. EU 2 was excavated to a total depth of 80 cm, at which point the yellow subsoil had mostly given way to weathering granite bedrock.

Although no structure was encountered in this unit, there was a feature of sorts. Feature 1 was in the southeast corner of EU 2 at a depth of 45-49 cm below the surface. It consisted of a cluster of 32
Map 8. 4-Mrp-343, Surface Unit 1 and BRM 1, with Excavations Units 2-15.
pieces of granite and cobbles, some apparently fire-cracked. There were
two fragments of granite cobbles that showed use as manos. The feature
is probably a dump of broken cooking rocks. The arrangement suggested
rocks dropped into a pit, but there was no pit visible in the soil.
There were no other artifacts in association other than flakes in the
same level. All the units in midden areas have some flakes below the
zone of darkened midden soil. Much of this is probably the result of
bioturbation, disturbance by roots and animal digging, but some may
represent early occupation which did not result in organically stained
soil. Feature 1 then is of undetermined age, a dump of rocks either in
a pit or on an old occupation surface.

EU 14 was 1 meter x 2.5 meters. The extra length extended the unit
up onto the bedrock of BRM 1 in order to examine the relationship of
midden to BRM 1. The stratigraphy was similar to that of EU 2, but
shallower; the midden and mixed material was only 20 cm deep, and the
unit was ended at 35 cm depth when it was mostly bedrock. The midden
did lap over the edge of the bedrock of BRM 1, but was not observed to
cover any mortars in EU 14. Samples were taken from each 5-centimeter
level of EU 14 for flotation and pollen analysis and for wet-screening.

The material recovered from these two midden units and from SU 1
was quite consistent. A large number of small, late points was found,
mostly broken. The glass bead from the 20-24-cm level of EU 2, already
described, also indicates a late occupation, possibly up to the Anglo
entrance into Wawona. The possibility that this is a site described by
Bunnell (1892) has been discussed in the history section.

The base of a large point, possibly of Pinto type, from EU 2 may be
an early artifact. The use of mano and metate is considered to be most-
ly an early trait in this area, and the manos and point from EU 2 may
indicate an occupation earlier than the Mariposa Complex.

Two more early type points, an Elko Corner-notched and a Concave-
based type were recovered from EU 16. There was no typologically late
material in this unit. This unit, and EU 18 nearby, were in areas with
some surface material, but no evidence of midden development. Surpris-
ingly, both units had a fairly high density of artifacts, to considera-
ble depth, although the soil throughout was a yellowish brown loam with
no traces of midden stain. EU 16 was dug to a depth of 85 cm, at which
point bedrock was beginning to dominate. Bedrock was encountered, and artifacts diminished after about 60-cm depth. Due to time limitations, EU 18 was abandoned at a depth of 50 cm, while still producing considerable obsidian debitage. These units, lacking midden soil and with early points, may represent an area of occupation earlier than that near BRM 1, but as discussed above, the nature of the obsidian debitage is the same throughout the site.

EU 1 and EU 17 were dug in areas of dark soil with visible obsidian, but proved quite shallow with very few flakes. EU 15 was downslope from the steep edge of BRM 1, a likely area for prehistoric refuse disposal. It too was shallow and had only a few more flakes than EU's 1 and 17. Although no midden was found in this likely area, it could be that erosion on the steep slope has removed soil and artifacts. A few rough granite pestles were observed on the slope, and just under the edge of BRM 1 there were several cobbles and rough pestles. Site 4-Mrp-343 had more ground stone in the form of pestles and manos than any other site in this project. This is not surprising in view of the importance of milling activities shown by the bedrock mortars.

Site 4-Mrp-343 gives evidence of a long and intensive occupation by Mariposa Complex people, and it is probable that even before these ancestors of the Miwok arrived and began to wear mortar holes and accumulate a midden, earlier groups used the site and left their waste flakes and broken projectile points.

4-Mrp-8

This is probably the most important site in Wawona. It is centrally located, close to a number of other sites, and at a point where river, meadow, and forested slope combine to provide a variety of resources (Map 2). Site 4-Mrp-8 occupies a relatively large area and has, as far as we know, the deepest midden deposit in Wawona. There is a large outcrop of broken bedrock with mortar holes. Fifty-one mortar holes were recorded by this project, in accordance with Bennyhoff's (1952) count of 53. Napton et al. (1974) overestimate and give 75, perhaps because of the confused and broken outcrop.

The site was mapped and sampled as an area about 100 meters x 100 meters (Map 7). Actually, there are some outlying areas that should be
Flakes were observed across the road to the north and into the meadowy area to the east, and the "Pioneer Village" and its trails and fences to the west may have obscured some of the site. These areas were not included in the sample because the information gained would not have been worth the time spent.

Table 29 shows the artifacts found in the surface sample. Some patterns are apparent. Two main midden areas are evident on the surface from dark soil and artifacts. One is along the south edge of the site toward the river bank (SU 12, 15, 16, and 17). There is another around the southern edge of the bedrock mortar group (SU 6 and 9). SU 1 and SU 8 are relatively concentrated but show no midden soil. SU 4 and SU 5 are in a moist area with dense meadow grass; SU 7 is nearby but drier.
Ground cover density was estimated, and the dense grass in some units may have affected collection somewhat, but it was found that large amounts of material were collected from several units with cover as dense as units having few artifacts.

Site 4-Mrp-8 is the most heavily trafficked of the Wawona sites. The historic glass showed evidence of trampling, and Al Gordon remembered shooting obsidian flakes from a slingshot as a boy on this site. It was expected that recent use would have affected the surface artifacts, especially by removing conspicuous tools such as arrowheads. The ratio of tools to flakes from the surface was .022, which is between the ratio computed for tools to flakes greater than 1 cm (.056) and tools to all flakes (.015) in EU 3 (Table 19). This makes sense if one remembers that a surface collection will probably recover a lower proportion of the small flakes than will screening excavated soil. Of the surface tools, 69.6 percent were scrapers, while 79.6 percent of the excavated tools were scrapers. There is, thus, no evidence that the relatively conspicuous tools, such as projectile points, were being selectively removed from the assemblage. Despite this lack of evidence for artifact collecting, it is probable that there has been some damage to the site from the activities of children, tourists, and casual artifact collectors.

Only three 1 x 2-meter units were excavated in 4-Mrp-8. EU 1 reopened a sewage line trench which had previously disturbed the southern midden area. EU 2 extended from the sewer line trench into undisturbed midden. The historic hearth in this unit has already been described. The midden had a depth of 35-40 cm in this unit. Two Desert Side-notched points were recovered in the midden, and a third was found out of context when the edge of the unit collapsed. A steatite bead was found in the midden and another in the presumably disturbed context of the hearth. All datable artifacts indicate a late deposition date for this midden area.

The midden near the bedrock mortars was disturbed by rodent holes, which brought up dark soil and obsidian. This gave promise of a deep deposit, and EU 3 revealed the deepest midden encountered during this project. There was no visible stratification of the midden deposit; homogeneous, dark, fine, sandy loam extended to a depth of 90 cm. After
this, the dark midden became mixed with clean, yellow sand and gravel with cobbles, apparently river-laid, which was excavated to a final depth of 105 cm. The artifacts from this unit have already been discussed (Table 14). There were no typologically datable pieces; all the points and bifaces recovered were fragmentary. There is some bias toward fragments of small bifaces in the upper levels and pieces of larger tools at greater depth.

Site 4-Mrp-8 is a large site with some time depth. The depth of midden argues a lengthy and/or very intense occupation. There was one early type point from the surface, and fragments of others in the midden which could also be early. Most of the material recovered should relate to a late occupation by people of the Mariposa Complex and the Miwok. The pierced dime probably indicates Miwok use after 1873, and some of the other material may also have been left by the few Miwok who remained in the valley after the hotel was established.

4-Mrp-330

This is a small patch of midden capping the remnant of an area mostly removed as road fill. There is a bedrock mortar in the river. It was recorded by Napton et al. (1974), at which time dark soil and obsidian flakes were observed. Our excavation unit recovered only four obsidian flakes, a horseshoe, and a few pieces of glass. The dark soil was less than 20 cm deep, after which the sterile gravel and sand of the river deposit was encountered. It is not possible to estimate how much of this site has been destroyed, but judging by the poverty of the midden and the single mortar, it was probably never very big.

4-Mrp-169

This site is near 4-Mrp-343 on the bank of the river (Map 2). Bennyhoff (1952) recorded a mortar rock with six holes, and obsidian chips on the ground surface upslope. Napton et al. (1974) did not find any obsidian, but nonetheless gives the site area as 91 meters x 122 meters. "This site is a bedrock mortar and associated midden. It is well preserved and merits continued preservation" (Napton et al. 1974: 50). No evidence for a midden is described, and none was seen in 1980. Indeed, the area around the mortar rock is clean river deposit, and the
slopes have deep leaf litter.

**Prehistoric Material: Conclusions**

Having described the evidence and interpreted some of it, a few conclusions and further interpretations can be set forth.

The Wawona material is a small sample, and, unfortunately, there is little that can help with problems of regional chronology. I have used Bennyhoff's (1956) three-complex system throughout. There is not enough information to revise his estimated dates, and they are an acceptable interpretation in the light of evidence from other regions. For reasons discussed earlier, I feel that Fitzwater (1962, 1968) was premature in dismissing Bennyhoff's Tamarack Complex.

Some time depth is represented at Wawona by relatively deep middens and a few points of early types, especially at sites 4-Mrp-8 and 4-Mrp-343. These indicate some occupation of Wawona during the Crane Flat Complex. There are no points characteristic of the Tamarack Complex, but there are no visible stratigraphic gaps either. The absence of Tamarack Complex material may indicate a period when the valley was not occupied, or it may only be a result of the small sample.

Most of the datable artifacts are small, late points and steatite beads and vessels, characteristic of the Mariposa Complex beginning sometime after AD 1200. All of the sites with datable material have some Mariposa Complex occupation, and probably most of the small sites in Wawona are exclusively Mariposa Complex.

The evidence from Wawona thus indicates an initial settlement during the Crane Flat Complex. Moratto (1972) dates similar early material and the initial occupation of the Buchanan Reservoir area at some time after 300 BC. He attributes this initial occupation to the spread of Middle Horizon groups from the west, made possible by an acorn-based economy (Moratto 1972) and possibly an amelioration of the climate (Moratto 1980).

After 600 BC, Moratto (1980) sees a deterioration of the climate, which led to competition and conflict among the foothill groups, with a dispersal of population and periodic abandonment of some sites. He suggests that conditions may have been better at higher altitudes. This
would correspond with the Tamarack Complex, marked by smaller projectile points probably indicating the introduction of the bow and arrow. There is no evidence from Wawona which can be reliably assigned to the Tamarack Complex.

Moratto (1980) suggests that the early Sierran groups were Yokuts related, and that some time after AD 1200, the ancestral Miwok speakers spread southward toward the Yosemite region. This move was made possible by a new improvement of the climate and intensified acorn exploitation. It should be noted, however, that Moratto's (1972) burial data from the Buchanan area do not provide any evidence of the replacement of an early population by a physically different group.

In any case, it is fairly certain that the protohistoric Mariposa Complex represents the ancestors of the ethnographic Miwok. The higher altitude sites in Yosemite could also have been used by the Paiute, and it would be difficult to separate Paiute and Miwok on the basis of artifacts in the Sierra.

The Mariposa Complex and related late assemblages are fairly well known and comparable to the ethnographic record for the Miwok. Thus, we can reconstruct, in some detail, the Mariposa Complex way of life in Wawona.

The Wawona Valley contains many small sites and a few larger sites, such as 4-Mrp-8, which is favorably located and in the center of the valley's complex of sites. This is similar, on a smaller scale, to the settlement pattern of late sites in the Buchanan Reservoir area. Moratto (1972) suggests that his Buchanan sites reflect the development of the Miwok settlement pattern of large, chiefly villages on main watercourses, with subsidiary villages surrounding them and on the tributary watercourses. Wawona is too high in the mountains to have seen much year-round occupation, and the sites seem too small in comparison to sites from lower altitudes. It is not too speculative to suggest that the sites at Wawona were the summer camps of a tribelet which moved from the foothills of the Merced drainage up to Wawona for the summer, maintaining the pattern of dependent settlements around a chiefly center. Alternatively, Wawona may have seen a more permanent occupation by a very small population.

The activities pursued during a summer occupation at Wawona would
have included some collecting and processing of acorns and other plant foods, amply evidenced by the numerous bedrock mortars. The Miwok informants of Barrett and Gifford (1933) preferred acorns of the black oak, which is a Transition Life Zone species, over those of other species.

The numerous projectile points, many broken, are evidence of hunting. The most important food animal, the deer, moved up the mountains in the summer, followed by its human predators.

The activity which left the most abundant evidence on Wawona sites was the procurement and working of obsidian, mostly in the form of bifaces. The inhabitants of Wawona climbed the mountains to trade with their eastern neighbors, the Mono Lake Paiute, and to obtain obsidian for their tools. By the time it reached Wawona, the obsidian had been knapped into the form of large bifaces, and it was further reduced in the Wawona camps. Other goods doubtless changed hands in this trade, but only the obsidian remains in the Wawona sites. The similarity of the obsidian debris throughout the archeological record in Wawona suggests that this system was a longstanding one. The obsidian trade would also have taken place in the summer when the mountain passes were open. Wawaona was one point in a network of trade routes which spread this useful material from the Great Basin to the Central Valley, and played an important part in the movement of ideas as well as artifacts.

Research Directions

Not all of the above reconstruction is based on firm evidence, but future work at Wawona sites could support or deny it.

The basic chronology needs considerable refinement. Unfortunately, no material suitable for C14 dating was recovered from good cultural context in this testing project. Further excavation may recover charcoal from a hearth or other context associated with diagnostic tool types. This would be especially interesting for early material, and the Tamarack Complex, in particular, needs better definition. The obsidian hydration and sourcing studies now underway should help us estimate the age of occupation at 4-Mrp-343 and 4-Mrp-8. These sites are most likely to be productive of early material.
The settlement pattern should be further investigated. Most of the
sites in Wawona have probably been located, and the general pattern of
dispersal is evident. My impression was that the material from these
sites was fairly homogeneous both within and between sites. However,
this should be further tested, as only four sites out of more than 30
have been minimally sampled by excavation. It would be interesting if
we could discern differences in activities between sites. Structures are
not likely to be found. Dwellings were probably simple cones of bark,
without well-defined floors or a house pit or even posts. However,
features such as storage hearths, pits, and earth-ovens might be
expected.

If there were differences in the activities going on at these
sites, the obsidian tools would be the most likely artifacts to examine
for evidence. It is possible that different kinds of reduction were
done at different sites. Microscopic studies of the use wear on tool
ges may eventually tell us more about the use of such nondescript tool
types as the flake scrapers so common in these sites.

It is unfortunate that the preservation of bone is so poor in
Sierran sites. Much information about past activities and subsistence
is thus lost to us. The analysis of carbonized vegetal remains recov­
ered by flotation can be a valuable source of subsistence information.
To be really meaningful, however, these must be recovered from good
cultural contexts, such as hearths and floors, where it can be reasona­
bly supposed that they result from the activities of man and not the
accidents of wind and fire. The seasonal occupation hypothesized above
makes sense in view of the climate and the activities which are evi­
denced in the Wawona sites. Organic remains from good contexts are also
sensitive indicators of seasonality and could help to determine whether
Wawona was occupied year-round or only in the summer.

Methodological Conclusions

In any field situation, some things work and some don't. The
methods used to recover data affect the conclusions possible.

This project depended on intensive analysis of a small sample of
material. The data necessary for management decisions were provided,
and some new data and interpretations of local prehistory developed. The homogeneity of the material from level to level and site to site indicates that for most conclusions the sample is representative enough. My impression from this project and the published work of others is that these small midden sites are, indeed, quite homogeneous and can generally be described from a small sample. However, this should not be taken to apply where two or more components of different ages are involved and deserves testing on other sites as well. It would be useful to strip an entire small midden site, exposing large horizontal areas in small well-controlled levels. This might give us a better idea of variability or lack of it in these sites, possibly expose features or artifact patterning not visible in small units, and answer questions about the formation of small middens.

Information collected from the surface is difficult to evaluate. Probably most of the sites in Wawona have been located, but as the bedrock mortar counts show, it is not always easy to find things under forest leaf litter, even artifacts as large as bedrock mortars. The random surface samples from 4-Mrp-8 and 4-Mrp-343 are consistent with subsurface data and are probably representative of the kind of artifacts present on these sites. Scarce items, such as early projectile points, may be under-represented in surface samples, but the range of obsidian flake and tool types is pretty evident from the surface. However, I do not feel that my surface collections were very useful in defining the extent and boundaries of the sites. The boundaries of sites in the Wawona area exist only by arbitrary definition. The whole valley was used, and some concentrated areas such as middens indicate localized areas of intensive use—"sites" where there is enough archeological evidence to warrant excavation or preservation. An intensive but non-statistical examination of the surface is a more efficient way of defining these areas than transect samples or random sampling of large areas.

A prerequisite to the intensive analysis of small samples of material is intensive recovery and use of available data. The use of 1/8-inch screens significantly increased the recovery of small artifacts, including some diagnostic beads and projectile point fragments, and would have been useful if small faunal remains had been preserved. The nature of the obsidian industry was pretty well visible from the larger
flakes, but the numerous small flakes confirm onsite flaking activities, and support the indications of the larger material. Water-screening through 1/16-inch mesh did not return enough information to be worth the labor in this case.

No matter what one recovers, it is of no use unless it is analyzed and reported. I deplore the lack of comparable information on flaking waste in California sites. Of course, my feelings derive from the kind of problems of interest to me, and the kinds of material available in the Wawona sites. No report is really complete, and others may criticize me for neglecting material they would like to know about.
A major goal of this project was the testing and evaluation of alternative locations for sewage treatment facility construction. The operations and findings on each site have been discussed in previous sections. What follows is an evaluation of the significance and further archeological potential of the sites and recommendations for management.

This site has two archeologically interesting areas, a small patch of prehistoric midden and the foundations of a former slaughterhouse, with its associated bone dump. A single 1 x 2-meter excavation unit in the midden showed it to be about 40 cm deep, with a moderate concentration of artifacts. The artifacts were mostly obsidian flakes and tools, and almost all datable artifacts indicate a late occupation during the Mariposa Complex. The site appears to be typical of the aboriginal occupation in Wawona and should be preserved or further excavated. A series of auger holes showed that the midden is limited in area, and it should be possible to avoid further damage to this small area by confining any pipeline trenches or access roads to the edge of the golf course or the existing dirt road, which borders the midden and has already disturbed its southern edge.

The slaughterhouse area, near the standing 1929 slaughterhouse and the existing sewage facility west of the golf course, was tested by a single excavation unit near the old foundation. This revealed a dense deposit of poorly preserved but identifiable bone from the slaughterhouse operations, probably around the turn of the century. If this area is to be disturbed, excavation of the foundations and a further sample of the bone dump is recommended. This material is evidence of the economic history of Yosemite and could provide information on herding in the park, the Wawona Hotel, and the development of the Sierra Nevada tourist industry.

The rest of the site area between the midden and slaughterhouse contains a small amount of prehistoric and historic material. The con-
centrations are low, the material is probably disturbed, and it is felt that an adequate sample has been taken. Monitoring of all construction is recommended because of the possibility of locating archeological material not visible from the surface, especially where the golf course fill and turf cover natural soil.

YOSE 80A-1

This is the second of the potential development areas. A previously unrecorded site was discovered here, consisting of a bedrock outcrop with five mortar holes, and a very light scatter of prehistoric material. The only datable artifacts were late type steatite beads. Because artifacts were so scarce, further excavation here would not sufficiently increase our knowledge of local prehistory to justify the work. The seven test pits and series of auger holes already dug by this project are considered sufficient mitigation of any construction impact, although monitoring is recommended.

YOSE 80A-2

This third potential sewage plant location is apparently on the site of the Sierra Lodge built in the 1920's. However, when the park removed the buildings in the 1940's, they did a thorough job. A few scatters of 20th-century trash were located, some of which seem to be debris from the destruction of buildings, but there are no foundations or other structural remains in situ. Two test units were excavated, one sterile and one in a trash deposit. The site is not in a favorable location for prehistoric occupation, and only two pieces of obsidian were observed. The historic Washburn ditch runs south of the area in the forest and should not be disturbed. The forested area was not considered part of the project area, and if construction is to extend into it, it should be checked. Otherwise, there does not seem to be any material of interest remaining on this site, and no further archeological work is recommended other than monitoring.
4-Mrp-343

This site is near the present sewage spray field and was tested against the possibility of spray field expansion. It is a large site for Wawona, with numerous bedrock mortars, definite midden areas, and some early material. This is a large and important site, with great potential for future research. An excavation sufficient to do this site justice would be relatively costly. It is strongly recommended that the spray field be expanded elsewhere, and this site protected from further disturbance.

4-Mrp-169 and 4-Mrp-330

These two sites are not immediately threatened by construction. There is only a bedrock mortar at 4-Mrp-169, and 4-Mrp-330 consists of a bedrock mortar and small, shallow midden remnant. No action is recommended.

4-Mrp-8

This is probably the most important site in Wawona. It is not immediately threatened by construction but is in the central developed area of Wawona and is heavily trafficked. The surface material has now been sampled, which will help to protect the information potential of this site from the impact of casual collection. Its central public location may actually help to protect it from looters digging holes, and vigilance by the park is recommended. This site holds the greatest potential in Wawona for research on early occupations, aboriginal adaptations to the Transition Life Zone, the nature of and reasons for occupation of Wawona, and the post-1850 Miwok survivors. It is recommended that 4-Mrp-8 be left as undisturbed as possible and protected from further damage by new trails, sewage lines, etc.

The above report summarizes the predictable ways in which the sites investigated by this project can yield information of interest in history or prehistory, the basis for the nomination of the Wawona District
to the National Register of Historic Places (determined eligible 1978). This investigation clearly indicates that pollen and bone preservation is poor and that information from these sources will not be available. Therefore, the potential for research on the natural resources used by the groups at Wawona and their seasonal round is diminished considerably. However, the lithic analysis presented here validates the opinion advanced in the statement of significance (Hammack and Anderson 1978) that lithic analysis "should give indications of types of activities carried out at the locality." Many other types of research, e.g., settlement pattern analysis, are also possible. While the full range of archeological material is not present, much information remains to be extracted from the Wawona sites. The archeological district is clearly significant at the regional level.
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