IMP-6427, A LAKE CAHUILLA SHELL BEAD MANUFACTURING SITE

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ABSTRACT

Data recovered from Caltrans' excavations at IMP-6427, a ca. A.D. 1660 site located along a former Lake Cahuilla shoreline, suggest the inhabitants made their own shell beads and ornaments, which makes this the first documented case of Native American *manufacture* of shell beads and ornaments at a Colorado Desert site. The artifact types suggest an affiliation in shell use tied to Kumeyaay and Southwestern cultures to the west, south, and east. The analysis has also indicated the need for a reliable bead chronology for this part of southern California, as the typology/ chronology developed by Chester King for the Santa Barbara Channel does not appear applicable to sites in interior southern California south of Cahuilla territory.

INTRODUCTION

A sample of 1101 shell fragments, weighing 143g, was analyzed. The sample includes whole, unmodified shell from both marine and freshwater environments, and modified specimens, including beads and ornaments, made from marine species. The sample comes from prehistoric archaeological site IMP-6427, located in central Imperial County, on the west side of the Salton Sea, a few miles from Kane Spring (Figure 1). Prior to the time when the site was occupied, an infilling of the Salton Trough had occurred. The site existed along a remnant shoreline of what was known as prehistoric Lake Cahuilla, at an elevation approximately 180 feet below sea level. Based on other dating sources presented in Don Laylander's paper (this volume; cf. also Laylander 1994), it is believed IMP-6427 was occupied around A.D. 1660.

The objectives of this analysis were to:

(1) identify the types of beads and ornaments recovered;
(2) identify the shell species used;
(3) determine the chronological placement of the site as indicated by time-sensitive shell artifacts;
(4) determine how the shell was acquired by the site inhabitants;
(5) confirm whether manufacturing of the artifacts took place at the site or elsewhere;
(6) review the ethnographic uses of shell by Native American peoples living in the region;
(7) discuss the sociopolitical implications of the shell assemblage; and,
(8) compare the IMP-6427 shell collection with other desert site assemblages.

Due to space limitations, this paper will concentrate on the *Olivella* spp. remains, on their analysis, chronological sensitivity, and manufacture. Those interested in my discussion of acquisition, ethnographic uses of shell, sociopolitical implications, and archaeological case studies, will have to read the final site report (Rosen 1994).

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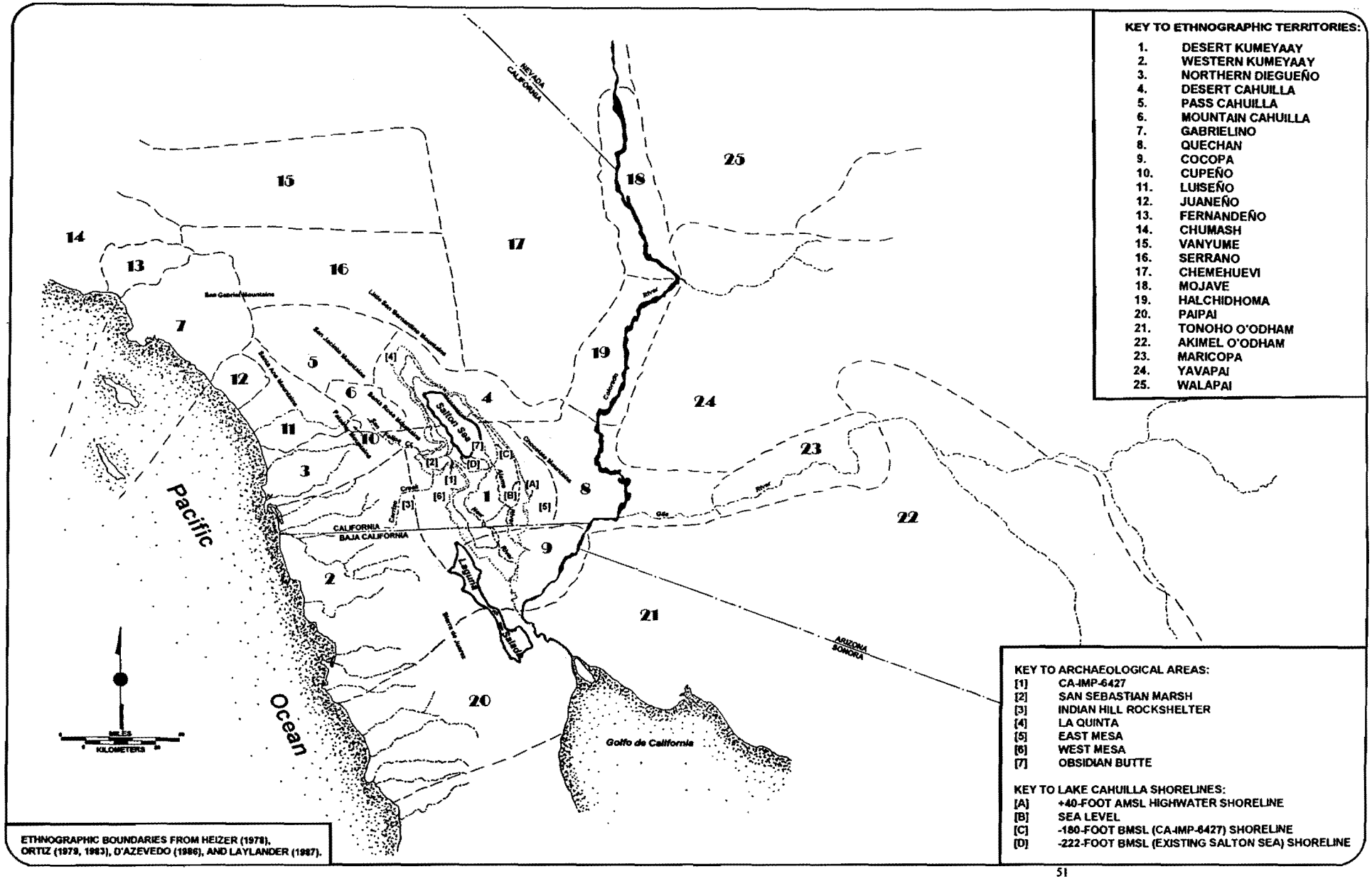

Figure 1. Regional area map.

ANALYSIS

The shell collection was recovered in the field from the site's surface and from unit and shovel test excavations. It was brought back to the Caltrans archaeology laboratory in San Diego for cleaning and analysis. The shell was lightly rinsed in water and allowed to air dry; specimens were not brushed or scrubbed.

Identifications were made using comparative collections owned by the author and those housed at the San Diego Natural History Museum. Additional help during the identification process was provided by curators Tom Demere and Crystal Bingham of the San Diego Natural History Museum, and by Kim Hutsell, shell curator at the Silver Sea shop in Old Town, San Diego.

Additionally, many studies were consulted that deal with various aspects of the *Olivella* genus, including those related to species identificaidentification (Mitchell 1992; Silsbee 1958), replicative experimentation (Hampson 1970; Macko 1978, 1983, 1984), conchological studies (Abbott and Haderlie 1980; Abbott 1974; Brusca 1980; Keen 1971; Olsson 1956), and specific archaeological case studies (Erlandson 1988; Gamble 1991; Gerow 1974; C. King 1991; L. King 1969). Table 1 lists those species identified in the IMP-6427 assemblage, and includes information on the geographical occurrences of species.

Tables 2 and 3 summarize the results of the analysis. All specimens were weighed, and modified specimens were measured. Weights were taken in grams, and accomplished with the use of a "Mettler H4" scale, capable of accuracy to a thousandth of a gram. Measurements were read with a standard slide caliper with accuracy to a tenth of a millimeter. The measurements include: maximum length by width by hole diameter for disc-like beads; maximum length by diameter for spire-removed beads; and maximum length by width by thickness for other modified shells.

The shell from the site can be divided into freshwater and marine components. There was no evidence to indicate that any of the freshwater shells in this assemblage were utilized for food (cf. Wilke 1978:40), and most are believed to be natural *in situ* occurrences.

Included among the non-*Olivella* sp. shells from the Elmore Site are a variety of forms and species, some exhibiting modification into bead or ornament forms, while others may have served as food and/or utilitarian items. The quantity and variety of species from IMP-6427 are greater than that reported from any other site in the Salton Trough. The species come from both the Gulf of California and from the Pacific Coast. They were definitely used for ornamentation and tools, and it is reasonable to assume that the larger species, like *Laevicardium elatum*, may have been used for food, although no specific evidence was found to confirm this.

The *Olivella* spp. assemblage from IMP-6427 includes both ornaments and detritus (bead manufacturing waste by-products).

RESULTS

The beads were classified using typologies developed by Bennyhoff and Hughes (1987) for *Olivella* sp. artifacts, and by Gifford (1947) for all others. Lillard et al.'s (1939) and Beardsley's (1954) nomenclatures were not used. Only the *Olivella* spp. findings are discussed below. Refer to Figure 2 for *Olivella* sp. shell morphology and terminology.

Bead Types

Type A1 (Bennyhoff and Hughes 1987:116)
(Gifford's [1947:10] Type F5)
Olivella sp. simple spire-removed bead - 17 specimens (Figure 3)

These are both *O. biplicata* and *O. dama* shells which have had their spire removed by punching. The outer lip was then chipped in some cases to further enlarge the opening to allow for threading, and then smoothed through grinding and/or polishing. The type is further divided based on the diameter of the shell:

TABLE 1

SHELL SPECIES IDENTIFIED FROM IMP-6427*

Species (Common Name)	Quantity % Total	Weight(g) % Total	Habitat
Anodonta dejecta (Freshwater Clam)	729 66.21	12.25 8.57	Freshwater species, sandy/muddy bottoms, depth from 3-5 feet; range: unknown
Cerithidea californica (California Horn Shell)	1 .09	.078 .05	Abundant on mud at high tidal level in back bays and estuaries; range: Bolinas Bay, California, to San Ignacio Lagoon, central Baja California
Conus californicus (California Cone Shell)	3 .27	2.209 1.55	Common on rocky and sandy bottoms from low water to 100 feet; range: Farallon Islands, California, to Magdalena Bay, so. Baja California
Cooperella subdiaphana	8 .73	2.267 1.59	Fairly common, shallow burrower in muddy areas of bays and on off-shore mud bottoms; range: Queen Charlotte Islands, British Columbia, to the Gulf of California
Cypraea spadicea (Chestnut Cowry)	2 .18	4.737 3.31	Fairly common in the sublittoral zone, especially under overhung rock ledges; range: Monterey, California, to Cedros Island, central Baja California
Fissurellidae (com. Fissurella volcano) (Volcano Limpet)	1 .09	.218 .15	Intertidal species, most common at mid-tide level on the undersurfaces of boulders; range: Crescent City, California, to Magdalena Bay, so. Baja California
Haliotis sp. (Abalone)	1 .09	.708 .50	Intertidal to sublittoral, to depths over 80 feet on the undersurfaces of rocks, or in crevices; range: Point Conception, California, to southern Baja California
Laevicardium elatum (Giant Egg Cockle)	22 2.0	80.642 56.43	Common on sand bottoms or sloping banks at low tide in bays and offshore; range: Mugu Bay, California, to so. Baja California
Olivella biplicata (Purple Olive)	7 .64	1.105 .77	Common at lagoon entrances and protected sandy areas of open coast at low tide, abundant in shallow water offshore along ex-posed sandy beaches; range: Vancouver Island, British Columbia, to Magdalena Bay, so. Baja California
Olivella dama (Dama Olive)	23 2.09	5.526 3.87	Found in shallow water on the outer sides of sandspits; range: head Gulf of California, to Mazatlan, Sinaloa
Olivella sp.	198 17.98	15.640 10.94	[cf. *O. biplicata* & *O. dama*]
Pectinidae (cf. *Argopecten aequisulcatus*, Speckled Scallop)	4 .36	.991 .69	Occurs on sandy/muddy bottoms of bays and lagoons below low tide level; range: Santa Barbara, California, to southern Baja California
Rangia leconti	1 .09	3.286 2.30	Freshwater species, found along former shorelines of Lake Cahuilla; range: unknown
Unidentified Oyster	30 2.54	1.349 .76	Usually found in bays, attached to rocks or oyster shell on mud flats
Unidentified other	73 6.63	12.151 8.50	
TOTAL	1,103	143.157	

*If no common name is given, then one is not recognized in the scientific literature. Shellfish habitats are from Bowersox (1972), Keen (1971), McLean (1978), and Morris (1966).

TABLE 2

SUMMARY OF NON-*OLIVELLA* SHELL ORNAMENTS AND UNMODIFIED MARINE SHELL FROM IMP-6427	
Type	Quantity
Cerithidea californica, unmodified	1
Conus californicus, bead	3
Cooperella subdiaphana, ornament	5
Cooperella subdiaphana, unmodified	3
Cypraea spadicea, unmodified	2
Fissurella volcano, unmodified	1
Haliotis sp., ornament	1
Laevicardium elatum, tool	4
Laevicardium elatum, unmodified	18
Pecten diegensis or *Argopecten aequisulcatus*, unmodified	4
Rangia leconti, unmodified	1
Unidentified clam, unmodified	9
Unidentified cockle, unmodified	12
Unidentified gastropod, ornament	1
Unidentified gastropod or clam, ornament	1
Unidentified mother-of-pearl-like shell, ornament	1
Unidentified mother-of-pearl-like shell, unmodified	1
Unidentified shell, unmodified	48
TOTAL	116

TABLE 3

SUMMARY OF *OLIVELLA* SPP. SPECIMENS FROM IMP-6427	
Type	Quantity
Olivella dama spire-removed bead	14
O. dama barrel bead	2
O. dama detritus: canal	5
O. dama detritus: columella	2
Olivella biplicata spire-lopped bead	3
O. biplicata detritus: canal	4
Olivella sp. barrel bead (cf. *O. biplicata*)	30
Olivella sp. spire-removed or barrel bead	9
Olivella sp. tiny saucer bead	2
Olivella sp. detritus: canal	80
Olivella sp. detritus: wall	64
Olivella sp. detritus: wall w/lip	10
Olivella sp. detritus: columella	4
TOTAL	229

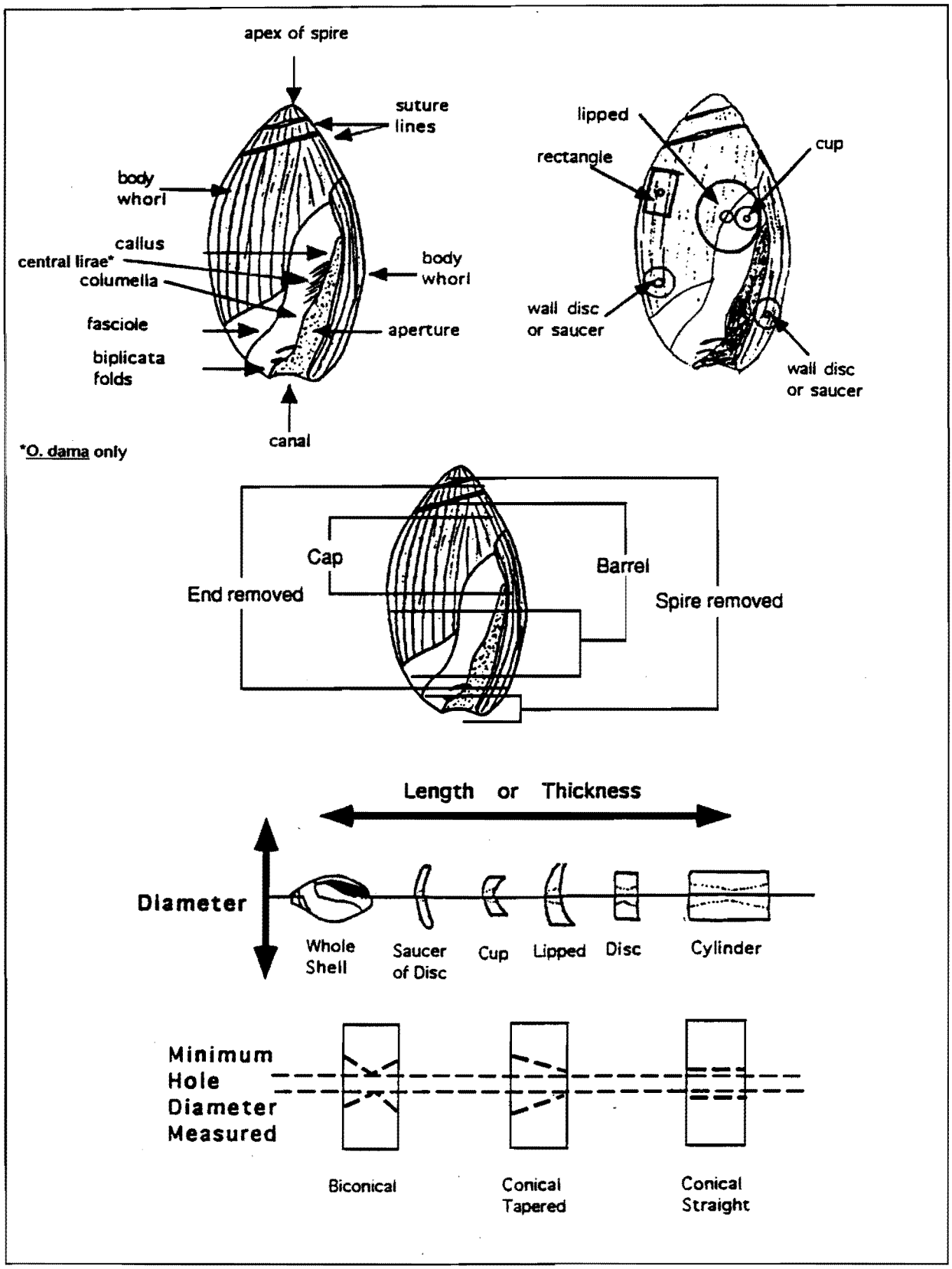

Figure 2. The *Olivella* sp. shell, showing morphology, terminology, and measurements used in bead analysis (after Gibson 1992:7,25).

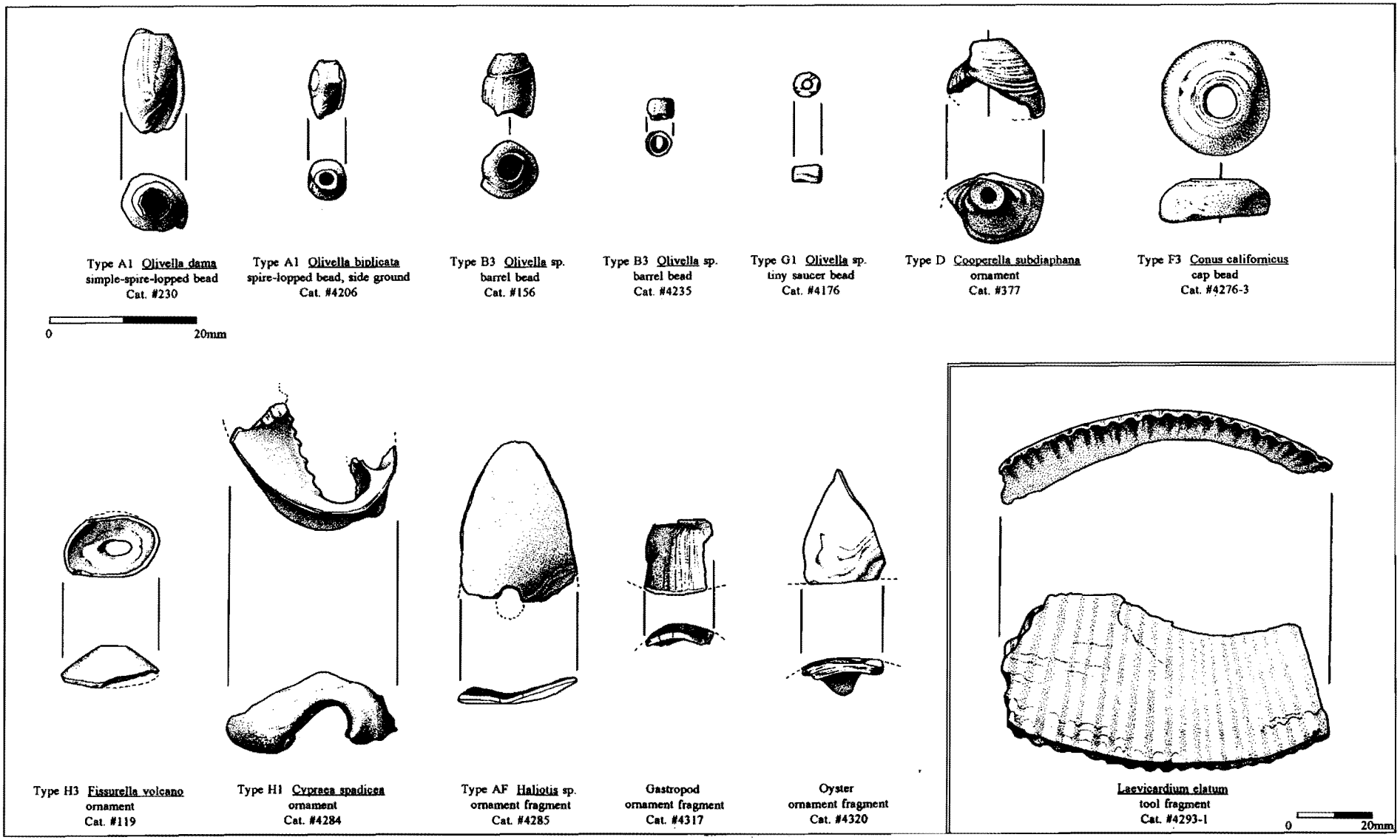

Figure 3. Shell artifact illustrations.
[*Olivella* sp. type numbers from Bennyhoff and Hughes (1987); other type numbers from Gifford (1947)]

Type A1a - Small spire-removed, diameter 3.0-6.5mm

O. biplicata - 3 specimens

O. dama - 11 specimens

Type A1b - Medium spire-removed, diameter 6.51-9.5mm

O. dama - 3 specimens

One rather remarkable specimen is ground on both sides opposite the shell's aperture. Bennyhoff and Hughes (1987:121) only consider side-grinding in relation to the aperture, not opposite it, i.e., their Type B1. There is also nothing in Gifford (1947), Gibson (1976, 1992), or King (1981) that compares to this specimen.

Type B3 (Bennyhoff and Hughes 1987:122)
(Gifford's [1947:11] Type G1a)
Olivella sp. barrel bead - 32 specimens (Figure 3)

These are also various *Olivella* specimens that have had portions of both the spire and canal ends removed. The bead's largest diameter is at its middle. The folds at the base of the columella have been removed. The spire end is removed and finished as with spire-removed beads. The canal (distal) end is similarly removed through punching, chipping, grinding, and then finished through grinding, smoothing, and polishing. Three size variations are recognized, based on shell diameter:

Type B3a - Small barrel, diameter 3.0-6.5mm

O. dama - 2 specimens

Olivella sp. - 20 specimens

Type B3b - Medium barrel, diameter 6.51-9.5mm

Olivella sp. - 4 specimens

Type B3 - Barrel (too fragmentary to measure diameter)

Olivella sp. - 6 specimens

Worth noting are two specimens that are obliquely ground at their proximal ends. While obliquely ground spire-removed beads are discussed by Bennyhoff and Hughes (1987:19), their Type A2, they do not mention obliquely ground barrel beads.

Type A or B (Bennyhoff and Hughes 1987)
Olivella sp. spire-removed or barrel bead - 9 specimens

These are beads that either broke during manufacture or during use and were discarded. Either way, they are too fragmentary to classify further.

Type G1 (Bennyhoff and Hughes 1987:132)
(Gifford's [1947:35] Type X3bI)
Olivella sp. tiny saucer bead - 2 specimens (Figure 3)

These are circular beads made from the wall of the main body whorl with a central perforation, usually conically drilled from the interior with exterior retouch. The edges are ground, the diameter is between 2.0 and 5.0mm, and the perforation diameter is between 0.8 and 2.0mm.

Detritus
Olivella spp. - 169 specimens

These represent the by-products of *Olivella* bead manufacture. Only seven of the pieces contained enough diagnostic information to be speciated to *O. dama*. None of the pieces exhibit modification to indicate they are bead fragments. Most canals show battering on their distal ends from the spire-removing process. *Olivella* sp. was not a food species, but was used throughout western North America for ornamentation, money beads, and in the maintenance of sociopolitical systems. Consequently, even though the pieces in this category may not show diagnostic modification themselves, there can be little doubt that they do represent intentional use of this genus at IMP-6427.

CHRONOLOGY

Some of the bead types are chronologically sensitive, but most are not. The most complete chronology for California shell beads and ornaments has been developed by Chester King (1981), and deals with Santa Barbara Channel region specimens. Other studies have dealt with this topic, but with areas too far removed from the Salton Trough to be considered relevant for the present study (cf. Beardsley 1948; Bennyhoff and Heizer 1958; Bennyhoff and Hughes 1987; Lillard et al. 1939).

The most numerous *Olivella* spp. beads from IMP-6427, the barrel and spire-removed, are also the least time sensitive. These types occur throughout prehistoric California and in all time periods, although they were definitely more numerous in earlier period sites along the Santa Barbara Channel coastline. From work the author has completed elsewhere (Rosen 1978:40, 1980:249, 1987:59-60), it appears that the spire-removed bead has been found in California contexts from 6000 B.C. to A.D. 1800 (Gibson 1973, 1975a, 1975b, 1976; King n.d., 1981; Elsasser 1978). The site's second-most numerous bead type, the end ground or barrel, also occurs throughout most time periods from 6000 B.C. to A.D. 1800 (Gibson 1992). Both types have also been widely found throughout western Nevada, Arizona, and northern Baja California (Bennyhoff and Heizer 1958; Bennyhoff and Hughes 1987; Haury 1976; Jernigan 1978).

The *Olivella* sp. tiny saucer beads occur in the Santa Barbara Channel area from roughly 600 B.C. to A.D. 1780 (Gibson 1992:30).

Based on King's Santa Barbara Channel bead chronology, IMP-6427 falls into phases L2a and L2b, which date to A.D. 1500-1650 and A.D. 1650-1782, respectively (King 1981:47). The radiocarbon dates obtained from the site correspond to these phases.

Olivella sp. spire-removed beads constituted the most numerous type during all early period phases; they were also the dominant type during middle period phase M1. Bennyhoff and Heizer (1987:63) discussed their occurrence at Leonard Rock Shelter in Nevada as being the earliest dated beads from the Great Basin (6000-7000 B.P.), and postulated that they came from southern California. The type was used throughout central and southern California and in the Great Basin. [King 1981:173-175, 352]

Olivella sp. spire-and-base-removed barrel beads were the dominant type during phases Ey (4500-2400 B.C.) and Ez (2400-1400 B.C.) (King 1981:47, 352).

King (1981:174) stated that "...the removal of increasingly larger portions of the shell indicates an increase in the use of olivella shells in economic as opposed to political contexts." Apparently, the beads were usually strung end to end, and King (1981:281) noted that "...beads made by removing shell spires were not used in large numbers during the Late Period", and that "...Late Period olivella spire ground and spire and base ground beads have usually been found in lots containing large quantities of other beads and ornaments."

King (1981:283) has reported that:

> Olivella spire removed and spire and base removed beads were used throughout Central and Southern California during the Late Period. Their frequency in relationship to olivella cupped, olivella wall, mussel shell, and other common beads is similar to their frequency in the Santa Barbara Channel. In Southern California they have been found as far south as Aliso Creek in Orange County, to the southeast in the Coachella Valley in Riverside County, and to the east in the Antelope Valley and on the Mojave River.

In actuality, finds of these types have been made in the Great Basin, from Imperial and San Diego Counties, throughout the greater Southwest, and northern Baja California.

King (1981:352, Graph 1) shows the frequencies of common whole-shell bead types (punched, abraded, chipped) from phases Ex to L1a. *Olivella* sp. spire-removed constitute the majority during phases Ex (6000-4500 B.C.) and M1 (1400-800B.C.), while spire and base removed are most numerous during phases Ey (4500-2400 B.C.) and Ez (2400-1400 B.C.). Thereafter, both types become significantly reduced in the Santa Barbara Channel region, being present throughout, but never in large proportions.

Olivella sp. spire-and-base-removed types do make somewhat of a comeback during phases M3 (A.D. 300-700), M5b (A.D. 1000-1050), M5c (A.D. 1050-1150), and L1a (A.D. 1150-1250), while spire-removed beads increase slightly during

phase M3 (A.D. 300-700).

It would seem that bead chronologies based on the Santa Barbara Channel are not satisfactory for the inland desert regions. Beads found in desert sites in late contexts are routinely those types found most often in early contexts along the coast. This author believes that among the Yuman groups of lower Alta California and northern Baja California, shell beads were used primarily for ornamentation and in socio-political contexts. Their use among in most of coastal and central valley California for money seems not to have extended south beyond Cahuilla territory.

MANUFACTURING

The ethnographic literature is hardly overwhelming when it comes to descriptions of southern Californian, Great Basin, and Southwestern Native American uses of shell uses not related to food. Some works deal with the subject on a Pan-American scale (cf. Orchard 1975), while others discuss uses in southern California (cf. King 1978), or the American Southwest (cf. Jernigan 1978). Invariably, ethnographic accounts mention the use of shell for various purposes, but almost never discuss which species were utilized or how they were acquired. Most Colorado Desert Native American informants state they did not have the knowledge to make items out of shell, that the products were acquired already finished (Drucker 1937; Gifford 1931; Spier 1933; Wilke 1978). Certainly, the archaeological literature for southern California desert sites supports this contention since finished shell objects far outnumber detritus or unmodified shell fragments. While some authors have suggested that some forms of shell artifacts may have been made locally, not one single account for a bead manufacturing locus could be found for the entire Colorado Desert region. It may be that previous studies did not separate out bead detritus from general shell faunal remains. It is also possible, and this author believes probable, that IMP-6427 represents unique archaeological finds, and is an actual shell bead manufacturing site in the Colorado Desert.

While specimens of almost every identified shell species from the site exhibited modification, the detritus from some species does not exhibit manufacturing scars. Most of these species are represented by quantities of shell too small to draw any conclusions about manufacturing at the site. Only *Olivella* sp. occurs in quantities large enough to give meaningful results. Of 345 shell pieces brought to the site for ornamental and/or consumptive purposes, 229 are *Olivella* sp. Of these, 60 are either complete beads or bead fragments, while the remaining 169 pieces are manufacturing detritus. To state with conviction that these remains are manufacturing debris and not just broken beads, the author looked at the patterning of the broken fragments, and any manufacturing scars which might be present on them.

First, however, a slight digression on the processes of *Olivella* sp. bead manufacturing is warranted. For this information, two sources are available, ethnographic descriptions and recent archaeological replicative experiments. More often than not, replicators followed ethnographic narratives, with the intent of producing finished *Olivella* sp. bead forms that mirror archaeological specimens.

Macko (1984:506) summarized *Olivella* sp. manufacturing steps, citing Gibson (1976:88), who in turn based his information on ethnographic accounts of J.P. Harrington (1912-1923). Five basic steps were discussed:

(1) breaking the shell using bipolar percussion;
(2) chipping the resulting fragments of shell into the desired bead form;
(3) (optional) bleaching the chipped bead blanks using a heat source, such as hot coals, which whitens and softens them;
(4) drilling the chipped blanks; and,
(5) stringing the drilled beads together and grinding them on an abrasive surface.

The whole shell is placed on an anvil stone and then struck on the tip. In reference to ham-

merstones, and to making money beads, one of Harrington's Chumash informants had this to say about making beads: "The first thing I do is break the *qo'y*. I take the *qo'y* one by one. I stand it on the anvil, my anvil is a rock and I take my rock and strike it on the tip and break it" (JPH/FL: Gibson 1976:82). [Hudson and Blackburn 1987: 118]

The harder the shell is struck, the more it fractures. Thus, a light tap should be sufficient to break the spire and quickly produce a lopped bead, which could then be further refined through grinding. Macko calls this production stage "spire-tapping". Further working of either end of the shell produces the barrel bead form. Steps (4) and (5) would only be used if further refinement were desired, and only two of 60 beads at IMP-6427 show refinement beyond step (3). It is assumed that the shells were bleached because none of them retain any amount of their original coloration. The application of a small amount of mineral oil, for example, would normally bring back a shell's color if it were still there to bring back; this technique is known to work on fossil shells (Kim Hutsell, personal communication, January 1993), however, it did not work on the beads from IMP-6427.

Olivella sp. spire-removed beads required the least amount of effort (and time) to produce. The bead was held against an anvil stone with the spire end up. The spire was then struck with a hard hammer of some kind. The amount of force of the blow caused one of three things to happen:

(1) If a spire-removed bead was the intended final product, the force applied to the shell would be light enough only to break the spire (apical end). The edges of the break could then be chipped to create a larger opening, if necessary, and/or then ground or smoothed to produce a clean edge.
(2) Using greater striking force would break the spire and the canal (or distal end) of the shell. Variously combined amounts of chipping, grinding, and/or smoothing of both ends would then produce either an end ground bead, or a barrel bead, depending upon the amount of shell removed.
(3) The application of the greatest amount of force would break the shell into component parts, such as wall, wall/lip, and columella fragments. Certain groups, most notably the Chumash of the Santa Barbara Channel region, made beads or ornaments from every part of the *Olivella* sp. shell.

Only two saucer beads were found at IMP-6427, but for information on how these forms were manufactured, there is a relevant ethnographic description from the Chumash culture area (Hudson and Blackburn 1987:118- 137), where this type was made in substantial numbers for use as money. The saucers were roughed out with a stone percussor on a stone base. The central hole drilling was done initially with fine chert drills (metal during the ethnohistoric period), then finished with swordfish bone or sea lion whisker, which was hafted firmly with tar onto a wooden cane shaft. Drilling was done by spinning the shaft between the palms, with the shell nestled in a hole on a flat wooden or stone base. The shaft was tarred where it was rolled between the palms. Drilling was done by old men or women who were identified as expert or professional bead drillers.

Since portions of the entire *Olivella* sp. shell were used for different kinds of beads, it should be possible to look at that debris to determine what kinds of ornaments were being made. Of the 60 beads found at IMP-6427, 58 are either spire-removed (17) or barrel (32) beads [nine are broken and are too fragmentary to tell if they are barrel or spire-removed]. Only two other *Olivella* sp. beads were made, and both are tiny saucers.

The spires are usually destroyed during the anvil manufacturing process and are usually not incorporated into the final bead form, and are not usually found as detritus in archaeological record. If only spire-removed beads were being made then there would be very little debris, and what would occur would be the result of accidental breakage when too much force was applied, or as broken bead fragments.

If barrel or end ground beads were the desired end product, then the largest debris fragments found would be various sized pieces of the canal or distal end of the bead. Of the 169 pieces of *Olivella* sp. detritus, 89 (53%) are canal. One would also expect to find fragments of the outer body whorl of the shell, since various portions of this part of the shell would have to be removed to complete a barrel bead, and 74 (44%) pieces from this part of the shell were recovered. The remaining six (3%) *Olivella* sp. debris are columella fragments. Since most of the columella section remains with a barrel or end ground bead [all of it remains with a spire-removed bead], it is not surprising that very few columella fragments were recovered.

If saucer, wall, cup, cap, or other similar beads forms were being made a significantly larger number of *Olivella* sp. body fragments would have been found. Even though these bead types are smaller than the barrel, end-ground, or spire-removed, still no more than one or two beads per shell would be made. This would produce a large amount of waste, in proportions approaching 95% of a species' weight, i.e., 5% beads, 95% waste. At IMP-6427 the beads account for 26% of the *Olivella* sp. totals.

What can the bead manufacturing scars say about how they were made? The most obvious scars on many of the finished beads are chipping scars. These occur primarily on the distal end. This suggests that initial spire removal was sufficient for clearing the proximal end opening of the bead. Removing the spire creates a longitudinal path through the bead, which allows for stringing. To finish the proximal end, it was either: (1) smoothed, (2) ground and smoothed, or (3) chipped, ground, and smoothed. Very few of the beads exhibit chipping scars on their proximal ends. However, almost all the distal end canal fragments exhibit some degree of chipping, and these are especially obvious on the barrel beads, which had the largest amount of shell removed. If the desired end product is a barrel bead, only so much force can be applied during initial reduction before the shell is accidentally shattered and rendered useless for barrel manufacturing. If enough force is applied to remove the canal end, a certain amount of remaining distal end must be removed to produce the barrel configuration. These final portions were probably removed by chipping away at the edge. The chipping process produces a rather jagged edge, so a certain amount of grinding and/or smoothing-polishing would be necessary to finish the edge. Even though the beads felt smooth to the touch, these chipping scars were still visible when viewed under the microscope.

Exactly what kinds of tools were used to chip the edges cannot be said for certain. In experiments the author has conducted, this chipping can be accomplished by using two thin-tipped bone flakers held together like a pair of snub-nosed pliers to grip the edge and then prying away small amounts from the edge. No doubt other methods could have been employed involving both anvil and hard hammer techniques. Nothing in the site's tool inventory is readily identifiable as something that was used to work beads. No bone flakers were recovered. A number of large sandstone slab pieces were found in the site area; however, no use wear was identified on any of them.

The detritus itself also provides a very convincing argument for the beads having been made locally. Almost every canal fragment exhibits battering scars on its distal end. If the whole shells were placed on an anvil stone to hold them in place, as some researchers and ethnographic accounts suggest, then striking the spire end would produce a scar at the distal end. The harder the striking force the more obvious the scar. This scar is readily duplicated in experiments using the anvil technique. The harder the anvil material, the more obvious the scar. Also, if the beads were traded to the site complete, there would be no reason for canal fragments to be found in the assemblage. Beads are lost or break accidentally and mix with site deposits, but the archaeological manifestations are whole and broken beads, not just broken *Olivella* sp. fragments, and certainly not canal fragments, and not in the frequency found at the Elmore Site.

It behooves future researchers, including those working with existing collections, to make sure fragments of *Olivella* sp. detritus are not being overlooked or mixed in with the faunal remains. It is also interesting to note that even though IMP-6427 might have had affiliations to large settlements at San Sebastian or Kane Springs, where cremations have been found, no human remains have been identified at IMP-6427. The beads at IMP-6427 were being made there, but not necessarily being used there for anything other than ornamentation.

CONCLUSIONS

The analysis of shell beads, ornaments, and waste from IMP-6427 has identified a bead manufacturing locus in the Colorado Desert of southern California. The quantity of beads being made cannot compare with other areas of the state, in particular, the Santa Barbara Channel region, but the assemblage from the Elmore Site contains more *Olivella* sp. waste by-products than any other desert collection this author could locate. It also appears that Santa Barbara Channel bead chronologies do not work for sites that lie south of Cahuilla territory. This may be true of all Yuman-related groups, where beads were simply not found in the quantities they were elsewhere in the state. Their monetary use does not appear to have extended to these groups, who used shell for ornamentation and in ceremonial situations. But the ethnographic literature for the Kumeyaay/Kamia does not discuss the use of strands of beads for money and exchange. Had this practice been present it would have been mentioned, as it is for the Cahuilla.

The above discussion dealt with four main topic areas:

(1) identification of species present and analysis of collection,
(2) shell bead and ornament typology and chronology,
(3) trade, acquisition, manufacturing, and use of shell beads, and
(4) distribution, sociopolitical implications, and case studies of shell bead uses.

The identification phase sought to determine shell species present in the IMP-6427 assemblage. Both Pacific Coast and Gulf of California species occur in the collection. Of those species which could be positively identified, more remains of Gulf of California species are present than Pacific Coast species. Since both source areas are equidistant to the site, stronger connections or ties to the Gulf could be inferred.

The most significant aspect of this study has to be the recognition of a shell bead manufacturing locus in an archaeological site in the Colorado Desert. Again, no other references to such a phenomenon could be found in the literature for the desert. The variety of species present is also greater than almost every other collection reported. *Cooperella subdiaphana* is the third-most common genera at the site, after *Olivella* sp. and *Laevicardium elatum*. No other references to this species' use for shell ornamentation could be found.

Many other olive species occur in the Gulf of California, including *O. fletcherae*, *O. zanoeta*, and *Oliva undatella*. While none of these could be identified at IMP-6427, the possibility exists that these species are represented in collections from desert sites. Future researchers should be aware of these species; they are similar to both *O. biplicata* and *O. dama*, and could have been utilized. *O. baetica*, like *O. biplicata*, occurs along the Pacific Coast, and may be represented at IMP-6427. This species is more like *O. dama* in overall configuration, but lacks the diagnostic lirae. Some of the smaller *Olivella* sp. shells may actually be *O. baetica*. Since positive identification of archaeological specimens belonging to this genus is very difficult, the use of Pacific Coast species may be greater than recognized in this analysis.

The typologies used, Bennyhoff and Hughes (1987) and Gifford (1947), provided adequate comparative samples to type the IMP-6427, but

two of the *Olivella* sp. beads recovered have no analogous type in either system: the side ground spire-removed and the obliquely ground barrel. The cultural influences affecting shell ornament and bead manufacturing in the lower part of California, in the cultural area south of the Cahuilla, seem to be different than those in Cahuilla territory north and west. The western Kumeyaay, Kamia, Colorado River groups, northern Baja California groups, and western Arizona groups form a more unified grouping of related bead types. Since it is hypothesized that Yuman peoples moved west from the interior about 1000 years ago due to the development of increasingly desert-like conditions (Rogers 1945:170; Wilke 1974:27-29), these peoples may have brought with them a use of shell which is different than the Shoshonean intrusion which moved southwest out of the Great Basin around the same time. The typologies and chronologies developed for Californian shell artifacts have concentrated on collections from the Santa Barbara Channel and Central Valley regions, no doubt due to the fact that the greatest quantities of shell artifacts have been recovered from these regions of the state. These typologies have then been indiscriminately applied to all other areas of western North America. Further research into this subject area is definitely warranted.

Seemingly unwarranted is the universal application of Chester King's bead chronology to all of California, Great Basin, and American Southwest. This was never King's intention, but it has happened because no one has come along to look at the relevancy of his chronology to other cultural areas. Bennyhoff and Hughes (1987) looked at the adequacy of King's chronology for use in the Basin, but they only discuss *Olivella* sp. beads. Jernigan (1978) made no formal connection between the Southwest and California, and extensively reviewed shell use through time for the American Southwest, east of the Colorado River. No extensive synthesis or reevaluation has been attempted for the Colorado Desert area of Alta California and Baja California. This seems necessary because the bead and ornament types from IMP-6427, like most other Yuman desert sites, were quite distinctive. This distinctiveness needs to be evaluated on its own, rather than continuing to apply possibly misleading or erroneous Santa Barbara Channel typologies and chronologies.

Trade of shell throughout the region may have been controlled from large village locations, such as those that existed at San Sebastian Marsh and perhaps Kane Spring. Connections to both the Gulf and Coast have been documented ethnographically from San Sebastian, and these alliances facilitated trade. Obsidian from Obsidian Butte, salt from southern Lake Cahuilla environs, and feathers from captured waterfowl, could have been exchanged for shell. Use of shell at IMP-6427 seems to have been restricted to ornamentation, or possibly exchange, but nothing at a level approaching other areas of the State. The use of *Olivella* sp. beads for money beads seems to be restricted to Cahuilla territory north and west, and is not found among Yuman groups like the Kumeyaay.

Shell beads and ornaments were used by all Native American groups living in the region and bordering it. The ways in which shell was used differed from group to group. Some used shell almost exclusively for ornamentation. Other groups made money beads and were involved in monetary exchange. Others exchanged shells as gifts to fulfill sociopolitical obligations. Still others used shell on ceremonial occasions. Few groups used shell for all these various reasons. Universal use of shell was noted for the image burning ceremony and for ornamentation. Only groups from Cahuilla territory north and west made money beads. Only a few groups gave shell beads as gifts. The ethnographic accounts tended to mention shell use, but were usually not specific about the species used, how the shell was used, or how the shell was modified. The ethnographic literature would suggest that the Desert Kumeyaay occupied IMP-6427. The Cahuilla do not appear to be a logical choice for the site's creators. Their own accounts suggest they did not approach the areas traditionally held by the Kamia or Desert Kumeyaay. While lower Colorado River groups may have moved into the Lake Cahuilla region,

they are much more likely to have occupied areas along the eastern shoreline. Bead types found at Elmore do more closely resemble types from northern Baja, than from any found to the north. Since related Yuman groups also occupied northern Baja, this similarity could be expected.

Since shell was used by all ethnographic peoples in the region, shell should be present in archaeological sites dating to the late prehistoric period. Archaeological studies conducted in the desert have resulted in the recovery of shell from most sites. Generally, only those sites that contain subsurface deposits yield shell in quantities greater than a few pieces. None of the sites, however, yielded shell in the quantity or variety present at IMP-6427. If IMP-6427 served as a center for the manufacture and trade of shell beads then the percentage of finished shell artifacts, as opposed to unworked shell manufacturing waste, should be low. If on the other hand, the manufacture of shell jewelry for exchange was a minor activity in the area, then the percentage of finished artifacts should be high. It follows then if the site area were a major center, then the site should exhibit a relatively high frequency of shell. If the area was peripheral to the exchange system, then the frequency of shell on the site should be low. The measure of what constitutes a high or low frequency of shell could not be worked out within the scope of this study; however, future research could compare these shell frequencies from other desert sites.

Shell use at IMP-6427 suggests that bead manufacture was one of the activities occurring at the site. The abundant waterfowl apparently extracted from adjacent Lake Cahuilla may have provided the site inhabitants with sufficient free time to engage in activities related purely to the aesthetic. Whether this pattern was repeated elsewhere through the Colorado Desert has yet to be demonstrated or discovered. Or, perhaps IMP-6427 represents a unique situation, where those circumstances which resulted in the shell assemblage do not repeat themselves in this region. Only further research and a careful examination of shell assemblages from the desert can help to illuminate the situation.

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