

**ARCHAEOLOGY OF THE NORTHERN
SAN JOAQUIN VALLEY**

BY

W. EGBERT SCHENCK AND ELMER J. DAWSON

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CONTENTS

	PAGE
Introduction: The Great Central valley of California.....	293
Geography.....	293
Geology.....	294
Archaeological possibilities.....	294
Region of the present work.....	295
Geography of the area.....	296
Location.....	296
Topography.....	297
Elevation.....	297
Streams.....	297
Lodi region.....	299
Stockton region.....	299
Travel.....	300
Climate.....	302
Flora.....	303
Fauna.....	304
Historical data.....	305
Archaeological work about Stockton.....	306
Archaeological work about Lodi.....	308
Surface surveys.....	308
Excavation work.....	309
Aboriginal sites.....	309
Determination.....	309
Location.....	310
Chronological indications.....	311
Description.....	316
Size.....	316
Height—Artificiality.....	316
Position.....	318
Condition.....	318
Shape.....	319
Age.....	320
Structure of mounds.....	323
Base.....	323
Mound mass.....	323
Structural details.....	325
Strata.....	325
Length of occupation.....	327
Layers and lenses.....	328
Pockets.....	329
Subsurface mounds.....	329

	PAGE
Composition of mounds.....	330
Surrounding land.....	330
Substrata.....	331
Mound mass.....	331
Human remains.....	334
Cremation.....	334
Graves.....	336
Horizontal distribution.....	336
Vertical distribution.....	337
Stratification.....	338
Preparation.....	338
Bodies.....	340
Position.....	340
Orientation.....	340
Preparation.....	341
Burial methods.....	341
Skeletal material.....	342
Burial associations.....	343
Proportion of burials with artifacts.....	343
Proportion of artifacts with burials.....	345
Types and frequency of occurrence of associated artifacts.....	345
Complexity of associations.....	346
Concentration of artifacts.....	347
Material culture.....	348
Articles of asphaltum.....	349
Articles of bone.....	349
Awls.....	350
Beads.....	350
Double-pointed pieces.....	350
Knives or daggers or awls.....	351
Miscellaneous.....	351
Teeth and claws.....	352
Tubes.....	352
Whalebone objects.....	356
Whistles.....	356
Articles of Caucasian make.....	357
Age suggestions.....	358
Articles of clay.....	359
Baked clay "balls".....	360
Beads.....	364
Earplugs and (or) labrets.....	364
Effigies.....	365
Miscellaneous.....	365
Perforated discs, rings, or "doughnuts".....	366
Pipes.....	366
Potsherds.....	366
Articles of horn.....	368
Antler tips.....	368
Club.....	368
Fishhooks or spearpoints.....	368
Miscellaneous.....	369
Pendants.....	369
Wedges.....	369

	PAGE
Articles of obsidian.....	370
Arrowpoints, spearheads, knives.....	370
Curves.....	371
Drills or perforators.....	372
Scrapers.....	372
Articles of shell.....	373
Beads.....	374
Pendants.....	377
Articles of steatite.....	379
Articles of chipped stone.....	380
Arrowpoints, spearheads, or knives of miscellaneous stone.....	380
Drills.....	381
"Eoliths".....	381
"Palaeoliths".....	382
Articles of ground stone.....	382
Beads.....	382
Dishes and jars.....	383
Double-pointed pieces.....	384
Drilled discs and doughnut stones.....	385
Knives.....	385
Labrets.....	385
Miscellaneous.....	385
Mortars.....	386
Pendants.....	387
Pestles.....	387
Pipes.....	389
Plummet-like stones.....	390
Whetstones or polishing stones.....	391
Articles of unworked stone.....	391
Anvils.....	391
Cooking stones.....	391
Crystals.....	392
Hammerstones.....	394
Miscellaneous.....	394
Mica.....	394
Paint.....	394
Pebbles.....	395
Seed.....	395
Textiles and cordage.....	395
Basketry.....	395
Cloth.....	396
Cordage.....	396
Matting.....	396
Nets.....	396
Summary of material culture.....	397
General aspects.....	397
Characteristic differences between Stockton and Lodi subregions.....	399
Conclusions.....	404
Culture disclosed.....	404
Cultural comparisons.....	406
Problems.....	407
Age.....	409
Explanation of plates.....	412

TABLES

	PAGE
1. Location of aboriginal sites in the Lodi-Stockton area.....	312
2. Description of the aboriginal sites of the Lodi-Stockton area.....	321
3. Types of baked clay balls (Lodi).....	367
4. Main characteristics of the material culture of the Lodi-Stockton area.....	397

PLATES

(Following page 413)

74. Burial
75. Textiles and cordage
76. Bone awls and double-pointed implements
77. Awl-like bone implements
78. Bone tubes
79. Whistles and miscellaneous objects of bone
80. Horn or bone fish spears or hooks
81. Horn and bone objects, miscellaneous
82-84. Baked clay balls
85. Baked clay articles
86. Baked clay bird effigies
87. Shell beads
88-90. Abalone shell pendants
91. Chipped stone points
92. Chipped stone, miscellaneous
93, 94. Obsidian points
95. Obsidian curves
96. Stone beads
97, 98. Ground stone objects
99. Mortars
100. Pestles
101. Pipes and plummets
102. Steatite objects

FIGURES IN TEXT

1. Sacramento-San Joaquin Delta region.....	296
2. Diagrammatic cross-sections of typical mound masses.....	324
3. Diagrammatic cross-section of Jones's excavation in site 82, Stockton.....	326
4. Diagrammatic cross-section of subsurface mounds.....	330
5. Designs on bird-bone tubes.....	354
6. Designs on bird-bone tubes.....	355

INTRODUCTION: THE GREAT CENTRAL VALLEY OF CALIFORNIA

GEOGRAPHY

Rising among the Siskiyou, the mountain barrier stretching across the northern portion of the state of California, the Sacramento river flows for some 160 miles in a southeasterly direction. From the Tehachapi mountains in the south, the drainage flows northwesterly about 275 miles, forming the San Joaquin river. When the two streams are about to come together head-on, they both swing to the west near latitude 38° N, gradually unite through a maze of channels, sloughs, lakes, and marshes, together form Suisun bay, break through the coast mountains at Carquinez strait, and empty into San Francisco bay. The valley of either of these rivers is practically a continuation of the other, and they are usually considered together as the Great Central valley of California.

This central valley is nearly 500 miles long and from 20 to 50 miles wide, with an area of about 16,000 square miles. Of this perhaps two-thirds is bottom land.¹ The valley floor is remarkably flat. From sea level it rises to some 50 feet elevation just east of Stockton; and the elevations of its northern and southern limits are about 500 feet. To the east, the Sierra Nevada mountains rise to more than 14,000 feet, and from them many perennial streams flow down into the valley. To the west a series of parallel ridges, enclosing a number of long, narrow valleys, separate it from the Pacific ocean. These coast ranges are much lower, having a maximum elevation of 5000 to 6000 feet. In the north they are precipitous, and in the south very arid, so that few streams reach the central valley from the west. The only definite break in the mountain walls is Carquinez strait.

¹ For the geographical and geological statements contained in this paper we are mainly indebted to the United States Geological Survey, principally to: Walter C. Mendenhall, Preliminary Report on the Ground Waters of the San Joaquin Valley, California, Water Supply Paper 222, 1908; and J. S. Diller, Guidebook of the Western United States, Part D, The Shasta Route and Coast Line, Bull. 614, 1916.

GEOLOGY

The central valley is a depression which seems to have existed as a great structural fault since well back in Tertiary times. Since then gradual subsidence has probably occurred with periods of uplift. In the meantime the streams from the hills have been busy filling the trough. The first depositions appear to have taken place under salt water, subsequent ones in a fresh-water lake. In Pliocene time the valley became land and deposition began under conditions similar to those of the present. The valley floor became a series of coalesced alluvial fans. In the south, where rainfall was scant, a series of shallow basins were formed, by the dams of the fans of the larger streams, through which the drainage of the main valley was not able to cut its way. In the central and northern regions, where precipitation was greater, the alluvial fans are still found along the borders of the valley, but are less striking, and the center of the valley is a flood-plain of which large areas are subject to inundation.

The older alluvium of late Pliocene or Pleistocene time is composed of clay, sand, and gravel. While varying much in composition and appearance, it is distinguished from the younger alluvium by the fact that it is characteristically red because of greater oxidation of its iron content. After deposition of the older alluvium, an uplift bent the edges of the valley up so that this alluvium was raised along the borders of the valley. The gravels and sands of the younger alluvium are also varied in character. They constitute the floor of the valley to a depth of 300 to 400 feet, and are being added to each year.

ARCHAEOLOGICAL POSSIBILITIES

The present paper considers this valley as a habitat for man. Apparently the Great valley has existed much as at present since man's earliest known appearance on earth. Climate, flora, and fauna seem to have retained their essential elements for hundreds of thousands of years. So far as physical environment is concerned, man could thus have lived here from his most remote antiquity. But any record which he might have left would have been buried by the recent alluvium and would be difficult of access except in extraordinary circumstances or by chance. Moreover, the present wash of the alluvial fans and silting over of the valley floor would tend to obliterate quickly human remains of even a few thousand or perhaps a few hundred years ago. Accordingly the archaeologist who approaches the region has little justification for expecting to secure very ancient data.

However, there does exist need for his work. Local, secondary differences can be distinguished, although in physical features, climate, flora, and fauna the valley is remarkably uniform. The river channels are easily navigable and frequently fordable, and the marshes are often dry so that man may traverse the entire valley. Nevertheless this uniform habitat was the home of five linguistic groups when the white man first appeared. Cultural differentiations have also been noted. So archaeological investigators can hope to offer some evidence as to how far back these cultural differences extend; to point out regions of similar characteristics; and to establish relationships with such areas. Such relationships may help to determine whether various cultural elements have been pushed into the region without being modified to essential similarity by the similar environment, or whether the culture of the valley represents a mainly indigenous growth modified only in its detail by the secondary differences of environment.

REGION OF THE PRESENT WORK

It is the hope of the Department of Anthropology of the University of California that studies of all characteristic regions of the Great Central valley can ultimately be made. Until such a broad survey can be made, the results of limited, local investigations are offered. An archaeological study was made by E. W. Gifford and W. E. Schenck, of the southern end of the Great Central valley.² This was just within the southern limits of the Yokuts linguistic division, which extended north to where the San Joaquin river turns west. Several studies have also been made of the shellmounds of San Francisco bay, the latest of which was Schenck's investigation of the Emeryville shellmound.³ This region lies outside the doorway of Carquinez strait. The historic Costanoan peoples occupying it extended within the doorway for a short distance east until they touched the Yokuts area. Somewhat east of both of these was the Miwok area. Adjoining the Miwok on the north were the Maidu, and to the west, and also adjacent to the Yokuts and Costanoan, were the Wintun. No identification of culture and languages is implied. But in addition to its relation to the areas previously worked, a region where five linguistic groups come together (or from which they have arisen) looks promising. It is a part of this region that the present work deals with. Our final reason for settling upon this area was the fact that a considerable amount of localized material was available.

² E. W. Gifford and W. Egbert Schenck, *Archaeology of the Southern San Joaquin Valley, California*, present series, 23:1-122, 1926.

³ The Emeryville Shellmound, Final Report, present series, 23:147-282, 1926.

GEOGRAPHY OF THE AREA

LOCATION

The area more particularly covered by this paper lies somewhat west of 121° west longitude and in about 38° north latitude. More specifically it extends from the northern vicinity of Lodi to the southern vicinity of Stockton in San Joaquin county, California; approxi-

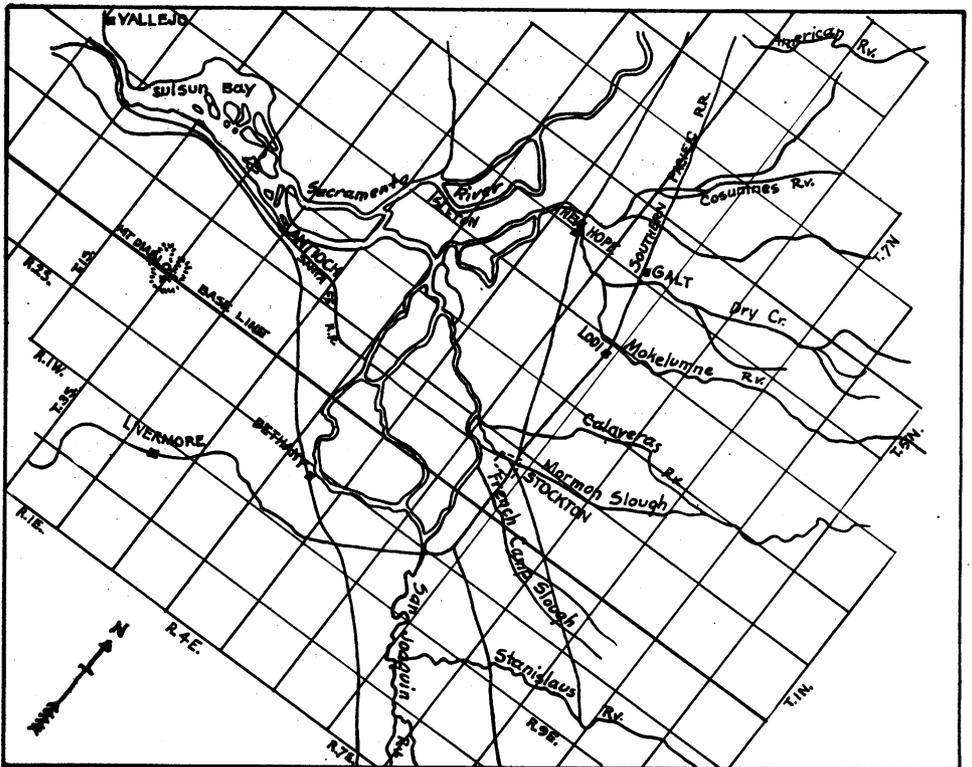


Fig. 1. Sacramento-San Joaquin Delta region.

mately from the center of township 5 N to the Mount Diablo meridian, about 25 miles (fig. 1). On the west we begin in the tidal marsh and extend our survey some 15 miles to the east: approximately from the center of range 4 E to the eastern line of range 7 E. To delimit such an area in the absence of marked physical barriers is in a sense arbitrary. Yet there are physical reasons for such a limitation.

TOPOGRAPHY

Elevation

Neither Carquinez strait nor Suisun bay marks the expectable termination of sea level. Instead, it is necessary to proceed about 35 miles east of the strait before the land begins to show a definite rise. From here it rises at the rate of about six feet in a mile until 50 feet elevation has been attained at the eastern limit of the area. Thus it will be seen that our area is the eastern shore of the great sea marsh of the San Joaquin-Sacramento delta at its widest, most pronounced, and most characteristic point. The survey extends both east and west of the present sea level contour line a sufficient distance to allow for variations and to make certain that one has passed definitely into the marsh on the one hand and out of it on the other. On the east we stop before reaching the foothill region.

Streams

This region has been changed by drainage and irrigation projects and by the clearing and leveling of land for agricultural uses. In these processes many of the minor physical features have been obliterated, but the major features can still be accurately detected. Above sea level the entire area was uniform in its general aspect, appearing as a level plain the principal topographical features of which were several watercourses crossing it from east to west. The divides between these streams were imperceptible. The streams are mentioned and briefly characterized below in the order of their occurrence from north to south.

Cosumnes river.—This is a perennial stream with a drainage basin of 580 square miles and an average annual discharge of about 880,000 acre-feet. It discharges into the Mokelumne river just before that stream debouches into the sea level marsh. Within our area the Cosumnes exhibits marked delta characteristics, with a very indefinite bed, many shallow channels, and marked meanders. It probably shifted its course readily over comparatively wide areas, and has formed sloughs, lakes, and marshy tracts. Only the high spots on its banks would appear to have been habitable; but these were available the year around.

Dry creek.—This is a rather prominent but intermittent stream rising in the foothills east of our area. It has a drainage bed of 280 square miles but an average annual discharge of only 162,000 acre-feet. Its bed is wide and shallow and there is little or no stream trench. The lower reaches felt tidal influence and possibly contained more or less stagnant water the year around.

But the same region would have been subject to inundation during the summer floods. Hence living here, if not actually limited, would at least be more satisfactory during the autumn and winter.

Jahant slough and Tracy lake.—Jahant slough was broad and shallow with a wide bed and no stream trench. It was very tortuous and received a number of similar tributaries before terminating in Tracy lake, which at times communicated with the Mokelumne river. The slough probably carried only flood waters, but its banks must have been above ordinary high water. The lake varied in size, with marshy banks unsuited to permanent human residence.

Mokelumne river.—Rising in the high Sierra Nevada, the Mokelumne is a typical mountain stream during a course of about 75 miles. It then debouches from the mountains 10 or 14 miles east of our area, which it crosses receiving the previously mentioned streams as tributaries. Upon reaching sea level its delta becomes very confused; so much so that some authorities consider it as the southernmost tributary of the Sacramento while others take it to be the northernmost affluent of the San Joaquin. No doubt its channels here have frequently changed. In our map (fig. 1) we plot it in general accordance with the California State surveys of 1886 and consider it an affluent of the San Joaquin, although it is connected with the Sacramento river by a slough just after reaching sea level.

In size the Mokelumne river is not only the principal stream of our area, but is the largest of the San Joaquin's tributaries, having an annual average discharge of 1,600,000 acre-feet without including the Cosumnes and Dry creek. With these streams the Mokelumne's discharge of 2,642,000 acre-feet is about 22 per cent of the entire San Joaquin valley run-off. The 1,600,000 acre-feet of the Mokelumne proper are collected in a drainage basin of 657 square miles, so that the run-off is about 2500 acre-feet to the square mile. This may be contrasted with a run-off of about 1000 acre-feet to the square mile for Kings river, the San Joaquin's next largest tributary. Since the type of rock through which the two streams flow is essentially the same, the Mokelumne has a much higher rate of erosion and deposition. The result is that the alluvial fan of the Mokelumne is of lower slope than any other San Joaquin tributary, and the river tends to drive its burden along a channel once cut rather than to spread out over the fan with each new freshet. The Sacramento river, sweeping down from the north, encounters the Mokelumne's deposit and is deflected thereby to the west, but is able to carry away a large part of the Mokelumne fan. This interaction is of interest archaeologically, since it seems that as a result, the Mokelumne would offer a comparatively old delta surface, parts of which might remain with no radical change for a very considerable period of years.

Across our area the bed of the Mokelumne is at present very definitely marked. At the east it averages about one-half mile in width and banks about 10 to 15 feet in height. Toward the west the banks gradually recede and decrease in height until the bed is lost in the marshy area. Within this bed the river has incised a channel about 80 feet wide and 15 to 20 feet deep which normally will more than contain the stream. However with each annual freshet the river gets out of this channel, cuts in part a new one within the bed, and leaves lakes, sloughs, and marshes. Hence one would not expect residence within the bed of the stream upon the immediate channel but rather along the banks of the bed. These offered sites not only above floods but within convenient reach of perennial water and the life of the river and river bottom.

Bear creek.—This watercourse was composed of several very slightly entrenched channels that ordinarily lost themselves before they came together a little east of sea level. It was a wet-weather stream and although its banks were above high waters the lack of water must have rendered them undesirable living sites. Bear creek breaks what would otherwise be a rather extensive streamless area between the Mokelumne and the Calaveras.

Calaveras river.—This river rises in the foothills but appears to have been a perennial stream. Its total course was not much over 50 miles; its drainage basin 490 square miles; and its average annual discharge only about 340,000 acre-feet. The Calaveras is in marked contrast to the Mokelumne, for it does not present the wide secondary bed, but simply the primary, narrow channel. It reaches sea level and joins the easternmost channel of the San Joaquin about three miles west of the center of the present city of Stockton. Apparently its banks would have been suitable permanent living sites.

Mormon slough.—The Calaveras river leaves the hills about twenty miles from its mouth and at 125 feet elevation. Here it divides, north as the Calaveras river, south as Mormon slough. It seems evident that at times Mormon slough was the more important branch of the river, for it passed through the center of what is now Stockton and emptied into the San Joaquin about two miles above the Calaveras. These two branches of the Calaveras are reminders of the instability of the streams of our area when long periods are under consideration.

French Camp slough.—A few miles south of Mormon slough a series of channels came together and formed French Camp slough. Some of the upper channels seem to have connected with Mormon slough. But all these appear to have carried water only in wet weather. The slough itself had vague banks but being subject to tidal influence probably carried water all year. This region doubtless offered many attractions to primitive man, even though much of it must have been inundated during the periods of high water in the San Joaquin.

LODI REGION

The north bank of the lower Cosumnes is our northern limit. For convenience we will call the area from this northern boundary to Bear creek Lodi region.

STOCKTON REGION

The southern bank of French Camp slough is our southern limit. Also for convenience, we will refer to the area between this southern boundary and Bear creek, including the banks of Bear creek, as Stockton region.

TRAVEL

Travel, among primitive man, must have occurred either when a group of people abandoned their living site and moved to a new site on account of pressure, economic or *vis armis*, or when members of a group regularly traveled from one known spot to another in search of supplies, articles of trade, etc. Some routes were likely to be used in one case, but were not suitable in the other.

Taken as a whole, the Great Central valley of California was singularly inaccessible. On the north for several hundred miles was a jumble of mountains, with streams in precipitous canyons and much heavy timber. Here and there were isolated valleys suitable for habitation. Groups creeping from site to site because of pressure might have penetrated this country and entered the valley of California. But it seems unlikely that frequent or regular interchanges would subsequently have taken place through this region. On the east the mountain barrier was one of the most formidable in North America and beyond it were many miles of broken, barren, and extremely arid country. Granted that man reached the eastern base of these mountains, the only practical passes over the northern and central portions of the range were furnished by the Feather and American rivers.⁴ Barring these, one must go to the extreme south, where the Sierra Nevada breaks down to the Tehachapis, for a pass into the central valley. Here, notably, is Walker's pass, used by the early American immigrants who were deflected by the range farther north. Here also, at the beginning of the historic period, there appeared to be taking place an infiltration of Shoshonean groups. From the nature of the country there seems little likelihood of groups having ever been forced across this eastern barrier. There is some evidence, however, that it was occasionally traversed, e.g., the Miwok, overlooking the valley, knew the Mono, east of the range, as salt people. On the south the Tehachapi mountains offered several passes leading into the Mohave desert or to southern California. It seems highly improbable that in the desert country enough pressure could be brought to bear to determine group movements. From southern California the most natural

⁴ Mr. Dron, a civil engineer with much experience in this country, informs us that roughly parallel with the Tioga pass and road and about thirty miles south of it is Mammoth pass, which attains an elevation of only about five or six thousand feet and is a comparatively easy route for foot travel. It debouches into a very broken country at the head of the main San Joaquin river. Mr. Dron believes that this route was used by the Indians, because there were present on the western side of the range implements apparently made from obsidian obtained from a deposit near the eastern end of this pass.

routes led up the coast. On the other hand, the passes to both regions were apparently used for trade; for in the earliest historical accounts are details of interchange with both the Colorado River tribes and those along the Santa Barbara channel. On the west the situation is more confused. It is generally assumed that the Pacific ocean was an absolute barrier to the aborigines who peopled, or afterwards lived in, California. Hence the coastal valleys must have been peopled from the north, the south, or the central valley. The coastal ranges though generally uninviting were seldom impassable and offered no serious obstacle to intercommunication. The easiest crossing was offered by the break in the ranges, which extends for some miles north and south of Carquinez strait. But there is ethnological evidence that, both in the south and north, groups occupying coastal valleys had spread across the mountains to the interior, or possibly vice versa.

Turning more specifically to our area, it will be observed that the American river debouches from the mountains only a few miles north of Lodi. Moreover its headwaters are adjacent to those of the Cosumnes and Mokelumne. From this it seems reasonable that some slight influence from the east might have reached our area quite directly, but that intrusions from this direction would be rare. From the north and south nothing could reach the area without first traversing 200 miles or so of the valley and passing through a series of other groups. Intercommunication in these directions, except with immediate neighbors, must have been quite restricted. To the west, the greater part of the floor of the valley was covered by a series of sluggish, many-branching river channels, sloughs, flood-water pools, islands covered with a dense growth of tule reeds (*Scirpus lacustris*), and coarse grasses. This vast marsh stretched many miles north and south of our area and was about thirty-five miles wide in front of it. At this point the marshy character is most pronounced since here the two great river systems commingle at tide level. That such a marsh offered impediments to travel is obvious, but that it was a restraining obstacle does not appear. Accounts of early explorers indicate that difficulties deflected travel but neither the explorers nor the aborigines were prevented from crossing the valley. However, it seems to have been necessary to go about 25 miles north or south of our area to effect such a crossing. This, of course, refers to travel by foot. To any group with the ability to use a boat or raft the channels offered hundreds of paths easy to traverse. Finally, Mount Diablo well beyond the western margin is plainly visible from all the central and eastern edge of the

valley and would have been a guiding landmark to travelers. Our area, then, was difficult to approach directly from any direction; but the way across the marsh to the sea appears to have been the most promising. The tule marshes offered isolation or refuge, and even allowing for the indirectness of the route, the shores of San Francisco bay could be reached in three or four days.

CLIMATE

The climate of the San Joaquin-Sacramento delta region is temperate and healthful. Its position opposite a low point in the coast mountains permits the moderating influence of the sea winds to affect the temperature of all seasons. The average January temperature is about 46° F. There is seldom freezing weather or snow. The lowest temperature recorded is 18° F. In the summer some very hot days are experienced; 115° F has been recorded. But the average for July and August is only about 72.5° F.

The region is comparatively arid, the average annual rainfall being only about 15.5 inches. This occurs from November to March. The balance of the year is rainless. However, this is not an entire measure of the humidity. Tidal influences extended clear across the valley floor. Both this area and strips to the north and south were moreover subject to inundations when the Sierra Nevada streams were in flood. This usually occurred after the valley rains, that is, in the late spring or early summer. The evaporation which the high temperatures and these marshy conditions occasioned created a humidity that must have rendered the eastern foothills or the bay shores much more attractive at this time of year. The fact that the Spaniards made most of their trips into the interior in October, reflects climatic conditions. The early ranchers grazed the overflowed lands in the summer, or sent their cattle to the mountains. With the coming of the rains, grass and cattle returned to the lower slopes. This is some indication possibly of the earlier movement of deer and Indians; the latter preferred the hills, on account of heat and insects, until early autumn.

FLORA

The entire floor of the delta region of the Great Central valley and all the adjoining land that was subject to tidal or to seasonal inundations supported a luxuriant swamp vegetation of coarse grasses and tule reeds (*Scirpus lacustris*). The latter was so dominantly characteristic that the region was called the Tulares by the Spanish. The tule played an important part in Indian economy. The stems were used for cigar-shaped rafts called balsas, for huts, mats, cordage, and similar purposes, while the pollen, seed, and roots were eaten.

In our particular area this tule region extended along the western front below sea level, around the sloughs extending in from this marsh, along the lower Cosumnes and Tracy lake, about the old channels, lakes, and cut-offs left in the Mokelumne bed, and near the lower Calaveras, Mormon slough, and French Camp slough. Tules grew in other marshy spots, but these were limited in extent, and that portion of the area not mentioned may be considered as free of them.

The immediate bottoms of the principal watercourses were covered with a thick undergrowth, principally of willows. Wild grape vines were also abundant here, as were cottonwood and poplar trees of fair size. Along the lower Mokelumne sycamores are still found; and on the Cosumnes, buckeye trees. These doubtless had a wider range originally. Near the streams also grew quantities of lupine and amole (soaproot). The fiber of this last plant was used by historical Indians and the root was eaten, or used as a cleaning agent.

The general plain presented long stretches of prairie separated by the dense growth along the watercourses and dotted with groves of live oak and white oak and covered with a grassy sward. This country was singularly beautiful. There was no undergrowth and the oaks grew so openly as to present the appearance of a vast park or an orchard in a long-cultivated country. These oaks were large trees, some being three or four feet in diameter at the base. The acorns which they yielded were the principal vegetable food of the aborigines. Fremont states that the Indians ate some of the grasses and *Erodium cicutarium*,⁵ and that the shrub called *la yerba buena*, which was particularly abundant in the Stockton region, was used medicinally. Fremont also presents an excellent description of the countryside before its alteration by modern conditions.

⁵ J. C. Fremont, Report of the Exploring Expedition to the Rocky Mountains in the Year 1842, and to Oregon and North California in the Years 1843-44, 248-249, 1845.

FAUNA

The outstanding feature of the animal life of our area was the great abundance of a few species suitable for food supply for man, and an almost entire absence of noxious or predatory species of sufficient size to have caused anxiety. The fauna is characteristically that of a marsh belt, for although foothill forms of life are also present they are comparatively rare. Probably the dominant animal was the tule elk. From all early accounts these elk, together with deer, were present in enormous numbers and must have formed a very important item in the economy of early man. The tule elk was found in the marshes. The deer were of two species, the mule deer from the Sierra Nevada mountains and the black-tailed deer from the coastal regions. These species intermingled along the slopes of our area, but so far as is known no great seasonal movements were made. Rather, groups migrated to different regions, and finding a satisfactory habitat remained. Yet the floods of early summer in the marshes and the droughts of late summer on the plain would perhaps have caused restricted seasonal movements. Antelope were probably also present in considerable number, although in later days these were more characteristic of the open, dryer portions of the valley floor. In the marshes, particularly in the Stockton region, golden beaver were very abundant. River otter, raccoons, lowland minks, a small shrew, two species of harvest mice, and a meadow mouse were also characteristic of the tidal marsh area. With the arrival of the overland fur trapper the beaver assumed great importance. Yet even before this the Spanish accounts suggest that this animal was regarded as important by the Indian. On somewhat higher ground were found coyotes, badgers, skunks, ground squirrels, gophers, wood rats, cottontail rabbits, and jack rabbits. Wild cats and kit foxes were probably present but scarce. Bears were rare. The black bear would not be expected at all. A grizzly bear might have been met occasionally. Mountain lions were absent.

Apparently it would be hard to exaggerate the number of water fowl that were formerly present in the marshy area of the Great Central valley. Early accounts indicate an abundance and a tameness which it is hard to conceive, influenced as we are by present-day standards of such life. Kotzebue's account of the flock of pelicans attacking one of his men may be cited as an example, or Captain Wilkes's impression even in 1841 that the wild ducks and geese were barnyard fowl. In prehistoric time all the common ducks and geese

must have been so plentiful and so tame that it would have required little effort, skill, or ingenuity on the part of man to have acquired a bountiful supply of food from this source. Herons (great blue and black crowned), cormorants, cranes (sand hill and little brown), and whistling swans were also numerous. Valley quail and mourning doves were plentiful and an important food source. Flickers and California woodpeckers were also abundant and were possibly valued for their bright feathers. The principal raptors were the Western red-tailed hawk and the Pacific horned owl. Bald eagles might occasionally have been obtained and a condor even more rarely.

These facts concerning the fauna of our region are based on modern observations. Actual skeletal material from the aboriginal sites is too limited to permit conclusions. As far as it goes it confirms the recent data.

HISTORICAL DATA

The early historical information concerning the aborigines of our area, as well as the ethnological aspects of the Spanish accounts have been previously presented.⁶ The modern ethnological material of the region has been brought together by Dr. A. L. Kroeber.⁷

The country was occupied when the first white men arrived, and while the data are not exact enough for definite determinations they will at least give an idea of the number of groups with which we may be dealing, and how to arrange our sites according to the group in which they belong on the basis of the populations reported by the Spanish explorers.

Sites	Group
1-6.....	Cosumnes
7-20.....	Cosumnes or Moquelemnes
21-48, 74, 76, 87, 90.....	Moquelemnes
49-73.....	Ochejamnes
75, 80, 84, 85.....	Passasimas or Yatchicomnes
77-79.....	Yatchicomnes
81, 86.....	Cholbones
82, 88, 91.....	Passasimas
83.....	Coyboses
89.....	Cosmistas

⁶ W. Egbert Schenck, *Historical Aboriginal Groups of the California Delta Region*, present series, 23:123-146, 1926.

⁷ B. A. E., Bull. 78.

ARCHAEOLOGICAL WORK ABOUT STOCKTON

From about 1880 to 1906 Mr. James A. Barr, for many years superintendent of schools of the city of Stockton, interested himself in the archaeology of that region. During the years 1898-1901 he explored many sites and with the assistance of his father, Mr. H. H. Barr, excavated in a number of them. The result was a collection of nearly 4000 specimens, which have been used by previous writers on the archaeology of central California and which will be our main source of information for the Stockton region. Unfortunately we were limited to a few interviews with Mr. James A. Barr because he died in June, 1925, before the present work was undertaken. However his family has kindly given us free access to his collection and turned over to us his excellent field notes. We have also talked with Mr. H. H. Barr and with Mr. Edward Hughes, now vice-principal of the Stockton schools, who did considerable field work with Mr. Barr.

There are 1133 of Barr's specimens which came from outside California. The balance of his material he catalogued under 2401 numbers. Each specimen is given a separate number except beads, which are grouped in strings according to "finds." Number 2401 also includes some 290 miscellaneous clay balls. Of the catalogue numbers, 345 came from distant parts of California and no cognizance is taken of them in this paper. Fifty-one numbers came from the adjoining area on the east and eighty-nine from that on the southwest. They are used herein incidentally for comparative purposes. Forty-six numbers came from our Lodi sites. The remaining 1870 specimens constitute our Stockton material.

Barr's record states exactly where each specimen came from, whether or not with a burial, where located with reference to the burial, and, generally, the depth. Twenty-two specimens came from thirteen sites. In none of these cases were more than four obtained at one site. Since these sites are vaguely located they cannot be marked on our map and have been excluded from our table of sites (table 1). However, at least some of them were apparently equivalent to Lodi sites which we have included and their existence should be borne in mind. Barr's other sites, with the number of specimens obtained from each, are as follows:

Our number	Barr's designation	
80	Stockton Channel mound.....	422
81	3 mounds, Woods ranch, Robert's island....	19
82	Walker Slough mound.....	398
83	Ott mound.....	265
85	Copperopolis Road mound.....	32
86	Pool mound.....	400
87	Martin ranch mound.....	87
88	O. R. Smith ranch mound.....	15
89	Brant's ferry, Robert's island.....	12
90	Lewis ranch.....	21
91	Island mound.....	167
92	French Camp slough.....	10
		1848

Since Barr explored widely and received much information from farmers, etc., there seems little doubt that sites 80, 82, 83, 86, and 91 were the principal aboriginal settlements in the Stockton region. Site 80 is probably identifiable with the Passasimas village described by the Spanish expedition of 1817, but it is possible that site 82 was this village. Sites 82 and 91, being only an eighth of a mile apart, may be regarded as one settlement. In 1897 Barr met in Amador county an Indian about fifty years old who claimed to have been born on site 80. Several finds of glass beads were made on site 82. Hence these sites were inhabited into historic times. Sites 83 and 86 are on the southwestern margin of our area. From their location they appear likely to have been villages of the Coybooses or Leuchas (Pitimis or Aupimis) and consequently inhabited at least when the Spanish came in 1805, 1810, and 1811. They appear moreover to belong to what the Spanish described as different people from those of sites 80, 82, and 91.

Barr did some work in several sites on Union island near Bethany where the Spanish of 1810-11 located the Yokuts village of Pescadero.

In Barr's published catalogue he speaks of "300 sites," which is misleading if applied to the Stockton region, but which gives an idea of his experience in archaeological collecting.

The Reverend H. C. Meredith also collected in the Bethany and Stockton mounds, and on the basis of his and Barr's work produced an article on the archaeology of central California to which reference is made several times hereinafter.⁸

Dr. W. H. Holmes in his *Anthropological Studies in California*⁹ also deals largely with the Barr and Meredith collections. We shall make reference to his excellent plates in describing various articles.

⁸ In Warren K. Moorehead, *Prehistoric Implements*, section 9:258-294, 1900.

⁹ Rept. U. S. Nat. Mus., 1900, 176-178, 1902.

In 1900, Dr. Philip Mills Jones, M.D., did some archaeological excavating near Stockton on behalf of the University of California. Barr was present at some of this work. The principal digging was done at site 82, and Jones had access to the Barr collection. A summary of Jones's work and his conclusions were published in 1923.¹⁰ This paper is meant when we refer to Jones's statements.

ARCHAEOLOGICAL WORK ABOUT LODI

Since 1912, one of the authors, Dawson, has spent considerable time in collecting reports, excavating sites, and making explorations in the Lodi region. Careful notes of this work were kept, and a collection of about 8000 specimens was obtained. All specimens were counted singly except that beads were counted by the string or sack, charred fragments, by the box, and clay balls catalogued in groups. This work by Dawson will form the backbone of the present paper, because it presents most available details.

For comparative purposes reference is made to material collected near the northern and western margins of the region, principally by Mr. B. W. Hathaway of Sacramento.

SURFACE SURVEYS

The area was gone over by the authors several times. The sites determined are shown in table 1. The sites themselves, and reports from farmers, indicated early in the course of the work that the situations usually lived upon by the aborigines were near the banks of bodies of water. This point is mentioned here because the intensive surveys were largely confined to such localities and would tend to emphasize the early indication. Cultivation, which began in the 1850's, may have destroyed other sites in more exposed positions before anyone was interested in recording the finds that farmers made. A number of possible sites near the mouth of the Cosumnes river have not been included. Historic sites on that river and near the northern margin of our area which are shown by Kroeber¹¹ are also omitted because of their indefinite localization, but it seems probable that they include our site 6 and possibly site 1. On the ground nothing at present marks the old sea level shore line. This region is

¹⁰ *Mound Excavations near Stockton, present series*, 20:113-122, 1923.

¹¹ *Op. cit.*, pl. 37.

intensively cultivated, and it may be that our list is most deficient in this region. West of this line, in the old marsh, no sites have been seen or reported in the Lodi region east of the Sacramento river.

EXCAVATION WORK

The following excavating was done by Dawson, the maximum depth of the holes being indicated. Site 1, 3 holes, 456 cu. ft., 3 ft. deep; site 6, 16 holes, 3842 cu. ft., 3 ft.; site 8, 4 holes, 232 cu. ft., 2 ft.; site 14, 2 holes, 60 cu. ft., 2½ ft.; site 15, 1 hole, 120 cu. ft., 1½ ft.; site 19, 4 holes, 380 cu. ft., 2½ ft.; site 20, 4 holes, 180 cu. ft., 2½ ft.; site 26, 1 hole, 24 cu. ft., 1 ft.; site 40, 3 holes, 180 cu. ft., 2½ ft.; site 43, 31 holes, 2211 cu. ft., 3 ft.; site 44, 1 hole, 128 cu. ft., 4 ft.; site 48, 3 holes, 135 cu. ft., 2½ ft.; site 49, 1 hole, 42 cu. ft., 2 ft.; site 50, 2 holes, 48 cu. ft., 2 feet.; site 52, 2 holes, 48 cu. ft., 2 ft.; site 53, 3 holes, 30 cu. ft., 2½ ft.; site 56, 1 hole, 240 cu. ft., 3 ft.; site 57, 2 holes, 144 cu. ft., 4 ft.; site 59, 4 holes, 164 cu. ft., 2 ft.; site 66, 15 holes, 750 cu. ft., 2½ ft.; site 68, 3 holes, 2159 cu. ft., 1½ ft.; site 70, 1 hole, 43 cu. ft., 2½ ft.; site 71, 1 hole, 43 cu. ft., 2½ ft.; site 73, 2 holes, 144 cu. ft., 3 ft.

Holes were generally dug as deep as the mound mass, very little excavation penetrating the substratum. A beginning was made in the spot which experience suggested as most likely to yield burials. If subsequent holes were dug, they were placed to test other portions of the site. The amount of digging depended largely on results obtained, and cannot be taken as a final proof of what the site might yield. However, it is believed that on the whole the work gives a fairly accurate indication of the possibilities.

It will be seen that sites 1, 6, 43, 66, and 68 are the principal sites of the region. Site 1 is probably entirely historic. Site 6 was used within historic times, as it yielded two glass beads. These two sites are on the Cosumnes river; site 43 is on the Mokelumne; and sites 66 and 68 are sea level sites. The five therefore offer comparisons of the different sections of the region.

ABORIGINAL SITES

DETERMINATION

In the surface surveys by either author the first criterion used for determining an aboriginal site was the presence of a mound. Only one site (31) was seen or reported which was not so characterized. The standards then used to determine whether or not a mound had been occupied were the presence of blackish soil (the ordinary soil being yellowish or reddish in color), the presence of artifacts, of

human skeletal material (frequently brought to the surface by rodents), of non-human bones, of refuse matter. When the mound was low and there were no skeletons and few animal bones and artifacts, the place was considered a temporary camp site. If the mound was higher and yielded a considerable amount of evidence it was taken to be a living site. If human bones were found it was also considered a burial site. On such a basis the sites listed in table 1 may be classified as follows:

Temporary camp sites.—Sites Nos. 2, 13, 16, 17, 18, 31, 64, and 65. This determination depends on surface inspection only.

Living sites.—(a) Sites Nos. 14, 26, 40, 49, 50, 53, 70, 71, 85. Some excavation has been done in all these sites without revealing burials. (b) Sites Nos. 3, 4, 5, 12, 21, 22, 23, 35, 38, 41, 42, 45, 47, 51, 58, 69, 76, 77, 87. Surface examinations show these to have been considerably used as living sites but no evidences of burials were discovered.

Burial and living sites.—Sites Nos. 1, 6, 8, 11, 15, 19, 20, 24, 25, 33, 36, 39, 43, 44, 46, 48, 52, 54, 55, 56, 57, 59, 60, 61, 62, 66, 68, 73, 74, 75, 78, 79, 80, 81, 82, 83, 84, 86. In all these sites human skeletal material was found as well as evidence of the sites having been used for living purposes.

Burial sites only.—As far as our data go no sites were used exclusively for burial.

Some sites have been included in our list on reports of reliable people. These were as follows: site 7, Mrs. Nichols found beads and arrowheads on surface; site 9, J. K. Dawson found pestle and skeletons while scraping; site 10, J. K. Dawson found human bones while digging; site 12, Henry Thompson found animal and bird bones and a bead while digging a trench; site 27, Eldred E. Brown noted skeletons during construction of road; site 29, W. S. Robbins noted barren burned ground and found artifacts; site 30, B. C. Dougherty found arrowhead and skeletal material and noted black burned soil; site 31, W. H. Adams found arrowheads on surface; site 32, Anita Woock noted skeletons during scraping; site 34, Fred Hoff noted skeletons during scraping; site 37, Tony Graffigna found arrowheads on surface and noted mound; site 67, A. W. Dawes and I. W. Dawes found skeletons while constructing seepage ditch; site 72, J. F. Gilmore, A. W. Dawes, and I. W. Dawes noted skeletons when site was scraped; site 76, E. H. Ridenour found baked clay balls and mound; site 77, George W. Ashby found arrowheads and mound; site 84, College of Pacific excavation revealed considerable skeletal material.

LOCATION

In table 1 are listed all the definitely determined sites in our area. The site numbers are chosen arbitrarily and since they are used for indicating the sites on a base map, filed in the University Museum, are given for convenient reference. The situation of sites is stated by section, township, and range—Mount Diablo meridian. For help in field work the present-day names of ranches on which sites are located

are given. Naturally these names change, but a definite point of departure is furnished. Detailed locations are also given, which, though approximate in many cases, particularly in the Stockton area (75-86), are believed to be accurate enough to enable one to relocate the sites. In most cases field datum points were not available, and it has been necessary to plot and scale the United States Geological Survey topographic maps. We have adopted the method of locating the site with reference to the lines dividing sections. For example, site 1 is 2500 feet south of the line dividing section 16 from section 21, and 1800 feet west of the line dividing section 21 from section 22. The elevation given is the elevation above sea level of the *base* of the mound and was obtained by plotting the sites on the United States Geological Survey topographic quadrangles.

A glance at the base map confirms the general statement already made that the sites were usually along the streams. Sites 64-74 inclusive, although not near a stream, are near the edge of the former sea level marsh. Sites 32, 33, 34, 76, 77, 78, and 79 were on Bear creek, which has been obliterated by cultivation. Sites 53, 54, and 55 were on sloughs which have also practically disappeared. Site 31 is an exception as far as can now be determined: it is not a mound and it is not situated on any water.

Chronological Indications

There seems a possibility of establishing age distinctions through the situation of these sites. The comparative stability of the Moke-lumne delta has been mentioned. But even considering this, it seems significant that practically all the sites away from the sea marsh should be grouped along the present-day banks of the streams. The very existence of the alluvial fan shows that the Moke-lumne has shifted its course from time to time. From this circumstance the mounds along the present-day stream beds would seem to be comparatively recent. The other group of sites is that which follows the shore line of the sea level marsh. It seems probable that the sea level contour was a much more stable line than the stream banks. Accordingly one might assume as a working possibility that some of the sites along the sea level line are likely to be older than any of the sites along the streams, if we predicate any great antiquity of man's residence in the area.

TABLE 1
LOCATION OF ABORIGINAL SITES IN THE LODI-STOCKTON AREA

Site No.	Location	Ranch on which located	Elevation (about)	Detailed location (approximate)
1	SW ¼ of NE ¼ of Sec. 21 T6NR6E.	Cantrell.....	50'	2500' S 16/21 line, 1800' W 21/22 line
2	SE ¼ of SE ¼ of Sec. 25 T6NR5E.	Johnson.....	29'	900' N 25/36 line, 900' W 25/30 line
3	NW ¼ of NE ¼ of Sec. 36 T6NR5E.	Johnson.....	29'	300' S 25/36 line, 2500' W 36/31 line
4	SE ¼ of NW ¼ of Sec. 36 T6NR5E.	Allyn.....	25'	2300' S 25/36 line, 2500' E 35/36 line
5	NE ¼ of NW ¼ of Sec. 36 T6NR6E.	Allyn.....	24'	2000' S 25/36 line, 1800' E 35/36 line
6	NW ¼ of SW ¼ of Sec. 36 T6NR5E.	Johnson.....	30'	2800' S 25/36 line, 300' E 35/36 line
7	NW ¼ of Sec. 23 T5NR5E.	Nichols.....	10'	
8	NE ¼ of NE ¼ Sec. 35 T5NR5E.	Old Harvey.....	7'	500' S 26/35 line, 1300' W 35/36 line
9	NW ¼ of NW ¼ of Sec. 35 T5NR5E.	Old Harvey.....	11'	
10	NW ¼ of NW ¼ of Sec. 35 T5NR5E.	Old Harvey.....	8'	1400' S 26/35 line, 100' E 34/35 line
11	SE ¼ of NE ¼ of Sec. 34 T5NR5E.	Old Harvey.....	7'	1600' S 27/34 line, 1200' W 34/35 line
12	NE ¼ of NW ¼ of Sec. 27 T5NR5E.	Old Crump.....	5'	
13	SE ¼ of SW ¼ of Sec. 22 T5NR5E.	Old Crump.....	10'	1000' N 22/27 line, 2300' E 21/22 line
14	NW ¼ of NW ¼ of Sec. 27 T5NR5E.	Old Crump.....	5'	1000' S 21/28 line, 150' E 28/27 line
15	1300' W of Site 14.	Old Crump.....	5'	900' S 21/28 line, 1150' W 28/27 line
16	SW ¼ of NE ¼ of Sec. 21 T5NR5E.	Old Crump.....	10'	2000' S 16/21 line, 1600' W 20/21 line
17	SW ¼ of SE ¼ of Sec. 21 T5NR5E.	Old Crump.....	5'	350' N 21/28 line, 2600' E 20/21 line
18	350' E of Site 17.	Old Crump.....	5'	300' N 21/28 line, 2950' E 20/21 line
19	380' E of Site 17.	Old Crump.....	5'	300' N 21/28 line, 2980' E 21/22 line
20	SE ¼ of SW ¼ of Sec. 21 T5NR5E.	Old Glenn.....	5'	On 21/28 line, 2000' E 20/21 line
21	SW ¼ of NE ¼ of Sec. 6 T4NR6E.	McCauley.....	24'	2000' S 31/6 line, 2000' W 6/5 line
22	1600' NW of Site 21.	McCauley.....	20'	1300' S 31/6 line, 3500' W 6/5 line
23	150' W of Site 22.	McCauley.....	20'	1300' S 31/6 line, 3650' W 6/5 line
24	NW ¼ of NW ¼ of Sec. 1 T4NR5E.	McCauley.....	15'	500' S 36/1 line, 750' E 2/1 line

TABLE 1—(Continued)

Site No.	Location	Ranch on which located	Elevation (about)	Detailed location (approximate)
25	NW 1/4 of NW 1/4 of Sec. 1 T4NR5E	McGilvary	16'	S bank of Mokelumne river (E of mapped area)
26	NE 1/4 of NE 1/4 of Sec. 20 T4NR8E	McGary		
27	SW 1/4 of SE 1/4 of Sec. 35 T4NR7E	Ingils	84'	
28	Canceled.			
29	NW 1/4 of NE 1/4 of Sec. 3 T3NR7E	Prezler	79'	
30	NE 1/4 of NW 1/4 of Sec. 4 T3NR7E	Joens	70'	
31	SE 1/4 of NW 1/4 of Sec. 24 T4NR6E	Littlehale	51'	900' S 13/24 line, 1600' E 23/24 line
32	SE 1/4 of NW 1/4 of Sec. 23 T3NR6E	Beckman	34'	
33	NW 1/4 of SE 1/4 of Sec. 27 T3NR6E	Rode	25'	
34	SE 1/4 of SE 1/4 of Sec. 28 T3NR6E	Hoff	23'	
35	NE 1/4 of SE 1/4 of Sec. 35 T4NR6E	Wenzel	45'	2200' N 35/2 line, 1200' W 35/36 line
36	NE 1/4 of SE 1/4 of Sec. 34 T4NR6E	Woodbridge cemetery	45'	2000' N 34/3 line, 800' W 34/35 line
37	SW 1/4 of NE 1/4 of Sec. 27 T4NR6E	Knoll	40'	
38	SW 1/4 of SW 1/4 of Sec. 22 T4NR6E	Farrell	40'	400' N 22/27 line, 500' E 21/22 line
39	NE 1/4 of NE 1/4 of Sec. 21 T4NR6E	Perley	40'	800' S 16/21 line, 100' W 21/22 line
40	NW 1/4 of SW 1/4 of Sec. 16 T4NR6E	Williams	30'	1800' N 16/21 line, 900' E 17/16 line
41	SE 1/4 of NW 1/4 of Sec. 16 T4NR6E	McCauley	35'	2300' S 9/16 line, 1800' E 17/16 line
42	NW 1/4 of NW 1/4 of Sec. 16 T4NR6E	McCauley	30'	100' S 9/16 line, 500' E 17/16 line
43	SW 1/4 of SW 1/4 of Sec. 9 T4NR6E	McCauley	30'	400' N 9/16 line, 500' E 8/9 line
44	SW 1/4 of SW 1/4 of Sec. 9 T4NR6E	McCauley	30'	500' N 9/16 line, 150' E 8/9 line
45	SW 1/4 of SW 1/4 of Sec. 9 T4NR6E	McCauley	30'	800' N 8/17 line, 100' E 8/9 line
46	SE 1/4 of SE 1/4 of Sec. 8 T4NR6E	Smith	25'	200' N 8/17 line, 1200' W 8/9 line
47	NE 1/4 of SW 1/4 of Sec. 8 T4NR6E	McCauley	25'	2100' N 8/17 line, 2500' E 7/8 line
48	NW 1/4 of SW 1/4 of Sec. 7 T4NR6E	DeVries	20'	1600' N 7/18 line, 1000' E 12/7 line

TABLE 1—(Continued)

Site No.	Location	Ranch on which located	Elevation (about)	Detailed location (approximate)
49	SW ¼ of NE ¼ of Sec. 12 T4NR5E.	McCauley.....	15'	2100' S 12/1 line, 2200' 12/7 line
50	SW ¼ of NE ¼ of Sec. 12 T4NR5E.	McCauley.....	15'	1800' S 12/1 line, 2300' W 12/7 line
51	SW ¼ of NE ¼ of Sec. 12 T4NR5E.	McCauley.....	15'	2000' S 12/1 line, 2600' W 12/7 line
52	NW ¼ of SE ¼ of Sec. 12 T4NR5E.	Old Ray.....	15'	1900' N 12/13 line, 2300' W 12/7 line
53	NW ¼ of SW ¼ of Sec. 11 T4NR5E.	Kile.....	11'	2400' N 11/14 line, 1300' E 10/11 line
54	SE ¼ of SW ¼ of Sec. 3 T4NR5E.	Old King.....	9'	400' N 3/10 line, 2300' E 4/3 line
55	SE ¼ of SW ¼ of Sec. 3 T4NR5E.	Old King.....	9'	700' N 3/10 line, 2100' E 4/13 line
56	NW ¼ of NE ¼ of Sec. 3 T4NR5E.	Old Wheeler.....	9'	600' S 34/3 line, 2800' E 3/2 line
57	SE ¼ of SW ¼ of Sec. 3 T4NR5E.	Old Thornton.....	9'	100' N 3/34 line, 1500' E 33/34 line
58	100' NE of Site 57.	Old Thornton.....	9'	150' N 3/34 line, 1600' E 33/34 line
59	NW ¼ of SW ¼ of Sec. 27 T5NR5E.	Koontz.....	9'	1300' N 27/34 line, 100' E 28/27 line
60	SW ¼ of SE ¼ of Sec. 28 T5NR5E.	Barber.....	6'	1200' N 28/33 line, 2400' W 28/27 line
61	SE ¼ of SW ¼ of Sec. 28 T5NR5E.	Barber.....	6'	1000' N 28/33 line, 2400' E 28/29 line
62	SE ¼ of SW ¼ of Sec. 28 T5NR5E.	Barber.....	6'	1100' N 28/33 line, 2350' E 28/29 line
63	SE ¼ of SW ¼ of Sec. 28 T5NR5E.	Barber.....	6'	1200' N 28/33 line, 2000' E 28/29 line
64	NW ¼ of SW ¼ of Sec. 29 T5NR5E.	Dutard.....	1'	1600' N 29/32 line, 1500' W 28/29 line
65	NW ¼ of SW ¼ of Sec. 29 T5NR5E.	Dutard.....	1'	2400' N 29/32 line, 2500' W 28/29 line
66	NE ¼ of NW ¼ of Sec. 29 T5NR5E.	Old Glenn.....	3'	500' S 20/29 line, 1700' E 30/29 line
67	SE ¼ of NW ¼ of Sec. 31 T5NR5E.	Old Dawse.....	0'	
68	NE ¼ of SE ¼ of Sec. 32 T5NR5E.	Old Journeay.....	0'	1800' N 32/5 line, 500' W 32/33 line
69	NE ¼ of SE ¼ of Sec. 5 T4NR5E.	Vail.....	4'	2000' N 5/8 line, 1000' W 5/4 line
70	NE ¼ of SE ¼ of Sec. 5 T4NR5E.	Vail.....	4'	1600' N 5/8 line, 1300' W 5/4 line
71	NW ¼ of SE ¼ of Sec. 5 T4NR5E.	Vail.....	4'	1900' N 5/8 line, 1500' W 5/4 line
72	SE ¼ of NW ¼ of Sec. 6 T4NR5E.	Cowell.....	0'	
73	SW ¼ of SE ¼ of Sec. 21 T4NR5E.	Brack.....	1'	600' N 21/28 line, 1500' W 21/22 line
74	SW ¼ of SW ¼ of Sec. 7 T3NR6E.	Free.....	17'	1000' N 7/18 line, 400' E 12/7 line

TABLE 1—(Concluded)

Site No.	Location	Ranch on which located	Elevation (about)	Detailed location (approximate)
75	About Sec. 75, Campo de Los Franceses.....	?	40'	Barr's Copperopolis camp site.
76	SW ¼ of SE ¼ of Sec. 29 T3NR7E.....	Ridenour.....	45'	
77	SW ¼ of SW ¼ of Sec. 5 T2NR7E.....	Ashley.....	40'	
78	NE ¼ of SW ¼ of Sec. 16 T2NR6E.....	Old Vail.....	10'	2000' N 16/21 line, 2300' E 17/16 line
79	NE ¼ of SW ¼ of Sec. 16 T2NR6E.....	Old Vail.....	10'	1900' N 16/21 line, 2300' E 17/16 line
80	Between Edison & Harrison Sts. N bank Stockton channel.....	City of Stockton.....	10'	Barr's Stockton channel mound
81	About Sec. 31, T1NR6E.....	?	5'	Barr's 3 miles SW of steel bridge across San Joaquin river: E. W. S. Wood's ranch
82	About NE ¼ of SW ¼ of Sec. 22 T1NR6E.....		2'	Barr's Walker slough, Jones' No. 4 mound
83	NE ¼ of NE ¼ of Sec. 10 T1SR6E.....		10'	Barr's Ott mound (S of mapped area)
84	SW ¼ of SE ¼ of Sec. 5, Campo de Los Franceses.....	College of Pacific Campus.....	10'	
85	About SE ¼ of Sec. 84, Campo de Los Franceses.....	?	50'	Barr's Copperopolis mound
86	"9 miles SW of Stockton"		?	Barr's Pool mound (SE of mapped area)
87	About SW ¼ of Sec. 36 T3NR7E.....		70'	Barr's Martin mound
88	About Sec. 71, Campo de Los Franceses.....	Old D. R. Smith.....	55'	(Barr)
89	Robert's Island, near Brant's Ferry about Sec. 12, T1SR5E.....		7'	(Barr SW of mapped area)
90	SE ¼ Sec. 36 T3NR6E.....	Old Lewis.....	35'	(Barr)
91	1/8 mile SW of Site 82.....			Barr's Island mound. "On extreme eastern point of island 1/8 mi. SW" of site 82
92	N bank of French Camp slough.....			"¼ mile E of toll road on Grant place." (Barr.)

DESCRIPTION

From what has been said of the topography of the country, its flora, and the situation of the aboriginal sites, the general features common to all of them will be readily visualized. In table 2 some of the descriptive features of the individual sites are summarized.

Size

Since the boundaries of a site are indefinite and hard to determine after a lapse of time, the maximum lengths and widths given in table 2 must be taken as approximate. It will be noted that there is a tremendous variation in the size of the sites, the largest (site 31) having an area of 250,000 square feet and the smallest (site 17) an area of only 300 square feet. Site 31 is merely a level area over which artifacts of various kinds have been found in considerable numbers. It does not present other evidence of having been lived upon, and being far from water may be regarded as exceptional. However, large sites such as 6 and 83 are not exceptional, while there are many small sites not much larger than 17. Do these differences in size reflect cultural differences? The larger sites point to larger groups and perhaps longer periods of occupation. The smaller sites seem to suggest not only smaller groups, but seasonal and transitory activities. Nothing indicates that the smaller are older.

In some cases small mounds are found near a large one, e.g., sites 42, 44, and 45 are near 43. But more frequently several small ones are close to one another without a large mound being present, e.g., sites 49, 50, 51 form a group, also 60-63, and 69-71.

There seems to be no correlation between size and situation. Along the north bank of the Cosumnes as far as two miles from the mouth there are no large mounds. Yet large mounds are not characteristic of any particular type of locality such as the marsh shore, the oak groves, or the stream banks. A large site, e.g., 6 or 82, was apparently located with more care than a small one, and possessed a number of minor points of advantage.

Height—Artificiality

The aboriginal sites in our area are commonly known as mounds, and, with the exception of site 31 and those sites which have been altered by modern agricultural work, the appellation is technically correct. Their mound-like appearance is heightened by their differ-

ence in color from the surrounding earth, and by their being generally upon a natural swell in the ground. However, the term "Indian mound" is apt to carry connotations of the large, artificial, prehistoric structures of the Ohio valley. In no way do the Lodi-Stockton mounds resemble these. Nor do they resemble the great shell heaps of the Californian coast. All the mounds of our area are low with very gently sloping sides. Many are no more than six inches high, while the highest is recorded as five feet. In all cases the actual height is hard to determine. The mounds have weathered down, and sometimes the ground of the base has been filled in. But principally it is almost impossible to tell how much is natural and how much has been added by man. In few cases do the mounds appear isolated, in even fewer are evidences left of possible borrow pits. Rather they appear as natural topographic features similar to other such features visible, and very frequently only as part of a larger ridge. These natural features have, however, been intensified by man's residence. At site 6, the highest Lodi mound, for example, the contours of the surrounding land indicate that unquestionably part of the height of five feet is due to a natural eminence. Yet the ground of the site to a depth of three feet shows ashes, burnt earth, clay balls, and the refuse to be expected in a midden. However, to assume that this three feet was either deliberately or incidentally added by man seems risky when a site such as 68, which offers proportionally as much evidence, skeletal and otherwise, of man's residence, attained a height of only about eighteen inches. The disturbance of soil, and the alteration of much of a site to a considerable depth, cannot be taken as sure evidence of the construction of a mound. Contemplation of these sites leaves us with the impression that the aborigines when selecting living sites chose high ground to obtain drainage, or perhaps heaped up a few inches of foundation for the same purpose, but that they did not construct mounds of any height for protection in time of flood or for other reasons.

Jones reached the same conclusion for the Stockton mounds; but Meredith and Holmes deemed these mounds "reared as places of habitation in an annually inundated country." Gifford states that on the Cosumnes river in Sacramento county (just north of our area)

were artificial mounds which were heaped up to form a sufficient elevation to preserve the huts from flood waters. The earth for such a mound was carried in baskets on the heads of villagers and dumped in the appropriate spot to form the village site. Proximity to food supply influenced the selection of the site and prompted the laborious process of mound building. In the case of the

mound which I examined it was said that the abundance of oak trees and the proximity of the affluent Deer creek influenced the selection. It is said that the building up of such a small mound took about a week and that all of the men and women of the community participated in the work. Such a site is said to have been occupied the year around, winter and summer.¹²

The structural details of the mounds we have examined do not seem in harmony with this explanation of Gifford's informant. Moreover the time for gathering acorns would be during the season when there were no floods.

Position

The situation of settlements near streams has been commented on. The orientation of the major axis of different sites as given in table 2, while showing no uniformity with reference to cardinal points, does show that the dwellings were generally stretched along the adjacent stream, as would be expected. Such an arrangement gave the most ready access not only to water but to the luxuriant growth of the stream bottoms. Minor points of advantage in situation may be detected, but a discussion of these involves considerable rationalization, and the differences seem unimportant when compared with the basic similarities common to all sites in our area. (The possible division into marsh shore sites and stream bank sites is excepted.) The farther east the site the less was the likelihood of inundation in times of flood. However, as the summer floods came when the mountains offered many advantages, it seems probable that the low-lying sites were not then occupied. Moreover, when floods came there seems no motive which would have caused men to have remained within their influence either on natural eminences or on artificially raised ground when a mile away an abundance of high ground was available offering essentially the same advantages as the inundated sites.

Condition

Under this heading in table 2 it is indicated whether or not the site had been disturbed by cultivation before coming to our notice. The indication is for major disturbances only, minor ones not being here taken into account. These sites are a favorite place for rodents' burrows, probably for the same reason that they were selected by man—comparative dryness. The burrows help to reveal the interior of unexcavated sites, but when one is working in a total deposit of

¹²E. W. Gifford, *Southern Maidu Religious Ceremonies*, *Am. Anthr.*, n.s., 29: 214x-257x, 1927.

three feet or less the shifting which rodents bring about throws a cloud of suspicion over possible stratigraphic evidence. In many places a very considerable proportion of the site has obviously been disturbed by such burrows. When one remembers that the rodents have probably been operating since the abandonment of the sites by the aboriginal residents, he realizes that their cumulative effect is by no means to be ignored. On the surface of some of the mounds, more or less definite depressions, such as might result from house pits, are discernible. But in general these are so vague and so irregular that no particular conclusions can be drawn from them. The sites on which depressions have been particularly noted are:

Site No.	Diameter of depression (feet)	Shape of depression	Depth of depression (feet)
6	140	irregular	1½
10	20	circular	½
17	12	circular	½
42	20	circular	1
43	25	irregular	1
45	30	circular	1
46	15	circular (two)	1½

The depression in site 6 is exceptional, inasmuch as the whole center of the mound is involved. It seems to reflect an original irregularity of the site rather than the work of man.

Shape

The data pertaining to shape are not very conclusive, inasmuch as the limits of a site are often indefinite. Settlements, originally laid out in regular, square, or rectangular form, would in the absence of permanent walls break down into indefinite mounds roughly circular or elliptical in outline. Also the hillocks and ridges upon which the settlements were situated would tend to give a circular or elliptical appearance to the site. On the other hand, the remains of a single large house such as the historic Indians of the region constructed¹³ would be expected to leave a circular trace similar to our smaller sites. Several such houses strung along the bank of a stream would leave an elliptical site. In view of this it is interesting to note that all our small sites are circular, and it seems likely that they represent single dwellings. The large sites are typically elliptical, such as would result

¹³ A. L. Kroeber, B. A. E. Bull. 78:447.

from a cluster of such dwellings. Site 6 was apparently the largest Lodi settlement, and on the basis of shape and size might have consisted of upward of 50 smaller houses.

Sites 31, 38, and 57, although large, are circular in shape. Allowance must be made in the case of both 31 and 57 for the obliteration of outline by cultivation. Site 38 may have been imperfectly observed or it may be an exception.

Age

If our smallest site (17) represents a single family of say six persons we have one person to every fifty square feet of site. On this basis all the Lodi sites would represent a total population of probably 10,000 and not over 15,000 persons. However, from the Spanish accounts, ethnological records, and the size and character of the individual sites it is certain that the mounds were not concurrently occupied and the current population was more likely about 500. Such a population would, as a unit, have to make thirty different moves in order to account for the site space observed. If we knew the intervals between moves the age of the oldest site might be approximated. Some sites are obviously temporary camp sites of small groups engaged in seasonal occupations. The uniformity of character, the small amount of variation in human accumulation, the number of sites suitable in size for the major units of the population, all point to more or less equal periods of residence between moves.

From some of the sites (see Strata, site 68) evidence is obtained pointing to a comparatively short term of residence on the average site. Suppose this to be two generations, then our thirty moves would account for the mounds observed in 1500 years. This estimate is highly speculative, and time of non-residence in the area is not accounted for; but the relatively recent age for the oldest mound is in keeping with the suggestion obtained from the sites along present-day stream banks.

TABLE 2
DESCRIPTION OF THE ABORIGINAL SITES OF THE LODI-STOCKTON AREA¹⁴

Site No.	Length in feet	Width in feet	Height in feet	Orientation	Shape	Condition
1	200	100	3	NE-SW; P.	Ell.	Und.
2	40	20	1/2	NW-SE; P.	Ell.	Und.
3	200	100	3	NE-SW; P.	Ell.	Und.
4	60	25	1 1/2	N-S	Ell.	Und.
5	25	25	1/2		Cir.	Und.
6	600	300	5	N-S; P.	Ell.	Und.
7	?	?	?	?	?	Und.
8	160	50	1	NE-SW; P.		P. De.
9	?	?	?	?	?	P. De.
10	300	80	3	E-W	Ell.	Und.
11	?	?	?	?		Des.
12	50	50	1 1/2		Cir.	Und.
13	35	35	1		Cir.	Und.
14	130	40	2	E-W; P.	Ell.	Und.
15	130	80	1 1/2	?	Ell.	P. De.
16	25	25	1/2		Cir.	Und.
17	20	15	1/2		Cir.	Und.
18	30	20	1/2	N-S	Ell.	Und.
19	20	20	1/2		Cir.	Und.
20	250	100	1/2	NE-SW	Ell.	P. De.
21	60	60	1 1/2		Cir.	Und.
22	80	80	2		Cir.	Und.
23	80	80	2		Cir.	Und.
24	60	25	0	E-W; P.	Ell.	Des.
25	40	40	0		Cir.	Des.
26						
27	?	?	?	?	?	P. De.
28	?	?	?	?	?	Und.
29	?	?	?	?	?	Und.
30	?	?	?	?	?	Des.
31	500	500	0		Cir.	Und.
32	?	?	0	?	?	Des.
33	135	40	0	NW-SE	Ell.	Des.
34	?	?	?	?	?	Des.
35	100	35	1	E-W	Ell.	P. De.
36	?	?	0	?	?	Des.
37	?	?	?	?	?	Und.
38	300	300	1/2		Cir.	Und.
39	50	25	1 1/2	N-S	Ell.	P. De.
40	150	60	1 1/2	NW-SE	Ell.	P. De.
41	30	30	0		Cir.	Und.
42	30	30	0		Cir.	P. De.
43	300	150	3	N-S	Ell.	Und.

¹⁴ The following abbreviations have been used: P., main axis more or less parallel to stream; Ell., elliptical in plan; Cir., circular in plan; Und., not noticeably disturbed by man; P. De., partly destroyed; Des., destroyed; Cov., partly covered by a levee; Cut, cut through by a road.

TABLE 2—(Concluded)

Site No.	Length in feet	Width in feet	Height in feet	Orientation	Shape	Condition
44	30	30	3		Cir.	Und.
45	50	50	3		Cir.	Und.
46	120	30	0	N-S; P.	Ell.	Des.
47	120	120	1½		Cir.	P. De.
48	60	25	1½	NW-SE	Ell.	P. De.
49	50	25	1½	E-W; P.	Ell.	Und.
50	25	25	1		Cir.	Und.
51	30	30	½		Cir.	Und.
52	60	60	1		Cir.	P. De.
53	180	60	3	E-W	Ell.	Und.
54	100	25	1	N-S	Ell.	P. De.
55	80	20	1	N-S	Ell.	P. De.
56	60	25	3	NE-SW	Ell.	Und.
57	300	300	0		Cir.	Des.
58	30	30	0		Cir.	Des.
59	100	40	0	NE-SW	Ell.	Des.
60	?	?	0	?	?	Des.
61	?	?	0	?	?	Des.
62	?	?	0	?	?	Des.
63	?	?	0	?	?	Des.
64	20	20	½		Cir.	Und.
65	60	20	½		Ell.	P. De.
66	145	80	3	N-S	Ell.	Und.
67	?	?	?	?	?	P. De.
68	130	65	1½	NE-SW	Ell.	P. De.
69	20	20	1½		Cir.	Und.
70	20	20	1½		Cir.	Und.
71	25	25	1½		Cir.	Und.
72	?	?	0	?		Des.
73	250	60	2½	NW-SE	Ell.	Und.
74	100	30	0	N-S	Ell.	Des.
75	?	?	?	?	?	?
76	?	?	?	?	?	Und.
77	?	?	?	?	?	Dis.
78	0	0	0	0		Des.
79	0	0	0	0		Des.
80	300	?	2	P.	Ell.	Cov.
81	?	?	?	?	?	Dis.
82	100	75	7 ¹⁵	P.	Ell.	Cov.
83	ca. 1 acre		3			Cut.
84	?	?	?	?	?	Des.
85	ca. 1½ acres		?	?	?	?
86	?	?	?	?	?	?
87	ca. 1 acre		?	?	?	?
88-92	?	?	?	?	?	?

¹⁵ Jones's estimate.

STRUCTURE OF MOUNDS

BASE

While our area as a whole is remarkably level, erosion has produced near the streams gentle swells and low ridges and hummocks. The tops of these more or less conform to the general slope so that they appear as heights only in relation to their immediate vicinity. These relatively high places usually constituted the bases of our mounds. In other words, though higher ground for residential purposes was obtainable back from the streams, nearness to a stream appears to have been the controlling factor in the situation of settlements. Once drawn to the stream banks, the settlements were made upon the ridges instead of in the gullies and swales between. With reference to their bases our sites may be divided as follows:

(Sites 75-92 uncertain.)

On a natural ridge: Sites 1, 3, 6, 8, 10, 13, 14, 15, 17, 18, 19, 20, 21, 22, 23, 35, 38, 40, 42, 43, 44, 45, 47, 48, 49, 50, 51, 52, 53, 54, 55, 56, 64, 65, 69, 70, 73.

On natural knoll: Site 16.

On rolling ground: Site 2.

On level ground: Sites 4, 5, 12, 59, 66, 68.

The use of a comparatively isolated mound for residential purposes might obscure the presence of an original natural height especially when it was as low as the bases of sites 4, 5, 12, 59, 66, 68 must have been. Still such mounds impress one more strongly as being artificial than do those situated on the ridges.

Certain sites, notably 19, 49, 59, present an interesting problem inasmuch as their bases are below the present level of the immediately surrounding land. See *Subsurface mounds*, p. 329.

MOUND MASS

Upon a mound's base there is found a mass of earth essentially the same as the base and the surrounding land, but which has been acted upon by man until in color, texture, constituents, or all of these it is readily distinguishable from the base. Such masses constitute the "mounds" of this paper. When the base is a natural ridge and is therefore more or less rounded, a typical cross-section of the mound mass would be a lune or crescentic figure about as shown in *a*, the upper sketch of figure 2. When the base is flat (sites 4, 5, 12, 59, 66,

68), the cross-section exhibits a more or less flattened semi-elliptical figure as illustrated in the lower sketch of figure 2.

In color the mounds are characteristically blacker than the surrounding soil. This is particularly striking after the ground has been plowed. Presumably this darker color is due to the greater amount of organic matter which man has accumulated upon them.

In texture the earth of the mounds is commonly supposed to be more mellow, to work more easily into loam, and to leave fewer clods. This belief is not limited to our present area but seems widespread in

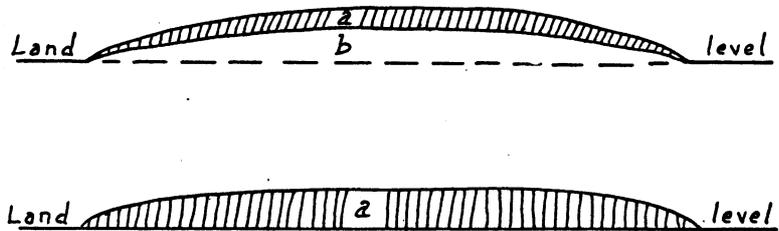


Fig. 2. Diagrammatic cross-sections of typical mound masses.
a = mound mass; *b* = natural ridge.

rural communities. It may be interesting therefore to characterize the Lodi sites on the basis of their adaptability to agricultural purposes.

Mounds not worked because surrounding land is not cultivated: Sites 10, 12, 13, 14, 15, 16, 17, 18, 19, 20, 47, 49, 50, 51, 53, 73.

Mounds growing better crops than surrounding lands: Sites 1, 3, 6, 33, 42, 43, 45.

Mounds upon which crops cannot be raised on account of sterility or roughness: Sites 59, 64, 65, 68.

Mounds growing crops neither better nor worse than the surrounding land: Sites 2, 4, 5, 8, 21, 22, 23, 24, 25, 26, 35, 40, 41, 46, 48, 52, 54, 55, 56, 57, 58, 69, 70, 71, 74.

The maximum thickness of mound mass which we have observed is forty-eight inches in sites 6 and 43. In most mounds the extreme would be 30 inches. The minimum is zero where a few surface indications were observed.

In Jones's Stockton mounds 1, 2, 3, the mound mass was about thirty inches, but at site 82 he found burials between five and six feet deep. His data from this mound are exceptional; for some of the burials were eight inches below what we would normally consider the mound mass. These burials were surrounded on all sides by the soil of the substratum, which showed no trace whatsoever of man's

presence or work except at the point of burial (fig. 3). This situation seems to indicate that some sites or portions of a site were used for burials before they were resided upon.

The height of the mound is not always an index of the thickness of the mound material, but it is generally a fair guide and shows that in the great majority of our sites the minimum rather than the maximum thickness is approached. This thinness seems important when it is remembered that the mass is not necessarily an accretion of new material but includes that originally in place which may have been disturbed by man's residence. One set of fire pits, dwellings, and graves would carry the disturbance to the average depth noted. One is tempted to go further and interpret the meagerness of even the thickest mass to mean a short term of occupancy.

STRUCTURAL DETAILS

Strata

Excavations have covered very considerable proportions of some of the mounds, but in no case has a series of cross-sections been run entirely across a mound. Therefore comprehensive details of internal structure cannot be presented. Such a study by a competent geologist should give us definite and interesting information in regard to relative ages.

It is the writer's observation that differences which appear as strata in short trenches are most frequently reduced to the relative unimportance of pockets when the horizon is extended. Perhaps, then, it is doubly significant that we have to report so few comprehensive strata or layers which might be taken to characterize really large horizontal areas of a mound.

Jones in his account of site 82 described seven strata, revealed by a drainage ditch. The essential elements are presented in our figure 3. A speculative interpretation by the present writer is as follows:

The burials in stratum VII suggest that part of a natural mound was used for burials before it was resided upon. Stratum VI represents a period of residence followed by a period of abandonment, when stratum V was accumulated. Stratum IV represents another living period which was followed by abandonment and the accumulation of stratum III. The difference between V and III is marked and the character of III suggests a silting over of the mound when under an unusually high flood, i.e., San Joaquin river influence. Stratum II shows residence again but the scarcity of artifacts is remarkable. I represents accumulations since the abandonment after II. Its great thickness, six times V, is puzzling. These data are presented partly because they refer to

one of our principal sites, and partly because they illustrate our contention regarding "strata." Jones estimated that the habitable portion of this mound was fifty by forty feet. Without exhausting its contents Barr exhumed over fifty bodies from it, many of them from the upper portions. It seems utterly impossible that so many burials could have been made in such a limited area and the mound still have presented the ideal strata described by Jones. He must have been dealing with small local pockets. Moreover this site was inhabited within historic times, and the upper eighteen inches would have had to accumulate in some seventy-five years, apparently without the assistance of man. If such accumulation can take place we have a fairly definite indication that none of the mounds which have masses about thirty-six inches thick need be older than 150 years even if man added nothing to them.

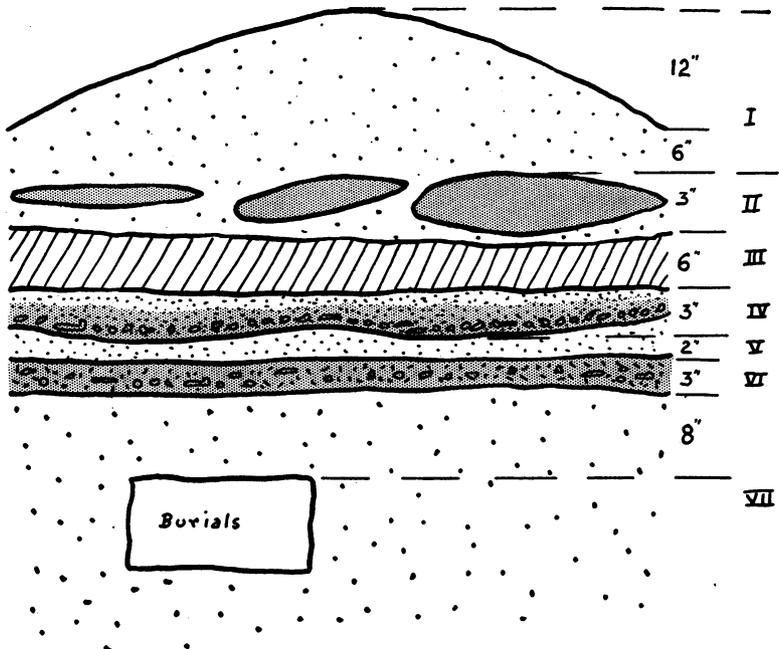


Fig. 3. Diagrammatic cross-section of Jones's excavation in site 82, Stockton. I. Light yellowish brown clay with sand and humus. II. Ash pockets, 2"-2' in diameter, trace to 3" thick. III. Black adobe. IV. Light yellow sandy clay shading into ashes with artifacts and refuse. V. Same as upper part of stratum IV. VI. Sandy soil mixed with ashes, artifacts, and refuse. VII. Tightly packed, yellowish brown clay substratum

Covering the entire surface of site 68 like a cap was a stratum of ground so hard that it could be broken into only with the greatest difficulty. This varied in thickness from eighteen inches to ten inches at the edges. Apparently this was not the original surface, for an attempt had been made to cultivate the site; and it seems probable that the surface layer had been scraped off. At sites 64 and 65 this same hard stratum was noted on the surface, but these sites had

also been cultivated. A similar stratum was reported on site 63. The surface of site 56 was covered with refuse from a hogpen to a depth of perhaps twelve inches. Under this was a stratum twelve inches thick so hard and tightly packed that a pick was necessary in digging. In sites 68 and 56 there was practically no mound mass below these hard strata.

Length of Occupation

These cement-like strata would seem to be the result of an interplay between natural agencies and man's activities. All these sites (56, 63, 64, 65, 68) are within a circle one and a half miles in diameter. But in this area no such hard layers were found except in the Indian mounds. Moreover human skeletons, animal bones, and artifacts were found embedded in these strata as in a mould, where they were held so firmly that they could be removed only by carving the earth away with a knife. Firmly fixed in this hard material, beads were found in a row as originally strung. Obviously the material must have been easily workable when the burials were made in it; whereas now a man with modern tools can move only about one and a half cubic feet in an hour's energetic work and the resultant clods and lumps may be soaked in water for twenty-four hours without appreciable effect.

The binding agent in this hard layer is lime and the formation is known as a calcareous hardpan. Dean Charles B. Lipman, of the Department of Agriculture of the University, explains its origin about as follows: When a soil contains a considerable calcium content and organic decay takes place near enough for the resultant carbon dioxide to affect this calcium, calcium carbonate is formed, which penetrates the soil until beyond the influence of the carbon dioxide, when it is precipitated, forming the hardpan. Such hardpan may arise from entirely natural causes, but in the present case probably did not, since it is found only on the mounds. On these the waste of human life not only produced a greater amount of organic decay and carbon dioxide, but man also accumulated shell, bones, and ashes which increased the calcium to be acted upon. The fact that all of these mounds are located in a very low area with poor drainage might help to explain why the calcium carbonate when once formed was not dissipated but conserved and precipitated on the spot. Other mounds with better drainage would lose the calcium carbonate before it was precipitated. This hardpan is not the same in color as the ordinary hardpan found in various parts of our area (e.g., two miles east in the Mokelumne

river bed). The darker color may also be explained by the presence of a greater amount of organic matter such as man would have accumulated.

The only site where this hardpan stratum has been extensively dealt with is 68. Here the stratum extends over the entire mound practically in a single mass. There are not a number of blocks or odd masses with breaks or softer material between them. There seems an implication of time of usage here. Since the hardness is partly the result of man's activities, one would expect a series of blocks unless the activities influenced the entire mound at practically the same time. In other words, if a long period of residence on the site is assumed, then the effects of the early years of residence should have resulted in the formation of a block to which the block due to a subsequent term would not have adhered. But if the site was used for a comparatively short term, the single homogeneous mass would result. Further it would be expectable that the activities of even a small group would quickly affect so small an area as site 68 (8450 square feet). If a used area hardened, such hardened portion would have interfered with future activities and would have resulted in a short term of residence on the site. However, in thickness of mound mass, in quantity of artifacts, number of burials, indications of refuse, site 68 appears to be an average mound. From this it would appear that the average mound was used for only a comparatively short term of years (see Age).

Layers and Lenses

Our excavations were conducted in such a manner that differences between layers and lenses could not be determined. The slope of most of the mounds is so gentle that very nice discrimination would be required to say whether a layer was parallel to the base or tended to follow the slopes. We hazard the opinion that the former was the case. As far as this goes it points away from a gradual accretion during human occupancy, since such a growth would characteristically give layers more or less conforming to the mound's slopes.

The Cosumnes river has cut away the edge of site 15 exposing the following distinct and extensive layers: On top, three inches of reddish sediment; next twelve inches of hard, more or less characteristic mound material; then an inch or so heavily impregnated with charcoal; lastly a hardpan base.

The general features to be expected in the mounds may be indicated by citing examples from trenches in sites 6 and 43.

- a. 8 inches cultivated loam containing some artifacts.
15 inches recently undisturbed containing some artifacts.
8 inches recently undisturbed containing some artifacts and burials.
Yellow clay substratum, barren.
- b. 7 inches cultivated loam containing some artifacts.
9 inches recently undisturbed containing some artifacts.
16 inches recently undisturbed containing some artifacts with ashes, bird and animal bones and few artifacts except baked clay balls.
Yellow clay, barren.
- c. 7 inches cultivated loam containing some artifacts.
8 inches recently undisturbed containing some artifacts.
½ inch ashes and charcoal.
16 inches recently undisturbed loam containing encrusted animal and bird bones and portions of baked clay balls.
Yellow clay, barren.

Barr found several burials from six inches to two feet down in the yellow clay and Jones's similar case has been mentioned. Hence it seems probable that more extensive excavations in the clay would show that it contained burials more frequently than discovered.

Pockets

Pockets are frequently found. Most commonly these are of ash and some of the ash pockets are as thick as six inches, two feet long, and one foot wide. There are smaller pockets of charcoal, burnt clay, relatively unmixed soil of one kind or another, soil of different texture, animal bones, concentrated refuse, and the like. These give the mound something of the character of a raisin cake, with the relationship between the "raisins" so involved that our data are inadequate for interpretation.

SUBSURFACE MOUNDS

In several cases excavations showed that the mound mass extended below as well as above the present surface of the surrounding land. A diagrammatic drawing of the most notable cases (19, 49, 59) is shown in figure 4. Unfortunately the sections X and Y are largely hypothetical since our data are not complete. If they are omitted it is evident that the portion below the land level could be accounted for by subsurface disturbance by the aborigines, and we would have a confirmation of the expressed probability that a large part of the mound masses is due to disturbance rather than accretion. But if X and Y are included no such conclusion is possible. In such a case the general land level must have been as low as the base of the mound when the

mounds were begun, and from twelve to eighteen inches of earth have accumulated over the general surface since that time. The fact that the soil of the base of the mound and that of the present surrounding land are somewhat different lends weight to such an hypothesis. How much time would be required for such a fill is problematical. A single great flood might accomplish it.

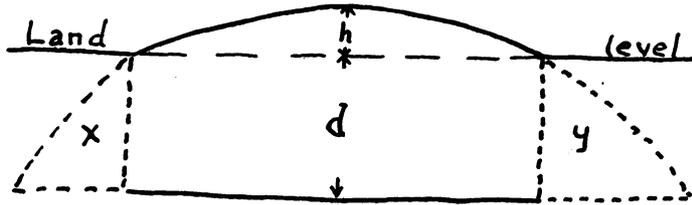


Fig. 4. Diagrammatic cross-section of subsurface mounds.

Site 19 although on a ridge is a very small part of that ridge, which is rather flat and about an acre in extent. Sites 17 and 18 are also on this ridge. Site 49 is also very small in area compared to the ridge on which it is situated. Otherwise the ridge sites would seem to argue against a fill by flooding. Judging from the situation the ridges must have been subject to floods and there is ample area to permit deposition.

COMPOSITION OF MOUNDS

SURROUNDING LAND

The soil of our entire area is the alluvium typical of the recent geological deposits. Gravel, characteristic of the older deposits, is entirely missing. Sand is present but in practically all cases it is mixed with clay in proportionally small but varying quantities, so that its presence is reflected merely by the type of soil. Where the land has been flooded within the last few years a layer of sediment has been left which is easily distinguished from the general alluvium deposit. On the north bank of the Mokelumne and along the Cosumnes this layer is reddish in color, because these banks were not dyked when hydraulic mining was under way in the foothills to the east and the red alluvium which characterizes the older geological formations was washed down and deposited. This very modern deposit of old material must be excluded from a consideration of our mounds since it does not affect their composition or structure. Elsewhere in the flooded areas the very recent sediment appears as a thin, blackish top soil.

The layer beneath the top soil varies in character. In places it is a yellow clay with a very small percentage of sand. In others it is black loam, by which term we indicate a greater proportion of sand and considerable humus. In other places it is a reddish yellow soil which through the deposition of salts becomes impervious to water and very hard. It is called hardpan.

SUBSTRATA

In the case of mounds, the soil directly beneath the mound mass is the same as that of the surrounding land if the surface soil is ignored. Where we have dug enough to determine this substratum the sites can be characterized as follows:

Yellow clay: Sites 1, 6, 43, 44, and probably 80, 82, 83, 85, 86, 91.

Black loam: Sites 40, 52, 53, 56, 57, 59, 66, 68, 70, 71.

Hardpan: Sites 8, 14, 15, 19, 20, 49, 73.

It seems possible that an intensive geological study might establish a comparative time element from these different types of substrata.

MOUND MASS

In most cases the mound mass is essentially the same as the substratum with the addition of certain elements. Site 73, which is a sandy layer on a hardpan base, appears as an exception. In other cases the surface soil of the surrounding land is different from the soil actually below the mound mass. This is not only due to the surface sediment previously described, but to the great difficulty of detecting the actual line between the mound mass and the substratum until one is well into the latter. Superior drainage, differences in the growth of plant life, and activities of rodents account naturally for a difference between the mound and the surrounding land. The second great difference is due to the actual disturbance of the soil, the mixture of its component parts, and the acceleration of natural action due to man's activities. These two sets of forces result in a change which quite generally enables one to detect an "Indian mound" even in the absence of definite human accumulations. However it is the human accumulations that surely characterize the mounds, and they are discussed in detail below.

Artifacts.—These are taken up at length in the section on material culture. From the standpoint of relative abundance of artifacts, the sites can be characterized as follows: None, site 73; few, sites 20, 40, 48,

49, 50, 52, 53, 54, 57, 70, 71, 72, 74, 79, 81, 84, 85, 88, 89, 90, 92; abundant, sites 1, 8, 14, 15, 19, 26, 43, 44, 59, 66, 68, 87; unusually abundant, sites 6, 80, 82, 83, 86, 91.

Human skeletal remains.—These are also discussed in a separate section.

Shell.—There are traces of shell in practically all mounds. In no case does this shell constitute a considerable or even a very noticeable part of the mass. It is generally present in the form of small bits with now and then an entire valve. In several instances (site 20, 150 shells six inches from the surface; site 57, 15 shells one foot from the surface; site 26, 20 shells six inches from the surface) groups of shells nested together were found. At site 82 a considerable mass of fresh-water mussel shells was found (*Gonidia angulata* Lea and *Margaritana margaritifera* Linn. have been identified). Mussels existed in considerable quantities in the marshy portions of our area and were used for food by the Indian inhabitants within historic times. Undoubtedly some of the mussels were brought to the mounds for food but the remains do not indicate that they constituted more than a small part of the diet of the aborigines. Consequently their presence or absence would not have been a controlling factor in the original locating of the sites.

Common snail shells (*Planorbis*) were also noted in quantities sufficient to suggest concentration by man, notably at sites 1, 6, 15, 19, 59. However, in 1925 after the water from the rains had subsided many thousands of these small shells were noted along the margin of the lake bordering site 6. Possibly their presence in the sites is a natural phenomenon.

Unworked marine shells were noted only at site 6 and to a limited extent in the Stockton sites. A number of unworked olivella shells (*Olivella biplicata*) were associated with shell beads and other artifacts near burials and presumably were to have been worked into beads on the spot. A few unworked clamshells (*Paphia tenerrima* Cpr.), some abalone shells, and one *Polinices lewisii* Gould were also noted. These were all associated with burials (see Articles of Shell).

Ash.—Wood ashes, a fine gray powder, were noted in all sites dug into except site 26. In many cases the ash is so mixed with the soil that its presence is detected only by the change in the color and texture of the soil. But its presence is usually more surely indicated by the occurrence of well compacted gray masses roughly elliptical or circular in shape. These pockets are as large as three feet long and as

thick as six inches. Presumably they represent fireplaces. Whether such fireplaces were on the surface or in pits is uncertain, but our limited data indicate the former. (See, for example, fig. 3 and Jones's description.) Neither have we any convincing data on the horizontal distribution of fireplaces. Ash pockets were not found in the immediate vicinity of burials, a fact which suggests that burials were made away from the fireplaces. But such an inference also implies the use of a mound by only one "set" of houses and burial places, because if more "sets" were involved the later would not be expected to coincide in situation with the earlier, and later burials, even away from the then existing fireplaces, would show an association with earlier ones. Our ash pockets are not all on one level. Some are near the top of the mound mass, others near the center, and still others at the bottom. But none have been found directly above others. This may be due to incomplete observation, for at site 82 Jones found three different levels (fig. 3) characterized by ash layers or pockets. Still the thinness of the great majority of the mound masses and the comparatively slight differences in the depths of the ash pockets (not over twenty-four inches) make a single irregular living layer, such as our observations reflect, quite probable. In "mounds 1, 2, 3, Stockton," Jones found that there were more ashes near the edges of the mounds. Our digging was generally near the center so we can offer no evidence in this matter.

Charcoal.—Charcoal was noted at all of our sites except 26. It occurs in bits scattered throughout the mound mass. Charred sticks of some size were now and then noted. Only in site 15 did it appear to constitute a definite layer. Here the lumps of charcoal were comparatively large and extended over a considerable area. This suggests a fire in the underbrush which was extinguished before complete combustion had taken place and then covered with sediment by the river which now cuts through the mound. It is hard to see how an extensive layer of charcoal would be accumulated through man's normal and continued activities (cremation excepted). In regular fireplaces the charcoal is consumed by later fires or it is broken and scattered by people walking about before it can form a definite layer, unless subjected quickly to some action which would preserve it. Charcoal might collect in depressions somewhat out of the way of ordinary activities, although such spots would not be expected on the top or slopes of small residential mounds. More data on this subject would be interesting since they might shed some light on the rate at which a mound is formed.

Many burials were noted with charred embers scattered through the soil near the skeletons, particularly at sites 6, 80, 82, 83, 86, and 91. Their presence and the absence of ash pockets points to the destruction of possessions or offerings at the time of burial.

Vertebrate remains (non-human).—Bones are found in practically all the mounds, although some of the mounds yield very few and others very many. These bones seem to be well distributed through the mound mass, although frequently absent in the vicinity of burials, and perhaps most plentiful near the ash pockets, often being embedded in this material. Most of the larger bones have been cracked open, presumably so that the marrow could be extracted. The presence of so many bones suggests that the mound dwellers did not possess dogs. After observing the effects of our own well fed dog on the refuse from camp—he left almost no bones—the writer cannot believe that a horde of half-fed Indian dogs would have left the large number of bones that are found about these sites. No systematic effort was made to preserve bones during the excavations, hence the inferences that might be drawn from such material must be foregone. Fish bones and bird bones were found in all sites except 73; animal bones in all sites. The animal bones include deer, elk, antelope, raccoon, gopher, beaver, bear (claws only), and *canis*. Jones identified in the Stockton mounds deer, elk, sheep, rabbit, duck, and geese bones. Bird bones found in the Lodi mounds included ducks and geese, horned owls, hawks, eagles, and condors. For the identification of these bones we are indebted to Miss Edna Fisher, Assistant Curator of Osteology, University of California Museum of Vertebrate Zoology.

HUMAN REMAINS

CREMATION

We interpret none of the evidence found to indicate the practice of cremation in the Lodi region. Human bones which had been scorched were noted; but such bones showed the scorching or burning on only one side and were generally in position. Some such instances might result from accidental burning, but most are probably incidental to the use of a fire at the time of burial for the destruction of property or the preparation of the site. In addition to the many fired stone artifacts found there was much evidence in the form of charred basketry, seeds, cordage, bone tubes, and the like to show that fires

frequently accompanied burials. That cremation of the body was not intended was shown by the lack of burned human bones and by the numerous cases where the burned artifacts accompanied an entirely unburned skeleton; e.g., at site 6, sixty-five pieces of burned bone implements were associated directly with an unscorched skeleton. The charred artifacts were frequently beneath such unburned skeletons. The presence of so many charred remains of such fragile materials is doubly suggestive, since the transformation of the material to charcoal would presumably be due to lack of air. These and such examples as a charred basketry cap found on an unburned skull at site 6, with strands of olivella beads still wound about it, suggest some such practice as the following: A small fire was made at the place of burial. In it were burned some of the artifacts which accompanied the dead. Then, and sometimes before the fire was out, the body was laid over the burial place and earth thrown over it. This earth smothered the fire and helped produce the many charred fragments noted. In many burials the fire was not used. With the exception of two skeletons at site 19 with fragments of charred basketry, all the associated burnt artifacts of the Lodi region were from site 6, where probably 75 per cent of the burials showed such associations. Since site 6 is at least partly historic, these charred artifacts and occasional burned human bones may represent a practice which developed in recent times.¹⁶ It is interesting to note that no such evidence came from site 68.

In the Stockton region there was more evidence of cremation. Of the 204 bodies recorded by Barr about twenty-four are described by him as "burned and decayed," "partially burned," "cremated," or in words of similar import. Four of these bodies "partly burned and an intrusive burial" were in one lot (site 86); three in another (site 86); and "four not burned so badly" were thrown in on top of three "badly burned" at site 91. Site 83, the other mound most productive

¹⁶ Kroeber, B. A. E., Bull. 78, assigns our Lodi region to the Plains Miwok (pl. 37). He states (p. 452) that "cremation of the dead was the usual but probably not universal practice of the Miwok." On the other hand the Wintun, who were at most only a few miles away to the west are said (p. 359) generally to have buried their dead. Moreover with the Wintun "property was buried with the dead in large quantities, and, in some regions burned near the grave" (p. 360); whereas with the Miwok the property was burned at an annual mourning ceremony, so that charred fragments of it would not be expected in the individual graves (pp. 429-432, 452). But B. A. E., Bull. 30:941 states that among the Miwok all the possessions of the dead were burned with them; and (p. 352) that the Cosumni residing on or near the Cosumnes river buried their dead in graves in the earth. Hathaway, who has worked mounds in Yolo county, presumably Wintun since they are partly historic, reports conditions very similar to those at site 6.

of such evidence, had more bodies buried in the clay substratum than any other site. In all these sites the evidence again suggests such incidental burning as has been described for Lodi. Jones found ten bodies in the Stockton region and no signs of cremation other than the following instance at site 82. "Immediately beneath them was a bed of ashes and charcoal, and the bones of the legs showed blackening and charring by fire."

On the whole, burial seems to have been the rule in the Stockton region. It is perhaps significant to note that Barr's most marked evidence of cremation came from the western and southern sites (83 and 86) which were more definitely in Yokuts territory. Kroeber¹⁷ states that, both among the Maidu to the north and the southern Yokuts, persons who died away from home were frequently cremated. Barr's groups of "intrusive" partially burned bodies may reflect this practice. A further possibility is that cremation applied to persons of particular importance. The remaining burial associations do not point that way either in quality, number, or complexity.

GRAVES

Horizontal Distribution

No evidence recovered indicated that sites were used for burials only; nor did it seem that a particular portion of a given mound was set aside for burial purposes exclusively.¹⁸ Further, graves did not appear to have been situated with any particular reference to a given direction or to the streams, i.e., they were not generally on the northern or western or other given directional part of a mound, nor on the side nearest to or farthest from the adjacent water. There did seem to have been a connection between the situation of the fireplaces and the graves. A grave was rarely found with one of the layers of wood ash which represented a fireplace. (In this connection the distinction must be made between the heavy deposits of wood ash and the light deposits of ash and charred material which were frequently associated with skeletons and which probably resulted from burning articles at the time of burial or possibly from cremation.) Such grave sites indicate that the dead were simply taken outside the ordinary living places for burial. The lack of coincidence in grave and fireplace sites has

¹⁷ B. A. E., Bull. 78:403, 499.

¹⁸ Kroeber (*op. cit.*) speaks of a "cemetery site" among the hill Maidu (p. 429) and of "graveyards" among the Yokuts (p. 499), but these do not seem to have existed anciently in our present area or on San Francisco bay.

been interpreted by us as pointing to a more or less contemporaneous origin of all graves and fireplaces in a given mound.

In the smaller mounds the graves usually occurred singly. As we have supposed such mounds to represent a single house site, it would seem that as members died they were buried in the nearest convenient space without particular reference to previous graves. Isolated graves were also found on the larger mounds, but more characteristically the graves occurred in these in groups. In many cases this association was so intimate that several bodies appear to have been placed in one large grave. It may be supposed that the larger mounds were more crowded and space for burials less available. Perhaps one group of graves represents the deaths during a given period of residence. After an absence and a subsequent reoccupation of the site a new grave group would be formed.

Neither the center of a mound, nor its edge, appeared to be characterized by an abundance of graves. They did appear to be more numerous on the higher portions.

Vertical Distribution

Burials occurred throughout the mound mass and in some cases in the substratum. Many burials were only six to eight inches deep, and the fact that so many are plowed out by the farmers shows that our finds were not exceptional. The deepest burials were recorded by Jones at site 82 where two were between five and six feet deep. However, it is very exceptional for a burial to be deeper than thirty-six inches.

Jones found two skeletons over forty inches deep and eight inches below any indication of mound mass (see our fig. 3). Hence they would appear to represent burials prior to the use of the site as a living-site or certainly before it was all so used. Barr also recorded instances of burials in the hard yellow clay substratum, although some of these were not over two feet below the surface of the ground. However, as other mound material seems to have been present, these instances might simply represent graves dug through the mound mass to six or eight inches below its general base. Our own excavations in the substratum were so limited that we have no evidence.

Stratification

Since the mound deposits were so thin and the graves generally so shallow, stratification was hard to detect. Jones's case, illustrated in our figure 3, has been mentioned. Barr's burial of seven partly burned bodies showed three of the skeletons forty-two inches deep and the other four "thrown in upon the three." The lower bodies showed traces of shell ornaments only; the upper ones, fifteen "Stockton curves," an arrowpoint, two pestles, and five shell ornaments. At site 75 he found at a depth of two feet a skeleton with shell ornaments and a bone awl, and one foot under it another skeleton with nothing. At site 68 practically all the skeletons were eighteen inches deep or less. Beneath one of these, thirty-six inches deep, was a skeleton with the same type of articles (crystals and shell beads) that were common above. In another portion of the site two other skeletons were found about thirty-six inches deep, but no burials were directly above these and no artifacts were present. In all these cases the upper and lower skeletons were oriented in the same general direction. At site 6, in excavating a group about two feet deep, a skeleton was found one foot deeper accompanied by a number of non-ornamental artifacts including two leaf-shaped obsidian blades. Only one other such blade was found at this site. They were comparatively abundant at site 68. In all, the evidences of stratification were meager and seem to be of little help in the matter of age.

Preparation

The evidence for dug-pit graves and that for heaped-over burials seems about even. The following points suggest dug pits: (1) It is not improbable that the mounds are due to disturbance of existing soil rather than to the accumulation of new material. In such an event the digging of graves would be expected to be a large factor in the disturbance. (2) At sites 19, 48, 56, 59, 68 skeletons were found below the surrounding land level, although it is possible that this land was built up after the burials took place, since all these sites are close to sea level. (3) The burials which have been cited as being in the substrata seem to require pits. (4) At sites 6 and 43 some ten burials were observed which appeared to be in straight-sided depressions six or eight inches deep in the yellow clay substratum. These depressions were just about large enough to hold a body. Such depressions might

represent scooped out holes. (5) A simple explanation of the varying depths at which burials were found is that burials were made in dug pits which varied in depth.

In favor of heaped-over burials are several points: (1) If these mounds were intentionally built up by man for the purpose of protecting his living quarters from floods the houses would be expected on the highest parts. Instead, these high parts are usually occupied by burials. It accordingly seems probable that the heaped-over type prevailed here. (2) At sites 1, 6, 19, 43, 66 a number of skeletons were found *on* the substrata. A simple explanation might be that gravediggers stopped when they reached this harder material. Yet there are graves in the substrata. Further, the surfaces of these substrata are not even, and the presence of the bodies in depressions, as cited at sites 6 and 43 in particular, suggests that the places were selected when the surface was visible and that these skeletons on the substrata represent covered-over burials that took place before the bulk of the mound was formed. (3) In many cases the comparatively wide distribution of associated artifacts seems to point away from the confining influence of a pit. For example, with one burial Barr found thirty-one "Stockton curves" arranged in the form of a semicircle around the feet. At another time he found a spearhead in two parts, three feet deep and six feet apart. Several similar separations were noted at site 6. (4) The charred artifacts point to heaped-over burials.¹⁹

Burials were usually shallow: even Jones's burials in the clay, with a different stratum eight inches above and no mound material with the bodies, indicate this. It seems hardly likely that pits five or six feet deep would have been dug, and such burials suggest that material was accumulated over the spots subsequent to the burials.

No evidence of the preparation of a grave by the strewing of sand, gravel, charcoal, red paint, or the like was noted.

¹⁹ In the Aleutian islands Waldemar Jochelson found heaped-over burials; *Archaeological Investigations in the Aleutian Islands*, Carnegie Inst. of Washington, Publ. 367:50-51, 1927. For suggestions of heaped-over burials at the Emeryville shellmound see Schenck, *op. cit.*, 195-197.

BODIES

Position

About 95 per cent of the burials noted in the Lodi region were outstretched, arms along the sides of the body, legs close together. Jones recorded eight burials outstretched, and only one which had the legs flexed. Barr is specific in only five cases, all of which were outstretched. Meredith says that three of the twelve bodies at site 89 were outstretched, the balance flexed. Going back nearly thirty years, with no notes, Mr. Hughes is under the impression that about half the Barr bodies were flexed. This may indicate that Barr recorded the outstretched bodies because they were exceptional, although the Jones test might be taken to indicate the practice at site 82. At any rate the large proportion of outstretched bodies in the Lodi region at least offers a noteworthy contrast to the historic customs of central California and to such archaeological data as we possess. According to Kroeber²⁰ the Wintun bodies were huddled, the Maidu flexed, the Miwok and Costanoan cremated. He does not give the Yokuts practice; but in the southern part of the Great Central valley bodies were flexed.²¹ Along the Santa Barbara channel they were flexed²² and this was almost the universal rule in the Emeryville shellmound.²³

Half of Jones's burials were on the face, half on the back. Of the six specified by Barr, five were on the back, one on the right side. In the Lodi region none were noted on the face, but we have no relative frequency data for the right side, left side, and back.

Orientation

In the Lodi region the head was always westerly, although probably half the burials vary as much as forty-five degrees from true west, and 15 per cent still more. Jones found 2 NW, 2 W, and 4 NE. Barr records only nineteen, i.e., 5 N, 9 NW, 4 W, 1 SW. Apparently throughout our area it was the intention to place the head toward the west. This was also found to be the case in the Emeryville mound and on San Miguel island.

²⁰ *Op cit.*, 359, 404, 452, 469.

²¹ E. W. Gifford and W. Egbert Schenck, *Archaeology of the Southern San Joaquin Valley*, present series, 23:47, 1926.

²² George G. Heye, *Certain Artifacts from San Miguel Island, California*, *Indian Notes and Monographs*, Mus. American Indian, 7:38, 1921.

²³ Schenck, *op. cit.*, 197.

Preparation

Little can be said as to the preparation of the body for burial. Paint found on the bones, and the position near the upper part of the body of ornamental artifacts, suggest that the corpse was adorned for burial.

Burial Methods

The same burial methods seem to have prevailed throughout our area. The most notable custom to be detected from archaeological evidence is the association of property with the dead. The burning of artifacts at the grave has been mentioned. The charring of beads, fire marks, position in ashes, all show that this burning was not limited to destructible articles. In other cases no attempt at burning is indicated, but pipes, pestles, obsidian blades, and the like have been broken or "killed" at the grave—all, or enough, of the pieces being recovered locally to show that accidental breakage is not involved. Sometimes the associated artifacts were carefully placed in position. As far as can be detected all these methods may have been used in a single burial. It does not appear that such associated articles were necessarily the property of the deceased. For example, with a child (site 83) were found a sinker, a "Stockton curve," twenty-four whistles, and four rocks. With an infant (site 83) were three "Stockton curves," one rock, an arrowhead, beads, a steatite dish, six pestles, and seven "rubbing stones." It seems particularly incongruous to consider the pestles and rubbing stones as an infant's property. Yet other instances were noted in which pestles and rubbing stones were the sole or main objects associated with burials of infants. This suggests that the articles found were the offerings of friends or relatives.

Infants seem to have been buried with no less care than adults and in the same general localities. Only one case of direct association between an infant and an adult was noted (site 68). However the very small percentage of infants found may indicate that usually they were disposed of in a more unceremonious manner and that our evidence deals with exceptional cases only.

Jones believed that the bodies near the edges of the mounds were accompanied by fewer artifacts than those more centrally located. The context makes it probable that he is reflecting Barr's opinion. Hathaway holds the same opinion for the Yolo county mounds. We have nothing to support this hypothesis. However it does appear

that the single burials contain less than those which occur in groups. As the single burials are more characteristic of the smaller mounds, some social differentiation may be implied. Hughes, Meredith, and Dawson state that flexed burials were accompanied by fewer artifacts.

Skeletal Material

Much of the skeletal material was in a very much disturbed condition when uncovered. Some skeletons were incomplete or bones appeared to have been broken after burial. In other cases portions of several skeletons were mingled, or isolated skulls were found. Much disturbance was undoubtedly due to rodents. The practice of burying several bodies in a grave was also confusing. Other explanations, suggested by Meredith, are burial after partial cremation and the reburial of bones uncovered accidentally. There seems no need to go farther afield for a cause nor to predicate any such hypothesis as dismemberment before interment.

The bones varied greatly in their state of preservation, which seemed to depend more upon the ground in which they were buried than upon their probable age. Bones in the more sandy mounds were much more decomposed than those in the hard mounds. For example, the bones from site 1, which is post-Caucasian, were very fragile, whereas those from the lime-saturated hardpan of site 68 were in splendid condition. They were white when broken, hard, and very heavy—so heavy as to suggest a definite step toward fossilization.

Unfortunately neither Barr nor Dawson saved their skeletal material. That which Jones recovered showed a normal central Californian type. But no sex and little age evidence is available. Very few infants were recorded by Barr and few were found by Dawson. This is in accordance with the results of all archaeological work done in California. Some infant skeletons were found. Hence it seems inadequate to assign their scarcity to their greater fragility. Some were buried with considerable ceremony, although others may have been disposed of so unceremoniously that traces of them are lost. A very low rate of infant mortality might also be conjectured, although a priori this seems improbable.

The teeth frequently show great wear but are almost always all present. A few pathological cases have been recorded. In one individual two ribs had been broken, lapped over, and knitted. In another case this was true of one rib. In still another a thigh bone had been broken and reunited some three inches shorter than it originally was.

A skeleton with very spongy bones was found. In another the vertebrae were fused except in the cervical region. Two vertebrae of an infant were fused. An instance of two toe bones grown together was noted. An obsidian arrowpoint of the small leaf-shaped notched type common at site 6 was found embedded in a human vertebra. Several skulls were observed with small holes in them which might have been made by bullets, and another with an arrow hole and portions of the arrowpoint inside the skull.

BURIAL ASSOCIATIONS

Later in this paper the various articles found in our archaeological sites are described in detail. Here it seems desirable to bring together some general data pertaining to their association with one another and with burials.

PROPORTION OF BURIALS WITH ARTIFACTS

It seems that not over one-quarter of all burials were entirely unaccompanied by artifacts. Jones excavated eight burials (site 82) in three of which artifacts were found. Barr records 189 burials with associated artifacts and but fifteen without. The number of burials found at the different mounds and the proportion accompanied by artifacts is indicated below.

Site no.	Skeletons seen	Percentage of skeletons with artifacts	Site no.	Skeletons seen	Percentage of skeletons with artifacts
1	6	100	75	?	?
6	102	98	78	Very few	?
8	1	0	79	Very few	?
15	4	50	80	23	100
19	6	50	81	Very few	?
20	1	0	82	53	100
43	22	90	83	26	95
48	2	0	84	Very few	?
56	2	0	85	6	70
59	4 (75 by others)	25	86	48	100
66	13	30	87	5	100
68	75	25	88	?	?
			89	?	?
			90	?	?
			91	42	65
			92	?	?
<hr/>			<hr/>		
<i>Total Lodi: 238</i>			<i>Total Stockton: Over 204</i>		

The data from some sites are uncertain. At site 6, notably, most of the burials were so confused that it was frequently impossible to determine individual associations. This placing of several bodies together makes our percentage of burials with artifacts possibly too high.

The presence of varying quantities of artifacts in graves and their entire absence in at least one-quarter of them is suggestive. The most obvious explanation is that the differences are due to variations in individual wealth. What a man possessed was buried with him. But as pointed out elsewhere the types of artifacts in many associations lead one to believe that all associated articles were not the property of the deceased. Also it seems improbable that in any Indian community even a quarter of the adult population would be entirely without a single, non-perishable article in a region where such articles existed in considerable quantities. It seems more likely that while associated articles were partly (perhaps primarily) the property of the person buried, they also represent donations from others. Accordingly they reflect the esteem in which the deceased was held and the economic status of his immediate group—the factors which impelled and enabled them to add to the property to be buried with the corpse, or which caused them to keep out even such property as he had possessed. The presence or lack of associations may indicate a difference of customs in different eras. Sites 1 and 6, where practically all graves contained artifacts, are partly modern. When, for example, site 68 shows only 20 per cent of its graves with associations, there is a suggestion that at one time the custom of burying property with the dead was not so powerful. The objection to such a view is that in many cases barren and fruitful graves are almost certainly contemporaneous. Perhaps sites 1 and 6 simply show that the general wealth was greater in modern times. Instead of reflecting a time difference the change in custom may be due to a change in groups. For example, our single graves were more frequently without artifacts and such graves characterized small mounds. Such mounds may represent a group, either contemporaneous or not, but different from the balance of the population in social status or otherwise. The presence of single or barren graves in the larger mounds would not seem to preclude such a possibility. Meredith's and Dawson's opinions that artifacts were more frequently associated with extended burials than with flexed ones bears out this hypothesis.

PROPORTION OF ARTIFACTS WITH BURIALS

If baked clay balls are omitted, 84 per cent of the Lodi artifacts recovered were associated with burials. Jones found seven artifacts, only one of which was not with a burial. About 90 per cent of all the Stockton specimens came from burials. It should be remembered that since many burials had been disturbed, the real percentage in all cases would be even higher than the apparent figure.

Clay balls are omitted because they seem to constitute a special class. They were rarely found with burials. The other types of artifacts which were most frequently not in association were bone awls, chipped stone pieces, and miscellaneous large stone artifacts. Such articles were very frequently found near ash layers. Articles not with burials were found singly rather than in groups.

TYPES AND FREQUENCY OF OCCURRENCE OF ASSOCIATED ARTIFACTS

In this section we deal only with the graves recorded as containing artifacts, i.e., 189 by Barr and 152 by Dawson. A convenient distinction may be made between ornamental objects (shell ornaments and beads of all kinds) and non-ornamental artifacts. Their relative frequency of occurrence was as follows:

Artifacts	Barr	Dawson
Non-ornamental only.....	26% of graves	10% of graves
Ornamental only.....	25% of graves	20% of graves
Mixed.....	49% of graves	70% of graves

It will thus be seen that shell ornaments and beads were found much more frequently than any other one type. These objects were found in many cases in such positions as to indicate that they had actually been worn by the corpse. In other cases they were near the head and face.

The non-ornamental objects might be expected to offer some indication of age, sex, or occupation. Age apparently is not indicated, because with infants such artifacts as pestles, awls, "Stockton curves," whistles, and the like were found in abundance. These articles were of the same types as those found with adults. Neither does sex seem to be indicated. Pestles and awls were repeatedly found in the same group with arrowpoints and "Stockton curves." Occupation may be suggested. See Concentration of Artifacts, below.

Pestles alone characterized no burials, but more graves contained pestles than any other non-ornamental artifact. About 36 per cent of

the graves had pestles. Pestles were most frequently associated with chipped stone work, which would be expected, since chipped stone is the next most frequent grave accompaniment. But it is interesting to note that 7 out of 9 Stockton pipes were in pestle-graves. In Lodi the figures were 8 out of 15.

The frequency of occurrence of other non-ornamental artifacts is given below :

APPROXIMATE PERCENTAGE OF THE ARTIFACT-BEARING GRAVES CONTAINING CERTAIN ARTIFACTS

Type of artifact	Stockton region Per cent	Lodi region Per cent
Ornamental.....	74	91
Pestles.....	36	37
Chipped stone (excluding curves).....	30	55
Stockton curves.....	19	6
Miscellaneous ground-stone objects.....	27	10
Whistles (bone).....	10	6
Awl-like implements (bone).....	10	10
Game bones.....	6	12
Other bone objects.....	10	9
Pipes.....	8	10
Plummet-like stones.....	3	4
Crystals.....	3	11
Steatite vessels.....	3	0

COMPLEXITY OF ASSOCIATIONS

The number of articles in a non-barren grave ranged from one to about fifty—beads not being counted. In about 15 per cent of the observed cases there was only one article. This would be increased to about 35 per cent for graves containing only one *type* of article. Where only one type of article occurred they were most frequently ornamental. But all types appeared, and there seems to be no relation between the types and the complexity of a group. Perhaps 15 per cent of the burials constitute our most complex class and carry thirty or more specimens of several types. No two cases are even approximately identical, but the following citations illustrate complex cases :

Site 83: 6 arrowpoints from neck to hips along backbone; 1 "Stockton curve" near right arm; beads across upper part of breast as if on strings; 3 pestles with hammerstone, crystal, and oblong rock one foot west; paint mortar and hammerstone just west of pestle; large hammerstone one foot east of head with 4 pebbles, obsidian chip, and 4 rubbing stones between it and head.

Site 83: 1 obsidian "Stockton curve" serrated on both edges, and one broken curve by right side of head; fragment of arrowhead near curves; two

fragments of notched bones under head; large number of shell ornaments so decayed that but one could be saved; 1 long pestle between right arm and backbone with head toward feet of skeleton; small steatite dish, handle down, between pestle and backbone; pipe between pestle and arm; curved rock near feet. Skeleton of adult, in 8 inches of clay, head to NW.

Site 68: Adult skeleton, 18 inches deep. Three spearheads along backbone; 230 rectangular olivella beads; 10 whole shell olivella beads; 3 quartz crystals; 4 false topaz crystals; baked clay "spindle whorl"; small flat stone; 15 shell ornaments. All specimens except spearheads on ribs or near chin.

CONCENTRATION OF ARTIFACTS

Probably the most suggestive feature of our burial associations is the comparatively large number of similar artifacts that appear with single burials. Our area is characterized by "Stockton curves" and clay balls. The Lodi region had far more stone beads than Stockton, while Stockton had more fish spears or hooks. Site 6 contained nearly all the obsidian arrowpoints of the Lodi region and these were essentially of one type. Site 68 contained far more crystals than the rest of the area combined. Site 82 yielded all the steatite vessels. Obviously a given group specialized, although the basis of such specialization is not clear. With the arrowpoints at site 6 it might have been utilitarian; with the steatite vessels, trade; with the crystals, travel. However it does not seem possible that any great period of a group's history can be under review so long as that group is definitely characterized by a given specialization of the kind now dealt with.

When we turn to individual burials the concentration is even more noteworthy. The instances noted are too numerous to admit of citation here. Some of them will be mentioned as artifacts are described. Not only did many articles of a given kind frequently appear with one skeleton, but the one "find" often constituted a large proportion of all such articles in the area. For example, the Stockton region yielded six crystals, yet one body at site 68 had forty-one. A burial at site 6 contained all but one of the bone beads found. A burial at site 80 yielded thirty-one "curves," as many as the entire Lodi region. The Stockton region gave only seventeen plummets, but in one burial near Bethany, Barr found thirteen. Such examples could be so multiplied that it seems possible that a closer study would reveal the fact that a given artifact (considered in *all* its details) characterizes only one, or at most a few, individuals. If this is true the total number of true primitive types reflects the total age of the culture under examination. A few types would mean a short age, since only a few individual lives would be reflected.

Whether this be true or not the relatively enormous effect of the presence or absence of a few individuals is noteworthy. If it be assumed that much of the property in a grave was donated, the concentration of similar articles suggests occupation not necessarily of the deceased himself but of his family or small immediate group. For example, of fifty-seven fish spears from the area, thirty-one came from one burial at site 87, and fifteen from another at site 15. On the donation hypothesis however it is hard to understand why such associated articles should run so true to type. Note, for example, the small bar-like abalone pendants with two holes in one end, thirty-seven of which were found in one grave at site 68 and none elsewhere. It appears probable that even here a single maker is indicated. This is more strongly suggested if it be assumed that it is an individual's own property which is buried with him.²⁴

More data from other areas are needed, but this concentration offers important possibilities. It indicates that differences must be emphasized instead of artifacts being grouped into types set up by the modern observer. It shows that much allowance must be made for the very few burials needed to change the entire complexion of an aboriginal site. A half-dozen Aleut otter hunters of the early 1800's buried in the mounds of our area could radically alter the collections. It finally suggests that no one site of the nature of those in our area covers a long period of years.

MATERIAL CULTURE

In describing the 10,000 specimens from our area we first divide them according to the material of which they are made. They are then subdivided on the basis of their probable use.

When specimens are referred to by number, B- indicates the Barr collection and D- that of Dawson. Only articles from the Dawson collection are shown in our plates. This is partly because they are typical of the area and partly because many of the Barr specimens have been previously illustrated, mostly in the works mentioned on page 307.

²⁴ The existence and suggestiveness of this concentration of similar articles was also noted and discussed by the writer in connection with the Emeryville shellmound. That the phenomenon is widespread appears from observations made by W. H. Hudson that have come to notice since the above was written. In *Idle Days in Patagonia*, chap. 3, he describes characteristic differences which he noted in aboriginal sites in Patagonia and the discovery of "something like division of labor in the different villages, and of the individuality of the worker."

As a rule no endeavor is made to compare our material with that from outside California. The principal exceptions are comparisons with Aleutian island artifacts. These are emphasized because it seems not improbable that the Aleut sea-otter hunters of the early 1800's may have left some trace. Records exist of their wandering as far afield as the Salinas valley where one was baptized in the San Antonio mission. In California the archaeological material available for comparisons is mostly from the Santa Barbara region, from the Upper San Joaquin valley, and from the San Francisco bay shellmounds.

ARTICLES OF ASPHALTUM

No specimens of asphaltum, pitch, fish glue, or other adhesive materials were recovered. Among the charred basketry specimens is one which exhibits evidence of having been covered with some substance which has retained its shape, although the basketry was burned. This suggests the pitch- or asphaltum-lined basketry common in the Santa Barbara region and the Southwest. The general lack of asphaltum and pitch is in keeping with the resources of the area, where neither material is procurable. But when it is recalled that marine shells, obsidian, river boulders, and other materials also not procurable within the area were freely used, the possible correlation between the non-existence of local raw materials and scarcity of use loses significance.

ARTICLES OF BONE

While bone artifacts came from all of our major sites, they were remarkably scarce when compared with the finds from the shellmounds. Only 5 per cent of the articles recovered in the Lodi-Stockton area were of bone. At other places these articles usually seem to have had utilitarian purposes. Here about two-thirds were whistles and tubes, which were probably non-utilitarian. Awls made up the next most important class. These were generally small and showed definite omissions, such as the large, heavy, ulna-bone awls. Knife-like or scraper-like pieces were proportionally numerous, as were double-pointed pieces. Other forms were very scarce. The saw-like fleshers of deer or elk scapulae were entirely missing. Bird bone was used far more than animal bone. It is possible that bone artifacts were scarce because the sites from which they came were occupied when the people were more interested in fishing and catching water fowl in the marshes than in hunting, which was done elsewhere at other seasons, or to a limited extent.

Awls

The Lodi region yielded about one hundred bone implements, which we class as awls or perforators; the Stockton region about half as many. Some of those grouped under type IV were probably used for other purposes. Fewer types are definitely represented than in the Bay shellmounds. See the Emeryville paper for the divisions used below.

Type I. Of ulna bones.—About four of these heavy awls appeared, all but one from Stockton.

Type II. Of cannon bones.—These were made of deer bone and were generally short and rather uniform in size. Plate 77*f-g* shows typical specimens. About one-half the awls were of this type.

Type III. Of deer tibiae.—Possibly 10 per cent of the awls were made of these bones, although in size and appearance they closely resemble type II.

Type IV. Of ribs or flat bones.—The specimens in this group are doubtful awls. See for example plate 77*d, e, h, i*. Some had chisel-like ends (pl. 79*a-b*). Others were perhaps marrow extractors; others scrapers. Knife-like pieces are separately grouped. Plate 76*k* illustrates a piece drilled for suspension or to serve as a large needle.

Type V. Of penis bones.—None found.

Type VI. Of bird bones (pl. 76*f, l, m*).—About 5 per cent were of this material. Plate 76*m* shows an interesting specimen with the foot still remaining as a grip. Plate 76*l* illustrates the most slender specimen.

Type VII. Of fish bone.—None.

Type VIII. Of uncertain or fragmentary bones.—About 20 per cent of the awls fell in this class. Most of them were small as the typical specimens in plate 76*a-e, g-j* show. Some were presumably used in basketry work, as one specimen showed grooves worn in its side such as would result from drawing fibers across it.

Beads

Bone beads were very rare. Only two finds were noted: forty pieces of bird bone (pl. 87*t-u*) with one burial at site 6, and one bead (pl. 87*v*) on the surface of site 59. Glass beads were also associated with this site 6 burial.

Double-pointed Pieces

These skewer-like pieces might be regarded as two-ended awls, but the specialization seems definite enough to suggest a special use and a different classification. Similar articles made of slate appeared. (See Ground Stone—Double-pointed Pieces.) Plate 76*n-x* shows typical specimens including the maximum and minimum sizes. There were about twenty from each region. The smaller and more numerous

pieces might have been used as parts of fishhooks or as fish gorges. The larger ones seem entirely unsuited to such a purpose. Meredith²⁵ states that such bone pieces were used as nose pins, as hairpins, or in sets of four as head fastenings for a quill band used in certain dances. The small specimens seem unsuited to any of these purposes, although they might have served as pins. Barr regarded them as needles. Heye thinks that similar articles found at San Miguel were parts of fishhooks.²⁶

Knives or Daggers or Awls

These were large awl-like implements of bone, grouped separately because of their sturdiness, their form, and their having a cutting edge as well as a point. Plate 77*a-c* shows typical specimens. These pieces were rare. Four came from site 59; one from 43; one from 68; and twelve from Stockton (six from site 86). They were usually found singly with burials. In one case two appeared with an infant. In two cases a hole was drilled in the handle as illustrated in plate 77*a*. This same specimen shows the "handle" set off by rows of incised lines. In four specimens from site 80 rows of notches appeared along one edge, in two instances they were in sets of three as though they had served for a tally or record. Three other bone fragments with rows of notches were noted.

Miscellaneous

Two large elk bones with a large slot cut most of the length of one side and the edges highly polished were found with a burial at site 66. Half of one of these pieces is shown in plate 81*f*. A similar piece came from another Lodi site, and we saw one from a Yolo county mound. The high polish attests to their fashioning and use by man. Perhaps they were used in skin working.

With a burial at site 68, sixty-four pieces of bird "wish bones" were found which had apparently been used as ornaments. Similar concentrations of bird bones with a skeleton were noted at Emeryville.

A fragment of a flat bone or horn from site 59 with a circular notched edge is shown in plate 79*c*.

Plate 79*h* shows a piece of bone cut all around to size.

²⁵ Prehistoric Implements, 270.

²⁶ *Op. cit.*, 83, pl. 52.

Teeth and Claws

Several finds of teeth and claws were made near skeletons. It is believed that they were regarded as charms or ornaments.

Bear claws (pl. 79d).—Twenty-four pieces. Ten of these were from one burial, site 19. The others were from two or three burials, site 6, and are charred. Still others came from Stockton.

Bird claws.—Fifteen pieces. With burials at sites 6 and 68 and from Stockton.

Beaver teeth.—Seven pieces from sites 6, 19, and Stockton. Not with burials and probably not selected.

Coyote (?) teeth.—Fifty-four incisor or canine teeth. All found with burials: eleven in one burial, twenty in another, five in another at site 68. Some at site 6, a few at 43, and one at 56. Forty-three molar teeth of a coyote-like animal. All from site 6 and many from the skeleton of an animal near an infant: perhaps a modern burial with a dog.

Elk teeth (pl. 79e).—Two canine teeth with burials: one each, sites 6 and 68. The one from 68 was accompanied by a polished elk molar.

Tubes

There came from each of our regions about forty short bone tubes, usually made of bird bone and unornamented or specialized. Plate 78*u* shows a typical specimen.

Slender short bone tubes were used for pipe stems as is shown by one still in place in a pipe from site 83, and two from site 6 (pl. 78*n, s*) still showing discoloration where they were inserted in the pipe. The extreme shortness of the pieces so used is interesting. Their scarcity suggests that reeds were more commonly used.

Most of the tubes were too large for pipe stems. Barr calls them "game bones" and Meredith²⁷ gives a circumstantial account of their use as such. Many of the specimens support this hypothesis: they have a high polish, the inside is not worn as would be expected if they had been strung as beads, and the decoration or marking which appears on perhaps a third (e.g., pl. 78*l*) might have served as a distinguishing mark in a game.

²⁷ Prehistoric Implements, 270.

Others of the tubes are much more sturdy and are made of animal bone (pl. 78*v-x*). These have a wide shallow groove around the middle. The inside is also finished so that the diameter of the bore is somewhat smaller at the middle. Such pieces are relatively scarce but appeared from both regions and from the adjoining areas to the southwest and northwest. They would appear to have served some utilitarian purpose.

Ornamented tubes.—In addition to the tubes described there were a number of bird bone tubes, elaborately ornamented with geometric designs of etched lines, that belong in an entirely different category. With the exception of the “banjo” pendants these specimens are the most definite expression of the aesthetic sense of the Lodi-Stockton aborigines that has been preserved. Plate 78*a-k, m, o-r, t, y* shows a number of typical specimens. It would seem that their purpose was aesthetic or ceremonial, for they are not specialized in form; in many cases one end is still in the rough, and while the other end is squared off the inside gives no evidence of finishing or use. (Two unornamented tubes were noted that had been used as containers. One, uncharred itself, contained a few small charred seeds: the other, small bits of some mineral. This material may have been magical or medicinal.) Several of the pieces were found in pairs, notably plate 78*a, y*. Perhaps they were so used.

The maximum and minimum sizes are shown in plate 78.

The designs of the Lodi specimens are shown in figures 5 and 6, which also indicate some of the corresponding pieces illustrated in plate 78. Most of these designs suggest basketry origins, but their adaptation to the tubes shows much skill. The application of the same design (e.g., fig. 5*f*) to pieces varying greatly in size (e.g., pl. 78*c, p*) suggests that the design was more or less standardized and was not conceived for the tube work. In plate 78*t*, probably one of the most handsome specimens, three distinct designs are used, each occupying a third of the tube. The ends were usually finished with a narrow band of different design. In addition to the designs shown in figures 5 and 6 a few variations appear. Four squares are used instead of three as in figure 5*a*. Plate 78*y* has six, seven, and eight bands within various squares instead of as in figure 6*b*. Other specimens show confusion in an apparent attempt to follow design (fig. 6*h*, pl. 78*o*). The fine lines and regularity of figures 6*a, d, l* are particularly noteworthy.

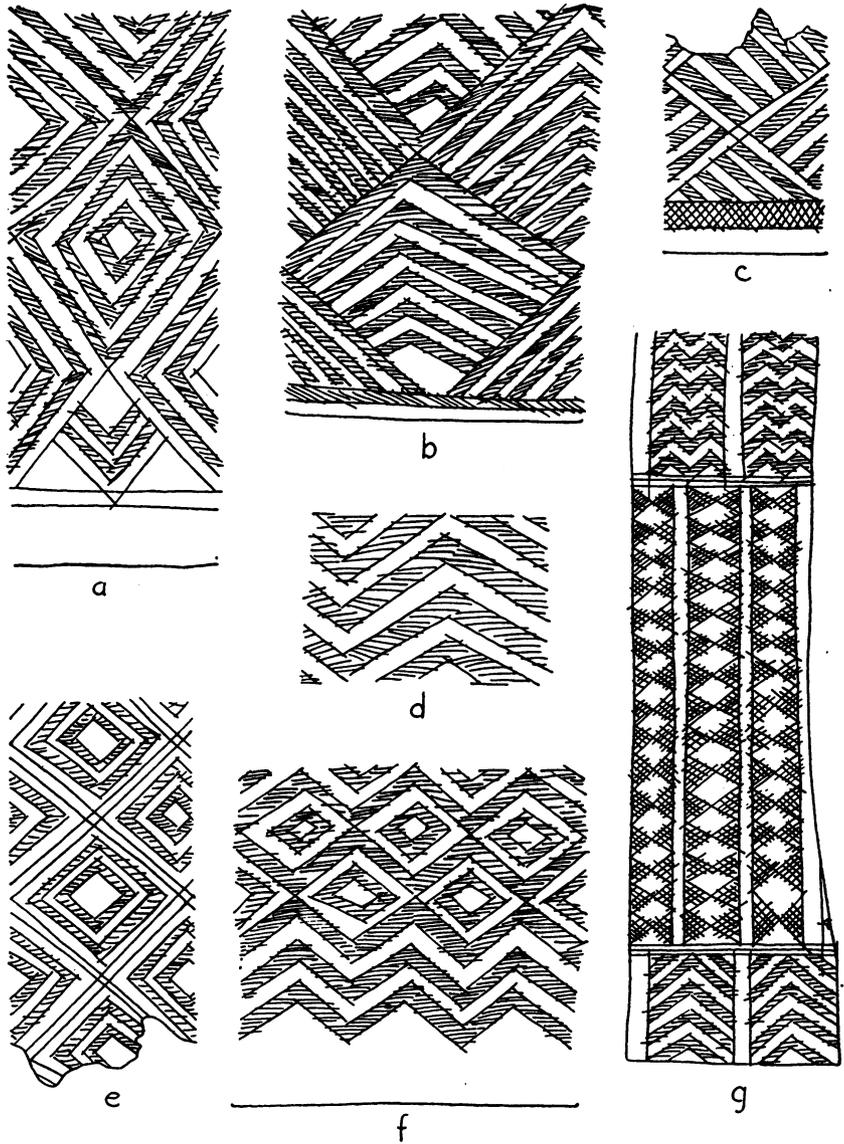


Fig. 5. Designs on bird-bone tubes. Some of these are illustrated in plate 78 as follows: *b*, plate 78*d*; *f*, plate 78*c*; *g*, plate 78*t*.

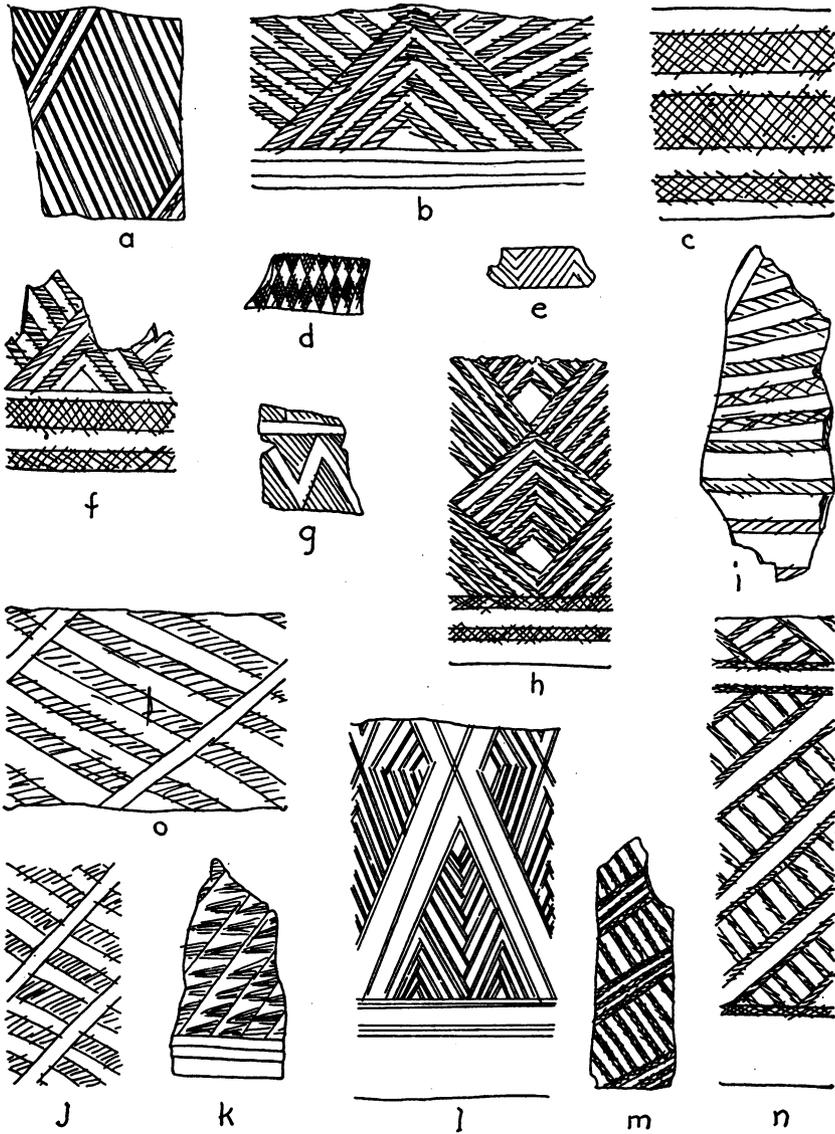


Fig. 6. Designs on bird-bone tubes. Some of these are illustrated in plate 78 as follows: *b*, plate 78*a*; *c*, plate 78*l*; *f*, plate 78*j*; *h*, plate 78*o*; *l*, plate 78*k*; *m*, plate 78*m*; *n*, plate 78*r*.

None of these ornamented tubes are reported from the Bethany region. From Stockton came only four or five with designs very similar to Holmes's plate 28*B*. In the Lodi region they appeared only at sites 6 and 43, where seventy-three pieces were found, principally at site 6. In the Yolo county sites they seem relatively abundant.²⁸

Whalebone Objects

Two or three fragmentary artifacts in the Stockton collection, but possibly not from our area, were made of whalebone. In each of the collections there was a fragment of what might have been a shaft, about 8 mm. in diameter, of the same material (pl. 81*e*). Several of the artifacts we describe under horn, particularly the spearpoints or fishhooks, might be of sea mammal bone and as such reflect the Aleut sea-otter hunters.

Whistles

Under this heading we include all bone tubes which have been specialized by a vent or hole in one side. There were about thirty such specimens from the Lodi region and about three times that number from Stockton. All whistles were of bird bone. In no case is there more than one vent. This vent is near the middle of the tube, sometimes on the concave side, sometimes on the convex. It may be either rectangular, elliptical, or semi-elliptical. The rectangular vents are comparatively large and have been cut out. The elliptical ones are more even and appear ground. The largest whistle was 235 by 18 mm. Plate 79*l-t* gives an idea of their variation in size as well as the variations of the vent. The very small whistles may be emphasized. One whistle was noted with a smaller bone tube mouthpiece.

None of the whistles were ornamented with etched designs or, as was common at Emeryville and in the Santa Barbara region, with paint, asphalt, or beads. In one case binding marks appeared, and as these coincided on two specimens found together the indication is that they were sometimes used in pairs (pl. 79*l-m*).

Whistles are noteworthy because of their concentration, several specimens usually being found in a group with a single burial.

²⁸ There were on exhibit in the Museum of the American Indian, Heye Foundation, New York City, in May 1927, a number of ornamented pelican-bone tubes very similar in general appearance to these Stockton-Lodi pieces. Their label stated the specimens were from Panama and were worn as dance trophies, a tube being added for each dance participated in. Such usage might explain concentration in particular graves, but their comparative scarcity would seem to imply peculiar qualifications of dancer and dance before they could be acquired.

ARTICLES OF CAUCASIAN MAKE

Three of the Lodi sites yielded articles of Caucasian manufacture (1, 6, and 26).

At site 26, glass beads were found on the surface and to a depth of one foot, as deep as we went, in the only pit dug. The total number of such beads recovered was about 1845. There are several types: white, from 4 to 10 mm. in diameter; red with greenish or black core, of the same size; various colors, such as green, red, amber, pink, black, and blue, and ranging from 3 to 10 mm. in diameter. No burials were found in the mound, but the beads were found in close proximity to the only other artifacts which the mound yielded.

At site 6 also the only articles of Caucasian make discovered were glass beads. About 85 of these were recovered. They were all small, from 4 to 12 mm. in diameter, and of various colors including black, white and silver, blue, red, green. Some had been burned. In this site sixteen pits or trenches were dug, and in only two of these were glass beads found. They were associated with only three of the 102 burials uncovered. The maximum depth to which we dug was forty-two inches. Glass beads were found as deep as twenty-four inches, while other artifacts and burials were found as deep as we went. But directly under the beads (i.e., at a spot where several beads were found together) were neither other artifacts nor burials. In several cases half a dozen or so beads were together. Otherwise the beads were found singly. Associated with some of the glass beads were a number of olivella shell disc beads with edges chipped instead of ground and generally inferior in workmanship to those found elsewhere in the mound. Certain other articles closely associated with glass beads appear of particular interest; viz., sixteen obsidian curves, four bear claws, fifteen coyote (?) teeth, seven clay bird effigies, one plummet, textile and cordage fragments. In other words, a very fair percentage of articles of these types found were modern.

Site 1 yielded all the types of glass beads found at sites 6 and 26 as well as several other types. This site is noteworthy because of the great quantity of these glass beads. At least 15,000 were recovered from the six burials uncovered. In addition there were found a number of quite modern articles such as tin cups, cut iron nails, overall suspenders fastener, a portion of a leather shoe, bone buttons, glass buttons, brass buttons. These were associated with four of the six burials. With the beads and other articles or with the burials which

they characterized were a number of shell ornaments similar to those found elsewhere.

In the Stockton region site 82 yielded several "finds" of glass beads which came from as deep in the mound as Barr dug. The locality of some of the Barr charred textiles is not certain, but it seems probable that sites 80, 82, 83, and 86 at least were inhabited within historic times.

Under this heading notice should also be taken of possible Aleut artifacts due to the Aleutian hunters brought to San Francisco bay by the Russians.

Age Suggestions

It does not seem worth while tracing the relations which the glass beads imply with the Hudson Bay Company's traders in the 1830's, Sutter's Fort in the 1840's, and with others subsequently. The importance of the presence of such articles lies rather in the standard which they supply for age estimations, first with reference to the length of occupancy of a mound, and then with reference to the types of aboriginal artifacts with which they were associated.

The articles found at site 1 indicate that the entire mound, as a living and burial site, was probably post-Anglo-Saxon. This mound then was first lived upon not over ninety years ago. It has not been occupied in recent years. Hence some seventy-five years would represent the maximum period of occupancy possible, while the probable period would seem much less. Within this time there was accumulated a mound mass from thirty to thirty-six inches thick or about as thick as any mound mass observed. In short, residence on a site for only two or three generations will apparently produce the characteristics of the most marked mounds of the Lodi region. There seems definite evidence here to support the indications offered by the details of the structure and composition of the mounds, i.e., that each mound represents a short period of occupancy, probably not over two or three generations.

We of course do not imply that no article found in the Lodi region is over seventy-five years old. The suggestion is that the aboriginal history of no one mound extends over a longer period. The total time represented by all the mounds is considered on pages 320 and 409.

The aboriginal artifacts directly associated with Caucasian-made articles do not appear to be unique, but they indicate that at least considerable proportions of some types are modern. It does not appear

improbable that sites 6 and 82, possibly the most marked cultural centers of the area, are post-Caucasian. If so, several of the most characteristic productions of the area can be attributed to contact with Caucasians or with the Indians from other localities whom they brought into the locality.

ARTICLES OF CLAY

Baked clay articles are one of the unique features of our area, although pottery was exceedingly rare. Baked clay balls were produced in profusion and in many forms. Considering the general absence of clay work in California north of the Tehachapi mountains their presence is noteworthy. Their greatest concentration was at site 6: this makes it seem probable that the balls are the result of a relatively recent practice. (These balls are found in Yolo county sites and it seems possible that they occur to some extent throughout the delta area.) Since they are not known elsewhere and were presumably created to fill the need caused by the lack of stone in the area, they appear to represent a local invention possibly based however on an imported knowledge that baked clay was used for known artifacts, e.g., spindle whorls or pipes. It is interesting that a people should possess so much knowledge of baked clay and develop it no further. Perhaps this may indicate that such knowledge was relatively recent.

Small clay effigies of birds were also present in considerable number. Similar specimens have not been reported elsewhere in California.²⁹

Pipes were rare, and, like spindle whorls, suggest importations from southern California. A few "doughnuts" suggest the Santa Barbara region, except that they were of baked clay instead of stone as at Santa Barbara. Hence, like earplugs, they suggest an attempt at reproducing imported stone forms in local clay. Other clay forms are insignificant.

Sites 6 and 43, river bank sites, disclosed a profusion of baked clay. Sites 66 and 68, sea level sites, yielded little, and mostly of other forms than balls.

²⁹ In May, 1926, the Field Museum of Natural History, Chicago, had on exhibit a collection of strikingly similar clay objects from Assyria.

Baked Clay "Balls"

Perhaps the most characteristic artifacts of our area were those of clay, called by previous writers "baked clay balls." We follow them herein because there is no better suggestion, although it seems to us that the term is unfortunate. "Ball" does not correctly describe the usual form, and its ordinary connotations seem to apply in no way to the articles. Also it fails to convey an impression of the variety and complexity of the objects. These baked clay specimens are remarkable for several reasons: their great abundance in our area; their limited distribution; their rare association with burials; the ability they reveal to adapt means to a need; their great variety of form; the uncertainty as to their use.

Barr, Jones, Meredith, and Holmes (see his pls. 26, 27, 28*H*) report many such articles from the Stockton region. However, the collecting of such material has been more consistent in the Lodi region, and more details are available. Hence our discussion is based upon the Lodi material. It is believed that the remarks can be applied with general correctness to the entire area.

Quantity.—Dawson had about 2600 whole or identifiable fragments which would be classed as "baked clay balls." All entire specimens seen were collected, but fragments only when decorated. Hence in the collection the percentage of decorated pieces appears unduly high.

Although so abundant within our area, practically no objects of this kind have been reported from elsewhere. Some have been found in the Yolo county and Bethany mounds, and other delta sites might yield them. But the origin, manufacture, and use of these clay articles seems to have been limited to the general vicinity of our area.

Occurrence.—Barr found these balls at all his principal sites. They appear to have been most plentiful at sites 80 and 82. Unless he ignored many specimens of this kind, clay balls were much less numerous in the Stockton region than in the Lodi region. Ninety per cent of all the Lodi material came from site 6, which yielded all types except those with longitudinal cut grooves ("f," p. 363), the only type from the sea level site 68. Site 43 was the second most fertile site. Sites 1, 8, 14, 18, 19, 20, 40, 44, 45, 50, and 52, which are on the outskirts of sites 6 and 43, yielded some clay balls but no other clay work. Site 15 yielded cylinders, doughnuts, and bird effigies in addition to balls. Sites 57 and 66 yielded spindle whorls and balls. Site 78 gave several plummet-like balls, the only form at that site.

The practical absence of balls from site 68 and their abundance at site 6 may be an indication of the relative ages of the two mounds. It is probable that the balls are recent, since they were most plentiful at partially modern sites (6 and 82). Also they appeared to be most numerous on or near the surface, although this may have been due to cultivation which would bring such articles to the surface. The much larger surface area examined might help create such an impression. At any rate balls were found throughout the mound masses and as deep as any other artifacts.

Very few of these balls were found with burials. Jones, whom we regard as reflecting Barr's opinion, was very emphatic about this dissociation. Barr records only two instances of balls with skeletons—four double-pointed ones with a body at site 86; and three plain balls with a body at site 91—but he records several cases where balls were found among the ashes away from burials. In Lodi it was very rare that a skeleton was accompanied by clay balls. Of all the artifacts of our area clay balls were least frequently with burials, although they were one of the abundant types. The fact that they may have served a utilitarian purpose is not sufficient to account for their absence when pestles, pebbles, hammerstones, and the like were frequently present. Why were these complicated and varied forms of clay, apparently a creation of the area, neither particularly valued at home nor imitated abroad? Whatever the answer, there seems to be here some indication of the reason for concentrations of particular objects. A type or variety originated through individuals. It might become emphasized by a small group. It did not spread because new ideas were not of interest.

Material.—Clay, with varying quantities of sand, such as is plentiful locally, is the material of which the balls are made.

Manufacture.—The clay was moulded into shape with the hands. The unevenness of the surfaces, the variations in size and form, eliminate the probability of a mould. At times a piece of basketry was apparently used somewhat as a mould, since certain forms are characteristically marked on several or all sides by basketry impressions. Such marking is quite different from the incidental impressions resulting from placing the wet clay on a basket or mat. Pieces of bark or leaves were also used as moulds. Some of the pieces thus formed bear a strong resemblance to a miniature tamale. All pieces are fire baked. Considerable skill is exhibited in the fashioning of the clay balls, but fundamentally they are very simple. They disclose a knowledge of

the possibility of shaping and using baked clay. They exhibit little of the potter's technique—no tempering, coiling, or turning.

Purpose.—The entire absence of stone in our area was a reason for making substitutes in clay. Generally it appears that this is what the baked clay balls were—articles which would normally have been made of small cobbles. Holmes regarded them as sling shots. No evidence is available to indicate that slings were used in California lowlands. Aside from this, the shapes seem to be less suitable for sling shots than other shapes which could have been made as easily. Jones thought the balls substitutes for cooking stones on account of their abundance, their association with fireplaces, and the many fragments probably due to refirings. This reasoning appears sound, but the variety of forms and the care shown in decoration seems to indicate that he did not cover the entire situation. Our suggestions are added under the following discussion of the various forms. In none of the specimens is abrasion due to use discernible.

Size and shape.—There is much variation in size, the maximum and minimum being given in table 3. The great majority of specimens would be about 75 by 40 by 30 mm. The largest specimen recorded was one of the tamale type from Bethany—150 by 90 mm.

A number of forms occur so frequently and are so definite as to preclude the probability of their being accidental variations. These various forms are given in table 3.

Spool-shaped (pl. 82*a-c*). Cylindrical pieces with concave sides. The pieces might be considered as grooved forms, the concavity of the sides being obtained by a very wide, shallow groove. However, there is an essential difference between such concavity and the grooving in the pieces called grooved. Most of the ends are convex; some are flat; a few concave. Many of these specimens if found isolated would probably be designated earplugs or labrets.

About one-fifth of this type might reasonably be placed in a separate group. These bear marked impressions of leaves, tule, or bark (pls. 83*h*, 85*l*) and were apparently wrapped in or molded in such material so that they resemble small tamales.

Cylindrical (pls. 83*a, d*, 84*a*). Generally cylindrical or rectangular prisms. In many cases the sides are nicely squared. Practically all of these specimens show clear basketry impressions on several sides.

Cupped (pl. 82*d-f*). Flat discs to hemispheres, with a marked depression on one side and the opposite side slightly convex. The depressions exhibit considerable variation. Two have been punched with the end of a stick (pl. 82*d*). Many are marked with the ends of the thumb or finger (pl. 82*f*). Many others have such marked cavities that were they of stone the specimens would undoubtedly be considered paint mortars (pl. 82*e*). Some of these depressions are 65 mm. in diameter by 13 mm. deep. One exceptional piece has slight depressions on both sides resembling a discoidal hammerstone.

Triangular (pl. 83*b*). These specimens are tetrahedral with well convexed sides.

Double cone (pl. 83*c*). These approach the spindle whorl type. However, not one perforated specimen was noted.

Cones. The base is deeply concaved and all specimens are decorated with punched designs.

Grooved. This group is distinguished by having one or more definite grooves on each specimen. It is the most numerous of the specialized groups and it seems to the writers that this groove played a part in the use to which the "balls" were put and was not intended for ornamentation. The ornamental lines and grooves differ radically from this fundamental groove. The most probable purpose of the groove was to aid in securing the ball to a cord or in binding it to some article. So secured the balls could have served as sinkers or bolas. At any rate the groove would seem to serve no purpose on sling shots and to be an unnecessary refinement in cooking stones.

Subdivisions have been made according to the type and position of the groove.

a. Heart-shaped pieces were formed by a longitudinal groove which passed over the center of one end (pl. 82*j*). Part of both sides and one end showed no groove at all.

b. Spade-shaped pieces were similar to the heart-shaped ones except that two grooves on each side were used and they passed over the same end a little apart (pl. 82*i*).

c. Pieces with a longitudinal groove down the middle of one side. They are such as might have been formed by laying a small branch upon a piece when wet and slightly pressing it (pl. 82*k*).

d. Same as *c* except that there is a groove on two sides. Since only two specimens were found it is probable that the second groove served no particular purpose and that these are *a* or *c* pieces not properly made.

e. Longitudinal grooves were made on three surfaces. Both cases noted exhibited poor workmanship and were probably mistakes.

f. Here the groove is *cut*. The cut is very clean and straight and divides the piece with remarkable evenness (pl. 85*e, f*). The pieces were smaller than the average and were unusually well finished with the appearance of having been polished or rubbed down. All twelve Lodi specimens found were from site 68, and nine were with burials. Only one other clay "ball," a plain one, was found at this site. Altogether this type appears exceptional and should perhaps not be classed as "balls" but rather as beads or pendants. One exception appears in the form of a rather crude, moulded, longitudinal encircling groove (pl. 82*n*).

g. Same as *c* except that the groove is transverse instead of longitudinal (pl. 82*g*).

h. Here the transverse groove passes clear around the piece (pl. 82*m*). If the pieces were in stone they would undoubtedly be classed as sinkers. This fact lends some weight to the assumption of a similar use for some of the other grooved types.

i. Here as in *f* the groove is *cut* instead of moulded (pl. 85*i*). Also as in *f* the pieces are above the average in workmanship. Otherwise they are similar to *h*. Note that the piece illustrated has a side left flat as in stones that are grooved for hafting.

j. Here notches occur in the ends (pl. 82*h*), and again if the pieces were in stone they would be termed sinkers. Considering the small number of pieces of types *h*, *i*, and *j* it is possible that they represent experimental attempts to make sinkers of clay.

k. This is an exceptional piece having a transverse groove around both ends (pl. 82*l*).

In addition to the forms listed, Barr obtained several double-pointed pieces not unlike some plummets. Site 88 yielded only this type. Four others were with one burial at site 86.

Fragments were seen which suggested pestle ends (e.g., pl. 82*o*). But such pieces did not show even such wear as might have been expected from ceremonial use.

Decoration.—Instead of a division according to form, the balls might be divided into plain and ornamented classes. However there appears to be some connection between ornamentation and particular forms. The unspecialized, cupped, double-cone, triangular, and grooved forms appear to be “decorated” only incidentally. In a small percentage of cases they carry impressions such as might have been obtained by setting them on basketry or bark when wet. Large percentages of the cylindrical and spool-shaped forms are decorated. The forms of decoration are as follows:

Basketry impressions. These occur on several surfaces of a piece. Impressions are both negative and positive. Three forms of basketry are indicated: fine (pl. 83*a*) on very few specimens; medium (pl. 83*d, g*) on the great majority; coarse (pl. 83*e, i-k*) on a few. This decoration is typical of almost all cylindrical forms (pl. 83*d*) and several disc-like unspecialized forms (pl. 84*a*).

Bark or leaf impressions, 35 examples noted. This includes the “tamale” specimens characteristic of the spool-shaped forms (pl. 83*h*).

Punched holes, either fine (pl. 83*n-r*) or coarse (*l-m*) were noted in seventeen cases. These appear in designs. All cones were so decorated. A special type is shown in plate 83*t*.

Finger nail impressions, both arranged in designs (pl. 84*b*) and appearing at random (pl. 84*d*), were seen in six cases.

Lines, both grooved and incised, appeared as designs in twenty-seven instances (pls. 83*s, 84e-j*).

Beads

In addition to the perforated specimens and the grooved clay balls (types *f* and *i*) which might be classed as beads, several tubular beads were found at site 6 (pl. 85*b*). Diameters ranged from 5 to 7 mm., and the longest was 25 mm. These seem a rather crude attempt to reproduce in clay a form more familiar in other materials.

Earplugs and (or) Labrets

(See also Spool-shaped Balls and Labrets of Ground Stone.) Twenty-one specimens were possibly used for earplugs or labrets. The sizes and forms are shown in plate 85*m-p*. Six were with burials at site 66, two from site 6, and 13 were from Stockton (see Holmes’s plate 284). The two from site 6 were better finished than most of the spool-shaped balls there, but the resemblance is so close that it seems impossible to say whether or not earplugs were used, and if so in what proportions they are represented in the collection.

Effigies

One of the most interesting and puzzling types of objects found in our area was a number of baked clay pieces apparently intended to represent birds, probably water fowl (pl. 86). Very few specimens are complete. The head is usually gone, and many specimens are so fragmentary and all are so conventionalized that it is impossible to determine the original object, though the shape suggests the effigies. Possibly effigies other than those of birds were sometimes intended. For example, plate 86*l* may represent the head of an animal or a bird in flight. Many of the effigies have a hole punched in them, usually in the base. However the arrangement of the hole suggests that its purpose was to secure a firm fastening to a twig or bone holder when this support was held upright, rather than to imitate the natural posture of a bird. At times there were several holes (pl. 86*j*). The color of these objects shows more variation than other baked clay work, the range being from black to pink. Only about 6 per cent of these objects were with burials, the great majority being on the surface. A remarkable thing about them is their concentration. None have been reported except as follows: one from site 15, two from 43, and about 200 from 6. Being largely from the surface of this site they may be modern. Toys, ceremonial objects, hunting talismans, amulets, and totems, have been suggested as possible uses.

No such articles of clay or stone have been noted in other parts of California, but they strongly resemble the "bird-stones" of eastern United States and Canada.³⁰

Miscellaneous

Three clay fragments were found with large grooves therein which had been rubbed smooth. The fragments are worthy of emphasis because they were the only ones in which the grooves gave any evidence of having been produced by wear.

Five clay squeezes, three from site 6 and two from 43, made by pressing a mass of clay in the hand, and showing finger impressions, were found (pl. 84*c*).

There were two roughly conical pieces from site 6 with depressions in the base—perhaps unusual cupped forms.

One piece from site 6 resembles a miniature pot (pl. 84*l*). It is solid with a 2 mm. longitudinal hole clear through it.

³⁰ For a discussion and illustrations of these see W. K. Moorehead, *The Stone Age in America*, 11-20, 1910. See also note 28 of this paper.

Perforated Discs, Rings, or "Doughnuts"

(See also Drilled Discs, Ground Stone.) The perforated clay discs show a greater variety of form than the drilled stone ones. Some are similar to "doughnut" stones⁸¹ and others are similar to the "spindle whorls" of Arizona,⁸² Mexico, and Peru. There are ten "doughnuts" with moulded holes (pl. 82*p*) from Lodi and two from site 78, one of which is decorated with rows of incised dots. From Lodi came fifteen "spindle whorls" with punched or moulded holes (pl. 85*g-h*), and from Stockton five. Seven of the Lodi specimens are from site 57 where few baked clay specimens were found. There are three globular or large bead-like pieces (pl. 85*j*): two from Lodi and one from Stockton. From site 15 came an egg-shaped, ornamented piece that might be classed as a tube or pipe (plate 84*j*).

Pipes

It seems remarkable that with pipes definitely known (see Pipes, Ground Stone), and with so many objects made from baked clay, so very few clay pipes should appear. Barr found only one piece (site 86) and he stated that this was the first clay pipe he had seen in the county. Site 6 yielded five pieces, and site 66, one. This last piece was little more than a rough cylinder and may never have been intended for a pipe. The other specimens more or less approach the flaring type shown in plate 85*a*, which also shows the average size. All these specimens were so crude as to suggest rejects. Perhaps they represent unsuccessful attempts by the ball-makers to reproduce in clay pipes obtained from elsewhere or previously made in other material.

In addition, fragments of thirteen clay tubes or cylinders were found. These seem likely to have been pipe rejects, although one piece was ornamented in much the same manner as the clay balls.

Potsherds

Few indications of clay vessels were found. One fragment from site 6 indicated a bowl 70 mm. diameter by 40 mm. high with walls about 15 mm. thick. It was decorated with a double diagonal line of small punched holes and had a 1-mm. hole near the rim. The step

⁸¹ H. W. Henshaw, *Perforated Stones from California*, B. A. E., 1887.

⁸² Kidder and Guernsey, *Archaeological Explorations in Arizona*, B. A. E., Bull. 65, pl. 51, 1919.

TABLE 3
TYPES OF BAKED CLAY BALLS (LODI)

Type	Number	Size in mm.	Per cent decorated	Plate
Spool-shaped.....	160	18-56 diam., 20-70 long.....	22	82a-c, 83h
Cylindrical.....	100	Unspecialized.....	95	83a, d, 84a
Cupped.....	50	35-75 diam., 15-40 thick.....	2	82d-f
Triangular.....	25	60-75 sides.....	4	83b
Double-cone.....	10	62 diam., 62 thick.....	0	83c
Cones.....	3	50 high.....	100	84e
Grooved.....		35-95 long, 30-65 wide, 25-50 thick.....	3	
(a) Heart shaped.....	134			82j
(b) Spade shaped.....	6			82i
(c) Longitudinal groove, one side.....	41			82k
(d) Longitudinal groove, two sides.....	2			
(e) Longitudinal groove, three sides.....	2			
(f) Longitudinal groove, cut.....	12			85e-f
(g) Transverse groove, one side.....	19			82g
(h) Transverse groove, clear around.....	6			82m
(i) Transverse groove, cut.....	7			85i
(j) 2 transverse grooves clear around.....	1			82l
(k) Notches in two ends.....	5			82h
(-) Fragmentary.....	34			
Unspecialized form.....	730	25-125 long, 25-125 wide, 5-50 thick.....	5	84d
Fragmentary.....	1300		100	

from a cupped "ball" to this vessel would not be great. Another fragment from the same site indicated a vase-like vessel with 10-mm. walls. The inside was black. Another fragment from site 50 showed a diamond design formed by heavy incised lines. Nine other small fragments were found, one from site 15, one from site 57, and the balance from site 6. In all cases the workmanship was crude, the small piece from 15 showing the best quality. None of these fragments particularly resemble the sherds from the southern San Joaquin valley, from southern California, or Mission pottery.

ARTICLES OF HORN

Horn articles were scarce and very few types appeared. We have presumed that deer and elk were abundant and formed a principal item of food; hence the absence of horn artifacts is remarkable. At Emeryville such things were relatively abundant.

Antler Tips

About thirty antler tips were found. Several of these showed that the base had been cut off, but there was no evidence of use. A few had perhaps been used as flakers. Lots of six pieces each were found at sites 80 and 82.

Club

A piece (pl. 81*a*) from site 6 had been cut off at both ends so that it formed a club-like article.

Fishhooks or Spearpoints

These articles were made of horn, or probably of the porous bone of a sea mammal. There were two types.

The first were probably gorges (pl. 80*f, j, k, m*). (See also Bone, Double-pointed Pieces.) It is possible that the objects illustrated in plate 80*j, k*, which were fragmentary, were points of awls. They came from site 69. Plate 80*f* was complete and was from site 66. Plate 80*m* might be a gorge or the portion of a fish spear³³ such as illustrated by plate 80*a*.

The second type is illustrated in plate 80*a, n-q*. These may have been barbs for composite fishhooks. A sketch showing such a hypo-

³³ See Jochelson, *op. cit.*, pl. 25, fig. 39.

thetical method of use is shown in the Emeryville paper.³⁴ Instead of being fishhook parts they may have been, and probably were, points for fish spears, and plate 80*a* roughly illustrates how they might have been mounted for this purpose. Fifty-seven of these artifacts were found: thirty-one with one burial, site 87; fourteen from other Stockton mounds in five "finds"; twelve from one burial at site 15. Meredith found fifty-one in one grave in the Bethany region. The concentration of such utilitarian objects is noteworthy. All those in plate 80 came from the burial at site 15. Some specimens have one barb; others, two. The Stockton specimens have one barb but have a peculiar point, rounded at the end and for about 10 mm., and then a marked shoulder.³⁵

In addition to the possible fish-spear points described above, specimens were found with barbs on both sides of a straight point. Plate 80*b-e* illustrates four barbed fragments and plate 80*g-i* three probable bases of similar implements. In general type these artifacts resemble the bone points for throwing implements used by the Aleuts and illustrated by Jochelson.³⁶ All such specimens in plate 80 came from site 6, separate "finds." From Stockton came five complete points. It is not impossible that such implements were introduced by the Aleut sea-otter hunters. Plate 80*l* probably shows a simpler form of lance head.

Miscellaneous

Plate 81*d*, a piece cut to shape.

Plate 81*e*, a broken, blunt-pointed shaft from site 6.

Pendants

From two burials at site 68 came two pendants (pl. 79*f-g*) made of horn or possibly from the shell of a turtle.

Wedges

A few wedges were found: two at site 68; one, site 66; one, site 9; a few from Stockton. As no wedges of other material were found it would appear that split timber was seldom used in the region. Plate 81*b, c* shows typical specimens.

³⁴ *Op. cit.*, 226.

³⁵ W. K. Moorehead, *Prehistoric Implements*, fig. 412.

³⁶ *Op. cit.*, pls. 23, 24, 25.

ARTICLES OF OBSIDIAN

The outstanding feature of chipped stone work in the Lodi-Stockton area was the production of obsidian curves. The workmanship exhibited by these articles is excellent, but it seems doubtful if greater skill was required in their manufacture than in the beautifully proportioned and wonderfully flaked points shown in plate 94*a-c*, or the many heavily and symmetrically serrated points illustrated by plate 93*d, h*. The large percentage of serrated points was a feature of the area. Note that in many cases (pl. 93*d*) the teeth project toward the point.

About four times as much chipped obsidian was found as chipped stone of all other kinds (see page 380). An abundant supply of raw obsidian was available in Napa and Lake counties in the Wappo and Pomo area to the northwest. This points, as do clamshell beads, to a considerable intercourse with that area. Eighty per cent of all the Lodi obsidian work came from site 6, which also yielded the most clam discs. Fifteen per cent of the Lodi obsidian came from site 43 and 5 per cent was scattered. Enough chips were found to suggest that the material was imported into our area in the raw state and worked up locally. The dominance of a few types suggests the same.

Arrowpoints, Spearheads, or Knives

It is usually impossible to ascribe specific use to a chipped stone point. Hence they may be conveniently discussed under one heading. Our points range from 13 to 185 mm. long, and although the transition is gradual, the great majority would be classed either as large or small. The large ones, say from about 45 mm. up, are thick and heavy and were probably spearheads or knives. The smaller ones were probably arrowpoints. One such was found embedded in a human vertebra.

In the Lodi region 588 entire points and 500 fragmentary ones were found. The 588 are classified below according to form, and it is believed that the results properly reflect the Stockton situation as well. The scheme of classification is that used in the present series for the Tulare region and Emeryville.³⁷

³⁷ See *Archaeology of the Southern San Joaquin Valley*, 81-85, and *The Emeryville Shellmound*, 239, not only for the plan of classification but for the results of those areas.

Type	Characteristic form	Plate	Approximate percentage of 588 found	
			Spear	Arrow
NAa	Not stemmed, both ends pointed.....	93a	3.5	.....
NAb1	Not stemmed, convex at one end.....	93b	5.8	.....
NAb2	Not stemmed, straight.....	93i	1.2	.....
NAb3	Not stemmed, concave at one end.....	94d	.3	.....
NBa	Triangular, straight base.....	93k	1.3	.....
NBb	Triangular, concave base.....	93j	4.5	.....
SAA	Contracting stem; shouldered.....			.3
SAb	Contracting stem; shouldered and barbed.....	94j		.15
SAc	Contracting stem; lozenge.....	94k		.15
SBa	Parallel-sided stem; shouldered.....	94i		5.
SBb	Parallel-sided stem; shouldered and barbed.....	94f		4.
SCa1	Expanding stem; shouldered, convex.....	93c	.3	45.
SCa2	Expanding stem; shouldered, straight.....	93h	.3	15.
SCb3	Expanding stem; shouldered and barbed, concave.....	94b	1.5	11.7
			18.7	81.3

Thus it will be seen that not only were 80 per cent of the pieces from one site but that 81 per cent may be reasonably classed as arrow-points. Moreover over 70 per cent fall within three groups. The difference between types SCa1 and SCa2 is so incidental that it seems probable that only one form was intended by the makers. This presence of a prevailing form agrees with what has been found in other areas. In the Tulare area type NA prevailed; at Emeryville large NA blades; NBb at Buena Vista. Some of the forms are so limited in number that their inclusion may be due to erroneous judgment in classification.

It also appears that where there were only a few points they were of the large type. It further seems possible that these are the older forms.

Most of the triangular pieces came from one burial at site 68. Three "pine tree" pieces, the only ones found, were in one burial.

See page 380 for points of other stone.

Curves

One of the apparently unique products of the aborigines of our area was a peculiar obsidian implement (pl. 95), characteristically curved or angular in outline, always sharpened on both edges, and usually serrated on either or both edges. Both ends are sometimes

pointed, and the point is very fine. The base is usually notched for mounting as is a knife. Some are twisted so that they will not lie flat. They have been called "Stockton" curves and several of those in Barr's collection have been illustrated by Moorehead and Holmes.

That such unusual forms were not accidental productions is proved by the large numbers recovered, 158 from the Stockton region and 31 from Lodi. However, their localization within the area is almost as remarkable as their previous apparent characterization of central California. All the Lodi specimens were from three burials close together at site 6. Barr found his in five mounds (sites 80, 82, 83, 86, 91), practically all definitely specified as with burials. One infant had thirty-one; one burial (7 bodies), fifteen; another, eight; two, five each; the balance were scattered. In one case a "burnt dress" was associated and in another case glass beads.

All are made of obsidian except three of the Barr pieces from site 91 which were of steatite. These were found with obsidian curves.

In size they range from 14 to 112 mm. long.

Previous writers have suggested that they were scarifiers, or knives, and Gifford was informed by a Central Miwok that they were artificial bear claws for bear-impersonating dancers. They break very easily and hardly appear serviceable as a cutting edge unless for delicate work. The nearest thing to them that we have noted is the obsidian hook reported by Heye from San Miguel island.³⁸

Drills or Perforators

In the Lodi collection were fifteen pieces which were classifiable under this heading. None of these were very good examples of such implements. Only a few were reported from Stockton.

Plate 98*h* illustrates a remarkable specimen from site 68, inasmuch as it was made of ground obsidian. It was perhaps used as a perforator.

Scrapers

Plate 94*l* shows one of three disc-like obsidian pieces probably used as scrapers. Few scrapers were found in other material (pl. 92).

³⁸ *Op. cit.*, fig. 2.

ARTICLES OF SHELL

Shell artifacts were both relatively and actually extremely plentiful in the Lodi-Stockton area. Beads were found in such large quantities that they were not gathered with care; yet they accumulated to such an extent that they were measured by the foot instead of the piece. About 3500 abalone shell ornaments are in the two collections. Shell artifacts were found with more burials than any other artifact and accompanied 75 to 90 per cent of those unearthed. At Emeryville only about 25 per cent of the burials were so accompanied.

The shell work was limited to ornamental forms. No utilitarian objects such as are reasonably frequent in the Santa Barbara region appeared. The disc type of clamshell bead was preferred and was at least four times as plentiful as the olivella disc bead most common on San Francisco bay and in the southern San Joaquin valley. The preference is not clear since olivella shells would appear to have been as available as clamshells. Other shell ornaments consisted almost exclusively of abalone pendants; but these appeared in many unique and unexpected forms. Some attempt at decoration by incised lines and dots was made, but the main dependence for effect was upon form.

The materials used imply a considerable intercourse with the sea-coast, since none of the shells used are fresh-water or bay forms. Comparatively few entire shells were seen. Among these at site 6 was a single *Polinices lewisii* Gould, a large marine snail which Baker³⁹ reports was much used by Californian aborigines in shell work. Less than a dozen abalone shells were associated with burials, and perhaps the same number of clam valves were seen. In a few cases these had notched edges. The presence of entire shells, and the lack of finished ornaments of Stockton-Lodi type on the coast, suggest that those found in the area were local products, although practically no chips were seen. A number of cases were recorded where new pendants had been made from broken forms. The shell may therefore have been so valuable that all was carefully utilized. Such economy would help to produce a variety of forms. The raw material for the beads seems to have been acquired through channels north of San Francisco bay. Incidentally the mounds on that side of the bay yield more shell work than do those on the southern shores. Also the people on the coast in this vicinity were of the Miwok linguistic group. The abalone might have come from the Monterey coast. Mrs. Ed. Yale

³⁹ For the identification of shells we are indebted to Dr. Frank C. Baker, Curator of the Museum of Natural History, University of Illinois.

of Mokelumne Hill, whose ancestors were Indians, resident in the foothills east of our district, stated to us that the abalone shell used by them was obtained from Monterey: and that the metate-like slabs of stone were used for grinding and polishing shell articles. Baker's identification would be in keeping with such a source, but other data make it appear improbable.

It is remarkable that shell ornaments never appear to have been "killed." Examples were noted where they had been burned, but that this practice was contemporaneous with or equivalent to "killing" is not certain. This absence of "killed" objects would seem to indicate that "killing" was not to prevent theft.

As suggested for the Emeryville mound, the horizontal distribution suggests differences due to individual makers. In our area were a number of types found only in this general vicinity. Moreover these were largely confined to a few sites. Further, numerous instances were recorded of single burials with from ten to fifty similar abalone pendants.

Our vertical distribution showed little. None of the elaborate abalone pieces were over three feet deep. Most of them came from mounds partly modern. Perhaps, therefore, they are relatively modern. On the other hand these mounds may have long been cultural centers.

Beads

For this section, reference should be made to glass beads (page 357), stone and steatite beads (page 382), bone beads (page 350), and clay beads (page 364).

For convenience no shell articles over 17 mm. diameter are considered beads but are discussed as pendants. Beads are first grouped according to material and then subdivided according to form. Practically all are drilled. The drilling appears to be mostly biconical though in the small discs the determination seems to depend considerably on the observer. Some holes might have been punched, but the appearance could well be due to wear. The state of preservation in all types varies greatly and seems to depend on other factors than age.

An estimate was made of the quantity of beads recovered. This was based partly on count, partly on linear measurement, and partly on weight. There were 108,400 in the Lodi collection, and Barr found approximately 50,000.

No statistical details for Stockton are available, although it is

believed that that region will accord with our Lodi discussion. But it must be remembered that in what follows about beads we take little account of the Stockton sites.

Beads of abalone shell.—The shell of *Haliotis rufescens* Swainson was most used. At San Miguel *Haliotis californiensis* was used almost exclusively. All were of the disc type.

Discs roughly square (pl. 87a); centrally drilled; fairly uniform size—about $7 \times 7 \times 1$ mm. Site 68 only. 2700 pieces.

Irregular thin discs (pl. 87b); centrally drilled; somewhat under 16 mm. diameter. Site 6 only. 10 pieces.

Circular (pl. 87c); two holes near center; from 12 mm. diameter to large pieces classed as pendants. Site 68 only. 150 pieces.

Rings (pl. 87d); average hole 3 mm. diameter; piece 6 mm. diameter. Site 6 only. 90 pieces.

None of these types except plate 87b were noted at Emeryville.

Beads of clam shell.—The shells of *Paphia tenerrima* Cpr., *Saxidomus nuttalli* Conrad, and *Tivela crassatelloides* Conrad were all used, the last two most extensively. These are all marine clams. *Tivela* was also much used in shell work in the Santa Barbara region.

Disc type.—Plate 87f-j. Discs, plain; maximum diameter 20 mm., minimum 5 mm.; maximum thickness 7, minimum 1 mm. Sites 1, 6, 19, 43, 48. At least 63,000 pieces.

In about 25 per cent the corrugations of the original shell were not polished off (87h). In very rare cases the edges were decorated with incised lines. Clam disc beads were the most numerous type in the Lodi region. The much smaller percentage present in the Stockton area would appear to check Kroeber's information that such beads arrived in the eastern San Joaquin valley principally from the Pomo Indians via the Wintun.⁴⁰ Their entire absence from sites 66 and 68 should be emphasized as it may indicate that these are older sites, since clam discs are most in evidence on the partly modern sites.

Plate 87k. Discs with two straight edges; made by grinding down the above type on two edges; average size $11 \times 7 \times 1\frac{1}{2}$ mm. Site 6 only. 900 pieces.

Plate 87e. Flat, ovate, thick, drilled from end to end; average size illustrated. Site 6 only, except a very few in Stockton region. 5 pieces.

Tabular type.—Plate 87x-ac. Maximum length seen, 90 mm. minimum 7 mm.; maximum diameter 10 mm., minimum 5 mm.; hole about 5 mm. diameter; largest piece 90 by 10 mm. Various colors: white,

⁴⁰ B. A. E., Bull. 78:421, 449.

probably normal, 529 pieces; purplish (pl. 87z), possibly from burning, 435 pieces; brown (pl. 87aa), probably from wear, 110 pieces. All the purple and brown beads and 435 pieces of the white ones were found at site 6 with one skeleton. Some white beads were found at sites 19 and 43 also. These were probably made from *Tivela crassatelloides*, the dark beads from the part of the shell near the hinge where it is colored purplish. The white beads could have been made from the light part of this clam, or from the axis of *Polinices lewisii* Gould, a large marine snail, or from some other thick snail. One unworked *Polinices* was recovered and also a few *Paphia tenerrima* Cpr.

Clamshell beads are practically absent in the Bay region; rare in the southern San Joaquin valley; numerous in the Santa Barbara region; but apparently occur more plentifully among the Pomo than elsewhere in California. The inference is that more trading was done by the Lodi aborigines in that direction, and hence their abalone also probably came from the seacoast north of San Francisco bay.

Beads of Olivella shell.—Plate 87l-m. Whole shells with spires ground off; great variation in size—5 to 25 mm. long. Practically all sites. 12,000 pieces. The most widely distributed bead in the area.

Plate 87n. Half-shells, more or less; edges rough; 8 to 16 mm. in diameter. Sites 6 and 43 mostly, also in Stockton. 3000 pieces.

Plate 87o. Circular discs, centrally perforated; 7 to 14 mm. diameter. Only at sites 1, 6, and 43; also at Stockton. 15,000 pieces. These beads generally show the natural curve of the shell, the smaller ones being flatter. As a rule, however, this curve is much more marked than in the olivella discs of the Bay or southern California. This cupped appearance is possibly due to the consistent selection of a different portion of the shell from that chosen by the other makers.

Plate 87p. Circular discs as above but with two edges more or less straight. Site 66, all with one burial. 250 pieces.

Inlay or bushing type; circular, flat, proportionately large hole; 2 to 3 mm. diameter. Sites 6 and 43, one burial only at each site. 1430 pieces. They have been found set as bushings for tubular stone beads at several other sites (pl. 96l-n).

Plate 87r. Rectangular; perforated near one end; slender; extra well made; average size $7 \times 5 \times 1$ mm. Sites 6 and 43, several lots. 7500 pieces.

Plate 87q and s. Rectangular; perforated near center; extra well made; vary from $10 \times 6 \times 1$ mm. to $5 \times 4 \times 1$ mm. Sites 66 and 68, several finds, mixed with whole shell beads.

In general the use of olivella beads in the Lodi-Stockton region does not check with the practice at Emeryville.

Beads of uncertain shell.—Tubular shell beads made from the axis or columella with the whorls still showing were observed. These were similar to beads found at San Miguel (Heye, pl. 113*h*). The shell used in our specimens was possibly that of the marine snail *Kellettia kellettia* Forbes, which is from the southern coast of California.

Pendants

The number and elaborateness of shell pendants was one of the outstanding features of the Lodi-Stockton region. This was in marked contrast with the San Francisco bay mounds, where such articles were scarce and comparatively simple. Even the Santa Barbara region with its wealth of shell material does not surpass our region in variety of design, skill of workmanship, or number of such articles.

Material.—All shell pendants were made of abalone shell, and in many cases almost the entire shell was used. In many instances small pendants had obviously been made from larger ones—presumably broken. The large pendants were usually worked on only one side; most of the small ones were polished on both sides. The drilling was biconical.

Position.—Most of the pendants were found on the upper portion of the body in such a position as to suggest that they had been in use as ornaments when burial took place. In a few cases they were over the eyes, on or in the mouth, and in a few others in heaps as though placed in the grave thus. In the Yolo county mounds the large pendants are reported as being frequently on top of the head. Barr found an infant with its head in an abalone shell.

Ornamentation.—The main dependence for effect was upon form. Other decorative efforts consisted in increasing the number of holes, in varying their position, and in incising the edges on the nacreous side with short lines (pl. 88*o*). A very considerable percentage of the circular pieces were so ornamented. In some cases a row of dots around the edge was used (pl. 89*c*) and in a few cases a cross or check instead of a straight line (pl. 88*a*). Notched edges were very rare. Plate 88*s* shows the most elaborate line design noted (site 43). The most delicate and elaborate form (pl. 90*f*) was from the same site.

Occurrence.—Abalone pendants were found at all sites where skeletons were unearthed. They seemed as plentiful and as elaborate even as far west as the Bethany sites. They were frequently in such

bad condition that they could not be collected, but the Lodi collection had about 2600 specimens and the Stockton collection 900. The concentration of certain forms and unusual quantities was noted in numerous cases; e.g., at site 83, seventy-three with one skeleton; at site 86 one hundred and twenty-five. Some of the Lodi concentrations are noted as the forms are described.

Form.—On the basis of form the pendants may be grouped as follows. The numbers given are for the Lodi region only.

Rim type pendants, crescentic in form and made from the heavy rim of the shell, were absent. They are found both on San Francisco bay and the Santa Barbara channel.

Dagger type pendants were also practically absent, only three pieces which might be so classed being noted. Some of the small rectangular pieces approached this form.

Rectangular type. While this type varied considerably in shape as well as in size, the sides were more or less straight and the corners square. Eight subtypes, based on the number of holes present, were noted, as follows.

Plate 88*a-f*, 89*e*. With *one* hole. Many specialized forms were seen, approximating shields, bars, tapers, etc. (pl. 88*d-g*). Maximum length 155 mm. (pl. 89*e*). Such large pieces were exceptional, only two being found in one grave at site 43. Ninety-two bar pendants as in plate 88*k*, but with one hole, were found at site 68. A few one-hole rectangular pendants were found at site 59, and were the only pendants there except a few circular two-hole pendants. 503 pieces.

Plate 89*l*. Breast-plate type. These were also rectangular and with one hole, but appear exceptional enough to be grouped separately. Maximum size 180 × 85 mm. Seven pieces were found with one skeleton at site 6. 13 pieces.

Plate 88*j, l-n*. With *two* holes, one at each end. Generally under 50 mm. long. Sites 6 and 43 only. Very rare variations have a third hole at the center. 436 pieces.

With both holes at same end, one over the other (pl. 88*k*). All in one grave at site 68. 37 pieces.

With both holes at same end, side by side (pl. 88*h, 89i*). Maximum length 62 mm. 20 pieces.

With both holes near center. 26 pieces.

Plate 88*q-r*. With *four* holes in various positions. Range from 17 to 100 mm. long. Several rhomboidal with specialized ends somewhat like plate 89*b*. 21 pieces.

With *five* holes. One piece was seen.

Unfinished outline. Only three such pieces were seen.

Many-holed type. One group of large, heavy pendants was characterized by a row of comparatively large holes near one edge (pl. 89*m*). These pendants were generally rectangular, although we recovered a number of fragments of large pieces which had been reworked and used in different shapes (pl. 89*f*). Twenty large pieces

and fifty of the smaller fragments were with one skeleton at site 6. One specimen came from site 43. There were no others from the Lodi region although several came from Stockton. 71 pieces.

Circular type. These pieces were more or less circular in form, often approximating elliptical or irregular forms.

Plate 89a. One hole, off center. Maximum diameter 80 mm. 17 pieces.

Plate 89d. One hole, near center. Maximum diameter 65 mm. Site 68 only. 33 pieces.

Plate 89k. Two holes, near center. Some were so small as to be classed as beads. Maximum diameter 100 mm. Site 68 only. 50 pieces.

Plate 89h. Two holes, one near edge. Maximum diameter 40 mm. Site 68 only. 11 pieces.

Plate 89c. Two holes, both off center, usually with a hole on opposite edges but sometimes with both close together at one edge. Maximum diameter 75 mm. Sites 6, 19, 43. 132 pieces.

Three holes, irregularly placed. Maximum diameter 35 mm. 14 pieces.

Plate 89b. Four holes variously placed. Sometimes, but not always, with two ends specialized as shown in the plate. 8 pieces.

Six-holed pieces were also seen. 3 pieces.

Irregular outline type. These are the most interesting forms, and all fall within the "banjo" group. There was usually a single hole at the unspecialized end. The largest was 160 mm. long.

Plate 90h. (See also Holmes's pl. 24.) *Entire-banjo*. 74 pieces.

Plate 90b, e. *Half-banjo*. These specimens may have been made from damaged entire-banjo pieces but they have been definitely cut and finished to the half-banjo form. 8 pieces.

plate 90g. *Semi-banjo*. Made by drilling instead of cutting. 3 pieces.

Plate 90a, c, f, i. *Modified-banjo*. The makers obviously had the banjo form in mind but did not attain it. 3 pieces.

A summary shows the following prevalence of types: Dagger, .2 per cent; rectangular, 71 per cent; unfinished outline, .2 per cent; many-holed 5 per cent; circular, 18 per cent; irregular (banjo), 6 per cent.

ARTICLES OF STEATITE

Steatite articles were so rare in the Lodi-Stockton area that they might well represent trade intrusions. The artifacts are discussed under their type headings in the Ground Stone section. The types and quantities revealed were as follows: beads, 3 kinds; curves, 3 (site 91); dishes or jars, 6; drilled discs, 2; earplugs or labrets, 4; fragments, 6; mortar, 1 (site 82); miscellaneous, 3; pipes, 28; pendants, 3; plummets, 1; tubes, 1 (miscellaneous ground stone). Attention is called to the large jars and the hourglass beads.

ARTICLES OF CHIPPED STONE

Arrowpoints, Spearheads, or Knives of Miscellaneous Stone

Only one-fifth of the chipped stone was other than obsidian (see page 370). The following remarks are based on the 144 entire specimens from the Lodi region. The Stockton specimens were essentially the same.

The tabulation shows the forms noted and the proportion of each.

Type	Characteristic form	Plate	Approximate percentage of 144 found	
			Spear	Arrow under 46 mm. long
	Not stemmed:			
NAa	Both ends pointed.....	91a-b	8.4	.....
NAb1	Convex at one end.....	91f	2.1	.....
NAb2	Straight at one end.....	91k	.7	.....
	Stemmed:			
SBa	Parallel-sided stem; shouldered.....	91j	5.6	4.8
SAa	Contracting stem; shouldered.....		4.2	.....
SAb	Contracting stem; shouldered and barbed.....		.7	2.
SAc	Contracting stem; lozenge shape.....	91g	.7	.....
SCa2	Expanding stem; shouldered, straight.....	91h	.7	.....
SCb1	Expanding stem; shouldered and barbed, convex.....		1.4	.....
SCb3	Expanding stem; shouldered and barbed, concave.....	91c, e, i	2.1	66.6
			26.6	73.4

Whether or not the expanding-stem forms should be classed as we have them, or as not-stemmed notched pieces, is problematical. At any rate, as with obsidian points, one type of point constitutes the great majority. Moreover practically all of the "arrowpoints" came from site 6 where closely similar points prevailed in obsidian. In other words, small points were characteristically absent in our area except at sites 6 and 82, where they were practically the only type. There is perhaps a somewhat more marked number of large stone forms than of large obsidian ones. Three of the large forms occurred only at site 6.

A considerable variety of non-obsidian materials was employed. Eighty-five per cent of the small points were of chert or closely allied material of various colors, and some of these pieces exhibited exceed-

ingly fine workmanship (pl. 91*i*). The remainder were of schistose material except one piece of quartz. Of the large pieces 70 per cent were schistose; 20 per cent, chert; 6 per cent, marble (?); 1 per cent, green chert; and 1 per cent white chert. It is interesting that so few pieces were made of the green chert, which was the only chert found in cores. The green chert type (SAb) was from site 68 only. The only other types from this site were non-stemmed, NAa and NAbl.

The maximum and minimum sizes are shown in plate 91, which also shows a number of average sizes.

One piece (pl. 91*b*) is noteworthy because it was ground after it was chipped.

From Stockton came three assymmetric points, sometimes called shaft scrapers (one, site 80; two, site 82).

Drills

A very few chert drills were reported. Plate 98*c* shows a green chert specimen from a burial at site 6. Barr had a long, slender, triangular specimen, which was ground as well as chipped (somewhat similar to pl. 91*b*).

“Eoliths”

No specimens were found which we would consider “eoliths” typologically. Obsidian chips were noted in practically all the sites. At site 6 they were extremely abundant and several pounds were collected from the surface in the course of three visits. Some of these were as large as two inches long, one inch wide, and a half-inch thick. But such flakes were exceptional and most of the chips were small. Sites 43 and 80 were next in abundance and yielded possibly one-quarter as many. Such chips might be taken to indicate workshops, but no rejects or uncompleted points were found at these sites. It is perhaps significant that site 6, certainly post-Caucasian, yielded the greatest evidence of obsidian working from the surface. A cache of twenty-eight obsidian chips was with one burial at site 80.

Chips of other material were comparatively rare. Those of green chert (which incidentally was the chert characteristic of Emeryville) were most common, and four cores of this material were collected. Strange to say very few artifacts of this material were found; the most notable were two pieces which may have been cores (pl. 92*g*).

“Palaeoliths”

To make the evolution to our neolithic forms complete we record the following “palaeolithic” forms, although we believe them to be accidental forms or rejects.

Plate 92*g* shows a green chert disc with sharp edges similar to European paleoliths. Two were found on the surface of site 43. The largest was 110 mm. in diameter. They were probably cores, although more regular than others found of the same material.

Plate 92*f*. A heavy, irregular, wedge-like piece of chipped schist. Found with a burial at site 68.

Plate 92*a-e*. Pebbles with the edges chipped or sharpened by striking. These are the same as the numerous “scrapers” of the Columbia river. A few pieces were found in both our regions.

ARTICLES OF GROUND STONE

Beads

Steatite.—For convenience the steatite beads are discussed separately. Three types appeared.

Disc type (pl. 102*j-o*).—Comparatively numerous, 500 from the Lodi region; Stockton uncertain. They varied in diameter from 3 to 14 mm., and in thickness from 1 to 10 mm. Only a few appeared with any one skeleton. About ten came from site 15, about twenty from site 43, and the balance from site 6.

Ring type (pl. 102*p-q*).—These are modifications of the disc type, comparatively thin, with comparatively large holes. Only four were found, each with a separate burial; three from site 6, and one from 43.

Hourglass type (pl. 102*c-i*).—These were very rare in the Stockton region, and Barr, finding large ones separately, supposed them to be nose pins. However, about seventy-five came from Lodi in eleven different “finds” at sites 6 and 43. The variations in size, proportions, and end design are shown in plate 102. In one case (pl. 102*g*) clamshell discs, with which they were alternated in stringing, were still in place. The design of these beads is quite unusual.

Magnesite.—The only other stone material used for beads, so far as we observed, was magnesite. Barr recorded a number of argillite beads, but we believe he referred to magnesite beads. They were rare in the Stockton region. All were with burials: forty-six pieces with

one at site 80; ten with another at site 83; and one at site 86. They were much more plentiful in the Lodi region. These beads were made of baked magnesite such as may be obtained in the raw state in eastern Lake county. They were generally cream colored, but some had turned to deep pink or brown, presumably from the baking. Some burned specimens were black. Many beads showed a high polish and a beautiful color, much like that of a meerschaum pipe, but the workmanship exhibited in their manufacture was only fair. Probably 10 per cent were bushed with shell discs 3 to 4 mm. in diameter (pl. 96*l-n*). One fragment was ornamented (pl. 96*k*).

The presence of so many of these beads is doubly interesting. Kroeber states⁴¹ that such beads originate in southeastern Pomo territory. So here again, as with clam discs and obsidian, there is strong indication of a close connection between our area and the western side of the Great Central valley. Moreover, since the beads were much more plentiful in Lodi than in Stockton, we apparently see indications of the line of demarcation of northern influence. The second point of interest is that they reveal the wealth of the group at site 6. According to Kroeber the southern Maidu valued a bead an inch long and a third in diameter, made of this material, at five American dollars. Hence those present at site 6 must have represented a very considerable exchange value, and the concentration of so much wealth again characterizes this site as a cultural center.

Disc type (pl. 96*a-j*).—Maximum diameter 28 mm., minimum, 5 mm.; maximum thickness 15 mm., minimum, 1.5 mm. Practically all from site 6, a few from 43, and still fewer from 15. About 1500 pieces.

Tubular type (pl. 96*o-y*).—Maximum diameter 20 mm., minimum, 5; maximum length 32 mm., minimum 8 mm. Hole drilled from both ends. Mostly from site 6; a few from 43. About 220 pieces.

Lozenge type.—Very similar to the shell beads shown in plate 37*e*. Very rare, only half a dozen in both collections. Found with several other magnesite beads.

Dishes and Jars

These were all of steatite. Two shallow vesels with small handles came from two burials at site 83. One was 115 mm. by 90 mm., the other 95 by 55 mm. The larger dish was with the skeleton of a person twelve to fourteen years old, about five inches deep in the yellow clay, with two feet of mound material on top. With this burial were also found two flat rocks, three pestles, a spearhead, a "Stockton curve," an arrowpoint, ten bone whistles, five bone tubes, and shell

⁴¹ B. A. E., Bull. 78:249.

beads. The other steatite dish was with an adult eight inches in the clay, with two "Stockton curves," an arrowpoint, two notched bones, pestle, steatite pipe, and a large number of badly decayed shell ornaments.

In this same site, with another burial, were two small dish-like objects of stone, not steatite.

These objects strongly resemble Aleutian lamps.⁴² Other articles at this site suggest the Aleut sea-otter hunters of historic times. On the other hand there is considerable resemblance to the Yurok "salmon grease dish" shown by Kroeber.⁴³

From site 82 four remarkable jars or vase-like vessels were recovered. (See Holmes's pl. 24.) The largest was 320 mm. high by 100 mm. in diameter, and tapered slightly toward the base. The smallest, found by Jones, was described as "a cylindrical vessel of magnesian mica some ten inches long and of oval section." This specimen was with a burial five or six feet deep—as deep as any artifact in the mound. Barr's specimens came from three feet deep, which is about the deepest he dug. All were not found by Barr himself, hence their associations were not clear. The walls are thin and the exteriors show such excellent workmanship as almost to suggest modern tools. At any rate the presence of four of them at one (at least partly modern) site and none elsewhere is notable.

Double-pointed Pieces

A number of pencil-like objects made of ground schist were found both in the Stockton and Lodi regions (pl. 97*i-q*). These were very similar to the larger, double-pointed, bone objects, mentioned before, and one would expect them to have been made for the same purpose. The longest was 150 mm., the shortest 55 mm. In cross-section they varied from circular to elliptical and from 5 to 10 mm. in diameter. Some of them seemed to come in pairs (pl. 97*i-j*). Still, 15 pieces of all types were found with one burial at site 68. In the Lodi region 25 pieces were obtained. All these were from site 68 with the exception of a possible fragmentary one from site 66. Two pieces were found isolated. The remainder were with three burials (15 with one; 4 with another; 3 with the third). These were not in place as nose pins or hairpins. The fifteen were in a compact bunch under the chin. The three were lying side by side under the jaw. The four were side by side near the ribs.

⁴² Jochelson, *op. cit.*, pl. 18, fig. 5.

⁴³ B. A. E., Bull. 78, pl. 16.

In the Stockton collection was a piece somewhat like plate 97*o*, but made of steatite and with a double-ridged center. This was more definitely suggestive of a nose pin.

Drilled Discs and Doughnut Stones

About twenty drilled discs were found in the Lodi region (pl. 98*e-f*). These varied in diameter from 60 to 90 mm., and in thickness from 10 to 20 mm. This thinness seemed to distinguish them from doughnut-shaped stones. All were biconically drilled. The average hole was about 7 mm. diameter. In one case the hole was oblong, which would permit the piece being wedged in position. Several pieces were broken by fire. One was of steatite (site 20). Another was from site 43; the balance from 6. There were about the same number from the Stockton region, one of steatite. Possibly they were used as pendants. However, similar discs were found made of clay and hardly suitable for ornaments. A more probable use, suggested by Meredith, is that they acted as fly-wheels for bow and hand drills. (See also Perforated Discs, Baked Clay.)

Knives

Two curved ground stone knives, about 125 mm. long, were found at site 83 with a burial. They were very similar to other specimens which Barr had from the Santa Barbara islands, and were probably traded in from there, although they might represent Aleut hunter intrusions.

Labrets

As mentioned, a few probable earplugs made of clay were found in the area. In addition, with one burial at site 66 were three steatite labrets, two of which are shown in plate 102*a-b*. These were the only such articles from the Lodi region, and they came from the site showing the most clay articles of the same presumed use. A specimen was also found at site 80, not with a burial. In view of such scarcity it is interesting to note that Barr obtained eleven from the Bethany mounds, all with burials.

Miscellaneous

Plate 98*b* illustrates a well polished granite piece, shaped like a pick, sharp-pointed hammer, or banner stone. This is so very exceptional and so similar to forms found in the eastern United States that

we cannot but regard it with suspicion. However, a reputable man claimed to have found it eight or ten feet deep when digging a well near site 31.

Plate 98*i*. This flat, hard, black piece of schist (?) is highly polished on all sides and edges. It came from a burial at site 6.

Plate 98*g* shows a fragment of a steatite tube with a groove at either end. Site 46.

Mortars

Quantity.—Mortars were singularly scarce in our area. Plate 99 illustrates the five entire specimens and the five fragmentary ones yielded by the Lodi region. Barr catalogued over 100, but a close check of the specimens showed that most of them came from the foothills east of our area, and that only eighteen were from the Stockton region. These specimens were similar to those shown in plate 99. It may be added that practically none of the farmers of our area have mortars about their places, as farmers ordinarily do in sites where such articles are plentiful and found in the course of farm work.

Occurrence.—Seven of the Stockton mortars came from site 82; four, from 80; two, from 83; and one each from five miscellaneous sites. Only four were with burials, two at 82 and two at 83. None of the Lodi mortars were with burials. Six came from site 6, twenty-four to thirty inches deep; one from site 43, same depth, and two from the surface; one from site 68, eighteen inches deep.

Size.—All these mortars would be classed as small. They range from 75 to 185 mm. in diameter, and from 35 to 75 mm. high, with bowls not over 25 mm. deep. One of the Barr specimens was so small (28 by 22 mm.) as to make the term mortar doubtful. Some of the cupped clay balls strongly resembled the small mortars.

Type.—All the mortars were irregular in shape, being of the type made from selected but unfashioned pebbles.⁴⁴ The workmanship is poor.

Usage.—One of the Stockton mortars contained red paint; several others showed paint marks. Barr described eight of his specimens as "paint mortars." Considering the size and shape of the mortars of the entire area, it is obvious that they were entirely unsuitable for the preparation of food. They were probably used for paint or cere-

⁴⁴ This is type V according to the classification followed at Emeryville, where such mortars were in the minority, and the prevailing type, II, a much higher production in every respect and not at all represented in the Lodi-Stockton area. Schenck, *op. cit.*, 244.

monially. In two cases, site 6, secondary use was indicated by holes in the base similar to those found in "tool sharpeners."

Age suggestions.—With acorns abundant and pestles recovered in considerable numbers, the entire absence of stone food mortars is interesting. For example, no mortars came from site 86, which yielded forty-two pestles. Probably wooden mortars were used, such, for example, as were used by modern Yokuts and Patwin. The absence of stone from our area supports such a view. It is possibly worth recalling, however, that Barr obtained many mortars immediately east of the area in a region the aborigines from our area seem to have frequented at times. Kroeber makes the absence of conical mortars among the modern Miwok a temporal characteristic, i.e., all such mortars found in their habitats are taken to be prehistoric, but the above suggests rather that their presence or absence is primarily a question of regions.⁴⁵

It may be added here that no metates were found. About six flat slabs somewhat concaved as if from rubbing were noted. However, since the largest of these was under a foot long, it seemed unlikely that they could have been customarily used in the preparation of food. Barr found also about fifteen discoidal stones somewhat similar to manos. As these were frequently pecked or concaved on the sides, it appeared to us more likely that they were hammerstones, or stones used in cracking acorns.

Pendants

A few pieces of ground stone, which had probably been fashioned for pendants or ear ornaments, were noted. Plate 97*b, c, e-h* illustrates most of them. Generally they were of slate-like material, although three pieces of steatite (pl. 102*r*) and one of polished amphibole (pl. 97*d*) were seen.

Pestles

Quantity.—Pestles were associated with more burials in our area than any other type of artifact except beads and shell ornaments (see page 346). Barr catalogued 179 specimens, excluding those he obtained outside our area. From the Lodi region 139 were obtained. About 90 per cent of all specimens were with burials.

Materials.—The great majority of the pestles were made of granite such as is obtainable in the mountains to the east. One group was characteristically made of a very coarse-grained granite.

⁴⁵ B. A. E., Bull. 78:448.

Types and size.—There were comparatively few types, and these were simple, although the workmanship displayed by some of the long cylindrical pieces was excellent. The frequency of occurrence of the types was as follows, though the types shade into one another so gradually that a rigid division between them is unwarranted.

Type of pestle	Per cent found		Typical illustration
	Stockton	Lodi	
Round, ends plain.....	44	70	Pl. 100 <i>a-b</i>
Flattish, robust, ends plain.....	?	24	Pl. 100 <i>f-g</i>
“Phallic” end.....	22	4	Pl. 100 <i>d</i>
“Ball bat” end.....	7	2	Pl. 100 <i>c</i>
Uncertain.....	27	0	.....

The round type with both ends plain was called by Barr “roller type.” It was characteristically round in cross-section; at times elliptical. It also had been fashioned and more or less polished. Both ends were used. A few specimens taper to one or both ends. They ranged in length from 125 to 525 mm. Perhaps two-thirds are less than 300 mm., and the great majority are between 250 and 275 mm. The Lodi specimens of this type fall into two divisions: first, those such as just described, which have diameters from 30 to 75 mm., but usually about 50 mm., and are accordingly comparatively slender (pl. 100*b*); second, pestles generally made of coarse-grained granite and very robust, the usual diameter being about 100 mm. (pl. 100*a*). Twenty-seven per cent of all the Lodi specimens were of this kind.

The flattish pestles were very similar to those last described, except that they were flattish or elliptical in cross-section rather than circular. Also they were frequently made of natural stones which had been selected but only partly fashioned.

Barr divided the pestles with one end used for pounding and the other specialized in a more or less ornamental manner into two groups. His so-called “phallic end” is illustrated in plate 100*d*. It seems to the present writers that evidence of phallic implications is insufficient. In cases the transition to the second or “ball bat” type (pl. 100*c*) is gradual; one form may well have grown out of the other and both have arisen from a desire for ornamentation, or as a device to keep the hands from slipping during work. We are familiar with no collateral evidence to support the phallus hypothesis. Some of the finest Stockton specimens are of the “ball bat” type and a greater propor-

tion of these were associated with burials than was the case with any other type. The range in length was also greatest—from 100 to 500 mm.

Occurrence.—No particular type characterized a given mound; frequently several of the types were together in the same grave. Obviously, then, they were used contemporaneously and probably for the same general purpose. Few were small enough for paint or medicine pestles. Nearly 95 per cent of the Lodi pestles were from two sites (20 per cent from site 43, and 75 per cent from site 6). This was probably due to the fact that more burials were found at these two sites, although the dearth of pestles at other sites was in keeping with the scarcity of mortars. All the Lodi pestles with specialized ends were also found at site 6. This scarcity and concentration is in marked contrast to Stockton, where such pestles were comparatively numerous and came from a number of sites.

Pestle-like pebbles.—In both regions a number (27 in Lodi) of long (80–250 mm.), slender pebbles were found which might have been used as pestles but which gave little or no evidence of such use. They were noted because they were frequently with burials and because they must have been selected and brought into our area by man. (See also Pebbles, page 395.)

In a few cases the sides of pestles were worn down in such a manner as might have been expected if they had been used as rubbing stones for crushing seed.

Pipes

Twenty-one stone pipes came from the Lodi region and twelve from Stockton. All were with burials except two of the Lodi specimens. A few clay pipes were also found (see page 366). Eleven of the Stockton pipes, and 17 of the Lodi pipes, the most elaborate ones, were of steatite; five were of whitish marble (?). Six specimens came from site 86; three from 83; and one each from 82 and 91. (Barr also obtained three steatite pipes from Bethany.) The Lodi pipes came from sites 6, 43, and 52. Most of them had been “killed” or broken, perhaps by being burned with other grave associations. Six of the site 6 specimens were in one hole some eight feet square, with several bodies. All pipes were tubular, as is customary in California. The flaring type and the long, slender type came from both regions. The best Stockton specimens are shown by Moorehead;⁴⁶ the best Lodi pieces, in our plate 101*a-j*. In two specimens the bone stem used is still present in part, as is also some charred material in the bowl. Plate 101*g* suggests an unusually large heavy pipe.

⁴⁶ *The Stone Age in America*, fig. 446, 1910.

Four of the marble pipes came from the same hole in site 6 as the six steatite pipes; the fifth from site 80. Plate 101*h* illustrates the most nearly complete one. Others were apparently quite large and heavy (pl. 101*i-j*). Since this material would show usage, the absence of any trace suggests that at least some of the pipes may have been used by sucking shamans rather than for smoking.

The number of pipes in the Lodi-Stockton area is in marked contrast with their scarcity in the Bay region.

Plummet-like Stones

Quantity and occurrence.—Barr catalogued seventeen specimens from the Stockton region. (He also obtained seventeen from the site near Bethany.) Dawson recovered eighteen, eight of which were from site 68. About half the specimens were with burials; seven were plowed up; two were found in dredging streams. Six of the specimens from site 68 were with one burial and thirteen of the Bethany pieces were with a single skeleton.

Material.—Nine Lodi specimens were made from a schistose material (pl. 101*o-q*), three of granite (pl. 101*n*), three of marble (pl. 101*m*), one of sandstone, and one of steatite (pl. 101*k*). The Stockton materials were essentially the same. The finish and workmanship was good in all cases. Barr obtained a few clay balls that resembled plummetts. From site 68 came a quartz pebble which had been pecked in part until it resembled an unfinished plummet (pl. 101*l*).

Form.—All of the unbroken Lodi specimens were perforated. Ten Stockton pieces were also perforated. This dominance of the perforated type was in marked contrast to the variety of forms found in the Alpaugh region of the southern San Joaquin valley and in the Suisun-San Francisco Bay region. In these regions the perforated pieces constitute but a small proportion. Moreover they are inclined to be bulbous, generally cruder, and more frequently of steatite (more like the plate 101*k* specimen). The range in size and form of the Lodi specimens is shown in plate 101. Three Stockton specimens were grooved at both ends, two were top-shaped, and two had nipped (or "phallic") ends.

Usage.—The present writer has discussed these plummet-like stones or charmstones in detail in the Emeryville paper. There seems nothing new to add except the suggestion that they may have been more numerous along the shores of Suisun and parts of San Francisco bay

and near Tulare lake because they were employed in certain forms of fishing (e.g., with nets) which were not suitable to the waterways of our area. However, if the one man at Bethany with thirteen pieces had got into our area, the proportion of such pieces there would have been markedly increased. The concentration of specimens lends no particular magical association to these pieces since they are no more concentrated than a number of other objects.⁴⁷

Whetstones or Polishing Stones

Dawson had sixty-six pieces of sandstone of various shapes and sizes, all showing such wear as would result from using them for whetting or polishing. They were mostly from sites 6 and 43. Many had holes for rounding points, and grooves for sharpening them. All were much worn, usually showing usage on several different surfaces. Plate 98*a* illustrates a typical specimen. It is interesting to contrast the relative abundance of these tool-making articles with the scarcity of the concaved metate-like stones, if the latter are conceived of as food-preparing apparatus. It seems more likely that the metate-like pieces and possibly some of these whetstones were used in the manufacture of shell artifacts.

ARTICLES OF UNWORKED STONE

Anvils

A very few oblong stones were observed with more or less battered sides, but with no wear on the ends as would be expected in the case of a pestle or hammerstone. Possibly they had been selected for such articles but never completed. Some of the discoidal stones with concaved sides were probably used in cracking acorns, both as hammers and as anvils.

Cooking Stones

Barr recovered a half-dozen or so flat stones. One, for example, was 240 by 140 by 75 mm. with broad, shallow depressions. This stone had been blackened by fire. It is possible that such stones were used to cook on. (See Whetstones.)

⁴⁷ Since writing the above the writer has seen on exhibit in the American Museum of Natural History, New York City, elongated, similar-ended, non-perforated plummets or "charmstones" from Arica, South America. These are still bound to lines and furnish very strong evidence of their use as sinkers in fishing.

Crystals

One hundred and forty-eight crystals were recovered from our area. The most notable thing about these was that 118 came from site 68 alone, where a single skeleton was found with 41 pieces. The regional distribution was also interesting, Lodi yielding 142 and Stockton only six. Crystals were found at sites 6, 43, 56, 59, and 68. In the Stockton region three came from site 82, and one each from sites 83 and 91. Crystals came from all levels of the mound mass. Three at site 43, one at 56, and four at 6 were found on or near the surface. At site 68 nine scattered specimens were recovered. All other crystals were found with skeletons. It seems probable that the specimens may have been found on the surface because of rodent's work.

Crystals were of two kinds: the plain quartz crystal with facets at one end, rough at the other, six-sided; and the crystal known to jewelers as false topaz. The latter were in all cases fragments of the large original crystals, but had apparently been selected and used in their fragmentary condition, since they were found with other crystals. No false topaz crystals came from the Stockton region.

The largest crystal was 190 by 25 mm. and was from site 82. None of them gave evidence of having been ornamented with asphaltum and shell beads, as was done on San Francisco bay and along the Santa Barbara channel. One piece had been partly fashioned (pl. 1011) and the edges of several pieces were worn, but whether this was natural or due to man's use it is impossible to state.

No crystals occur naturally within our area. In the foothills to the east (Calaveras county) are caves in which plain crystals are found, and in the same region both types of crystals may be found on the surface.

Crystals have usually been supposed to have had magical connotations. In two of the Stockton burials a single crystal was the only object with the skeleton. In a number of cases only one crystal was present, but it was associated with other artifacts. These associations varied in complexity, some of them being our most complex, but so far as can be determined neither the individual articles nor their grouping with crystals appear characteristically different from the usual burial groups. In other words, if they were magical the evidence suggests that they were individual charms rather than parts of shamans' charm bags.

The remarkable concentration of crystals at site 68 was one of the most interesting cultural facts of the area. It seems worth while indicating in detail the groups found with burials.

Number of crystals	Articles with skeleton
7	3 quartz, 4 false topaz. Olivella shell beads, shell disks and ornaments; spindle whorl, paint, and 3 obsidian points.
1	Quartz. Shell disks, olivella shell beads, several pencil-like objects of slate, and amphibole objects.
21	False topaz. Six leaf-shaped blades, bone awl, shell bead, and animal tooth.
41	False topaz. Nothing else found with skeleton.
2	Quartz. Olivella shell beads and bird claws. One of the crystals is a double one.
16	4 quartz, 12 false topaz. Shell ornament, 2 portions of shell ornaments, and olivella shell bead.
1	Quartz. Shell ornaments and shell beads.
1	False topaz. Shell beads and chipped stone object.
19	7 quartz, 11 false topaz, one worked (?) quartz. Three pencil-like objects of slate, plummet-like stone, two pieces of zinc blende, olivella shell bead, and 5 coyote teeth.

It will be seen that the associations with these crystals were not remarkable. Yet here were five burials, any one of which yielded more crystals than all the sites of the Stockton area. Omit them and there was nothing remarkable in the crystal distribution at site 68. Another point that strikes one is the lack of all other artifacts with the burial having forty-one crystals, about ten times as many as obtained from the entire Emeryville shellmound. It seems unreasonable to the writer to assume that site 68 was unusually rich in shamans. It also is unlikely that for a long period of years the people of this site should have specialized in crystals at a location which offered no natural advantage or suggestion for such specialization. It seems more plausible to suppose that a group wandering in the foothills happened upon a natural concentration of crystals and collected a great many. Subsequently they settled at site 68; and our five burials reflect the result of this one expedition and discovery. It is this phase which seems to us important, for here as in the concentration of types of artifacts the impression given is that of only a brief span of culture.

Hammerstones

In each region possibly a dozen stones were found which had been battered in such a manner as to suggest their having been used as hammers. Some were pebbles; others were fragments of a heavy greenstone. None appeared to have been shaped, and they varied greatly in size and form.

In addition there were in the Lodi collection four discoidal stones with the sides pecked slightly concave and the edges battered.

Miscellaneous

Several pieces of minerals were found placed with burials. All these minerals can be obtained in the Sierra Nevada mountains just east of our area.

Nine slivers of asbestos (amphibole) came from site 68; three from site 43; two from 6; and one from 66.

Two small lumps of zinc blende (sphalerite) were with a skeleton at site 68.

The other minerals noted were from site 6, and included chalcopyrite, chlorite schist, and muscovite schist.

Mica

About ten pieces of mica (pl. 97a) cut to an irregularly square shape with 20 mm. sides and perforated (punched?) near one edge with a 3 mm. hole were found at site 68 with several burials. Mica ornaments were not found at any other site in our area, but were noted in the Emeryville shellmound.

Paint

Barr recorded nine lots of red "paint"; and we recovered thirteen lots from the Lodi sites. These were all, with one exception, found in association with skeletons, and paint was noted on the bones of other skeletons where it could not be collected. Barr noted one case where the paint was shaped as it came from the mortar, and another where it was in the form of a cylinder seven inches long and four inches in diameter. In one Lodi case, also, the material had been pulverized and shaped. Otherwise it came in small irregular lumps. In three cases these showed grooves made in the course of use (pl. 98d). This paint is the ferric oxide common among the Indians of California.

None of it was found in its yellow form (ferrous oxide), nor was paint of any other color noted, with the possible exception of a few pieces of chalky white material.

Pebbles

In the Lodi collection are 132 pebbles and in Stockton about the same number, which cannot be natural to the mounds but which show no signs of having been fashioned or used by man. They vary from very thick flat pieces 25 mm. wide to round pieces 150 mm. in diameter by 60 mm. thick. The material is granitic or basaltic with the former predominating. Some of these were probably used for fire or cook-stones, as they show signs of having been heated. Others were possibly selected for their odd shape or coloring. Still others were possibly acorn shellers.

A weathered obsidian pebble was found at site 6.

SEED

In the charred material several kinds of seed were observed: two species of acorns, a seed like a small hazelnut, and a quantity of millet-like seed. A small amount of very fine charred seed was recovered from a small bone tube which had not been burned.

TEXTILES AND CORDAGE

Practically all evidence of such materials was in the form of charred fragments from sites 6 and 82.

Basketry

All basketry noted was of the coiled type, usually with a two or three-rod foundation (pl. 75*a-c, e*). A one-rod foundation was apparently also used (pl. 75*d*). The weaving as a rule was very good. Several different degrees of fineness were noted (pl. 75*a, c*). This was the historic type of basketry in the region. A possible basketry cap with shell bead ornaments was indicated in one case. Caps have not been recorded for the historic Indians of regions immediately surrounding our area.

Cloth

Plate 750-*p* shows cloth of two different weaves. These fragments appear to be cotton or wool and probably were contemporaneous with the glass beads in the same mounds, although they were not found together. Barr also noted articles which he described as "fragments of a dress." There is no evidence to support the theory that cotton was used or cloth of any kind woven in central California in prehistoric time. Hence our rather perfunctory dismissal of these specimens. Their extreme fragility made examination difficult. If it were established that they were cotton cloth it is difficult to see how they would mean more or less than the glass beads.

Cordage

Specimens of 2-ply left-twist string are 1 mm. in diameter (pl. 75*f-g*); 2 mm. diameter (pl. 75*j*); 3 mm. diameter (pl. 75*i*); and 5 mm. diameter (pl. 75*k*). The smallest cord was used for stringing beads and for binding an inserted object, perhaps a drill or dart-bead, into a split twig (pl. 75*f*). The 2 mm. cord was used for nets (pl. 75*m*) and in making tule mats (pl. 75*l*).

A three-ply 6 mm. braided cord was also seen (pl. 75*n*).

Some of the material still remaining in pendant holes suggested a sinew or twisted strip of bark.

Matting

No coarse mats were noted, possibly because such articles would not be burnt as offerings to the dead. Plate 75*l* shows a mat, probably of small tule strips laid parallel and held by twined rows of cord. These might have been parts of cradles.

Nets

In both regions, and in an even more marked degree in Yolo county, to the northwest, fragments of charred nets were found. In most cases they were in such shape (pl. 75*m*) that no details as to size and mesh could be obtained. Since the early Spanish accounts report the Indians of the Delta region fishing with nets, it may be assumed that our specimens were so used. Conclusions as to their relative abundance seem unwarranted.

SUMMARY OF MATERIAL CULTURE

It would seem that in an area where the culture was as even as in prehistoric California, much of the value of archaeological work will depend upon detection and comparison of secondary differences. Such differences can be given only in detailed descriptions. Hence we deplore their elimination, as must result in any attempted summary. With these reservations, and as a matter of convenience to the reader not interested in local aspects, we give in table 4 a few generalizations which seem to apply to the material culture of the Lodi-Stockton area as a whole.

TABLE 4

MAIN CHARACTERISTICS OF THE MATERIAL CULTURE OF THE LODI-STOCKTON AREA

<i>Articles of</i>	<i>Characteristics</i>
Bone	Relatively scarce; mostly bird bone, perhaps some sea mammal. Marked preponderance of non-utilitarian forms: etched tubes most definite aesthetic expression. Fleshers, ulna awls, and special forms notably absent.
Clay (baked)	Unique "balls" in profusion: elaborate forms and decoration. Unique effigies of birds. A few southern forms—pipes, spindle whorls, "doughnuts." Some earplugs.
Caucasian make	Profusion of glass beads but in restricted localities. Perhaps cotton cloth.
Horn	Scarce. Fishhooks or spears notable (perhaps of sea mammal bone). Wedges practically absent.
Shell	Very abundant: all ornamental forms. Unique abalone pendants. Clamshell disc favorite bead. Olivella relatively scarce.
Steatite	Rare but some unusual forms, e.g., hourglass beads, small dishes, tall, thin-walled jars. A few labrets.
Chipped stone	Four-fifths of obsidian: three-fourths "arrows," most of arrows expanding base type. Unique and problematical curved forms of obsidian.
Ground stone	Relatively scarce. Food mortars entirely absent; pestles plentiful. Pipes comparatively plentiful; plummetts scarce and mostly of the perforated type. Many baked magnesite beads.
Unworked stone	Very little but prominent because of natural absence of stone in area. A few odd forms: a few mineral specimens. Concentration of crystals noteworthy.

General Aspects

A few possibilities which these broader aspects suggest may also be set down. The small quantity of bone artifacts and the limited proportion of animal bone characterize the culture; but they also suggest

that only a limited phase of a given group's life is reflected. The unique baked clay "balls" may point to the beginnings of an independent invention. This is emphasized by the bird effigies also limited to the area. However, the presence of other clay forms and the possible recency of the "balls" suggest that the idea of the use of baked clay was received from elsewhere, and a local degeneration of the idea is indicated. The occurrence at site 1 of modern Caucasian articles throughout a mound mass as deep as the average mass of other sites shows how quickly a "mound" can be developed. Two other sites, 6 and 82, which disclosed glass beads, were major sites. Indirect Caucasian influence may perhaps be represented by evidence left in the area by Aleut sea-otter hunters. The limited use of horn would correlate with the scarcity of animal-bone artifacts. The absence of wedges and the presence of fishing apparatus seem fairly definite occupational suggestions. The abundance of marine shell work may indicate excursions quite far afield. This would be in keeping with the conclusions which may reasonably be drawn from the early historical accounts. On the other hand trade only may be indicated. On the whole the shell work points to affiliations north of the Golden Gate, although the abalone could well have come from the ocean shore as far south as Monterey, as one informant suggested to us. The prevalence of unique forms of abalone pendants is to be emphasized as a local expression. Chipped obsidian again shows a unique expression in the "Stockton curves" and in the preponderance of a certain type of arrowpoint which is not the type predominating in the southern San Joaquin valley, at Santa Barbara, Emeryville, or on the Columbia river in Oregon. The raw obsidian and the magnesite beads again point to close affiliations with the area immediately northwest. The fact that the steatite work, although so limited in quantity, yet exhibits such a high degree of workmanship and so many unusual forms, impresses one with the feeling that such articles were imported. The absence of stone food-mortars and the presence of many good pestles points to the use of wood as among the modern Yokuts. Stone pipes were relatively elaborate and abundant, but were mostly made of steatite and not so plentiful as to preclude their possible arrival through trade. It is not clear that most of them were used for smoking. Plummets were scarce, and the preponderance of one type (perforated) is noteworthy. The Emeryville evidence suggested this was the older type. The present evidence tends to reverse such a suggestion and points rather to the perforations being a feature of usage.

The culture within our area cannot be said to disclose an evolutionary process. Some six of our sites are far richer in their yields than the other eighty-five. But this seems a matter of usage. Site 43 gives considerable evidence of being contemporaneous with site 6, yet the material from 43 is much less in quantity and of fewer forms. We suppose the six to have been village sites and the others camp sites or temporary stopping places. On the whole, the culture of sites 6 and 82 seems more complex than that of site 68, which is also a major site. Since 6 and 82 are partly modern, their greater complexity may be due to the passage of time.

Characteristic Differences Between Stockton and Lodi Subregions

Regional differences.—It may be seen that certain articles characterize the general vicinity of our area, viz., clay "balls," obsidian curves, and "banjo" pendants. Moreover, characteristic differences may be noted between the Stockton and Lodi regions. For example, Stockton yielded more steatite, more fish-spears, more curves, and perhaps on the whole showed more affiliations with the south and west. Lodi yielded more clamshell beads, more magnesite, and rather suggested connections with the north and west. It would perhaps be reasonable from the evidence examined to assume that these differences were contemporaneous and express regional cultural differentiations.

Aside from the relative age of the types of artifacts, these differences show the beginnings of a cultural division within our area, the line falling about where we have drawn that between the Lodi and the Stockton regions. (In considering such a division it seems well to remember the relatively enormous effect which the burial of one man with even a somewhat unusual concentration of artifacts might have.) The cleavage is more clear when the Bethany region is considered. This produced, proportionally, more "fishhooks," more pipes, more labrets than did Stockton or Lodi. On the other hand Lodi is richer in the materials from the northwest, notably clamshell beads and magnesite. Abalone pendants seem to have been equally abundant along the entire western front of our area, but by the time we have reached the eastern shores of San Francisco bay proper the types have changed. The few "doughnut stones," spindle whorls, and potsherds might indicate contacts with the southern San Joaquin valley, and the steatite and tubular shell beads with the Santa Barbara channel. However, one hundred miles beyond our region south or west the

differences seem more marked than the resemblances. Less data are available for the areas to the northwest. While we lose our main similarities after one hundred miles, the connection in this direction is more continuous and more marked. The relation with the area adjoining on the east is vague. It is known that in historic times the Indians from our area retreated east. Hence remains there should be to some degree the same as in our area. However, when Barr went through the region collecting, he secured more mortars than anything else, and these are entirely different from those of our area. The writer is not willing to relinquish the theory that the people of our area ranged into the mountains on the east, for this is attested by the early Spanish accounts, and by the fact adduced from these accounts that there was little aboriginal settlement in a region which did not have a mountainous hinterland. If the people of our area did range eastward, then the archaeological evidence from that area must be obtained before we have a complete story.

Since Stockton resembles Bethany, and Lodi, Yolo county, and both differ from the region to the east, it may appear that the cultural division followed topographical lines, e.g., that the culture of the valley floor differed from that of the hills. This is doubtful. Stockton and Bethany are markedly different from the Tulare region, yet all are on the marshy valley floor. The strongest resemblances are between Lodi and Lake county, where we have passed from the valley into a hilly region. Neither is it clear that linguistic cleavages are followed. The Stockton-Lodi line generally coincides with the Yokuts-Miwok line. Yet the resemblances between Lodi (Miwok) and Yolo county (Wintun) appear greater than between Lodi and the east (Miwok). Also the resemblances between Lodi (Miwok) and Lake county (Pomo) are in many ways as strong as between Lodi and Stockton. But here again the fact that residence in the marshy areas may have been seasonal and for specific purposes must be taken into consideration.

If we assume that certain aborigines dwelt continuously on our sites, in our area, or in the near-by regions, for long periods, how are we to account for the sudden flare and disappearance of certain well developed types? With no preliminary forms and little discernible subsequent effect one man suddenly appears with thirty-one highly specialized fishhooks or spears, or another with a string of hourglass steatite beads, another with a steatite jar 300 mm. high. It seems to us that the simplest explanation is that we are not looking upon the evi-

dence of one people long stationary in a given habitat but upon that left by several shifting groups any one of which spent a comparatively short time on any one of our sites or in our area.

Social and personal differences.—The concentration of many articles in certain graves was presumably a social matter. When it is found that in such concentrations there is a tendency for a given type to predominate, we may have evidence of occupation and even of a specialization in labor. But it is further found that the type predominant in a certain grave is frequently peculiar to that grave or appears in only a few graves at most. Thirty-one of fifty-seven "fish-hooks" found were in a single grave at site 87. Seventy out of seventy-one pendants of the heavy, many-holed type were in a single grave at site 6. One hundred and nine out of 148 crystals came from five graves at site 6. Such examples could be multiplied, and seem to characterize these single graves almost as definitely as our present area is differentiated by regional characteristics from other areas. Such differences as those of the graves may represent both regional and temporal changes, but primarily they appear to reveal individual or *personal* differences. This implies, as do the burial burnings, that property was not accumulated from generation to generation. It implies that most of the property buried with a man had been made by him or obtained from only one or a very few makers.

We assume these differences to be due to individual variations in taste, skill, perseverance, and ability to follow previous models. Out of such variations entirely new types may theoretically arise, but our interest at present is only with the variations within the type. On the other hand we are not dealing with the many minute differences which might set each piece of 100 off from all others, but rather with such marked differences as would readily divide the 100 into say five groups, and the fact that some such division was originally made by the producers. (See particularly the data concerning concentrations under Burial Associations.) A careful count of such variations would seem to furnish at least a kind of restraining suggestion as to the length of occupancy of a given site or area. Why more types do not evolve, how it would be possible to have a long period of even culture when each small group of graves shows its own peculiar variations, need not concern the present point that if only a small number of variations are noted at one site after a proper search, then only a short history is under review. This seems to apply to any of the sites of our area.

Temporal suggestions.—However the matter of characteristic differences may be carried further without changing our standard of comparison. Certain sites show characteristic forms. For example, site 6 alone had bird effigies. It had more clam discs and magnesite beads than the rest of the area. Site 68 yielded most of the crystals and practically no baked clay "balls." All the steatite jars came from site 82. Such differences may be regional in their nature but it seems possible that they may also be *temporal*. Because, for example, site 6 was at least partly historical, and since site 68, which is not far away, differs from it characteristically, the latter site might be assumed to reflect an older culture.

On the evidence of part of the material culture which they exhibit, we have divided the sites of the Lodi region into three age-groups. (The Stockton data are insufficient to permit a similar classification there. Sites 80 and 82 probably belong to group II.) Some of the main characteristics of these groups are summarized below.

Group I. Site 1 only. Very recent. American period. Majority of artifacts Caucasian. Base of mound on level of surrounding land. Situated on high bank of Cosumnes river near eastern edge of valley floor. Artifacts: Abundant; poorly worked obsidian arrowpoints; some plain clay balls; unusual quantity of glass beads; no charred material, curves, crystals, or plummet-like stones; many other types also absent.

Group II. Sites 6, 8, 19, 43, 48, and possibly 66. Age: Between groups I and III; glass beads show site 6 partly historical. Structure: Ash pockets prominent; light, burned soil; many bone fragments, frequently of large size; base generally higher than surrounding land; ground comparatively soft and works easily. Situation: Banks of Cosumnes and Mokelumne rivers; all above swamp area; built on natural ridges or knolls. Artifacts: Abundant; many delicate arrowpoints; abundance of baked clay objects; no rectangular olivella beads (except at site 66); obsidian curves (site 6 only); shell ornaments unusually abundant; ornamented bird-bone tubes, whistles, pipes, drill-discs, pestles, small mortars, plummet-like stones (very few), crystals (scarce), tool grinders, all present.

Group III. Sites 56, 59, 68. Age: Oldest, prehistoric. Structure: No ash pockets; heavy black soil; few and small-sized, animal bone fragments; base lower than surrounding land; ground very hard and difficult to work. Situation: Sites 56 and 59 about eighth of a mile from Mokelumne river, site 68 a mile and a half from the same stream; all in or near swamp area and on flat ground. Artifacts: Comparatively few; notably absent are delicate arrowpoints, baked clay balls (a very few), clam disc beads, stone beads, curves, charred material, drill-discs, ornamented tubes, mortars, pestles, pipes, whistles, tool grinders; present are mica ornaments (site 68 only); plummets; crystals very abundant; shell ornaments rare and of characteristic types (particularly at site 68).

If site 68 is indeed representative of an earlier culture its characteristic features are of interest. The notable absences have been recorded. Some of

the artifacts which it presents and which are characteristically different from those of group II are as follows: Bone, or perhaps turtle shell, ornaments. Bird-bone (wishbone) ornaments. Small, well shaped, baked clay balls with encircling, longitudinal, *cut* groove. Horn chisels or gouges. Rectangular abalone beads. Rectangular olivella disc beads drilled in center. Circular abalone pendants with two perforations, both near center or one near center and the other near edge. Abalone, rectangular, bar-like pendants with two holes one above the other near one end. Large, leaf-shaped chipped blades. Ground obsidian perforator (?). Ground leaf-shaped chaledony blade. Slate pendants. Double-pointed pieces of slate. Mica ornaments.

Most of the artifacts of our area came from burials with which they had been intentionally associated. There was evidence of the destruction of many other artifacts at the graves. Probably many other of the articles which we recovered had been placed with burials, although not so found, e.g., about one-half of the site 80 collection was dredged up in the widening of the channel through the site. Allowance must also be made for other diggers, agricultural work, and the activities of rodents. When the burial articles are set aside, the amount of material left of a truly kitchen-midden type, i.e., incidental losses, wastage, rejects, and the like, is extraordinarily small. Since we possess ample evidence that the people had a considerable number and variety of articles, this paucity points to the fact that a site was not occupied long enough for much incidental accumulation.

Before concluding this discussion of probable age, it may be noted that even the prominent types which distinguish a region need not imply much time for their production. In many cases the quantities involved are so small that one man could be responsible for the evidence observed, e.g., the four steatite jars of site 82, the 200 bird effigies of site 6, or the fifty-eight "fishhooks" of the area.

We are aware that in answer to many of the questions raised in this discussion of material culture it may be simply stated that we are dealing with incomplete data: that more material would clear up many seeming anomalies. This is all too true with reference to our adjacent regions. Yet with some 400 skeletons and some 10,000 specimens, we must have no insignificant portion of the archaeological material existing in the sites on the surface of our area. They should be at least a sufficient basis for the formulation of the problems and possibilities of its culture.

CONCLUSIONS

CULTURE DISCLOSED

Leaving aside the implication of the Caucasian articles, a few isolated pieces, and problematical types, some of the broad, probable facts of aboriginal life in our area may be set down. Many features of this picture are matters of opinion. The facts upon which they are based may be found in the detailed sections of this paper.

The pictures which the writers reconstruct, from the earliest as well as the latest data, reveal small groups appearing in our area with well developed neolithic cultural characteristics. These groups selected low rises near water for their habitations. Such sites they altered by raising slight foundations to procure drainage, by constructing houses with the sides banked with earth, by digging fire places, and by burying the dead. They did not deliberately construct artificial mounds for residential or other purposes. Here the group lived part of the year, probably during the autumn when the acorns were ripe and during the early winter when innumerable water fowl were available in the marshes. In the spring and early summer the marsh and low ground was flooded and all or part of the group went eastward into the foothills or mountains. At other times the group or a portion of it may have wandered as far west as the sea.

Most prominent among the economic activities of these groups was the preparation of food. Acorns and other seed were gathered and crushed with stone pestles, well formed and of material from the eastern foothills. Wooden mortars were used, but tools for working wood were few, horn wedges being scarce, and stone axes entirely absent. Cooking may at first have been done over open fires but later, cooking baskets were probably used. At any rate baskets were plentiful, generally of the coiled type, and of excellent workmanship. Stone was absent from the area and as a substitute clay balls were possibly used for cooking "stones." This use of baked clay developed until numerous forms were produced, so specialized and so decorated that it no longer seems possible to regard them as intended solely for cooking purposes. Imitations of other forms, "doughnut stones," tubular beads, drilled stone discs, were also made, but pottery vessels were not produced. By hunting, elk, antelope, and deer were frequently procured; bear and coyote very seldom. Birds were much more in evi-

dence. Water fowl were particularly abundant, but hawks, eagles, and even condor have also been identified. Snares may have been used in hunting, since nets were made. Bows and arrows were also utilized, particularly in later times. At all stages small points of the type actually used for arrows were far more abundant than larger points. Obsidian imported from Lake and Sonoma counties, fifty miles or so to the northwest, was generally used in the production of points, and great skill was shown in making them. Fish were taken with line and gorge or hook, with nets and sinkers, and by spearing. The hooks and spears, though few in number, were elaborate in form.

Few social customs were revealed. Smoking was apparently common. Earplugs were much worn. Labrets of a fully developed type were known but very rare. Small bone tubes probably used for gambling purposes were plentiful. It is probable that magnesite, and clamshell beads were regarded as a medium of exchange.

Aesthetic development was expressed mainly in personal adornment. The greater part of the material culture preserved consists of ornamental objects. Clamshell beads, elaborate abalone pendants, baked magnesite beads all attest that much time and effort were spent in this direction. Variation in form and material in stringing beads, the use of pendants and "drops," the shingling of beads over textiles, were all resorted to for effect. Paint was also used in personal adornment. Considerable ability in graphic art was shown in later times by the production of bird-bone tubes elaborately ornamented with incised designs and apparently intended solely for decorative or ceremonial purposes. Many clay balls were also decorated with comparatively elaborate designs. In form, the obsidian "curves" and many of the points showed an appreciation of the beautiful. The presence of many whistles may attest an attempt at music although it is possible that these were calls used to attract birds in hunting.

Suggestions of the mysterious side of existence were not lacking. Crystals and odd formations carry magical connotations. The unstained pipes suggest the sucking shaman removing "pains." The bird effigies were possibly fetishes or talismans made by hunters of water fowl and aiding mysteriously in their capture. Most notable however was the care bestowed upon the dead, who were buried rather than cremated and placed in an extended position rather than flexed. The grave was near but not within the house. In the grave with the dead many objects were placed, and many others were burned at the time of burial.

CULTURAL COMPARISONS

When the material culture within our area was considered, personal differences between graves were noted, sites showed temporal differences, and localities regional ones. The proper emphasis to be placed upon these differences is a problem yet to be solved. However, when we considered the culture of our area as a unit, if such a thing is possible, it showed a local individuality which distinguished it from all other Californian cultural centers. Material points of resemblance were found between our area and Santa Barbara, the southern San Joaquin valley, Emeryville, and the northern coast of California. One could go farther afield and find similarities with Arizona (clay spindle whorls), with the Aleutian islands (fish spears and steatite dishes), with the eastern United States (bird effigies).

Within our area the beginnings of a division appeared. In burial customs and material culture the Stockton region showed more affiliation with the south and west, while the Lodi region showed closer connections with the north and west. Here a cultural division seemed to coincide with the linguistic line of cleavage between the Yokuts and Miwok. But cultural similarities were more marked than the differences between the Miwok of the Lodi region and the Wintun to the west. The connection with the east is not clear. Much raw material came from there and considerable collateral evidence suggests that the people of our area ranged into the foothills. But data reported from there in modern times (e.g., the practice of cremation and an abundance of mortars, a few of which Barr obtained from living Indians) offer a striking contrast to our area. Even in the direction of strongest resemblance, the west, the cultural elements soon realign themselves, and by the time the western side of the valley floor is reached the local individuality of our area is lost. It was suggested that perhaps the cultural divisions would follow topographical ones, that whether the valley was lived in permanently or resorted to seasonally its possibilities would produce characteristic cultural features. That some such features were produced seems plain, but that these features were the dominant ones in the culture is quite doubtful. After we get beyond the neighborhood affiliations, data are not available for comprehensive comparisons, but on the whole it seems doubtful if we are dealing with material that can disclose the direction of man's advent into California—one of the major problems with which we started.

PROBLEMS

Stratification in other states has yielded enormous results, and we earnestly advocate the most careful attention to its possibilities. But in such sites as the shallow earth mounds of California and Oregon it seems possible to miss opportunities in other directions by an over-emphasis on stratification. Stratification found in such sites, even if not confused by contemporaneous burials and the ravages of rodents, will be but a matter of inches, and of little practical value considering the general low level of Californian culture, the probable shortness of occupancy of any site, and, particularly, the great differences in contemporaneous graves. Until a satisfactory explanation of the relatively enormous differences in individual graves is set up, one can go very far afield by interpreting stratigraphically differences in graves that are separated vertically without interpreting equivalent differences in graves separated horizontally. Instead, it seems that one must turn for relative age to a study of different mounds, hoping with the aid of geological and physiographic features to establish grounds for age comparisons.

In the matter of total age it seems that one can most profitably start with the year 1800 and work back, rather than begin with the palaeolithic of Europe. Few sites in California offer the geographical probability of having endured even a few thousand years and then appearing in the state in which they are found. Nor does the total volume of evidence brought under review (sites, skeletal and cultural material) suggest an accumulation of ages, when the remains at individual sites are used as criteria.

Another feature, which is puzzling in any case but particularly so if we endeavor to carry our evidence very far back, is the flare of types. A fully developed and highly specialized type appears (e.g., fish spears or labrets in our region, pipes or ornamented crystals at Emeryville). Their existence implied a preliminary period of development. But of such a period we have no evidence. Then frequently these highly developed types as suddenly disappear. What such full-blown appearances mean is not clear, but they do not appear to fit into the picture of a long evolutionary period nor to be phenomena of localized development.

When one "fish spear" was found at Emeryville, and twelve in the Lodi region (site 15), how are we to compare the two areas, remembering that in each case we have but the contents of a single

grave, and that at Stockton we find thirty-one in a single grave? If the scope be extended a little, what weight shall be given to clay bird effigies which differentiate our area from Santa Barbara but which also differentiate site 6 from other sites? In short, what is to be made of the concentration of a large number of similar artifacts in a grave, of the fact that a few graves may thus characterize the material culture of an area, and of the final fact that exactly similar articles are frequently not to be found outside the grave in which they appear so abundantly? Our conclusion was that we had here expressions of individuality and that they implied the exhibition of a series of isolated pictures rather than a continuous reel, and also that a short rather than a long history was involved. It seems that if a careful analysis of these individual types could be made we would have a definite factor bearing on age. They emphasize the great necessity of weighing the evidence reviewed so that areas will be compared with areas and not with single graves. These concentrations also bring before us the problem of determining where these types arise.

Another problem which the material of our area presents lies in the types not found elsewhere. Are clay balls an independent local invention? If a local development, what did the people use (e.g., for cooking stones) before the balls were invented? If the balls were first produced elsewhere, either by the same people or by others, is it not strange that no trace is left elsewhere? The "Stockton curves" present the same problem in a more obscure form. More data are needed. In the meantime we suggest that two different processes are indicated. Such articles as the curves are merely marked variations in individual workmanship that have acquired a temporary popularity with a few individuals. They differ in degree only from the clusters of similar abalone pendants. Types such as the clay balls mark local attempts to apply an idea received from elsewhere. Clay balls came late to our area, perhaps not until Mission times; the use of baked clay was far more extensive and more highly specialized in southern California. It is these facts, and the fact that our area showed other evidence of contact with the southern area, that lead us to the conclusion that the idea of the possibilities of baked clay came from elsewhere. None of the peculiar local types of the Lodi-Stockton area suggest the evolutionary growth of a means to accomplish a previously desired end.

AGE

When all the discovered sites of the area were noted, it was found that they were usually near water, one group along the banks of present-day streams, and another along the shore of the sea level marsh that covered much of the valley floor. It seemed to us probable that the streams were more subject to fluctuations than the sea level line, that present-day stream bank locations would not imply great antiquity, and, finally, that some of the sea level sites should be the oldest in the area. From early historical accounts and from Caucasian artifacts recovered, it was seen that the major sites of both classes were occupied about 1800 A.D. In short we were presented with a culture at least in part dated 1800, and the problem of determining how far back of that date it extended.

In attacking this problem we must consider four factors, viz., the average size of the current population at any given time, continuity or discontinuity of residence, the site space occupied, and the frequency of moves.

The average village population in the San Joaquin valley, as reported by the first Spanish explorers, was about 200. Near Stockton, the Spanish expedition of 1817 reported "113 natives, part Yatchicomnes and part Muquelemnes, half of them painted and armed, with an aspect of war." Since our Lodi region seems to have had only two major sites, we conclude that a population of 500 for that region would probably not be far off.

Continuity of residence cannot be determined. Seasonal absences would not affect the present reasoning. It has been suggested to us that centuries might have elapsed between the burial of the body with the glass beads at site 82, and that with the steatite jar at the same site. Such an assumption cannot be flatly disproved. But, considering the actual occupation of our area in 1800, the connection between the sites and present-day topography, the general similarity of the sites, the relative homogeneity of the material culture, the economic advantages of the area, the probable necessity of traversing it if any group made a passage up or down the Great Central valley, it seems more reasonable to us to assume that the area was occupied essentially part of every year from 1800 as far back as our present calculations extend.

We believe that most of the present surface sites in the Lodi region have been recorded. The total site space was between 500,000 and

750,000 square feet. On the basis of probable single house sites and ethnological data it was estimated that one man required about fifty square feet on the average. Our estimated current population of 500 would thus require a maximum of 15,000 square feet, and, in order to produce the site space noted, would have had to change sites thirty times.

How frequently were sites changed? In examining the growth of mounds it was seen from site 1 that the usual depth and characteristics could be acquired rapidly. The thinness of the mound masses (not over three or four feet), the number of bodies in a mound (from fifty to a hundred), the lack of space for more bodies (notably at sites 68 and 82), certain structural features (e.g., the homogeneous cap over site 68), the presence of glass beads as deep as other artifacts, and the evidence discussed in the summary of material culture, all point to the fact that a site was probably not occupied normally for more than two or three generations. If we call it fifty years and multiply this by thirty, the number of times sites were changed in the Lodi region, we obtain 1500 years as the probable age of the oldest site there. Since the evidence suggests that the two regions were contemporaneously occupied, it is probable that the same maximum age would apply to the Stockton region as well.

Since great age is frequently assumed a priori, in the absence of evidence to the contrary, because of the simplicity of the material culture, or the tendency of the older school to connect such forms with the chronology of Europe, it would be unfair to the present study not to stress the fact that we regard all other Californian mounds that have been reported upon, with the possible exception of some of the shellmounds of the coast, as being properly subject to the same kind of criticism as that which we have applied to the Lodi-Stockton mounds. All mounds that have been studied were situated in territory occupied when Caucasians arrived, and little if any evidence has been produced to show that the culture revealed by archaeology was different from that of the eighteenth century, or that gave geological proof that the sites were very old.

Our insistence upon the relative recency of the evidence which we have been examining is due to our belief that some day earlier evidence may be produced. In such an event it could be properly valued only if the later evidence had been truly placed. Geological data showed that our area offered a suitable habitat for man since early Pleistocene time. Such data also showed that the area is situated on one of the

most stable portions of the floor of the Great Central valley. Since this is true, and since ethnologists are convinced that California has been occupied by man from remote times, it seems possible that the alluvial fill in the general vicinity of our area may yet reveal archaeological evidence of these early inhabitants.

EXPLANATION OF PLATES⁴⁸

Plate 74.—Typical burials in site 6, Lodi area. These graves were excavated not by the authors but by Baron Erland Nordenskiöld's party in 1926. Pictures taken by Julian H. Steward. *a*. Undisturbed skull resting on pestle, about 3 feet deep; *b*. Undisturbed skeleton near several others, with two antler points, between 4-5 feet deep; *c*. Portion of *b* with bones more exposed; *d*. Adult male on back with banjo type abalone pendant; abundant traces of feather (?) cape or blanket around body; 6-7 feet deep.

Plate 75.—Textiles and cordage. *e* is 48 mm. long.

Plate 76.—Bone artifacts. *a-m*, awls; *n-x*, double-pointed implements. *a* is 87 mm. long.

<i>a</i> . 3251	<i>e</i> . 2631	<i>i</i> . 945	<i>m</i> . 77	<i>q</i> . 601	<i>u</i> . 3345
<i>b</i> . 1224	<i>f</i> . 1454	<i>j</i> . 81	<i>n</i> . 2049	<i>r</i> . 2375	<i>v</i> . 966
<i>c</i> . 280	<i>g</i> . 3287	<i>k</i> . 2372	<i>o</i> . 1522	<i>s</i> . 2816	<i>w</i> . 1878
<i>d</i> . 2817	<i>h</i> . 1520	<i>l</i> . 2697	<i>p</i> . 1953	<i>t</i> . 1521	<i>x</i> . 3226

Plate 77.—Awl-like bone implements. *a* is 250 mm. long.

<i>a</i> . 796	<i>d</i> . 785	<i>g</i> . 276	<i>j</i> . 1527	<i>m</i> . 3285	<i>p</i> . 788
<i>b</i> . 75	<i>e</i> . 2077	<i>h</i> . 1982	<i>k</i> . 217	<i>n</i> . 3284	<i>q</i> . 3184
<i>c</i> . 77	<i>f</i> . 1529	<i>i</i> . 217	<i>l</i> . 1204	<i>o</i> . 89	

Plate 78.—Bone tubes. *a* is 272 mm. long.

<i>a</i> . 3334	<i>e</i> . —	<i>i</i> . 2871	<i>m</i> . 3197	<i>q</i> . 2051	<i>u</i> . 1213
<i>b</i> . 3335	<i>f</i> . 3203	<i>j</i> . 2059	<i>n</i> . 2479	<i>r</i> . 2080	<i>v</i> . 2371
<i>c</i> . 814	<i>g</i> . 2364	<i>k</i> . 2872	<i>o</i> . 2366	<i>s</i> . 3240	<i>w</i> . 2078
<i>d</i> . 813	<i>h</i> . —	<i>l</i> . 1678	<i>p</i> . 2056	<i>t</i> . 797	<i>x</i> . 2480
					<i>y</i> . 3333

Plate 79.—Whistles and miscellaneous objects of bone. *a* is 97 mm. long.

<i>a</i> . 994	<i>d</i> . 2821	<i>g</i> . 399	<i>j</i> . 2079	<i>m</i> . 783	<i>q</i> . 2481
<i>b</i> . 1067	<i>e</i> . 2997	<i>h</i> . 1211	<i>k</i> . 1880	<i>n</i> . 2810	<i>r</i> . 2808
<i>c</i> . 76	<i>f</i> . 874	<i>i</i> . 2809	<i>l</i> . 784	<i>o</i> . 1955	<i>s</i> . 820
				<i>p</i> . 1223	<i>t</i> . 2807

Plate 80.—Horn or bone fish spears or hooks. *l* is 67 mm. long.

<i>a</i> . 94	<i>d</i> . 3194	<i>g</i> . 3192	<i>j</i> . 99	<i>m</i> . 1203	<i>p</i> . 95
<i>b</i> . 2377	<i>e</i> . 3195	<i>h</i> . 3193	<i>k</i> . 82	<i>n</i> . 94	<i>q</i> . 94
<i>c</i> . 3241	<i>f</i> . 97	<i>i</i> . 2820	<i>l</i> . 98	<i>o</i> . 94	

Plate 81.—Horn and bone objects, miscellaneous. *a* is 263 mm. long.

<i>a</i> . 2924	<i>b</i> . 1256	<i>c</i> . 317	<i>d</i> . 3303	<i>e</i> . 2157	<i>f</i> . —
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Plate 82.—Baked clay "balls." *a* is 75 mm. long.

Plate 83.—Baked clay "balls." *a* is 66 mm. long.

Plate 84.—Baked clay "balls." Diameter of *a* is 61 mm.

Plate 85. Baked clay articles. Diameter of *a* is 38 mm.

<i>a</i> . 1517	<i>d</i> . —	<i>g</i> . 3283	<i>j</i> . 1609	<i>m</i> . —	<i>p</i> . 1753
<i>b</i> . 2700	<i>e</i> . 1502	<i>h</i> . 853	<i>k</i> . 1103	<i>n</i> . —	
<i>c</i> . 1516	<i>f</i> . —	<i>i</i> . 2806	<i>l</i> . 331	<i>o</i> . 1977	

⁴⁸ The specimens illustrated are identified by their numbers in the Dawson collection. They are all from the Lodi region.

Plate 86.—Baked clay bird effigies. *j* is 49 mm. long.

<i>a.</i> 1217	<i>c.</i> 2892	<i>e.</i> —	<i>g.</i> 1874	<i>i.</i> 35	<i>k.</i> 2632
<i>b.</i> 1735	<i>d.</i> 1734	<i>f.</i> 1604	<i>h.</i> 1743	<i>j.</i> 2891	<i>l.</i> 2894

Plate 87.—Shell beads. *ab* is 80 mm. long.

<i>e.</i> 1991	<i>t.</i> 3298	<i>u.</i> 3298	<i>v.</i> 44	<i>y.</i> 3929	<i>ab.</i> 563
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Plate 88.—Abalone shell pendants. *a* is 34 mm. long.

Plate 89.—Abalone shell pendants. Maximum diameter of *a* is 78 mm.

Plate 90.—Abalone shell pendants. *b* is 78 mm. long.

<i>b.</i> 731	<i>c.</i> 507	<i>g.</i> 1831
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Plate 91.—Chipped stone points. *a* is 114 mm. long.

<i>a.</i> 1099	<i>c.</i> 2547	<i>e.</i> 3161	<i>g.</i> 1513	<i>i.</i> 687	<i>k.</i> 215
<i>b.</i> 927	<i>d.</i> 696	<i>f.</i> 1504	<i>h.</i> —	<i>j.</i> 14	

Plate 92.—Chipped stone, miscellaneous. Diameter of *a* is 95 mm.

<i>a.</i> 148	<i>b.</i> 1134	<i>c.</i> 228	<i>d.</i> 203	<i>e.</i> —	<i>f.</i> 1327
					<i>g.</i> —

Plate 93.—Obsidian points, not stemmed. *a* is 105 mm. long.

<i>a.</i> 2	<i>c.</i> 644	<i>e.</i> 2456	<i>g.</i> 2400	<i>i.</i> 400	<i>k.</i> —
<i>b.</i> 3223	<i>d.</i> 1902	<i>f.</i> 2520	<i>h.</i> —	<i>j.</i> 460	

Plate 94.—Obsidian points. *a* is 130 mm. long.

<i>a.</i> —	<i>c.</i> 2390	<i>e.</i> 2930	<i>g.</i> 1570	<i>i.</i> 2938	<i>k.</i> 1545
<i>b.</i> 2389	<i>d.</i> 2954	<i>f.</i> —	<i>h.</i> 347	<i>j.</i> 292	<i>l.</i> 345
					<i>m.</i> 1229

Plate 95.—Obsidian "curves." Maximum length of *a* is 60 mm.

<i>a.</i> 2792	<i>c.</i> 2855	<i>e.</i> 2856	<i>f.</i> 2659	<i>g.</i> 2500	<i>h.</i> 2857
<i>b.</i> 2663	<i>d.</i> 2657				

Plate 96.—Stone beads. Diameter of *a* is 27 mm.

<i>a.</i> 2150	<i>e.</i> —	<i>i.</i> —	<i>m.</i> 3121	<i>q.</i> —	<i>u.</i> 2586
<i>b.</i> 1975	<i>f.</i> 195	<i>j.</i> —	<i>n.</i> 2588	<i>r.</i> —	<i>v.</i> 2927
<i>c.</i> 2580	<i>g.</i> —	<i>k.</i> 3110	<i>o.</i> 2585	<i>s.</i> —	<i>w.</i> 1976
<i>d.</i> 2705	<i>h.</i> —	<i>l.</i> 2381	<i>p.</i> 2884	<i>t.</i> —	<i>x.</i> 2886
					<i>y.</i> 2492

Plate 97.—Ground stone objects, miscellaneous. *i* is 152 mm. long.

<i>a.</i> 405	<i>d.</i> 41	<i>g.</i> 3119	<i>j.</i> 1137	<i>m.</i> 407	<i>p.</i> 418
<i>b.</i> 308	<i>e.</i> 373	<i>h.</i> 268	<i>k.</i> 923	<i>n.</i> 408	<i>q.</i> 419
<i>c.</i> 479	<i>f.</i> 841	<i>i.</i> 920	<i>l.</i> 922	<i>o.</i> 412	

Plate 98.—Ground stone objects, miscellaneous. *i* is 127 mm. long.

<i>a.</i> 1322	<i>c.</i> —	<i>e.</i> 3243	<i>g.</i> 313	<i>h.</i> 1130	<i>i.</i> 2499
<i>b.</i> 1474	<i>d.</i> 807	<i>f.</i> 2880			

Plate 99.—Mortars. *b* is 185 mm. long.

Plate 100.—Pestles. *a* is 540 mm. long.

Plate 101.—Pipes and plummets. *a* is 262 mm. long.

<i>a.</i> 791	<i>d.</i> 792	<i>g.</i> 2498	<i>j.</i> 2357	<i>m.</i> 947	<i>p.</i> 955
<i>b.</i> 3282	<i>e.</i> 787	<i>h.</i> 2356	<i>k.</i> 948	<i>n.</i> 70	<i>q.</i> 953
<i>c.</i> 159	<i>f.</i> 2586	<i>i.</i> 2358	<i>l.</i> 1136	<i>o.</i> 957	

Plate 102.—Steatite objects. Diameter of *a* is 34 mm.

<i>a.</i> 100	<i>d.</i> 3116	<i>g.</i> 3337	<i>j.</i> 3117	<i>r.</i> 2382	<i>u.</i> 2074
<i>b.</i> 99	<i>e.</i> 2153	<i>h.</i> —	<i>k.</i> 3117	<i>s.</i> 2383	<i>v.</i> 804
<i>c.</i> 2731	<i>f.</i> 3289	<i>i.</i> 2716	<i>l-q.</i> —	<i>t.</i> 2154	



a



b

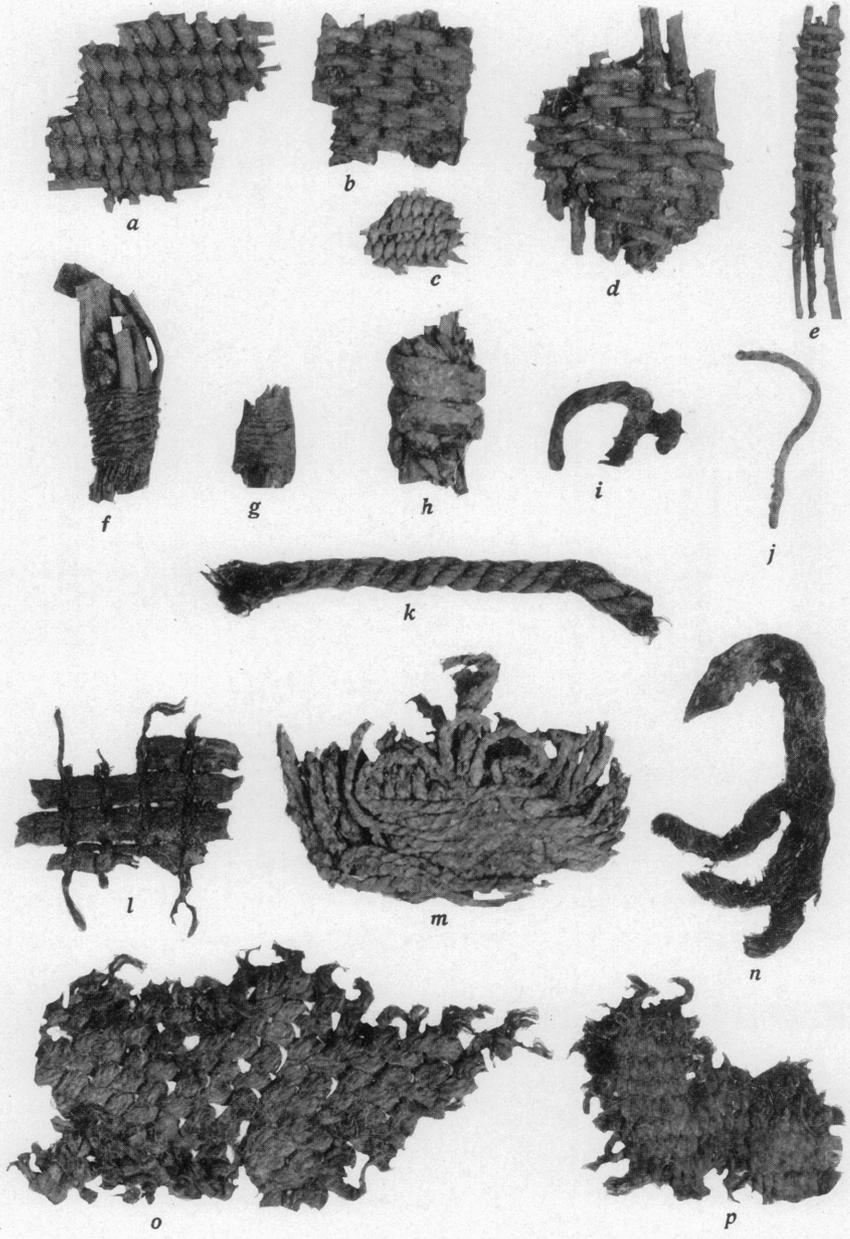


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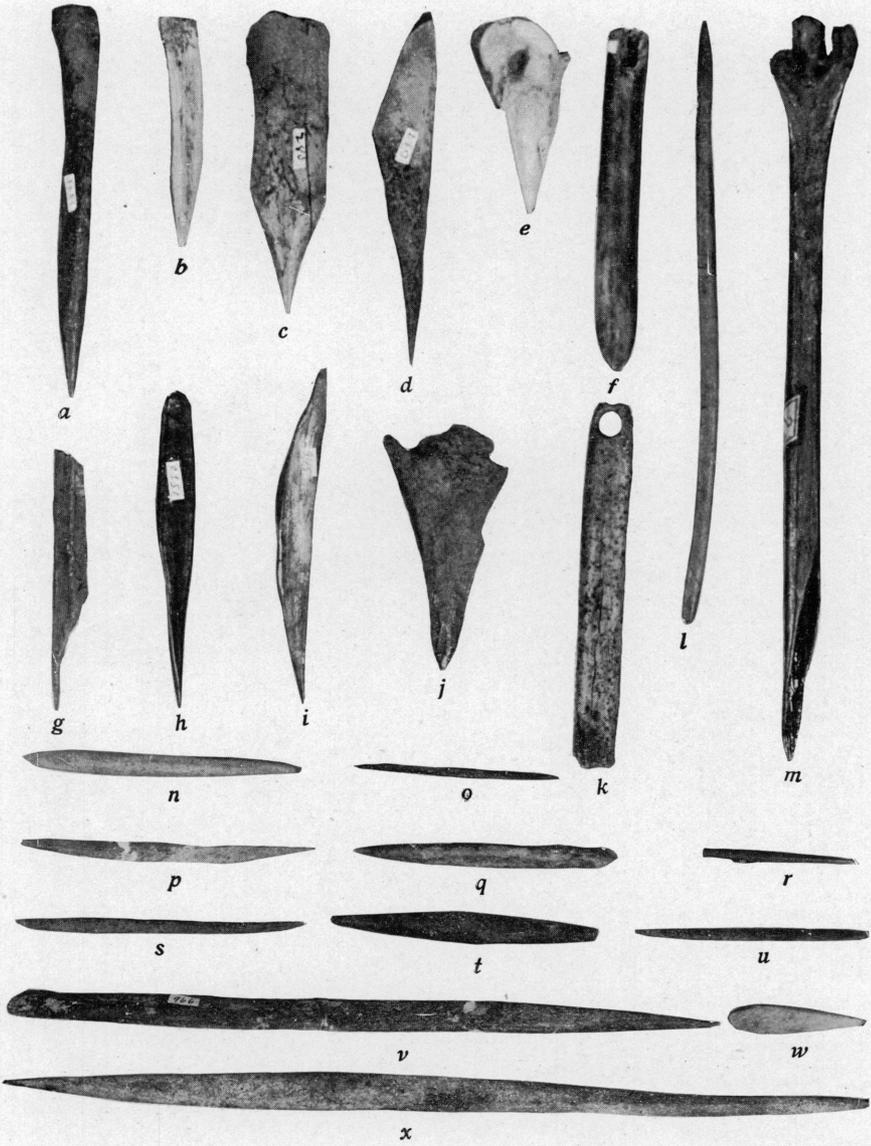


d

BURIALS



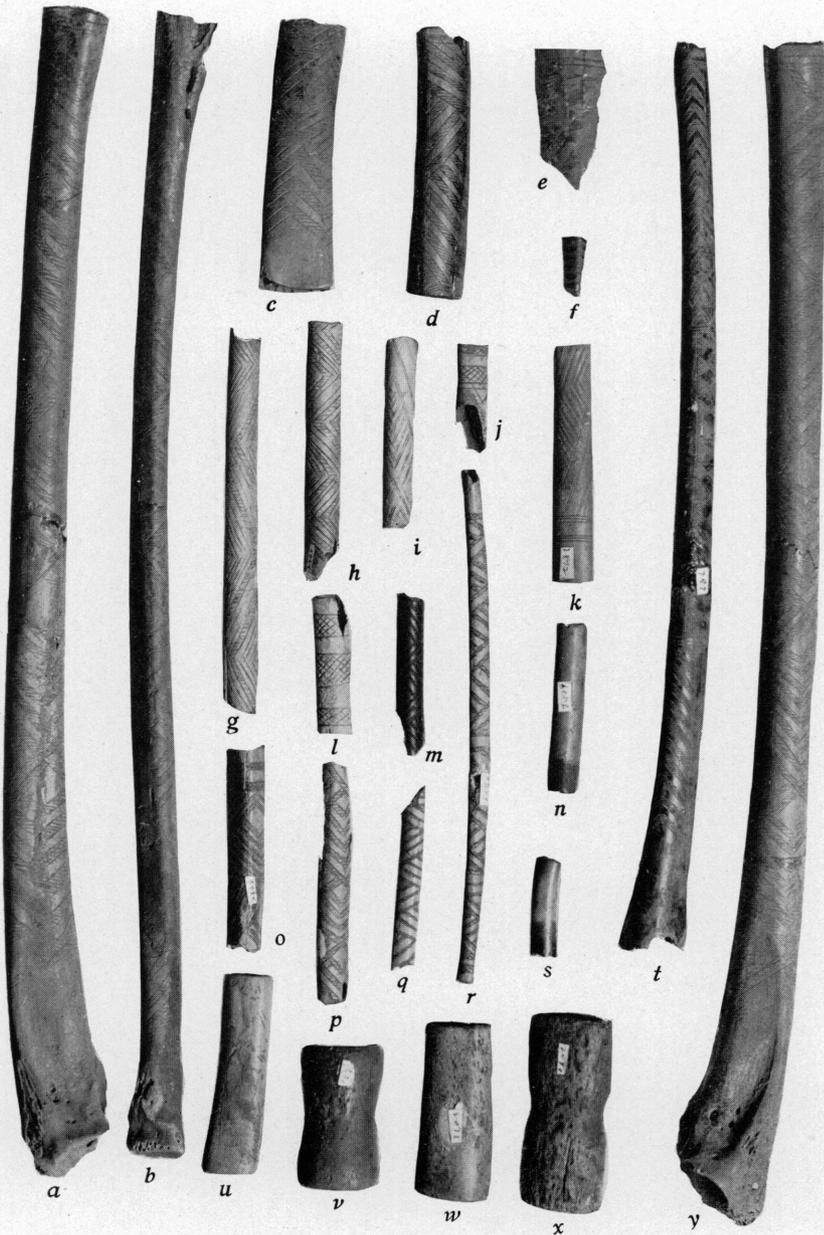
TEXTILES AND CORDAGE



BONE AWLS AND DOUBLE-POINTED IMPLEMENTS



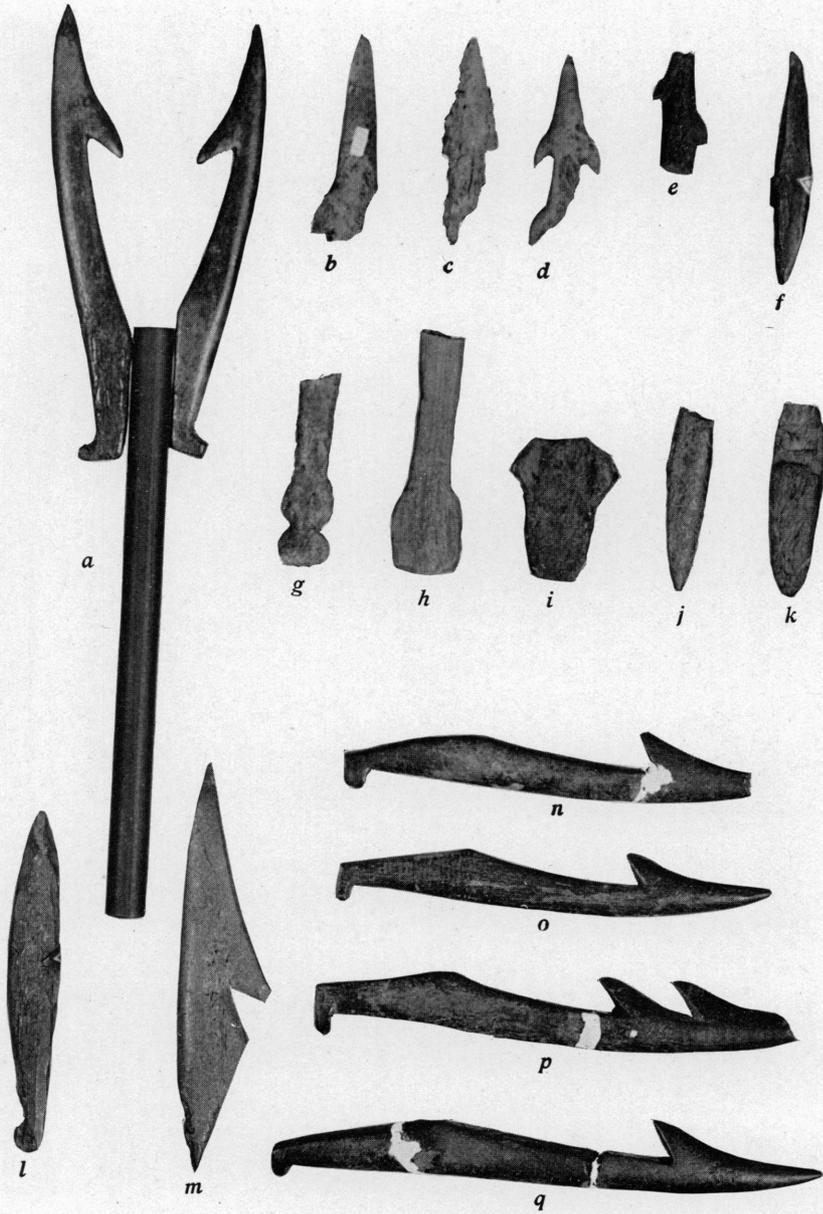
AWL-LIKE BONE IMPLEMENTS



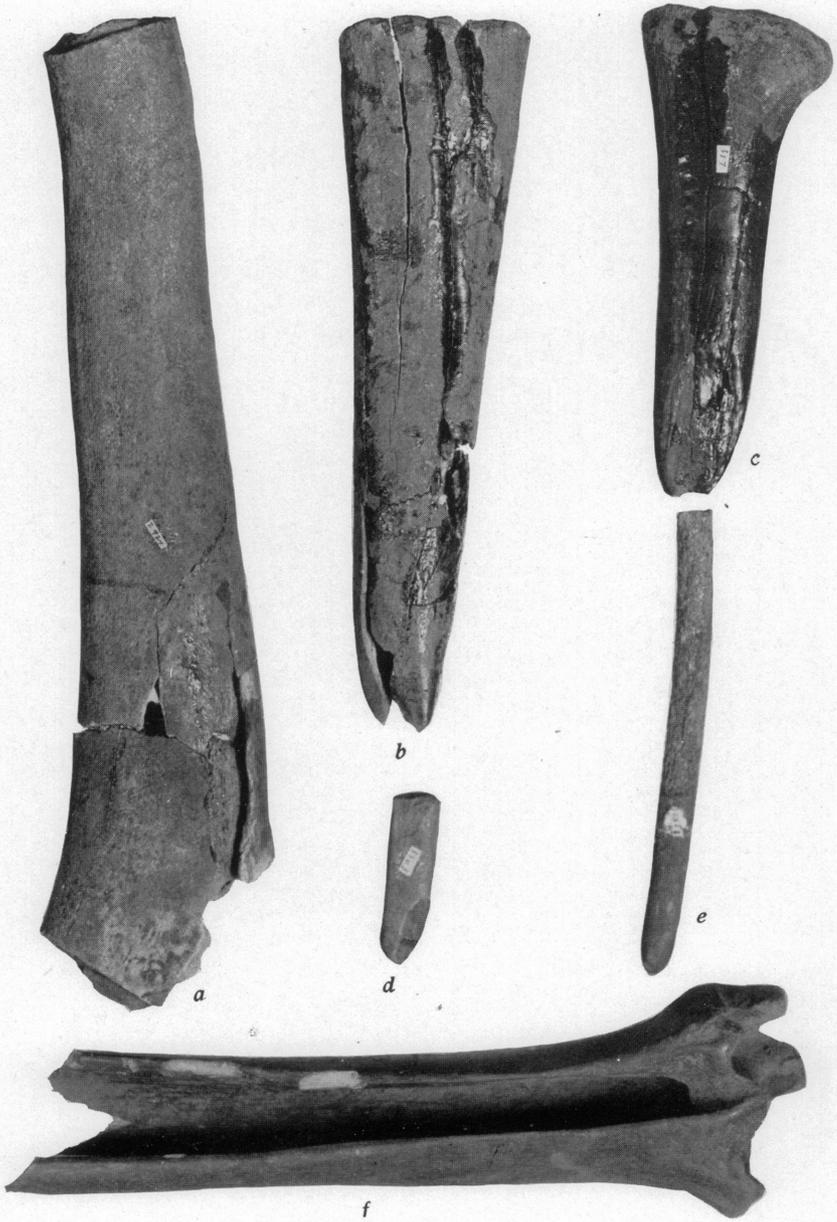
BONE TUBES



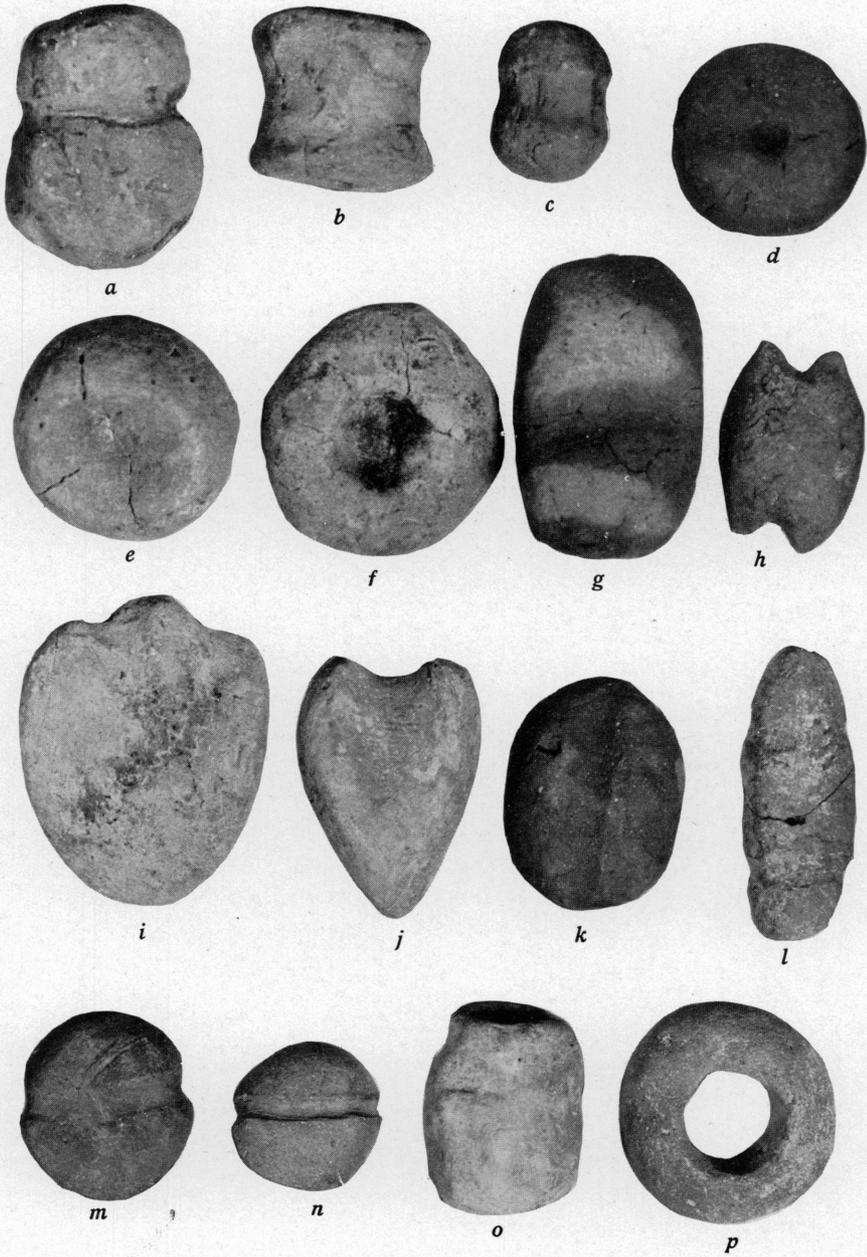
WHISTLES AND MISCELLANEOUS OBJECTS OF BONE



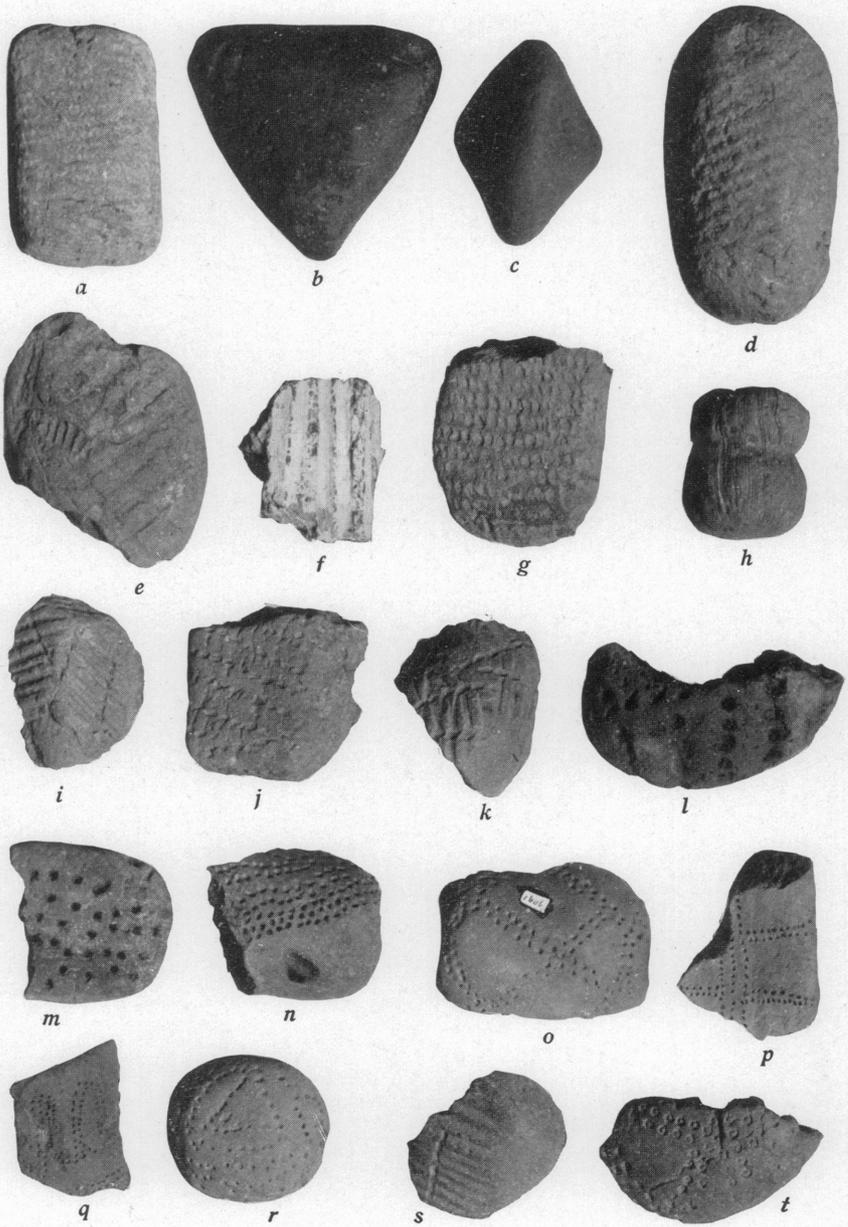
HORN OR BONE FISH SPEARS OR HOOKS



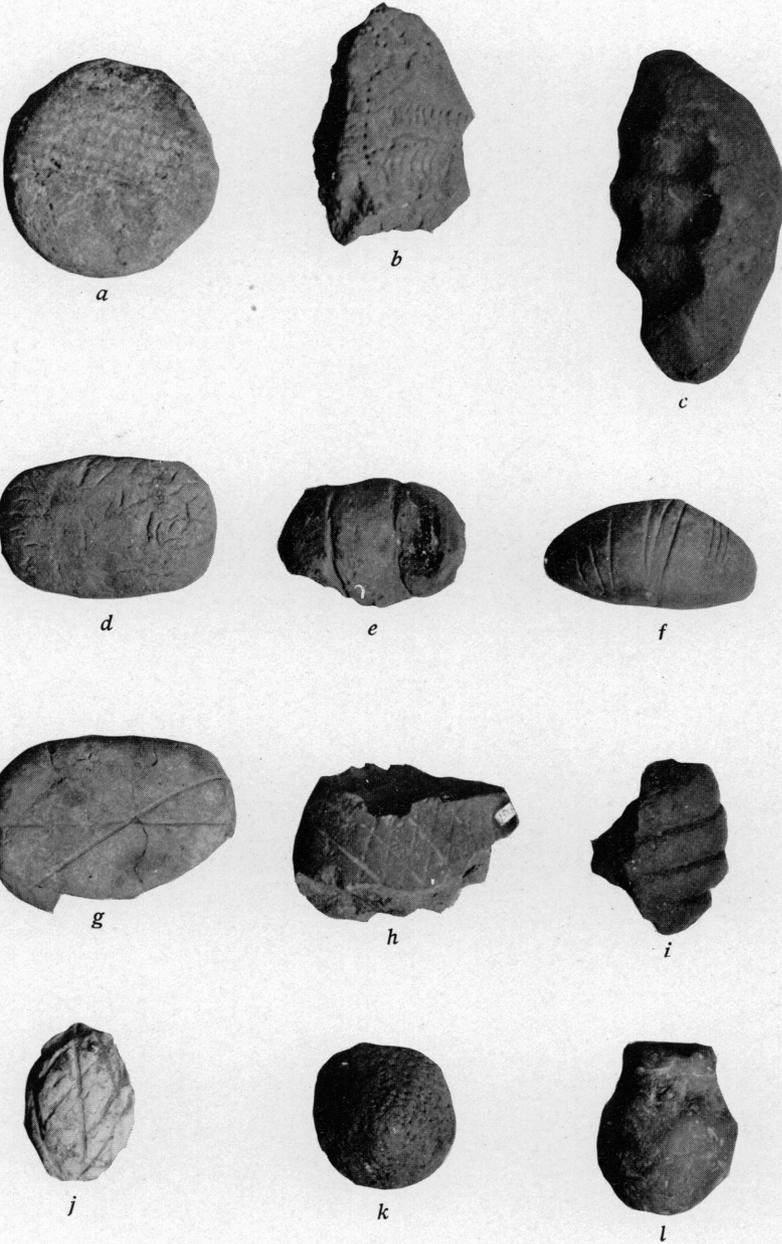
HORN AND BONE OBJECTS



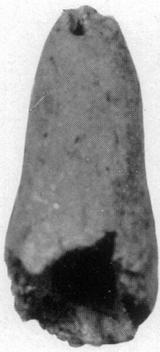
BAKED CLAY BALLS



BAKED CLAY BALLS



BAKED CLAY BALLS



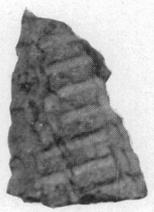
a



b



c



d



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f



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h



i



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k



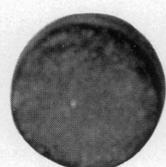
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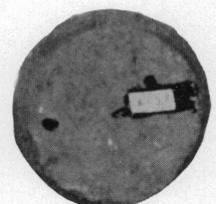
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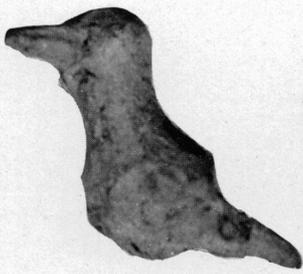


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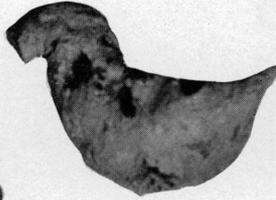


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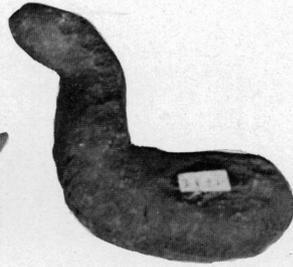
BAKED CLAY ARTICLES



a



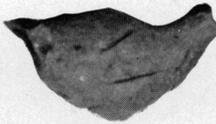
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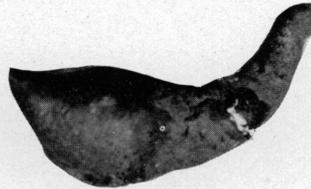
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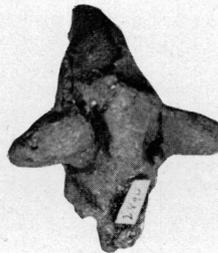
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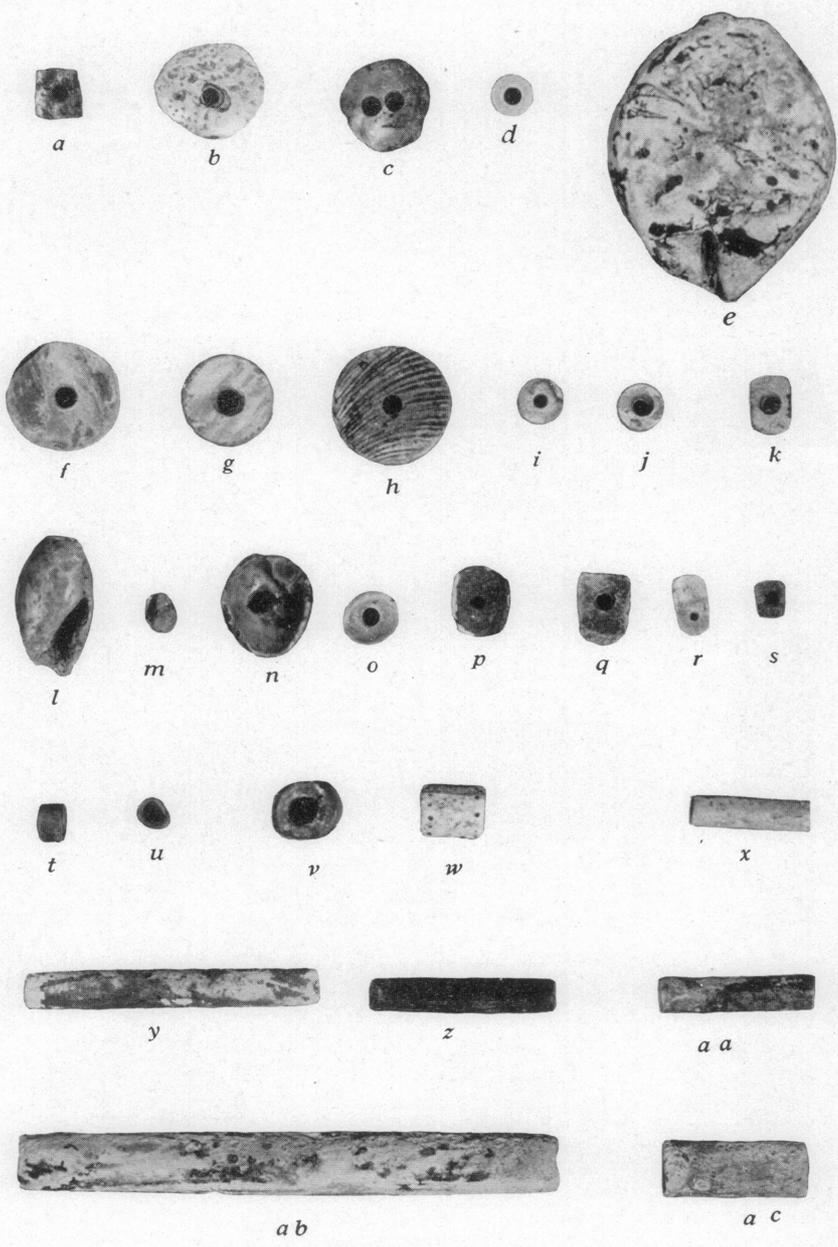


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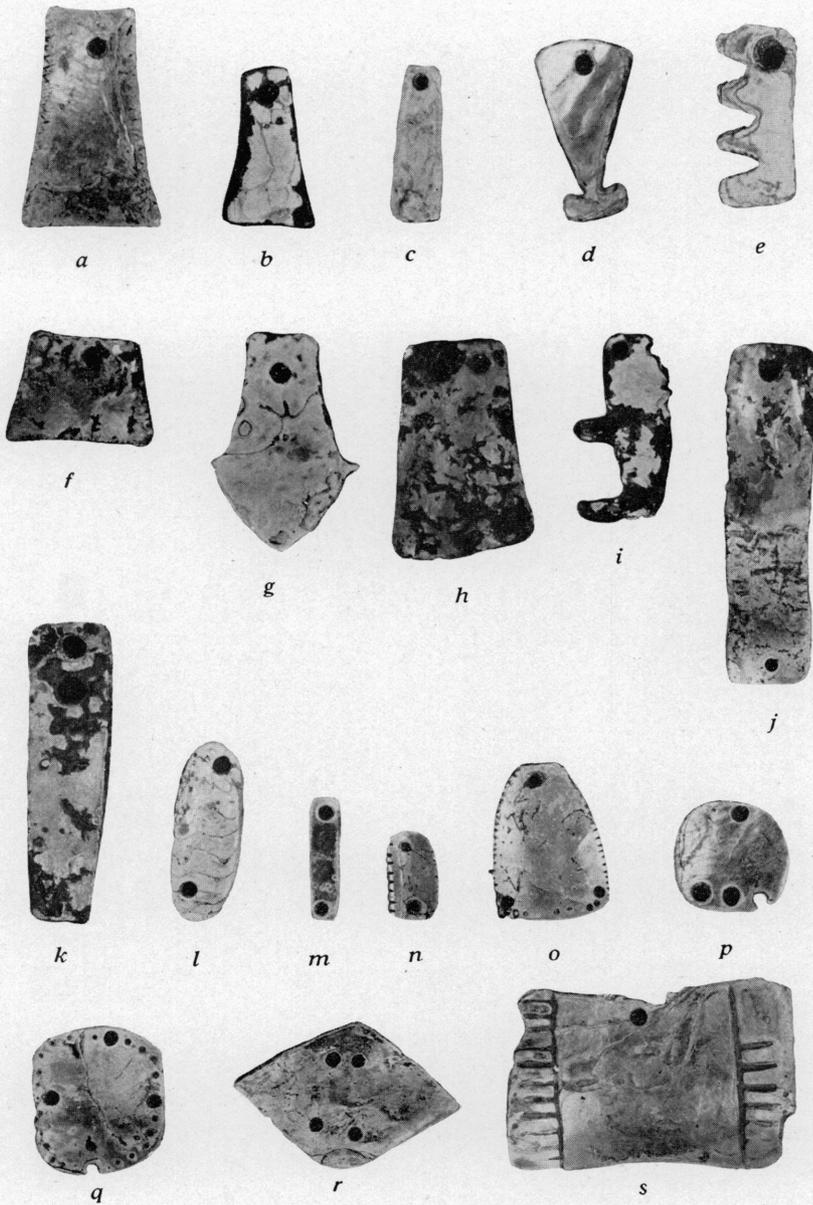


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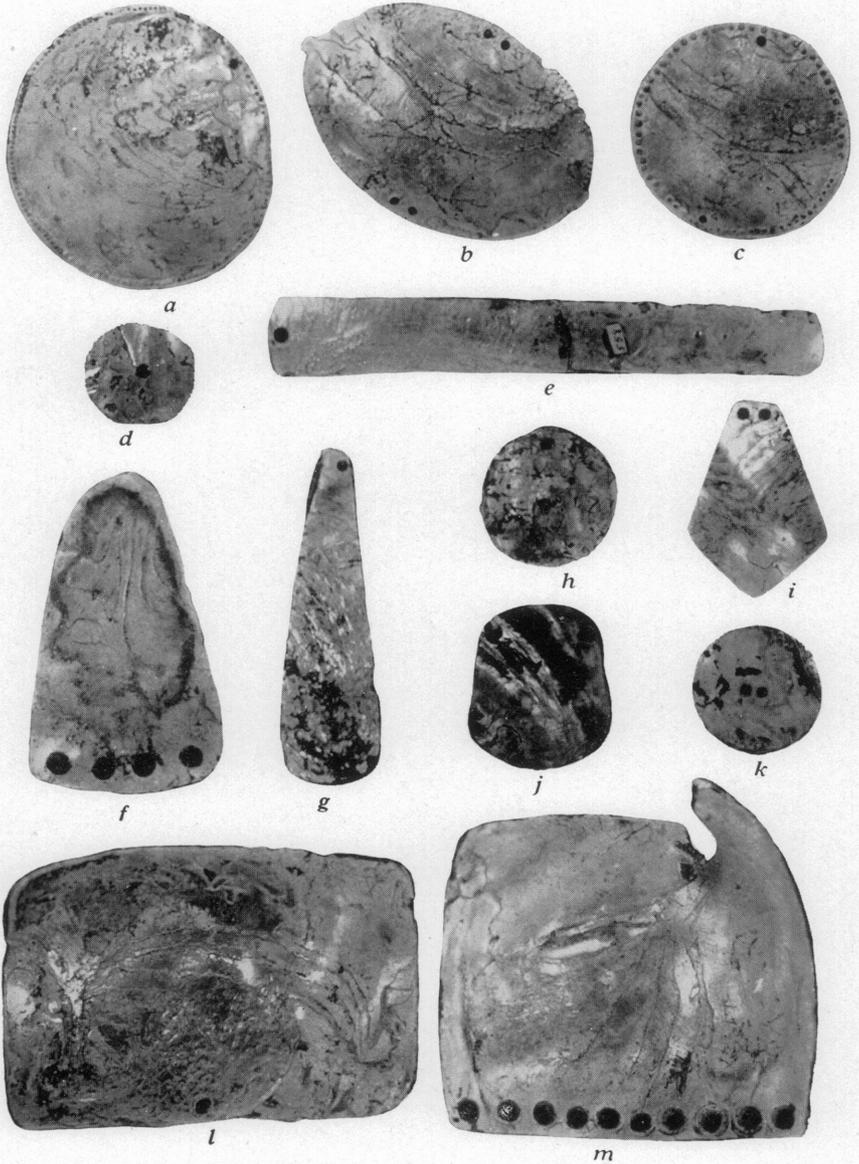
BAKED CLAY BIRD EFFIGIES



SHELL BEADS



ABALONE SHELL PENDANTS



ABALONE SHELL PENDANTS



a



b



c



d



e



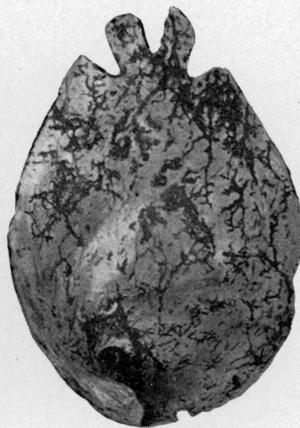
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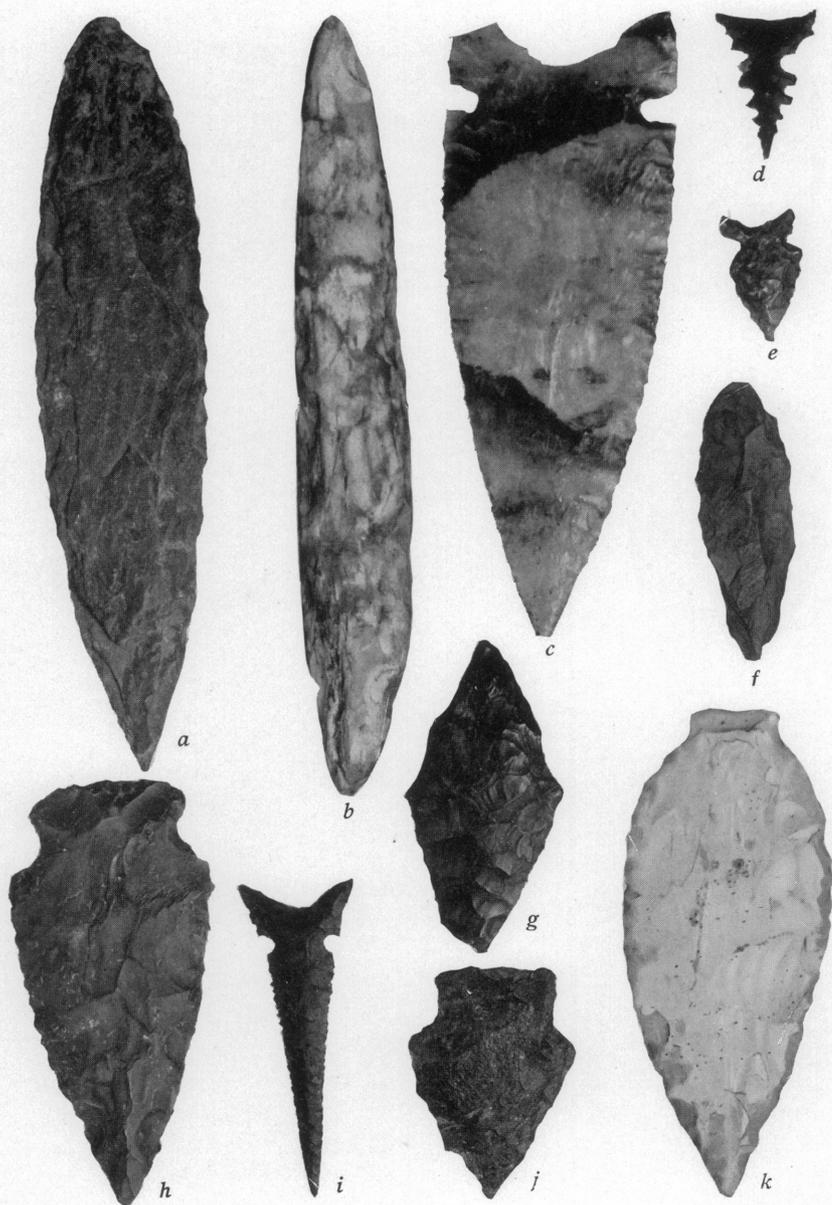


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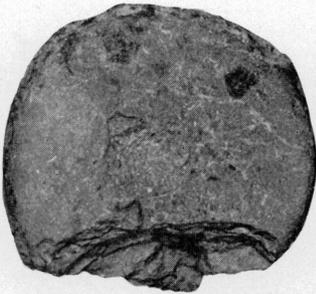


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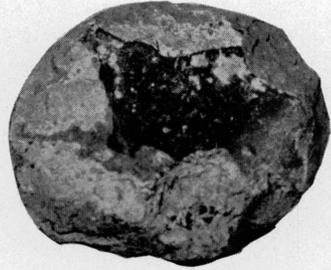
ABALONE SHELL PENDANTS



CHIPPED STONE POINTS



a



b



c



d



e



f



g

CHIPPED STONE



a



b



c



d



e



f



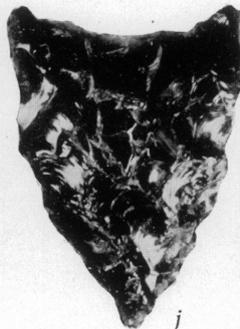
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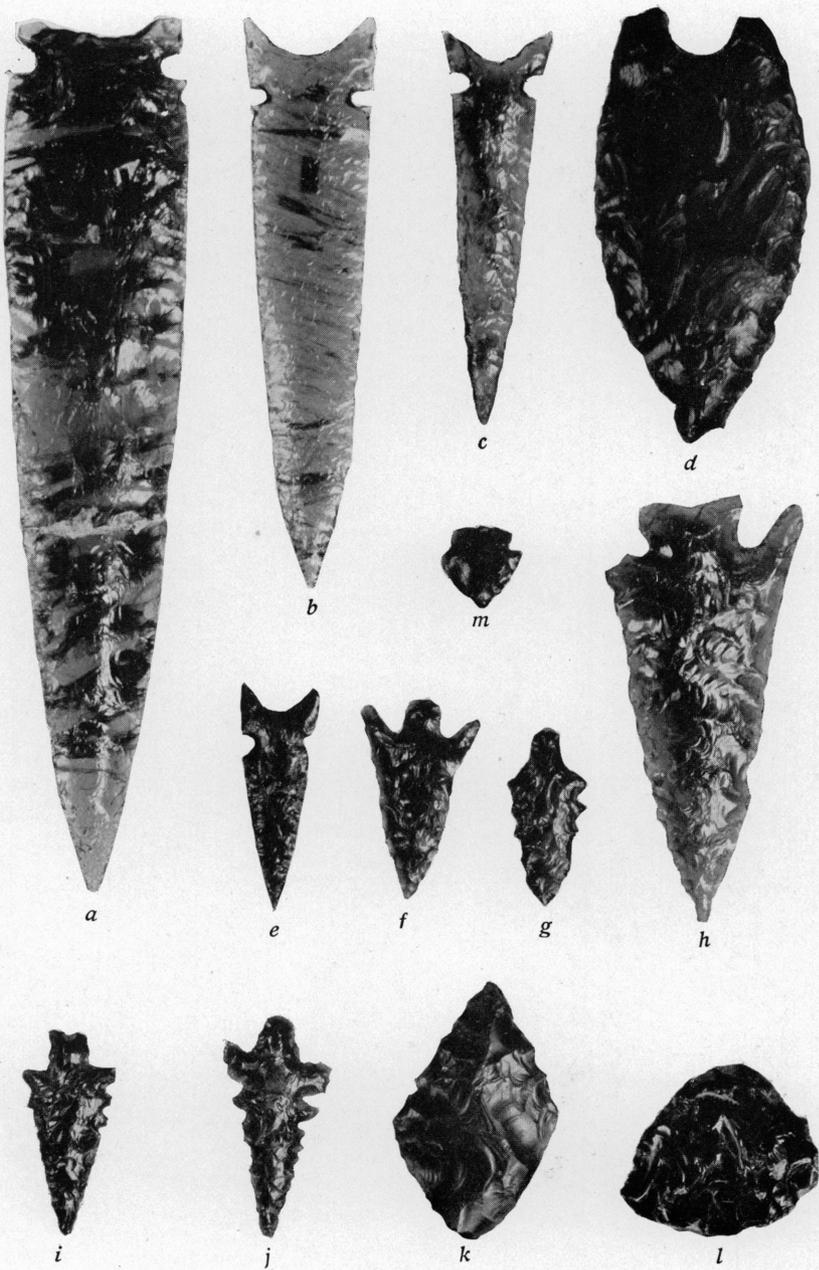


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OBSIDIAN POINTS



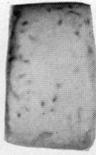
OBSIDIAN POINTS



OBSIDIAN CURVES



a



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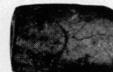
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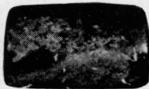
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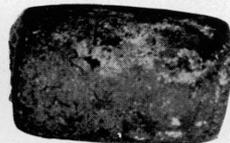
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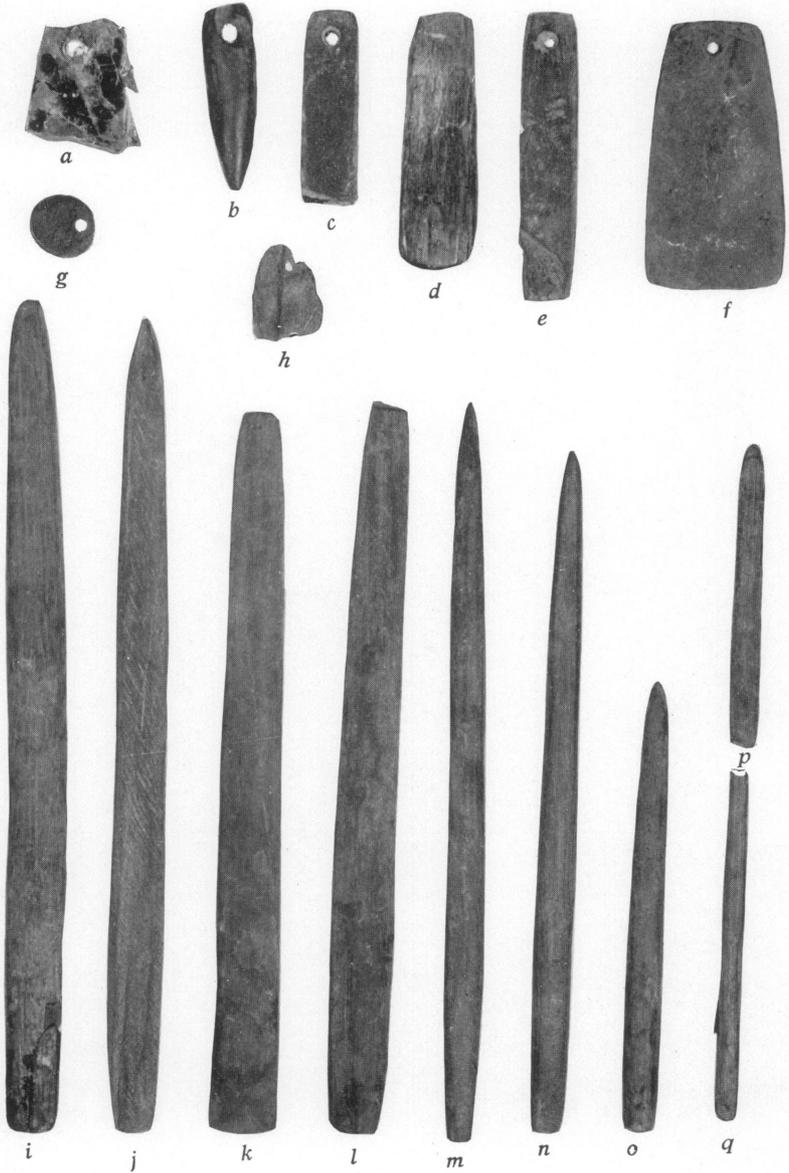


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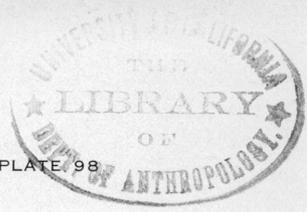


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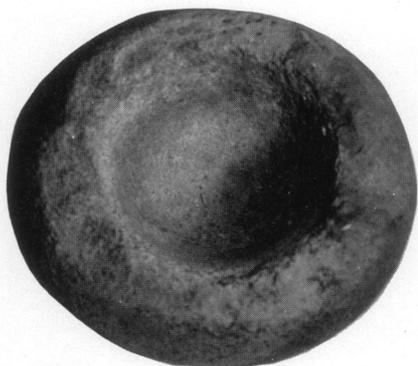
STONE BEADS



GROUND STONE OBJECTS



GROUND STONE OBJECTS



a



b



c



d



e



f



h



g

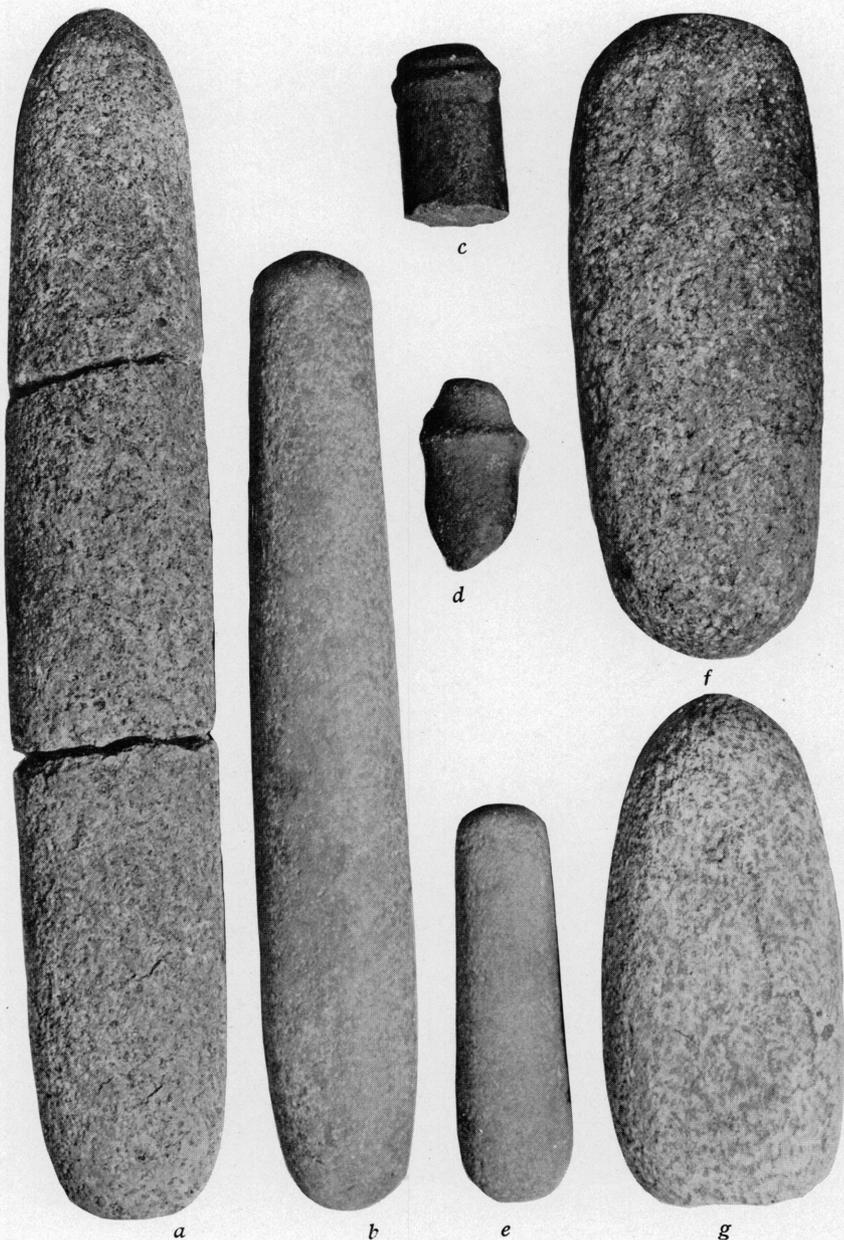


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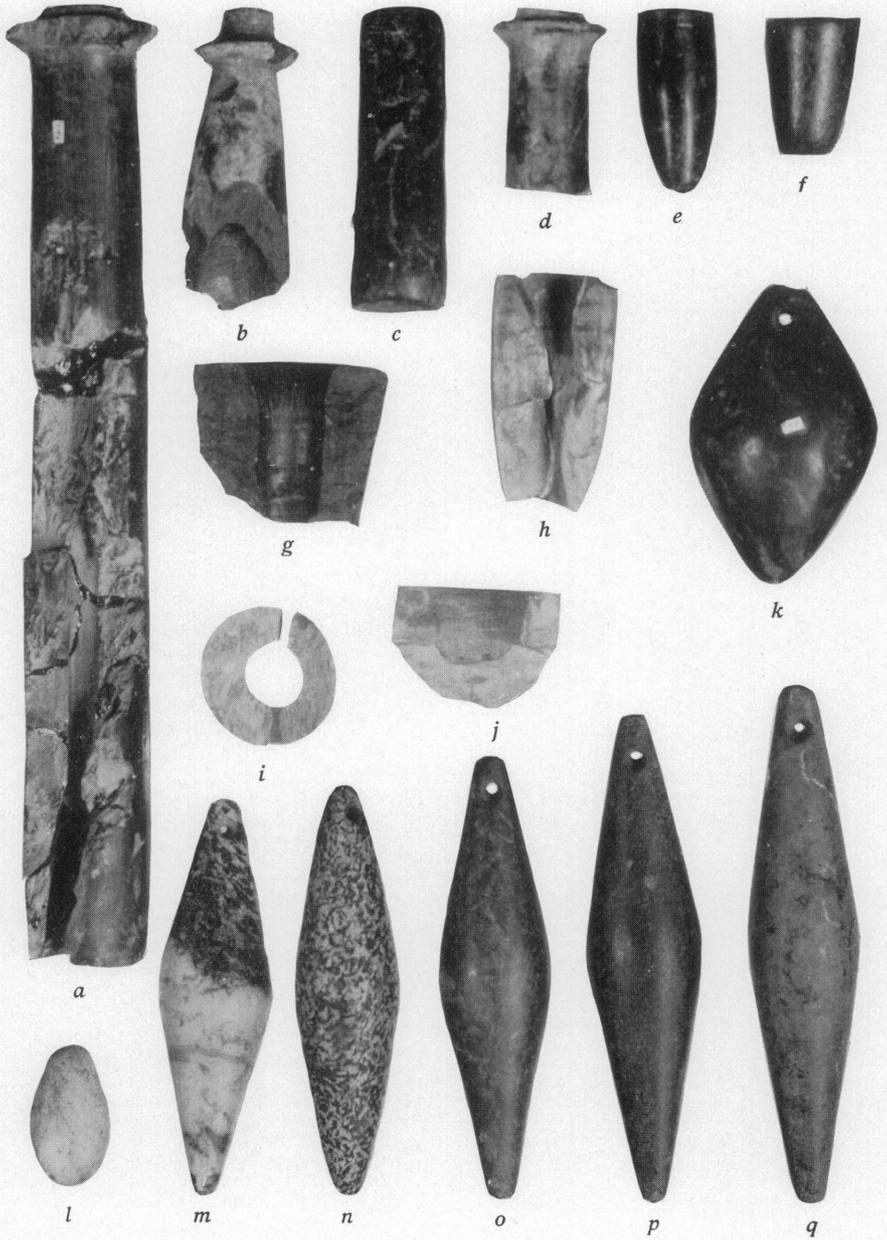


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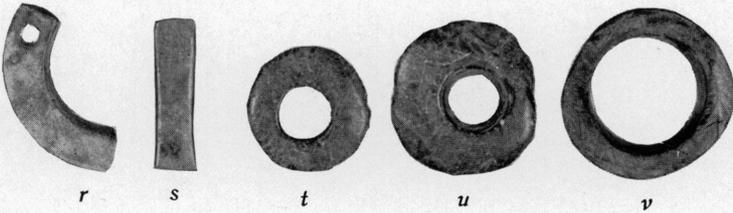
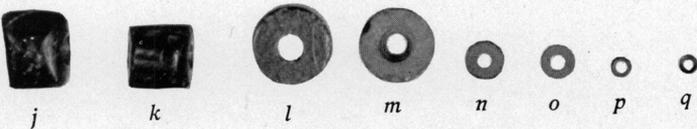
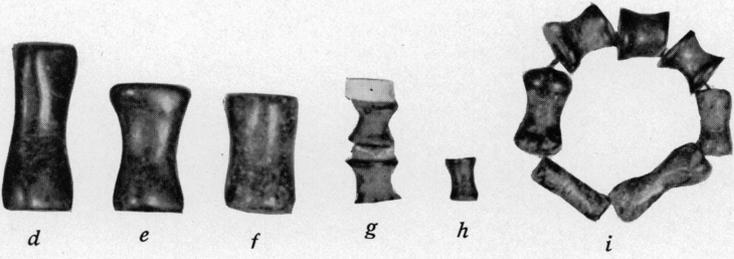
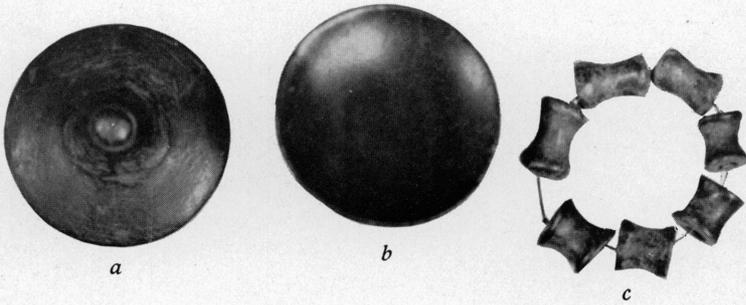
MORTARS



PESTLES



PIPES AND PLUMMETS



STEATITE OBJECTS