# ARCHEOLOGY OF THE JONSON SITE (CA-Sac-65), SACRAMENTO COUNTY, CALIFORNIA

Peter D. Schulz,
David M. Abels
and
Eric W. Ritter



Prepared by

The Archeological And Historical Services Unit,
State Department of Parks and Recreation

for

The State Department of Water Resources

under

Interagency Agreement No. B-50173

June 13, 1977

# ARCHEOLOGY OF THE JONSON SITE (CA-Sac-65), SACRAMENTO COUNTY, CALIFORNIA

Peter D. Schulz
David M. Abels
and
Eric W. Ritter

## INTRODUCTION

Scientific archeology is more than half a century old in the lower Sacramento-San Joaquin Valley, and a large number of sites have been excavated. Except for a compendium of brief site summaries published more than three decades ago (Lillard, Heizer, and Fenenga 1939), however, relatively little of the recovered information has found its way into print. In addition, most of the sites which have been excavated – and virtually all of those on which reports have been published – are major villages situated along the rivers which transect the area. Consequently sites of other types should retain considerable information on local patterns of adaptation. This paper reports the excavation of one such site, and relates the recovered material to the settlement pattern of the lower Sacramento Valley.

The Jonson site (CA-Sac-65) is located within former Plains Miwok territory in southwestern Sacramento County, 3 km south of Hood. It lies about 2.5 km east of the Sacramento River, on the former shoreline of South Stone Lake, at an elevation of 3 m above sea level. Excavation took place in April and May, 1974 and revealed evidence of a limited inventory of subsistance and ritual activities.

## ENVIRONMENT

The lower Sacramento Valley is characterized by a Mediterranean climate with hot, dry, rainless summers and cool, rainy winters. These climatic conditions have not changed perceptibly since prehistoric times. The biotic components of the environment, however, have been altered dramatically in the last 125 years.

### Native Conditions

The Jonson site is located in an area of low-lying alluvial lands. Such lands were originally protected by natural levees of the Sacramento River, which were effective in preventing flooding for much of the year, but were often breached or topped by winter floods. The site itself is situated upon a natural knoll and immune to all but the highest flood waters.

The local native vegetation can be segregated into three major communities: freshwater marsh, riparian forest, and valley grassland (Fig. 2). These are associated with different soils and topographic conditions, and support somewhat different faunas.

Freshwater marsh (the tulares) is associated in this area with low-lying and poorly-drained soils, mostly of the Sacramento series (Holmes et al 1915; Cosby 1941). These lands are readily inundated and are intersected by sloughs and lakes. The vegetation is dominated by reedy emergent species, particularly tules, which in permanently submerged or saturated areas exist in almost pure stands that once extended for miles in all directions (Fig. 4a). More deeply submerged areas supported floating aquatics or consisted of open water, while higher lands supported swards of reedy or herbaceous species which trended into grasslands (MacDonald et al 1974).

The marsh community provided a number of resources utilized by the native population. The most important of these were probably the fish which abounded in the lakes and sloughs (Schulz and Simons 1973) and the seeds, shoots and bulbs of the dominant plants. Turtles and shellfish were also collected; and beaver, waterfowl and marsh birds were trapped and hunted. Elk, the largest game animals, were taken here in drives and by single hunters.

Upon the higher natural levees - comprised of Columbia series soils (Holmes et al 1915) - and separating the marshlands from the major river channels, were dense stands of riparian forest (Fig. 4b). This community was dominated by oaks, cottonwoods, willows, ash and a number of other trees, with a thick understory of vines and shrubs (Thompson 1961). This was the most productive of native biotic communities, but the extent of its utilization by the Miwok is unknown. Oaks were common and acorn production exceptionally high, and - at least in higher areas with little undergrowth - acorns could be readily gathered (MacDonald, personal communication). Berries of various kinds were abundant, but they were only seasonally available and not storable. Game was confined largely to deer, cottontails, and occasional elk. More important than the resources of the forest (excepting acorns) were those of the river itself, and abundant ethnographic reports testify to the importance of salmon and other anadromous fishes in the native diet.

The valley grassland community existed on higher lands, composed predominantly of Glann and San Joaquin loams, situated away from the rivers and back of the marshlands (Holmes et al 1915; Weir 1950). The grasslands were originally dominated by various perennial bunchgrasses and annuals, sometimes interspersed with scattered oaks (Berry 1972). This community was important as a source of grass seeds and game (antelope, jackrabbits, quail). Elk were abundant, but more difficult to take on the open plains than among the tules. Acorns were less abundant than in more heavily wooded communities.

Native exploitation of these zones is assumed to have entailed seasonal dispersal from a major winter village to smaller camps to harvest the various resources.

Less than 1 km west of the Jonson site is the Hollister mound (Sac-21) (Fig. 5a). Its size, wealth of faunal material, number of interments, diverse assemblage, and well-developed midden soil indicate that it

served as a major village (tribelet center) for the western South Stone Lake locality in late prehistoric times (Lillard, Heizer and Fenenga 1939:57-59; Schulz, unpublished data). The Jonson site was presumably a satellite of Sac-21, but neither the seasonal chronology nor the economics of such a relationship has been clarified.

Historic Conditions

Europeans first entered the area early in the nineteenth century, but intrusions were strongly resisted by the local Miwok until the early 1830s, when their population was devastated by malaria. Permanent European settlements soon followed, and many of the Plains Miwok were removed to Mission San Jose or New Helvetia. The remaining villages were finally destroyed during the gold rush of 1849 (Bennyhoff 1977).

Early Euroamerican use of the region extended principally to cattle ranching and harvesting firewood in the riparian forests. Farming began within a few years along the river, but reclamation of the Stone Lake Basin did not occur until 1906. In that year a railroad levee was built across the center of the lake. The west half was drained and, except for occasional winter flooding, has remained dry since.

Draining the lake and the surrounding marshlands opened the way for intensive agriculture. Cultivation has involved considerable leveling over the years, but the site knoll has remained relatively intact. During floods it served as a refuge for animals, and early residents regularly hunted stranded rabbits there in winter.

For almost half of this century a house and outbuildings occupied the site and an adjacent knoll to the south. This complex served chiefly as a farm labor camp. During the 1940s the buildings were razed and the mound dragged. From 1 to 2 feet of deposit is estimated to have been removed during these operations (E. Jonson, personal communication).

## EXCAVATION PROCEDURES

The extent of the site was difficult to determine since on- and off-site surface soils were not visibly different, but site area is estimated at 1650 $m^2$, based primarily on artifact scatter. This area was first mapped and gridded into potential 150 by 150 cm units. Fifteen units were randomly selected for initial testing. An additional 24 units were arbitrarily selected to further expose features encountered in the random units, as well as to test areas not otherwise sampled; two shallow trenches were excavated with a backhoe for the same purpose (Fig. 3, 4c). Vertical control was maintained by arbitrary 10-cm levels, except where stratigraphy was well defined. Maximum depth of the site was 80 cm, although most units did not exceed 30 cm in depth. Total excavated volume was 32.6 $m^3$, an estimated 5% of the deposit.

All excavated material was passed through 1/8-inch mesh screen. All bone, shell, and cultural material was saved. Samples were also collected on and off the site for soil analysis.

## SOILS AND STRATIGRAPHY

Soils of the site and the underlying knoll were examined in the field and samples were collected for chemical and physical tests in the laboratory. Determinations were made for color, pH, carbon, phorphorus, nitrogen, lime, gravels and texture.

### Stratigraphy

Stratigraphy at the Jonson site closely parallels that at other sites in the region (Ritter 1972; Schulz and Ritter 1976). Two major soil horizons are evident, each in turn further subdivided (terminology follows U.S. Dept. Agriculture 1951). The A1p and A2 horizons contain cultural material; the B1 and B2t horizons are culturally sterile (Fig. 6).

The surface or A1p horizon is shallow (ca 20 cm) over much of the site except where prehistoric subsurface excavations occurred. It is massive-structureless, friable when moist and loose to slightly hard when dry. Bioturbation and agricultural disturbance have caused some mottling with underlying horizons. A clear wavy to diffuse broken boundary separates the A1p from the underlying B1 horizon in shallower areas of the site.

In the deeper areas of the site the A1p horizon is similar to that described above. It is separated with a wavy clear boundary at about 20 cm from the underlying slightly hard, massive A2 horizon which in turn is separated at about 30-40 cm by a wavy clear to gradual boundary from the AB or transitional horizon, also massive and slightly hard in dry consistency. All three of these horizons contain cultural materials apparently mixed at least in part by bioturbation.

An irregular, diffuse boundary separates the AB from the B (B1 or B2t) horizon. These underlying B horizons are slightly plastic when wet and hard when dry. Structure is weak coarse angular blocky. The only cultural materials present are those introduced by burrowing animals or in cultural pits.

The stratigraphy is more complex and far less distinct where burials were interred. Here the profile is complicated by burial-associated burning and increased mixing.

### pH

Vertical pH determinations within the cultural deposit range from a high of 7.6 (mildly alkaline) to a low of 6.0 (medium acid). Generally, pH increases with depth within the midden and into the sterile subsurface. The readings within the midden are higher than those of the surrounding surface soils (Table 1).

Higher subsurface readings throughout the mound reflect downward leaching of metallic elements. Burning and refuse disposal on the site have provided increased calcareous materials within the deposit, thus raising the pH.

Readings within the midden do not vary enough to indicate that more than a single component is present. Bioturbation, however, may have obscured such evidence.

Carbon (C) and Nitrogen (N)

In archeological midden deposits there is a relatively rapid loss of nitrogen by leaching and of carbon through oxidation, with a rapid turnover of organic matter (cf. Cook and Heizer 1965:18). In general those sites with either greater antiquity or less human activity over time would be expected to have lower amounts of C and N than recent or intensely occupied sites (cf. Setzer 1947). Furthermore, surface organic matter accumulation and simultaneous removal through leaching will ordinarily establish relatively steep vertical concentration gradients for these elements.

Based on a few determinations from the site and the off-site swale area, it appears that a generalized gradient is present for both C and N. Sharp drops in readings are apparent between the midden and sterile subsurface sediments (Table 1). Readings are higher for the area of cultural deposit than for the surrounding mineral soil. Site readings most closely match those from Sac-333 (Ritter 1974:Table 1) where occupation was recent but apparently not intense, as opposed to other sites with more intense use over extended periods.

Phosphorus (P)

Perhaps more than any other element, P provides a dependable index of the influences of man on the soil. P introduced from the activities of men and animals is rapidly incorporated into the soil following deposition and then participates in the normal cycle. It moves by leaching relatively slowly in alkaline soils but fairly rapidly in slightly acid soils, such as that at Sac-65. Sites of fairly recent human occupation may nonetheless retain relatively high levels compared with off-site areas. The present samples seem to point in this direction: midden P readings contrast sharply with those obtained within the sterile subsoil, indicating a dichotomy in soil formation processes and suggesting that site occupation was relatively recent (Table 1).

Texture

Surface textures of the site and immediate off-site swale area do not differ significantly (Table 1). While the off-site sample is slightly finer textured, both can be classified as sandy clay loams. Subsurface samples of midden and off-site soils are also similar. Sediments beneath the midden and those from the off-site sample show clearly correlated vertical fluctuations in sand and clay content - apparently an old fan remnant with a well-developed soil.

Surface gravels demonstrate probable periodic sheetwash which has left the larger particles and artifacts behind on the knoll.

## FEATURES

The only discrete features encountered were occasional pits dug into the sterile subsoil. These were poorly defined and none contained any notable concentrations of artifacts or faunal or floral remains. One example, located in Unit N16E5 and several adjoining units, was particularly large (Fig. 5c). Diameter was estimated at about 4m and maximum depth was 80 cm below the modern surface. In size this resembled a housepit, but no other distinctive characteristics were present.

## BURIALS

Four human burials were encountered at the Jonson site. In addition, a small amount of human bone was scattered throughout the deposit. Of the four burials, three were badly disturbed. At least two contained grave goods, although neither grave lot could be considered rich.

Burial 1, consisting of a dense concentration of badly fragmented bone, was located at a depth of 50-65 cm in Unit N15E5. The bones were of an adult, and many were burnt. Absence of any concentration of ash or charcoal indicates that this was a secondary partial cremation.

Burial 2 - again a secondary partial cremation - occurred at a depth of 30-50 cm in Units N13E5 and N14E5. Like Burial 1, it was badly disturbed, and no articulations were preserved. The grave pit - shared with Burial 3 - was clearly discernible, filled with A horzon soil, and intrusive into the sterile B horizon. The individual was an adult, but sex and age were indeterminate. A burnt and broken steatite labret was found in association.

Burial 3 was the only relatively intact interment encountered. It was found at a depth of 51-75 cm, directly below Burial 2. The individual was an adult female (age 20-25 years), tightly flexed on the right side, oriented to the west (280° magnetic), and holding 2 charmstones (Fig. 5d). The teeth bore no trace of the abraded grooves found among all the adult interments at the nearby Stone Lake site (Schulz n.d.).

The temporal relationship of Burials 2 and 3 is not at all clear. The exact superposition of the grave pits (in a site in which interments are not abundant) and the fact that what remained of Burial 2 lay entirely above Burial 3 suggest that the two are contemporaneous. This cannot be demonstrated, however, and since the upper burial is disturbed either could be considerably older than the other.

A bone collagen sample from Burial 3 yielded a radiocarbon age of about AD 1420 (530±160 BP, UCR-169). This would place it near the end of Phase 1 of the central California Late period.

Burial 4, an adult interment - again so damaged that neither position nor sex could be ascertained - was recovered at a depth of about 50 cm in Unit N15W12. A poorly defined grave pit, filled with A horizon deposit, was intrusive into the B horizon. A Stockton serrated projectile point may have been in association.

## FORMAL FLAKED STONE TOOLS

Although it contains a small assortment of other artifacts, the Jonson assemblage consists primarily of flaked stone materials. These are segregated here into formal tools, informal tools, and waste. Formal tools are characterized by the presence of trimming; that is, flake scars so invasive and extensive that it is difficult or impossible to reconstruct the shape of the parent blank (Nelson and Posnansky 1970). Bifaces of several forms dominate the assemblage; gravers, drills and spokeshaves occur less frequently.

### Desert Side-Notched Point (Form 1)

This category of tools consists of small triangular bifaces with concave, notched, or V-shaped bases and bilateral notching high on the point (Fig. 7a). Serrations are not present. Tools of this description were classified as Desert side-notched projectile points by Baumhoff and Byrne (1959). The single Sac-65 specimen (a basal fragment) is assignable to their Delta subtype (Table 2).

The cultural associations of this point type lie chiefly with Phase 2 of the central California Late period although a small number of specimens have been recovered from definite Phase 1 contexts. The Delta subtype appears to predate A.D. 1300 in the western Great Basin (Walter 1970) and may be nearly this old in central California.

### Stockton Serrated Points (Form 2)

These small tools are characterized by triangular blades, flat-to-rounded bases, distinct basal elements, and especially by deep distinctive serration on both cutting edges. They have been termed Stockton serrated points by Johnson (1940). Large collections may be readily subtyped into stemmed and corner-notched varieties (Fredrickson 1968). Since only three specimens were recovered from Sac-65 (Table 2) this was not deemed practical, but both subtypes are represented. All three specimens retain patches of cortex on one or both faces (Fig. 7b-d).

Stockton Serrated points are found throughout the Late period in central California. The poor workmanship of the Sac-65 specimens, however, is reminiscent of late Phase 1 or of Phase 2 specimens from Sac-29 (W.H. Olsen, W.A. Pritchard, personal communications), CCo-30 (Fredrickson 1968), and possibly Ala-329 (Coberly 1973). Two of the specimens are stemmed forms most characteristic of Phase 1 assemblages, while the third has the rounded base more common in Phase 2 (Fredrickson 1968).

### Expanding Stemmed Point (Form 3)

This category contains a single small triangular bladed point with an expanding stem (Table 2). This form has been reported at Sac-29 by Olsen (1963:Type 2).

The Sac-65 specimen is not finely made; it is somewhat asymmetrical, shows irregular semiserration, and retains patches of cortex (Fig. 7e). Temporal affiliation is with the Late period, but cannot be more specifically defined.

Corner-Notched Point (Form 4)

The lone fragment assigned to this form is a small crudely made tool with a rounded base and deeply notched corners, retaining much of the surface of the original blank (Fig. 7f). This technique of point manufacture from small thin blanks using a minimum of flake removal seems to be a common late prehistoric pattern and is also represented at nearby Sac-145.

The broken edge of the Sac-65 tool was utilized after it had lost its ability to function as a projectile point.

Broad Leaf-Shaped Bifaces (Form 5)

Artifacts of this form are large leaf-shaped tools with convex sides and rounded to bluntly pointed bases (Fig. 7g-k). Ten specimens were recovered, all but one fragmentary (Table 2).

Tools similar to these are found throughout the central California culture sequence, and provide little in the way of temporal information. However, the Sac-65 specimens lack the transfacial parallel flaking common in Middle period tools of this type.

Gravers, Drills and Spokeshave

Gravers form an interesting part of the assemblage. Two are formed on biface fragments, each having one lateral margin steeply trimmed, leaving a graving point formed by that edge and the truncation (Fig. 8l). One additional specimen is formed on a flake (Fig. 8m) and another on angular waste (Table 3).

Two drill fragments were recovered, one made on a thick blade, the other reworked from a biface. Both have thick lenticular cross sections and bear striations indicative of rotational usage.

A single biface base and shaft fragment is trimmed on a lateral margin, forming a spokeshave (Fig. 8n).

## OTHER FLAKED STONE MATERIAL

It is noteworthy that formal tools (described in the previous section), which have been so strongly emphasized in archeological research, comprise less than 5% of the lithic inventory at Sac-65. Instead, debris accounts for 90.6% of all flaked stone material. Informal tools account for 4.3% and cores for less than 1% of the entire industry (Table 3).

## Flake Tools and Debris

A total of 967 pieces of flaked stone waste, excluding cores, was recovered at Sac-65 (Table 3). An additional 41 pieces, excluding blanks, are defined as tools on the basis of retouch or utilization.

Retouch is defined as the presence of relatively small flake scars, tending to be uninvasive, which have not greatly altered the original shape of the specimen. Tools with edges systematically treated in this matter are classified as scapers; the assemblage contains 11 specimens (Fig. 8o). Casual retouch (edges with sporadic retouch separated by minor edge damage or utilization) is found on 11 flakes and pieces of waste material (Fig. 8p).

Utilization was more difficult to define than retouch, since much of the debris had suffered minor edge damage. (It is probable that much of this damage occurred after excavation, during transportation of the flaked stone material in association with other large and heavy artifacts). Utilization is, therefore, defined as continuous or sporadic edge damage viewed on one or more edges with the presence of at least three flake scars. Such effects were encountered on 19 flakes and pieces of angular waste (Fig. 8q-r).

One of the factors involved in selection of flakes for use was absolute size (represented by the maximum dimension of the flake). When the distribution of the maximum dimension of unutilized as opposed to retouched, casually retouched, and utilized flakes is plotted, the flakes selected for use fall in the upper range and outside of the main distribution of flakes (Fig. 9). The probability that selection was a nonramdon process is statistically significant ($P = .001$ by Chi square). It is also noteworthy that there is no significant difference in the size of end-struck or side-struck flakes and that the tools are fairly evenly distributed between these two types of flakes (Fig. 9).

## Reused Biface Fragments

An interesting phenomenon is the presence of casual retouch and utilization on the truncated ends of leaf-shaped biface fragments. Of the 42 obsidian fragments, 13 are casually retouched and 4 show signs of utilization. Those that have been retouched show numerous combinations of edge and facial flake removal. Of the shaft fragments, 2 were retouched on both truncations and 4 were retouched on only one (Fig. 7p). Several are both casually retouched and utilized on the truncation.

## Cores and Blanks

Along with the large collection of lithic debris are two cores and a single blank (Fig. 7s). The paucity of such material is typical of Late period sites in the lower Central Valley (Jackson and Schulz 1975).

## Raw Material

Raw materials include obsidian, a light green chert, quartzite, basalt, and a small percentage of other materials, including a variety of silicates (Table 3). Obsidian is by far the most important material, accounting for as much as 88% of the total assemblage, 92% of the tools and 88% of the waste. Source analysis of 17 obsidian specimens indicates that they are all derived from quarries at Napa Glass Mountain (Jackson and Schulz 1975).

Although chert is a relatively minor material, accounting for only 5% of the total assemblage, it accounts for 13% of the informal tools. The rest of the materials provided only 5% of the total lithic assemblage and only one tool – a biface fragment of a siliceous material.

# OTHER ARTIFACTS

Although the bulk of the assemblage (excluding baked clay detritus) consists of flaked stone, artifacts of other materials were found.

## Labret

Associated with Burial 2 was a single burnt and fragmentary steatite labret or earplug (Fig. 8a). The face of the specimen is concave, with a diameter of 28.5 mm. The object originally possessed a distinct stem, although this has been broken off.

Ornaments of this type were found in association with rectangular, split-punched and oval Olivella beads at Yol-13 (W.H. Olsen, personal communication), and with split-punched Olivella beads at Sac-43 (Fenenga 1939a). This would indicate presence of the style in early Phase 1 of the Late period. It is not known how late these ornaments were worn, but a tentative association with Desert Side-notched points at Sac-29 (Olsen 1963), combined with the Sac-65 occurrence, suggests that they may have been in use at least until the end of Phase 1.

## Charmstones

Two plummet-shaped charmstones, one of siltstone and the other of cryptocrystalline quartz, were found with Burial ? (Fig. 8b-c). The former specimen retains a length of 123 mm and has a crudely etched encircling groove near the upper end. The other is 128 mm long, but is broken off at the neck; no groove is evident. Neither appears to have been perforated.

These charmstones are not of temporally diagnostic styles, although the form of the quartz specimen is common in Late period Phase 1 grave associations at CCo-138. In the small Phase 2 deposit at Sol-3, 30 fragmentary charmstones were found which resemble the Sac-65 grooved specimen. These:

> consist mainly of notched or incised ends of long spindle-shaped pieces made from fine-grained sandstone, argillite, and siltstone. Many of the ends are battered and bear a coating of asphaltum. The absence of whole specimens, the high frequency of notched or serrated ends, the presence of asphaltum, and their battered ends raise a question of function for these objects. It is possible that they served as fish-line or net sinkers. If the notches and asphaltum were for purposes of attaching a string and the string should break while in use, the portions brought back to the village would be these termini which still were attached to the line. In addition to serving a functional purpose they could still retain their charm potency as far as fishing was concerned. To strengthen the utilitarian and non-esthetic function, it is significant none were associated with burials (Treganza and Cook 1948:295).

Although the characteristics of the Sol-3 charmstone assemblage suggest a utilitarian function, it is difficult to believe that fishing line or dragnet weights, used over the soft-bottomed sloughs of the lower Central Valley, would produce such consistent breakage. This pattern of damage would be far more plausible among weights of casting or drop nets, or of bolas. These would have been used over the same muddy bottoms but the weights would occasionally have struck sharply against each other – either during the cast or during escape attempts of quarry such as large waterfowl. The absence of any other wealth or ritual objects with Burial 3 at Sac-65 might suggest that the ''charm potency'' of these stones was considered minimal.

Antler Harpoon

The only antler artifact recovered was a fragment of a harpoon, found at a depth of 20-30 cm in Unit N15E3. The fragment retained only two barbs along one side of the shaft, but it appears similar to Late period forms illustrated by Bennyhoff (1950). A few shaped pieces of bone were recovered, but these were far too fragmentary for their original form or function to be discernible.

Baked Clay Objects

Although the Jonson site yielded few purposefully shaped and smoothed baked clay artifacts, clay debris was common and over 28 kg of this material was recovered. The debris differed from the artifacts in its unsmoothed, eroded, and more granular appearance. It is possible that weights or boiling stones were commonly manufactured at the site from inferior clays, while a few more finished pieces were imported. The latter group is represented by 14 fragments of various cobble-like forms. In addition a complete baked clay ball, 70 mm in diameter and weighing 223 gm, was recovered (Fig. 8e).

Other forms included a cylinder fragment (diameter 14 mm) and a small spool-shaped object (diameter 21 mm; Fig. 8d) similar to those reported by Heizer (1937:''Smoothed spool shape'') and Olsen (1963:Type 1). The original form and purpose of the cylinder is indeterminate; the spools may have been used as slingstones (Heizer 1937) or net weights.

The surface of one of the cobble-like fragments bore impressions (Fig. 8f) derived from a coiled basket (M.A. Baumhoff, personal communication).

## FAUNAL REMAINS

A total of 549 identifiable bone elements (including nine fish scales) was recovered from the site, and these are assigned to 11 species of fishes, 5 of reptiles, 6 of birds, and 14 of mammals (Table 4). The fauna contains several domestic species which were introduced in historic times, as well as a number of snakes and small rodents which may be equally recent. Most of the material, however, dates from the original occupation.

Due to its paucity and poor preservation, the material provides little cultural or environmental information. The fish fauna closely parallels that at Sac-145 (Schulz and Simons 1973) and is indicative of marshy or lacustrine conditions. Further indication of the exploitation of this zone is provided by the remains of turtles, waterfowl, and possibly elk. Of the species present, only the snow goose - a winter (October-April) immigrant - provides any indication of site seasonality. Because of their eroded condition no attempt was made to use fish scale or bone annuli for this purpose.

## HISTORIC ARTIFACTS

The farm and farm labor camp which occupied the site during much of the present century contributed a respectable supply of artifacts to the shallower levels of the Sac-65 deposit. These bear no connection to the Miwok occupation, and no attempt will be made to deal with them here.

## CHRONOLOGY

Pedological observations at Sac-65 suggest occupation was neither intense nor of long duration, and chemical tests indicate that it occurred rather late in the prehistoric sequence of central California.

Limited areas of more intense activities such as inhumation, storage, and burning are indicated by deeper midden deposit, higher pH readings and other chemical differences. Most of the site area, however, exhibits only slight evidence of aboriginal activity. This is partially due to the removal of cultural soils by sheetwash and agricultural activities.

The midden exhibits no sharp stratigraphic breaks except where it superimposes on the lower sterile sediments. While bioturbation and recent disturbances may have obscured such differences, the most logical assessment of this site is that the deposit represents a single relatively brief and recent occupation.

The time of occupation is more closely defined both by the character of the assemblage and by radiometric dating. Although the temporal positions of most of the Sac-65 artifact forms are only roughly known, all may be plausibly if not diagnostically assigned to the Late period. Most of these forms are known primarily from Phase 1 contexts of this period. Only three forms (represented by one Form 1 and one Form 2 bifaces and the grooved charmstone) are more common in Phase 2, and these are sometimes found in Phase 1.

The evidence thus would seem to favor a short occupation centered late in Phase 1. The radiocarbon date of 530±160 B.P. (UCR-169) on bone collagen from Burial 3 is fully compatible with this assumption.

## DISCUSSION

The Jonson site collection is small, but it may provide important information for the understanding of aboriginal settlement patterns in this area of California. Except for the few (burial associated) ceremonial or ornamental artifacts, all of the assemblage consists of task-associated implements. Also noteworthy is the fact that the only procurement activities (hunting and fishing) demonstrably reflected in the assemblage were male-dominated activities. Butchering and hide preparation, two processing tasks represented, were also within the male activity sphere (Barrett and Gifford 1933: 248).

Evidence of women's activities may be found in the baked clay artifacts and debris, and the presence of women at the site is fully documented by the sex of Burial 3. Also, although informal flaked stone tools are frequently assumed to relate to male-dominated tasks, this is often not the case. Flake tools, for example, were used by Miwok women in basketry fiber preparation (Barrett and Gifford 1933:237).

It is noteworthy, however, that those tools most commonly associated with women's activities - grinding tools and bone awls - were absent from the collection. The site presumably would have provided an excellent base from which to gather the seeds, bulbs, and shoots of marsh plants. Such gathering activities, however, would have required no imperishable tools, and it is possible that any such plant products harvested (unlike grass seeds or acorns) may have likewise been prepared without stone grinding tools. The absence of awls presumably indicates that basket-weaving occupied little of the time spent by women at the site. And since virtually all Miwok women wove baskets - and devoted considerable amounts of time to producing the variety of woven containers and utensils necessary for both their everyday and ritual activities - this in turn suggests they visited the site for only brief periods.

Because of the common California pattern of dispersal to seasonal camps for the performance of important tasks, it is easy to assume that excavation of such camps will provide clear evidence of specialized activity. The present investigation has found this to be only partially true. Judging from tool inventories and faunal remains, fishing and hunting were undertaken from every site thus far investigated in the area, as were at least a limited range of ceremonial activities, particularly interment of the dead. The primary differences thus far discerned between sites lie in the abundance of seed processing equipment and in the number and wealth of burials.

This last point relates to an aspect of central California society which has previously received little attention – the distribution of wealth and relationship to settlement patterns. King (1974) has postulated that in the San Francisco Bay Area wealthy families occupied small sites overlooking the bay, while poorer members of the society inhabited the larger shellmounds along the shore. In the lower Sacramento Valley the opposite may have been the case, with the rich settled permanently at major villages while smaller camps scattered throughout a group's territory were utilized by its poorer members. The apparent poverty of the Sac-65 burials (as well as the complete absence from the midden of wealth objects), in comparison with those from large Late period sites such as Sac-21, Sac-60, and Sac-85 (McKee 1933; Heizer 1934; Fenenga 1939; Lillard, Heizer and Fenenga 1939; Johnson 1974), is in accord with this hypothesis. (It is also supported by data from Sac-145, which will be presented elsewhere.)

Thus, as expected, some differences are evident between the Jonson site collection and those from major Late period villages in the area. If these accurately reflect a persistent pattern, they may be considered a key to important information on settlement, adaptation and social structure in prehistoric central California.

## ACKNOWLEDGEMENTS

We wish to thank Catherine Mossberg and William Allardice for assistance in analysis of the soils, and M.A. Baumhoff, J.A. Bennyhoff, J.J. Johnson, W.H. Olsen, and W.E. Pritchard for information on regional archeology. Elmer Jonson provided us with information on local history and greatly assisted our work in the field. Mammal and reptile remains from the site were identified by H.M. Wagner, and bird remains by D.D. Simons. Line drawings were done by Joyce Kubokawa.

This project was supported by the California Department of Water Resources under Interagency Agreement B-50173 with the Department of Parks and Recreation.

TABLE 1

CA-Sac-65 Soils Data

| Unit | Depth | Horizon | Color/Hue | pH | C(%) | P(ppm) | N(%) | Lime | Texture (%) Sand | Silt | Clay | Tare (GMS) Gravel | Soil | Total |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| N15E5 | 40-50 | B | 10YR 4-3 | 7.6 | | | | | | | | | | |
| | 50-60 | B | " 3-4 | 7.6 | | | | | | | | | | |
| N15W11 | 0-10 | A1p | 10YR 4-3 | 6.0 | | | | | | | | | | |
| | 10-20 | A1p | " 4-3 | 6.1 | 0.9690 | 19 | | - | 60.4 | 21.8 | 17.8 | 16 | 1827 | 1843 |
| | 20-30 | B | " 4-3 | 6.8 | | | | | | | | | | |
| | 30-40 | B | " 4-3 | 6.9 | | 20 | | | | | | | | |
| | 40-50 | B | " 4-4 | 7.0 | | 22 | | | | | | | | |
| | 50-60 | B | " 4-4 | 6.7 | 0.3977 | 17 | 0.0315 | - | 61.8 | 13.4 | 24.8 | | | 2207 |
| N16E5 | 0-10 | A1p | 10YR 3-3 | 6.5 | 1.2915 | 14 | 0.0826 | - | 63.0 | 18.0 | 19.0 | 12 | 1406 | 1418 |
| | 10-20 | A1p | " 4-3 | 6.4 | | | | | | | | | | |
| | 20-30 | A2 | " 4-3 | 6.7 | | | | | | | | | | |
| | 30-40 | A2 | " 4-4 | 6.8 | | | | | | | | | | |
| | 40-50 | AB | " 4-3 | 6.9 | | | | | | | | | | |
| | 50-60 | AB | " 4-4 | 7.1 | 0.7209 | 17 | 0.0476 | - | 63.0 | 18.2 | 18.8 | 8 | 2113 | 2121 |
| | 60-70 | B | " 4-4 | 7.1 | | | | | | | | | | |
| | 70-80 | B | " 4-4 | 7.1 | | | | | | | | | | |
| | 80-90 | B | " 4-4 | 7.5 | | | | | | | | | | |
| | 90-100 | B | " 5-6 | 6.9 | | | | | | | | | | |
| | 100-110 | B | " 5-6 | 6.8 | 0.2553 | 15 | 0.0224 | - | 57.0 | 12.0 | 31.0 | | | 843 |
| | 110-120 | B | " 5-6 | 6.9 | | | | | | | | | | |
| | 120-130 | B | " 5-8 | 7.5 | 0.1894 | | | - | 62.0 | 9.2 | 28.8 | | | 771 |
| | 130-140 | B | " 5-6 | 7.2 | | | | | | | | | | |
| | 140-150 | B | " 5-6 | 7.5 | | | | | | | | | | |
| | 150-160 | B | " 5-6 | 7.0 | | | | | | | | | | |
| | 160-170 | B | " 5-8 | 7.0 | | | | | | | | | | |
| | 170-180 | B | " 5-6 | 6.3 | 0.2300 | 0.0 | 0.0154 | - | 74.4 | 4.8 | 20.8 | | | 1084 |
| | 180-190 | B | " 5-6 | 6.8 | | | | | | | | | | |
| | 190-200 | B | " 5-8 | 7.0 | | | | | | | | | | |
| | 200-210 | B | " 5-6 | 6.7 | | | | | | | | | | |
| | 210-220 | B | " 5-6 | 6.9 | | | | | | | | | | |
| | 220-230 | B | " 5-6 | 6.9 | 0.1769 | 0.0 | | - | 84.4 | 2.8 | 12.8 | | | 801 |
| | 230-240 | B | " 5-6 | 6.7 | | | | | | | | | | |

| Unit | Depth | Horizon | Color/Hue | pH | C(%) | P(ppm) | N(%) | Lime | Texture (%) Sand | Silt | Clay | Tare (GMS) Gravel | Soil | Total |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Off-site | 0-10 | | 10YR 5-3 | 5.5 | 0.9720 | 1.5 | | - | 54.8 | 24.4 | 20.8 | | | 1056 |
| | 10-20 | | " 4-3 | 5.7 | | | | | | | | | | |
| | 20-30 | | " 4-3 | 5.7 | | | | | | | | | | |
| | 30-40 | | " 4-3 | 6.2 | | | | | | | | | | |
| | 40-50 | | " 4-3 | 6.5 | | | | | | | | | | |
| | 50-60 | B | " 4-3 | 6.7 | 0.3968 | 1.0 | 0.0658 | - | 54.8 | 24.2 | 21.0 | | | 858 |
| | 60-70 | B | " 3-4 | 6.9 | | | | | | | | | | |
| | 70-80 | B | " 4-3 | 7.0 | | | | | | | | | | |
| | 80-90 | B | " 4-3 | 7.2 | | | | | | | | | | |
| | 90-100 | B | " 4-4 | 7.5 | | | | | | | | | | |
| | 100-110 | B | " 4-4 | 7.6 | 0.2473 | 0.0 | 0.0630 | - | 56.4 | 20.8 | 22.8 | | | 864 |
| | 110-120 | B | " 4-4 | 7.5 | | | | | | | | | | |
| | 120-130 | B | " 4-4 | 7.7 | | | | | | | | | | |
| | 130-140 | B | " 4-4 | 8.0 | | | | | | | | | | |
| | 140-150 | B | " 4-4 | 8.2 | | | | | | | | | | |
| | 150-160 | B | " 5-4 | 8.2 | 0.4847 | 0.0 | 0.0224 | + | 63.8 | 15.4 | 20.8 | 68 | 891 | 959 |

TABLE 2

Stone Bifaces from CA-Sac-65

| Form | Cat. No. | Provenience | Lengtn | Width | Thk. | Wt. | Material | Notes |
|---|---|---|---|---|---|---|---|---|
| 1 | 471 | N15E2: 10-20 | – | 14.2 | 3.1 | – | Obsidian | Base |
| 2 | 435 | N15W12/13:20-30 | (19) | 14.1 | 2.8 | – | Obsidian | |
| | 487 | N15E3: 0-10 | – | 11.3 | 3.4 | – | Obsidian | |
| | 797 | Surface | (21) | 12.0 | 2.5 | – | Obsidian | |
| 3 | 517 | N15E4: 0-10 | 23.3 | 16.0 | 3.0 | 0.7 | Obsidian | |
| 4 | 50 | N19W5: 0-10 | – | – | 6.5 | – | Obsidian | Tip |
| | 57 | N8W6: 0-10 | – | – | 7.6 | – | Obsidian | Shaft |
| | 75 | S4W12: 0-10 | – | 34.8 | 7.2 | – | Chert | Base |
| | 87 | N6W2: 0-10 | – | 21.0 | 5.7 | – | Obsidian | Tip |
| | 114 | N16E5: 30-40 | – | – | 6.1 | – | Obsidian | Tip |
| | 115 | N16E5: 30-40 | – | – | – | – | Obsidian | Base |
| | 451 | N15W13: 0-10 | – | – | 5.5 | – | Obsidian | Base |
| | 592 | N16E3: 0-10 | – | – | 6.8 | – | Obsidian | Tip |
| | 666 | N16E6: 10-20 | – | 14.5 | 7.1 | – | Obsidian | Base |
| | 697 | N17E4: 0-10 | – | – | 6.9 | – | Obsidian | Shaft |
| | 796 | Surface | 45.9 | 18.3 | 8.4 | 6.9 | Obsidian | |
| | 798 | Surface | – | – | 6.7 | – | Obsidian | Tip |
| | 800 | Surface | – | – | 6.4 | – | Obsidian | Tip |
| | 824 | Trench:25-30 | – | 21.3 | 6.9 | – | Obsidian | Base |
| | 829 | Surface | – | – | 5.6 | – | Obsidian | Shaft |

TABLE 3

CA-Sac-65: Raw Material of Flake Stone Tools

| | | Obsid | Chert | Ozite | Baslt | Other | Total |
|---|---|---|---|---|---|---|---|
| FORMAL TOOLS | | | | | | | |
| Bifaces: | Small | 5 | – | – | – | – | 5 |
| | Leaf-shaped | 14 | – | – | – | 1 | 15 |
| | Untypable | 25 | – | – | – | – | 25 |
| Gravers: | Flake | – | 1 | – | – | – | 1 |
| | Other | 3 | – | – | – | – | 1 |
| Drills | | 2 | – | – | – | – | 2 |
| INFORMAL TOOLS | | | | | | | |
| Scrapers: | Flake | 7 | – | – | – | – | 7 |
| | Angular Waste | 4 | – | – | – | – | 4 |
| Retouched: | Flakes | 6 | 1 | – | – | – | 7 |
| | Flake Fragments | 1 | – | – | – | – | 1 |
| | Angular Waste | 3 | – | – | – | – | 3 |
| Utilized: | Flakes | 6 | – | – | – | – | 6 |
| | Flake Fragments | 4 | 2 | – | – | – | 6 |
| | Angular Waste | 5 | 2 | – | – | – | 7 |
| | Blanks | 1 | – | – | – | – | 1 |
| | | 84 | 6 | – | – | 1 | 93 |
| WASTE | | | | | | | |
| | Flakes | 391 | 19 | – | 5 | 2 | 417 |
| | Flake Frag. | 161 | 6 | – | 4 | 1 | 172 |
| | Ang. Waste | 297 | 24 | 21 | 12 | 24 | 378 |
| | Cores | 1 | 1 | – | – | – | 2 |
| | | 850 | 50 | 21 | 21 | 27 | 969 |

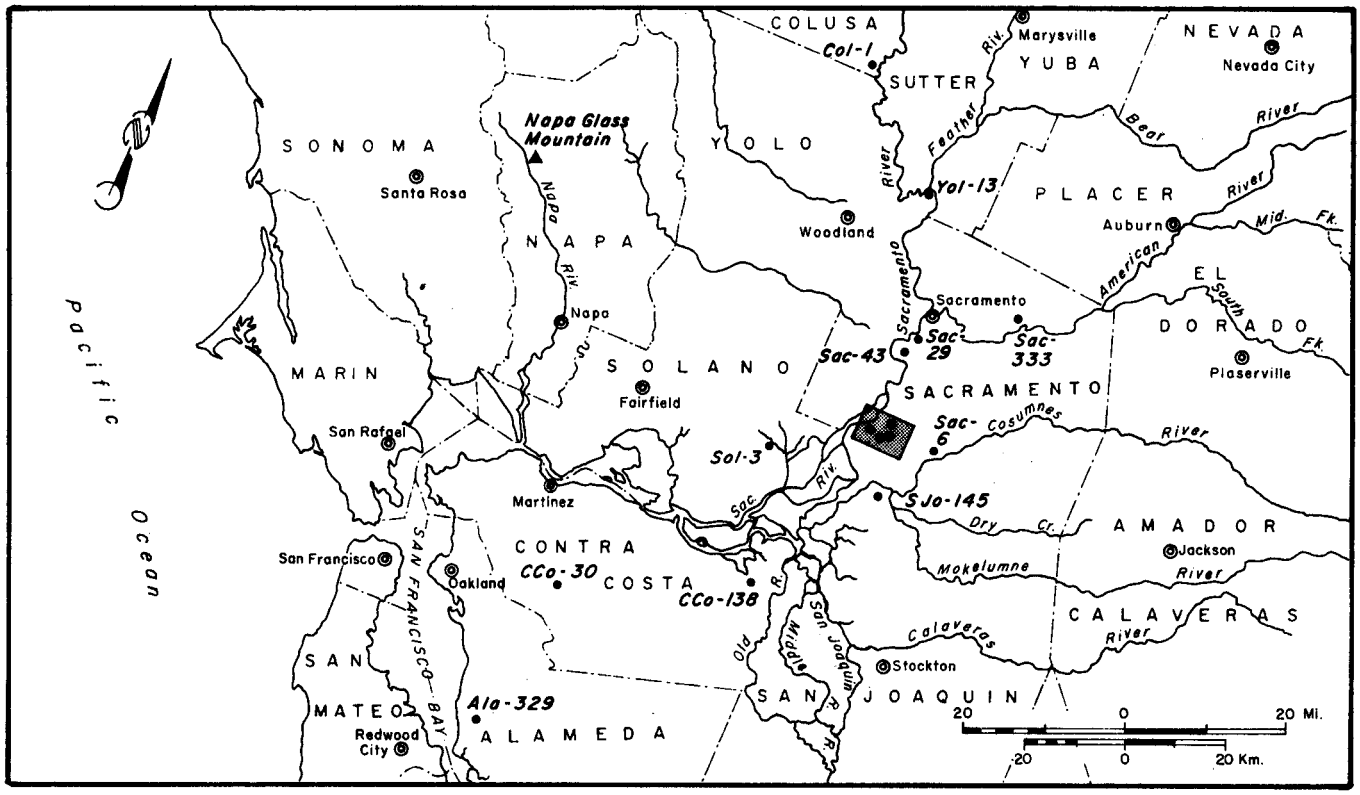
TABLE 4

Faunal Remains at the Jonson Site

| Species | Common Name | Elements | Individuals |
|---|---|---|---|
| Acipenser sp. | Sturgeon | 54 | 1 |
| Oncorhynchus tshawytscha | King (Chinook) Salmon | 1 | 1 |
| Catostomus occidentalis | Sacramento Sucker | 9 | 4 |
| Mylopharodon conocephalus | Hardhead | 2 | 1 |
| Pogonichthys macrolepidotus | Splittail | 1 | 1 |
| Orthodon microlepidotus | Sacramento Blackfish | 5 | 1 |
| Lavinia exilicauda | Hitch | 12 | 7 |
| Ptychocheilus grandis | Sacramento Squawfish | 2 | 1 |
| Gila crassicauda | Thicktail Chub | 23 | 14 |
| Archoplites interruptus | Sacramento Perch | 240 | 10 |
| Hysterocarpus traskii | Tule Perch | 1 | 1 |
| Clemmys marmorata | Pond Turtle | 12 | 1 |
| Coluber cf. constrictor | Racer | 1 | 1 |
| Lampropeltis cf. getulus | Common Kingsnake | 7 | 1 |
| Pituophis cf. melanoleucus | Gopher Snake | 2 | 1 |
| Thamnophis sp. | Garter Snake | 1 | 1 |
| Chen hyperborea | Snow Goose | 1 | 1 |
| Anas sp. | ''Mid-size'' duck | 9 | 3 |
| Anas sp. | Teal | 5 | 1 |
| Anas platyrynchos | Mallard | 3 | 2 |
| Fulica americana | Coot | 3 | 1 |
| *Meleagris gallopavo | Turkey | 1 | 1 |
| Sylvilagus sp. | Cottontail | 4 | 1 |
| Lepus cf. californicus | Jackrabbit | 11 | 1 |
| Spermophilus beecheyi | Ground Squirrel | 10 | 1 |
| Thomomys bottae | Botta Pocket Gopher | 19 | 2 |
| Peromyscus sp. | White-Footed Mouse | 2 | 1 |
| Microtus cf. californicus | Field Mouse | 85 | 10 |
| Procyon lotor | Raccoon | 1 | 1 |
| cf. Urocyon | Fox | 1 | 1 |
| Canis sp. | Dog or Coyote | 3 | 1 |
| *Felis cf. catus | Domestic Cat | 1 | 1 |
| *Sus scrofa | Pig | 4 | 1 |
| Odocoileus hemionus | Mule Deer | 14 | 1 |
| Cervus elaphus | Elk | 3 | 1 |
| *Bos sp. | Cow | 4 | 1 |

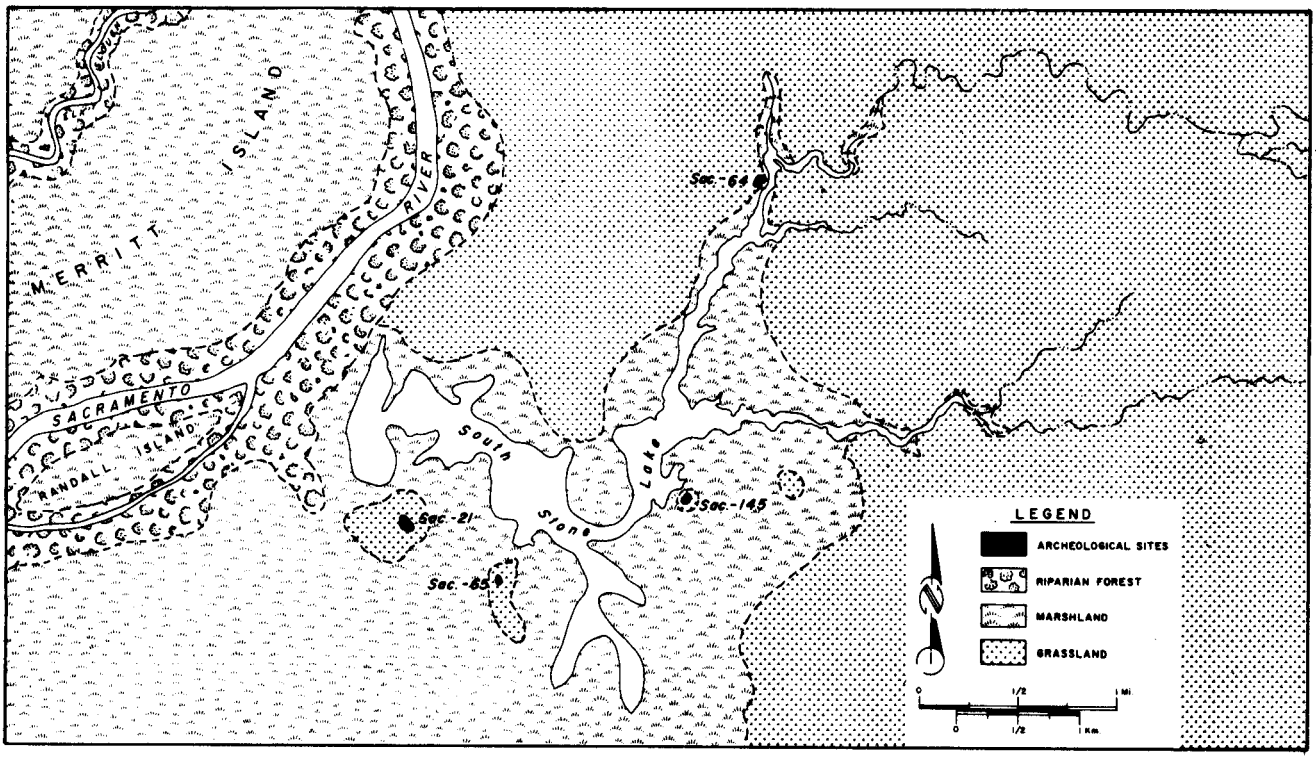
*Historically introduced species.

FIGURE 1




Central California showing sites mentioned in text. Shaded area indicates location of Figure 2.

FIGURE 2




Hypothetical distribution of native plant communities around south Stone Lake.

FIGURE 3

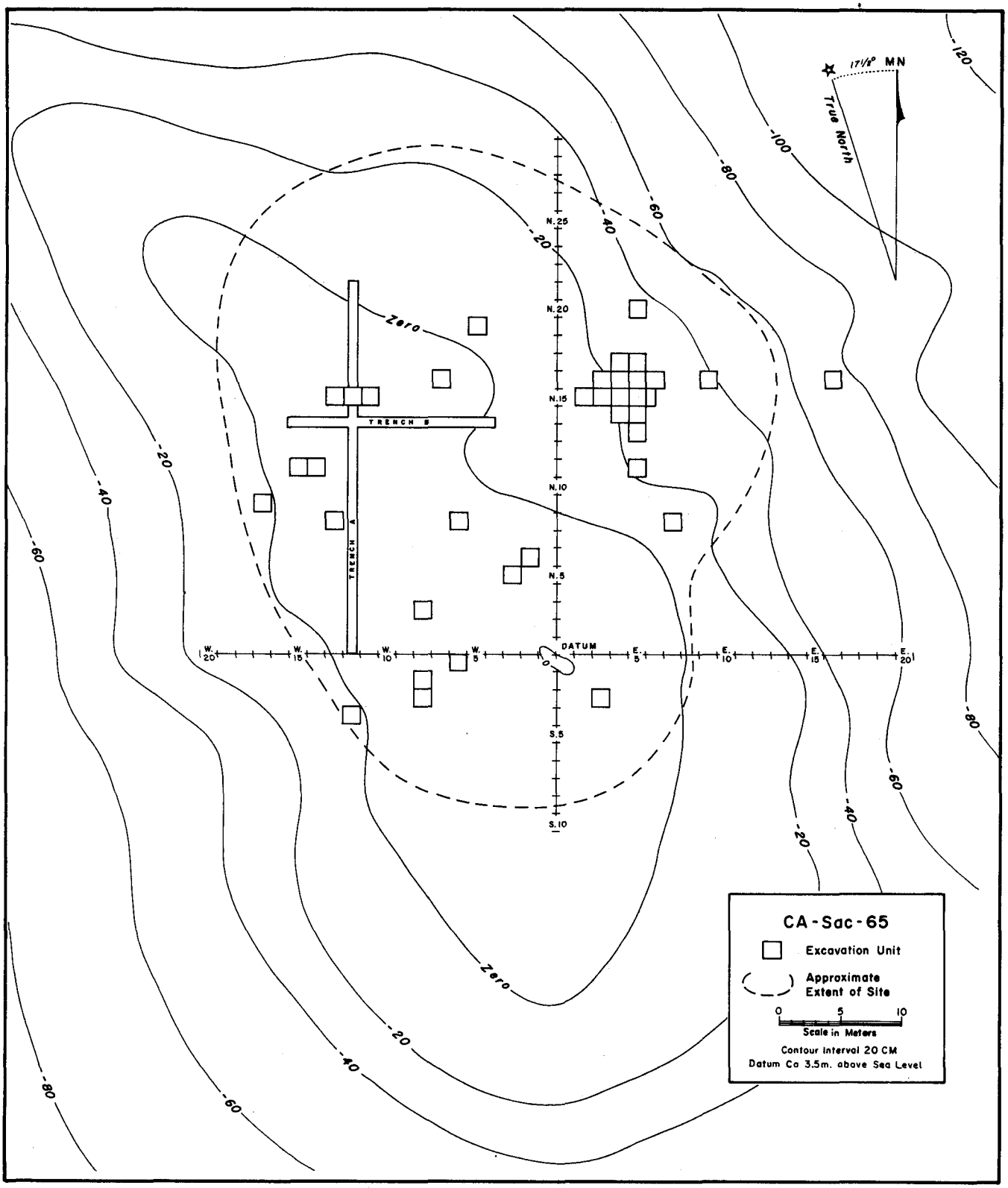

17½° MN
True North
-120
-100
-80
-60
-40
-20
Zero
N.25
N.20
N.15
N.10
N.5
DATUM
S.5
S.10
W.20
W.15
W.10
W.5
E.5
E.10
E.15
E.20
TRENCH B
TRENCH A
CA-Sac-65
Excavation Unit
Approximate Extent of Site
0 5 10
Scale in Meters
Contour Interval 20 CM
Datum Ca 3.5m. above Sea Level

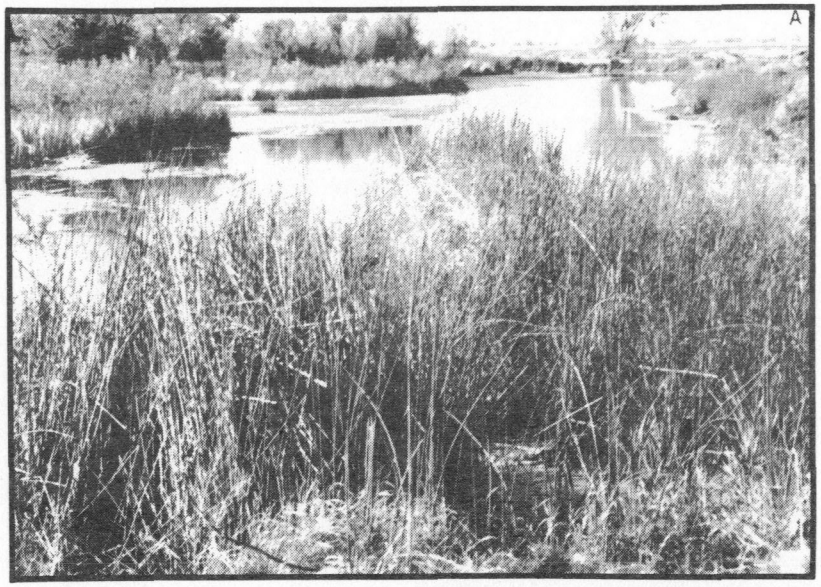
FIGURE 4

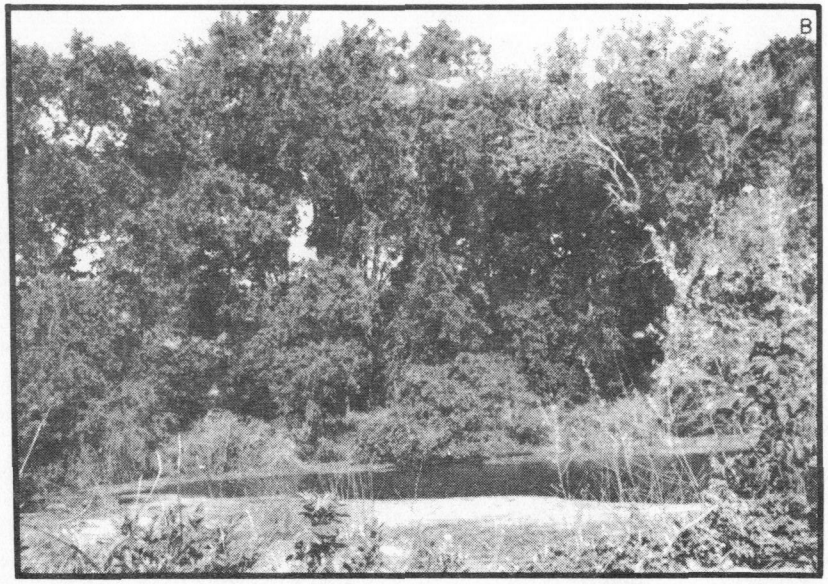
a) Marsh vegetation at Snodgrass Slough, west of the Jonson site. Tules in the foreground.

b) Riparian vegetation along drainage channels south of Stone Lake.

c) Backhoe trench excavation at Sac-65.

d) Completed excavation units at Sac-65.


A


B


C

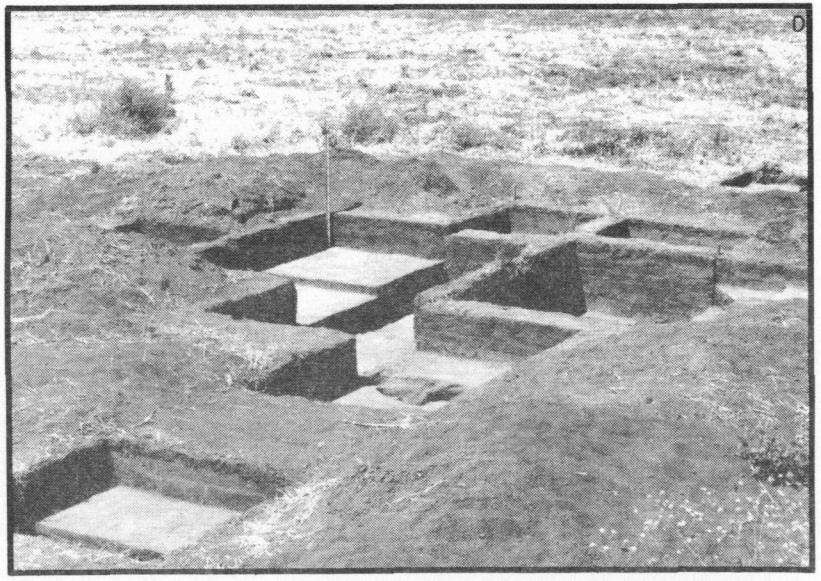

D

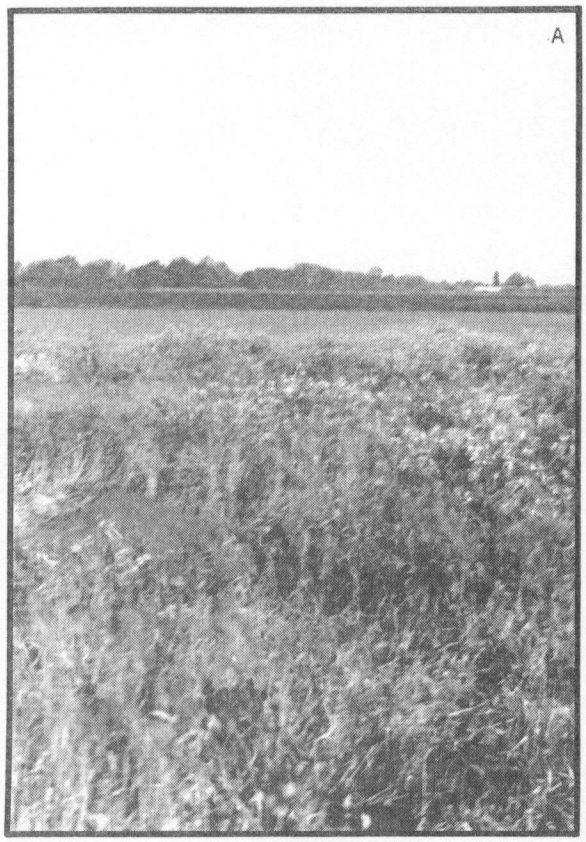
FIGURE 5

a) View to the northwest from Sac-65. Hollister mound lies beneath the power tower in background.

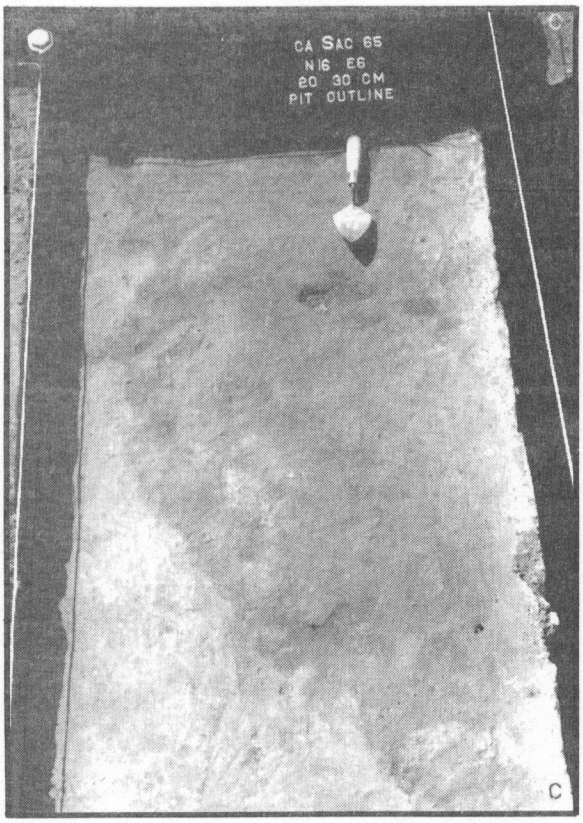
b) Hand excavation at Sac-65.

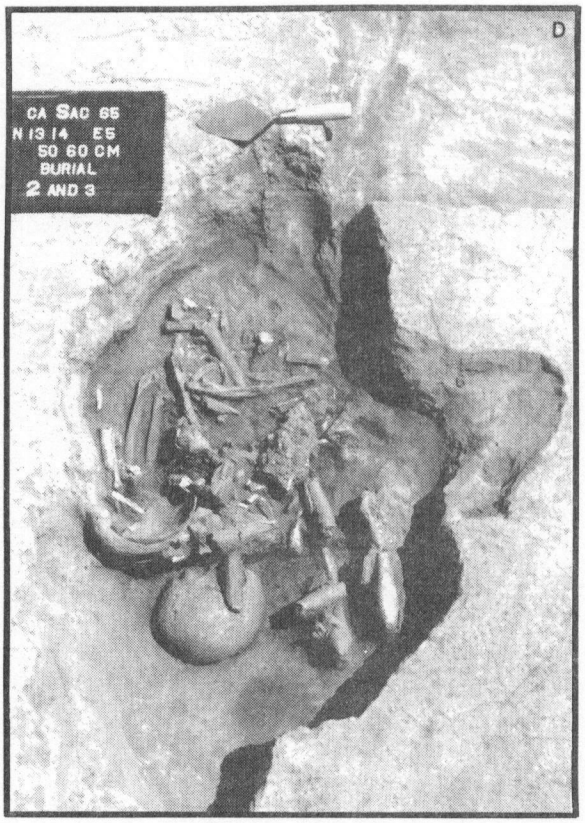
c) Outline of large pit feature in center of site.

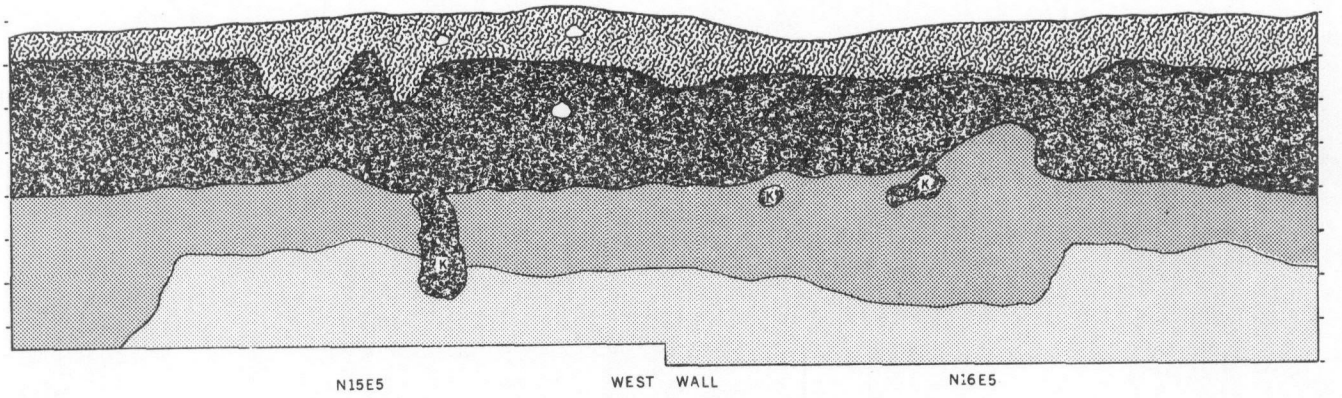
d) Burials 2 and 3.

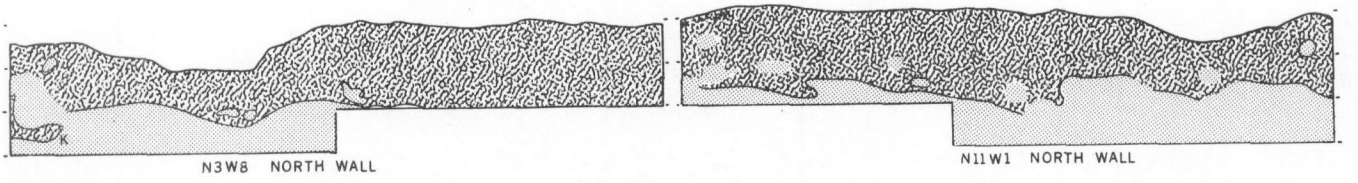

A


B


CA SAC 65
N16 E6
20 30 CM
PIT OUTLINE
C


CA SAC 65
N 13 14 E5
50 60 CM
BURIAL
2 AND 3
D



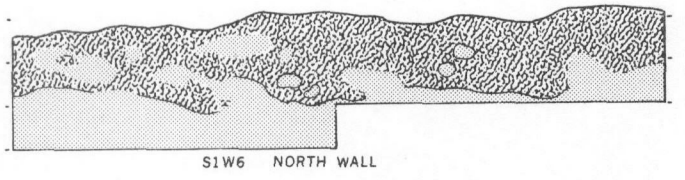
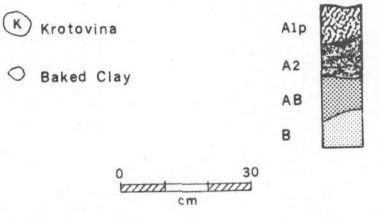




FIGURE 4

CA-Sac-65 SOIL PROFILES



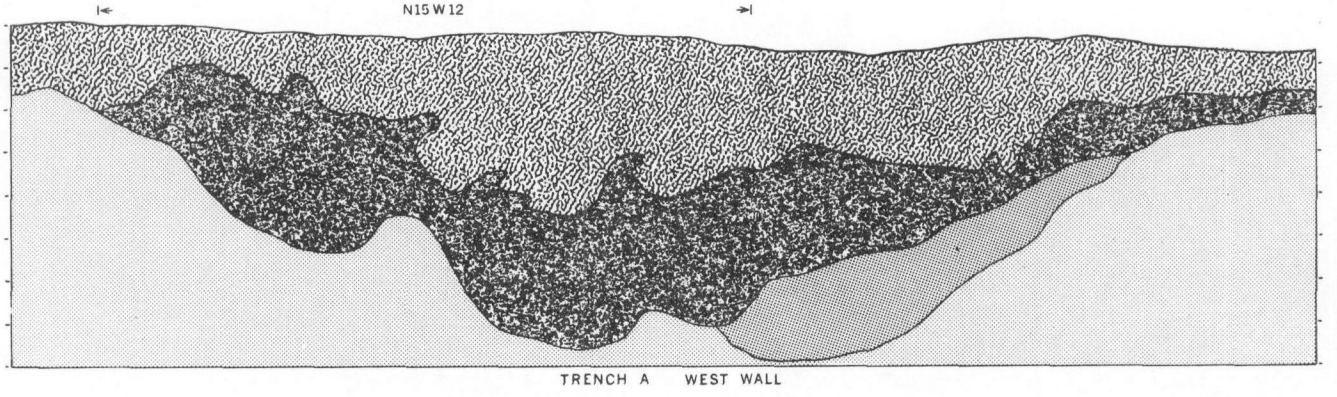



FIGURE 7

Chipped Stone Artifacts from Sac-65 (Actual Size)

a) Form 1 projectile point (022-44-471). Unit N15E2: 10-20 cm.

b) Form 2 projectile point (022-44-435). N15W12/13: 20-30 cm.

c) Form 2 projectile point (022-44-797). Surface.

d) Form 2 projectile point (022-44-487). N15E3: 0-10 cm.

e) Form 3 projectile point (022-44-517). N15E4: 0-10 cm.

f) Form 4 projectile point (022-44-831). Surface.

g) Form 5 biface (022-44-87). N6W2: 0-10 cm.

h) Form 5 biface (022-44-751). N20E5: 0-10 cm.

i) Form 5 biface (022-44-796). Surface.

j) Form 5 biface (022-44-798). Surface.

k) Form 5 biface (022-44-824). Trench A.

l) Graver formed on biface fragment (022-44-322). N13E5: 10-20 cm.

m) Graver formed on flake (022-44-100). S3W8: 0-10 cm.

n) Spokeshave formed on biface fragment (022-44-262). N11W15: 30-40 cm.

o) End scraper (022-44-835). N11W14: 20-30 cm.

p) Casual retouch on biface fragment (022-44-19). N18W13: 0-10 cm.

q) Utilized flake (022-44-600A). N16E3: 10-20 cm.

r) Dorsally retouched and ventrally utilized flake (022-44-323A). N13E5: 10-20 cm.

s) Blank, bifacially retouched (022-44-493). N15E3: 10-20 cm.

FIGURE 7

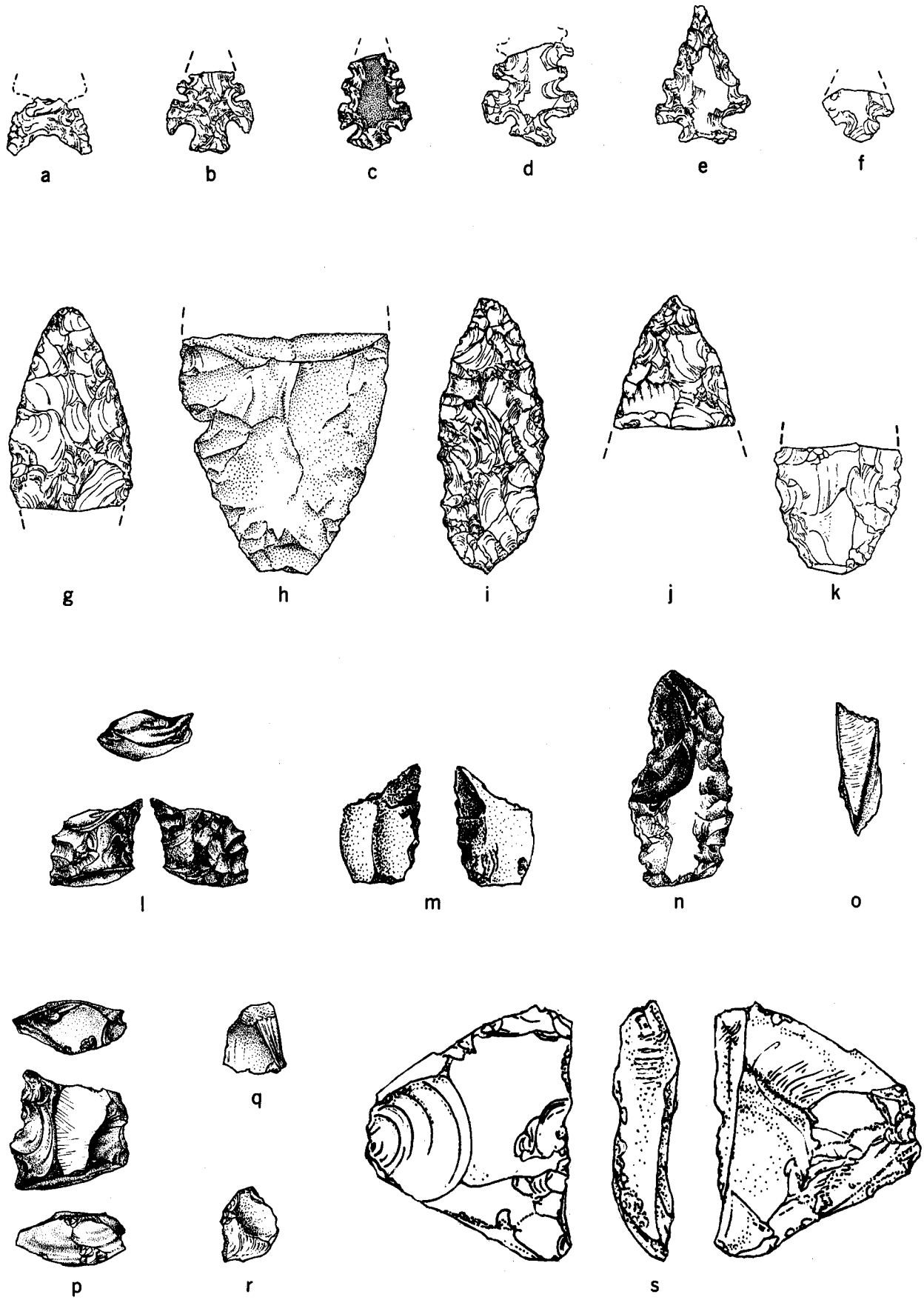


FIGURE 8

Ground Stone and Baked Clay Artifacts from Sac-65

a) Steatite labret (022-44-783). Burial 2.

b) Siltstone charmstone (022-44-787). Burial 3.

c) Quartz charmstone (022-44-792). Burial 3.

d) Baked clay spool (022-44-261). N11W15: 20-30 cm.

e) Baked clay ball (022-44-522). N15E4: 20-30 cm.

f) Baked clay ball fragment with basket impressions (022-44-710). N17E5: 0-10 cm.

FIGURE 8

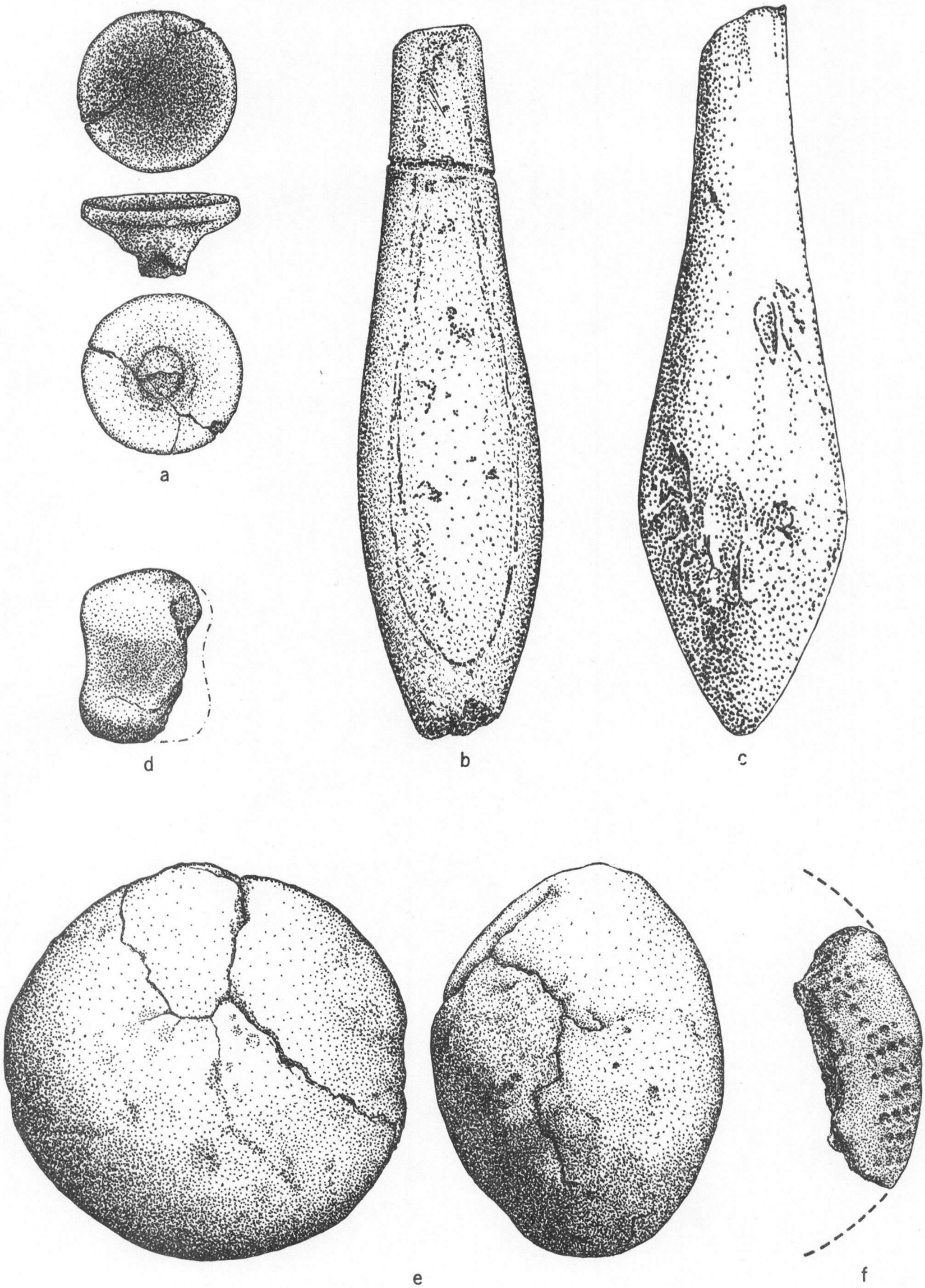
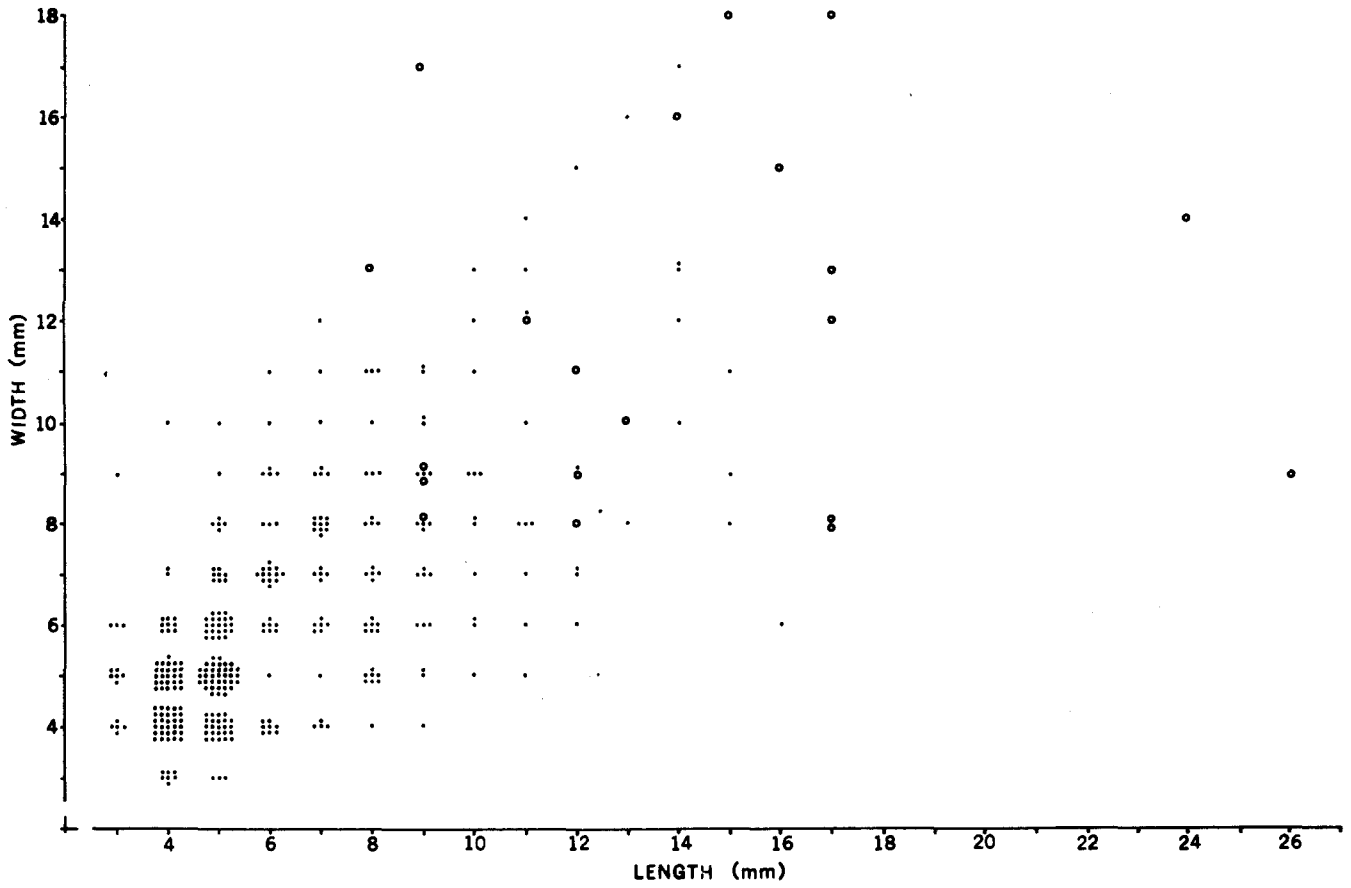


FIGURE 9




Size distribution of utilized (circles) and non-utilized (dots) obsidian flakes.

## REFERENCES


BARRETT, S.A. and E.W. GIFFORD
1933 Miwok material culture. Milwaukee Public Museum, Bulletin 2(4): 117-377.

BAUMHOFF, M.A. and J.S. BYRNE
1959 Desert Side-notched points as a time marker in California. University of California Archaeological Survey Reports 48:32-65.

BENNYHOFF, J.A.
1950 Californian fish spears and harpoons. University of California Anthropological Records 9(4):295-337.

1977 The Ethnogeography of the Plains Miwok. Center for Archaeological Research at Davis Publication 5.

BERRY, J.
1972 The Central Valley Prairie - Volume 1: California Prairie Ecosystem. California Department of Parks and Recreation, Sacramento.

COBERLY, M.B.
1973 The archaeology of the Ryan mound, site Ala-329, a central California coastal village site. University of Northern Colorado Museum of Anthropology Occasional Publications in Anthropology, Archaeology Series 4:1-109.

COOK, S.F. and R.F. HEIZER
1965 Studies on the chemical analysis of archaeological sites. University of California Publications in Anthropology 2:1-102.

COSBY, S.W.
1941 The Sacramento-San Joaquin Delta area, California. United States Department of Agriculture, Bureau of Plant Industry Soil Survey, Series 1935, No. 21:1-50.

FENENGA, F.
1939a The excavation of site S. 43. MS on file, Archaeological Research Facility, University of California, Berkeley.

1939b Nicolaus site No. 2 (S. 85). MS on file, Archaeological Research Facility, University of California, Berkeley.

FREDRICKSON, D.A.
1968 Archaeological investigation at CCo-30, near Alamo, Contra Costa County, California. Center for Archaeological Research at Davis, Publication 1:1-187.

HEIZER, R.F.
1934 Field notes from Sacramento Junior College excavations at the Hicks site, 1933-34. MS on file, Archaeological Research Facility, University of California, Berkeley.

1937 Baked clay objects of the lower Sacramento Valley. American Antiquity 3(1):34-50.

HOLMES, L.C., J.W. NELSON and PARTY
1915 Reconnaissance Soil Survey of the Sacramento Valley, California. United States Department of Agriculture, Bureau of Soils, Washington.

JACKSON, T.L. and P.D. SCHULZ
1975 Typology, trade, and trace analysis: a test of local manufacture of Sacramento Valley obsidian tools. Journal of New World Archaeology 1(2):1-8.

JOHNSON, E.N.
1940 The serrated points of central California. American Antiquity 6(2):167-170.

JOHNSON, J.J.
1974 Reconnaissance archeological survey of the Morrison Stream Group in Sacramento County, California. MS on file, Sacramento District, U.S. Army Corps of Engineers, Sacramento.

KING, T.F.
1974 The evolution of status ascription around San Francisco Bay. Ballena Press Anthropological Papers No. 2:35-54.

LILLARD, J.B., R.F. HEIZER, and F. FENENGA
1939 An introduction to the archeology of central California. Sacramento Junior College, Department of Anthropology, Bulletin 2:1-125.

MACDONALD, R., S.C. HOLLAND and R.F. HOLLAND
1974 Vegetation of South Stone Lake, Sacramento County, California. MS on file, Archeological and Historical Services Unit, California Department of Parks and Recreation, Sacramento.

McKEE, C.B.
1933 The Sacramento Junior College excavations at the Hollister mound. MS on file, Archaeological Research Facility, University of California, Berkeley.

NANCE, J.D.
1970 Lithic analysis: implications for the prehistory of central California. University of California, Los Angeles, Archaeological Survey Annual Report 12:64-102.

NELSON, C.M. and M. POSNANSKY
1970 The stone tools from the re-excavation of Nsongezi Rock Shelter, Uganda. Azania 5:119-172.

OLSEN, W.H.
1963 The Comparative Archaeology of the King Brown Site (4-Sac-29). M.A. thesis, Sacramento State College, Sacramento.

RITTER, E.W.
1972 Midden/soil studies of the Stone Lake site (CA-Sac-145). MS on file, Archeological and Historical Services Unit, California Department of Parks and Recreation, Sacramento.

1974 Soils, sediments and geomorphology of the Deterding and Governor's Mansion sites, Sacramento County, California. MS on file, Archeological and Historical Services Unit, California Department of Parks and Recreation, Sacramento.

SCHULZ, P.D.
1977 Task activity and anterior tooth grooving in prehistoric California Indians. American Journal of Physical Anthropology 46(1):87-92.

SCHULZ, P.D. and E.W. RITTER
1977 Archeology of the Safflower site (CA-SJo-145). MS on file, Archeological and Historical Services Unit, California Department of Parks and Recreation, Sacramento.

SCHULZ, P.D. and D.D. SIMONS
1973 Fish species diversity in a prehistoric central California Indian midden. California Fish and Game 59(2):107-113.

SETZER, J.
1947 Chemical Analysis of Indian Mounds. M.S. thesis, University of California, Berkeley.

THOMPSON, K.
1961 Riparian forests of the Sacramento Valley, California. Annals of the Association of American Geographers 51(3):294-315.

TREGANZA, A.E. and S.F. COOK
1948 The quantitative investigation of aboriginal sites: complete excavation with physical and archaeological analysis of a single mound. American Antiquity 13(4):287-297.

UNITED STATES DEPARTMENT OF AGRICULTURE
1951 Soil survey manual. United States Department of Agriculture, Agricultural Handbook 18:1-503.

WALTER, N.P.
1970 A computer aided study of the physical measurements of Owens Valley, California, projectile points. Nevada State Museum Anthropological Papers 15:47-82.

WEIR, W.W.
1950 Soils of Sacramento County, California. Agricultural Experiment Station, University of California College of Agriculture, Berkeley.