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**Abstract:**
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# Milling Stone Cultures in Northern California: Berryessa I

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IN a recently published California volume of the *Handbook of North American Indians* (Heizer 1978), William J. Wallace had the responsibility for summarizing the archaeology of California from 9000 B.C. to 2000 B.C. He proposed three periods within this time range: Period I, Hunting (9000-6000 B.C.); Period II, Food Collecting (6000-3000 B.C.); and Period III, Diversified Subsistence (after 3000 B.C.). We present some evidence here that appears to be relevant to Wallace's Period II. The portrayal of this period or horizon is basically an expansion of Wallace's earlier (1954) paper on this subject. It is thought that subsistence during this period was based on "harvesting of wild seeds and other edible plant parts." The artifact inventories of the period are given as follows (Wallace 1978:28): "a lack of variety characterized the artifact assemblages. Heavy deep-basined mills predominate. The rare projectile points are typically heavy, indicating continuing employment of darts and throwing sticks. Crude service tools fashioned from cores or thick flakes commonly occur. Bone and shell items are scarce."

The above discussion is based upon and refers to Southern California. Wallace says (1978:28) "Outside Southern California seed collecting is less well documented." He then refers to evidence of this period in Northern California at Sacramento and Oroville. In the North Coast Range, manifestations of the sort Wallace discussed have been noted by both Fredrickson (1974) and Meighan (1955).

In point of fact, the amount of material from Northern California attributed to Wallace's Milling Stone Horizon is miniscule as compared with Southern California. The question arises from this as to whether the people of the Milling Stone Horizon were present in Northern California only in very small numbers, if at all, or, on the other hand, whether they were present but that their remains are less known for one reason or another.

Our data favor the hypothesis that they were present but are less known. The reason for our lack of knowledge is two-fold. First is that their remains have been overlooked. Northern California archaeology from its beginnings in the 1930's has concentrated on the later and more spectacular cultures; very little attention has been paid to simpler and peripheral remains. Thus, in a 133-page monograph on the archaeology of the Napa region (Heizer 1953), a three-page appendix is devoted to the material of the Milling Stone Horizon. This very monograph suggests the second reason why these remains are less known—they are much more difficult to find. One of the sites reported in that monograph is Nap-131. This is a site which is quite undetectable from the surface. It was discovered only because a road cut through it, and R. F. Heizer (personal communication) happened to see a handstone (mano) embedded in that cut while driving by. It is our view that much Milling Stone Horizon material in Northern California is similarly difficult to find but a great deal of it exists.

The recent two-year drought (1975-77) provided an opportunity to find out just how such material might be brought to light. During the drought, Lake Berryessa on Putah Creek lowered its level about 40 feet leaving surfaces exposed that were considerably altered from their pre-1956 (year of inundation) condition. How we happened on to the situation is outlined below. This is the first in a series of papers in which we hope to report in detail on the extent, condition, and nature of such material in one small part of the North Coast Range of California.

During the winter of 1975-76, an archaeological survey was made over a small parcel of land near Lake Berryessa, Napa County, California, as part of a proposed campground and

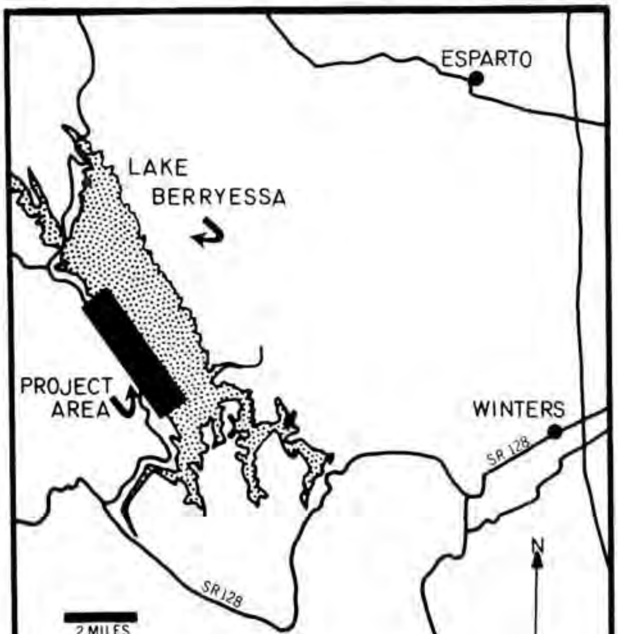


Fig. 1. Location map showing project area.

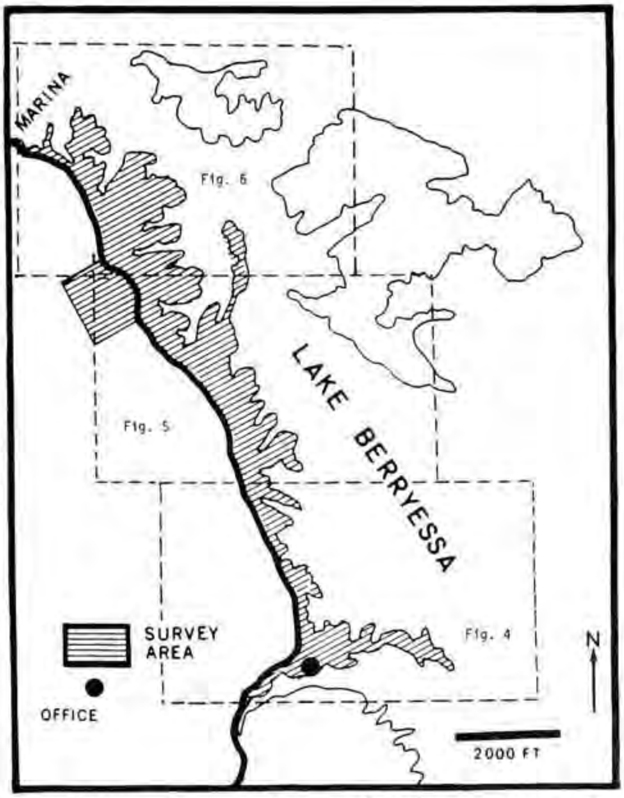


Fig. 2. Location map showing Oakshores survey area.

recreational improvement project identified as Oakshores Park. Figure 1 shows the general location. Figure 2 indicates the survey area.

Although the study area (Oakshores Park) is contiguous to Lake Berryessa and appears (at the present time) to be a favorable place for human occupance, prior to the construction of Monticello Dam it was a considerable distance from the principal stream draining the area (Putah Creek), and would not usually be considered a very likely place to search for or find substantial evidence of prehistoric occupation. Thus, when the Bureau of Reclamation requested the Oakshores survey, it appeared that it would be yet another public archaeology project in which the primary value would be the exercise gained by the surveyors.

After some reflection, however, the Oakshores survey project appeared to be an excellent opportunity to examine a parcel of marginal land under near ideal and controlled circumstances. A road extends the full length

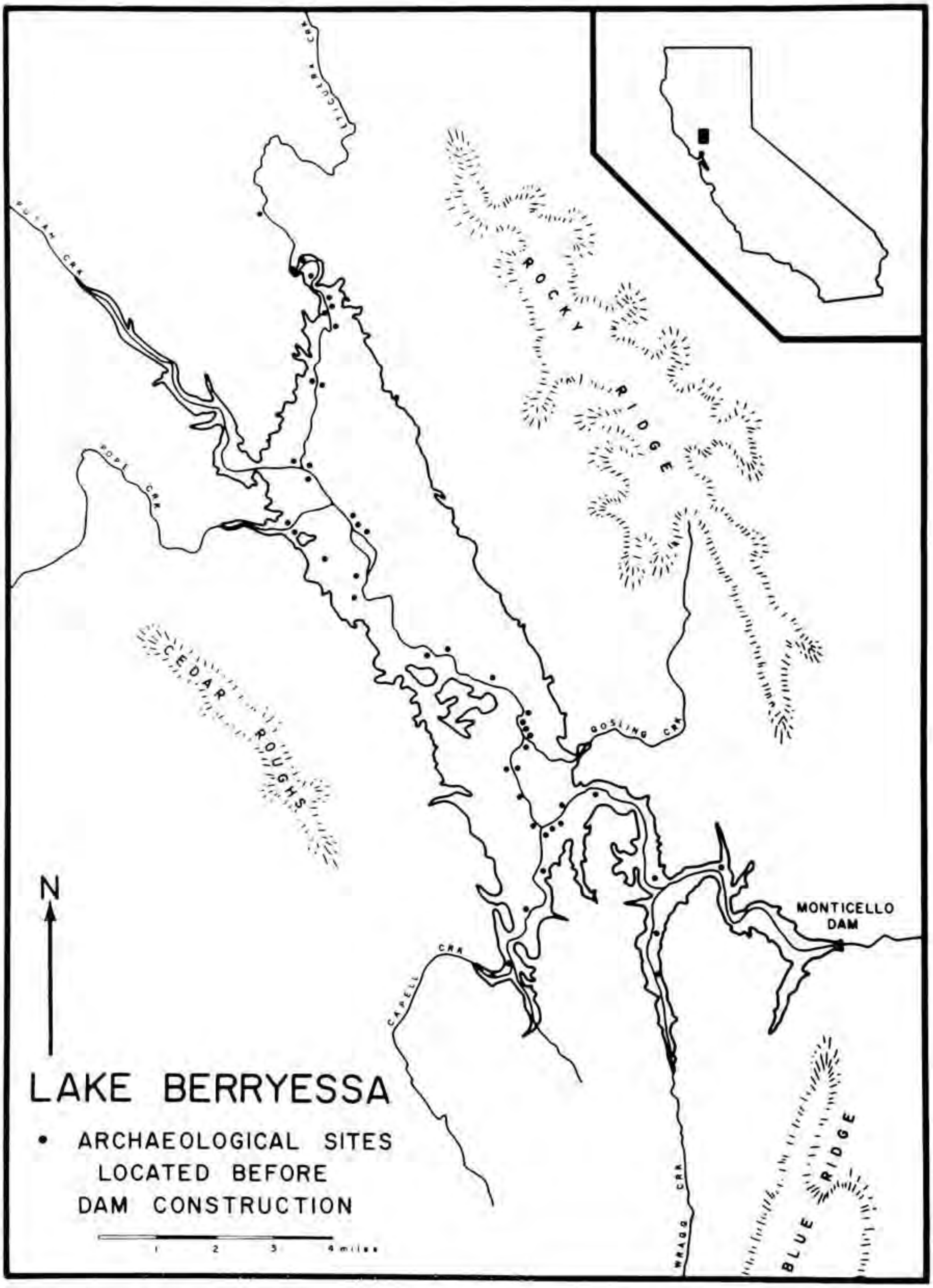


Fig. 3. Map showing archaeological sites located as a result of previous surveys.

of the parcel so that no part of the survey area was more than one-half mile from a vehicle. The winter had been exceedingly dry and grass cover was greatly reduced, thereby increasing the likelihood of locating artifacts and features. As an additional plus, the survey area was adjacent to an area covered by earlier archaeological surveys made prior to the construction of Monticello Dam and the subsequent filling of the lake. As part of these earlier investigations, a number of sites were located along the margins of the principal streams in the area (Putah, Capell, Eticuera, and Pope creeks). Some of the sites located at that time were partially excavated or tested. Figure 3 locates the sites recorded as part of the earlier surveys. Although it is not entirely clear from the available reports, it is assumed that some survey effort during the early investigations was extended to at least part of the hillside areas adjacent to the valley sites.

Given these circumstances, the planned Oakshores survey would complement the previous investigations and with some luck provide additional settlement and subsistence information over a wider range of terrain and geographic settings.

## THE SURVEYS

Although not made explicit in the proposal submitted to the Bureau of Reclamation, it was hypothesized that sites would be present in the survey area, and that they would be small subsistence-oriented locations which in some way or another could be related to the larger villages and camps located along the valley streams. It was assumed that bedrock mortars would surely be part of this pattern.

To implement the project, all of the land included in the Oakshores development area (Fig. 2) was examined by archaeologists walking over the terrain in such a manner that all exposed soil surfaces were examined, and in those few places where the grass cover was still intact it was removed at regular intervals with a shovel so that the underlying soil could be examined. In short, the survey was intensive, and it was focused on the recovery of archaeological remains that might well have been overlooked under other circumstances.

In spite of this rather intensive effort, not a single site was located within the survey area. Even after checking some areas more than once not a single flake, bedrock feature, or other bit of evidence of prehistoric occupance was noted. Given the terrain and general environmental considerations and the fact that several sites of consequence were situated in the valley a relatively short distance away, this complete lack of cultural remains was an enigma.

A consideration of the circumstances that might account for such a dearth of archaeological remains suggested at least four viable possibilities: (1) there was no significant utilization of this kind of terrain by the prehistoric occupants of the North Coast Range province in general; (2) terrain such as this was normally or usually exploited or utilized, but for some special reason the Oakshores area was not; (3) the area had actually been utilized but under circumstances where no tangible remains were left behind; or (4) the survey area had been utilized and artifacts or other evidence of this utilization were simply not apparent.

Given the information available relative to resource exploitation for Northern California from ethnographic sources, along with some understanding of prehistoric subsistence patterns in general, it seemed likely that at least some portions of the larger survey area would have been utilized, and there is no reason to believe that the Oakshores area would have been avoided for any reason (given the presence of the major sites nearby). Therefore, it seemed that of the four hypothetical possibilities, only the latter two were reasonable.

It is of course quite possible to make use of an area and its produce without leaving recognizable evidence of such use. Food resources could easily have been collected and transported to the nearby streamside camps for processing without leaving imperishable tools behind. The collection of acorns without the associated processing (implying use of mortars and pestles) leaves very little evidence. The same applies to small game hunting which is often done with wooden-tipped arrows, snares, traps, etc., none of which would normally survive to be recovered by archaeologists. This is of course a major difficulty in any attempt to deal archaeologically with catchment areas and such related concepts.

Although it seemed unlikely given the nature of the surveys, the last possibility, that artifacts were present but simply not being discovered, had to be considered.

In sum, although the situation was difficult to accept in view of our general notions about resource exploitation and prehistoric space utilization, we had to face the fact that a careful survey over a substantial territory had produced no tangible evidence of occupance or utilization. It was agreed at that point that a short report was in order pointing out that the survey had been accomplished and that the planned campground development would not impact any known cultural resources.

However, in the interim between the first examination of the area and the last trip up for one more effort, the lake level had dropped even further as a result of the drought conditions and a substantial strip of beach was newly exposed. Although the contract called for a survey extending only to the high water mark (maximum pool level), it was decided to make one more examination of part of the survey area including, this time, some of the newly exposed beach surface.

The first few hundred feet of survey along the beach below the normal high water line (440 feet elevation) resulted in the recovery of a single obsidian flake. A careful examination of the location both below and above the high water mark produced no additional artifacts. The flake (Fig. 7C), which was clearly of cultural origin, was recorded as an isolated piece with no special significance. Several hundred feet further along the same beachline, however, a nearly complete obsidian projectile point (Fig. 7A) was recovered, and again the surrounding area was combed with great care. No other artifacts were noted. Along an adjacent spit of land (which in pre-lake days had been a long narrow ridge) two heavy chert "cores" were noted but not considered seriously because of the strong possibility that they were the result of natural fracturing. These were seen as *possible* tools, but because of the context and the lack of clear-cut cultural modification, they were set aside. A short distance down the same beach, however, another heavy core was noted, and this time there was no question as to its origins. The flaking pattern was clearly cultural (Fig. 8E). Not far down the same beach a pitted mano was recovered (Fig. 9A). Again the survey was extended to the land surface above the beach, expecting to find evidence of a camp, but without success. The survey was then continued along several spits or points of land extending into the lake. Consistent with the pattern established to that point, isolated artifacts were recovered at various locations along the beachline, but none was found anywhere above the high water mark. Because of the rather consistent occurrence of artifacts on nearly every point of land examined so far, it was decided to extend the beachline survey to include the entire 11 mile shoreline of the Oakshores project area. As a result of the extended survey, a number of additional artifacts were recovered. Figures 4, 5, and 6 show the locations of the sites. A brief description of the artifacts recovered as a result of the expanded survey is presented below.

A total of 244 artifacts were recovered as a result of the Oakshores survey project. Two hundred seven of these have been sorted into

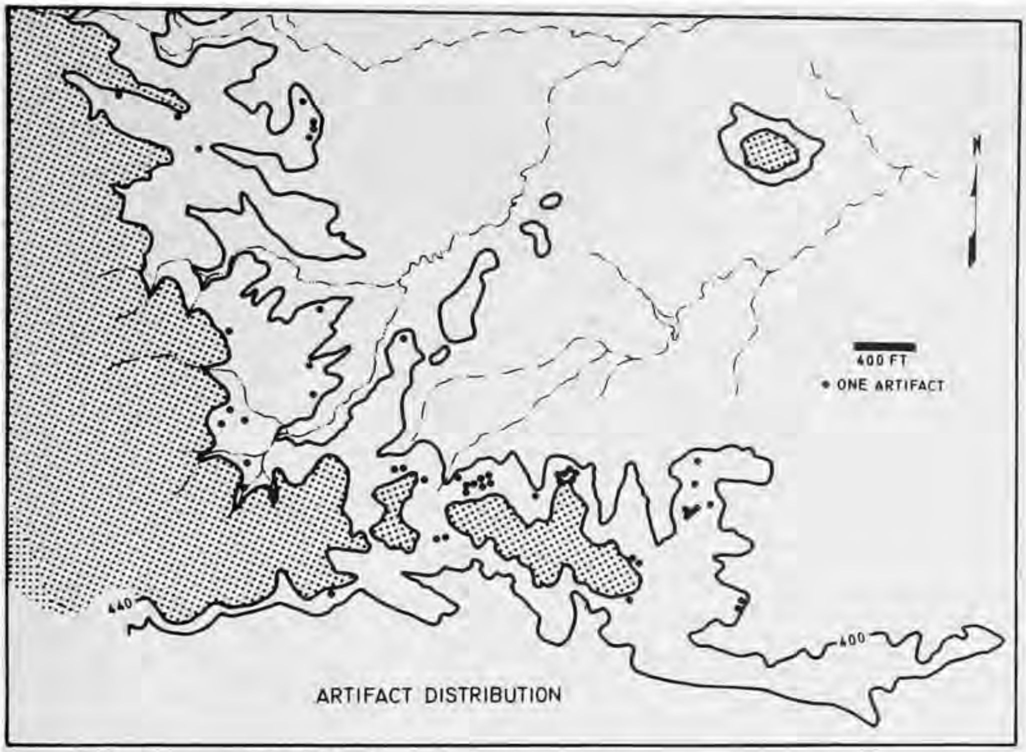


Fig. 4. Distribution of individual artifacts within Oakshores survey area, southern sector.

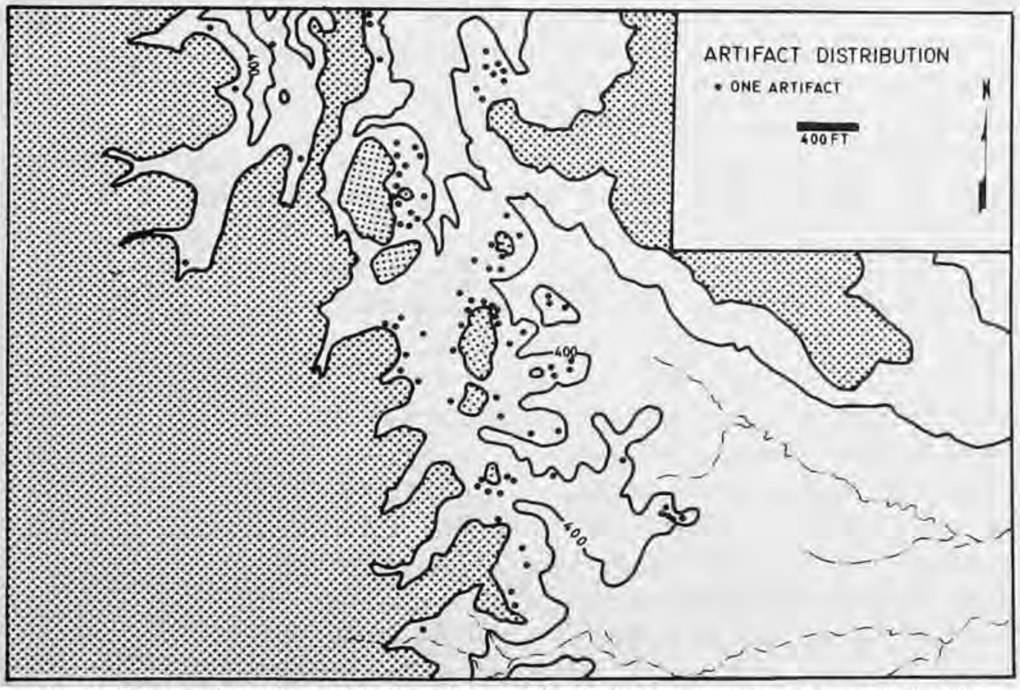


Fig. 5. Distribution of individual artifacts within Oakshores survey area, central sector.

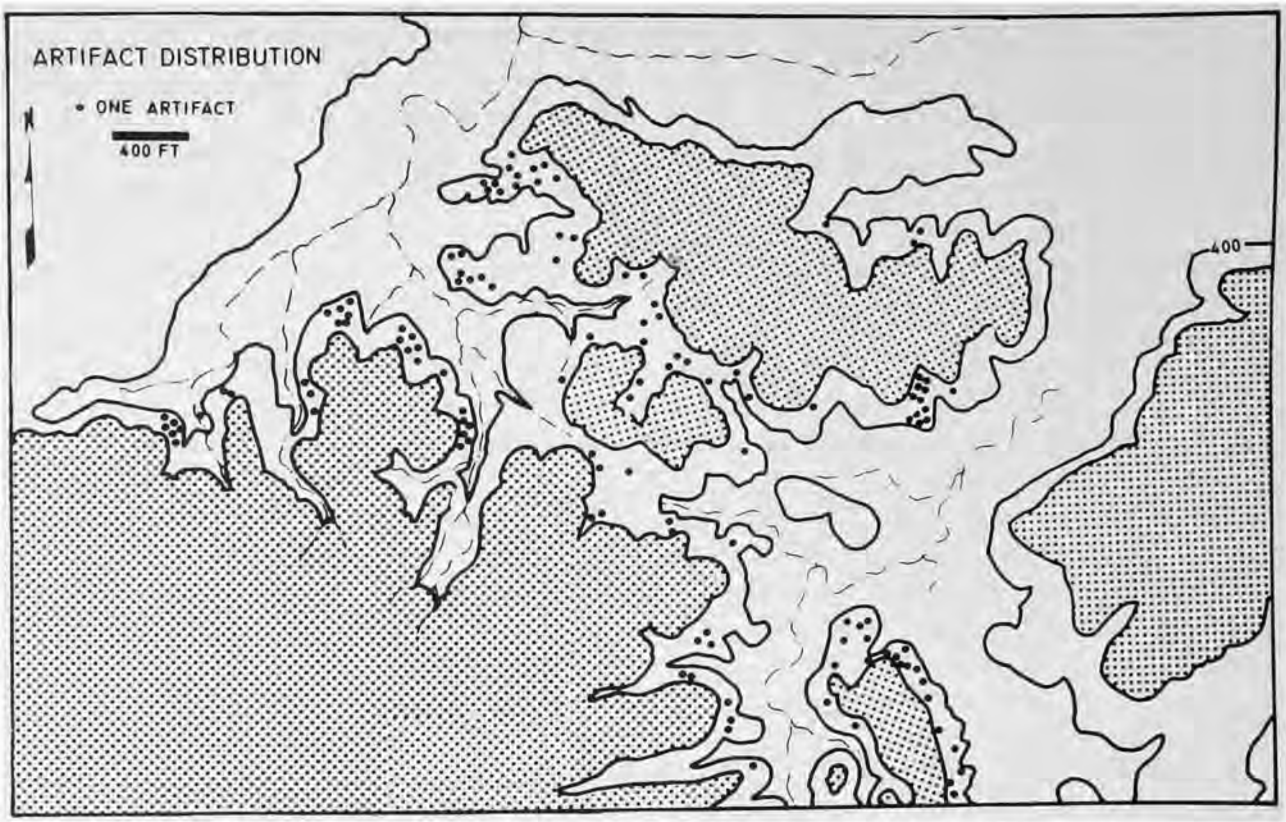


Fig. 6. Distribution of individual artifacts within Oakshores survey area, northern sector.

categories based on formal and presumed functional characteristics. The categories should not be seen as types, and the functional designations in many instances are simply an economical way of categorizing several classes of tools that otherwise would require elaborate descriptive statements.

## MILLING TOOLS

**Manos** (9)

Several artifacts were recovered that seem to be handstones used on a metate-like surface. Four categories are proposed at the present time: unshaped uniface (5), unshaped biface (1), shaped biface (2), and nondiagnostic fragments (1). (The number following each category represents the number of items for that category.)

Three of the manos had small depressions pecked into one or more surfaces (Fig. 9A, B, D). Two artifacts in this category have pestle-like surfaces on one end.

**Metates** (6)

A total of six metates (including fragments) were recovered for the Oakshores survey area. These are unshaped sandstone slabs of varying sizes marked by shallow depressions or wear surfaces on one or more sides. Three of the six specimens were left in place along the beach. The metates are not illustrated.

## PROJECTILE POINTS

A single obsidian projectile point was recovered from the Oakshores sector of the Berryessa beachline surveys. This artifact (Fig. 7A) is identified as an Excelsior point based on its size and configuration (Fredrickson 1973:199-200).

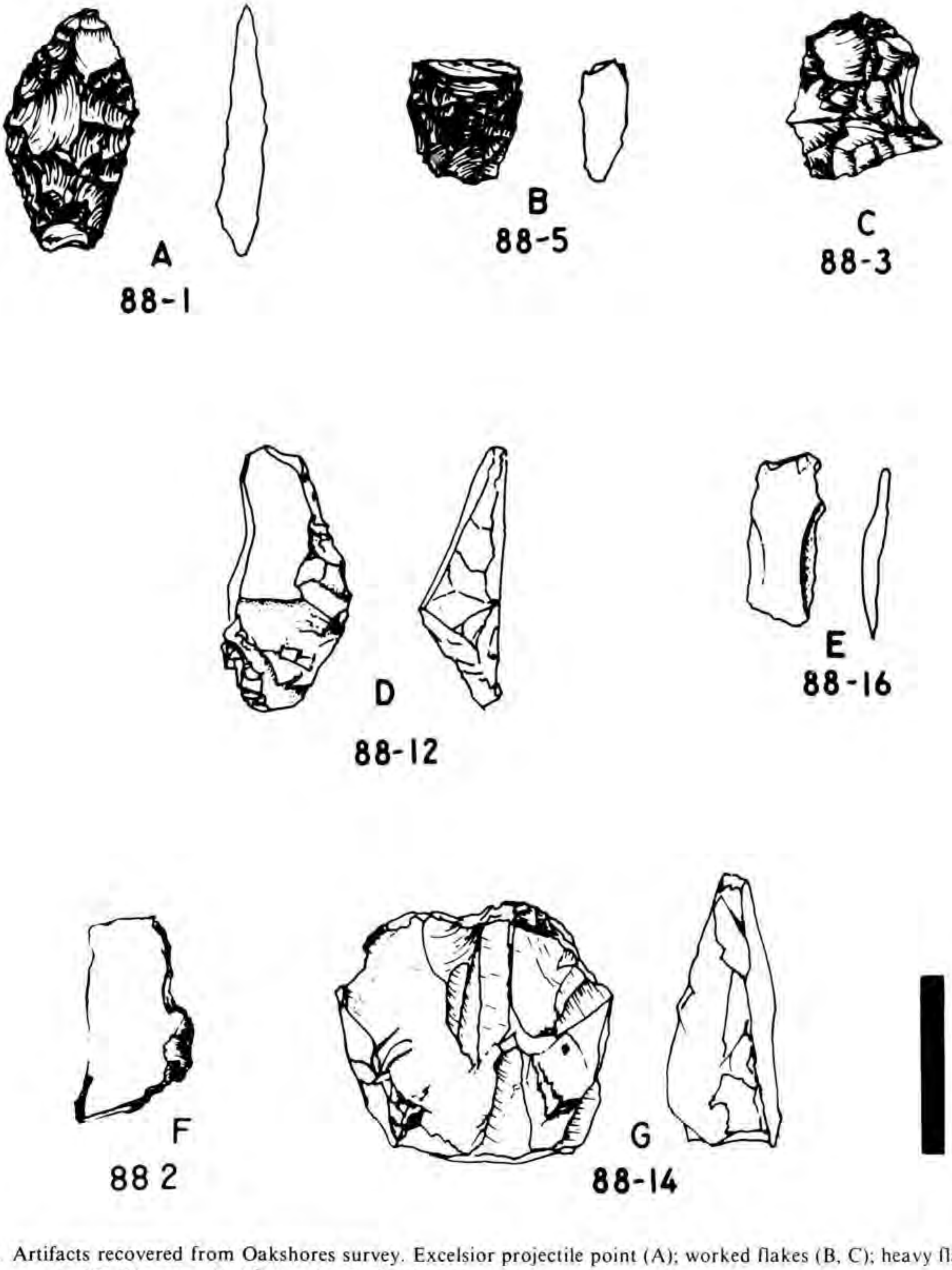


Fig. 7. Artifacts recovered from Oakshores survey. Excelsior projectile point (A); worked flakes (B, C); heavy flake scraper (D, G); retouched flakes (E, F). Scale 3 cm.

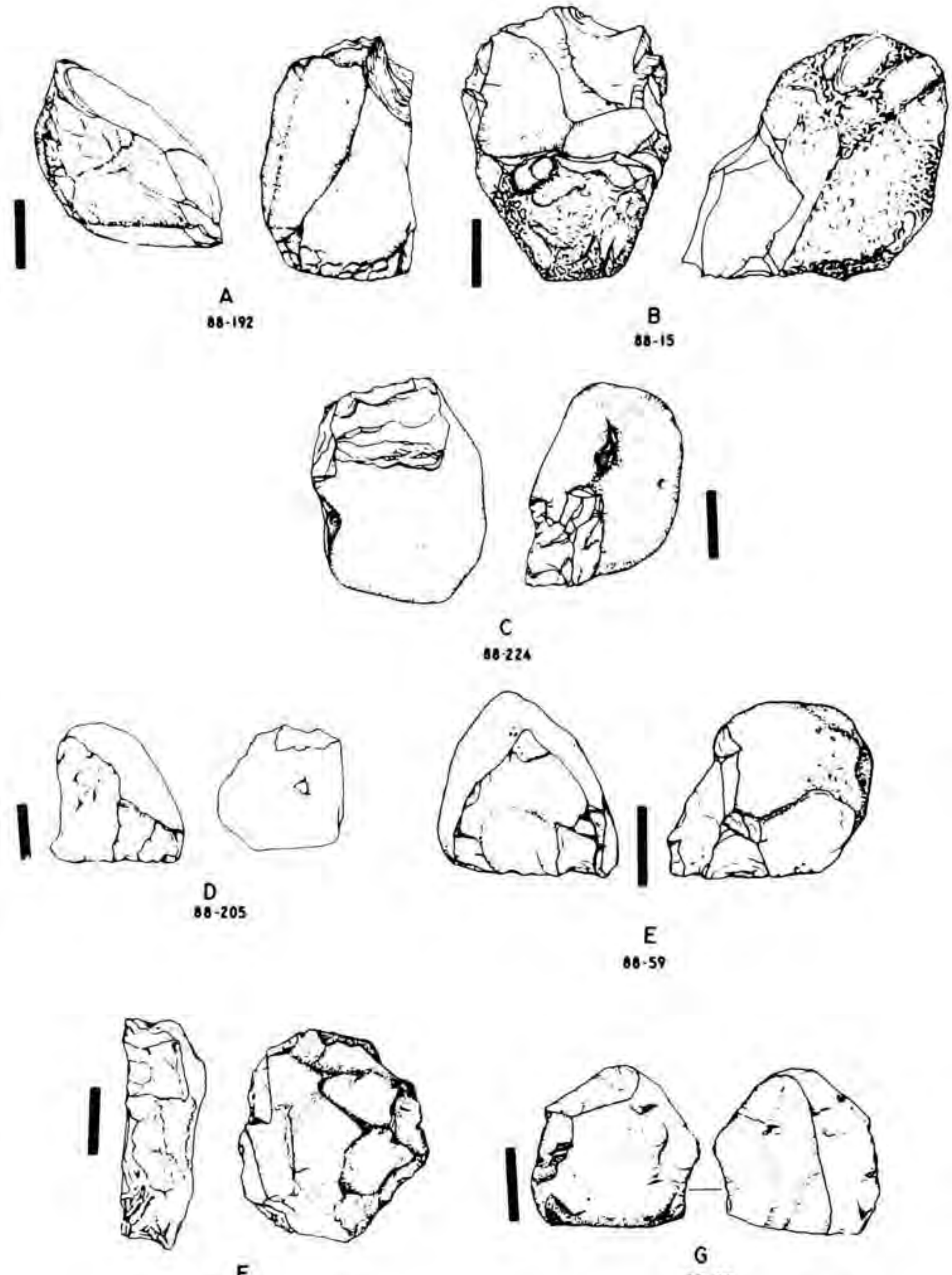


Fig. 8. Artifacts recovered from Oakshores survey. Irregular cobble scrapers: beveled horse hoof (A-C), horse hoof (D); core (E); domed scraper: unifacial, cortex based (F); split pebble/cobble casual knife (G). All scales are 3 cm.

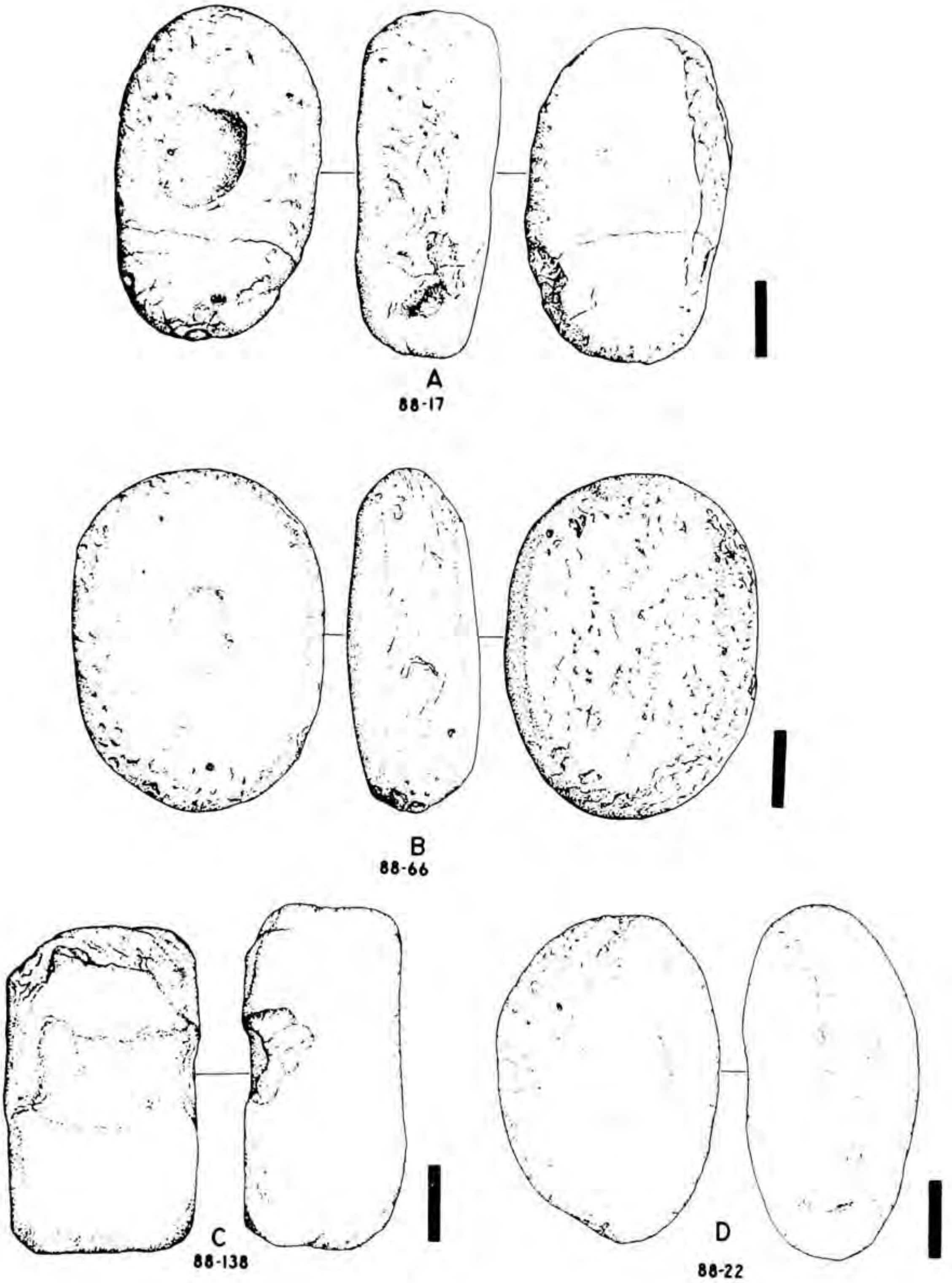


Fig. 9. Artifacts recovered from Oakshores survey. Pitted manos (A, B); pitted rock (C). Scales 3 cm.

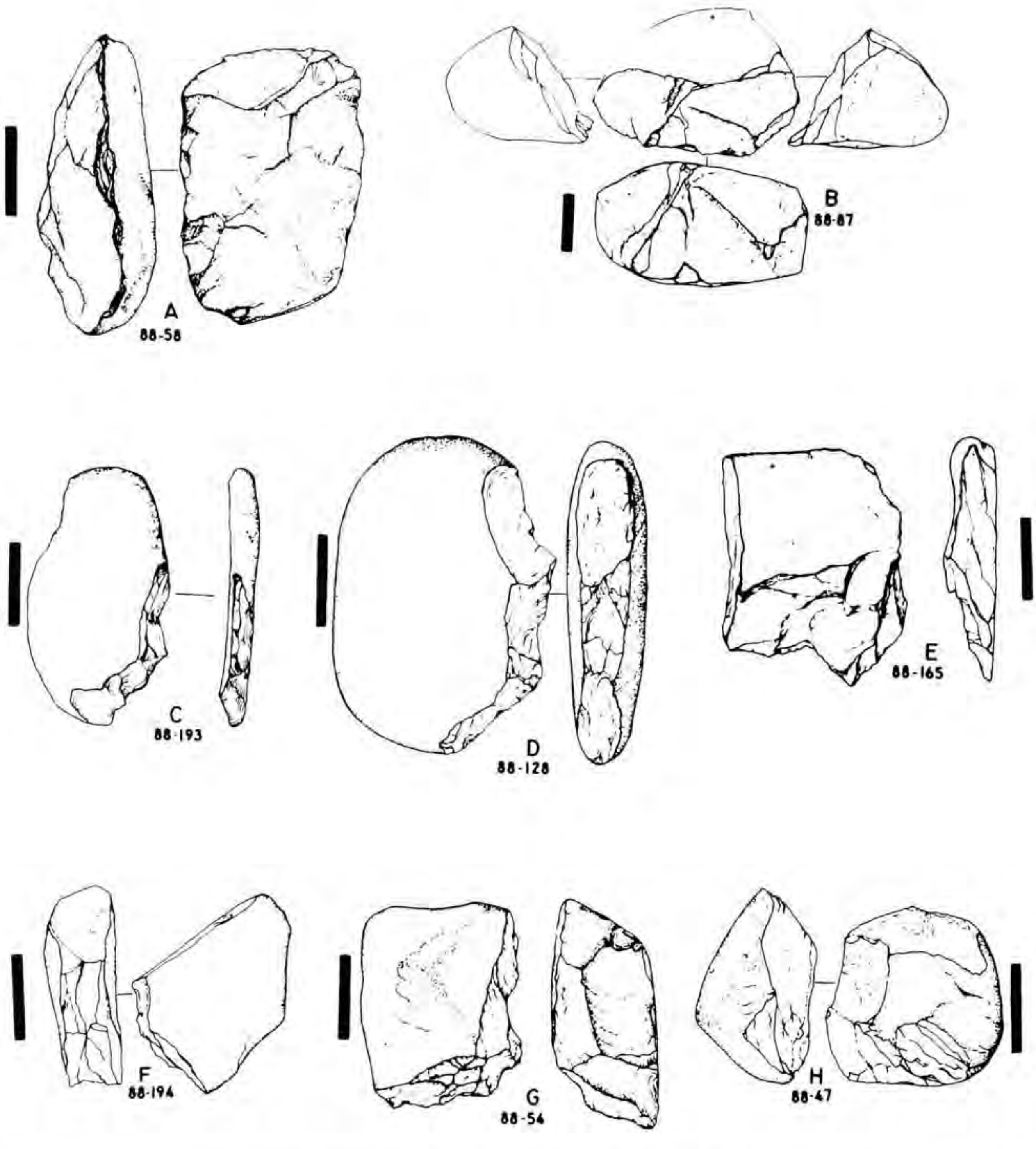


Fig. 10. Artifacts recovered from Oakshores survey. Cobble scrapers—irregular unifacial, cortex based: elongate, side flaking, angular (A, B); tabular (C-F); side and end flaking (G, H). Scales 3 cm.

## SCRAPING TOOLS

The largest category of artifacts recovered from Oakshores consists of objects tentatively described as scrapers. The function, of course, is not based entirely on empirical evidence, and some of the artifacts included below may well have served some other purpose. Multipurpose functions are assumed in many instances. A total of 166 artifacts are placed into this general grouping which is subdivided as follows:

**Cobble Scrapers** (158)

*Irregular unifacial, cortex based* (137)

1. Tabular (13) (Fig. 10C)
2. Small tabular (3) (Fig. 10D, F)
3. Elongate, end flaking (26) (Fig. 11A-E)
4. Heavy elongate, end flaking (15) (Fig. 12A-E)
5. Elongate keeled, end flaking (2) (Fig. 13D)
6. Horse hoof (4) (Fig. 8D)
7. Beveled horse hoof (9) (Fig. 8A-C)
8. Elongate, side flaking (24) (Fig. 14A-F)
9. Elongate, side flaking, angular (8) (Fig. 10A, B)
10. Side and end flaking (8) (Fig. 10G, H)
11. Multiple surfaces (11) (Fig. 15D)
12. Heavy plane (6) (Fig. 13A-C)
13. Broken cobble (6) (Figs. 13F, 15A)
14. Broken cobble, keeled planar (2) (Fig. 16E, F)

*Irregular unifacial, flake scar based* (12)

1. Broken cobble (5) (Fig. 16D)
2. Heavy broken cobble (1) (Fig. 13E)
3. Cortex backed (4) (Fig. 16A-C)
4. Heavy core, multiple (2) (Fig. 15B, C)

*Irregular bifacial* (9)

1. Elongate, end flaking (5) (Fig. 17D, E)
2. Elongate, side flaking (1) (Fig. 17F)
3. Elongate, end and side flaking (1) (Fig. 17C)
4. Heavy cobble, beaked (2) (Fig. 17A, B)

**Domed Scraper** (1)

*Unifacial, cortex based* (1) (Fig. 8F)

**Core Scraper** (1)

*Multiple surfaces* (1) (not illustrated)

**Flake Scrapers** (6)

*Heavy flake scraper* (3) (Fig. 7D, G)

*Retouched flakes* (3) (Fig. 7E, F)

## KNIVES OR CUTTING TOOLS

Artifacts with relatively sharp edges suitable for cutting seem to be uncommon in the Oakshores inventory and conventionalized knife forms are conspicuous by their absence. Twenty-one knife-like artifacts were recorded although it is recognized that many implements categorized here as scrapers may well have served as cutting tools under some circumstances. Cutting tools here include five large basalt flakes that could have been casually used as knives and three small obsidian flakes that *might* have been used for cutting, although there is no actual evidence to support this possibility. Based primarily on edge angles, two other categories of artifacts are identified as possible cutting tools:

*Split pebble knife/scraper* (3) (Fig. 15F, G)

*Split pebble/cobble casual knife* (10) (Figs. 8G, 15E)

These two categories are simply thin cobbles or pebbles from which flakes have been removed forming a reasonably sharp edge along one or more sides.

## OTHER ARTIFACTS

In addition to the artifacts described or listed above, several other items were collected. These include the following:

**Smoothing Stone** (1) (not illustrated)

One artifact was found that appeared to be a small mano. Because of its size it is considered to be some kind of smoothing stone.

**Anvil Stone**

This is a worked stone with a pecked and battered surface suggesting use as an anvil (not illustrated).

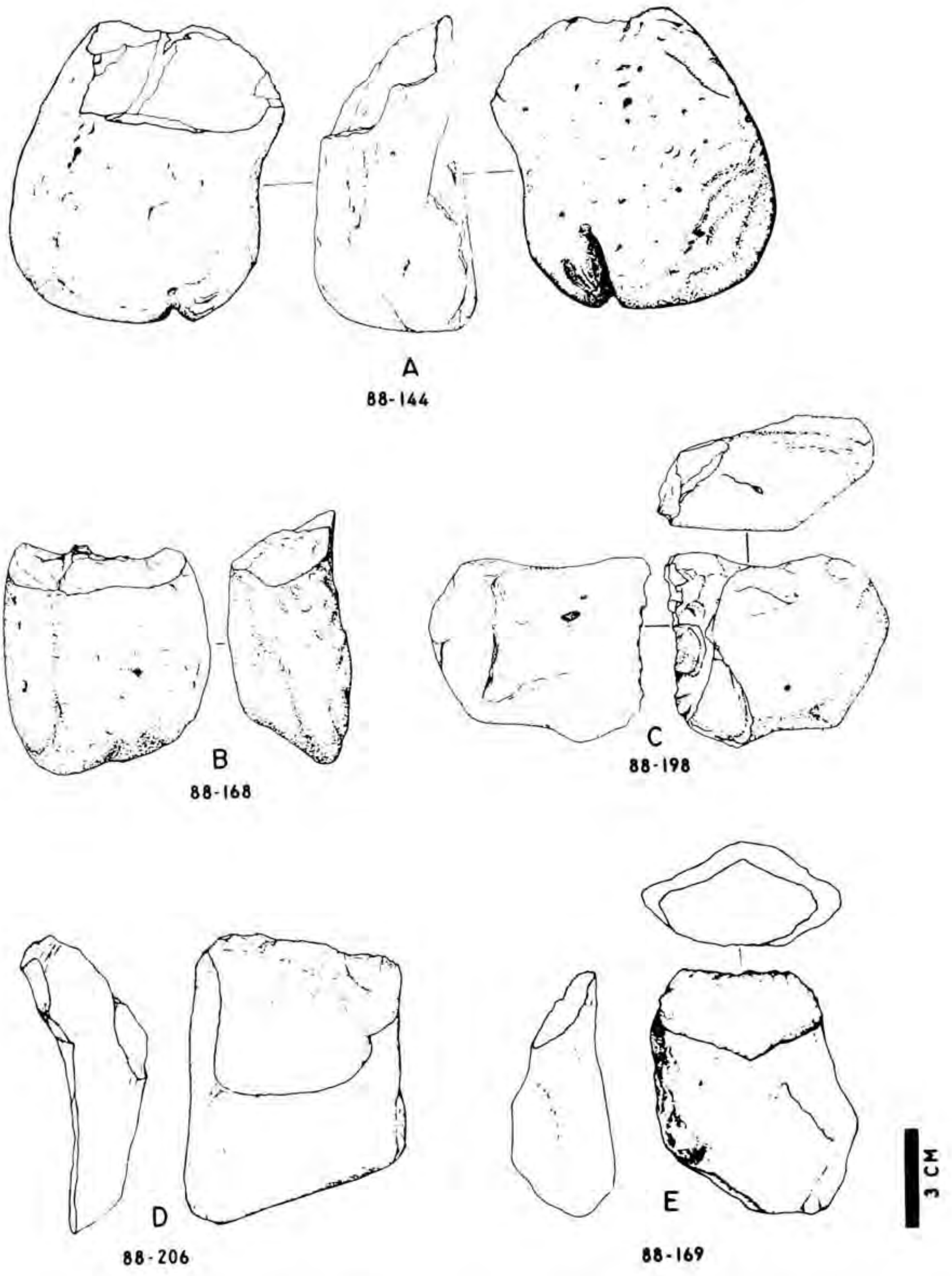


Fig. 11. Artifacts recovered from Oakshores survey. Cobble scrapers—irregular, unifacial, cortex based: elongate, end flaking (A-E). Scales 3 cm.

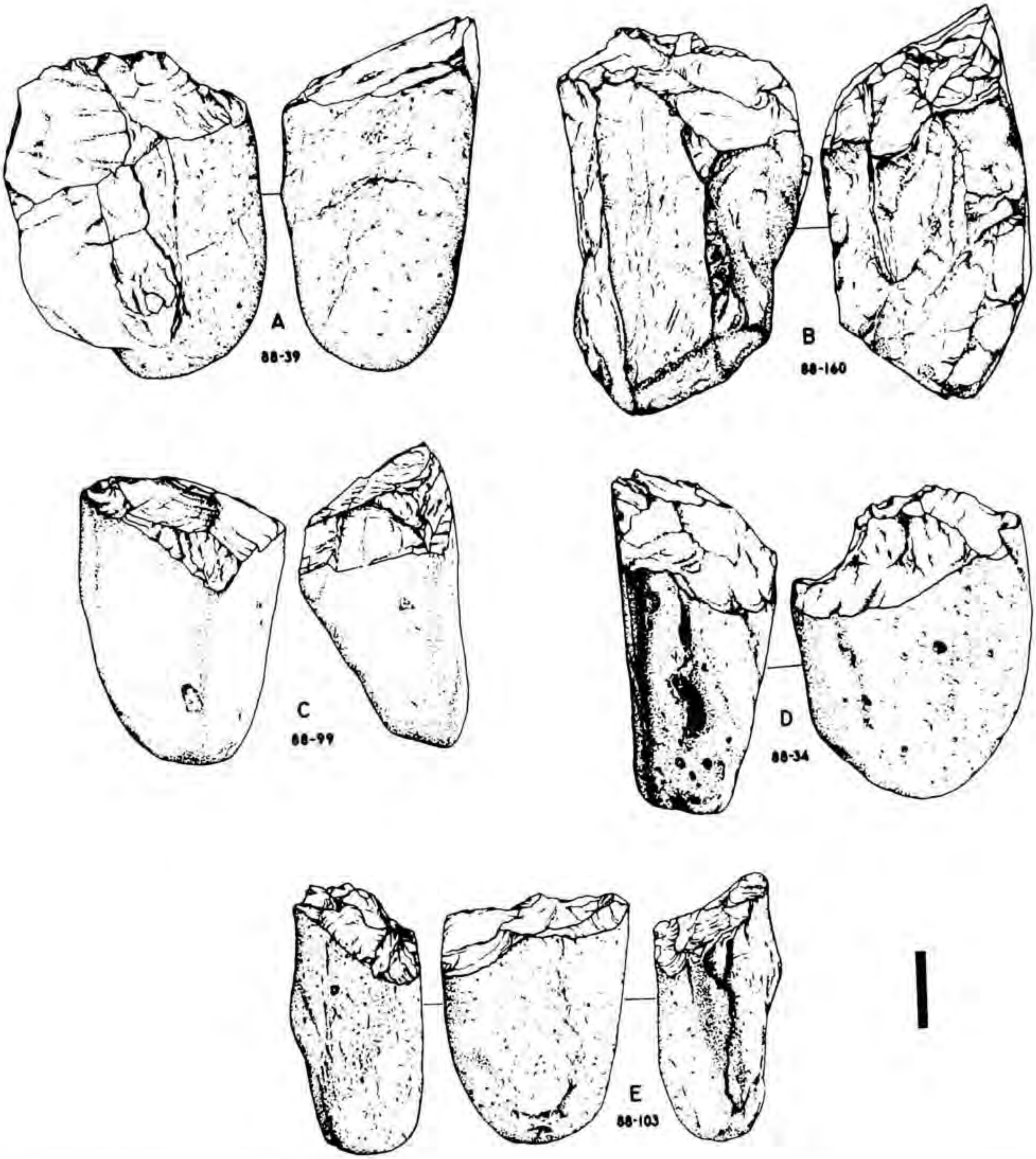


Fig. 12. Artifacts recovered from Oakshores survey. Cobble scrapers—irregular, unifacial, cortex based: heavy elongate, end flaking (A-E). Scales 3 cm.

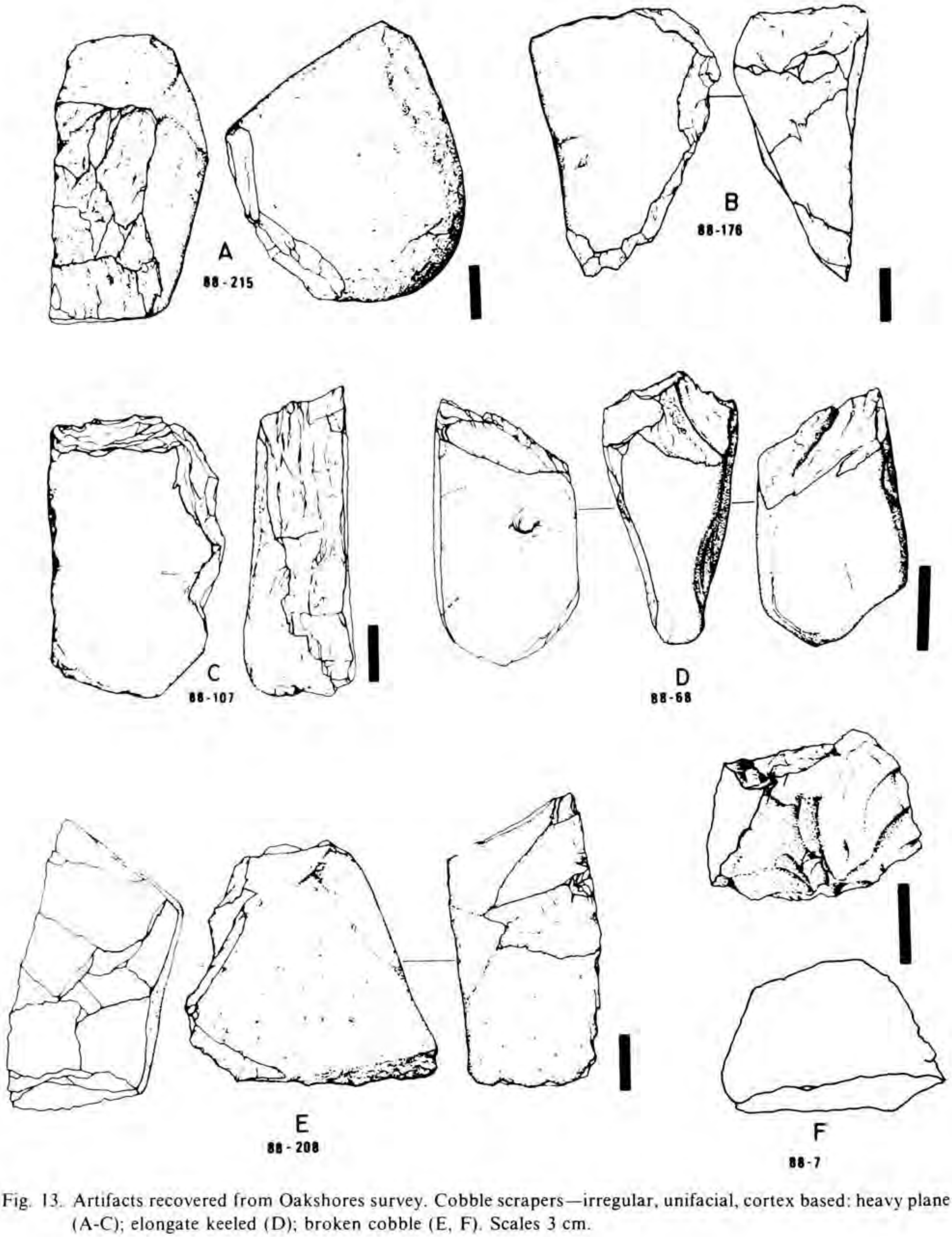


Fig. 13. Artifacts recovered from Oakshores survey. Cobble scrapers—irregular, unifacial, cortex based: heavy plane (A-C); elongate keeled (D); broken cobble (E, F). Scales 3 cm.

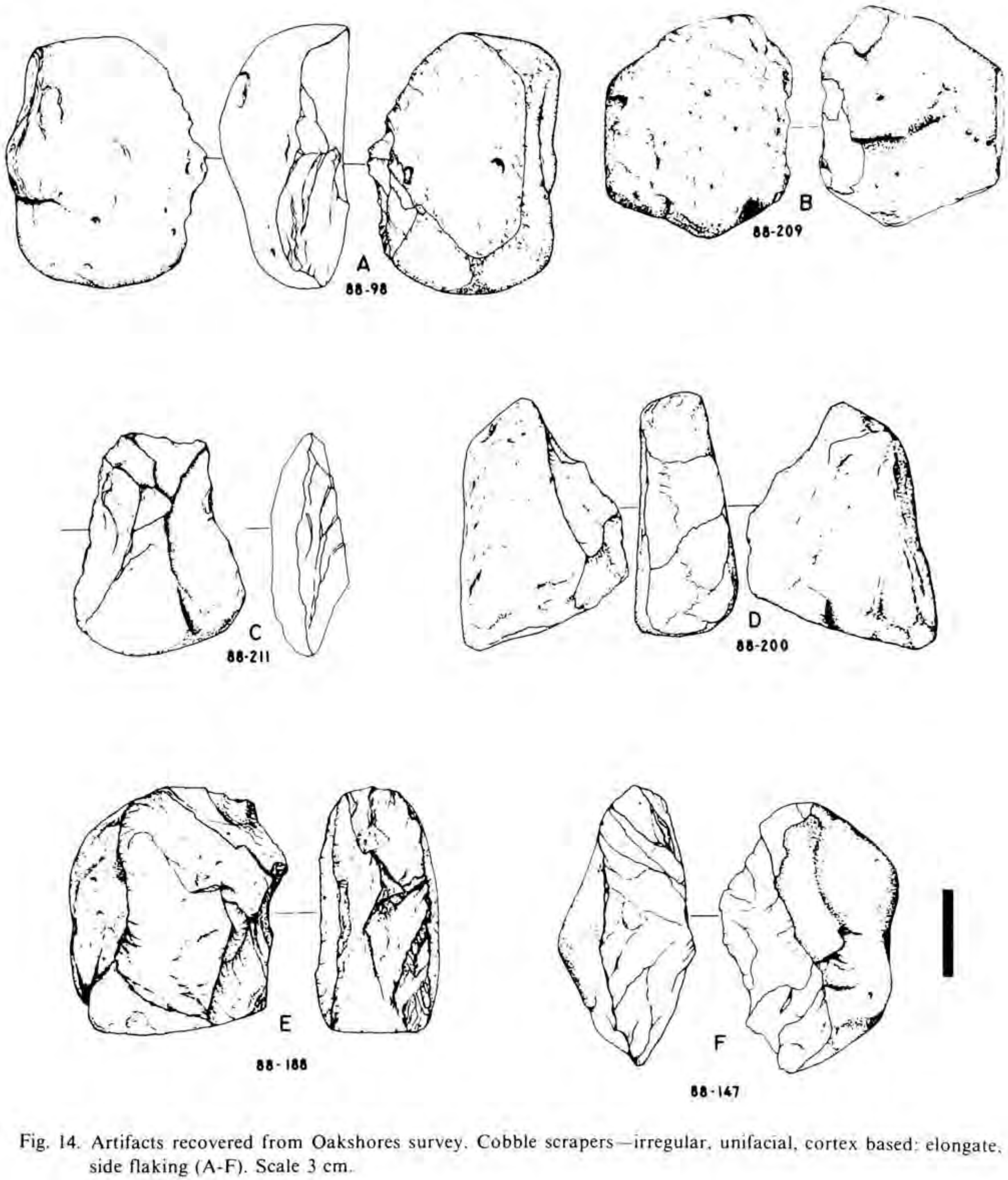


Fig. 14. Artifacts recovered from Oakshores survey. Cobble scrapers—irregular, unifacial, cortex based: elongate, side flaking (A-F). Scale 3 cm.

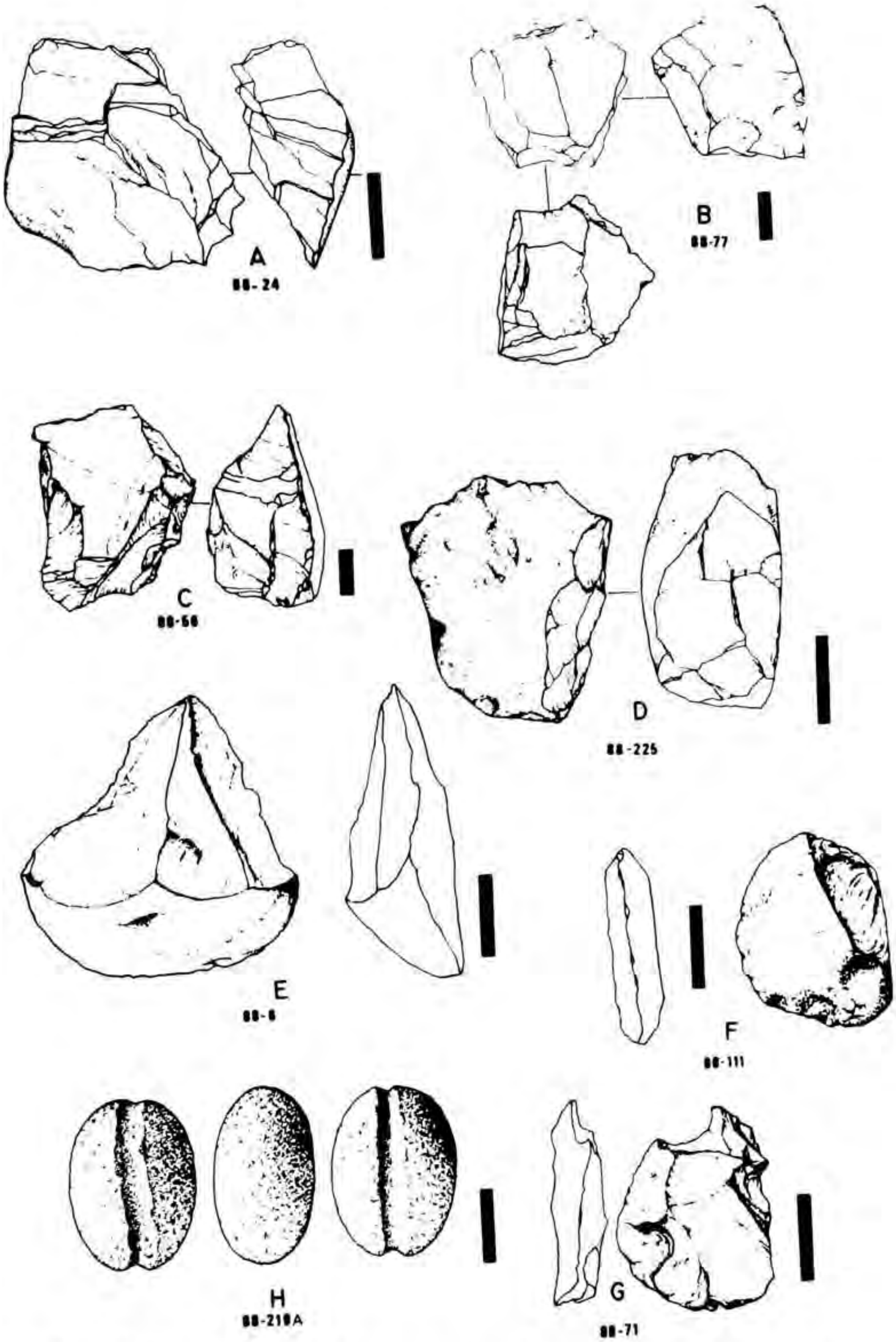


Fig. 15. Artifacts recovered from Oakshores survey. Cobble scrapers—irregular, unifacial, cortex based: multiple surfaces (D); broken cobble (A). Irregular, unifacial, flake scar based: heavy core, multiple (B, C). Split pebble knife/scraper (F, G). Split pebble/cobble casual knife (E). Grooved stone (H). Scales 3 cm.

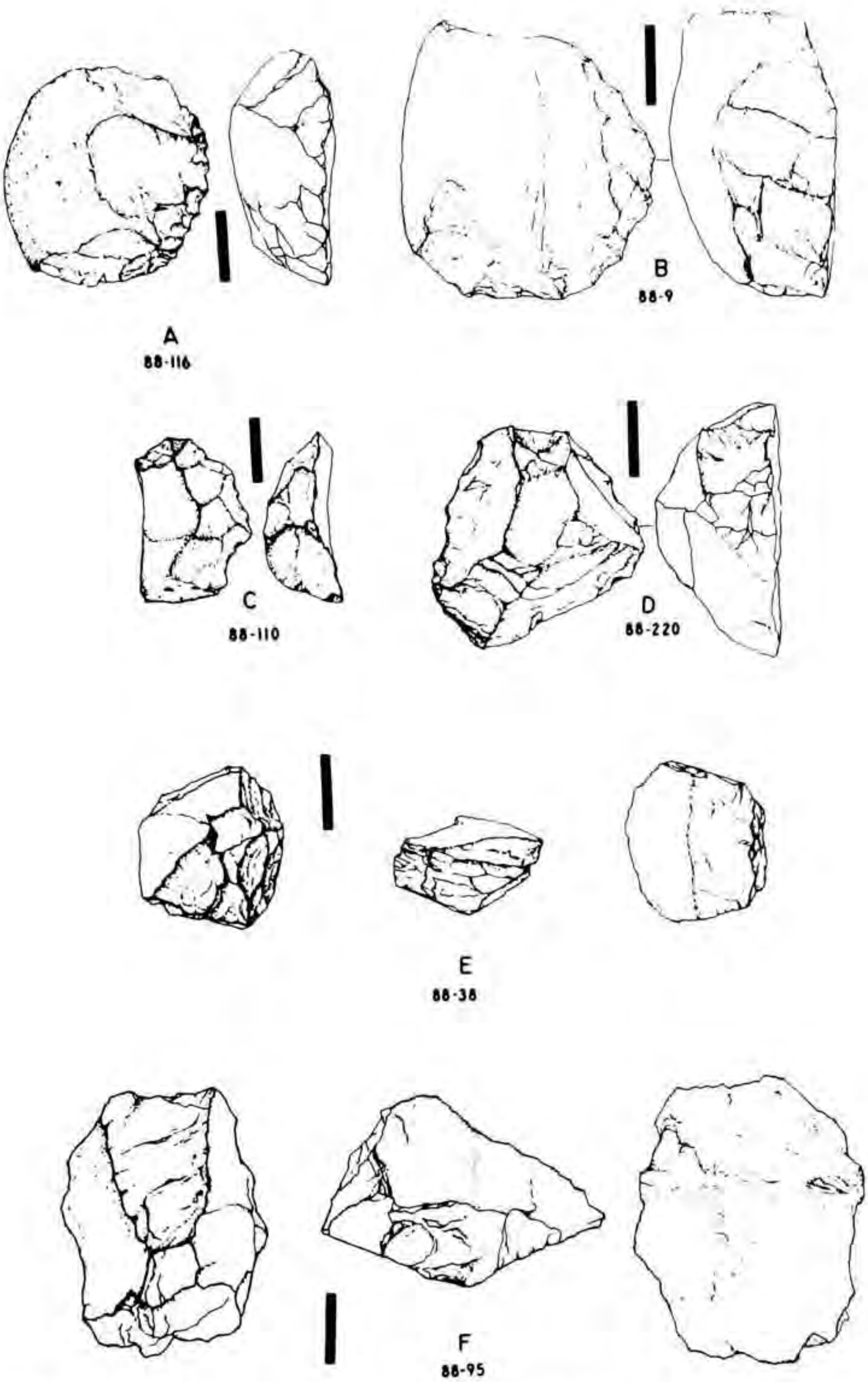


Fig. 16. Artifacts recovered from Oakshores survey. Cobble scrapers—irregular unifacial, flake scar based: cortex backed (A-C); broken cobble (D). Irregular, unifacial, cortex based: broken cobble, keeled planar (E, F). Scales 3 cm.

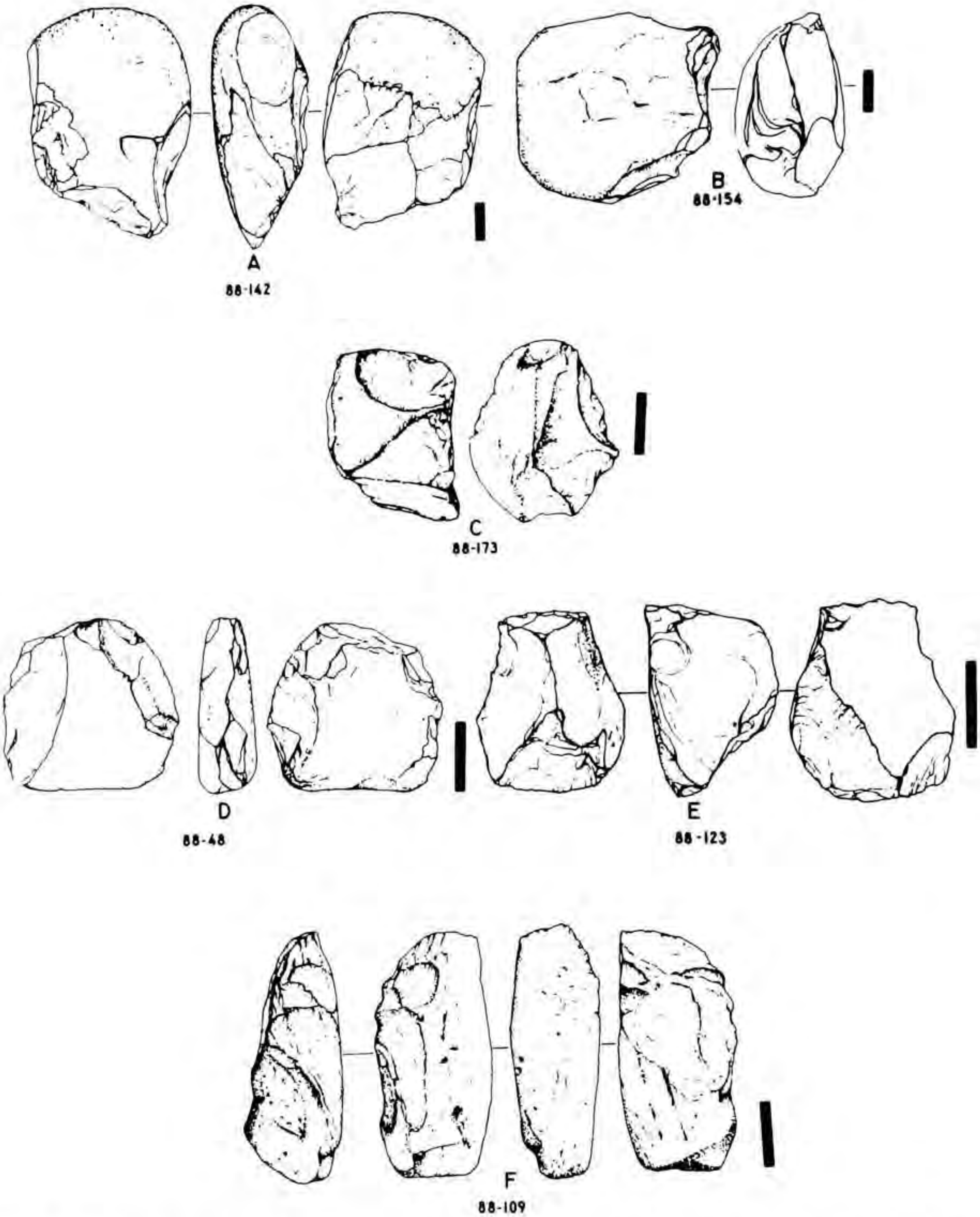


Fig. 17. Artifacts recovered from Oakshores survey. Cobble scrapers—irregular, bifacial: heavy cobble, beaked (A, B); elongate, end and side flaking (C); elongate, end flaking (D, E); elongate, side flaking (F). Scales 3 cm.

### Pitted Rock

This is a tabular sandstone fragment with a pit pecked into one surface. The pit is similar (identical?) to those noted on several mano forms. In this case, however, the base rock has not been shaped or used (Fig. 9C).

### Grooved Stone (1)

This is a relatively rare artifact here, although others have been recovered from other Berryessa survey sectors. The artifact here is a small oval-shaped stone with a groove incised around the long circumference (Fig. 15H).

### Worked Flakes

Probable fragments of completed artifacts or unfinished tools (points or knives?) (Fig. 7B, C).

In addition to the artifacts described or listed above a total of 21 broken cobbles and 16 pieces of broken field stone were collected which are believed to have been culturally modified. These are probably artifacts and very likely served some kind of scraping or chopping function.

**Table 1**

**ARTIFACT PERCENTAGES FOR OAKSHORES COLLECTION**

| Overall Categories | Artifacts | Percentage Total | Percentage of Diagnostic |
|---|---|---|---|
| Milling | 15 | 6.14% | 7.24% |
| Projectiles | 1 | .40% | .48% |
| Scraping | 166 | 68.03% | 80.19% |
| Cutting | 21 | 8.60% | 10.14% |
| Other | 4 | 1.63% | 1.93% |
| Miscellaneous fragments | 37 | 15.16% | |
| | 244 | 99.96% | 99.98% |
| **Scraper percentages** | | | |
| Cobble scrapers | 158 | 95.18% | |
| Domed scrapers | 1 | .60% | |
| Core scrapers | 1 | .60% | |
| Flake scrapers | 6 | 3.61% | |
| | 166 | 99.99% | |
| **Cobble scraper percentages** | | | |
| Unifacial | 149 | 94.30% | |
| Bifacial | 9 | 5.69% | |
| | 158 | 99.99% | |
| Unifacial cortex based | 137 | 91.94% | |
| Unifacial flake scar based | 12 | 8.05% | |
| | 149 | 99.99% | |
| **Unifacial, cortex based** | | | |
| Percentage of total cobble scrapers | | 86.70% | |
| Percentage of all scrapers | | 82.53% | |
| Percentage of all diagnostic artifacts | | 66.18% | |
| Percentage of all artifacts collected | | 56.14% | |

**Table 2**

**DIMENSIONAL INFORMATION FOR ILLUSTRATED ARTIFACTS**

**(FIGS. 7 to 17)**

| | Length (mm.) | Width (mm.) | Thickness (mm.) | Weight (g.) | Edge Angle (degrees) |
|---|---|---|---|---|---|
| **Figure 9** | | | | | |
| 88-17 | 127 | 77 | 53 | 535 | — |
| 88-66 | 134 | 100 | 51 | 874 | — |
| 88-138 | 123 | 75 | 59 | 948 | — |
| 88-22 | 126 | 86 | 63 | 777 | — |
| **Figure 7** | | | | | |
| 88-1 | 43 | 23 | 8 | 7 | — |
| 88-5 | 21* | 20 | 9 | — | — |
| 88-3 | 28 | 25 | 4 | — | — |
| 88-12 | 47 | 24 | 15 | 15 | — |
| 88-16 | 31 | 13 | 2 | — | — |
| 88-2 | 37 | 20 | 4 | — | — |
| 88-14 | 49 | 45 | 18 | 51 | — |
| **Figure 10** | | | | | |
| 88-58 | 52 | 98 | 48 | 235 | 55 |
| 88-87 | 79 | 109 | 65 | 584 | 69 |
| 88-193 | 100 | 53 | 13 | 104 | 55 |
| 88-128 | 105 | 74 | 25 | 299 | 63 |
| 88-165 | 91 | 71 | 20 | 190 | 53 |
| 88-194 | 75 | 50 | 27 | 142 | 78 |
| 88-54 | 76 | 62 | 36 | 221 | 76 |
| 88-47 | 40 | 60 | 49 | 152 | 70 |
| **Figure 11** | | | | | |
| 88-144 | 94 | 78 | 42 | 376 | 56 |
| 88-168 | 76 | 67 | 35 | 229 | 80 |
| 88-198 | 65 | 60 | 28 | 147 | 81 |
| 88-206 | 94 | 75 | 41 | 240 | 83 |
| 88-169 | 80 | 60 | 35 | 173 | 52 |
| **Figure 12** | | | | | |
| 88-39 | 150 | 87 | 75 | 1394 | 78 |
| 88-160 | 117 | 87 | 60 | 651 | 74 |
| 88-99 | 132 | 100 | 56 | 963 | 79 |
| 88-34 | 107 | 76 | 48 | 541 | 78 |
| 88-103 | | | | | |
| **Figure 13** | | | | | |
| 88-215 | 124 | 146 | 68 | 1760 | 88 |
| 88-176 | 169 | 115 | 65 | 1423 | 82 |
| 88-107 | 156 | 94 | 58 | 1435 | 85 |
| 88-68 | 92 | 48 | 48 | 250 | 75 |
| 88-208 | 123 | 143 | 68 | 1842 | 84 |
| 88-7 | 55 | 78 | 53 | 288 | 82 |
| **Figure 8** | | | | | |
| 88-192 | 83 | 63 | 81 | 501 | 87 |
| 88-15 | 125 | 81 | 91 | 769 | 59 |
| 88-224 | 80 | 73 | 85 | 555 | 79; |
| 88-205 | 74 | 80 | 73 | 425 | 88 |
| 88-59 | 78 | 85 | 69 | 480 | 79 |
| 88-118 | 98 | 91 | 36 | 425 | 84 |
| 88-177 | 69 | 67 | 16 | 93 | 53 |

Table 2 (cont'd.)

| Figure 14 | Length (mm.) | Width (mm.) | Thickness (mm.) | Weight (g.) | Edge Angle (degrees) |
|---|---|---|---|---|---|
| 88-98 | 70 | 89 | 45 | 316 | 70 |
| 88-209 | 62 | 76 | 23 | 147 | 55 |
| 88-211 | 87 | 71 | 34 | 172 | 60 |
| 88-200 | 70 | 73 | 33 | 175 | 57 |
| 88-188 | 78 | 80 | 38 | 296 | 68 |
| 88-147 | 60 | 95 | 48 | 250 | 78 |
| **Figure 16** | | | | | |
| 88-116 | 91 | 101 | 48 | 495 | 70 |
| 88-9 | 110 | 100 | 56 | 820 | 84 |
| 88-110 | 58* | 83 | 35 | 162* | 64 |
| 88-220 | 97 | 90 | 50 | 528 | 80 |
| 88-38 | 55 | 71 | 44 | 223 | 94 |
| 88-95 | 114 | 90 | 72 | 752 | 79 |
| **Figure 17** | | | | | |
| 88-142 | 181 | 127 | 73 | 2313 | 75 |
| 88-154 | 168 | 131 | 83 | 466 | 84 |
| 88-173 | 72 | 88 | 61 | 313 | 83 |
| 88-48 | 77 | 74 | 24 | 174 | 57 |
| 88-123 | 66 | 55 | 43 | 154 | 86 |
| 88-109 | 58 | 115 | 38 | 338 | 81 |
| **Figure 15** | | | | | |
| 88-24 | 96 | 74 | 35 | 318 | 78 |
| 88-77 | 106 | 98 | 83 | 920 | 92 |
| 88-56 | 96 | 80 | 58 | 459 | 82 |
| 88-225 | 74 | 80 | 45 | 290 | 77 |
| 88-6 | 101 | 99 | 35 | 243 | 50 |
| 88-111 | 78 | 60 | 18 | 99 | 53 |
| 88-219A | 70 | 40 | 52 | 197 | — |
| 88-71 | 70 | 55* | 15 | 62 | 32 |

*Broken

Table 3

ARTIFACT DIMENSIONS BY CATEGORY

**Cortex based, irregular cobble scraper**

**Irregular cobble scraper, tabular** (Fig. 10C, D, E, F)

Specimens — 16

| | |
|---|---|
| Length | Range 67-144 mm., average 93.4 mm. |
| Width | Range 50-107 mm., average 70.8 mm. |
| Thickness | Range 13-38 mm., average 27.4 mm. |
| Weight | Range 104-638 g., average 300 g. |
| Edge angle | Range 53-78°, average 67.7° |

**Irregular cobble scraper, end flaked** (Fig. 11A, B, C, D, E)

Specimens — 26

| | |
|---|---|
| Length | Range 65-110 mm., average 85.4 mm. |
| Width | Range 48-99 mm., average 66.1 mm. |
| Thickness | Range 22-58 mm., average 39.6 mm. |
| Weight | Range 122-804 g., average 359.5 g. |
| Edge angle | Range 52-95°, average 63.3° |

**Irregular cobble scraper, broken** (Figs. 13F, 12A)

Specimens — 6

| | |
|---|---|
| Length | Range 55-96 mm., average 73 mm. |
| Width | Range 48-88 mm., average 73.8 mm. |
| Thickness | Range 35-53 mm., average 45.3 mm. |
| Weight | Range 168-444 g., average 277 g. |
| Edge angle | Range 67-91°, average 78° |

**Irregular cobble scraper, broken (keeled)** (Fig. 16E, F)

Specimens — 2

| | |
|---|---|
| Length | Range 55-114 mm., average 84.5 mm. |
| Width | Range 71-90 mm., average 80.5 mm. |
| Thickness | Range 44-72 mm., average 58 mm. |
| Weight | Range 223-752 g., average 487 g. |
| Edge angle | Range 79-94°, average 86.5° |

**Table 3 (cont'd.)**

**Irregular cobble scraper, heavy end flaked** (Fig. 12A, B, C, D, E)
Specimens — 15

| | |
|---|---|
| Length | Range 87-150 mm., average 116.5 mm. |
| Width | Range 75-106 mm., average 86.2 mm. |
| Thickness | Range 41-84 mm., average 60.4 mm. |
| Weight | Range 356-1394 g., average 802 g. |
| Edge angle | Range 57-88°, average 74.4° |

**Irregular cobble scraper, elongate keeled, end flaking** (Fig. 13D)
Specimens — 2

| | |
|---|---|
| Length | Range 92-139 mm., average 115.5 mm. |
| Width | Range 48-58 mm., average 53 mm. |
| Thickness | Range 48-72 mm., average 60 mm. |
| Weight | Range 250-672 g., average 461 g. |
| Edge angle | Range 70-75°, average 72.5° |

**Irregular cobble scraper, horse hoof** (Fig. 8D, E)
Specimens — 4

| | |
|---|---|
| Length | Range 74-88 mm., average 81.7 mm. |
| Width | Range 60-85 mm., average 75 mm. |
| Thickness | Range 58-73 mm., average 66.7 mm. |
| Weight | Range 393-510 g., average 452 g. |
| Edge angle | Range 71-88°, average 79.5° |

**Irregular cobble scraper, elongate, side flaked** (Fig. 14A, B, C, D, E, F)
Specimens — 24

| | |
|---|---|
| Length | Range 45-103 mm., average 73.6 mm. |
| Width | Range 68-115 mm., average 88.3 mm. |
| Thickness | Range 23-72 mm., average 44.12 mm. |
| Weight | Range 106-686 g., average 344 g. |
| Edge angle | Range 52-96°, average 69.7° |

**Irregular cobble scraper, elongate, angular side flaking** (Fig. 10A, B)
Specimens — 8

| | |
|---|---|
| Length | Range 50-79 mm., average 60.3 mm. |
| Width | Range 76-110 mm., average 94.8 mm. |
| Thickness | Range 31-65 mm., average 47.1 mm. |
| Weight | Range 120-584 g., average 273.1 g. |
| Edge angle | Range 49-69°, average 59.6° |

**Irregular cobble scraper, side and end flaking** (Fig. 10G, H)
Specimens — 8

| | |
|---|---|
| Length | Range 40-128 mm., average 80.8 mm. |
| Width | Range 50-104 mm., average 74.1 mm. |
| Thickness | Range 28-60 mm., average 49.3 mm. |
| Weight | Range 85-930 mm., average 414.2 g. |
| Edge angle | Range 68-87°, average 73.5° |

**Irregular cobble scraper, multiple surface** (Fig. 15D)
Specimens — 11

| | |
|---|---|
| Length | Range 74-137 mm., average 102.9 mm. |
| Width | Range 81-127 mm., average 106 mm. |
| Thickness | Range 49-88 mm., average 62.3 |
| Weight | Range 290-1665 g., average 845.9 g. |
| Edge angle | Range 65-100°, average 76° |

**Irregular cobble scraper, unifacial, flake scar based**
**Irregular cobble scraper, broken cobble** (Fig. 16D)
Specimens — 5

| | |
|---|---|
| Length | Range 80-110 mm., average 93.4 mm. |
| Width | Range 71-105 mm., average 87.6 mm. |
| Thickness | Range 36-60 mm., average 47.8 mm. |
| Weight | Range 371-691 g., average 536.8 g. |
| Edge angle | Range 75-88°, average 79.8° |

**Irregular cobble scrapers, broken cobble, heavy** (Fig. 13E)
Specimens — 1

| | |
|---|---|
| Length | 123 mm. |
| Width | 143 mm. |
| Thickness | 68 mm. |
| Weight | 1842 g. |
| Edge angle | 84° |

**Irregular cobble scraper, cortex backed** (Fig. 16A, B, C)
Specimens — 4

| | |
|---|---|
| Length | Range 91-123 mm., average 108 mm. |
| Width | Range 83-110 mm., average 98.5 mm. |
| Thickness | Range 35-56 mm., average 47.2 mm. |
| Weight | Range 495-790 g., average 701.6 g. |
| Edge angle | Range 64-84°, average 70.7° |

**Irregular cobble scraper, heavy core multiple** (Fig. 15B, C)
Specimens — 2

| | |
|---|---|
| Length | Range 96-106 mm., average 101 mm. |
| Width | Range 80-98 mm., average 89 mm. |
| Thickness | Range 58-83 mm., average 70.5 mm. |
| Weight | Range 459-920 g., average 689.5 g. |
| Edge angle | Range 82-92°, average 87° |

**Irregular cobble scraper bifacially flaked**
**Irregular cobble scraper biface, end flaking** (Fig. 17D, E)
Specimens — 5

| | |
|---|---|
| Length | Range 66-98 mm., average 82.8 mm. |
| Width | Range 55-90 mm., average 60 mm. |
| Thickness | Range 24-47 mm., average 38.6 mm. |
| Weight | Range 154-502 g., average 285 g. |
| Edge angle | Range 57-86°, average 68.6° |

**Irregular cobble scraper, biface, side flaking** (Fig. 17F)
Specimens — 1

| | |
|---|---|
| Length | 58 mm. |
| Width | 115 mm. |
| Thickness | 38 mm. |
| Weight | 338 g. |
| Edge angle | 81° |

**Irregular cobble scraper, biface, end and side flaking** (Fig. 17C)
Specimens — 1

| | |
|---|---|
| Length | 72 mm. |
| Width | 88 mm. |
| Thickness | 71 mm. |
| Weight | 313 g. |
| Edge angle | 83° |

**Table 3 (cont'd.)**

**Irregular cobble scraper, heavy plane** (Fig. 13A, B, C)

| | |
|---|---|
| Specimens — 6 | |
| Length | Range 124-169 mm., average 146.5 mm. |
| Width | Range 94-146 mm., average 112.6 mm. |
| Thickness | Range 58-77 mm., average 68.3 mm. |
| Weight | Range 1233-1760 g., average 1513.6 g. |
| Edge angle | Range 82-92°, average 86.1° |

**Irregular cobble scraper, heavy, biface beaked** (Fig. 17A, B)

| | |
|---|---|
| Specimens — 2 | |
| Length | Range 168-181 mm., average 174.5 mm. |
| Width | Range 127-131 mm., average 129 mm. |
| Thickness | Range 73-83 mm., average 78 mm. |
| Weight | Range 466-2313 g., average 1389.5 g. |
| Edge angle | Range 75-84°, average 79.5° |

**Domed Scrapers**
**Unifacial cortex based** (Fig. 8F)

| | |
|---|---|
| Specimens — 1 | |
| Length | 98 mm. |
| Width | 91 mm. |
| Thickness | 36 mm. |
| Weight | 425 g. |
| Edge angle | 84° |

## DISCUSSION OF THE BERRYESSA ARTIFACTS

Although limitations of space preclude a detailed discussion of the artifacts here, several points seem worth noting. These include the following:

*1. The overwhelming preponderance of cobble tools relative to other chipped stone forms, with an emphasis on tools with probable scraping functions.*

The categorization of most of the cobble tools as scrapers rather than as chopping or cutting implements is based primarily on edge and flaking angles as well as on evidence from other locales where similar forms have well-defined wear facets on the planar and other surfaces.

It is proposed that these were casual tools made and discarded on the spot as part of some subsistence-related activity, and that they were multipurpose implements used on occasion for cutting and chopping as well as scraping. Reuse and subsequent reworking (sharpening) of some implements through time would account for the different levels of modification noted in any form category.

The several variant form categories proposed here are probably unrelated to specific function, and it is not likely that a variety of specialized functions are represented by the various subdivisions proposed here. There is, for example, unlikely to be any meaningful functional or cultural difference in this assemblage between a cobble tool with a flake scar base and one with a cortex base.

Likewise, it is considered unlikely that end flaking versus side flaking versus side and end flaking represents meaningful cultural or functional differences in the present assemblage. Similarly, scrapers made on tabular pebbles or small cobbles are probably not functionally different from those made on more rounded forms.

Size, on the other hand, may be meaningful, and heavy planes were no doubt used differently than the smaller cobble tools. It is proposed that scraping functions here included both planing (push plane movements) and reversed direction scraping with drawknife-like movements toward the operator. These are probably evident both in artifact sizes and edge angle differences.

The question of probable function as indicated by edge angles and other physical criteria will be considered in somewhat greater detail in another context when the Oakshores artifacts are examined in conjunction with a larger artifact series recovered from another sector of the Berryessa shoreline.

2. *The presence of milling implements (manos and metates) and the apparent absence of mortars and pestles.*

3. *The scarcity of projectile points, chipping waste, and other small chipped stone implements (in spite of the fact that such artifacts are present in substantial numbers on other sites in the general area).*

4. *The seemingly significant differences between the Oakshores inventory and that reported for the nearby streamside sites excavated or investigated by Arnold and Reeves in 1959.*

A more detailed comparison of the artifacts recorded by Arnold and Reeves (1959) for several of the streamside sites and those found at Oakshores emphasizes the differences between the two assemblages. Very few items are shared.

Projectile points similar to the single Excelsior point recovered from Oakshores are reported from two of the excavated streamside sites (Nap-89 and Nap-98). These are shown in Plates 15a and 16b of Arnold and Reeves (1959). It is not a common form here, however, and makes up a relatively small percentage of the total projectile point inventory.

Obsidian flakes were present in substantial numbers on all of the excavated streamside sites. Only a tiny handful was recovered from the entire Oakshores area.

Arnold and Reeves report 48 mortars (including fragments) and some 100 pestles from the streamside site locations (Nap-89, 98, 60, and 94). In contrast, no mortars or pestles at all were recovered as a result of the Oakshores survey.

Arnold and Reeves do report pitted pebbles and possible handstones that appear to be similar to those found at Oakshores. If pitted stones and manos are included in the same category (following Arnold and Reeves), 18 specimens were recovered from the four excavated sites. These are illustrated in their Fig. 1C, category g. The majority are from Nap-98, and nine of these are surface finds from the general area near the site. According to Arnold and Reeves (page 30), these probably *do not* belong with the Nap-98 assemblage.

No metates were reported by Arnold. In contrast, six metates were recorded at Oakshores.

Other artifacts from the streamside sites excavated by Arnold and Reeves include several additional projectile point forms, knives, many worked flakes, abraded stones, ocher-stained rock, sandstone tablets, hammerstones, and a variety of ornaments including shell beads. Several kinds of worked bone are described, including awls and antler tools. Other than one projectile point form and several casual knives, none of these artifacts were found at Oakshores and, in contrast, the heavy cobble tools so common at Oakshores are rare or absent from all of the reported streamside sites.

A cursory examination of the literature available for North Coast Range locales east of the general Napa Valley region reveals a dichotomy not unlike that suggested for the Berryessa streamside sites and the artifact assemblages found on the Oakshores beachline. Several sites and aggregates of sites are essentially similar to those described by Arnold and Reeves (cf. Johnson 1967). Others are somewhat different than the Berryessa streamside locations, but are obviously late in time and generally do not include elements similar to those found at Oakshores. On the other hand, a few locations are now known that duplicate most of the elements found at Oakshores and appear not to have artifacts and features similar to those at the Berryessa streamside sites.

The Capay Valley region, which lies just east of the Berryessa Valley and is environmentally similar, has been subjected to surveys and investigations over several years, and a number of sites have been recorded for the area. None of the Capay Valley data have been published, but some site data are available in summary form (Johnson 1967). The Capay sites, as presently known, appear to be essentially the same as those described by Arnold and Reeves for the Berryessa streamside locations. Of the seven sites described by Johnson in 1967, for example, six have mortars and pestles (the seventh site apparently had only two artifacts present and is not meaningful in this context).

Two Capay sites (Yolo-D4 and Yolo-28) had *possible* manos, but no metates were reported. Pitted cobbles were recorded for two sites. These artifacts are described by Johnson as "bead vices" although the basis for this designation is unclear. Shell beads were noted in substantial numbers on four of the seven sites, with the presence or absence of beads seemingly being related to the presence or absence of burials in the excavated deposits. Projectile points were recovered from most of the sites and usually were of forms considered to be late in time. Johnson made some tentative comparisons between the Capay and Berryessa sites excavated by Arnold and Reeves and proposed that the occupancies in both regions were late in time.

Surveys in the Paskenta-Newville reservoir area in Glenn and Tehama counties by Chartkoff and Childress (1966) resulted in the location of 67 prehistoric and historic sites generally in environmental contexts not unlike the Berryessa Valley. Most of the prehistoric sites there are situated along the margins of Thomes Creek, and a substantial percentage of them appear to be recent camps or villages with obvious midden deposits and house pits. Artifacts were rare, however, and only 130 were recorded for the entire survey area. No metates or manos were reported, and cobble tools, if present, were not described. A category designated "chopper" *may* refer to tools similar to those found at Oakshores, although only one artifact of this type was recorded, at site Tehama-S-282.

Surveys made along the route of the Tehama-Colusa Canal by Treganza, Edwards, and King (1965) resulted in the location of 19 sites, most of which are situated along the easternmost margins of the North Coast Range. As in the case with the Paskenta-Newville surveys, surface artifacts were scarce, and only five were reported for the entire survey. These included a single mano and an anvil stone from site Gle-1 (San Francisco State University number). Bedrock mortars were also present at this site along with some evidence for fire-cracked rock.

In addition to the surface collections for the Tehama-Colusa Canal project, four sites were partially excavated but with minimal results insofar as artifact recovery is concerned. Except for two manos at Tehama-23 and three basalt cores from Tehama-233, none of the excavated sample bears any resemblance to the Oakshores assemblage.

As part of the same general project, five reservoir sites were surveyed by Chartkoff from 1967 through 1969 (Chartkoff 1969). These reservoir locations are scattered along the eastern margins of the North Coast Range and are part of the West Sacramento Canal unit of the Central Valley Project. A total of 21 prehistoric sites were recorded for the five reservoir locations, and artifact descriptions provided by Chartkoff suggest that two sites out of the 21 (Funks Reservoir area) had artifacts similar to those found at Oakshores. These include cobble tools and manos. It was noted at the time that the two sites were atypical (on the basis of the manos) and might well represent an older occupance (Chartkoff 1969:14).

A change in routing led to a resurvey of part of the Tehama-Colusa Canal unit with the subsequent discovery of several additional prehistoric sites along the north bank of Thomes Creek. Test excavations were made at three of these locations (Tehama-256, 261,

262) by Rob Edwards in 1969. The results of these excavations are reported in an M.A. thesis (Edwards 1969).

In contrast to most of the sites so far described in this brief summary (excluding the two Funks Creek sites), the Thomes Creek sites investigated by Edwards were characterized by a surface scatter of heavy core and cobble tools, basalt chipping waste, manos, and metates. Mortars and pestles were present, but rare. It was agreed at the time of their discovery that these were in fact clearly Milling Stone oriented assemblages. Space limitations preclude a more detailed discussion of these artifacts here, but it is obvious that they are similar to the artifacts recovered as a result of the Oakshores surveys at Berryessa.

A later reexamination of the Funks Creek reservoir area led to the discovery of two additional sites and resulted in a greatly expanded inventory for the originally recorded sites (Colusa-28, 37) (West, Levulett, and True 1975). The Funks Creek artifacts are essentially the same as those found at Oakshores.

Surveys conducted prior to the construction of the Indian Valley reservoir, which is situated 25 miles north of the Berryessa Valley, resulted in the location of 74 prehistoric sites (Orlins 1971). An examination of the site sheets included with the Indian Valley report suggests that *most* sites there do not fit the Oakshores pattern, although several Indian Valley sites did include occasional artifacts similar to those found at Oakshores, and it appears likely that there is a milling stone-cobble tool based component present in the Indian Valley area.

Finally, a recent reexamination of the Oat Reservoir location (originally surveyed in 1969 by Chartkoff) resulted in the location of several heretofore unreported prehistoric sites scattered along the margins of Oat Creek (West and True 1977). All of the Oat Creek sites fit the developing milling stone-cobble tool pattern suggested by the artifacts reported from Thomes Creek, Funks Creek, and Oakshores at Lake Berryessa.

In sum, artifacts similar to those found along the Oakshores beachline are known from several eastern North Coast Range contexts, and although the total number of such locations and artifacts (outside of the Oakshores locale) is not large, it seems clear that this aggregation of milling stone-cobble tool based artifacts is an important element in North Coast Range prehistory.

## DISCUSSION AND CONCLUSIONS

The Oakshores assemblage, although relatively small and localized in its own right, is, when considered in conjunction with sites with similar artifacts at Thomes Creek, Funks Creek, and Oat Creek, believed to be a significant addition to our knowledge of North Coast Range prehistory. This significance can probably be counted in several ways.

Overall, it is probably a local manifestation of a larger widespread milling stone based pattern represented in other North Coast Range contexts by material categorized by Fredrickson and others as Borax Lake (Fredrickson 1974; Meighan 1955). In this sense, it is significant because it establishes the presence of this pattern in an area where it had been previously unreported.

The Oakshores material has further implications, however, both in terms of the actual makeup of its inventory and the circumstances of the actual artifact distributions. Cobble tools or other heavy core tools (choppers) are mentioned as elements in Borax Lake pattern inventories, but they appear to be either relatively rare, or have been generally ignored in the earlier descriptions. At Oakshores they represent the predominant element in the assemblage.

The nature of these tools and their distribution on the Oakshores beachlines provides some interesting insights into the subsistence related activities of their makers and raises

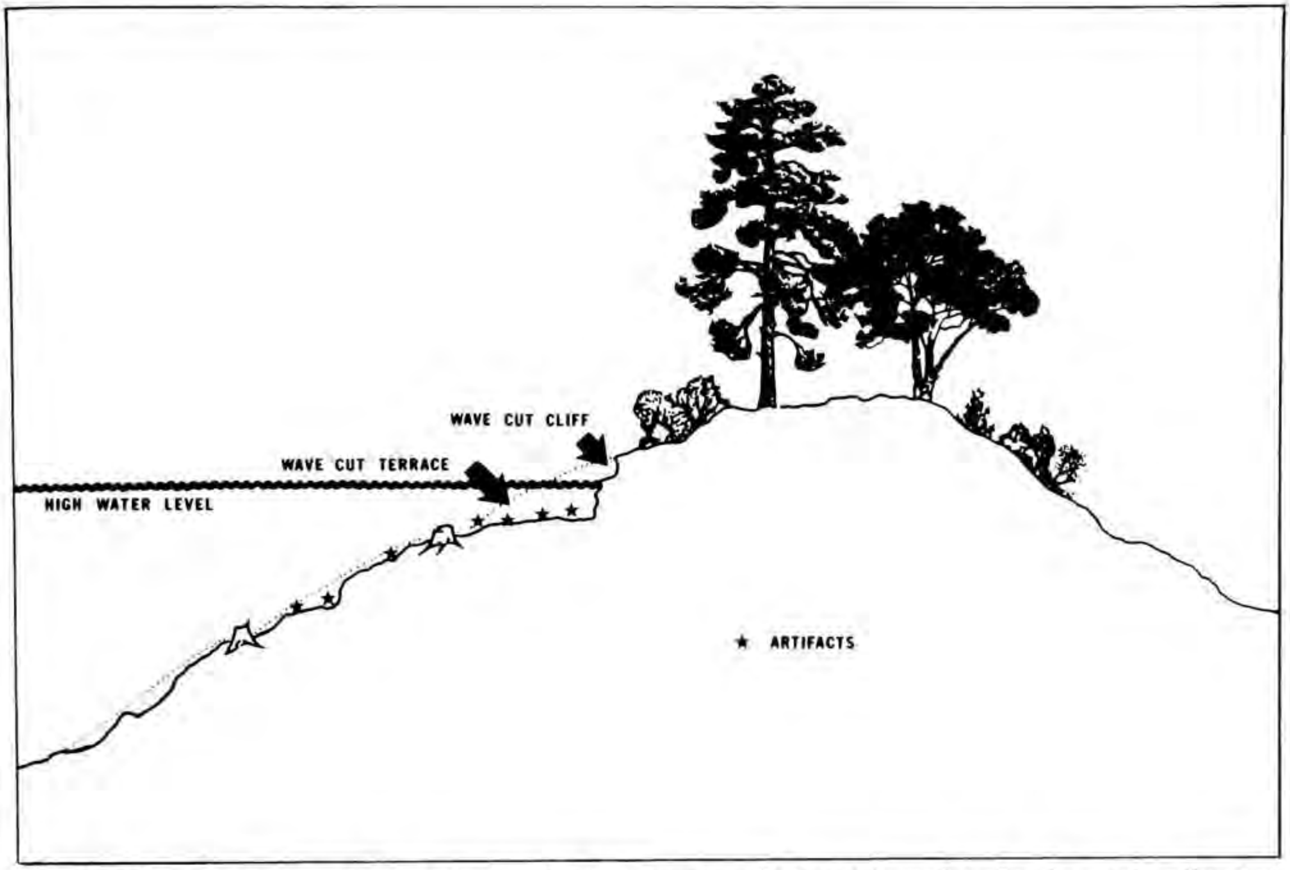


Fig. 18. Schematic diagram showing relationship of recovered artifacts to lake surface, beaches, and undisturbed terrain. Not to scale.

several provocative questions relative to the overall archaeology of the area at large.

The Oakshores artifacts are seen at the present time as isolated individual items rather than as elements making up a site in the traditional sense. They are found on eroded beachlines and clearly support the idea that cultural material is present in the area in spite of the fact that repeated efforts to locate similar artifacts above the beachline were unsuccessful. Based on their locations, it is clear that the artifacts were exposed or deposited on the beach surface as a by-product of erosion which removed varying amounts of soil or other cover from the original surface. It is proposed that the artifacts were not deeply buried (in most cases) but were covered by just enough soil and organic material so that they would not be visible to an archaeologist under normal survey conditions. Figure 18 is a schematic showing the disposition of typical artifacts on an eroded beach where surviving stumps provide excellent indicators of the amount of erosion that has taken place. Based on the contextual circumstances as we interpret them, it appears that the individual artifacts so far recovered have not been moved very far. That is to say they were dropped on the developing surface as the soil matrix was eroded. Although they may have moved downslope slightly, they are probably within a few feet of their prelake location. Most artifacts recovered to date appear to be concentrated along ridges, on the upper slopes of small hills or knolls, and on saddles between small knolls.

Based on the indicated distributions and the casual nature of the artifacts, we propose that these implements are the by-product of as yet undefined subsistence activities, that they represent tools fabricated more or less on the spot and that they were probably discarded after brief use. On occasion, the same tool would be reused more or less fortuitiously at another time by the same or some other person, so that in time a range of utilization or edge modification would result.

We present this possibility as an idea to be tested with further investigations. The implications of these data are probably of some significance both in terms of North Coast settlement and subsistence patterns, and in terms of archaeological data recovery techniques in general.

Limitations of space preclude a detailed discussion of the subsistence and settlement implications in the present paper. These will be considered in greater detail in future publications. However, some comments on the archaeological implications are in order and these are presented briefly below:

If the situation outlined above for Oakshores is as we perceive it, significant numbers of artifacts exist that are being overlooked both in isolated contexts and probably as sites, and are therefore not presently being considered in the interpretation of the North Coast Range prehistory.

In the Oakshores situation, at least, many of these artifacts are different from those found in the traditional site contexts, suggesting either some time differential or some specialization relative to task specific activities. We are quite convinced that the Oakshores artifact distribution is not unique and wish to propose that significant amounts of data *are* being overlooked (missed) with meaningful implications for both the processual and chronological aspects of California prehistory. Additional support for this thesis is suggested both by recent work in the Sierra foothills and in earlier work in Southern California.

Archaeological surveys made in the Sugarpine Reservoir basin (Placer County) over the past two years resulted in the discovery of two categories of sites. One category included small bedrock mortar sites believed to be part of a lifeway that included larger camps or villages in other locations. The second consisted of scatters of artifacts seemingly unrelated to the bedrock mortar sites. In this latter case, there was no obvious indication of soil alteration or midden, and the sites were seldom marked by more than one-half dozen artifacts. Most important in the context of the present discussion, *all* of the sites in this second category *were located in disturbed areas* (locations bulldozed as a result of logging activities, on logging roads, and [in one instance] on an exposed eroded slope). Not one site in this category (which included manos and cobble tools as diagnostic artifacts) was found in an area in which the surface had not been disturbed. It was our contention in this instance that many more similar sites are present in adjacent areas and that they were not being recovered simply because they are not visible to survey crews under normal circumstances (Hellen and True 1976).

Surveys in other parts of the Auburn Reservoir project *suggest* similar situations. In one locale, for example (an area of easy access), surveys during 1966-67 located two sites (both with bedrock mortars). Reexamination of the locale in 1976, after portions of the area had been bulldozed, resulted in the discovery of another site and artifacts (manos and chipping waste) not previously noted.

Likewise, several years ago a number of surveys over portions of upland San Diego County in typical chaparral situations failed to locate any sites. Subsequent reexamination after clearing and bulldozing resulted in the discovery of several artifacts not previously noted. As a result of this observation, the locations of a number of previously recorded sites were reexamined, and it was noted at the time (*ca.* 1958) that *in almost every case* Milling Stone and probable San Dieguito sites in northern San Diego and western Riverside counties were located in situations in which the previous surface had been disturbed either by farming and land clearing operations or by significant erosion. In short, for that period of time in that part of the state, locations that have been disturbed have sites on them; those in which the surface is intact seemingly do not. This relationship has held remarkably consistent over the past twenty years in Southern California and there is little reason to suggest that it does not hold equally well for Northern California.

Recent surveys over the now exposed Folsom Lake bottom resulted in the discovery of several sites not located during the original surveys prior to the filling of the reservoir, and there is reason to believe that the situation there is not unlike that at Berryessa (John Foster, personal communication 1977). Likewise, a number of sites have been reported along the shoreline of Shasta Reservoir as a result of dropping water levels, and although we do not yet have any specific information as to the artifacts or kinds of sites observed there, we believe that the situation again is probably similar to that noted at Berryessa (F. A. Riddell, personal communication 1977).

The presence of artifacts and sites in contexts not normally observed using standard archaeological survey techniques under circumstances where there has been no significant erosion or ground surface disturbance is of course important in any interpretational scheme. Failure to consider such resources would considerably distort the results of such interpretation. Our concern here is not simply that we are not getting all of the resources, since archaeologists have always known that their data base was incomplete and that they were missing sites here and there along the way. What is alarming is the suggestion of the scale and nature of these missing pieces. If the evidence at Berryessa (and Folsom and Shasta as well) is in any way a measure of the gaps in the record in general, it would appear that we are, or have been, missing more than just an occasional piece of the puzzle and that significant gaps or distortions are probably present in all of the interpretative efforts so far proposed for California.

The foregoing discussion makes two principle points, one methodological and one culture-historical. The first concerns the means we must use to recover certain remains that are now covered by soils and thus normally undetectable. The existence of artificial lakes provides a tool in the discovery of these remains. The annual drawdown in the reservoirs makes it possible even in normal years to observe a certain amount of land under optimal conditions. Prolonged droughts, of course, improve these conditions for discovery considerably.

The existence of the material described above as well as other material we shall report on in later papers indicates that the Milling Stone Horizon was widely present in northern California rather than merely sporadically as previous evidences suggested. Of course, the question of whether it was as abundantly represented in the north as in the south cannot be settled here. Our feeling is that it will ultimately be found in most parts of the north about as much as the south. In fact, we believe the Milling Stone Horizon represents a single group of people with substantially similar culture who essentially filled up (in some sense) the area now covered by the State of California in the period from 6000 to 3000 B.C.

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*University of California, Davis*

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**Abstract:**
Although data collection and analysis are far from complete, initial results suggest that there is significant patterning in the artifact distributions thus far compiled. As a tentative hypothesis, therefore, it is proposed that in the extant artifact distributions there is evidence for a hierarchical use of space related to: (1) terrain; (2) distance from primary water sources; and (3) probable locational differentials in the kinds and quantities of subsistence resources available for exploitation.

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# Archaeological Investigations at Lake Berryessa, California: Berryessa II

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IN 1976 an archaeological survey of lands slated for development for recreational purposes (Oak Shores) resulted in the discovery of a number of prehistoric artifacts along the shoreline of Lake Berryessa (Fig. 1), which was then receding because of a protracted period of drought. Results of the initial Berryessa survey were published in 1979 (True, Baumhoff, and Hellen 1979). At the time, it was unclear whether the observed artifact distributions were unique to the Oak Shores locale or represented evidence of a more widespread pattern present in other parts of the North Coast Range province. As a first step in the investigation of the latter possibility, two additional lines of inquiry were initiated: (1) a re-examination of several critical areas above the 440-foot contour (overflow elevation of Lake Berryessa) within the Oak Shores project area; and (2) an intensive survey of a second segment (designated the "bridge sector" [Fig. 2]) of the exposed shoreline and reservoir bed.

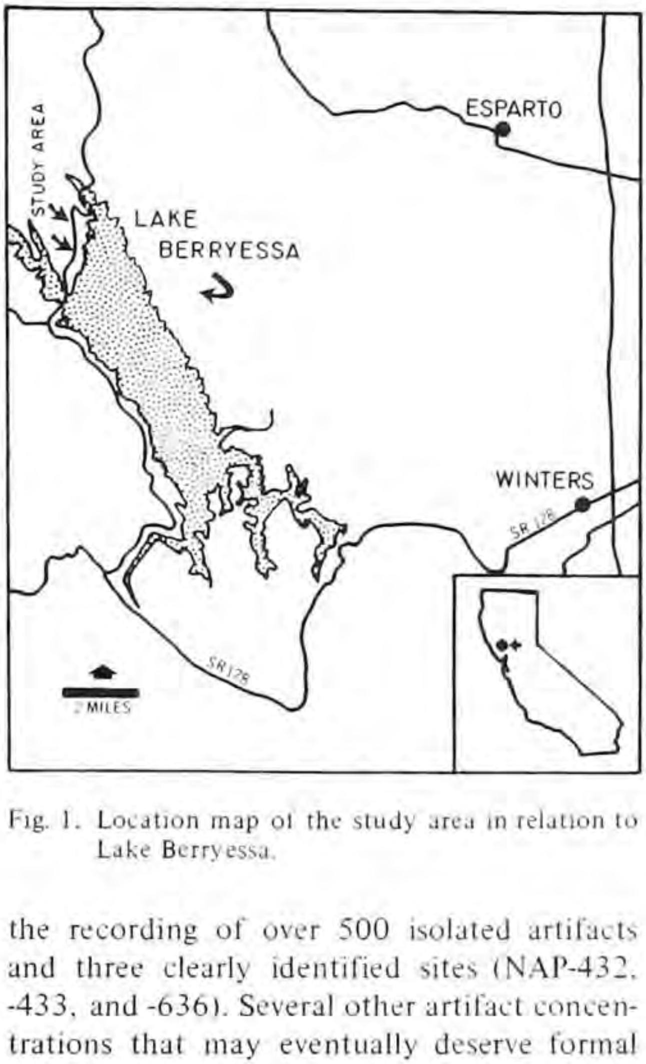


Fig. 1. Location map of the study area in relation to Lake Berryessa.

Results of the re-examination were essentially negative. Even though the drought had reduced normal grass cover, the only archaeological remains found above the 440-foot contour consisted of a small scatter of obsidian flakes at one, quite limited, locus in the Oak Shores area. The bridge-sector survey, in contrast, produced encouraging results with the recording of over 500 isolated artifacts and three clearly identified sites (NAP-432, -433, and -636). Several other artifact concentrations that may eventually deserve formal recognition as sites were also noted.

## BERRYESSA II–THE BRIDGE SECTOR

For recording purposes, the bridge sector was subdivided into five survey units (A-E, see Fig. 2). Each unit was examined by walking

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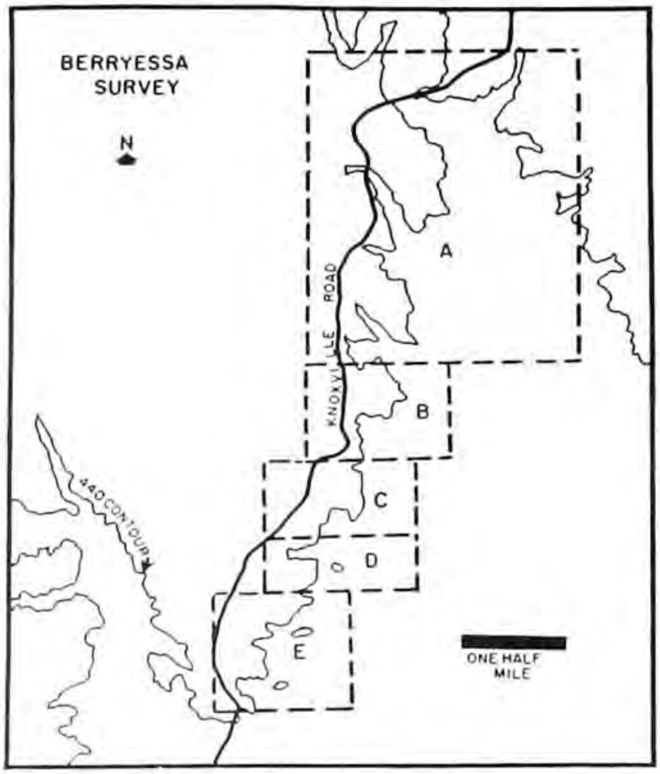



Fig. 2. Bridge-sector survey units A-E.

transects along the exposed reservoir bed parallel to the existing lake edge. Artifacts observed during the survey were flagged and their locations recorded on United States Geological Survey 7.5-minute topographic maps. When concentrations of artifacts were encountered, individual artifact locations were recorded on a larger scale topographic map (400 feet to the inch) or on enlargements made using a pantograph. All artifacts were marked in the field using a locational code and, except for most of the metates, all artifacts were collected and are currently housed at the Department of Anthropology, University of California, Davis, under accession number 223. Metates that were not retrieved were left in their original inverted positions and are presently under water. Distributional maps of the artifacts found in each survey unit are presented in Figures 3-7.

Preliminary results from the ongoing investigations at Lake Berryessa tend to confirm the pattern initially noted during the Oak Shores study, and suggest several potential long-term research directions. Because of this perceived interest, and given the likelihood that analysis and publication of data from the three major newly recorded sites (NAP-432, -433, -636) will not be possible in the near future, the decision was made to expedite data dissemination with a series of short papers each presenting the results of different survey phases.

Individually, the papers examine somewhat different but presumably related aspects of regional artifact distributions. The first paper (True, Baumhoff, and Hellen 1979) described the Oak Shores material, noted the presence of core-cobble tools in what appeared to be a Milling Stone context, and considered distributional patterns among isolated artifacts. Objectives in the second paper (this article) are to describe the morphological and spatial characteristics of artifacts located during the bridge-sector survey, and to propose a tentative hypothesis regarding topographic patterning in the distribution of artifacts. The third paper (in preparation) will present survey data for the remainder of the reservoir shoreline and discuss the types of isolated artifacts from the region as a whole as these relate to the topographic pattern examined here. Comprehensive evaluation of the hypotheses generated in each paper is planned as part of pending monographs on excavations at the three major sites (NAP-432, -433, -636) discovered during the bridge-sector survey.

## Artifact Descriptions

A total of 535 artifacts was collected during the survey. These have been sorted into six tentative categories based on general morphology and certain assumed functional attributes: (1) grinding tools (metates, manos, mortars, pestles); (2) pounding tools (hammers); (3) scraping tools (cobble, core, and flake scrapers); (4) cutting tools (convention-

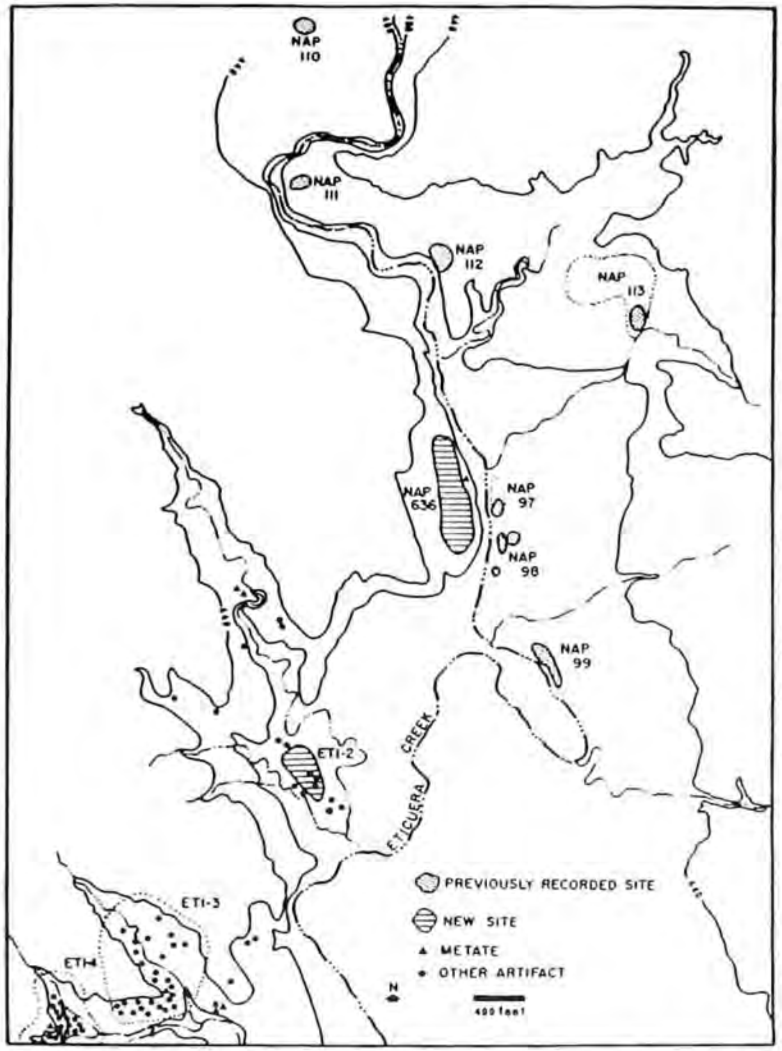



Fig. 3. Artifact and site locations in survey unit A. Dotted lines indicate boundary extensions at previously recorded sites, or artifact clusters at loci currently lacking formal recognition as "sites." The latter given informal, Eticuera Creek designations (ETI). Sites classified as villages include NAP-97, -98, -99, -110, -111, and -112; NAP-636 (ETI-1) is considered a major camp, locus ETI-2 a camp, and loci ETI-3 and -4 scatters (see text for definitions).

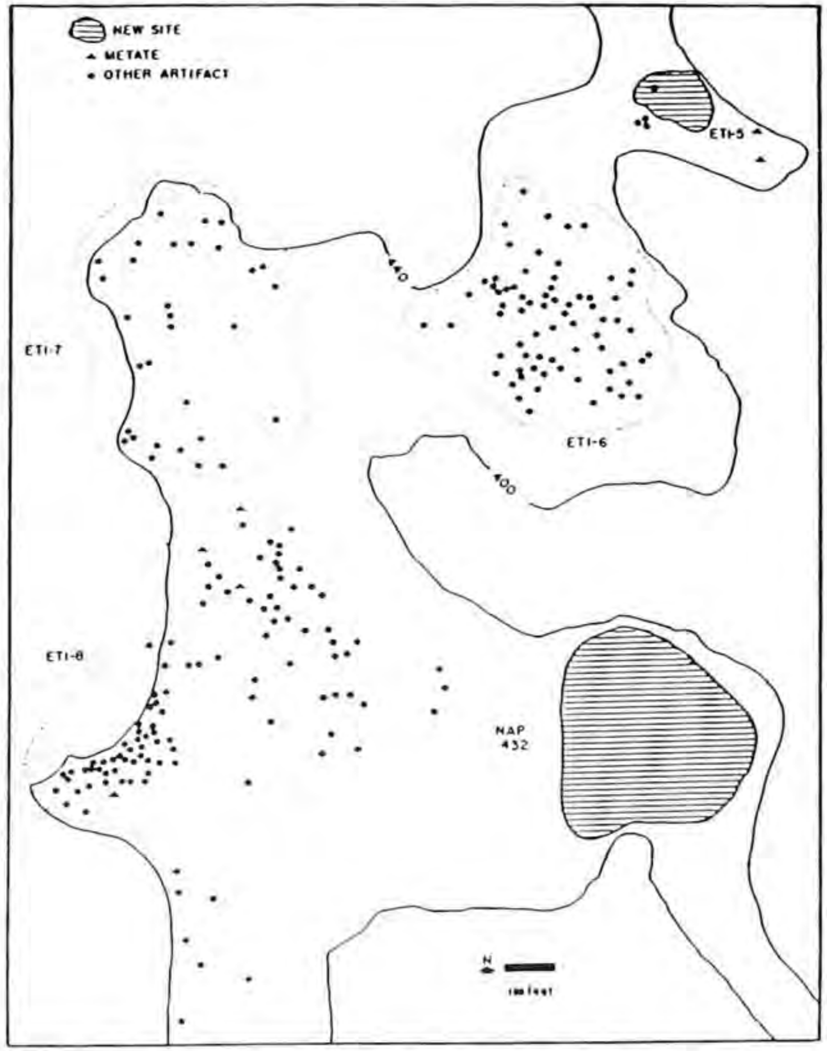



Fig. 4. Artifact and site locations in survey unit B. Dotted lines indicate artifact clusters at loci currently lacking formal recognition as "sites." Site NAP-432 is classified as a major camp, locus ETI-5 as a camp, locus ETI-6 as a concentration (tentative), and loci ETI-7 and -8 as scatters or possible concentrations (see text for definitions).

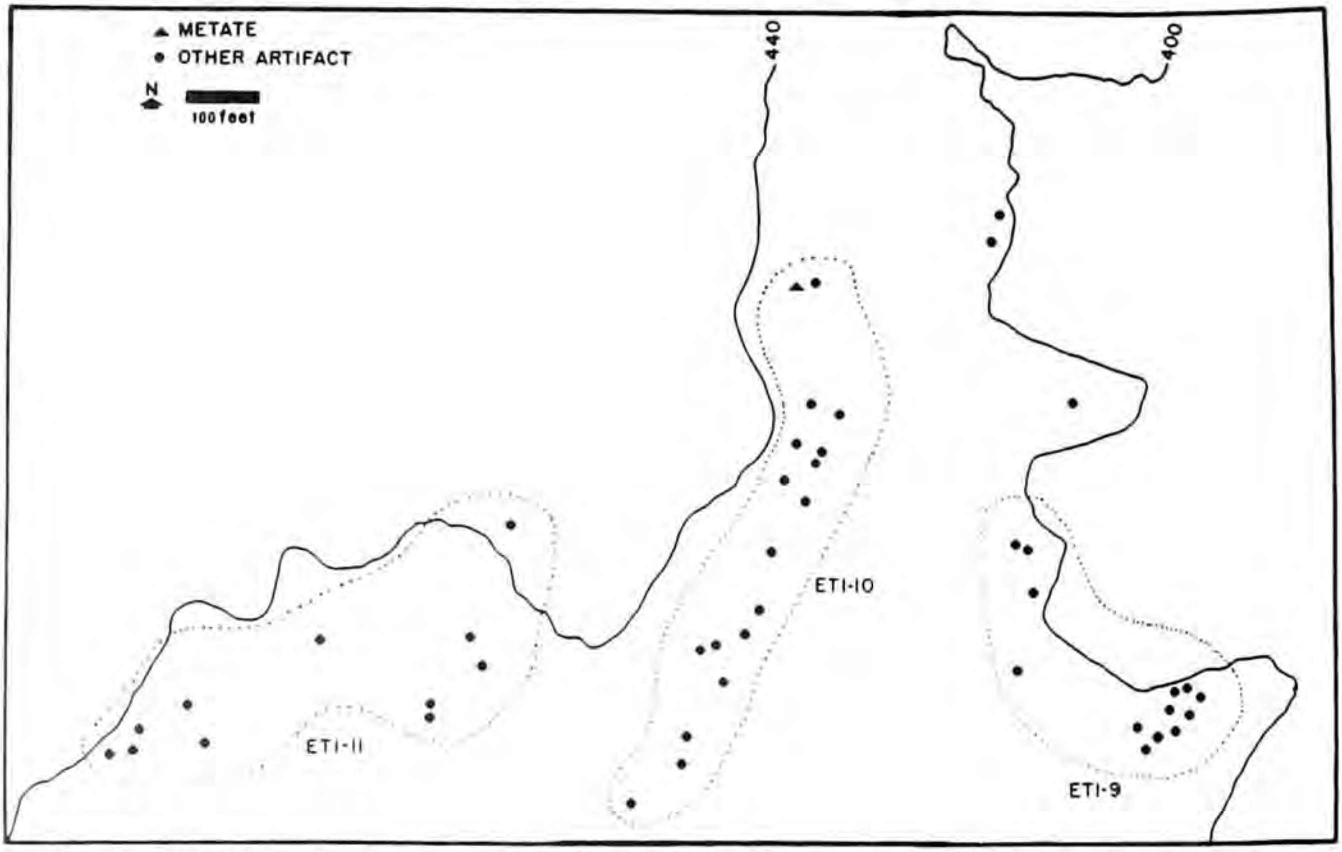



Fig. 5. Artifact locations in survey unit C. Dotted lines indicate artifact clusters at loci currently lacking formal recognition as "sites." Loci ETI-9, -10, and -11 are tentatively classified as scatters, but may consist of unrelated isolates (see text for definitions).

alized and irregular knife-like forms); (5) projectile points; (6) other (includes drills, grooved pebbles, worked flakes, possible chopping tools, pitted cobbles, unmodified flakes, and broken cobbles). These categories should not be viewed as formal artifact types, and the functional designations are probably best considered as an economical way of labeling and analyzing gross classes of artifacts that would otherwise require complicated, confusing descriptions. In short, the data presentation here has been deliberately minimized and, to the degree possible, reduced to tabular form. Representative examples of the artifacts comprising each category are illustrated so that interested readers can compare the items from Lake Berryessa with more formally defined artifact types found elsewhere in the North Coast Ranges.

The functions assigned to artifacts in each category have not been empirically demonstrated. This is especially true for those artifacts categorized as scraping tools. At least some of these artifacts may be cores resulting from the production of flakes for use as casual knives or for tool manufacture. Classification of an object as a scraping tool was based on overall morphology, roughly measured edge angles, evidence of use-wear on a few specimens, and comparisons with similar artifact forms from other California contexts that display clear-cut indications of use, e.g., polished and worn facets on working edges (cf. True 1958, 1980; Basgall and True 1985). A realistic assessment of this loosely defined scraper category suggests that, on the whole, the artifacts represent casual tools with more than one function, and that some specimens

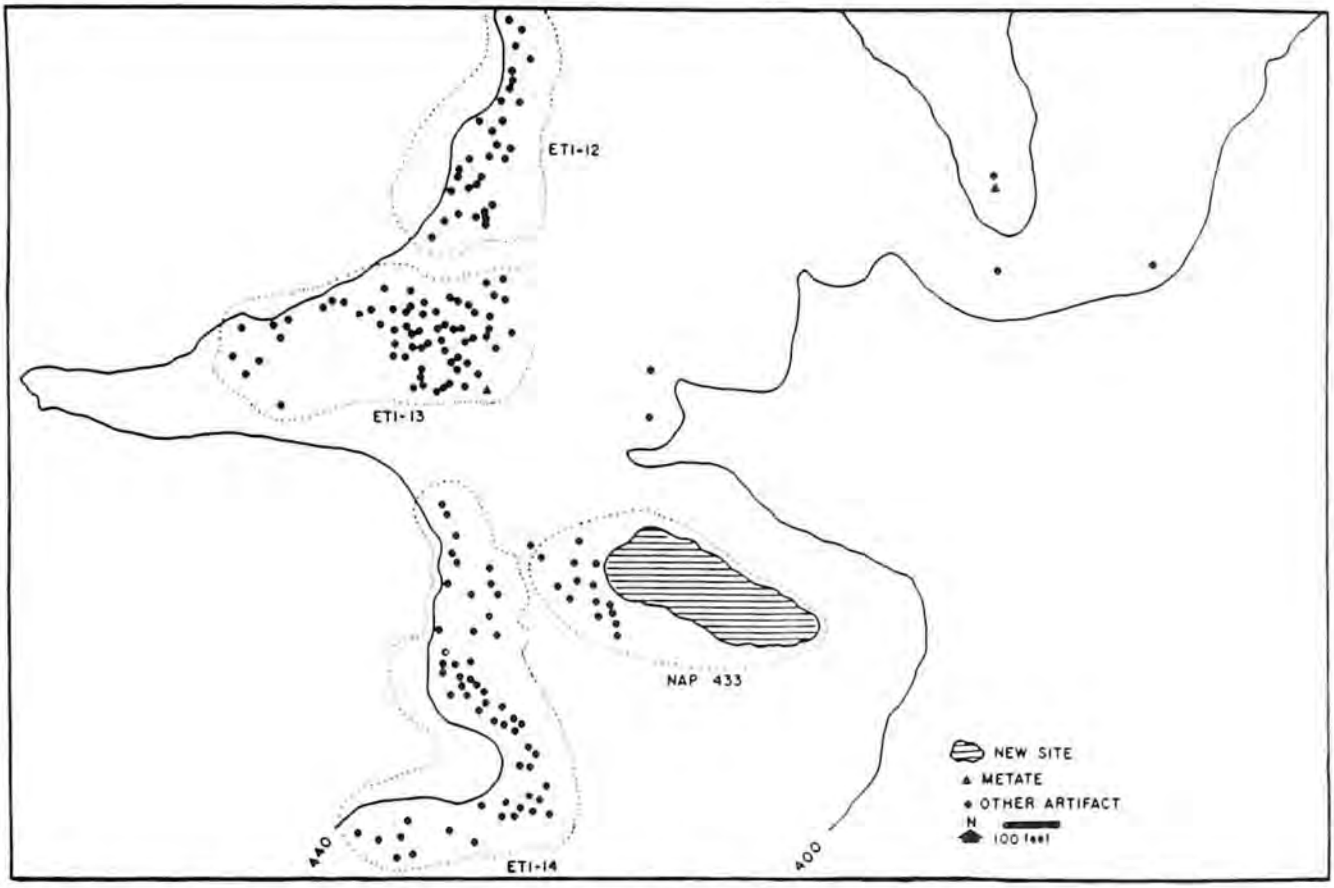



Fig. 6. Artifact and site locations in survey unit D. Dotted lines indicate possible boundary extensions at previously recorded sites, or artifact clusters at loci currently lacking formal recognition as "sites." Site NAP-433 is classified as a major camp, locus ETI-12 as a scatter, locus ETI-13 as a concentration (possibly a camp), and locus ETI-14 as (tentatively) a scatter (see text for definitions).

are quite probably cores. Further, it should be stressed that the generalized (versus specific) treatment of these artifacts is not accidental. Given the relatively limited understanding of core-cobble tools in general, the distinct probability that they represent multi-purpose, casual implements, and the recognition that particular artifact morphologies are likely a consequence of functional considerations (e.g., size, availability of material, preferred edge) rather than of aboriginal mental templates, development of a detailed, formal typology at this time is unwarranted and could be counterproductive.

**Grinding Tools** (Tables 1-2; Figs. 8-12). Metates and manos are the principal artifacts comprising this category. Mortars and pestles are present in the general Lake Berryessa region, but are rare or absent in the bridge-sector area.

The metates include both slab and basin forms. Most are unshaped and typically were fashioned from sandstone. The manos tend to display varied outlines and, for purposes of analysis, have been sorted into subcategories based on the presence or absence of deliberate shaping and the number of ground surfaces. Several specimens are pitted, and one subcategory is characterized by what appears to be a pestle-like end (Fig. 11).

**Pounding Tools** (Table 3; Figs. 13, 15h). Relatively few pounding tools were found during the bridge-sector survey. Two different forms are recognized: cobble hammers and

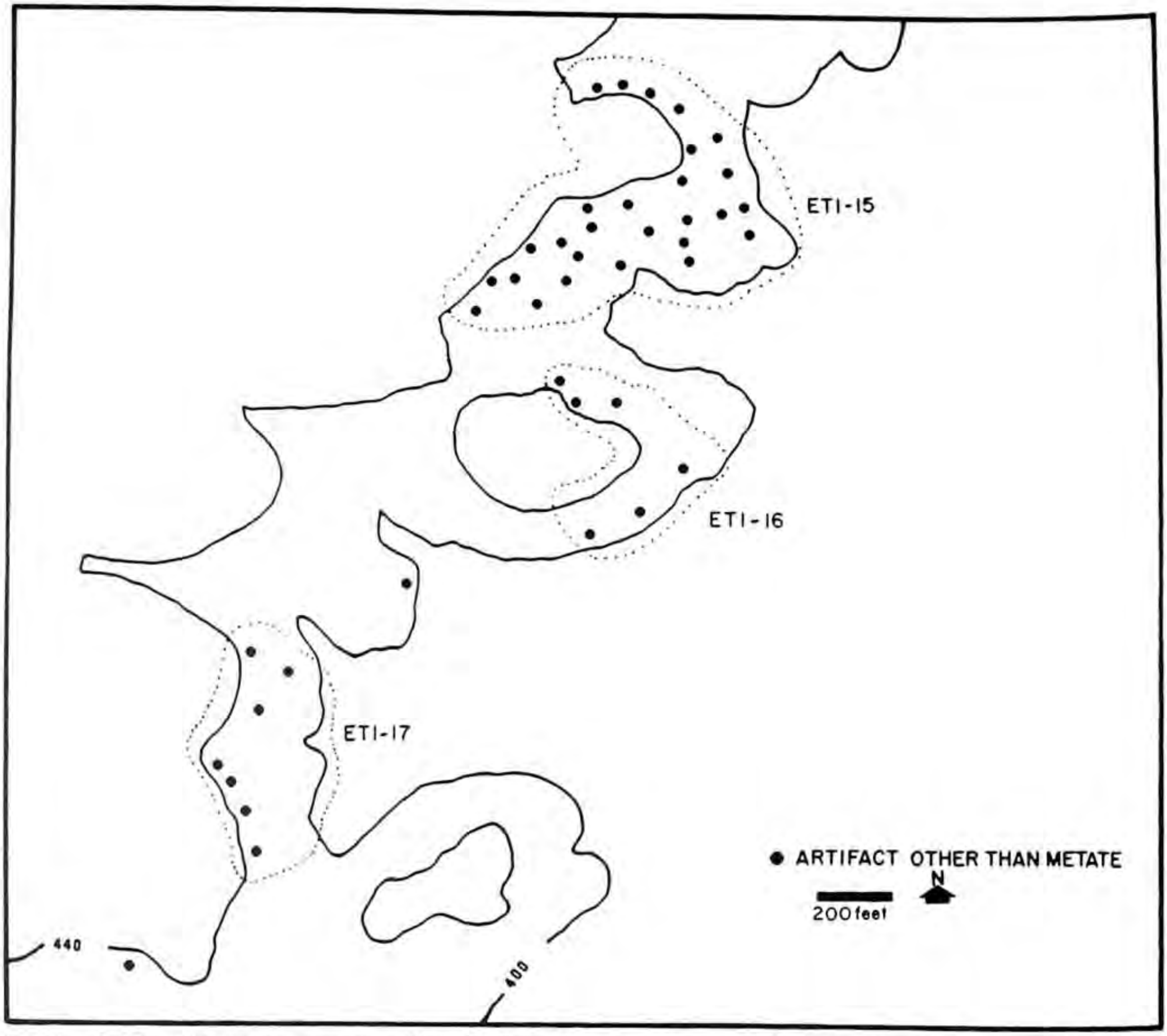



Fig. 7. Artifact locations in survey Unit E. Dotted lines indicate artifact clusters at loci currently lacking formal recognition as "sites." Locus ETI-15 is classified as a scatter, and loci ETI-16 and -17 as possible scatters or as groups of unrelated isolates (see text for definitions).

shaped-core hammers. It can be assumed that many more casual, hammer-like artifacts occur in the region, but were not collected because they lack definitive indications of human use.

**Scraping Tools** (Tables 4-5; Figs. 14-17). The most common tools in the bridge-sector collection are implements presumably employed in as yet undefined scraping activities. These objects were fashioned from large, heavy flakes, occasionally from cores, and most often from small cobbles or large pebbles. Although the classifications are quite tentative, cobble scrapers have been sorted into 14 provisional subcategories based on overall morphology and flake-removal locations relative to a planar surface (Table 4; Figs. 14-15). These subcategories are recognized, in part, to maintain continuity and comparability with artifacts described in the

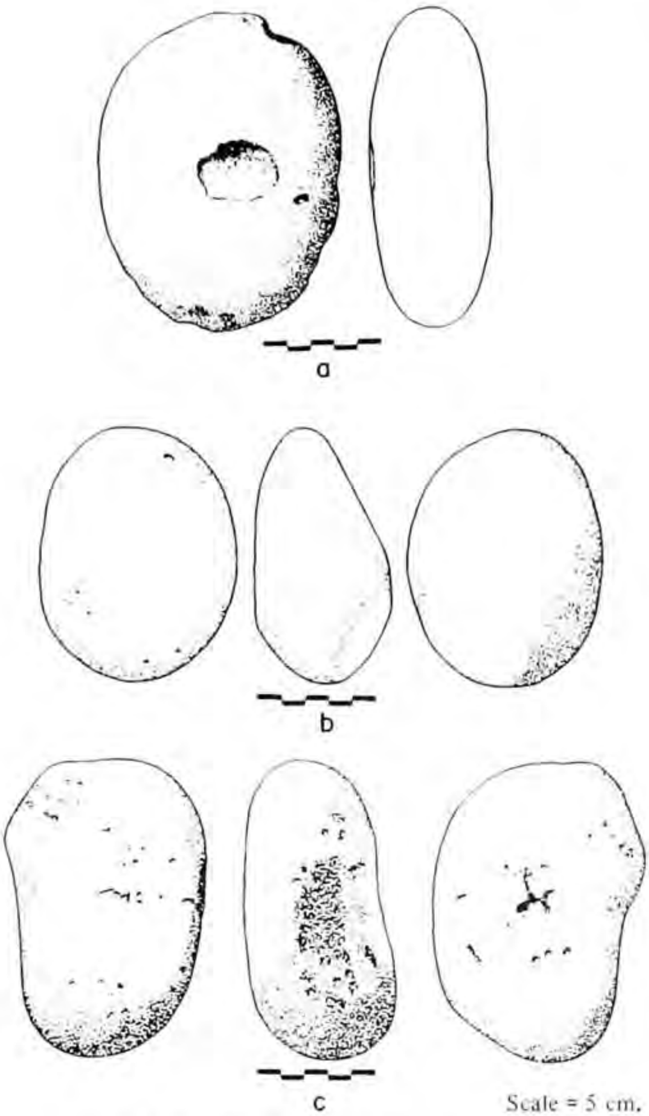



Fig. 8. Unshaped unifacial manos.

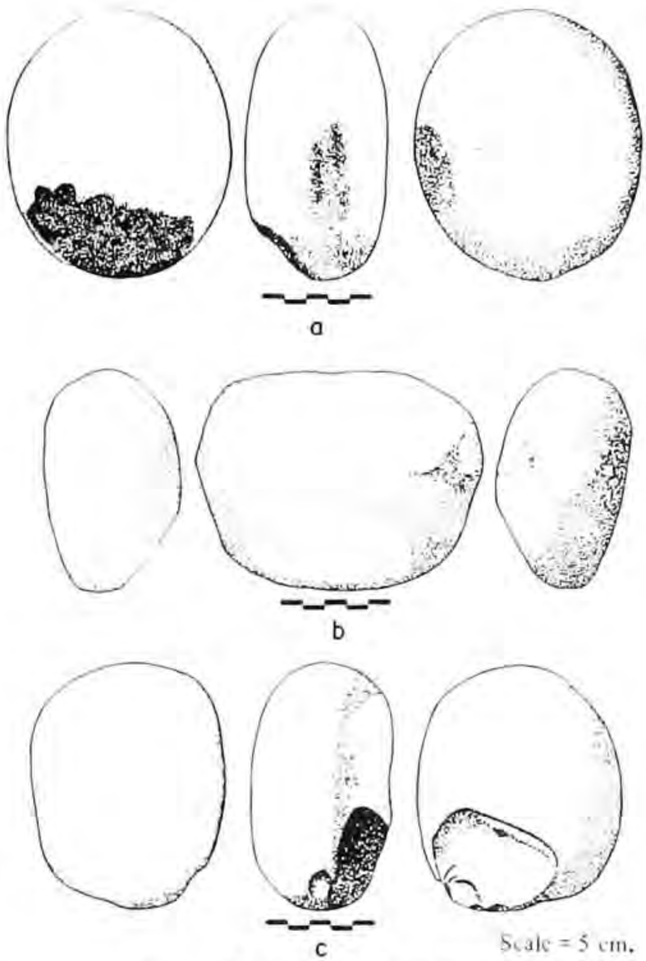



Fig. 9. Unshaped bifacial manos.

initial Berryessa report (True, Baumhoff, and Hellen 1979) and, in part, to isolate potentially meaningful morphological and technological differences that may ultimately be shown to have cultural, temporal, or functional significance. In general, the classificatory system used here follows that developed for the earlier report. However, because of certain questions raised by reviewers about the subcategories proposed in 1979, the present categorizations have been simplified. Readers interested in the cobble scrapers from the Lake Berryessa region should consider those

Table 1

GRINDING TOOLS

| Category | Number | Percentage of Manos | Percentage of Grinding Tools |
|---|---|---|---|
| Metate | 16 | n/a | 14.5 |
| Unshaped unifacial mano | 8 | 9.5 | 7.3 |
| Shaped unifacial mano | – | – | – |
| Unshaped bifacial mano | 35 | 41.7 | 31.8 |
| Shaped bifacial mano | 24 | 28.6 | 21.8 |
| Mano/pestle | 5 | 6.0 | 4.5 |
| Nondiagnostic mano fragment | 12 | 14.3 | 10.9 |
| Pestle | 2 | n/z | 1.8 |
| Smoothing stone | 8 | n/a | 7.3 |
| Total | 110 | 76.4* | 99.9 |

*Percentage of grinding tools consisting of manos.

Table 2

ATTRIBUTE DATA FOR GRINDING TOOLS*

| Category | Number | | Length | Width | Thickness | Figure |
|---|---|---|---|---|---|---|
| Unshaped unifacial mano | 8 | average | 131.2 | 103.2 | 58.3 | 8 a-c |
| | | s.d.** | 16.0 | 12.3 | 10.6 | |
| | | range | 110-148 | 85-118 | 37-71 | |
| Unshaped bifacial mano | 35 | average | 127.5 | 91.7 | 57.9 | 9 a-c |
| | | s.d. | 21.1 | 13.3 | 10.5 | |
| | | range | 91-172 | 68-125 | 42-85 | |
| Shaped bifacial mano | 24 | average | 126.0 | 91.9 | 56.4 | 10 a-c |
| | | s.d. | 15.7 | 10.3 | 8.6 | |
| | | range | 97-153 | 65-114 | 42-71 | |
| Mano/pestle | 5 | average | 121.2 | 77.2 | 62.8 | 11 a-c |
| | | s.d. | 9.5 | 11.7 | 8.9 | |
| | | range | 110-133 | 61-96 | 47-75 | |
| Pestle | 2*** | | 288 | 75 | 73 | 12 a |
| Smoothing stone | 8 | average | 88.7 | 63.6 | 37.1 | 12 b-e |
| | | s.d. | 5.2 | 11.6 | 7.3 | |
| | | range | 81-94 | 48-86 | 29-47 | |
| Nondiagnostic mano fragment | 12 | | | | | not illustrated |
| Metate | 16 | | | | | not illustrated |

*All measurements in mm.
**Standard deviation.
***One specimen fragmentary.

Table 3

ATTRIBUTE DATA FOR POUNDING TOOLS*

| Category | Number | | Length | Width | Thickness | Figure |
|---|---|---|---|---|---|---|
| Cobble hammer | 2 | average | 102.5 | 74.5 | 50.5 | 13 a-b |
| | | s.d.** | 4.5 | 1.5 | 2.5 | |
| | | range | 98-107 | 73-76 | 48-53 | |
| Shaped core hammer | 2 | average | 70.5 | 66.0 | 28.5 | 13 c-d, 15 h |
| | | s.d. | 20.5 | 17.0 | 0.5 | |
| | | range | 50-91 | 49.83 | 28-29 | |

*All measurements in mm.
**Standard deviation.

found during the bridge-sector survey in conjunction with those described for Oak Shores (True, Baumhoff, and Hellen 1979: 135). Also, though of minimal importance to this paper, approaches to more generalized treatment of large classes of related casual and multi-purpose tools are being further developed, by the senior author and M. E. Basgall (Univ. of California, Davis), as part of a comprehensive re-evaluation of core-cobble tools in southern California Milling Stone complexes.

The possibility that core-cobble scraping tools display potentially meaningful functional and/or temporal differences in the Berryessa region will be a focal issue in ongoing investigations. Hopefully, analysis of the artifacts and other data from NAP-432, -433, and -636, and discovery of well-defined, datable components, will provide the basis for

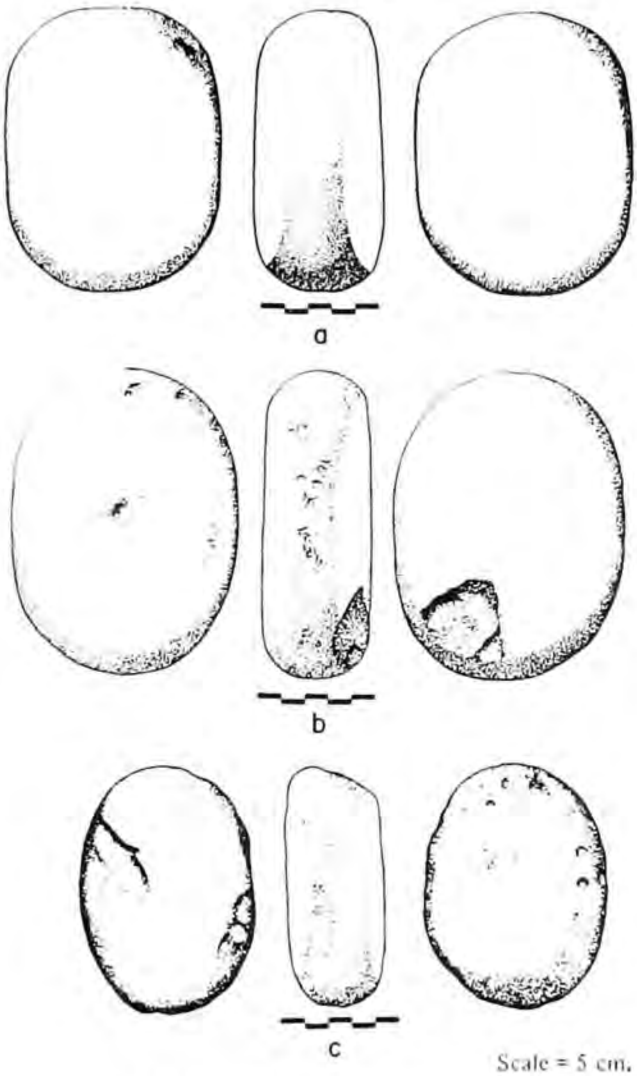



Fig. 10. Shaped bifacial manos.

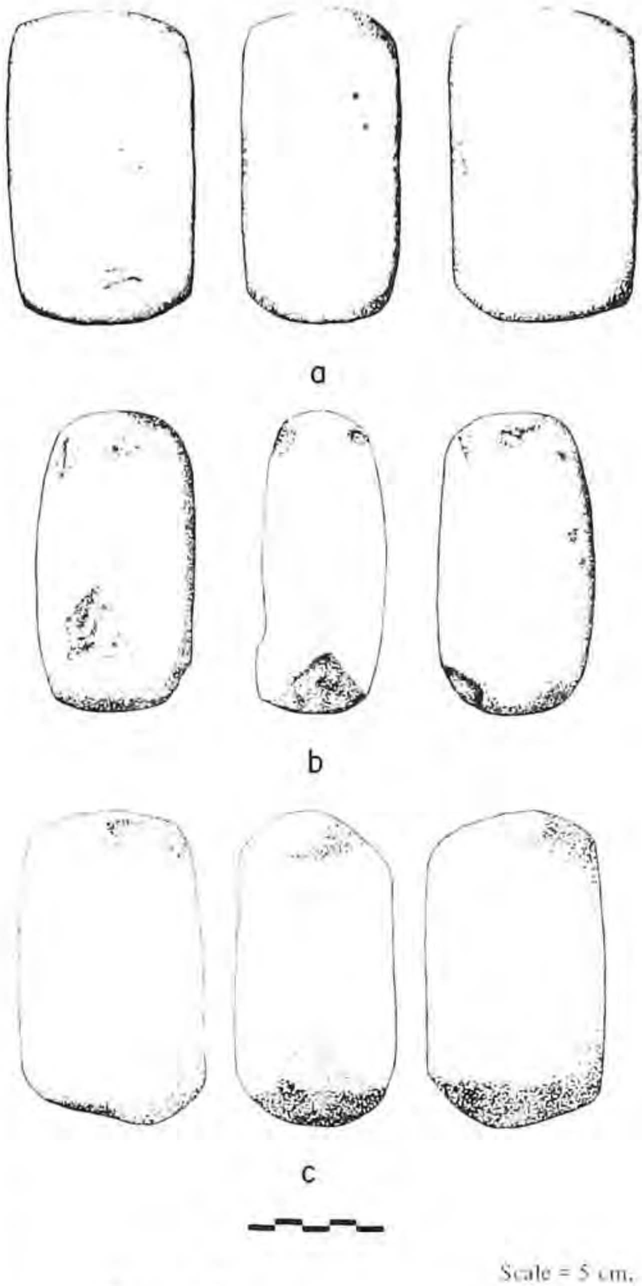



Fig. 11. Mano/pestle grinding tools.

a useful, refined typology of core-cobble tools. On the other hand, regardless of possible temporal differentiation, it should be stressed that there is a strong likelihood that the aggregate of tools seen here as core-cobble scrapers represents a functional and formal continuum. At present, available evidence supports the suggestion that these objects are indeed casual tools – made on the spot for one or more undefined purposes, used but once or twice, and then discarded.

**Cutting Tools** (Table 6; Fig. 18). Although some of the objects categorized as scrapers may also have functioned as cutting tools, several other artifacts were found during the bridge-sector survey that bear edges suitable for cutting. These tend to be minimally modified, casual tools, and most are simply flakes with possible evidence of use on one or more edges.

**Projectile Points** (Table 7; Fig. 19a-b). Only two projectile points were recovered during the bridge-sector survey. Both are

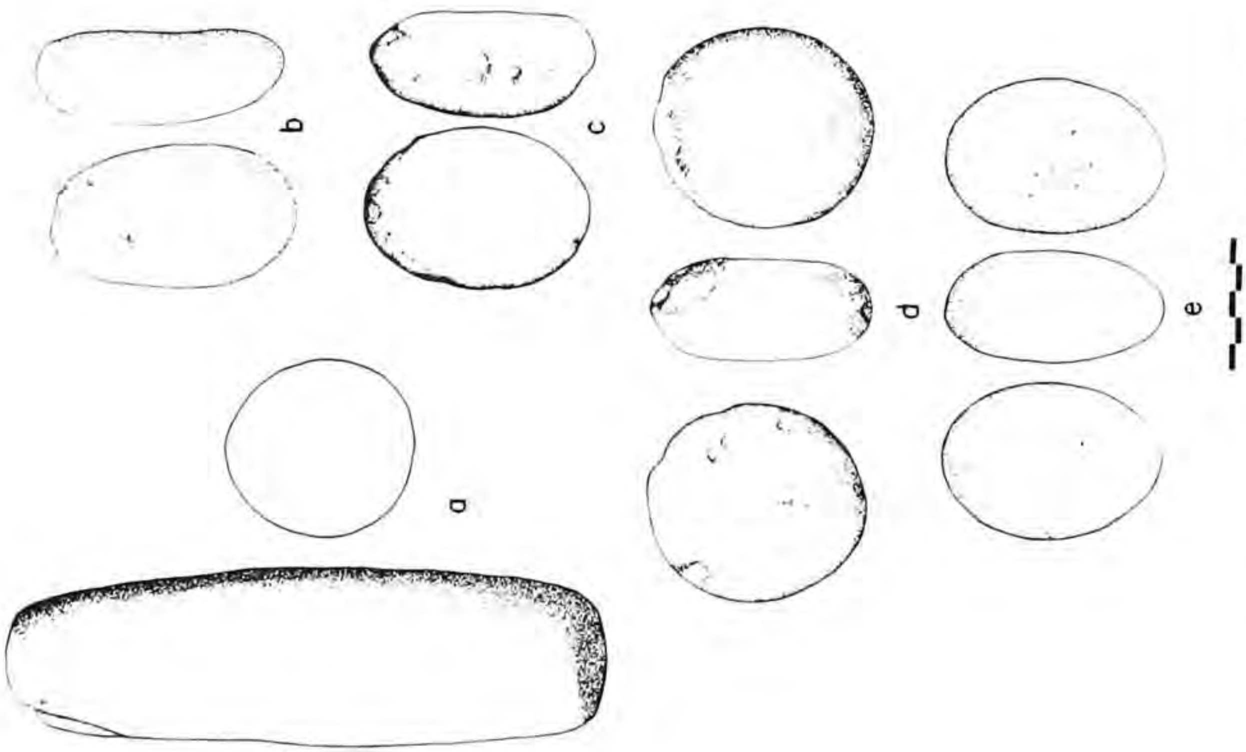



Fig. 12. Pestle (a) and smoothing stones (b-e).

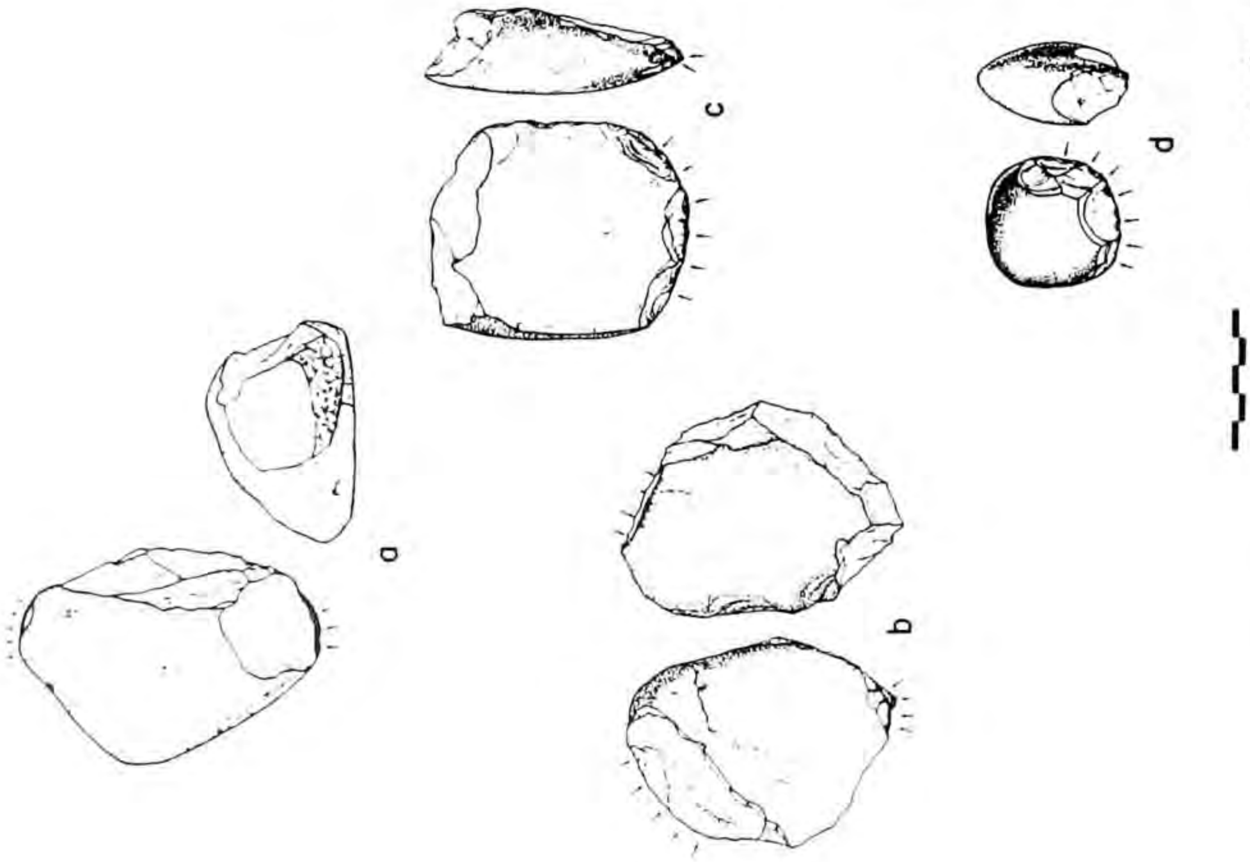



Fig. 13. Cobble hammers (a-b) and shaped core hammers (c-d).

Table 4

**ATTRIBUTE DATA FOR IRREGULAR COBBLE SCRAPERS***

| Subcategory | Number | | Length | Width | Thickness | Edge Angle | Figure |
|---|---|---|---|---|---|---|---|
| 1 | 14 | average | 85.0 | 81.7 | 27.8 | 58.8 | 14 a |
| | | s.d.** | 14.1 | 19.9 | 6.2 | -- | |
| | | range | 65-110 | 42-113 | 12.39 | 47-71 | |
| 2 | 29 | average | 92.0 | 74.3 | 46.5 | 67.4 | 14 b |
| | | s.d. | 26.8 | 16.9 | 10.9 | -- | |
| | | range | 62-175 | 44-109 | 27-68 | 45-89 | |
| 3 | 14 | average | 148.2 | 95.7 | 64.7 | 74.4 | 14 c |
| | | s.d. | 33.4 | 13.7 | 15.0 | -- | |
| | | range | 89-230 | 76-127 | 42-92 | 60-90 | |
| 4 | 22 | average | 114.2 | 95.4 | 50.4 | 65.8 | 14 d |
| | | s.d. | 33.4 | 15.0 | 12.2 | -- | |
| | | range | 63-173 | 65-135 | 33-77 | 55-90 | |
| 6*** | 21 | average | 102.9 | 78.2 | 45.9 | 73.6 | 14 e |
| | | s.d. | 21.0 | 15.2 | 7.3 | -- | |
| | | range | 48-132 | 48-100 | 29-56 | 65-87 | |
| 7 | 21 | average | 97.0 | 78.3 | 47.1 | 75.8 | 14 f |
| | | s.d. | 16.8 | 15.3 | 8.3 | -- | |
| | | range | 75-126 | 51-111 | 34-61 | 70-90 | |
| 8 | 12 | average | 58.9 | 80.5 | 57.9 | 65.6 | 15 e |
| | | s.d. | 14.7 | 12.5 | 18.5 | -- | |
| | | range | 35-92 | 59-100 | 38-107 | 57.77 | |
| 9 | 11 | average | 88.2 | 84.4 | 53.4 | 80.0 | 15 a |
| | | s.d. | 13.8 | 14.0 | 12.2 | -- | |
| | | range | 66-109 | 55-104 | 40-81 | 63-93 | |
| 10 | 9 | average | 88.0 | 102.0 | 45.6 | 72.0 | 15 b |
| | | s.d. | 20.9 | 34.1 | 15.5 | -- | |
| | | range | 57-123 | 65-160 | 28-82 | 65-80 | |
| 11 | 21 | average | 80.0 | 72.6 | 59.9 | 79.7 | 15 c |
| | | s.d. | 16.9 | 19.2 | 12.5 | -- | |
| | | range | 59-122 | 45-120 | 41-85 | 67-95 | |
| 12 | 14 | average | 120.3 | 106.6 | 65.6 | 78.8 | 15 d |
| | | s.d. | 25.2 | 21.5 | 16.2 | -- | |
| | | range | 81-162 | 80-140 | 43-104 | 67-90 | |
| 13 | 9 | average | 102.5 | 75.5 | 51.0 | 77.5 | 15 f |
| | | s.d. | 22.9 | 14.4 | 11.1 | -- | |
| | | range | 73-158 | 65-107 | 37-65 | 65-90 | |
| 14 | 12 | average | 68.0 | 59.5 | 31.7 | 70.7 | 15 g |
| | | s.d. | 6.9 | 4.2 | 6.1 | -- | |
| | | range | 62-75 | 53-67 | 22-40 | 50-90 | |
| 15 | 16 | average | 73.7 | 66.4 | 42.2 | 74.8 | not illustrated |
| | | s.d. | 15.7 | 17.7 | 12.1 | -- | |
| | | range | 52-100 | 42-108 | 28-68 | 55-90 | |
| Total | 225 | | | | | | |

*Edge angle measurements in degrees, all other measurements in mm.
**Standard deviation.
***No Subcategory 5.

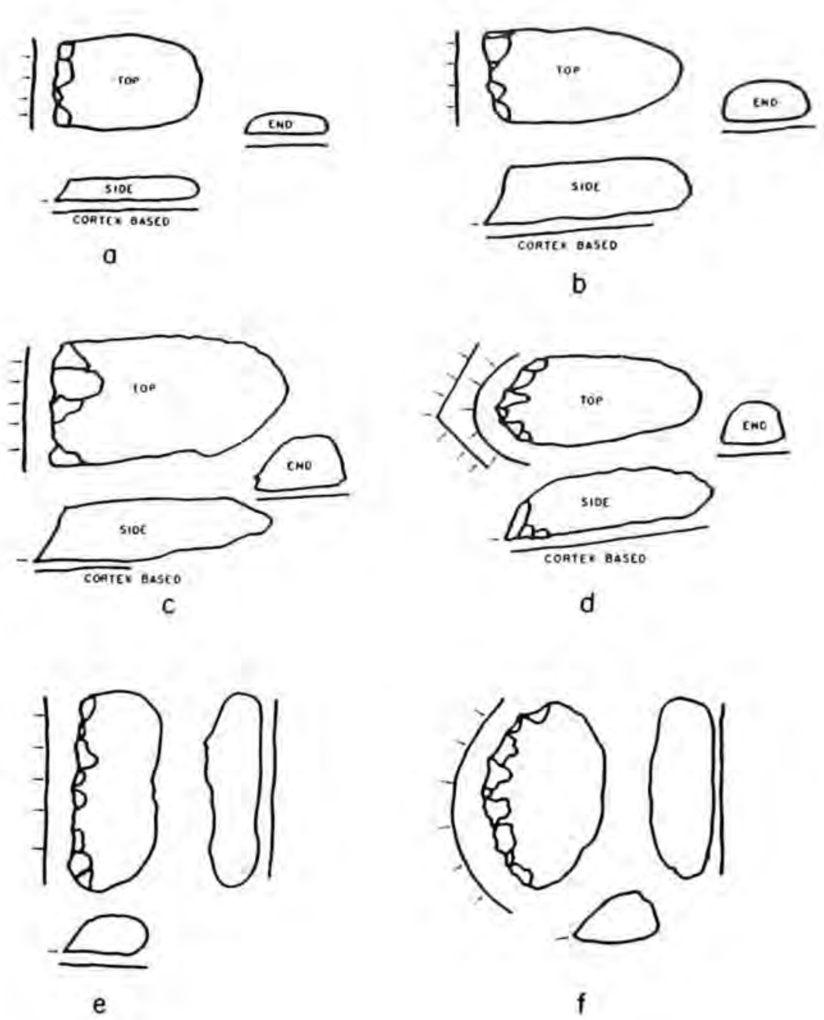



Fig. 14. Schematic representations of tools tentatively identified as irregular cobble scrapers; subcategories 1(a), 2(b), 3(c), 4(d), 6(e), and 7(f).

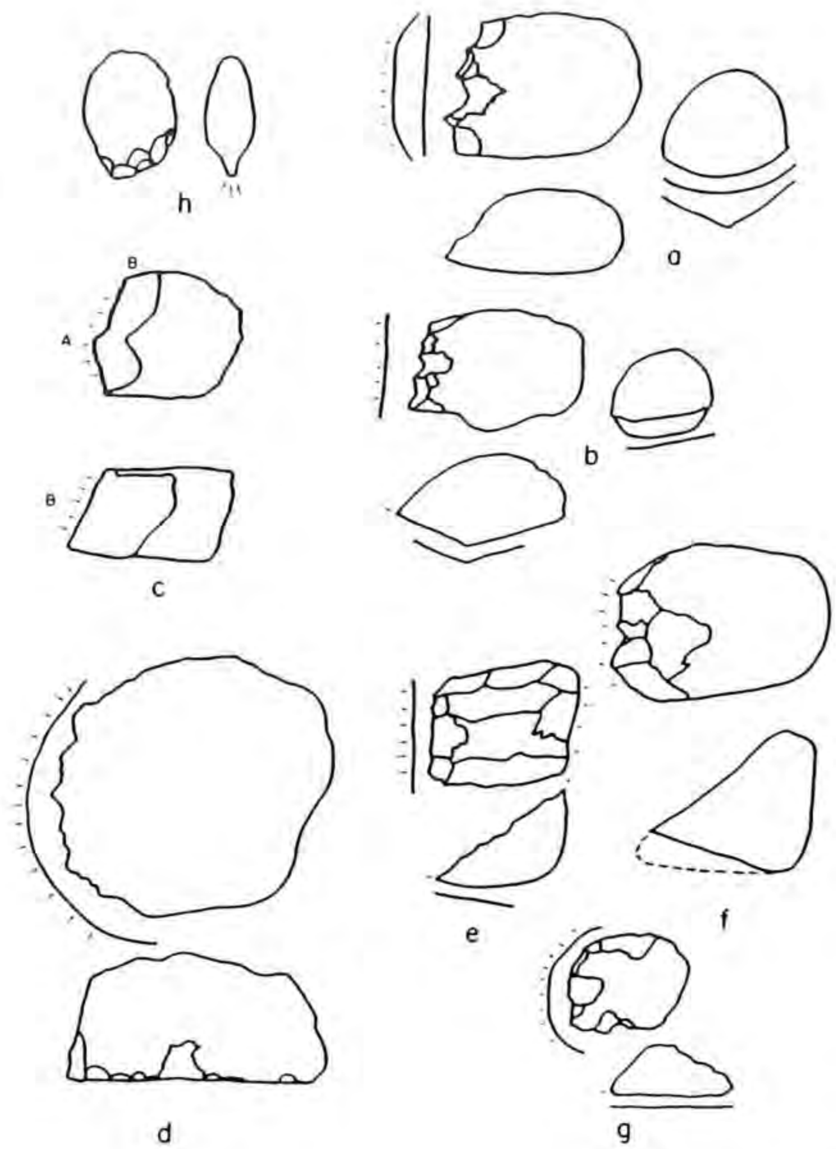



Fig. 15. Additional schematic representations of tools tentatively identified as irregular cobble scrapers; subcategories 8(e), 9(a), 10(b), 11(c), 12(d), 13(f), and 14(g); shaped core hammer (h).

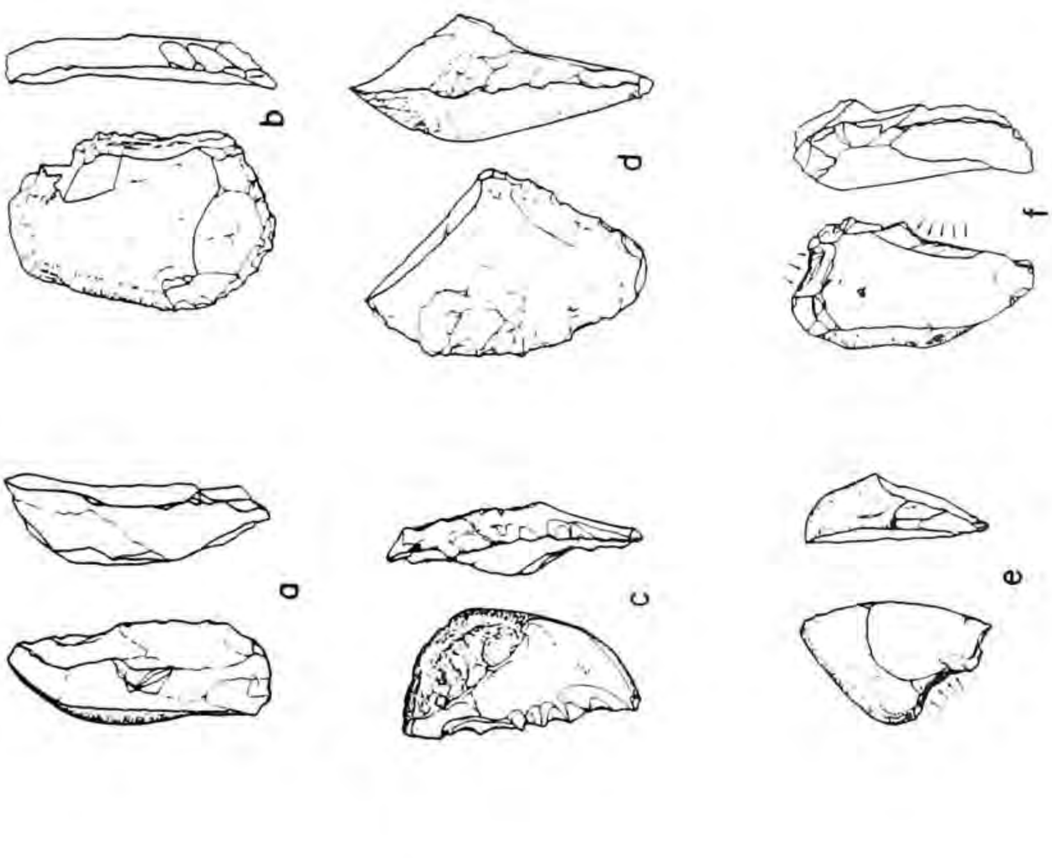



Fig. 16. Tools tentatively identified as irregular flake scrapers: heavy (a-d) and spokeshave (e-f).

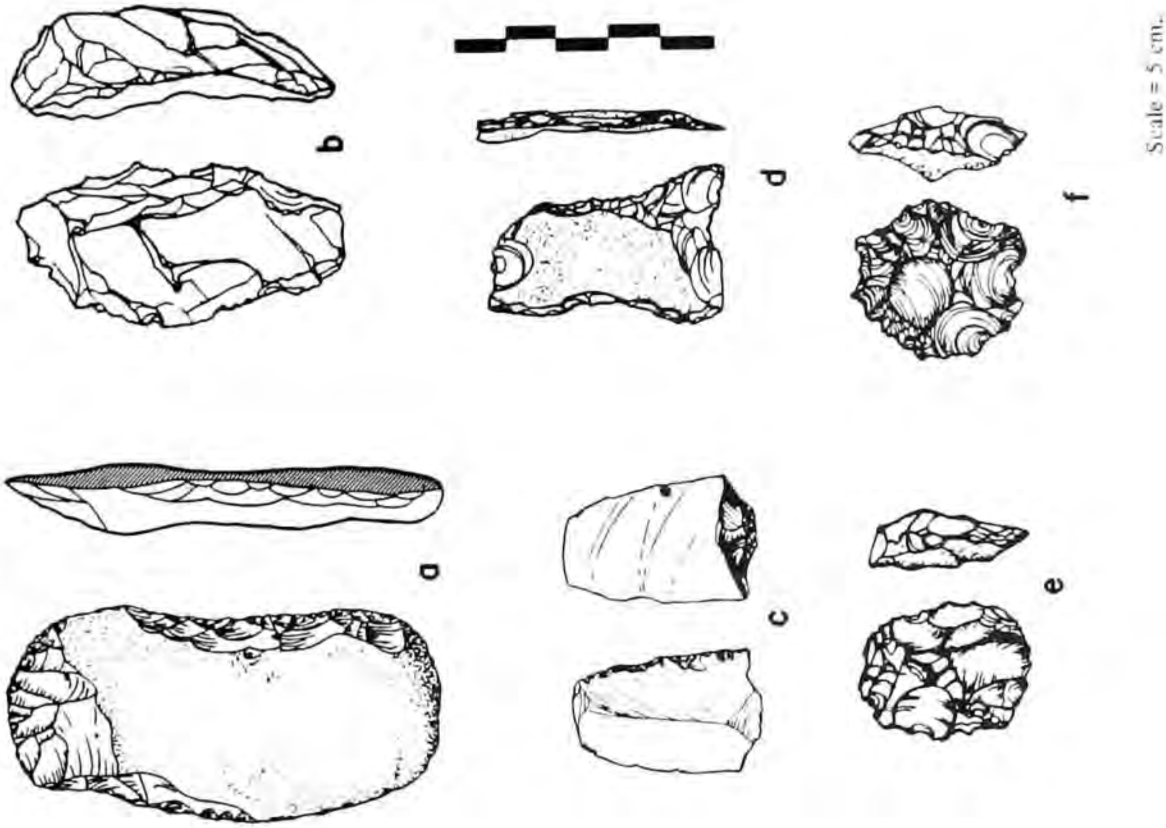



Fig. 17. Tools tentatively identified as irregular conventional flake (a-d) and spokeshave (e-f).

Table 5

ATTRIBUTE DATA FOR IRREGULAR FLAKE SCRAPERS*

| Subcategory | Number | | Length | Width | Thickness | Edge Angle | Figure |
|---|---|---|---|---|---|---|---|
| Heavy | 19 | average | 79.8 | 62.3 | 25.7 | 67.4 | 16 a-d |
| | | s.d.** | 17.1 | 12.7 | 6.2 | -- | |
| | | range | 44-104 | 34-83 | 15-35 | 50-85 | |
| Spokeshave | 4 | average | 66.7 | 48.0 | 22.5 | 93.7 | 16 e-f |
| | | s.d. | 11.2 | 1.2 | 3.8 | -- | |
| | | range | 51.80 | 46-49 | 19-29 | 90-100 | |
| Conventional | 8 | average | 46.2 | 31.1 | 12.7 | 67.2 | 17 |
| | | s.d. | 17.9 | 5.7 | 4.7 | - | |
| | | range | 30-83 | 25-41 | 5-20 | 65-70 | |
| Total | 31 | | | | | | |

*Edge angle measurements in degrees, all other measurements in mm.
**Standard deviation.

Table 6

ATTRIBUTE DATA FOR FLAKE CUTTING TOOLS*

| Subcategory | Number | | Length | Width | Thickness | Figure |
|---|---|---|---|---|---|---|
| Used flake, heavy, irregular | 27 | average | 84.6 | 61.8 | 22.0 | not illustrated |
| | | s.d.** | 22.9 | 17.6 | 6.9 | |
| | | range | 34-140 | 25-107 | 10-35 | |
| Used flake, regular | 18 | average | 25.2 | 19.5 | 5.5 | 18 |
| | | s.d. | 7.1 | 4.7 | 2.6 | |
| | | range | 15-41 | 14-35 | 2-12 | |
| Total | 45 | | | | | |

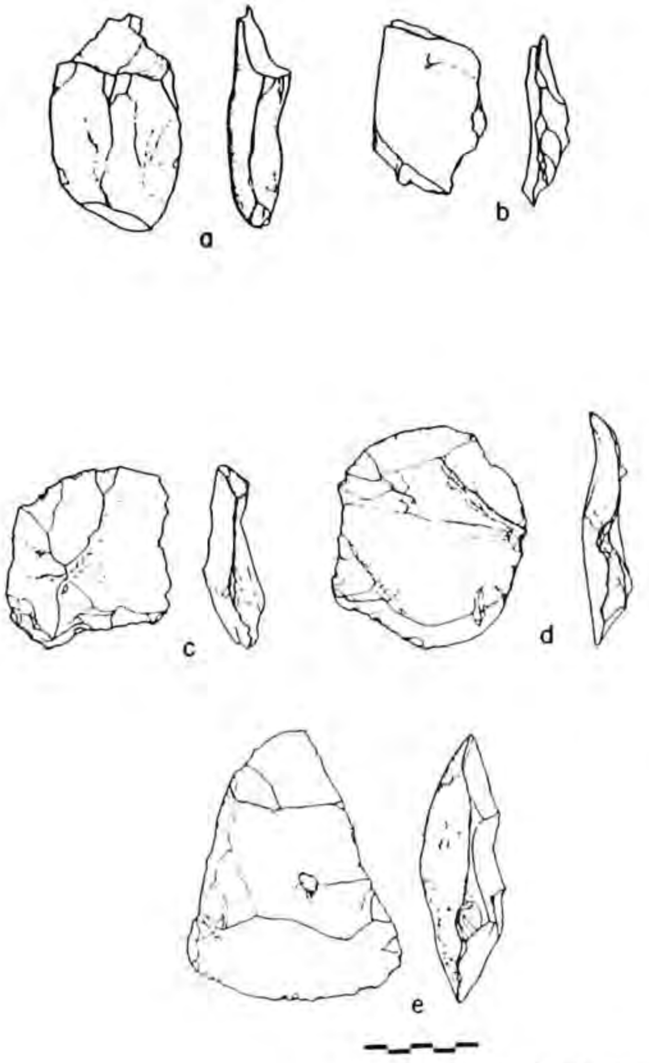
*All measurements in mm.
**Standard deviation.

Table 7

ATTRIBUTE DATA FOR PROJECTILE POINTS, DRILLS, WORKED FLAKES, AND CHOPPING TOOLS*

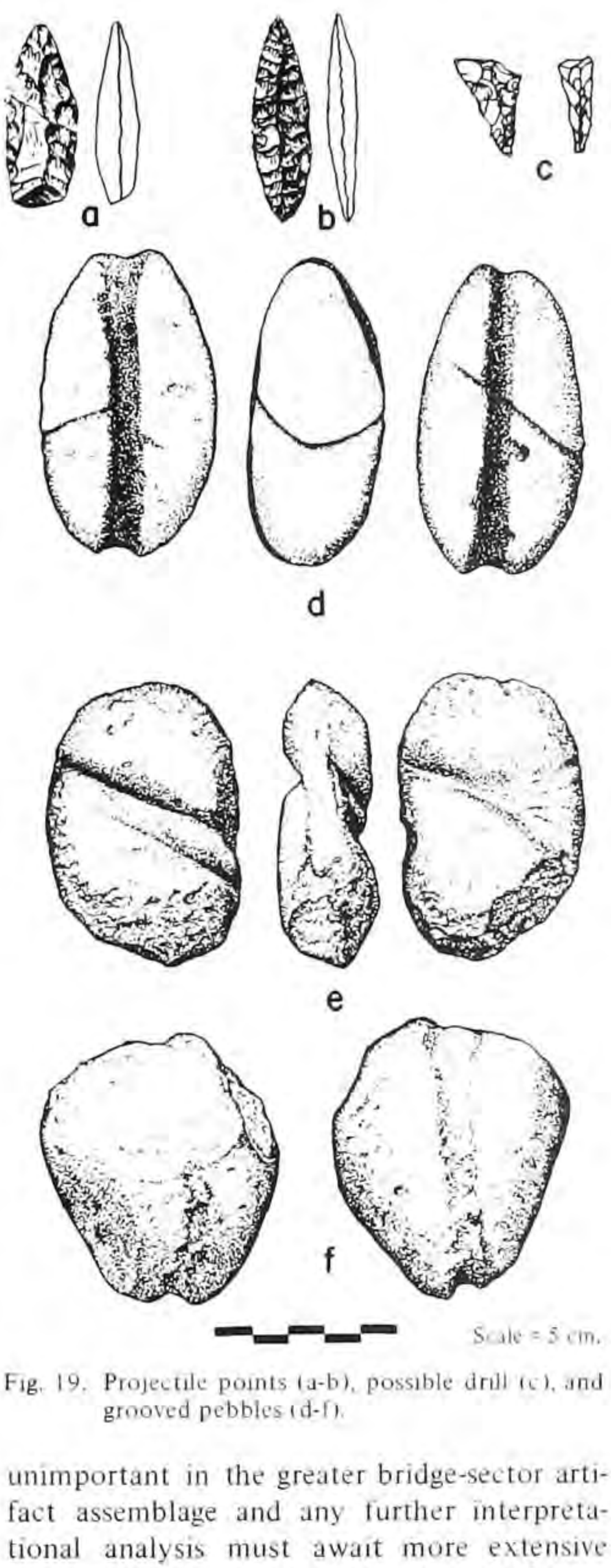
| Artifact | Catalog No. | Length | Width | Thickness | Material | Figure |
|---|---|---|---|---|---|---|
| Projectile point | 223-9** | 49 | 21 | 12 | basalt | 19 a |
| | 223-520 | 55 | 17 | 7 | obsidian | 19 b |
| Drill*** | 223-65 | 24 | 16 | 8 | obsidian | 19 c |
| Worked flake | 223-132 | 59 | 45 | 19 | chert | -- |
| | 223-137 | 25 | 23 | 7 | obsidian | -- |
| | 223-263 | 43 | 26 | 11 | obsidian | -- |
| | 223-354 | 39 | 24 | 10 | chalcedony | -- |
| Chopping tool*** | 223-26 | 100 | 92 | 67 | basalt | -- |
| | 223-285 | 109 | 98 | 56 | volcanic | -- |
| | 223-301 | 96 | 103 | 70 | chert | -- |

*All measurements in mm.
**Fragment.
***Tentative functional designation.




Scale = 5 cm.

Fig. 18. Tools tentatively identified as flake cutting tools (used, regular).




Scale = 5 cm.

Fig. 19. Projectile points (a-b), possible drill (c), and grooved pebbles (d-f).

relatively thin, leaf-shaped forms. Neither specimen displays temporally diagnostic morphological characteristics.

**Other**. Several additional artifacts were collected during the survey that cannot be assigned to the five previous categories. These items are briefly described below.

***Drill*** (Table 7; Fig. 19c). One obsidian artifact is identified as a possible drill because of its overall morphology and cross-sectional configuration. No obvious wear is evident on the specimen. This single isolate is relatively unimportant in the greater bridge-sector artifact assemblage and any further interpretational analysis must await more extensive distributional analyses within the Lake Berryessa region.

***Grooved Pebbles*** (Table 8; Fig. 19d-f). Three grooved pebbles were found during the bridge-sector survey. Two of the specimens feature longitudinal grooves around the long axis of the pebble. Both of these are believed to have functioned as net weights or in some similar capacity. The third specimen is characterized by irregular lateral grooving that appears to be the result of some kind of sharpening activity.

***Worked Flakes*** (Table 7). This is a catchall category for objects that show evidence of modification (i.e., flaking scars), but which are nondiagnostic in terms of any recognizable form or function. Included here are fragments of finished and unfinished tools, and tool rejects. Such artifacts are not common in the bridge-sector area of Lake Berryessa.

***Chopping Tools*** (Table 7). Cobbles or heavy, core-like objects that possess attributes suggestive of use as chopping tools were located during the survey, but were relatively scarce. Three specimens are included here, but the functional interpretation is tenuous. It is also reasonably possible that these items represent accidental manufactures, cores, or natural but fortuitously shaped objects that have no cultural significance at all.

***Pitted Cobbles*** (Table 8; Fig. 20). Twelve small- to medium-sized pitted cobbles were collected during the bridge-sector survey. Typically fashioned from sandstone, these artifacts display clearly defined pits pecked into one or more surfaces. No mano-like wear surfaces are apparent, but the general appearance of the pits is similar to those observed on the pitted manos described above.

***Unmodified Flakes*** (Table 8). A number of stone flakes that appear to be cultural in origin were recovered during the survey. They are primarily cortical and seldom exhibit secondary flaking. The flakes may be by-products of tool manufacture (e.g., cobble scrapers), or may have been produced for use as casual knives. Most of the potentially functional pieces are basaltic, although a small number of obsidian flakes were also found. Distributionally, these unmodified flakes were usually discovered in the general vicinity of major sites or postulated camp locations.

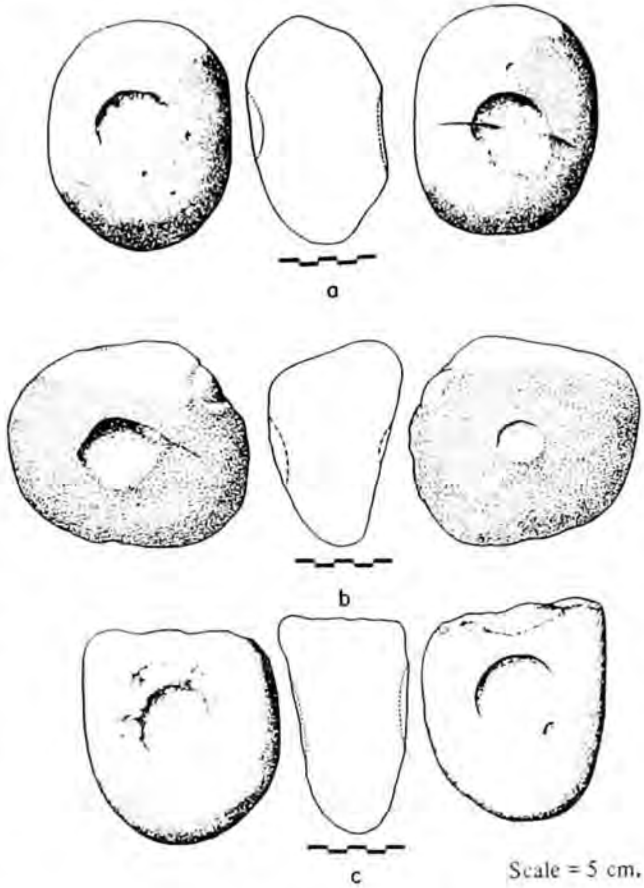



Fig. 20. Pitted cobbles.

***Broken Cobbles***. Several cobble and pebble fragments that *may* be the result of cultural activity were observed during the survey. These appear to have been broken deliberately, but no evidence of use or secondary modification is apparent.

**Artifact Discussion**

An examination of the bridge-sector artifact inventory, summarized by material type in Table 9, suggests several observations: (1) the dominant artifactual form is a cobble-derived tool (42% of the inventory consists of

Table 8

ATTRIBUTE DATA FOR GROOVED PEBBLES, PITTED COBBLES, AND UNMODIFIED FLAKES*

| Artifact | Number | | Length | Width | Thickness | Figure |
|---|---|---|---|---|---|---|
| Grooved pebble | 3 | average | 78.5 | 55.0 | 39.3 | 19 d-f |
| | | s.d.** | 1.5 | 7.3 | 9.8 | |
| | | range | 75-80 | 48-65 | 28-52 | |
| Pitted cobble | 12 | average | 127.0 | 95.3 | 64.9 | 20 |
| | | s.d. | 16.7 | 17.5 | 10.1 | |
| | | range | 102-165 | 62-116 | 44-82 | |
| Unmodified flakes (obsidian) | 7 | average | 19.0 | 13.2 | 2.6 | – |
| | | range | 15-24 | 12-15 | 1-6 | |
| Unmodified flakes (basaltic) | 45 | average | 69.1 | 51.2 | 19.2 | – |
| | | range | 36-128 | 25-79 | 7-29 | |

*All measurements in mm.
**Standard deviation.

Table 9

ARTIFACT MATERIAL TYPES

| Artifact | Basalt | Volcanic | Sandstone | Metamorphic | Other | Total |
|---|---|---|---|---|---|---|
| Metate | – | – | – | – | – | 16 |
| Mano | 12 | 33 | 30 | 9 | – | 84 |
| Pestle | – | – | 1 | – | 1 | 2 |
| Smoothing stone | – | – | 7 | – | 1 | 8 |
| Hammer | 2 | 1 | – | – | 1 | 4 |
| Irregular cobble scraper | 141 | 31 | 6 | 39 | 8 | 225 |
| Irregular flake scraper (heavy) | 16 | 2 | – | – | 1 | 19 |
| Irregular flake scraper (spokeshave) | 4 | – | – | – | – | 4 |
| Irregular flake scraper (conventional) | – | – | – | – | 8 | 8 |
| Used flake, heavy, irregular | 26 | 1 | – | – | – | 27 |
| Used flake, regular | – | – | – | – | 18 | 18 |
| Projectile point | 1 | – | – | – | 1 | 2 |
| Drill | – | – | – | – | 1 | 1 |
| Grooved pebble | – | – | 3 | – | – | 3 |
| Worked flake | – | – | – | – | 4 | 4 |
| Chopping tool | 1 | 1 | – | – | 1 | 3 |
| Pitted cobble | – | 1 | 11 | – | – | 12 |
| Unmodified flake (small) | – | – | – | – | 7 | 7 |
| Unmodified flake (large) | 43 | 1 | – | – | 1 | 45 |
| Broken cobble | 37 | 1 | – | 4 | 1 | 43 |
| Total | 283 | 72 | 58 | 52 | 54 | 535 |

irregular cobble scrapers); (2) basalt is the predominant and/or favored lithic material in the survey area (53%), followed by an unidentified volcanic rock (13%); (3) collectively, metates and manos comprise 19% of the total inventory; and (4) flakes or artifacts fashioned from flakes represent 24% of the total inventory – but it should be stressed that few specimens possess definitive evidence of use or purposeful secondary modification, and their function(s) or significance is not at all clear.

For descriptive purposes, the cobble-derived implements (i.e., cobble scrapers) have been sorted into 14 arbitrary subcategories based on size and the nature, location, and number of working edges. Although these simple morphological divisions can be readily identified in the bridge-sector assemblage and have some degree of empirical validity, it is considered unlikely that the subcategories are, in actuality, culturally significant. Further, there is increasing reason to believe that core-cobble tools found in generally comparable cultural contexts more often than not represent casual tools – and that they constitute multi-purpose tools potentially reflective of numerous use-events spread over a considerable period of time. Also, based on a preliminary examination of the limited Lake Berryessa sample, a morphological continuum between the recognized subcategories may be evident for several different attributes.

A more detailed and definitive statement relative to core-cobble tools and their presumed (scraping) function(s) is in order, but must await accumulation of data from a larger and more varied geographic sample. The basic concern here, in any case, is not with the viability of the above admittedly arbitrary and deliberately generalized categorizations, it is with the demonstrable occurrence of a large number of core-cobble artifacts that may reflect a potentially important but as yet undefined cultural activity.

Since it has long been assumed, in other contexts, that the angle of a flaked-stone working edge is an important indicator of tool function (e.g., Wilmsen 1968), edge-angle measurements were obtained for all relevant artifacts in the bridge-sector assemblage. However, inasmuch as almost every specimen is by definition "irregular" rather than conventionalized, these edge angles are highly variable and a considerable range is evident for most artifacts. In light of this complication, three angle measurements were taken from the *apparent* working edge of each tool. The measurements were then averaged for each implement. In turn, averages, standard deviations, and ranges were determined for each of the 14 subcategories of cobble scrapers (Table 4). Because of the irregular morphology of these tools, the edge-angle data presented here must be viewed in a general rather than specific sense.

As can be seen in Table 4, average cobble-scraper edge angles range from 59 to 80 degrees. Although there appear to be potentially significant differences in average edge angles among several of the subcategories, the range of edge angles per subcategory indicates considerable overlap. Consequently, it is evident that edge angles themselves do not clearly distinguish the subcategories from one another. What is probably significant, however, is that all of the cobble-scraper edge angles exceed 40 degrees and, with one minor exception (59 degrees), all of the subcategory averages exceed 60 degrees. Moreover, 12 of the 14 subcategories contain specimens displaying edge angles greater than 80 degrees. Based on prevailing notions about flaked-stone edge angles, therefore, the evidence suggests a scraping or planing rather than cutting function. Given this possibility, all of the specimens were examined for direct indications of use (e.g., wear facets, striations, battered surfaces, etc.) and, though only in a few instances, what *appeared to be* use-related wear was recognized and noted. It was clear, however, that battered edges are virtually nonexistent and that most cobble scrapers were casual tools used a few times at most and then discarded.

## ARTIFACT DISTRIBUTIONAL UNITS: SITES AND NON-SITES

Recognizing that the spatial characteristics of artifacts recovered from the bridge-sector area of Lake Berryessa may reflect only local patterns, for purposes of this discussion artifact locations have been organized into a hierarchy of "site" circumstances (i.e., "distributional units") differentiated by the extent to which artifacts are concentrated in particular places. The basis for this organizational system is primarily artifact density over space, but presence or absence of midden, presence or absence of obsidian, and locational contexts have also been taken into account. Two considerations come to mind with respect to this approach. First, it is important to state that the distributional units delineated below are only tentative constructs and that they probably reflect the special circumstances thus far observed in the investigations at Lake Berryessa. It is also important to note that these units have been documented in the specified spatial contexts and, although intuitively defined for purposes of discussion, they are no less real. Their significance and place in the larger cultural matrix of the North Coast Ranges, of course, remains to be seen. This leads to the second consideration which relates to the work of other investigators in the general region.

The distributional units outlined here are simple organizational devices designed to aid explanation of the archaeological record to no more than a local level. They are not proposed as classificatory divisions with specific regional or areal significance. The degree to which these quite tentative distributional units hold up will depend upon the outcome of ongoing and future research in the Lake Berryessa region and throughout the North Coast Ranges. Moreover, it is acknowledged that to date the work at Lake Berryessa has been conducted largely in isolation of other important and valuable studies carried out in recent years in the general region. Of particular interest in this regard are settlement patterns reconstructed for other North Coast Range areas (e.g., Jackson 1976; Jackson and Fredrickson 1978; Fredrickson and Hayes 1978; Stewart and Fredrickson 1979) that appear to be associated with artifact distributions similar to those recognized at Lake Berryessa. (As an aside, it might be noted that the eventual utility of these and other studies to the work at Lake Berryessa is directly related to their accessibility – which would be enhanced considerably by formal publication of research results in journals and monographs available to the wider academic community. Since 1960, for example, of over 60 documents on the prehistoric archaeology of north coastal California, only a handful have actually been published [e.g., Fredrickson 1974, 1984; Hildebrandt 1984; Meighan and Haynes 1968, 1970].)

In that a detailed discussion of the Lake Berryessa artifact assemblage is planned for the third paper in the present series (Berryessa III), minimal attention is given here to quantifying the *kinds* of artifacts characterizing the distributional units outlined below. It is understood that this is a crucial gap and that such data are ultimately indispensable to the analysis and interpretation of the artifactual evidence. Nevertheless, to maintain the flexibility of a phased investigative approach, this aspect of the research at Lake Berryessa will not be addressed directly until after all project-related surveys have been completed and larger artifact samples obtained. This work is in progress. Most of the shoreline has now been surveyed at least once, a data-recovery program has been completed in one new study sector (Putah Creek), and other sectors will be investigated as soon as circumstances (natural or cultural) bring about a lowering of the lake level.

**Isolate**

Single artifacts located in isolated contexts comprise this non-site distributional unit. No specific criteria are proposed to define precisely the degree of spatial separation required to distinguish isolates from one another and from more inclusive distributional units, but a threshold of at least several meters seems likely.

**Scatter**

Scatters are distributional units consisting of low-density artifact aggregates more spatially concentrated than isolates, but which still lack the integrity usually required for formal site recognition. No attempt has yet been made to formalize the attributes of this distributional unit with respect to size, boundary definition, or artifact density. The unit differs from a concentration (see below) in that the latter is characterized by a distinct spatial focus. Scatters are variable units that can range in size and artifact density from a few items spread over a dozen square meters to over a hundred items located along a linear axis hundreds of meters in length.

**Concentration**

These distributional units consist of relatively low-density artifact aggregates, typically more concentrated than scatters, but which have as one of their principal diagnostic attributes a location on some clearly defined, small-scale geographic feature. In their modern setting at Lake Berryessa, concentrations occur on elongate land features extending into the lake — as peninsulas, knolls, or islands, or as saddles between knolls or islands. However, these locations must be viewed in terms of their pre-reservoir setting and in that context they represent low ridges and small knolls overlooking adjacent drainages.

Two other diagnostic attributes of concentrations in the Lake Berryessa region are that they lack midden and rarely contain anything beyond core-cobble tools. Distributional units occurring between concentrations appear to be limited to isolates and scatters. Generally, concentrations, as envisioned here, would qualify for formal recognition as sites.

**Station**

Stations are distributional units comprised of small flake scatters lacking formal tools and midden. At present, only obsidian flakes are found at stations in the Lake Berryessa region, but it is possible that other materials will characterize stations encountered during future fieldwork. Stations tend to be small, covering a few square meters at most, and rarely contain more than a few dozen flakes.

**Camp**

In the context of the ongoing studies at Lake Berryessa, a camp consists of a small area of midden, associated obsidian flakes, and usually a few other artifacts (e.g., manos, scrapers, etc.). Critical attributes of this distributional unit are the presence of midden, flakes, and a small number of different kinds of artifacts. Camps are typically small (a few dozen square meters) and, based on all known examples to date, feature shallow midden deposits.

**Major Camp**

This distributional unit is distinguished from a camp on the basis of its greater size and larger number of artifacts. Major camps (e.g., NAP-432, -433, -636) usually cover relatively large areas (more than 1,000 sq. m.), and their artifact assemblages typically contain a variety of tools and debitage. Midden is present, but can vary in depth, development, and degree of induration. Large quantities of waste flakes are present, presumably indicating recurrent occupations over more than short periods of time.

**Village**

The most inclusive distributional unit is the village. Village sites are situated immediately adjacent to the principal streams in Berryessa Valley (Eticuera and Putah creeks), and typically feature well-developed, dark middens. Villages thus far examined in the region contain diverse artifact inventories, large quantities of flakes, and extensive faunal remains. At present, and for purposes of this tentative organization of artifact distributional units, villages are characterized by assemblages attributed to the most recent prehistoric occupations in the region (see Arnold and Reeves [1959] for a description of these sites prior to the filling of the reservoir). Village site artifact inventories include shell beads, *Haliotis* ornaments, burials, small obsidian projectile points, mortars and pestles, and a variety of less common but usually diagnostic artifacts. Based on available evidence, heavy core and cobble tools are conspicuous by their rarity and a milling complex (mano/metate) appeared to be absent at lakeshore and reservoir-bed sites exposed as a result of the 1976-1977 drought. Currently, all village sites within the immediate Lake Berryessa project area lie under water. Site NAP-539, located upstream from the lake on Eticuera Creek, appears to be the only intact prehistoric village in the general vicinity.

The artifact categories and distributional – i.e., site – units delineated above have been documented in diverse enough settings throughout the Lake Berryessa region to suggest, with a certain degree of security, that they are indeed representative of late prehistoric land-use patterns. Explanation of the *meaning* of such a hierarchy of sites in terms of adaptive strategies and cultural development over time has yet to be addressed. Temporally diagnostic patterns are probably evident in the archaeological record and there are no doubt reasons to attribute at least part of the observed patterning to atemporal adaptive traditions. These potentially critical issues will be addressed as best possible in the course of planned future investigations.

Sites such as those described here as stations, camps, major camps, and villages almost certainly have previously described counterparts in other regions of the North Coast Ranges, and it seems likely that at least some degree of functional comparability and/or direct historical relationship will become apparent when the Lake Berryessa data are subjected to a geographically broad, comprehensive analysis. Notwithstanding the interpretive potential of such correlations, it is the documentation and explanation of artifact isolates, scatters, and concentrations that to date represent perhaps the most important or interesting aspects of the Lake Berryessa research project.

## CONCLUSIONS

Although data collection and analysis are far from complete, initial results suggest that there is significant patterning in the artifact distributions thus far compiled. As a tentative hypothesis, therefore, it is proposed that in the extant artifact distributions there is evidence for a hierarchical use of space related to: (1) terrain; (2) distance from primary water sources; and (3) probable locational differentials in the kinds and quantities of subsistence resources available for exploitation.

It is recognized that an explicit discussion of the objects comprising these artifact distributions, as well as detailed descriptions of the sites thus far recorded, are crucial necessities that must be dealt with at some point. The present concern, however, is by design limited to the nature of artifact distributions (i.e., relatively distinguishable artifact concentrations over space) and to differences in their elevation above and distance from adjacent primary drainages. Despite this obviously overly simplistic assessment of what is in reality probably a very complex set of relationships across space and time, the explanatory hypothesis put forth here is seen as a not unreasonable first step toward unraveling components of the larger and more complex regional subsistence-settlement system.

Specifically, it is hypothesized that the greater the elevation above and distance from Eticuera and Putah creeks, the more widely dispersed and apparently casual are the prehistoric artifacts. Based on an extrapolation of data thus far generated during the Oak Shores and bridge-sector surveys, a schematic illustration of this distributional patterning is presented in Figure 21. Site locations and artifact distributions in the bridge sector of Eticuera Creek were examined during the 1976-1977 drought when the surface of Lake Berryessa dropped below the 400-foot contour. The predicted location of major camps and villages in the Oak Shores area cannot, of course, be verified without a substantial lowering of the lake. This inhibits comprehensive testing of the hypothesis. It is possible, though, to achieve at least a partial evaluation of the hypothesis by examining survey data from intermediate areas lying between the bridge sector and Oak Shores. To obtain the necessary data, surveys are in progress along Putah Creek and in areas of the reservoir where the old Putah Creek stream bed is most distant (laterally and vertically) from the normal surface elevation of the lake (440-foot contour).

As suggested above, the simplistic straight-line distribution of artifacts and sites depicted in Figure 21 would probably be altered by the presence of significant tributaries (which might themselves be characterized by comparable, but highly localized, distributional patterns), and by the irregular distribution of potential vegetal subsistence resources. The prehistoric significance of a particular resource certainly depended on its economic value and, to an important degree, on its accessibility. Given these hypothesized but not improbable circumstantial variables, it seems possible that relative isolate frequencies and the development over time of artifact scatters and concentrations would be related directly to local resource potential and accessibility — and to relative distances from primary drainages.

An important aspect of the available survey data that is also relevant to the speculations offered here is the fact that non-site artifacts (i.e., isolates, scatters, concentrations) are not evenly distributed across the landscape, and there may well be meaningful correlations between these distributional units and potential vegetal resources. It is also assumed that there would be at least some differentiation in the kinds of artifacts associated with particular distributional units. Logically, of course, the kinds of artifacts present should show some relationship to the nature of the resource being exploited, just as the degree of artifact concentration is probably related to the accessibility and relative importance of a specific resource locale. Intuitive and non-quantified assessments of the artifact distributions thus far compiled seem to indicate differential distributions by artifact type as well as by degree of concentration.

Based on the extant survey data, locales on moderate slopes a considerable distance above principal drainages are primarily characterized by isolates or well-dispersed artifact scatters. No convincing evidence of significant milling activities has thus far been found in such contexts, and most of the artifacts appear to represent casual tool use. Artifact densities (scatters and concentrations) in-

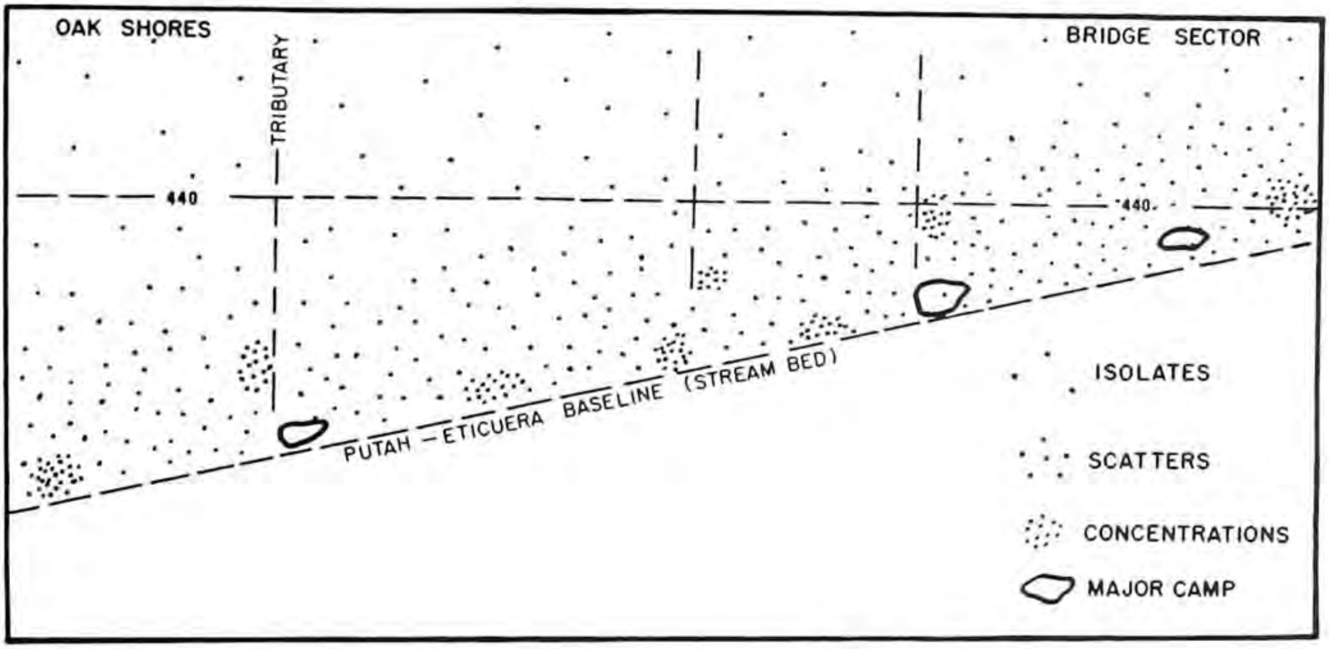



Fig. 21. Idealized schematic depiction of postulated distribution of isolates, scatters, concentrations, and major camps along Putah-Eticuera drainage; village locations on creek not shown (see text for definitions).

crease on knolls, ridges, and generally accessible terrain adjacent to but not necessarily close to the base-line drainage. Milling equipment is occasionally represented. As shown schematically in Figure 22, there appears to be a hierarchy of collecting and processing activities dependent, in part, upon the distance from a base camp and, in part, upon the nature of the processing tasks (e.g., preliminary processing done as part of resource acquisition and preparation for transport, as opposed to multi-stage processing conducted as part of the food-preparation process itself).

Although it might be argued that the artifact aggregates designated here as concentrations actually represent small camping sites, this possibility is set aside for now due to two factors. First, even though concentrations may, in rare instances, contain milling implements in addition to the usual core-cobble tools, they do not display the wide array of artifacts found at sites here referred to as camps or major camps (e.g., obsidian flakes, flaked obsidian tools, a variety of core and cobble tools, common milling elements). Second, known major camps at Lake Berryessa are characterized by the presence of subsurface features that may have functioned as earth ovens or in some other way been related to food processing. No evidence of such features has been found at any of the recorded scatters or concentrations.

The possibility that the extant artifact distributions reflect temporally as well as (or instead of) spatially differentiated subsistence-settlement activities must also be considered. In this regard, a clear-cut difference has been noted between the assemblages found at major camps and those known for villages located along the principal streams. Temporal differentiation is suggested by divergent artifact inventories and settlement locations, and by the degree of midden induration. All of the village locations thus far examined, for example, have relatively well-developed non-indurated middens marked by the presence of molluscs, burials, small obsidian projectile points, a variety of shell

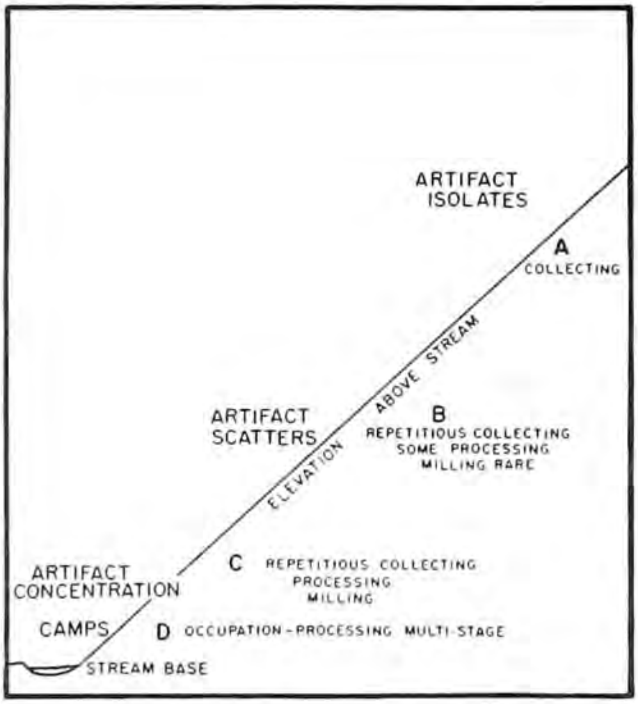



Fig. 22. Schematic representation of hypothesized topographic patterning in artifact distributions.

beads and ornaments, and the mortar-and-pestle (Arnold and Reeves 1959). In contrast, known major camps contain somewhat more indurated middens, less evidence of soil discoloration, the mano-and-metate, cobble tools, and medium- to large-sized obsidian and basalt projectile points (e.g., leaf-shaped, Excelsior, possibly Borax Lake forms). Therefore, it seems likely that there may be at least some chronological differentiation between what are here called major camp and village sites. For the moment, however, the important question is not how major camps and villages ultimately relate to one another; rather, it is the relationship(s) between isolates, scatters, and concentrations and the more-inclusive distributional units (camps, major camps, villages) that is of primary interest. Available data tentatively suggest a relationship between the scattered core-cobble tools and major camps, and it may be that an as yet undefined subsistence shift (either in terms of resources exploited or modes of collection and processing) took place between the end of the camp-oriented settlement pattern and development of the late prehistoric village-oriented settlement pattern.

As mentioned at the outset of this paper, several further phases of the research at Lake Berryessa are underway or in planning. Research questions and strategies for each phase will build upon the results obtained during earlier investigations. This cumulative process allows for the constant evaluation and refinement of explanatory hypotheses such as those considered here, and for the development of new, potentially insightful perspectives on the nature of hunter-gatherer adaptation in the North Coast Ranges.

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