Cross-Dating Great Basin Sites by Californian Shell Beads*

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Cross-dating, or the determination of time synchronisms by means of the occurrence in context of distinctive culture items which have been carried from their outland point of origin, is one of the basic tools of archaeology. One has only to recall the extension of the Neolithic, Bronze, and Iron Age Chronology of the Eastern Mediterranean area to Europe to find an example. In North American archaeology the technique of extensional dating is widely known, but has not been utilized as effectively as it could have been. In the Southwest the extension of the Anasazi dendrochronology to the Hohokam area by means of Puebloan trade sherds found in a stratigraphic context has been most important, and Haury has explicitly set forth the operative principles of the method [1].**

Any material culture item which was made in quantity, which can be accurately dated at its place of manufacture, which formed a desirable item to peoples beyond the zone of primary manufacture and which was transported or diffused, usually by inter-group trade, can serve as the means of effecting inter-regional chronological time synchronisms. One such link may be the means of injecting definite time reckoning into a relative chronology whose direction and succession are clear, but which may perforce float or be suspended, so to speak, in the time continuum since it cannot be anchored at either end or within its floruit. It is precisely in such chronologies where radiocarbon dating is most effective, for two or more radiocarbon dates may provide sufficient enlightenment to enable extrapolation of time for a long culture sequence. For our part, we would place more reliance on a single, well-documented cross-date based on ceramics or shell beads than we would on a single radiocarbon date which might appear to be more exact but which, standing alone and unverified, therefore is a potential avenue of error and misdirection.

The more specific and localized both as regards time and place of origin an element is, the more reliable that element will be in tracing cultural connections and erecting parallel chronologies. Conversely, the more generalized and non-specific the trait in question the less reliable it is as a means of proving cultural community.

The generic connection between Central California and the Great Basin culture was early recognized by Kroeber although the unifying features linking the two areas were mainly traits of such simple form that the unity resolved itself into a low level similarity definable in terms of features

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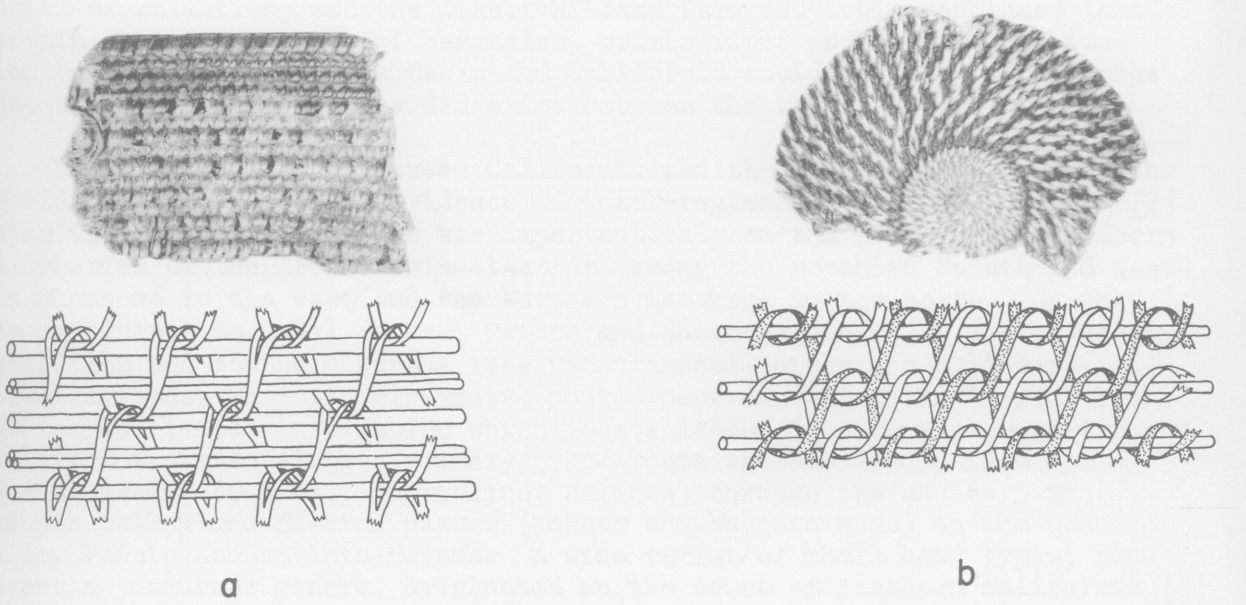


(to accompany preceding paper)

Plate I. Fine Coiled Basketry from the Humboldt Valley

such as hunting-gathering subsistence, importance of basketry, clanless social organization, and the like. Willard Park and Lowie concluded that certain specific aspects of shamanism, crisis rites and social organization occurring both in the Basin and California could be taken as evidence that specific relationships did exist between the two areas.

Trade and commerce between California and the Great Basin peoples can provide us with objective evidence of inter-regional contrasts. Steward [2] notes that commerce or trade was important only on the western and northern peripheries of the Great Basin--that is, among the Northern Paiute and Western Shoshone in the west and the Northern Shoshone in the north. On the ethnographic time level several Paiute and Shoshone groups in southeastern California and southern Nevada received clamshell disks and cylinders, Olivella beads, Haliotis ornaments, and perhaps dentalium shells from the west. The limited information which is available [3] strongly suggests that shell beads passed along a primary trade route which extended from the coastal groups (Chumash, Gabrielino, Salinan) through the southern San Joaquin Valley and Sierran passes (Yokuts and Western Mono) to the Owens Valley Paiute and on into Nevada. A wide variety of shell bead types, representing numerous genera, originated on the coast of Southern California [4], and many of these types reached the southern San Joaquin Valley. However, present evidence would indicate that only the clam (Tivela) disks and cylinders, the more common Olivella beads and Haliotis ornaments, and perhaps dentalia, were traded across the Sierra Nevada. The same beads may have followed another trade route which probably existed along the southern edge of these mountains, via the Gabrielino, Serrano and Kamia Indians but no adequate account of trade is on record for these groups. Still another route is indicated for Saxidomus clam disks which were traded south from Bodega Bay via the Miwok Indians to the Owens Valley Paiute [5]. Several of these Great Basin groups measured the shell disk beads by the length of a string wrapped around the hand [6]. This measure is California in origin, and is indicative also of the fairly large quantities of beads which were imported into the Basin.

Two archaeological sites in Owens Valley have produced shell beads (Table 3) [7]. The Cottonwood site, occupied during the historic and protohistoric periods, has produced some eleven bead types [8], all of which are found on the southern coast. The five Tivela clam beads could have come only from the southern coast. The thin-lipped Olivella bead (like Fig. 1, Nos. 18, 19), most common in Central California, and the Olivella rough disk (Fig. 1, No. 40), most common in Southern California, are both diagnostic of the protohistoric to historic periods in both regions, while the other types occur at least occasionally with similar late associations [9]. One of the Tivela clam disks has peripheral incisions (Fig. 1, No. 57) and a unique lenticular cross-section. In view of the abundance of steatite beads at this site, plus the fair number of thin-lipped Olivella beads, it is puzzling that no definite Saxidomus clam disks or Tivela clam cylinders were found.

The Rose Spring site, also in Owens Valley, represents a deep, stratified deposit which has produced a sequence of bead types [10] and provides evidence for shell bead trade with Southern California over a lengthy time period. From the surface and top two feet of deposit (with pottery) came the thin-lipped [11] and rough disk Olivella beads, diagnostic of the protohistoric and historic periods. The single split, punched Olivella bead (like Fig. 1, No. 20) was found in the 24-36 inch level (late, but preceramic). Still deeper, between 48 and 64 inches, were found two thin disk beads of Tivela clam (Fig. 1, No. 53); this separation of thin-lipped Olivella beads and thin clam disks supports the possible emphasis on thin Tivela disks before the protohistoric period which was suggested in endnote no. 9. About 1000 Haliotis small ring beads (Fig. 1, No. 64) were found with Burial 4 at 86 inches depth and in the surrounding midden [12]. These represent a Southern California type which was popular well before the protohistoric period.

Among the Northern Paiute the ethnographic evidence attests to the importation of clam disk beads, Olivella shell beads, and Haliotis and Dentalium shells used for ornaments [13]. It is stated by Steward that the eastern limit of the use of shell bead "money" in the ethnographic period was Reese River, but this can hardly mean more than that this river was the point past which shell beads in quantity did not reach. Exact and detailed descriptions and illustrations of shell beads found in sites east of Reese River in central and eastern Nevada will be the means of determining the antiquity and range of this trade in shell beads.

Shell beads have been found at some 25 archaeological sites in the region extending from the lower Humboldt Valley in western Nevada to Honey Lake in northeast California (Map 1, Table 3). Though most of the collections are very small (only five sites have more than 25 specimens), some 11 Pacific Coast shell species are represented: Olivella biplicata and O. baetica, Dentalium pretiosum, Macoma nasuta, Saxidomus giganteus and S. nuttallii, Tivela stultorum, Glycymeris migueliana, Haliotis rufescens and H. crachero-dii, and Mytilus californianus.

Whole Olivella shells with the spires ground down or broken off to permit stringing are the most common, which indicates that essentially unmodified shells formed the bulk of the imports. The following occurrences and approximate number of simple spire-lopped beads have been noted [14]:

Table 1

Site	Total	Type 1a	Type 1b
Ch-2	9	7	2 (1 incised)
Ch-3 [15]	6	3	3
Ch-13	1	0	1
Ch-15	11	0	11
Ch-16	5	4	1
Ch-18 [16]	over 500	most	some
Ch-35 [17]	1	1	0
Ch-39 [18]	over 58	45	over 13 (2 incised)
Ch-65	1	0	1 (incised)
Ch-67	1	1	0
Ch-78	1	0	1
Ch-83	1	1	0
Ch-89	1	1	0
Pe-14 [19]	52	0	52
Wa-63	1	1	0
Las-1 [20]	34	23	11
Las-7 [21]	224	(burials 143	11
		(midden 46	24

The specimens from Pe-14 (Leonard Rock Shelter) are the oldest shell beads yet found, with a radiocarbon date of 6000 to 7000 years B.P. No clear evidence of Californian coastal peoples of this antiquity has thus far been found, but the hypothesis is permissible from these beads that the Pacific shore was occupied at this time. To judge from other beads found at many of the remaining sites the trade in these simple spire-lopped Olivellas continued in all later periods. The incised specimens (Fig. 1, Nos. 5-7) are discussed below under local manufacture.

With other bead types we are able to make specific identifications of prehistoric shell beads imported from California, and to point out cross-chronological links between the two areas. A significant shell bead complex appears in variable strength at four sites. The following types are found together as burial associations and in the midden at the Karlo site (Las-7) [22]: thick, rectangular Olivella beads (type 2b, Fig. 1, No. 16); predominance of small spire-lopped Olivellas (type 1a, Fig. 1, No. 1); square Haliotis beads with one (type 1, Fig. 1, Nos. 65, 66) or two (type 2, Fig. 1, No. 67) central perforations [23]; square mussel beads (Mytilus californianus, Fig. 1, No. 70); Haliotis ornament types A1, C(1)1, C(2), and C(2)1 (see Fig. 1, Nos. 71-76); Macoma clam disks (Fig. 1, No. 52) [24]; and oval Olivella beads (like Fig. 1, Nos. 47, 48).

This complex probably represents the Early Lovelock period because Grave 18 from Lovelock Cave, assigned to this period by Grosscup [25] on

other grounds, contained at least ten rectangular Olivella beads (type 2b) and twenty square Haliotis beads (type 1) [26], as well as two Macoma clam disk beads. All spire-lopped Olivella beads from the Cave which have data represent type 1a, and come from levels assigned to the Early and Transitional Lovelock periods. A single lot of one hundred eighty-eight Olivella flat disk beads (Fig. 1, No. 41) [27] was found at 84 inches depth which probably represents an Early Lovelock level. The depth of one type C(2)1 Haliotis ornament (Fig. 1, No. 76) would indicate Early Lovelock associations, while one type C(1)a (Fig. 1, No. 72) and one type C(2) (Fig. 1, No. 74) were found in Transitional levels. Two related specimens [types C(1) and C(1)1] lack data [28]. The twelve cap Olivella beads (Gifford type G1b, Fig. 1, No. 11, herein) also lack data but may belong with this complex, or perhaps represent a slightly later period [29].

Surface specimens from Ch-2 include rectangular Olivella beads (type 2b, Fig. 1, No. 17), small spire-lopped Olivellas, and Macoma clam disks (Fig. 1, No. 51), while Ch-60 has yielded one type 2b rectangular Olivella bead [30].

Most of these bead types are found in three cultural assemblages of Central and Southern California, as follows:

Table 2

	Early and Transitional Lovelock 4 sites	Windmiller facies[31] 5 sites	Berkeley facies[32] 2 sites	Early Island period[33] 2 sites
Olivella type 2b	X	X	X	X
Haliotis bead type 1	X	X	X	X
Haliotis bead type 2	X	X		X
Mussel bead type 1	X	X	X	X
Haliotis orn. type A1	X	X	X	
Haliotis orn. type C(1)	X	X	X	X
Haliotis orn. type C(1)1	X	X		
Haliotis orn. type C(2)	X	X	X	X
Haliotis orn. type C(2)1	X	X		
(Olivella type G1b)	(X)	(X)		(X)
Macoma clam disk	X			
Olivella flat disk	X			
Olivella oval	X			

At present the type 2b Olivella beads, the two Haliotis bead types, and the square mussel bead are limited to these cultural phases, and appear

to reflect a widespread temporal horizon. The other types persist into, or are more characteristic of, the Middle or Intermediate periods in California.

Several factors suggest that it would be premature to attempt to determine any specific source or trade route for the Great Basin beads since multiple Californian sources appear to be indicated. It should be noted that we are dealing with only 13 sites (most of which have small collections) in four restricted regions and the data are therefore quite limited. The Windmiller facies of the Early Horizon of Central California shares the largest number of types with Early Lovelock. The square abalone and mussel beads from these two complexes are virtually indistinguishable, whereas those from the Berkeley facies average slightly smaller and those of the Early Island complex are distinctly smaller and contain a higher frequency of Haliotis cracherodii. However, the rectangular Olivella beads of the Windmiller facies often differ from those of the other three cultures in being larger and more frequently shelved, with less tendency toward squarish proportions (like Fig. 1, No. 17, which is unusual). Similarly, the abalone ornaments from the Windmiller facies are consistently larger than those of the other three cultures. The type G1b Olivella beads from Lovelock Cave with little doubt represent finished beads imported from Southern California because this type is virtually absent from Central California [34], whereas it is abundant and part of a developmental sequence on the Santa Barbara coast. However, the square abalone beads of Early Lovelock rather clearly did not come from Southern California and none of the thick Tivela clam disks (also part of the Early Island complex) appear to have been exported at this time.

Radiocarbon dates are available for all but the Early Island culture. While the Early-Transitional Lovelock and the Berkeley complexes appear to be roughly contemporaneous, dating from around 1500 to 500 B.C. [35], the Windmiller facies appears to have terminated about 2000 B.C. [36]. The clam disk and the Olivella flat disk and oval types which are found only in the Early Lovelock assemblage would support this apparent persistence of the early complex in the Great Basin after it had been replaced in the lower Sacramento Valley. The Macoma clam disks represent a very rare type in California, the known distribution of which is limited to five interior sites of the lower Middle Horizon. The relative high frequency of such beads in the Great Basin is therefore unusual and might indicate a northern coast source. The Olivella flat disk beads are unique but may be related to type 3c saucers of the Middle Horizon in Central California. The oval Olivella bead is a problematical type, discussed below under local manufacture. It would therefore appear that the western Great Basin was receiving a variety of shell beads from several different sources during the millenium prior to 500 B.C.

The remaining sites given in Table 3 appear to be later in time, but the lack of meaningful association imposes serious limits on interpretation. In Central California the saddle Olivella bead (type 3b, Fig. 1, Nos. 22-24) appears to follow the Macoma clam disk in time, and to be

ancestral to the modified saddle bead (type 3b2, Fig. 1, Nos. 34, 35). However, types 3b and 3b2 sometimes occur together and the number of specimens from the Great Basin is insufficient to emphasize temporal differences. The split, drilled Olivella bead (type 3b1, Fig. 1, Nos. 25, 26) [37] and the Olivella saucer (type 3c, Fig. 1, Nos. 36, 37) are also general Middle Horizon types in Central California. It is therefore probable that the Humboldt Lakebed site (Ch-15) was occupied during Middle Horizon times. Although the Lakebed specimens are all from the surface, they probably were originally associated with cremations and burials which have been exposed by recent wind erosion at this site. Recently a radiocarbon date of 2960 + 250 years was obtained from one of these cremations, which would indicate that the site was occupied in 1000 B.C., a time which probably marks the approximate end of the Early Lovelock and the beginning of the Transitional Lovelock periods.

It also appears likely that some of the specimens from Tommy Tucker Cave may date from the Middle time period. Definite examples of both the saddle (Fig. 1, Nos. 22, 24) and modified saddle (Fig. 1, No. 34) Olivella bead were found in the cave [38]. One type J2aIV Haliotis ornament [39] was also found, though this Middle Horizon type is usually associated with the earlier Macoma clam disk complex in Central California.

The occurrence of the split, drilled Olivella bead, with the local scoop and oval forms, at Pelican Island probably indicates some occupation during Middle Horizon times also, though persistence of these types into Late times is possible. Though most of the beads from Ch-2 indicate occupation during the Early Lovelock period, the two saddle Olivella beads suggest some later occupation during Middle times.

Available evidence would favor the derivation of these Middle Horizon beads from a Central California source. No saddle Olivella beads have yet been noted in Southern California, and none of the 16 Southern California beads classed as type X3c by Gifford appear to be the same as the modified saddle type, which number in the thousands in Central California. Though type 3b1 does occur in Southern California it appears to be a minor type and may represent a trade item derived from Central California.

A number of shell bead types indicate trade or influence between California and the Great Basin during Late Horizon times. The split, punched Olivella bead (type 3a2, Fig. 1, No. 20) achieves its highest frequency in Central California during the first half of Phase 1 of the Late Horizon, though sporadic occurrences are known from Phase 2 sites. The type is relatively rare in Southern California, but it has a wide distribution in the San Joaquin Valley. The punched perforation and frequent chipped, unground edges represent radical departures from the drilling and careful finish which normally characterize California shell bead manufacture. The appearance of these beads would suggest unfinished blanks, but their pattern of arrangement in graves leaves no doubt but

that finished beads are represented. It is possible that this bead type was made by groups which lacked the coastal tradition and technology of drilled, carefully ground beads, and the San Joaquin Valley might qualify as the original source of this type. At any rate, the split, punched bead is one of the most widespread types found in the western Great Basin, and most occurrences are probably temporally equivalent to the earlier portion of Phase 1 of the Late Horizon [40]. This possible dating is strengthened for the Humboldt Lakebed site by the presence of the Olivella thin rectangles with central perforation (type 2a1, like Fig. 1, Nos. 12, 13). This type, when not associated with type 2a2 and 3e Olivella beads, is diagnostic of the earlier portion of Phase 1 in Central California. Type 2a1 has not yet been reported from Southern California.

Shell artifacts suggest that the major occupation of the Pelican Island site occurred during the later half of Phase 1 of the Late Horizon. The Olivella thin rectangles with end perforation (type 2a2, Fig. 1, Nos. 14, 15) and the cupped Olivella bead (type 3e, Fig. 1, No. 39) are characteristic of this period, along with the persistence of type 2a1 Olivella beads (Fig. 1, Nos. 12, 13). Only type 3e appears in Southern California. The Olivella rough-disk (like Fig. 1, No. 40) does not appear in Central California until Phase 2 times, but since only a single bead is represented, and other Phase 2 diagnostic types are absent, it is doubtful whether occupation of the Pelican Island site lasted into the full protohistoric period. It appears likely that the rough-disk bead originated in Southern California during terminal Phase 1 times and might have reached the Great Basin before it penetrated the Sacramento Valley.

The type N6aI Haliotis ornament (Fig. 1, No. 79) from Thea Heye Cave is a distinctive type found in middle Phase 1 times of the Late Horizon in California. The specific form of this specimen (with the flattened basal edge in contrast to the rounded base form illustrated by Gifford) is at present limited to the Colusa province, near the mouth of the Feather River. The small disk beads (type 3d, like Fig. 1, No. 38) lack temporal significance, occurring throughout Middle and Late times in Central California and over a long time period in Southern California.

It is of interest to note that both of these possible Phase 1 sites yielded Dentalium beads (Fig. 1, Nos. 58, 59), and end-ground Glycymeris beads were found at Pelican Island (Fig. 1, No. 60). The single rectangular bead made from Glycymeris shell (Fig. 1, No. 61) is probably a local imitation of Olivella type 2a2, for no such type has been reported elsewhere. This fact, plus the absence of Phase 2 (protohistoric) types at both sites, strongly suggests that the end-ground Glycymeris beads and the whole and cut Dentalium beads may date from the upper half of Phase 1 of the Late Horizon (700 to 1500 A.D. in the Sacramento Valley). To date occurrences of these beads noted in Northern California sites have been limited to the historic or protohistoric time level. In view of the quantity of Dentalia, this latter period is probably represented at the Parran Lakebed site. The end-ground Glycymeris beads probably came from the Humboldt Bay region, while the Dentalia were presumably derived from Vancouver Island via Northern California [41].

The Saxidomus clam disk (Fig. 1, No. 50), the thin-lipped Olivella bead (Fig. 1, Nos. 18, 19), and the type OlaIII Haliotis ornament (Fig. 1, No. 80), are all diagnostic types of Phase 2 of the Late Horizon in Central California. The presence of these types would indicate protohistoric occupation of Ch-3, Ch-15, and Ch-16 [42]. Abundant ethnographic accounts indicate that the Saxidomus beads originated in the Bodega Bay region of Central California, and the other two types are most characteristic of Central California. The large Tivela clam disk (type VlbI) from the Humboldt Lakebed site must have come from Southern California in unfinished form for it is not completely perforated (Fig. 1, No. 56).

Another significant aspect of shell beads from the western Great Basin is the definite evidence for local manufacture or modification of certain types. Virtual proof of such a local industry is provided by Olivella shell refuse from the Pelican Island site. Some 214 fragments from medium to large Olivella shells are represented. Not a single spire is included, and 16 fragments retain evidence of ground-off spires, so we may conclude that spire-lopped beads were broken (or rarely sawed) and reused to make smaller beads. The largest number of pieces (75) are small shelved sections, useless for any standard bead type (Fig. 1, No. 81), followed in number by equally useless fragments (51) of the orifice and columella (Fig. 1, No. 82) and 41 tiny scraps of shell. Only 11 large sections of the lip or main body whorl (Fig. 1, No. 83) are included, and this small number of pieces from the main part of the shell (from which most beads were made) provides strong evidence that this collection of fragments does not represent the remains of spire-lopped beads which were accidentally broken. Only 8 fragments retain the entire callus (Fig. 1, No. 84), another basic part of the shell (from which type 3e and 3a1 beads were made), which again indicates that a selective process was responsible for the frequency and nature of the shell refuse. In addition, 12 fragments bear traces of grooves which indicate that the Olivella shells were sometimes split vertically by sawing (Fig. 1, No. 85), and in all cases the potential bead portion of the fragment has been removed, leaving the useless, rejected ends [43]. One fragment indicates horizontal sawing (Fig. 1, No. 86). Some 15 fragments with one or more sawed or ground edges (Fig. 1, No. 87) appear to have been suitable for beads but were never finished or broke during manufacture.

Additional support for the idea of local bead manufacture at this site is provided by two unusual rectangular beads, one made of Glycymeris shell (Fig. 1, No. 61) and one made of mammal bone (Fig. 1, No. 62). No such beads have been reported elsewhere. Moreover, many of the Pelican Island Olivella rectangles are less symmetrical or more rounded (Fig. 1, Nos. 13, 15, and like 61) than typical California beads. Since the shell refuse was associated with rectangular (types 2a1, 2a2) and cupped (type 3e) beads, and since sections of the shell which were used to make such beads are unusually scarce in the refuse, we may conclude that these types were being manufactured at the Pelican Island site at a time contemporaneous with upper Phase 1 of the Late Horizon.

Other sites also provide evidence of local manufacture or modification [44]. For the protohistoric period there is the large Tivela disk from the Humboldt Lakebed site (Fig. 1, No. 56). An attempt has been made to perforate the specimen, not in the center (as would be normal in Southern California) but toward one edge. This suggests that at least the drilling was attempted locally. The scrappy nature of most of the Haliotis beads and ornaments from Tommy Tucker Cave suggest local manufacture [45], perhaps in upper Middle and Phase 1 times. The square Haliotis beads with three or four perforations (Fig. 1, Nos. 68, 69), found at present only at the Karlo site, may have a local origin during Early Lovelock times.

The flat disk Olivella beads (Fig. 1, No. 41), found with Early Lovelock associations at Lovelock Cave, resemble type 3c Olivella saucers of the Middle Horizon in California. However, these Great Basin beads have the outer face ground flat, a modification not found elsewhere.

The remaining types might form a local complex, but better data on associations are needed before their significance can be determined. The grooved rectangle (Fig. 1, Nos. 42, 43), with a sawed perforation, is foreign to California where drilled perforations are normal. Unfortunately, these Lovelock Cave specimens [46] lack depth provenience. Since most of the beads from this site appear to represent the Early and Transitional Lovelock periods, it is possible that the grooved rectangles signify a local attempt to replace the early drilled rectangles (type 2b) when the trade in the latter beads was cut off. Alternatively, the rounded edges of the grooved rectangle might indicate affinity with the modified saddle (type 3b2). Derivation from the later type 2a thin rectangles would appear unlikely.

The other quite distinctive type is the scoop Olivella bead (Fig. 1, Nos. 44-46) found at six Great Basin sites [47]. The associations of this type are not clear because other bead types indicate an extended occupation for most of these sites. The scoop bead occurs at two probable Early Lovelock sites, but at Karlo the single bead was found in the midden, and at Ch-2 the surface also yielded saddle Olivella beads of the Middle Horizon. The Pelican Island, Humboldt Lakebed, and Tommy Tucker Cave sites were probably occupied in both Middle and Late Horizon times. A local derivation from the split, drilled Olivella bead (type 3b1) appears most plausible, however, so a Middle Horizon dating may be indicated.

This derivation has been suggested because of the similarity of the scoop bead to six of the type 3b1 beads which are end perforated (Fig. 1, Nos. 29-33; one of these is perforated at both ends, Fig. 1, No. 33) [48]. Such end perforation has not been noted in type in 3b1 beads from Central or Southern California, so it would appear that undrilled blanks were imported or, more likely, that the entire 3b1 bead was made locally from split spire-lopped beads. The latter possibility is supported by the unusual amount of spire which remains on some beads (Fig. 1, Nos. 27, 28); in California these beads were usually well-rounded (like Fig. 1, Nos. 25, 30) by grinding off most of the spire.

The oval Olivella bead type (Fig. 1, Nos. 47-49) is even more problematical [49]. Such shelfless beads occur as rare variants in strings of both type 3b1 (Middle Horizon) and type 3a1 (protohistoric) in Central California, merely indicating that occasional use was made of non-shelf or non-callus portions of the shell during the manufacture of these different types. Such beads do not occur in strings by themselves except in the San Joaquin Valley (protohistoric), one Phase 1 site in the Sacramento Valley, and probably in Southern California. The form is too simple to require a single origin. The occurrence of a string of such beads in Lovelock Cave (no depth provenience), two such beads with Early Lovelock burials at Karlo, and their presence with non-protohistoric associations at Pelican Island and Tommy Tucker Cave, all contribute to the feeling that the oval Olivella bead in the Great Basin may be a Middle Horizon type, perhaps derived locally from the 3b1 Olivella bead.

Despite the vexing problem posed by the lack of adequate associations, the available evidence tends to favor the tentative proposal that the grooved rectangle, scoop, oval, and split-drilled (end perforated) Olivella bead types were manufactured locally during Middle Horizon times, after trade in the beads of the early complex (Olivella 2b, Haliotis squares, etc.) declined. The Karlo and Ch-2 associations, plus the absence of Late Horizon types at Lovelock Cave argue against the origin of these local types in Phase 1 times. Persistence of these local types is possible, because type 2a1 thin rectangles (characteristic of lower Phase 1 times) are quite rare in the Basin and may reflect restricted trade. However, the abundance of type 3a2 beads (also lower Phase 1 in time) does not support such a proposal. Solution of this problem will require additional evidence on the association of these types.

These locally distinctive bead types are significant not only because they further illustrate the inventive capacity of the prehistoric peoples of the western Great Basin, but also because they may have served as trade items to peoples further east and may possibly offer a future means of extending the time-culture linkage within the Great Basin.

Another local characteristic is the relative prevalence of incised shell beads. Spire-lopped Olivellas with horizontal cross-hatched bands were found at Ch-2, Ch-39, and Ch-65 (Fig. 1, Nos. 5-7). The four specimens (out of less than 1000 spire-lopped beads) are comparable to three specimens (out of more than 12,000) from Southern California [50]. One of the 39 split, punched (type 3a2, site Ch-15) beads is incised (Fig. 1, No. 21) and two (out of more than 1000) similar beads, with different designs, were found in the southern San Joaquin Valley [51]. Three of the 18 split, drilled beads (type 3b1, site Ch-15) are incised (Fig. 1, Nos. 27, 28, 33), a type which was never decorated in California. A unique scoop Olivella bead from Ch-2 has a nicked edge (Fig. 1, No. 46), and the incised Tivela large disk (Fig. 1, No. 57) from Iny-2 is also distinctive.

The incised Tivela disk from Iny-2 represents the protohistoric or historic period, and, though unique, can be related to the tradition of edge-

incising which is common in Southern California. The origin of the style of surface incision found on the remaining beads (excluding the scoop bead) is quite uncertain because none of the specimens from the Great Basin can be adequately dated (all are surface finds). In so far as the other beads found at each site are a reliable guide, the Ch-2 specimen should date from Middle Horizon times at the latest. Beads from the Humboldt Lakebed site run from Middle Horizon to protohistoric times, but unless the decorated bead forms represent extreme persistence, the three incised type 3b1 specimens should represent the Middle Horizon, and the single incised type 3a2 bead should represent lower Phase 1 of the Late Horizon. The decorated spire-lopped bead from Pelican Island could date from Middle or terminal Phase 1 times, but a protohistoric dating seems unlikely. The Ch-65 bead was an isolated find. Thus a Middle Horizon age is possible at all sites. If so, a local origin for this art expression would be indicated for no incised Californian beads appear to be this old. An alternative possibility would be a derivation from the simple line patterns incised on bone artifacts found in Middle Horizon sites in California [52].

If the type 3b1 beads did persist into Phase 1 times at Ch-15, a possible stimulus may have come from the incised bone tubes of Central California [53]. Triangle and diamond patterns are shared, though the designs on bone in California are cross-hatched, whereas these patterns on shell in the Basin are hachured. In addition, the art of incising bone was restricted to the Delta province during Phase 1 times and did not spread to the coast or adjacent Colusa province until the protohistoric period. In view of such a limited local distribution, one may doubt whether influence from the Delta would be expressed in a different medium as far away as the Basin in Phase 1 times. Unless the bead types have no correspondence, incising would appear to be older than the protohistoric period in the Basin. Another possible source of inspiration might be Southern California, where, though incised Olivella beads are rare, there was some development of surface incising on clam and other beads [54]. There is little support for the existence of such incising before the protohistoric period, however. It would appear significant that, despite the fantastic difference in the size of the collections which have been compared, there are eight incised beads from the Great Basin in contrast to only five comparable beads from California [55]. It is therefore possible that this art expression is most typical of the Basin, and such beads may as likely be the work of local artists following a local tradition as they are to represent trade items or diffusion from California.

In summary, all known periods from the Early Horizon through Phase 2 of the Late Horizon are represented by shell bead types in the western Great Basin, and this may be taken as evidence of persistent contact between the two areas over the last 3000 to 4000 years, or more. The Californian shell beads from Basin sites are, to use Childe's term "homotaxial types." From this we can propose with some assurance the general equivalence of the Early and lower Transitional Lovelock periods with the terminal Early and lower Middle Horizons of Central California. Beads which are diagnostic of these two latter periods are found together at both the

Lovelock Cave and Karlo sites, which suggests a longer persistence of the Early Horizon complex in the western Great Basin. Radiocarbon dates also support such a relationship. Little evidence for later occupation of these sites is afforded by intrusive shell beads but a local complex may represent the upper Transitional and lower Late Lovelock periods. A group of burials at the Karlo site appear to represent later occupation, but no shell beads were associated with them. The removal of most of the upper deposit at Lovelock Cave by commercial guano miners nearly fifty years ago may account for the apparent absence of later shell bead imports. It is also possible that the main occupation and burial locus of the later cave inhabitants shifted to the nearby Humboldt Lakebed site (Ch-15).

The oldest shell beads from this Humboldt Lakebed site are of Middle Horizon type. As already noted, a radiocarbon date from this site shows that it was occupied in 1000 B.C., a time which probably marks the beginning of the Transitional Lovelock period. Occupation of the site continued into lower Phase 1 times of the Late Horizon, but no shell beads of the upper Phase 1 period have yet been found here. Assuming that the site was abandoned, it was reoccupied in Phase 2 (protohistoric) times.

The beads from Tommy Tucker Cave (Las-1) suggest occupation during the upper Middle Horizon and the beginning of Late Horizon times, but no beads of later periods were found. Other artifacts indicate at least occasional use of the Cave into historic times, however.

Although the Pelican Island site may have been occupied in Middle Horizon times, the most definite shell bead complex is assignable to the upper half of Phase 1 of the Late Horizon, and the few specimens from Thea Heye Cave suggest a similar dating. Too few beads are available from other Nevada sites to warrant speculation on the duration of occupation.

Relationships with Southern California are most evident during the Early-Transitional Lovelock period, and in protohistoric times. Northern relationships, indicated by Dentalium and Glycymeris beads, may extend back to the terminal Phase 1 period of the Late Horizon, and continued into historic times. There is considerable evidence for the local manufacture of a variety of shell bead types, and specimens were more frequently incised with simple geometric designs than was the case in California.

In Owens Valley, the Rose Spring site may have been occupied from upper Middle (?) times into the protohistoric period. Shell beads from the Cottonwood site indicate protohistoric to historic occupation [56]. Contact with Southern California appears to have been dominant, though trade with Central California is probably represented also.

Table 3: Shell Artifact Types from the Western Great Basin

SITE NO.	TYPE: Saxidomus clam disk: Vla II, III	Olivella thin lipped:3a1	Haliotis ornament: Ola III	Haliotis disk bead: 3	Tivela large clam disk:VlbI	Tivela thick clam disk:VlaI	Olivella rough disk	Dentalium:B2	Glycymeris end ground:D9	Glycymeris rectangle	SITE NAME
Iny-2*	46		1	3	1	1					Cottonwood
Iny-372*	6					1					Rose Spring
Ch-16*	1										Hidden Cave
Pe-13	1										
Ch-3							1				
Ch-56							20				Parran Lakebed
Pe-12							1				Granite Pt. Cave
Pe-27							1				
Ch-39						1	7	6	1		Pelican Island
Wa-63							7				Thea Heye Cave
Ch-15	4	75	1		1						Humboldt Lakebed
Ch-35*											Humboldt Cave
Ch-67											
Las-1*											Tommy Tucker Cave
Pe-6							1				Toy
Ch-118							1				Stillwater Marsh locality
Ch-89											
Ch-28											
Ch-2											
Ch-60											Salt Wells
Ch-18*											Lovelock Cave
Las-7*											Karlo
Total	6	127	1	1	4	1	3	39	6	1	

*Excavated sites. Unstarred sites represent surface or dateless collections.

Table 3 (continued)

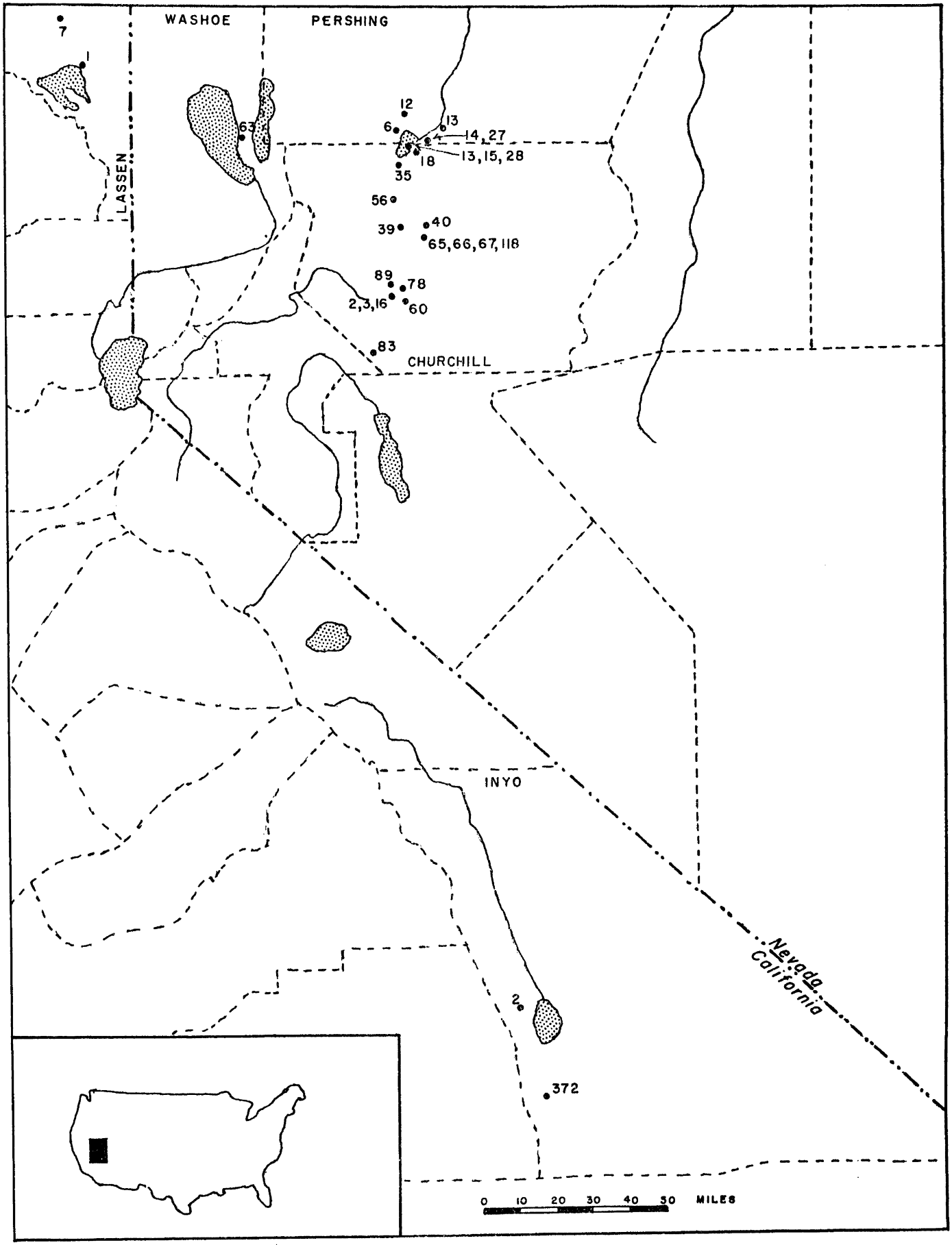
SITE NO.	TYPE Olivella thin rectangle:2a2	Olivella cupped: 2e	Haliotis ornament: N6aI	Olivella thin rectangle:2a1	Olivella split, punched:3a2	Olivella small disk:3d	Tivela thin clam disk:V1aI	Haliotis ring bead:J2aI, III	Olivella modified saddle:3b2	Olivella saddle: 3b	SITE NAME
Iny-2*		1			1	3	1				Cottonwood
Iny-372*					1		2	1000			Rose Spring
Ch-16*											Hidden Cave
Pe-13											
Ch-3											
Ch-56											Parran Lakebed
Pe-12											Granite Pt. Cave
Pe-27											
Ch-39	138	23		8	4						Pelican Island
Wa-63			1			8					Thea Heye Cave
Ch-15				3	23				4	3	Humboldt Lakebed
Ch-35*					1						Humboldt Cave
Ch-67					1						
Ch-13											
Las-1*					7	230			8	7	Tommy Tucker Cave
Pe-6											Toy
Ch-118											Stillwater Marsh locality
Ch-89					1						
Ch-28										1	
Ch-2										2	
Ch-60											Salt Wells
Ch-18*											Lovelock Cave
Las-7*											Karlo
Total	138	24	1	11	39	241	3	1000	12	13	

Table 3 (continued)

SITE NO.	TYPE: Haliotis ring ornament: J2aIV	Olivella saucer: 3c	Olivella split, drilled: 3b1	Olivella oval	Olivella scoop	Olivella grooved rectangle	Olivella flat disk	Macoma clam disk: VIa1V	Olivella cap: G1b	Olivella thick rectangle: 2b	SITE NAME
Iny-2*											Cottonwood
Iny-372*											Rose Spring
Ch-16*											Hidden Cave
Pe-13											
Ch-3											
Ch-56											Parran Lakebed
Pe-12											Granite Pt. Cave
Pe-27											
Ch-39			4	6	1						Pelican Island
Wa-63											Thea Heye Cave
Ch-15		6	8	3	4						Humboldt Lakebed
Ch-35*											Humboldt Cave
Ch-67											
Ch-13					2						
Las-1*	1		4	3	2						Tommy Tucker Cave
Pe-6			1								Toy
Ch-118			1								Stillwater Marsh locality
Ch-89											
Ch-28											
Ch-2					1			6		3	
Ch-60										1	Salt Wells
Ch-18*				30		16	188	2	12	12	Lovelock Cave
Las-7*				2	1			5		8	Karlo
Total	1	6	18	44	11	16	188	13	12	24	

Table 3 (continued)

SITE NO.	TYPE: Haliotis square bead:2	Haliotis square bead:1	Mytilus square bead:1	Haliotis ornament: C(1)	Haliotis ornament: C(1)1	Haliotis ornament: C(2)	Haliotis ornament: C(2)1	Haliotis ornament: A1	SITE TOTALS	SITE NAME
Iny-2*									58	Cottonwood
Iny-372*									1010	Rose Spring
Ch-16*									1	Hidden Cave
Pe-13									1	
Ch-3									1	
Ch-56									20	Parran Lakebed
Pe-12									1	Granite Pt. Cave
Pe-27									1	
Ch-39									199	Pelican Island
Wa-63									16	Thea Heye Cave
Ch-15									135	Humboldt Lakebed
Ch-35*									1	Humboldt Cave
Ch-67									1	
Ch-13									2	
Las-1*	2								264	Tommy Tucker Cave
Pe-6									2	Toy
Ch-118									2	Stillwater Marsh locality
Ch-89									1	
Ch-28									1	
Ch-2									12	
Ch-60									1	Salt Wells
Ch-18*		25		2	1	1	1		290	Lovelock Cave
Las-7*	1	924	122		1	5	1	3	1073	Karlo
Total	3	949	122	2	2	6	2	3	3093	



Map I. The Western Great Basin

Endnotes

1. Haury, 1940, pp. 95, 96.

2. Steward, 1938, p. 45; 1941, element numbers 1324-1326, 1888. The data for the Northern Paiute are also in agreement (Stewart, 1941, element numbers 1323-1326, 1889).

3. Summarized by Sample, 1950, pp. 18-20. Additional information on Nevada is provided by Steward (note 2 above) though little detail is given. The denial of disk beads by the Northern Paiute of Owens Valley is probably incorrect since the use of shell disk money is affirmed and other sources on trade imply considerable exchange of this commodity. The use of dentalia is recorded as uncertain, but such beads were available on the southern coast and did reach the southern San Joaquin Valley. At the same time the "long shell beads" suggested as dentalia for the Mono Lake Paiute (Steward, 1938, p. 258) may well represent Tivela clam cylinders. Glass beads had largely replaced those of shell in historic times so that archaeology will have to fill in the uncertainties in the ethnographic record.

4. Gifford, 1947.

5. Sample, 1950, p. 17.

6. Steward, 1933, p. 258; 1941, element number 1891.

7. It has been necessary to use a composite typology in Table 3 because none of the previous taxonomic attempts have recognized all of the significant form variations. The number-letter designations which follow the type names refer to one of the following typologies:

Lillard, Heizer and Fenenga, pp. 12, 15-17 Heizer, 1949, Figs. 5a, 6a		Gifford, 1947
Olivella bead type	2a	X3aI, X2a
	2b	X2a, X3aI
	3a1	X3bII
	3a2	X1a, X2a
	3b	X3bI (part)
	3b1	X1b, X2b, X3bI
	3b2	X3c, X3aI
	3c	X3bI (part)
	3d	X3bI (part)
	3e	X4 (part)
	--	G1b

Lillard, Heizer and Fenenga, pp. 12, 15-17 Heizer, 1949, Figs. 5a, 6a		Gifford, 1947
Haliotis bead type	1	S5a, Q3 (part)
	2	S6a, Q7aIII (part)
	3	J2a (part)
Mussel bead type	1	T1c
Haliotis ornament type	A1	AP2
	C(1)	J2, K1
	C(1)1	K4
	C(2)	K3
	C(2)1	--
	--	N6aI
	F1	O1aIII
	--	All clam, dentalium, and glycymeris types

The Lillard, Heizer and Fenenga typology, part of which is shown above in concordance with that of Gifford, except as noted (i.e., for clam, dentalium and glycymeris types, which refer to Gifford's typology only) is based on form variations which have demonstrable significance in terms of grave-lot seriation and stratigraphy, and it therefore has been preferred when pertinent. The Gifford typology is based solely on form and species and many of the categories lack cultural meaning. Thus Gifford has split all rectangular *Olivella* beads into two groups depending on whether or not a remnant of the whorl-shelf remains, but has ignored the larger perforation and greater thickness of the Early Horizon beads (type 2b) when compared to the Late Horizon beads (type 2a); in addition, Gifford has included a rectangular variant of the split, punched bead (type 3a2, X1a) with the drilled rectangular beads. The separation of type 3b1 by Gifford into three types (depending on the amount of whorl shelf which is present) has no temporal significance; all three variants can be found on the same string. Gifford's type X3bI is a catchall of oval and circular beads which can be divided into a number of significant types by means of grave-lot analysis. Similarly, Gifford has separated both types 1 and 2 of *Haliotis* beads from the same string into two types on the basis of parallel or non-parallel sides, and then has lumped these beads with ornaments of all sizes. *Haliotis* disk and ring beads are lumped with larger ornaments by Gifford.

Such types as the scoop, oval, flat disk, and rough disk *Olivella* beads have not been isolated previously and therefore bear no letter-number designation. Type 2a *Olivella* rectangles have been divided into two variants, type 2a1 (with central perforation), and type 2a2 (with end perforation) because this difference has temporal significance. Types 3a2 and 3b1 have previously been termed "half-shell" beads but are termed "split" beads herein because they are often only quarter-sections. Spire-lopped *Olivella* beads

are omitted from Table 3 but are discussed in the text, and only those Haliotis ornaments which resemble significant California types have been included in this table.

It must also be emphasized that the application of these Californian typologies to specimens from the Great Basin, and the conclusions derived therefrom, must be regarded as tentative. Trade in finished shell beads and ornaments from the California coast into the Great Basin is supported by ethnographic reports and by the similarity in form of most archaeological specimens. At the same time, evidence will be presented herein for some local manufacture of shell beads, and such an industry could alter the temporal relationships which have been inferred. There is evidence for some trade with the Southern California coast, a region which had the richest shell artifact assemblage but which lacks any adequate chronological framework. There are some suggestions (based on incomplete investigations of E. P. Lanning) that the sequence of bead types was not always parallel in Central and Southern California, and the analysis presented herein may be overly weighted in favor of Central California.

Equally important is the nature of the Great Basin collections. With few exceptions, the specimens were found on the surface or unassociated in the midden, and many of the sites appear to have been occupied intermittently over a long time period. Such conditions are not conducive to accurate classification, which is best applied to a large sample of associated specimens. Individual beads may be intermediate between recognized types because of normal variation, local manufacture, or the fact that a number of types represent different stages of a single evolving tradition; although an attempt has been made to classify each isolated bead, the results should be reviewed when more information is available on shell artifact associations in the Great Basin. A large number of specimens are fragments (especially at Ch-39) which also increases the uncertainty of classification.

The following specimens (including spire-lopped beads) are part of the Nevada State Museum collections (Carson City): all artifacts from Pelican Island (NSM site 1-41, numbers 2 through 5, 55, 180, 181, 182, 187); all Ch-2 specimens (site 1-42, numbers 79, 144, 145, 146); and the Ch-60 bead (1-43-4). In addition, 60 type 3a1, one type 3b2, and one type 2a1 Olivella beads (NSM catalog number 14-1-260) came from the Humboldt Lakebed, just over the Pershing County line; since this site is probably an extension of site Ch-15, these beads have been lumped in Table 3 with specimens [in the University of California Museum of Anthropology (U.C.M.A.) collections] from this latter site.

Three lots of spire-lopped Olivellas, one oval Olivella bead, and two Haliotis ornaments [types C(1), C(1)1] from Lovelock Cave are in the U.C.M.A. All other specimens from this site are in the Museum of the American Indian, Heye Foundation (New York). These latter specimens have been classified from notes and photographs obtained by G. L.

Grosscup, but the actual beads would be necessary to allow certain identification. All specimens from Thea Heye Cave are also in the Museum of the American Indian.

The beads from Ch-56, Pe-6, Pe-27, Ch-118, fifty spire-lopped Olivellas from Pe-14, and one spire-lopped Olivella from Las-1 are all in private collections. All remaining specimens shown in Table 3 are in the U.C.M.A.

8. The two types not shown in Table 3 represent a distinctive incised Tivela clam disk (type V1h of Riddell, 1951, p. 19; lumped with V1bI in Table 3, herein, because of space limitations), and one spire-lopped Olivella (probably O. baetica rather than O. pedroana; definitely not O. biplicata).

The beads from Iny-2 were classified in terms of the Gifford typology by Riddell (1951, pp. 18, 19, Table 1). The classification used herein for Olivella beads affords the following distinctions: one rough disk and three small disks (type 3d) were separated from type X3bI, and one cupped bead (type 3e) was distinguished from type X3bII. In addition, small fragments of one large clam disk (type V1bI) and one thin clam disk (type V1aI?) have been added; the latter specimen is too small to allow certain identification as Tivela rather than Saxidomus.

9. The Haliotis disk bead (Fig. 1, No. 63) and Olivella small disk bead (like Fig. 1, No. 38) have little temporal significance at present because both appear with Middle and Late Horizon associations in Central California (significance uncertain in Southern California). No adequate study has yet been made of the Tivela clam disks of Southern California. The large disk (Fig. 1, No. 55) is known to be late but the first appearance of the type is uncertain. There are suggestions that the greatest popularity of the thin disk (like Fig. 1, No. 53) occurred before the protohistoric period in the south, or earlier than was true of the similar Saxidomus clam disks of Central California, but occasional use of Tivela thin disks appears to have persisted into later times. The Tivela thick disks (Fig. 1, No. 54) appear to have had a much longer duration, appearing at least by the Early Island period (Olson, 1930), but more study of their temporal significance is needed. The Olivella cupped bead (like Fig. 1, No. 39) was most popular before the thin-lipped Olivella bead, and was ancestral to it, but the cupped form did persist in reduced quantity. Likewise the split, punched Olivella bead is most common near the beginning of the Late Horizon, but occasional manufacture appears to have continued into protohistoric times.

10. Only preliminary analysis of a test excavation in Iny-372 is available (Riddell, n.d.), and the bead collection from the midden is too small to be emphasized. However, the sequence of types is in agreement with that found elsewhere.

11. A single variant thin-lipped bead was found near Burial 2 at 36-48 inches depth. If the specimen was associated with the burial it probably represents a lipless variant of type 3a1 (such beads are occasionally found in strings of this type). If the bead is an accidental association it more likely represents the oval bead type.

12. The vast majority of these rings were made of Haliotis cracherodii, with perhaps twelve examples of H. rufescens. The uniform size (14-22 mm. diameter) and quantity of these beads indicate a distinct type, also found in graves on Santa Rosa Island (Jones, 1956, Pls. 114d, 115d) and elsewhere in Southern California (included with beads and ornaments of all sizes in type J2 of Gifford, 1947). The ring ornaments of H. cracherodii which occur in small numbers in lower Middle Horizon sites of Central California are consistently larger.

13. Stewart, 1941, element numbers 1323-1326, 1889.

14. Spire-lopped Olivellas represent type 1a (small, Fig. 1, Nos. 1, 2) and 1b (large, Fig. 1, No. 3) in the Lillard, Heizer and Fenenga typology. Gifford (1947) separated plain (type F5b) and incised (F5a) beads. Size has little significance unless large numbers of beads are available. In Central California, small (immature shells) beads predominate during the Early Horizon and Phase 1 of the Late Horizon (perhaps because the large shells were used to make quantities of the rectangular beads in both periods), while large (mature shells) beads predominate in other periods. However, the variation is too great to allow the use of bead size as a primary temporal guide. In the present report the division point between small and large beads has been placed between 9 and 10 mm. diameter (length is of little value because of the variable degree of spire and orifice grinding or breakage). The greater number of small spire-lopped Olivellas at Las-7 and Ch-18 support the Early Horizon relationships suggested by other shell artifacts, though the specimens average slightly larger than their California counterparts.

The great majority of these beads represent O. biplicata, but some ten specimens from Las-7 represent the rare O. baetica (Fig. 1, No. 4). No temporal significance is apparent in this species difference in California middens.

Most specimens have ground spires, but broken spires occur also. Both variants appear throughout the cultural sequence in Central California. Grinding of the orifice (non-spire) end (Fig. 1, No. 9) is found on some seventy-six specimens from Las-7, many beads from Ch-18, two from Ch-2, and on one bead from Ch-78. This trait is also present in the Early Horizon of Central California (as well as Phase 1, Late Horizon). The grinding is seldom as extreme as that found on the barrel Olivella bead (Gifford, 1947, type G1a; Fig. 1, No. 10, herein) of Southern California, though there is intergradation (see endnote 29).

The various collections represented in this tabulation are given in the terminal section of endnote 7.

15. Five of these beads from Ch-3 have diagonally ground spire-ends (Fig. 1, No. 8), comparable to type 1c of the Early Horizon of Central California (Heizer, 1949, Fig. 5c'). While it is quite possible that this variation is fortuitous, as suggested by Gifford (1947, p. 10, type F5b), it still may be significant that the only definite lots of such beads so far noted come from Sac-107 and Ala-307, associated with beads of the Early Horizon complex, and from the Tranquillity site (Fre-48), which also appears to be quite old (Hewes, 1946, p. 213, Fig. 28m). The Ch-3 beads are larger than typical Early Horizon spire-lopped specimens, however, with diameters of 6, 9, 9, 10 and 11 mm.

16. All specimens from Lovelock Cave which have data are type 1a and occur below 72 inches depth (Early and the beginning of Transitional Lovelock periods). Various methods of stringing these beads are shown by Loud and Harrington (1929, Fig. 17, Pl. 53) and Orchard (1929, Figs. 8, 9).

17. The single specimen from Humboldt Cave was found in an upper level assigned to the Late Lovelock culture (Heizer and Krieger, 1956, p. 67).

18. As discussed under local manufacture in the text, a large number of fragments from Pelican Island indicate that other bead types were made from large spire-lopped specimens at this site. One of the incised beads is a small weathered fragment; the other is shown in Fig. 1, No. 6.

19. These specimens from Leonard Rock Shelter represent one string of about fifty beads and two isolated beads from the deep guano layer, with a C-14 date of 5088 $\pm$ 350 B.C. (Heizer, 1951b, pp. 92-94).

20. Fenenga and Riddell, 1949, p. 211, Fig. 58u-w; Riddell, 1956b, p. 2.

21. The much higher frequency of large beads from the midden may indicate that some of the type 1b beads post-date the burials.

22. Riddell, 1956a, pp. 45-47.

23. Not shown in Table 3 are three beads with three perforations (Fig. 1, No. 68) and one with four perforations (Fig. 1, No. 69), types which have not been found elsewhere. The epidermis has been ground off most of the abalone beads but traces suggest that Haliotis rufescens shell was used more often than H. cracherodii; the grinding and species proportions are also characteristic of the Early Horizon in Central California.

24. Only one of the five Macoma specimens was found with a burial. Riddell (1956a, p. 46) describes these as "late type clamshell disk beads" (i.e., Saxidomus) but all appear to be Macoma.

25. G. L. Grosscup (University of California) is in the process of re-analyzing the collection made by M. R. Harrington at Lovelock Cave, and has kindly furnished the cultural attributions made herein.

26. Harrington's notes indicate that about two hundred rectangular shell beads were present, but Grosscup could find only about thirty beads. The proportion of the two types is approximate because preservation conditions did not allow a specific count.

27. Illustrated by Orchard, 1929, Fig. 11.

28. Loud and Harrington, 1929, Pl. 53c, d. It may be noted that type C(1)1 was claimed as an historic Northern Paiute type (ibid., p. 106).

29. Identification of type G1b has been made from photographs and therefore is not certain; a few may represent type G1a. The problem of end grinding of spire-lopped Olivella beads requires further analysis. Slight grinding of the orifice end occurs on beads from both Central and Southern California, but has not been distinguished typologically. In Southern California the process was carried much further (in what is probably a developmental sequence) from slight end grinding (Fig. 1, No. 9) through type G1a (Fig. 1, No. 10) and type G1b (Fig. 1, No. 11) to type G1c (see Gifford, 1947; the type has a superficial resemblance to type 3e, Fig. 1, No. 39, herein). However, no precise limits for each of these types has been worked out, and no analysis of the variation in terms of grave lots has been made. The division between slight end grinding and type G1a is particularly vague. Casual inspection suggests that there are more type G1b specimens at SCrI-3 (Early Island, see endnote 33) than has been indicated by Gifford (1947), though type G1a is certainly dominant. A few type G1a may be represented in the Early Horizon collection from Central California, but only one type G1b specimen has been noted. Of the seventy-six end ground beads from Karlo, only one specimen (Fig. 1, No. 10) appears to qualify as type G1a so the type has not been entered in Table 3. None of the Karlo beads approach type G1b. It seems probable that all type G1b specimens were traded from Southern California, and if all twelve of the Lovelock Cave beads are type G1b they perhaps indicate a slightly later time period than that represented by the square Haliotis and rectangular Olivella beads.

30. Since other traits of this early complex are absent at Tommy Tucker Cave, it seems probable that the two Haliotis beads (type 2) found at this site (Riddell, 1956b, Fig. 4 l, m) represent local manufactures with a fortuitous resemblance. Most of the other Haliotis

beads and ornaments illustrated by Riddell are not standardized types in Central California and may indicate a local industry which utilized fragments of broken ornaments or reworked whole specimens to allow wider circulation of these valuables.

31. Heizer, 1949, pp. 17, 18. Mussel shell beads were not noted in this report, but do occur. See also endnote 34.

32. The Berkeley facies refers to an unpublished assemblage with both Early and Middle Horizon traits recently found at Ala-307 on San Francisco Bay. A related complex (different facies?), also unpublished, has been found at site SMa-77, excavated by Stanford University.

33. Olson, 1930. The Early Island culture, as used herein, refers specifically to site 3 on Santa Cruz Island (SCrI-3), where several thousand beads were found with many burials. The bead complex does not appear at other sites placed in this period by Olson. A handful of beads without provenience from Camp 5 on Santa Rosa Island (Jones, 1956, p. 205, Pl. 100c upper) also represent this complex.

34. Only one type G1b specimen has been noted in Central California, from the Early Horizon site SJo-68. It probably was traded from the south. Type G1a, rather than G1b, is most typical of Early Island sites, but more analysis is needed (see endnote 29).

35. Lovelock Cave dates are given in Heizer and Krieger, 1956, pp. 74-76; dates for the Berkeley facies (Ala-307) are given in Crane, 1956, p. 669.

36. Heizer, 1951a, p. 25. Two additional dates (4350 ± 250, 4100 ± 250 B.P.) have recently been obtained from the same site, SJo-68.

37. As discussed below under local manufacture, six of the eighteen type 3b1 beads are local variants.

38. Unfortunately, all beads and ornaments from Las-1 occurred as isolated finds in the midden with little meaningful stratigraphic relationship. Positive classification of single beads is often impossible, and the problem is particularly difficult for these type 3b and 3b2 specimens which represent a single developmental tradition. Six of the 3b2 and two of the 3b beads are actually intermediate forms, and the entire lot may represent the time period when type 3b was changing into type 3b2. In addition two of the six doubtful type 3b2 beads have a larger than normal perforation, suggestive of the oval Olivella bead, but are smaller than typical oval beads. Riddell (1956b, pp. 2, 3) used the Gifford classification (types X3bI, X3c), but as already indicated, type X3bI is a catchall for any oval or thin disk bead.

39. The type J2aIV Haliotis ornament (Riddell, 1956b, Fig. 4u, Fig. 1, No. 78 herein) has all trace of the epidermis removed, and therefore is

not a typical Central Californian form (usually Haliotis cracherodii). The Las-1 specimen seems more similar to Southern California ornaments (temporal significance uncertain).

40. The single type 3a2 bead from Humboldt Cave came from the 12-18 inch level of the Late Lovelock period (Heizer and Krieger, 1956, p. 67).

Those from Tommy Tucker Cave were scattered in the midden. As indicated by Riddell (1956b, pp. 18-20) the occupation of this cave is difficult to interpret (evidence of gambling, historic avoidance, and the absence of grinding implements suggest that a specialized retreat may be represented). Despite 60 inches of excavated deposit, no clear stratigraphic change is apparent. Except for two Olivella 3b2 beads and the two hundred thirty type 3d beads, which were found on separate strings in the deposit, all shell beads occurred as isolated finds in the midden and show no meaningful stratigraphic relationship. However, only the 3d, one 3b1, and three 3a2 beads (excluding the spire-lopped specimens) were found in Room 1 (Fenenga and Riddell, 1949, Fig. 58t, x-a'. These were not included in Riddell, 1956b). The remainder, including the Haliotis specimens listed in Table 3, herein, were found in Room 2 at the darkened rear of the cave. Most of these suggest Middle Horizon types, and a variety of bone artifacts suggestive of Middle affiliation also occurred in the same deposit of Room 2. However, two type 3a2 (typical of Phase 1 of the Late Horizon in Central California) occurred in the 40-60 inch level of Room 2, below most of the Middle Horizon beads (types 3b, 3b1, 3b2). This may indicate the persistence of the Middle Horizon bead complex into Phase 1 times in the Great Basin, comparable to the persistence already noted for the Early Horizon bead complex. It may also be that type 3a2 appeared earlier in the Basin than in Central California, or possibly the midden was disturbed. The problem cannot be solved until these bead types are found with burials or more meaningful associations in the Great Basin.

41. While a northern origin seems most likely, it should be kept in mind that the Santa Barbara coast could also have been source for both whole and cut sections of Dentalium pretiosum (see Gifford, 1947, type B2). The specimens from Ch-39 (one of the 7), Ch-56, Pe-12, and Pe-27 represent whole shells (Fig. 1, No. 58), while six of those from Ch-39 and all from Ch-3 and Thea Heye Cave represent short, cut sections of the shell (Fig. 1, No. 59). The form of the Pe-6 and Ch-118 specimens was not recorded.

42. Though other artifacts indicate a long occupation for Hidden Cave (Ch-16), the clam disk bead was found at 6 inches depth.

43. The splitting of these shells by sawing would appear to be a most uneconomical method of manufacture. It took one of the authors some twenty minutes to cut through one side of a whole spire-lopped shell from the spire-end to the tough basal callus, and to split the latter

would have taken even longer. (Three thin, sharp, unmodified obsidian flakes were used, each of which became dulled by the removal of small chips to produce a typical unifacial "side scraper." This may indicate that the chipping on at least some side scrapers is the result of use rather than purposeful manufacture. A bifacial obsidian "knife" was too thick to be effective.) While the aboriginal worker was doubtless more efficient, it still must have taken longer to saw through both sides of the shell than would have been the case if the shells had been crushed. This sawing may indicate a desire to secure as much bead material as possible, and therefore may reflect the relative scarcity of, and high value placed on, the spire-lopped Olivella bead. However, the rarity of these sawed sections and the nature of the refuse suggest that most shells were merely crushed.

44. It will be assumed herein that unique types have a local origin, though it is possible that such archaeologically unknown regions as the northern California or Oregon coasts might be the source of these unusual types.

45. See endnote 30.

46. The method of stringing these beads is illustrated by Orchard, 1929, Fig. 10. A triangular ornament of Haliotis cracherodii (type U4 of Gifford, 1947; Fig. 1, No. 77, herein) was attached to one of the strings. This form has little temporal significance in California, but the green (black) abalone was most commonly used during Middle Horizon times. This species was also used over a long time period in Southern California.

47. Beads have been included in the scoop type if they are end perforated, and have the shelf end removed which produces a flaring appearance. Normally the canal at the unmodified orifice end remains, though one atypical specimen (Fig. 1, No. 45) has been ground on all edges. None of the end perforated type 3b1 (see endnote 48) have been included because they retain the shelf. Quite possibly the latter beads should be placed with the scoop rather than with type 3b1, but better evidence for association is needed.

48. These end-perforated, split-drilled beads have been included with normal type 3b1 beads in Table 3. There are five specimens from the Humboldt Lakebed site (including the unique double perforated bead), and one from Tommy Tucker Cave. Of the Lakebed specimens, two probably represent broken type 3b1 beads which were redrilled and reground (Fig. 1, Nos. 31, 32) because the perforation is normally placed at the orifice (non-shelf) end, and the small size of these two beads is atypical. It may be noted that two beads from "Modoc or Siskiyou County, California" are also end perforated (Fig. 1, No. 30).

49. The distribution given for the oval Olivella bead in Table 3 should be regarded as tentative. As indicated in the text, some are possibly

only variants of types 3b1 or 3a1. In addition, it is possible that others are variants of types 3b or 3b2 with a larger perforation than is normal for saddle or modified saddle beads. One of the Las-7 specimens has a small perforation but does not have characteristic shape of type 3b or 3b2. As indicated in endnote 38, there are intermediate forms at Las-1. The proportions of Fig. 1, No. 49 (unique, from Ch-15) suggest type 3b but the perforation is much too large. This bead (as well as Fig. 1, Nos. 26, 31, 32 and 45) suggests the local reworking of broken fragments without regard to any particular type. Such problems are inevitable when dealing with single beads, and more strings of associated specimens are needed to clarify the degree of standardization in Great Basin beads.

50. Gifford, 1947, type F5a.

51. Wedel, 1941, Pl. 27f.

52. Lillard, Heizer and Fenenga, 1939, Pl. 21. Incising on bone is also common in the Great Basin (Riddell, 1956b, Fig. 6; Loud and Harrington, Pl. 12d, i; Heizer and Krieger, 1956, Fig. 3, p. 18) but no precise dating is yet available for this art. Most of the simple designs on these bone specimens from the Basin more closely resemble the art of the Middle Horizon than the complex style which developed in Late Horizon times in California. The common use of short lines, found on many of the bone pieces cited above, as well as on the shell bead shown in Fig. 1, No. 21, herein, is especially characteristic of the Basin and is so simple that a local development is as likely as diffusion.

53. Lillard, Heizer and Fenenga, 1939, Pl. 29p-t. Surface incising of shell beads is absent from Central California, except for the two southern San Joaquin Valley specimens.

54. E.g., Gifford, 1947, types AV3b, AW2a.

55. Edge incision (e.g., Gifford, 1947, types X5a, X5b; Fig. 1, Nos. 46, 57, herein) is excluded from this comparison. Pattern incision of the outer surface of the bead appears to represent a distinct tradition.

56. The spread of types at the Cottonwood site in Table 3 is misleading because the four lower types persist as rare occurrences into the protohistoric period.

Bibliography

Abbreviations Used

AAnt:	American Antiquity.
BAE-B:	Bureau of American Ethnology, Bulletin.
UC-AR:	University of California Anthropological Records.
UC-PAAE:	University of California Publications in American Archaeology and Ethnology.
UCAS-R:	University of California Archaeological Survey, Report.
-Ms.:	Unpublished manuscript.

Crane, H. R.
1956 University of Michigan radiocarbon dates I. Science 124:3224.

Fenenga, F. and F. A. Riddell
1949 Excavation of Tommy Tucker Cave, Lassen County, California. AAnt 14:203-214.

Gifford, E. W.
1947 Californian shell artifacts. UC-AR 9, No. 1.

Haury, E. W.
1940 Excavations in the Forestdale Valley, East-Central Arizona. University of Arizona Bulletin 11, No. 4.

Heizer, R. F.
1949 The archaeology of Central California I: The Early Horizon. UC-AR 12, No. 1.

1951a An assessment of certain Nevada, California and Oregon radiocarbon dates. In, F. Johnson, Radiocarbon dating, AAnt Memoir 8:23-25.

1951b Preliminary report on the Leonard Rockshelter site, Pershing County, Nevada. AAnt 17:89-98.

Heizer, R. F. and A. D. Krieger
1956 The archaeology of Humboldt Cave, Churchill County, Nevada. UC-PAAE 47, No. 1.

Hewes, G. W.
1946 Early man in California and the Tranquillity site. AAnt 11:209-215.

Jones, P. M.
1956 Archaeological investigations on Santa Rosa Island in 1901. UC-AR 17, No. 2.

Kroeber, A. L.
1925 Handbook of the Indians of California. BAE-B 78. Washington.

Lillard, J. B., R. F. Heizer and F. Fenenga
1939 An introduction to the archeology of Central California. Sacramento Junior College, Department of Anthropology, Bulletin 2. Sacramento.

Loud, L. L. and M. R. Harrington
1929 Lovelock Cave. UC-PAAE 25, No. 1.

Olson, R. L.
1930 Chumash prehistory. UC-PAAE 28, No. 1.

Orchard, W. C.
1929 Beads and beadwork of the American Indian. Museum of the American Indian, Heye Foundation, Contributions 11:1-140.

Riddell, F. A.
n.d. Report on the test excavation of the Rose Spring site, Inyo County, California (site Iny-372). UCAS-Ms. No. 232. 1956.

1956a Archaeological research in Lassen County, California. UCAS-R 33:44-49.

1956b Final report on the archaeology of Tommy Tucker Cave. UCAS-R 35:1-25.

Riddell, H. S.
1951 The archaeology of a Paiute village site in Owens Valley. UCAS-R 12:14-28.

Sample, L. L.
1950 Trade and trails in aboriginal California. UCAS-R 8.

Steward, J. H.
1933 Ethnography of the Owens Valley Paiute. UC-PAAE 33, No. 3.

1938 Basin-Plateau aboriginal sociopolitical groups. BAE-B 120.

1941 Nevada Shoshone. Culture Element Distribution XIII. UC-AR 4:209-259.

Stewart, O. C.
1941 Northern Paiute. Culture Element Distribution XIV. UC-AR 4:361-446.

Wedel, W. R.
1941 Archaeological investigations at Buena Vista Lake, Kern County, California. BAE-B 130.

Explanation of Figure 1

Symbols Used

UCMA: University of California Museum of Anthropology collection, Berkeley.
NSM: Nevada State Museum collection, Carson City, Nevada.
MAI: Museum of the American Indian, Heye Foundation, New York City.

All figures are natural size.

Olivella beads (all but No. 4 represent O. biplicata).

1. Type 1a, spire-lopped. Site Las-7. UCMA 1-196733a.
2. Type 1a, spire-lopped. Site Ch-83. UCMA Field No. 147.
3. Type 1b, spire-lopped. Site Pe-14. UCMA 2-26732.
4. Type 1a, spire-lopped, O. baetica. Site Las-7. UCMA 1-196729.
5. Type 1b, spire-lopped, incised. Site Ch-65, UCMA 2-30496.
6. Type 1b, spire-lopped, incised. Site Ch-39. NSM 1-41-187.
7. Type 1b, spire-lopped fragment, incised. Site Ch-2. NSM 1-42-79.
8. Type 1c, spire-lopped with diagonal grinding. Site Ch-3. UCMA 2-30406.
9. Type 1b, end-ground, spire-lopped. Site Ch-78. UCMA Field No. 31.
10. Type G1a, barrel. Site Las-7. UCMA 1-196733b.
11. Type G1b, cap. Site Ch-18. MAI 13-4658.
12, 13. Type 2a1, thin rectangle, central perforation. Site Ch-39. NSM 1-41-181.
14, 15. Type 2a2, thin rectangle, end perforation. Site Ch-39. NSM 1-41-181.
16. Type 2b, thick rectangle. Site Las-7. UCMA 1-196896.
17. Type 2b, thick rectangle. Site Ch-2. NSM 1-42-145.
18, 19. Type 3a1, thin-lipped. Site Ch-15. UCMA 1-65714a.
20. Type 3a2, split, punched. Site Ch-15. UCMA 1-65708a.
21. Type 3a2, split, punched, incised. Site Ch-15. UCMA 1-65712.
22. Type 3b, saddle. Site Las-1. UCMA 1-101595a.
23. Type 3b, saddle. Site Ch-15. UCMA 1-65715.
24. Type 3b, saddle. Site Las-1. UCMA 1-101434a.
25. Type 3b1, split, drilled. Site Las-1. UCMA 1-101436.
26. Type 3b1, split, drilled. Site Las-1. UCMA 1-101655a.
27. Type 3b1, split, drilled, incised. Site Ch-15. UCMA 1-65711.
28. Type 3b1, split, drilled, incised. Site Ch-15. UCMA 1-65713.
29. Type 3b1, split, drilled, end perforated. Site Ch-15. UCMA 1-65708b.
30. Type 3b1, split, drilled, end perforated. "Modoc or Siskiyou Counties, California." UCMA 1-59934.
31. Type 3b1, split, drilled, end perforated, reworked. Site Ch-15. UCMA 1-65708b.

32. Type 3b1, split, drilled, end perforated, reworked. Site Ch-15. UCMA 1-65718.
33. Type 3b1, split, drilled, double perforated, incised. Site Ch-15. UCMA 1-65710.
34. Type 3b2, modified saddle. Site Las-1. UCMA 1-101434b.
35. Type 3b2, modified saddle. Site Ch-15. UCMA 1-65717.
36, 37. Type 3c, saucer. Site Ch-15. UCMA 1-65716.
38. Type 3d, small disk. Site Las-1. UCMA 1-74719.
39. Type 3e, cupped. Site Ch-39. NSM 1-41-182.
40. Rough disk. Site Iny-2. UCMA 1-202654.
41. Flat disk (ground face). Site Ch-18. MAI 13-4647.
42. Grooved rectangle. Site Ch-18. MAI 13-4648.
43. Grooved rectangle. Site Ch-18. MAI 13-4660.
44. Scoop. Site Ch-15. UCMA 1-65708c.
45. Scoop. Site Ch-15. UCMA 1-65709c.
46. Scoop, nicked edge. Site Ch-2. NSM 1-42-79.
47. Oval. Site Las-1. UCMA 1-101595c.
48, 49. Oval. Site Ch-15. UCMA 1-65714b.

Varied Genera.

50. Saxidomus clam disk, type V1aIII. Site Ch-15. UCMA 1-65719.
51. Macoma clam disk, type V1aIV. Site Ch-2. NSM 1-42-144.
52. Macoma clam disk, type V1aIV. Site Las-7. UCMA 1-196793.
53. Tivela clam thin disk, type V1aI. Site Iny-372. UCMA 1-188073.
54. Tivela clam thick disk, type V1aI. Site Iny-2. UCMA 1-202658.
55. Tivela clam large disk, type V1bI. Site Iny-2. UCMA 1-202599a.
56. Tivela clam large disk, type V1bI, incipient perforation. Site Ch-15. UCMA 1-65720.
57. Tivela clam large disk, incised, type V1h. Site Iny-2. UCMA 1-202599b.
58. Whole Dentalium shell, type B2. Site Ch-39. NSM 1-41-180.
59. Dentalium sections, type B2. Site Ch-39. NSM 1-41-180.
60. Glycymeris shell, end ground, type D9. Site Ch-39. NSM 1-41-4.
61. Glycymeris rectangle. Site Ch-39. NSM 1-41-2.
62. Bone rectangle. Site Ch-39. NSM 1-41-181.

Haliotis beads.

63. Type 3, small disk. Site Iny-2. UCMA 1-202665.
64. Type J2aI, ring bead. Site Iny-372. UCMA 1-188112.
65. Type 1, square, single perforation, average size. Site Las-7. UCMA 1-196897.
66. Type 1, square, unusually small. Site Las-7. UCMA 1-196897.
67. Type 2, square, double perforation. Site Las-7. UCMA 1-196883.
68. Square, three perforations. Site Las-7. UCMA 1-197107.
69. Square, four perforations. Site Las-7. UCMA 1-197106.

Mytilus californianus bead.

70. Type 1, square. Site Las-7. UCMA 1-196897.

Haliotis ornaments.

71. Type A1. Site Las-7. UCMA 1-196891.
72. Type C(1)a. Site Ch-18. MAI 13-4742b.
73. Type C(1)1. Site Las-7. UCMA 1-197086.
74. Type C(2). Site Ch-18. MAI 13-4743.
75. Type C(2)a. Site Las-7. UCMA 1-196699.
76. Type C(2)1. Site Ch-18. MAI 13-4646.
77. Type U4 ornament on string with *Olivella* grooved rectangle beads. Site Ch-18. MAI 13-4660.
78. Type J2aIV. Site Las-1. UCMA 1-101546.
79. Type N6aI. Site Wa-63. MAI 15-8850.
80. Type O1aIII. Site Ch-15. Private collection.

Olivella shell refuse from bead manufacture.

81-87. Cut edges and grooves are indicated by darker lines. Site Ch-39. NSM 1-41-3.

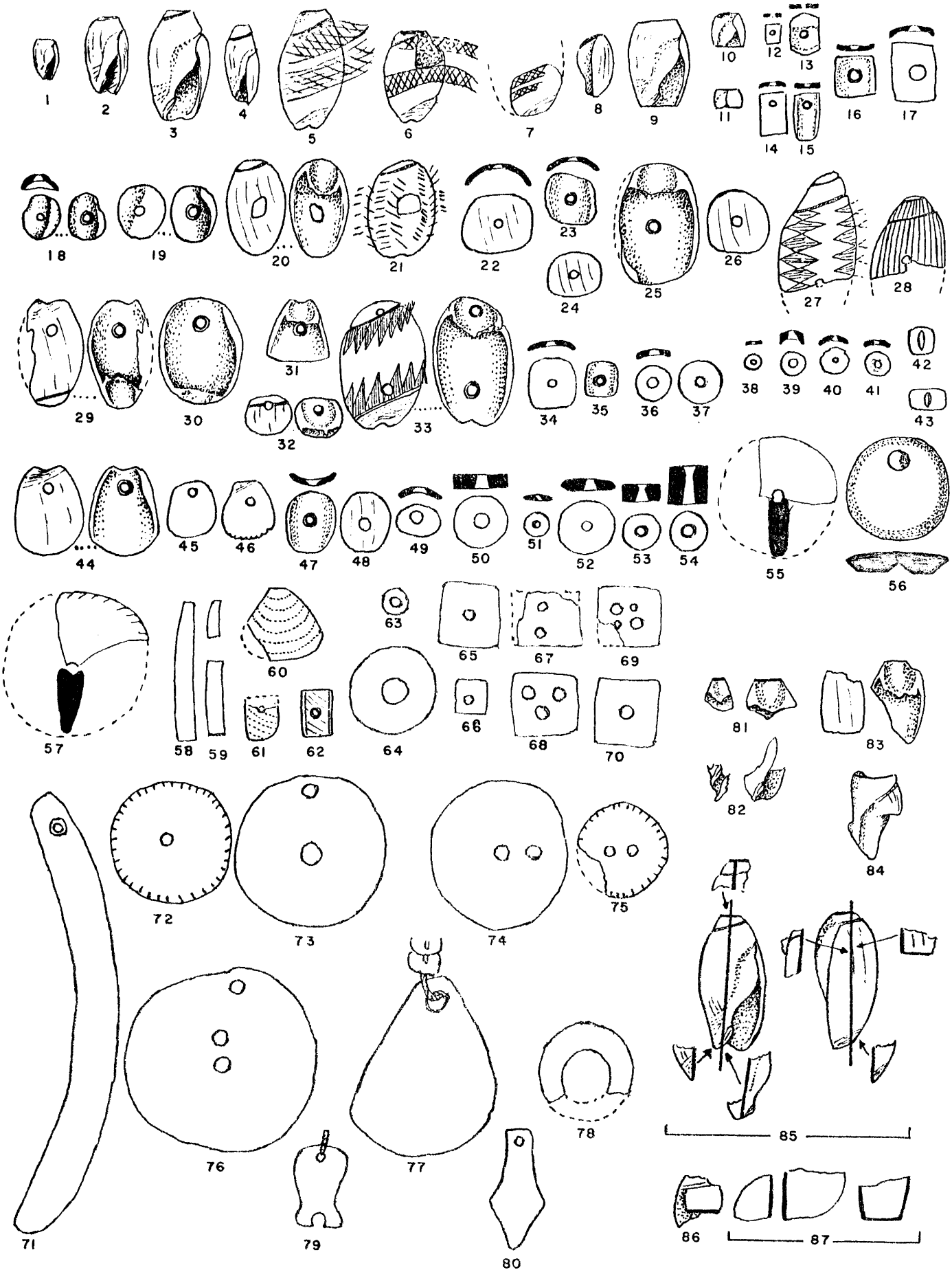


Fig. I. Shell Artifacts from the Western Great Basin