Approach and Process of Dating Lake Mohave Artifacts

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CULTURAL material from Lake Mohave has been dated through research which involved (1) reconstructing the geomorphic history of Lake Mohave, (2) developing a model defining depositional situations on the lake margins, and (3) deducing the most probable depositional situation with which cultural material would be associated. Selected deposits were then tested at one site, Bench Mark Bay, resulting in the discovery of buried cultural debris in association with lake deposits dating 10,270 ± 160 years B.P., and surface material representing a second early occupation apparently associated with the final recession of Lake Mohave, dated at about 8000 years ago.

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The Lake Mohave sites present problems of dating cultural material that are typical of many sites in the California deserts. The artifacts lie on the deflated surface of ancient shorelines making it impossible to demonstrate association of individual artifacts with ancient geological features. The cultural material found on these deflated surfaces may be as old as the surface or it may date from anytime after the formation of the surface. The difficulty of dating the Lake Mohave artifact assemblages has given rise to controversies over the years (Campbell *et al.* 1937; Rogers 1939; Roberts 1940; Brainerd 1953; Warren and DeCosta 1964; Heizer 1965, 1970; Warren 1970). This paper presents the results of investigations aimed at demonstrating the association of specific artifacts with geomorphic features of known age. As a result, the occupation at Lake Mohave by 8000 B.C. can be firmly established.

The approach to solving the problem of dating Lake Mohave artifacts was recognized by Elizabeth Campbell fifty years ago. She stated (1936:295):

> It is to be hoped that a thorough study of their [flint and stone objects] relations to their topographic situation will ultimately throw light on placing types in their proper order.

Unfortunately, Campbell never carried this approach through its logical steps to a successful conclusion. Warren and DeCosta (1964) reviewed the problem of dating Lake Mohave artifacts, and their review formed the basis for the research design of the work reported here.

Two problems that needed solutions if Lake Mohave artifacts were to be dated were (1) establishing temporal relationships of artifact assemblages and former lake stands, and (2) dating former lake stands (Warren and DeCosta 1964:206). The second problem proved more readily solvable than the first. The geomorphic history of Lake Mohave (Ore and

Warren 1971) deals fundamentally with a reconstruction of the history of lake fluctuations and a correlation of these fluctuations with lake features upon which sites are located. The archaeological problem was to locate cultural material in direct association with one or more dated geological features. The relevant portions of the geomorphic history of Lake Mohave are summarized below.

The fluctutation of water level in Lake Mohave for which data are available began about 14,500 years ago when the water was above 286.5 m. (940 ft.) elevation and flowing through the outlet channel into the next basin. This lacustral period is based on radiocarbon-dated shells from deposits near the outlet channel and is followed by the first recorded interlacustral around 14,000 years ago. The second high water occurred from *ca.* 13,750 to *ca.* 12,000 years ago, and is inferred from four tufa and six shell dates including three shell dates from the 287.1 m. (941-943 ft.) beach line. The second interlacustral was centered about 11,500 years ago.

The third high stand, dated by seven shell and four tufa dates, began about 11,000 years ago and ended shortly before 9000 years ago. One date applies to a beach at 285.3 m. (936 ft.) elevation. This lacustral was interrupted by a brief interlacustral period recorded in the stratigraphic record but not distinguishable by radiocarbon dates.

A fourth possible high water stand which probably did not overflow the outlet and which instead may be associated with declining water of the preceding lacustral is dated at 8350 years ago by a single tufa date. Extensive drying began about 7500 years ago and marked the end of Lake Mohave.

Correlating cultural materials with lake features had proven difficult because cultural material had been found only on erosional surfaces. Therefore, later occupation may have added cultural debris to that deposited by earlier occupation. The best solution was obviously to find cultural material buried in dated geological deposits. The process of locating such cultural material was based on the following logic.

The level of Lake Mohave changed in two ways. Through time the water level progressively lowered because of erosion of the outlet channel. At the same time, seasonal and longer term cyclic changes in lake level occurred. Such fluctuation of water level and changes in lake margin morphology resulted in lacustrine and marginal deposits representing two different stratigraphic situations:

a. Where the beach slope was gentle and waters transgressed and regressed over long distances, poorly sorted, shell-bearing off-shore sands and silts intercalated with well sorted, coarser, strand-line deposits would be expected. In this situation no interlacustral unit separates the final deposits of one lacustral period from the initial deposits of the next.

b. Where shorelines were steep, so that coarser materials were locally available, near-shore lacustral deposits alternate with interlacustral colluvial, fan, or recessive lacustrine gravels. Several cycles of rising and falling lake levels can be recognized in deposits where the shoreline was steep.

A third form of shoreline deposition is post-lacustral fan material and talus that covers the shoreline in steep areas. It is obvious that buried artifacts would be far easier to locate in the lake deposits than beneath these massive, coarse deposits.

Bearing these stratigraphic situations in mind, we selected a site that satisfied two requirements:

a. Located lakeward from a surface site on a high beach line, and

b. An area of wide, gently sloping beach, which could have been occupied during low water periods, and on which cultural material would be buried during a succeed-

ing lacustral advance.

M. J. Rogers and Campbell collected a fairly large number of artifacts from this site area (Rogers n.d.; Campbell n.d.), which we designated Bench Mark Bay, and additional material was collected by the authors. The following discussion includes only the data that relate directly to the problem of dating cultural remains. Neither Rogers' nor Campbell's collections are discussed here.

Bench Mark Bay is on the northwest shore of Lake Mohave. It is about 450 m. long and about 100 m. wide. Wave cut cliffs are present on the sides of the bay where the slope is steep and are particularly well developed on the headlands at the mouth of the bay. A long sloping beach with its uppermost elevation about 287.1 m. (942 ft.) curves around the head of the bay. This surface has been in part destroyed by a road. At the head of the bay on the beach slope is a boulder alignment extending from 282.5 m. (927 ft.) to 281.9 m. (925 ft.) elevation. Adjacent to this alignment, a unit was excavated to a depth of 60 cm. (2 ft.). A typical offshore silty sand with varying amounts of caliche cement is present throughout the deposits. At a depth of 15 to 40 cm. (0.5 to 1.3 ft.) below the surface four man-made flakes and one artifact were found. Enough *Anodonta* (freshwater mussel) shell was also recovered to provide a radiocarbon date.

Nineteen units varying in elevation from beach deposits at 282.2 m. (926 ft.) elevation to the colluvial deposits above the high beach line at 288.3 m. (946 ft.) were excavated. Fourteen of these units yielded cultural material, primarily flakes, from the surface to a depth of 60 cm. (Fig. 1). The vertical and horizontal distribution of the flakes suggest the age of occupations at this site (Fig. 2).

The evidence and interpretation are:

1. The high portion of the beach, at about 287.1 m. (942 ft.) is now a deflated surface exhibiting a thin layer of desert pavement but containing flakes and occasional artifacts to a depth of 15 cm.

2. On the lower portion of the beach at 281.9-282.5 m. (925-927 ft.) is an alignment of rocks; a few flakes and artifacts were recovered from the surface in this area.

3. The deposit exposed through excavation at the 282.2 m. (926 ft.) elevation is a typical offshore silty sand. This interpretation of the deposit at the 282.2 m. (926 ft.) elevation was substantiated when a windstorm etched the side wall of the excavation, removing the fine sediments from a series of siphon holes left by shellfish leading from the *present surface* to a depth of approximately 60 cm. In the bottom of one of these, exposed in the side wall, were the articulated shells of an *Anodonta* (Fig. 3).

4. From the original test unit (at 282.2 m. [926 ft.] elevation), a flake, unifacially worked to a narrow tip at one end, was recovered at a depth of 39 cm. Additional flakes were recovered between 30 and 39 cm. depth. Flakes were also recovered between 15 and 30 cm. in six units at low elevations on the beach. All these flakes and the single artifact were clearly buried in the offshore sediments between the surface where the syphon hole began and the *Anodonta* shells at 60 cm. depth. These flakes and the artifact must therefore predate the time of the high lake in which the *Anodonta* lived (Fig. 2).

5. A radiocarbon assay of *Anodonta* shell collected at a depth of 15 to 45 cm. in the original test unit dated 10,270 ± 160 radiocarbon years ago: 8320 B.C. (Y-2406). These *Anodonta* shell fragments were collected while excavating and could represent a mixture of broken shells laid down at the time of occupation of the area and *Anodonta* that had burrowed to that depth from the surface sometime *after* the occupation. While the date may not represent the exact time of occupation, it provides a youngest possible date for the artifact emplacement. The occupation represented by this cultural material occurred at least as early as 8000 B.C. and possibly earlier.

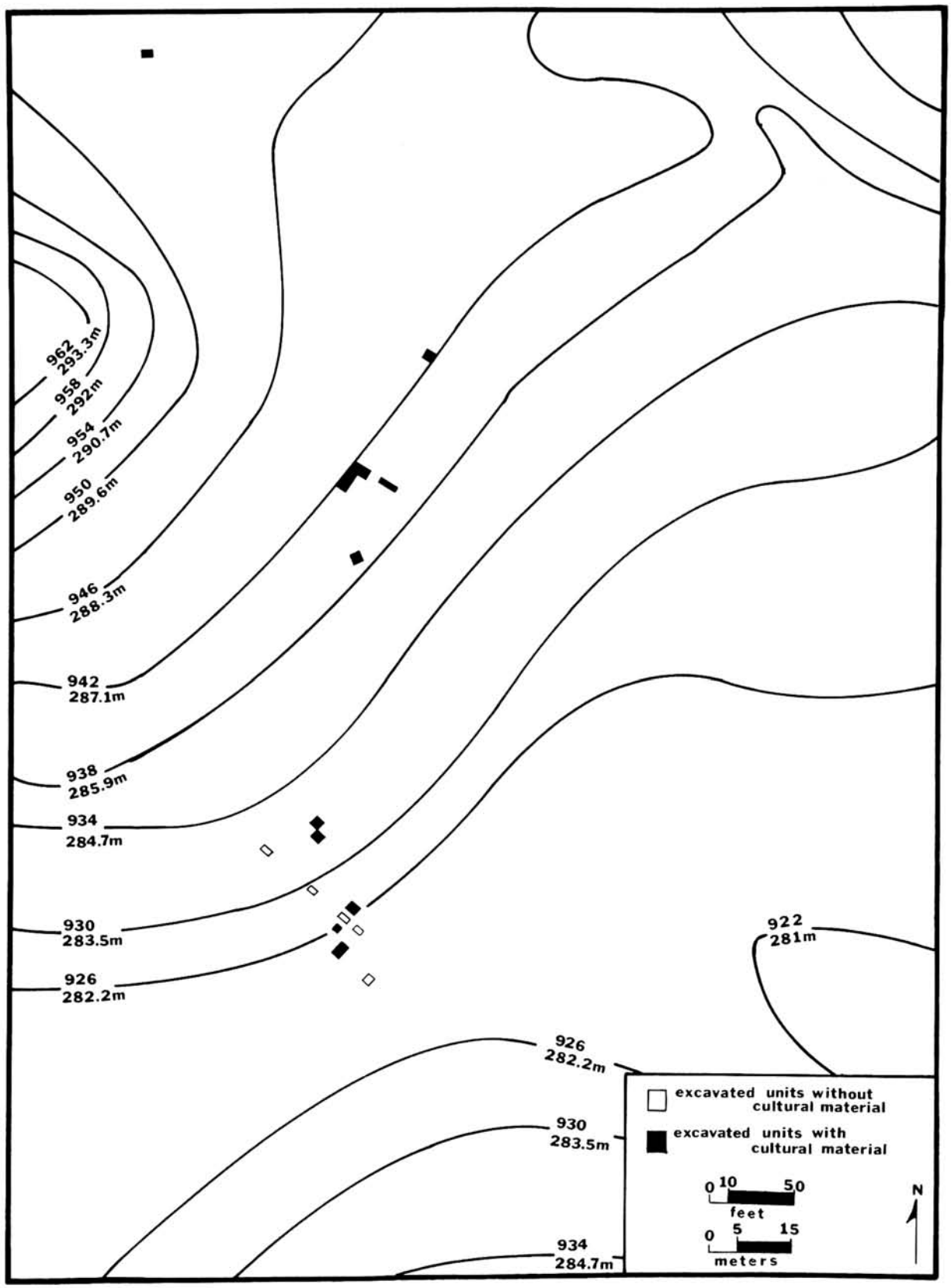

Fig. 1. Map of Bench Mark Bay showing excavation units.

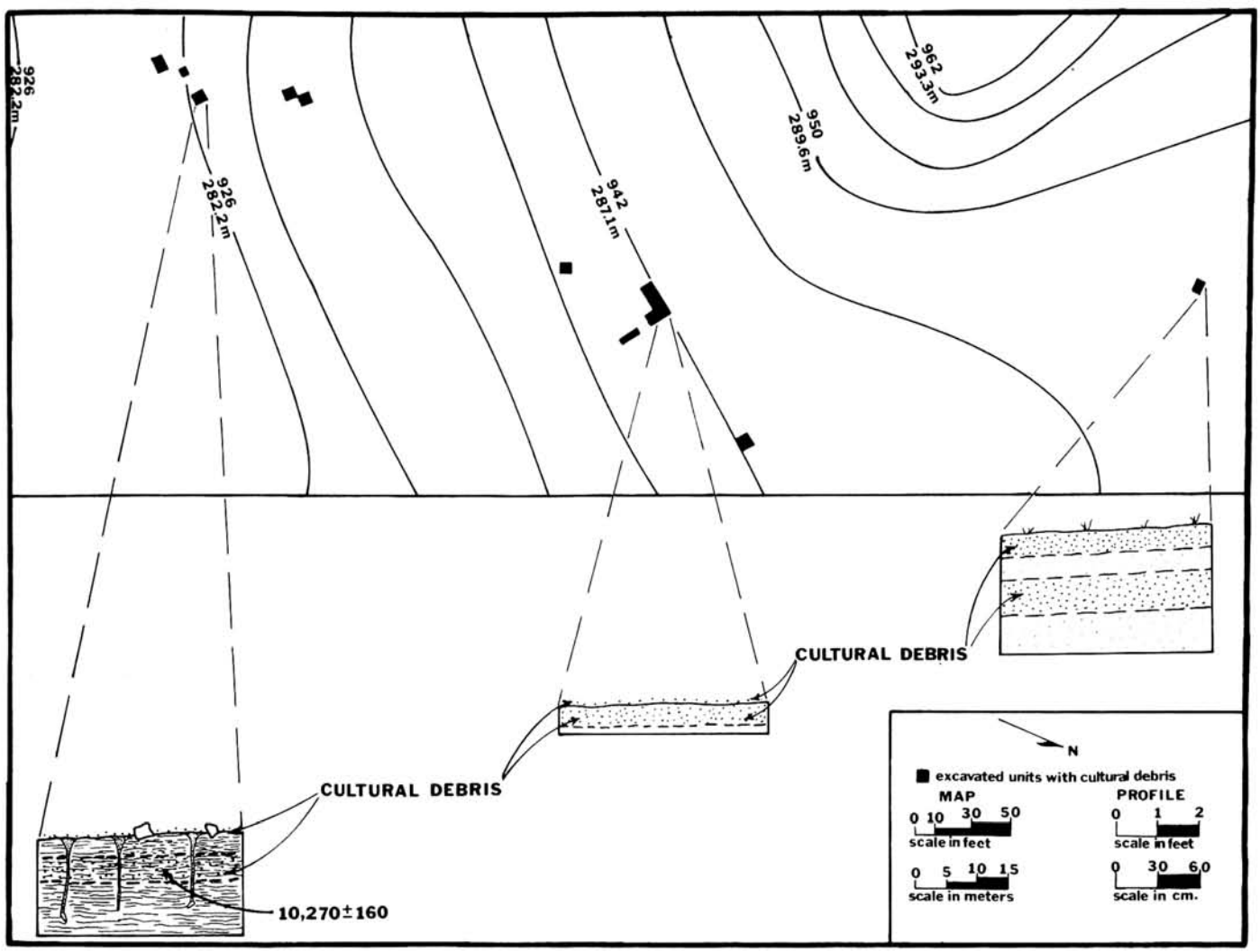

Fig. 2. Map of excavation units with selected profiles illustrating postulated stratigraphic relationships.

A second occupation at the 282.2 m. (926 ft.) elevation of the beach is represented by the rock alignment and a few artifacts and flakes from the surface. While these cannot be dated, ten other rock alignments nearby at the 280.4-281.6 m. (920-924 ft.) level suggest that they were constructed at a time when the lake was at or near that level. A date of approximately 6000 B.C. is suggested on the basis of lake chronology (Ore and Warren 1971).

Excavation units were placed in the high beach at 287.1 m. (942 ft.) elevation in search of buried artifacts. These units were excavated in 7.5 cm. (3 in.) levels to a depth of 15 cm. (6 in.). In addition to a large number of flakes, three units yielded small fragments of bone and two units yielded three artifacts. All bone and the three artifacts were found between 7.5 and 15 cm. depth. In all cases, the artifacts were clearly buried in a beach deposit containing other cultural materials. While the age cannot be demonstrated by direct dating at this time, it appears that the deposits date from the high lake stand of about 8000 B.C. The artifacts enclosed within these deposits should have approximately the same or greater age.

Finally, a unit was placed above the elevation of the highest lake level in a gently sloping area covered with sediments apparently derived from a nearby slope. Flakes and bone fragments were found in two levels separated by a sterile intervening level. The uppermost

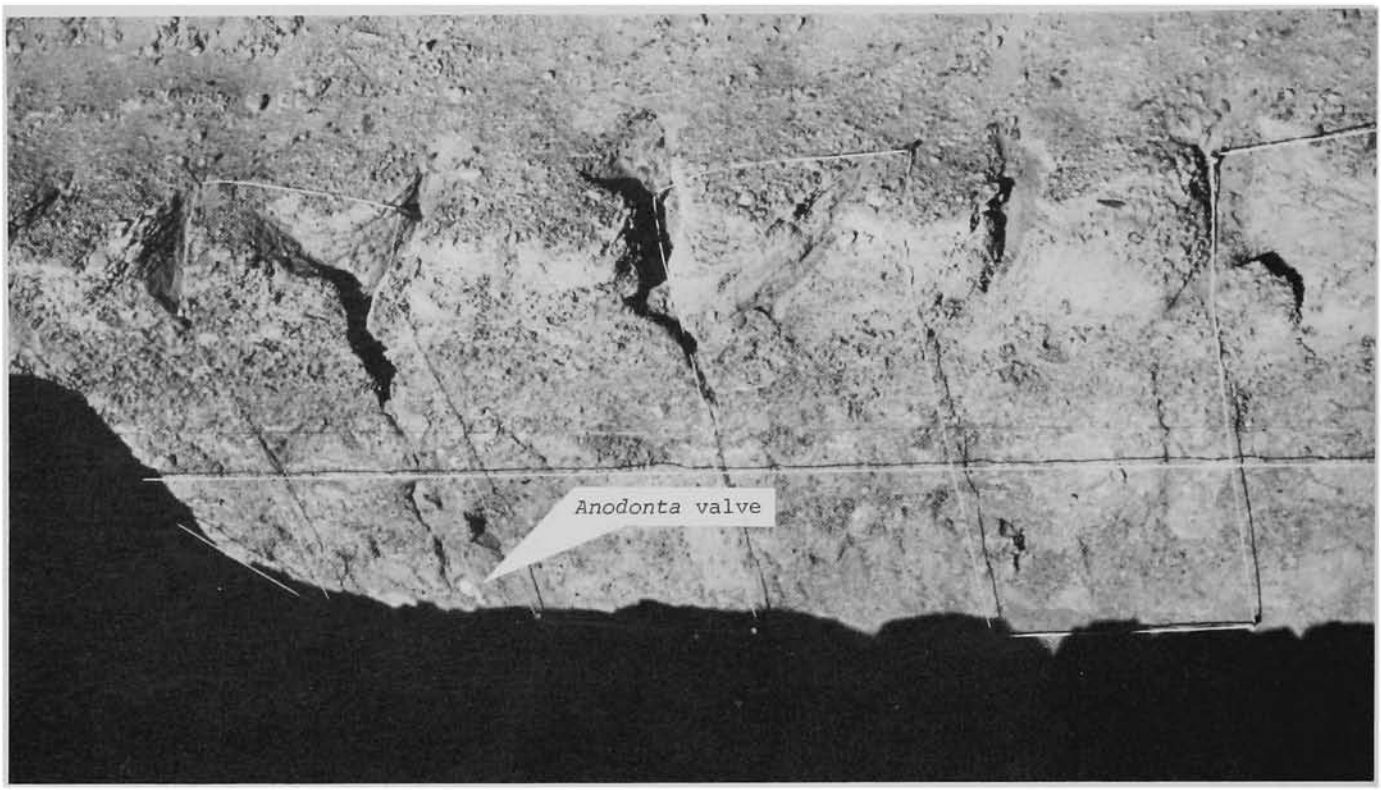

Fig. 3. Photo of profile of excavation unit at 282.2 m. (926 ft.) elevation illustrating *Anodonta* with syphon leading to surface.

level containing cultural material was found near the surface (0-15 cm.) while the second was nearly a foot thick at 30 to 60 cm. depth.

The artifacts recovered from the excavation at the 287.1 m. (942 ft.) elevation suggest some antiquity. These artifacts are three implements classified as engraving tools (however, two probably served several functions) and a single projectile point base.

Graver No. 1 (Fig. 4*a*) is made on a long flake, with the bulb of percussion at one end. The only modification is the removal of a series of small flakes at the end opposite the bulb of percussion, producing a small sharp point. This artifact was found at a depth of 39 cm. buried in beach deposits in the original test unit. This unit was placed low on the regressive beach at an elevation of 282.2 m. (926 ft.). The graver measures 57 x 34 x 7 mm.

Graver No. 2 (Fig. 4*c*) is a fragment of a unifacially worked flake with two small sharp points and a broad point with squared end. This may have been a multipurpose tool with a concave edge serving as a spokeshave and the small sharp point on an excurvate edge serving as a scraping or engraving edge. This implement appears to be slightly sandblasted and may have been exposed on the surface at some time in the past. It measures 30 x 18 (inc.) x 4 mm.

Graver No. 3 (Fig. 4*b*) is a side-struck flake, tear-drop shaped in outline and plano-convex in cross section. A series of four evenly spaced points are located across the broad end. The two edges of the pointed end are unifacially flaked on opposite faces to form a sharp drill-like point. This implement exhibits no sandblasting or water wear and presumably was buried soon after being discarded. It appears to be a specialized engraving or scraping tool as well as a drill. It measures 50 x 32 x 8 mm.

The projectile point base (Fig. 4*d*) exhibits well-controlled flaking. Flake scars are gener-

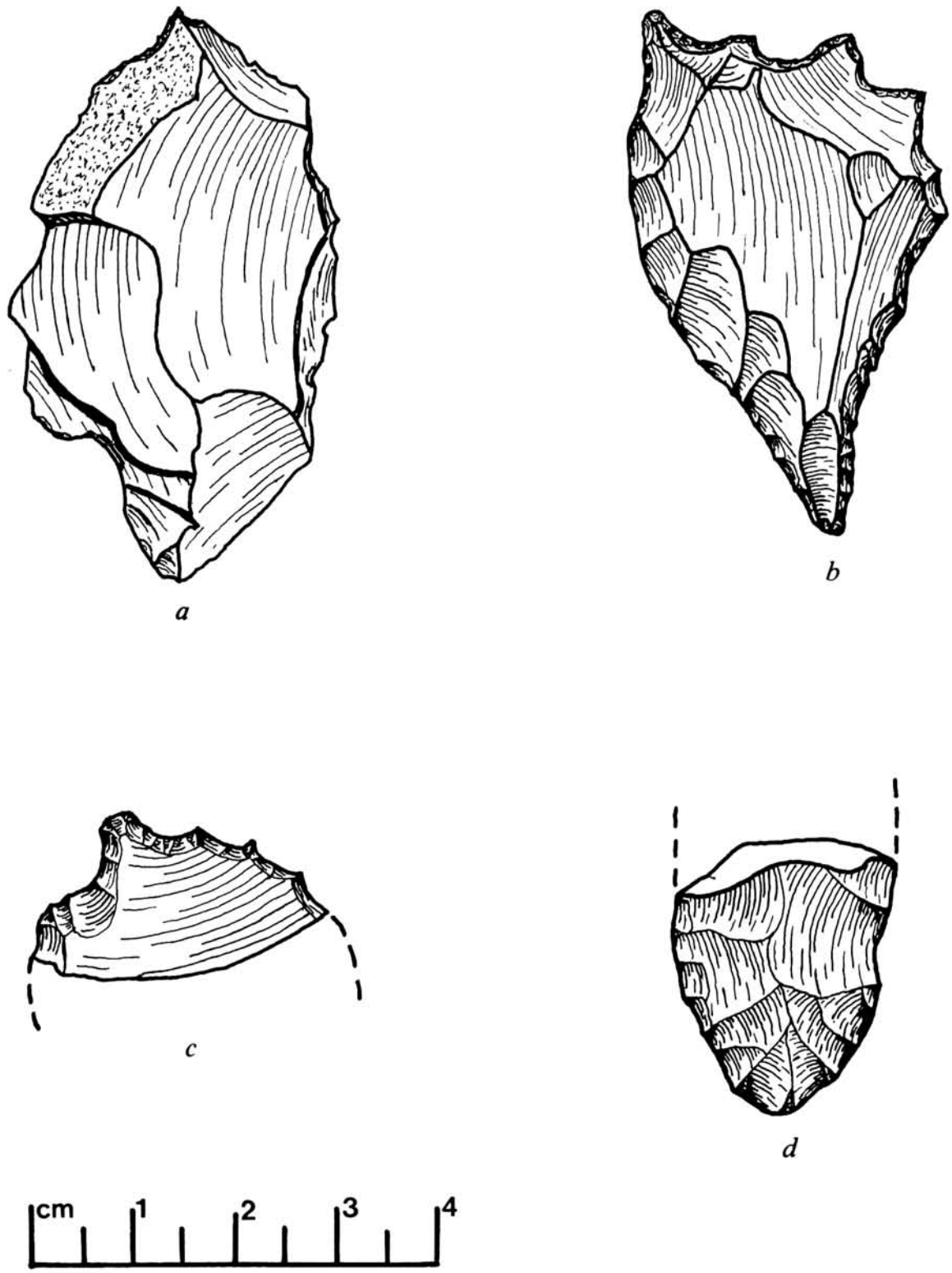

Fig. 4. Artifacts recovered from excavations at Bench Mark Bay. *a*, *b*, and *c* are engraving tools; *d* is base of projectile point.

ally broad and shallow with finer retouching limited to small portions of the edges. Cross-section is lenticular and the edges have been slightly smoothed near the break. This point fragment has a width of 22 mm. and a thickness of 6 mm.

Although the few artifacts recovered and discussed here are an inadequate sample for comparative study, it should be noted that these types of gravers and leaf-shaped points are common in the material reported by Campbell *et al.* (1937) for Lake Mohave sites. Similar gravers have also been reported for sites on old beach lines of Lake Tonopah (Campbell 1949) and Lake Lahonton (Warren and Ranere 1968; Tuohy 1970).

The three artifacts from the excavation at the 287.1 m. (942 ft.) beach line suggest an ancient occupation. However, it is not possible at this time to determine if any or all of them have been buried during a later higher water stand after they were left by their makers. The shallowness of the deposit might suggest that they all be considered surface finds. This is especially true of graver No. 2, which exhibits sandblasting. This sandblasting could have occurred at any time the beach was exposed and does not indicate that it was buried only recently. Graver No. 3 exhibits no sandblasting and appears to have been buried soon after it was discarded. The sample of flakes recovered from the same excavation unit also exhibits this same phenomenon: some are sandblasted and some are not. The presence of small bone fragments and relatively large numbers of flakes from the top six inches suggests a midden deposit that has been deflated.

The vertical and horizontal distribution of cultural debris indicate that occupation of the site occurred at two different times. The excavated units low on the beach at 282.2 m. (926 ft.) and above the highest beach level at 288.3 m. (946 ft.) provide stratigraphic evidence of vertical separation of cultural deposits. The excavations in the high beach at 287.1 m. (942 ft.) level provide evidence of only one cultural deposit in the upper 15 cm. This suggests that the two occupations have been compressed by deflation into what is today a single deposit. The radiocarbon date from the 282.2 m. (926 ft.) level and the lake chronology suggest a considerable age for both of these occupations.

An early date of at least 8000 B.C. can be assigned to the deposits which enclosed the graver and flakes buried at the 282.2 m. (926 ft.) beach level. This same date for cultural material enclosed in the deposits at the 287.1 m. (942 ft.) beach level is consistent with the lake chronology outlined by Ore and Warren (1971). The lowest level of cultural debris at the 282.2 m. (926 ft.) and 288.3 m. (946 ft.) elevations may represent the same occupation. This occupation probably is also represented on the 287.1 m. (942 ft.) beach where deflation has compressed the two occupations so that they cannot now be separated stratigraphically. This interpretation is possible if the lower elevation was occupied during seasonally low water. However, if the debris buried at the lower elevation represents occupation during a lower lake stand, then the occupation of the high beach could date to an earlier period, perhaps as early as 11,000 B.C.

The rock alignments and cultural debris at 282.2 m. (926 ft.) to 280.4 m. (920 ft.) appear to be associated with a lower lake stand with a suggested date of 6000 B.C. The upper level of occupation at the 288.3 m. (946 ft.) elevation may also date from this time. If this is so this occupation may also have contributed debris to the deflated deposits at the 287.1 m. (942 ft.) beach line.

In this paper, we have attempted to illustrate a research design for solving a particular problem of dating that should be applicable to solving similar problems in the California deserts and elsewhere. In performing this research, we think that we have demonstrated that cultural material occurs enclosed in lake

deposits dated at 10,270 ± 160 radiocarbon years before the present and that man was inhabiting the shores of Lake Mohave by at least 8000 B.C.

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