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Morphological and Temporal Projectile Point Types: Evidence from Orange County, California

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Investigators in southern California often employ Great Basin and Mojave Desert projectile point chronologies to date their prehistoric assemblages. This approach is tested using atlatl darts from five Newport Coast sites. In an attempt to partition the Orange County Middle Holocene into discrete temporal segments, the projectile points are classified, where possible, using Great Basin and Mojave Desert point typologies. The Middle Holocene occurrence of a great variety of forms, a consequence of rejuvenation and other factors, complicates the effort. No clear, precise temporal markers emerged from the study, and the data do not support the atlatl point chronology proposed by Koerper and Drover (1983). On the basis of these results, it is concluded that Great Basin and Mojave Desert atlatl dart types cannot be applied indiscriminately to projectile points for chronological control in coastal southern California.

RESEARCHERS in western southern California have few well-stratified sites with an abundance of points and associated radiocarbon dates to develop point chronologies. Thus, they often rely on Great Basin point typologies and chronologies to date lithic assemblages containing points similar to those found in the Great Basin (see Boxt and Rechtman 1981:23-25; Villanueva 1981:38-39, 42; Drover et al. 1983:10-13, 68; Koerper and Drover 1983:2-19; Cottrell and Del Chario 1984:28-31, 68; Cottrell 1985; Cottrell et al. 1985:36; McCarthy et al. 1987:1-46; McDonald et al. 1987:47-55; Swope and Puffer 1989:27-32). Although some attempts have been made to develop projectile point-based chronologies specifically for coastal areas (see Koerper and Drover 1983; Jones and Hylkema 1988), they are rare. The only long chronological sequence proposed for Orange County (Koerper and Drover 1983) generally supported traditional Great Basin atlatl dart point chronologies, but it relied heavily on the data of a single site, CA-Ora-119-A. The Koerper and Drover (1983) effort was presented by the authors as a heuristic scheme that unquestionably would be modified and refined, perhaps considerably, as its various proposed time markers were tested with subsequent data.

This paper addresses the applicability of Great Basin point typologies and chronologies to western southern California. Herein, only the subject of atlatl dart points is addressed; the subject of arrow points will be addressed in a separate paper. The discussion will be restricted to the Orange County coast. Research into Orange County projectile point morphology, chronometrics, and time-space systematics is well served by the large suites of radiocarbon assays and projectile points from sites investigated within the Newport Coast Archaeological Project (NCAP). These data are used to address the question of time sensitivity for a variety of locally recovered atlatl dart projectile forms. Specifically, this paper explores what level of temporal precision might be provided by the NCAP data. Would NCAP data support the point chronology proposed by Koerper and Drover (1983)? Is it possible to use Great Basin point types for cross dating sites in Orange County? Concomitantly, can correspondences between Great Basin chronologies and Orange County chronologies be demonstrated? Further, what factors impact efforts to develop an Orange County chronology based on atlatl dart point morphologies?

The discussion of atlatl projectile points is set against the background of a debate in which there is both challenge to (Flenniken and Raymond 1986; Flenniken and Wilke 1989; Wilke and Flenniken 1991) and defense of (Thomas 1986; Bettinger et al. 1991) Great Basin atlatl dart point forms as time markers for typological cross dating (e.g., Hester and Heizer 1973; Bettinger and Taylor 1974; Heizer and Hester 1978; Thomas 1981).

THE GREAT BASIN DEBATE

Results from recent experimental archaeological studies suggest that contingencies of point manufacture, hafting, breakage during use, and rejuvenation result in morphological changes in the shape of a projectile, thereby calling into question the reliability of certain projectile point types to serve as time markers (Flenniken 1985; Flenniken and Raymond 1986; Titmus and Woods 1986; Flenniken and Wilke 1989). Guided by Thomas' key for defining projectile types (1981, 1983), Flenniken and Raymond (1986) each manufactured 15 Elko Corner-notched points; but when hafting their replicated artifacts, 22 of the 30 projectiles needed basal alteration for a correct fit to a specific foreshaft notch. In the process of shaping the base to the haft, five of the points changed from Elko Corner-notched to Elko Eared, prompting the speculation that the two kinds of Elko dart points are occasioned by hafting modification (Flenniken and Raymond 1986).

After the dart foreshafts were fitted into cane mainshaft sockets, the completed darts were propelled with a facsimile western North American atlatl to simulate situations in which a hunter missed his intended target. Salvageable impact-damaged points were rejuvenated into functional projectiles. One-third of the 24 salvageable points changed morphological type, and thus Flenniken and Raymond (1986) concluded that when Elko Corner-notched points sustained impact damage, rejuvenation may have resulted in Elko, Gatecliff, or Rosegate "temporal types" or even some other form not covered in Thomas' key (1981, 1983).

Flenniken and Wilke (1989:153) summarized and synthesized the experimental studies, and concluded that two archetypal forms, Elko Corner-notched and Northern Side-notched dart points, when damaged and rejuvenated, account for the entire range of dart points commonly used as time-sensitive artifacts in the Great Basin. An Elko series point with a use-life involving breakage and rejuvenation could become a Gypsum Cave (Elko Contracting-stem, Gatecliff Contracting-stem), a Little Lake series (Little Lake Split-stem, Pinto Square-shoulder, Pinto Barbed, Bare Creek Eared, Gatecliff Split-stem), or a Humboldt series point (Humboldt Concave-based, Pinto Sloping-shoulder, Pinto Shoulderless). A point from the Little Lake series might be rejuvenated into a Humboldt series or a Gypsum Cave point (Flenniken and Wilke 1989:154).

According to Flenniken and Wilke (1989: 155), Northern Side-notched dart points might be rejuvenated into Gypsum Cave, Little Lake series, or Elko series points. The Elko points might become Gypsum Cave, Humboldt, or Little Lake series points. Subsequently, the Little Lake series point could be rejuvenated into either a Gypsum Cave or a Humboldt series point (Flenniken and Wilke 1989:155).

Useful time-diagnostic artifacts allow high-probability predictions of independently derived chronometric dates (Thomas 1986:623). The actuarial nature of projectile point chronologies results partly from variability introduced by curation, rejuvenation, and other prehistoric behavior. The major issue considered is whether the magnitude of such variability precludes using most Great Basin atlatl dart point forms for cross dating.

Those who support the Great Basin projectile chronology accept that some amount of curation is a source of variability. Thomas (1976), for instance, discussed the unidirectional skewing effect of the heirloom hypothesis by reference to a nineteenth-century Diegueño magico-religious wand tipped with an Elko Eared point. Other heirloom examples include Elko (Fowler and Matley 1979), Gypsum Cave, and Folsom (Harrington 1933: 117) types.

Bettinger et al. (1991) also accepted some amount of rejuvenation of archetypes into Elko Eared, Little Lake, Gypsum Cave, and Humboldt points, but the issue was succinctly stated as "whether such resharpening actually accounts for enough of the latter forms to vitiate their use as time markers" (Bettinger et al. 1991:167). Thomas (1986) questioned the assumption that Flenniken and Raymond's (1986) production reality could be imposed on the mindset of prehistoric flintknappers. If it is more economical, from the modern replicators' way of thinking, to rejuvenate salvageable projectiles, does it necessarily follow that prehistoric hunters would have done so? Thomas (1986: 621) provided an example from Hidden Cave, Nevada, of a point midsection rehafted without rejuvenation, thereby illustrating one ancient hunter who "employed a more expedient 'reality' than that assumed by Flenniken and Raymond."

According to Bettinger et al. (1991:167), if the various dart point types represent sequential rejuvenations rather than change over time, the Elko Corner-notched and Northern Side-notched archetypes should exhibit, on an average, greater weight than supposed rejuvenated forms within any site or region. A data base for verification of this test implication was built on the metric analysis of dart projectiles from 31 Great Basin sites. The so-called rejuvenated forms were indeed as large or larger than the supposed archetypes (Bettinger et al. 1991:171), indicating that the disputed dart points might continue as useful time markers.

Wilke and Flenniken (1991:173) called this exercise in weight measurements "meaningless," and countered Bettinger et al. (1991) by saying that

> The extant specimens of Gypsum Cave, Little Lake, and Humboldt points available for measurement . . . were not made from the extant specimens of Elko and Northern Side-notched points available for measurement. . . . Both populations represent exhausted artifacts derived from some other population or populations no longer available for measurement because they were reworked into the specimens archaeologists recover and measure.

Wilke and Flenniken (1991:173) stated that if dart types consistently occur in stratigraphic sequence, only then might they be reliable time markers. They pointed to the fact that in deep sites with long-term occupations, from Oregon to Idaho to Utah to southeastern Nevada, the various dart points co-occur in the same stratigraphic units (1991:173).

METHODOLOGY

Identification of associations between atlatl projectile types and radiocarbon dates is tenuous for most multicomponent Orange County middens where spatial integrity is likely to have been compromised by bioturbation, cultivation, and other site formation processes. Further, where stratigraphic mixing has occurred, temporally unrelated events may become merged in radiocarbon assays generated from aggregate samples, usually shellfish remains. Shellfish remains are the most commonly submitted sample type; consequently, sites with numerous radiometric dates supporting comparatively limited occupations and having atlatl dart points were selected for this study.

The data base provided by NCAP excavations includes eight Middle Holocene (3,350-6,650 RCYBP) sites with a total of 79 radiocarbon dates. The chronological data sets cluster relatively tightly for each site. The three sites with the fewest dates offer little to no projectile information. The remaining five sites, CA-Ora-660, -664, -665, -667, and -929 (Fig. 1), account for 66 RCYBP dates that fall within the Middle Holocene (Table 1). All atlatl dart morphological point types in dispute occur within the assemblages of these five sites, as does a variety of other points not easily classified.

Atlatl dart points are defined as those projectiles which weigh in excess of 3.5 grams (after Fenenga 1953:322), and/or are of forms approximating those conventionally attributed to atlatl dart projectile points in the Great Basin (e.g., Elko series, Northern Side-notched type, Gypsum Cave, Little Lake or Pinto series, and Humboldt series; see Heizer and Hester [1978]; Flenniken and Wilke [1989]). Points were classified as known Great Basin types wherever possible using Thomas' (1970, 1981) keys (hereinafter called "the Great Basin Key") and Vaughan and Warren's (1987) set of operations (hereinafter called "the Mojave Desert Key"). For a description of the attributes used for assigning the various types, the reader is referred to the formal taxonomic keys of Thomas (1970, 1981) and Vaughan and Warren (1987). The basic difference between the two keys is the selection of the Proximal Shoulder Angle (PSA). When the two angles on a point were different measurements, Thomas (1981) used the smaller; Vaughan and Warren (1987) used the larger. Measurements needed for typing specimens are given in Table 2. Point fragments too incomplete to provide comparative data are not included in this study. Breakage patterns discussed in this paper are described in detail in Titmus (1985), Titmus and Woods (1986), and Woods (1987, 1988). Percussion and pressure flaking patterns are defined by Bordes (1961) and Crabtree (1982).

Most of the projectile points do not fit into either the Great Basin Key or the Mojave Desert Key. This is not surprising, considering that these keys were not formulated for coastal California. Their use, however, is justified in addressing what has been, up to now, a controversy in the Great Basin, i.e., the association of specific forms with specific temporal spans. Because many of the points could not be classified using these two keys, the traditional typologies given by Harrington (1933, 1957), Bettinger and Taylor (1974), Heizer and Hester (1978), Jennings (1986), and Warren and Crabtree (1986) were relied on, since these are commonly used by researchers in the southern California coastal area.

RESULTS

Five sites were used in the study: CA-Ora-660, -664, -665, -667, and -929. The results of the analysis of the points from these sites and the associated radiometrics are presented below by individual sites.

CA-Ora-660

From CA-Ora-660, 12 radiocarbon assays were obtained ranging from 4,230 to 5,820 RCYBP (Table 1). With the corrections for the Suess Curve and the marine reservoir phenomenon, the range extends from 4,745 to 6,535 calibrated years B.P. (Fig. 2). With the exception of a single *Haliotis* specimen (UCI-275) noted as item 8 from Feature 2 (see Mason et

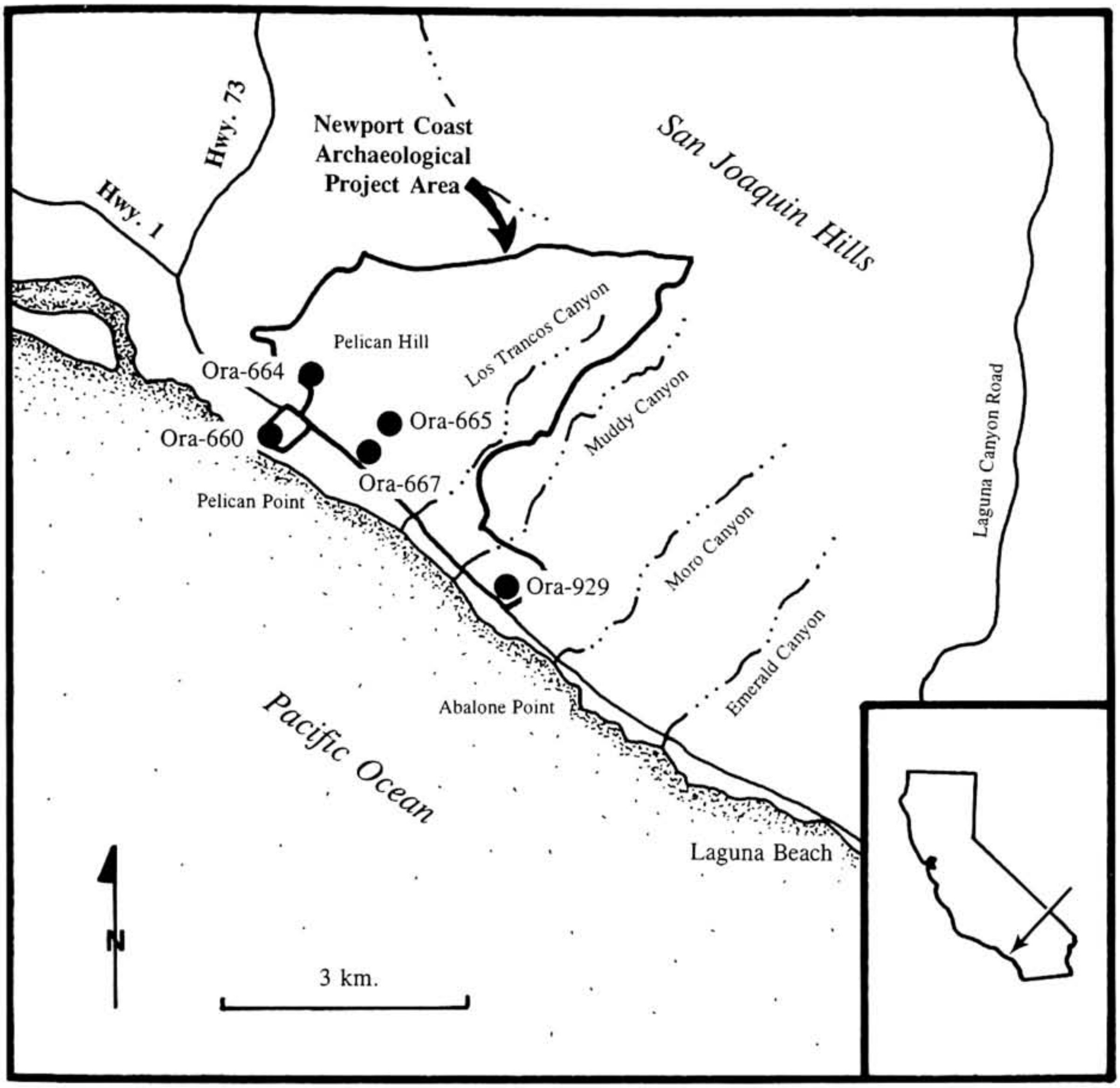

Fig. 1. Location of five Archaic sites from the Newport Coast Archaeological Project.

al. [1992a] for feature discussion), all dates were obtained on aggregate bulk-sampled shellfish samples (Mason and Peterson 1994).

Two of the three points from CA-Ora-660 cannot be classified using either key (Fig. 3). No. 660-10361 would be called "Silver Lake" in the Mojave Desert (see Warren and Crabtree 1986:185). It is made of quartz and has reverse chevron flaking on one face of the blade and scaler pressure flaking on the reverse face. No. 660-10395, made of a light tan rhyolite, would be called "Pinto Shoulderless" by Harrington (1957:50). For coastal southern California, it might be more appropriate to call the point a "leaf" with a straight base (see Warren and Crabtree 1986:186). One face of the blade was finished with oblique parallel pressure flaking; the other exhibits chevron pressure flaking.

The third point, No. 660-12456, made of metasedimentary rock from the Bedford Canyon

Table 1
RADIOCARBON DATA

Laboratory Number	Unit	Level (cm.)	Material	Reported RCYBP	$^{13}C/^{12}C$ Age Adjustment	Calibrated Years BP[a]
			CA-Ora-660			
BETA-35422	26	0-20	*Mytilus*	4,930 ± 80	5,350	5,581 ± 85
UCI-200	26	20-40	*Mytilus*	5,130 ± 100	5,550	5,767 ± 104
UCI-201	26	40-60	*Mytilus*	4,940 ± 80	5,360	5,589 ± 85
BETA-35423	26	60-80	*Mytilus*	5,820 ± 90	6,240	6,535 ± 95
UCI-202	26	80-100	*Mytilus*	5,130 ± 100	5,550	5,767 ± 104
BETA-35424	26	100-120	*Mytilus*	5,230 ± 90	5,650	5,906 ± 95
UCI-203	26	120-140	*Mytilus*	5,040 ± 100	5,460	5,695 ± 104
BETA-35425	26	140-160	*Mytilus*	5,110 ± 100	5,530	5,747 ± 104
UCI-204	26	160-180	*Mytilus*	5,360 ± 90	5,780	6,026 ± 95
BETA-35426	26	180-200	*Mytilus*	5,550 ± 90	5,970	6,268 ± 95
UCI-205	25	40-60	*Chione*	4,230 ± 100	4,650	4,745 ± 104
UCI-275	53	72	*Haliotis*	5,040 ± 40	5,460	5,695 ± 50
			CA-Ora-664			
BETA-36923	52	10-20	*Chione*	4,110 ± 80	4,530	4,531 ± 85
BETA-36924	52	40-50	*Chione*	4,020 ± 90	4,440	4,417 ± 95
BETA-36925	52	60-70	*Mytilus*	4,400 ± 70	4,820	4,871 ± 76
BETA-36926	25	10-20	*Chione*	3,750 ± 90	4,170	4,064 ± 95
BETA-36927	25	30-40	*Chione*	3,930 ± 70	4,350	4,321 ± 76
BETA-36928	25	70-80	*Chione*	3,670 ± 70	4,090	3,937 ± 76
BETA-36929	42	40-50	*Chione*	3,980 ± 70	4,400	4,393 ± 76
BETA-36930	42	60-70	*Chione*	3,790 ± 70	4,210	4,098 ± 76
BETA-36931	42	80-90	*Chione*	3,990 ± 70	4,410	4,400 ± 76
BETA-36932	52	20-30	*Chione*	4,180 ± 90	4,600	4,629 ± 95
BETA-36933	89	10-20	*Chione*	3,490 ± 110	3,910	3,693 ± 114
BETA-36934	89	50-60	*Mytilus*	4,950 ± 100	5,370	5,596 ± 104
BETA-36935	89	60-70	*Mytilus*	4,710 ± 140	5,130	5,309 ± 143
BETA-36936	89	70-80	*Mytilus*	4,630 ± 100	5,050	5,261 ± 104
			CA-Ora-665			
BETA-35427	169	30-40	*Chione*	4,800 ± 70	5,220	5,444 ± 76
BETA-42027	241	10-20	*Chione*	5,010 ± 90	5,430	5,647 ± 95
BETA-35428	237	30-40	*Chione*	4,980 ± 70	5,400	5,627 ± 76
BETA-35429	245	30-40	*Chione*	4,880 ± 90	5,300	5,550 ± 95
BETA-42028	249	30-40	*Mytilus*	4,730 ± 80	5,150	5,322 ± 85
BETA-42029	261	30-40	*Mytilus*	4,870 ± 80	5,290	5,543 ± 85
BETA-42030	1023	27-42	*Mytilus*	4,910 ± 90	5,330	5,569 ± 95
BETA-42031	968	7-18	*Mytilus*	4,590 ± 80	5,010	5,227 ± 85
			CA-Ora-667			
BETA-23827	27	20-40	*Mytilus*	4,510 ± 100	4,930	5,037 ± 104
BETA-23828	27	40-60	*Mytilus*	4,610 ± 80	5,030	5,246 ± 85
BETA-23829	27	60-80	*Mytilus*	4,580 ± 90	5,000	5,217 ± 95
UCI-149	161	10-20	*Mytilus*	4,630 ± 60	5,050	5,261 ± 67
UCI-150	161	20-30	*Mytilus*	4,520 ± 75	4,940	5,046 ± 81
UCI-151	161	30-40	*Mytilus*	4,450 ± 60	4,870	4,967 ± 67
UCI-152	161	40-50	*Mytilus*	4,800 ± 80	5,220	5,444 ± 85
UCI-153	161	50-60	*Mytilus*	4,400 ± 75	4,820	4,871 ± 81
UCI-154	161	60-70	*Mytilus*	4,930 ± 80	5,350	5,581 ± 85
UCI-155	161	70-80	*Mytilus*	4,840 ± 85	5,260	5,471 ± 90
UCI-156	161	80-90	*Mytilus*	5,025 ± 60	5,445	5,657 ± 67
UCI-157	161	90-100	*Mytilus*	4,800 ± 65	5,220	5,444 ± 72
UCI-226	213	74	*Haliotis*	3,870 ± 100	4,290	4,230 ± 104
UCI-227	293	44	*Haliotis*	3,950 ± 100	4,370	4,354 ± 104
UCI-228	2335	73	*Haliotis*	4,800 ± 70	5,220	5,444 ± 76
UCI-237	2767	72	*Haliotis*	4,800 ± 70	5,220	5,444 ± 76
UCI-229	2767	53	*Haliotis*	4,040 ± 80	4,460	4,435 ± 85
UCI-216	2767	44	*Haliotis*	4,570 ± 50	4,990	5,167 ± 58
UCI-232	2767	62	*Haliotis*	4,300 ± 60	4,720	4,818 ± 67
UCI-231	2767	26	*Haliotis*	3,900 ± 60	4,320	4,270 ± 67
UCI-236	2767	53	*Haliotis*	3,390 ± 60	3,810	3,580 ± 67
UCI-235	2767	72	*Haliotis*	4,290 ± 50	4,710	4,814 ± 58
UCI-234	2767	80	*Haliotis*	3,870 ± 50	4,290	4,230 ± 58
UCI-233	2767	65	*Haliotis*	4,290 ± 70	4,710	4,814 ± 76
UCI-230	2767	65	*Haliotis*	4,480 ± 70	4,900	4,993 ± 76
			CA-Ora-929			
BETA-24001	29	40-50	*Mytilus*	5,640 ± 80	6,060	6,324 ± 85
BETA-24002	29	30-40	*Mytilus*	4,750 ± 100	5,170	5,360 ± 104
BETA-43397	19	10-20	*Mytilus*	4,540 ± 80	4,960	5,069 ± 85
BETA-43398	19	30-40	*Mytilus*	4,310 ± 90	4,730	4,823 ± 95
BETA-43399	19	50-60	*Mytilus*	4,380 ± 90	4,800	4,859 ± 95
BETA-43400	19	70-80	*Mytilus*	4,440 ± 90	4,860	4,960 ± 95
BETA-43401	19	90-100	*Mytilus*	3,990 ± 80	4,410	4,400 ± 85

[a] Marine carbonates calibrated using Stuiver et al. (1986).

Table 2
DART POINTS FROM THE NEWPORT COAST ARCHAEOLOGICAL PROJECT

Cat. No.	Material[a]	Len.[b]	Wid.	Thk.	Wt.	W_B	W_b/W_m	L_A	BIR	DSA	PSA	NA	W_N	MWSh	BCI	WSh	S_{index}
							CA-Ora-660										
10361	quartz	44.0	24.8	10.1	9.8	14.4	0.581	44.0	1.000	140	140	80	17.7	23.9	0.0	6.2	25.94
10395	rhyolite	26.5	14.3	5.6	1.9	10.8	0.755	26.5	1.000	180	75	0	12.3	14.9	0.0	2.6	17.45
12456	BC meta	35.4	16.4	6.0	3.5	10.7	0.652	34.9	0.986	210	150	80	9.6	16.5	0.5	6.9	41.82
							CA-Ora-664										
13885	Monterey chert	73.3	28.4	10.3	20.2	9.9	0.349	73.3	1.000	--	--	--	--	--	0.0	--	--
15190	fused shale	34.8	20.2	9.2	5.8	--	--	31.8	--	--	--	--	15.4	19.9	3.0	4.5	22.61
18711	quartz	32.5	16.5	6.0	3.1	--	--	32.5	1.000	--	--	--	--	--	0.0	--	--
32596	Monterey chert	38.3	22.2	5.1	3.8	9.0	0.405	37.4	0.977	--	--	--	--	--	--	--	--
							CA-Ora-665										
20455.02	quartz	37.3	18.2	9.4	6.1	--	--	37.3	--	--	80	--	15.6	17.2	--	1.6	9.30
20887	quartz	39.4	19.5	10.3	7.5	--	--	39.4	--	--	70	--	15.1	17.8	--	2.7	15.17
22203	quartz	37.0	19.0	10.0	6.1	--	--	37.0	--	180	60	--	16.4	18.5	--	2.1	11.35
30448	BC meta	49.7	23.3	10.0	12.9	--	--	49.7	--	--	--	--	--	--	0.0	--	--
30462	Monterey chert	42.1	20.5	7.0	5.1	17.6	0.859	42.1	1.000	220	130	70	13.9	20.3	0.0	6.4	31.53
30472	quartz	37.0	22.5	11.1	9.4	16.0	0.711	37.0	--	90	90	90	15.1	20.5	0.0	5.4	26.30
30934	chert	44.1	22.3	10.0	7.6	23.2	1.040	42.6	0.966	195	140	55	14.1	21.8	1.5	7.7	35.32
30994	cherty shale	46.4	21.7	5.6	5.7	21.7	1.000	42.4	0.914	--	--	--	--	--	4.0	--	--
31008	quartz	36.7	19.1	9.2	5.8	--	--	36.7	--	195	70	140	19	35	--	16.0	45.71
31068	Monterey chert	25.0	24.0	5.6	2.8	22.0	0.917	22.8	--	195	140	50	14.9	23.5	2.2	8.6	36.60
31069	Monterey chert	18.4	26.3	5.1	2.1	26.4	1.004	11.5	--	--	--	--	17.2	--	6.9	--	--
31137	quartz	15.0	15.0	8.0	2.0	13.7	0.913	13.8	--	240	90	120	11.4	13.7	1.2	2.3	16.79
31149	Monterey chert	40.1	19.6	10.0	5.4	19.5	0.995	37.3	0.930	195	140	45	12.4	18.8	2.8	6.4	34.04
							CA-Ora-667										
11578	quartzite	30.7	18.2	6.4	3.6	18.1	0.995	28.3	0.922	210	120	65	12.2	16.9	2.4	4.7	27.81
13598	quartzite	49.8	21.8	11.3	12.7	13.2	0.606	49.8	--	--	--	--	--	--	--	--	--
13748	Monterey chert	25.1	26.0	7.3	4.7	19.5	0.750	23.2	--	220	90	140	20.7	25.8	1.9	5.1	19.77
13894	BC meta	50.4	19.5	7.0	6.2	7.7	0.395	50.2	--	--	--	--	--	--	--	--	--
13944	cherty shale	45.3	25.6	8.6	6.7	21.1	0.824	45.0	0.993	195	135	120	19.6	25.4	0.3	5.8	22.83
14083	Monterey chert	22.9	27.5	7.3	4.4	12.6	0.458	19.3	--	--	--	--	--	--	3.6	--	--
14351	chalcedony	37.7	17.3	4.5	2.6	16.4	0.948	36.2	0.960	195	140	70	10.8	17.1	1.5	6.3	36.84
21059.02	Monterey chert	23.2	28.0	6.9	3.8	15.6	0.557	18.2	--	--	--	--	--	--	5.0	--	--
30593	basalt	46.0	22.3	11.0	11.8	13.7	0.614	44.0	0.957	210	80	130	14.6	20.2	2.0	5.6	27.72
35417	Monterey chert	43.8	21.5	5.8	5.0	21.5	1.000	34.4	0.957	195	160	40	14.6	22.1	9.4	7.5	33.94
35558	quartzite	24.0	17.8	6.2	2.3	18.4	0.984	21.8	0.908	196	135	55	12.4	17.8	2.2	5.4	30.34
35577	basalt	40.2	18.6	7.0	5.4	15.4	0.828	40.2	1.000	--	--	--	--	--	0.0	--	--
35578	BC meta	52.7	22.0	9.3	11.9	19.5	0.886	51.0	0.968	220	90	135	17.9	21.9	1.7	4.0	18.26
35581	chert	33.2	19.7	8.2	5.2	15.4	0.782	31.0	0.934	--	--	--	--	--	2.2	--	--
35582	Monterey chert	29.8	34.8	10.8	11.5	34.7	0.997	27.3	--	--	--	--	--	--	2.5	--	--
35586	chert	48.4	24.0	7.7	8.3	13.9	0.579	48.3	0.998	--	--	--	17.5	20.6	0.1	3.1	15.05
35592	metavolcanic	40.7	18.5	7.3	4.5	18.5	1.000	38.5	0.946	--	--	--	--	--	2.2	--	--
35612	Monterey chert	41.1	20.7	6.5	5.7	--	--	39.7	0.966	--	--	--	--	--	1.4	--	--
							CA-Ora-929										
13578	quartz	37.6	17.0	7.7	5.6	5.6	0.329	37.6	--	--	--	--	--	--	--	--	--
13944A	PDL	36.7	13.8	5.7	2.9	5.8	0.420	36.7	--	--	--	--	9.7	13.6	--	3.9	28.68
14235	quartz	37.6	16.3	9.2	5.7	8.6	0.528	37.6	--	--	--	--	15.6	16.4	--	0.8	4.88
15266	PDL	14.1	19.7	6.6	2.1	15.6	0.792	12.3	--	--	--	--	--	--	1.8	--	--
17511	BC meta	31.3	19.3	7.8	4.1	12.4	0.642	29.3	0.936	225	90	140	13.9	19.2	2.0	5.3	27.60
18009	quartz	49.2	34.3	8.6	15.0	5.7	0.166	49.2	--	160	70	90	9.7	34.3	--	24.6	71.72

[a] BC meta = Bedford Canyon Metasedimentary; PDL = Piedra de Lumbre "chert."

[b] Len. = Length; Wid. = Width; Thk. = Thickness; Wt. = Weight; W_B = Width of base; W_b/W_m = Width of Base / Maximum Width; L_A = Axial Length; BIR = Basal Indent Ratio; DSA = Distal Shoulder Angle; PSA = Proximal Shoulder Angle; NA = Notch Angle; W_N = Width of Neck; MWSh = Maximum Width at Shoulder; BCI = Basal Concavity Index; WSh = Width of Shoulders; S_{index} = Shoulder Index (see Thomas 1981; Vaughan and Warren 1987). Linear measurements are in millimeters; weight is in grams; angles are in degrees.

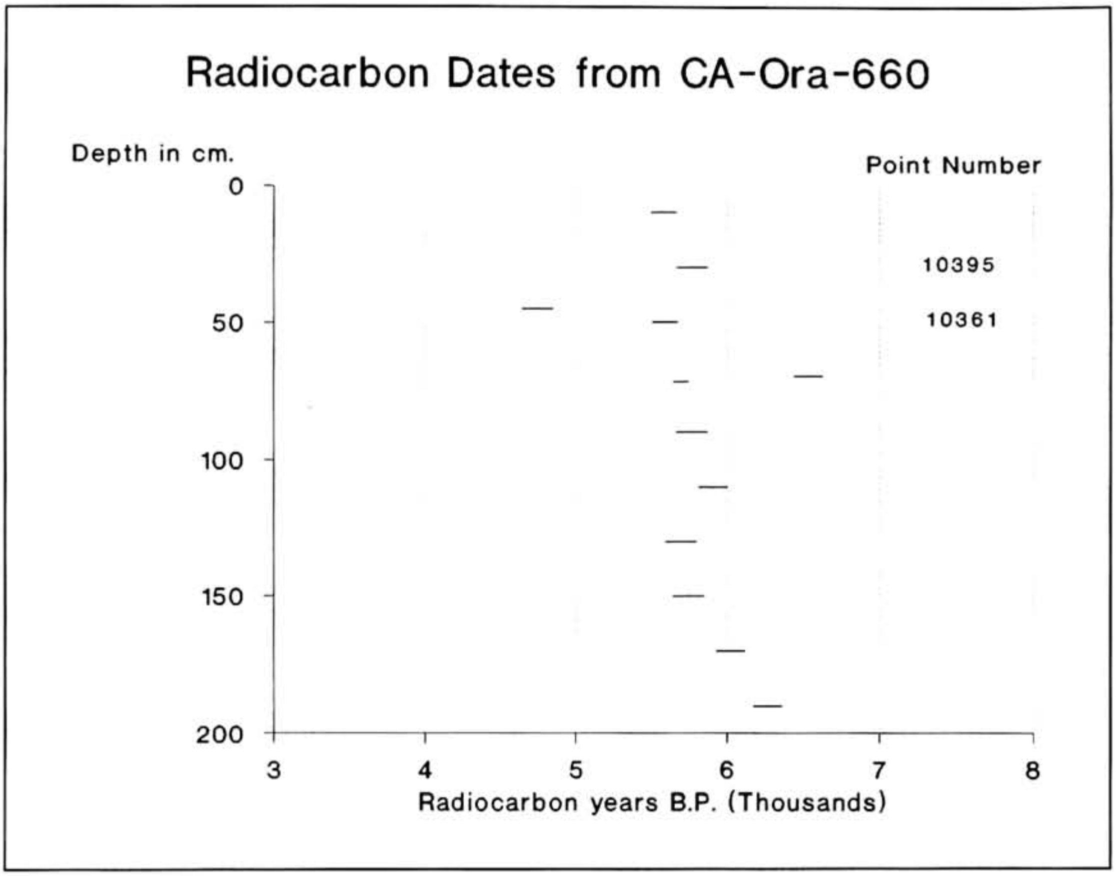

Fig. 2. Calibrated radiocarbon dates and projectile point depths for CA-Ora-660. No. 660-12456 is from a backhoe trench with unknown depth.

formation, would be termed an "Elko Corner-notched" point using the Great Basin Key. The extreme tip of this point and one tang are missing. The blade exhibits the same pressure flaking pattern as No. 660-10395 (chevron on one face; oblique parallel on the opposing face). Remnants of three notching flake scars are present at the intersection of the blade and the stem.

At CA-Ora-660, Silver Lake, Elko Corner-notched, and Pinto "shoulderless" points co-occur. The assemblage dates from 4,745 to 6,535 calibrated years B.P.

CA-Ora-664

The occupation of CA-Ora-664 is dated by 14 radiocarbon assays, ranging from 3,490 to 4,950 RCYBP (Table 1). Corrections for secular variation and the upwelling factor result in a range of 3,693 to 5,596 calibrated years B.P. (Fig. 4). All dates were obtained from bulk-sampled, aggregate shellfish (Mason and Peterson 1994).

Four dart points complete enough to be considered in the analysis were recovered from Ora-664 (Fig. 5). Three are large leaf points (Nos. 664-13885, 664-18711, and 664-32596) which fail to be classified with either key. No. 664-13885 is banded brown chalcedony and shale from the Monterey Formation. Both the medial and lateral cross section forms are irregular. One face exhibits a chevron pressure flaking pattern and the other a scaler pressure flaking pattern along the lateral margins. No. 664-18711 is a smaller leaf made of quartz,

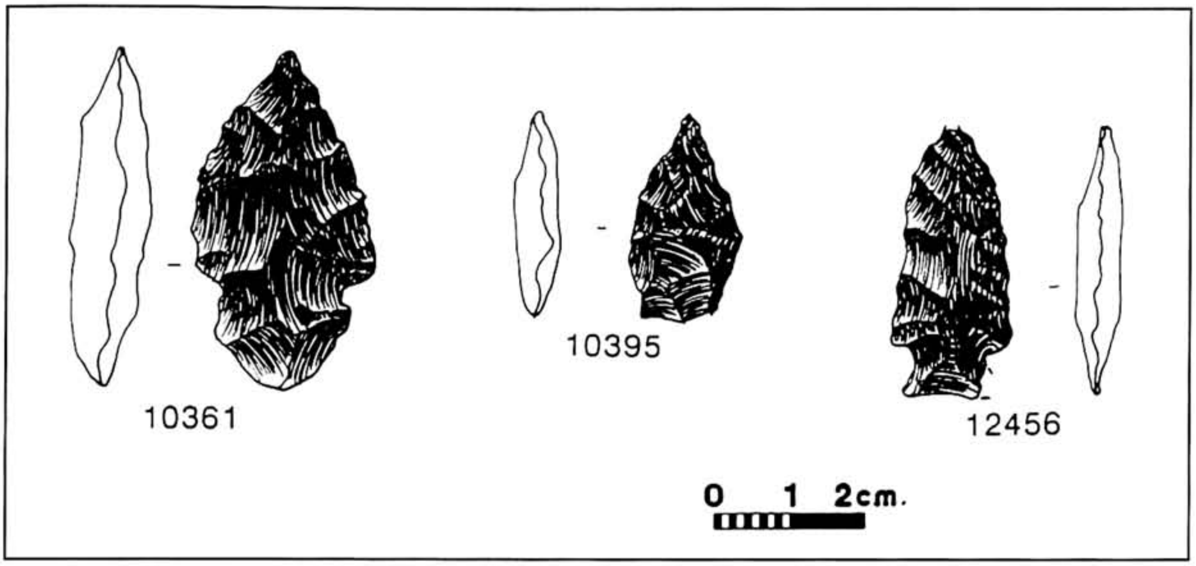

Fig. 3. Projectile points from CA-Ora-660.

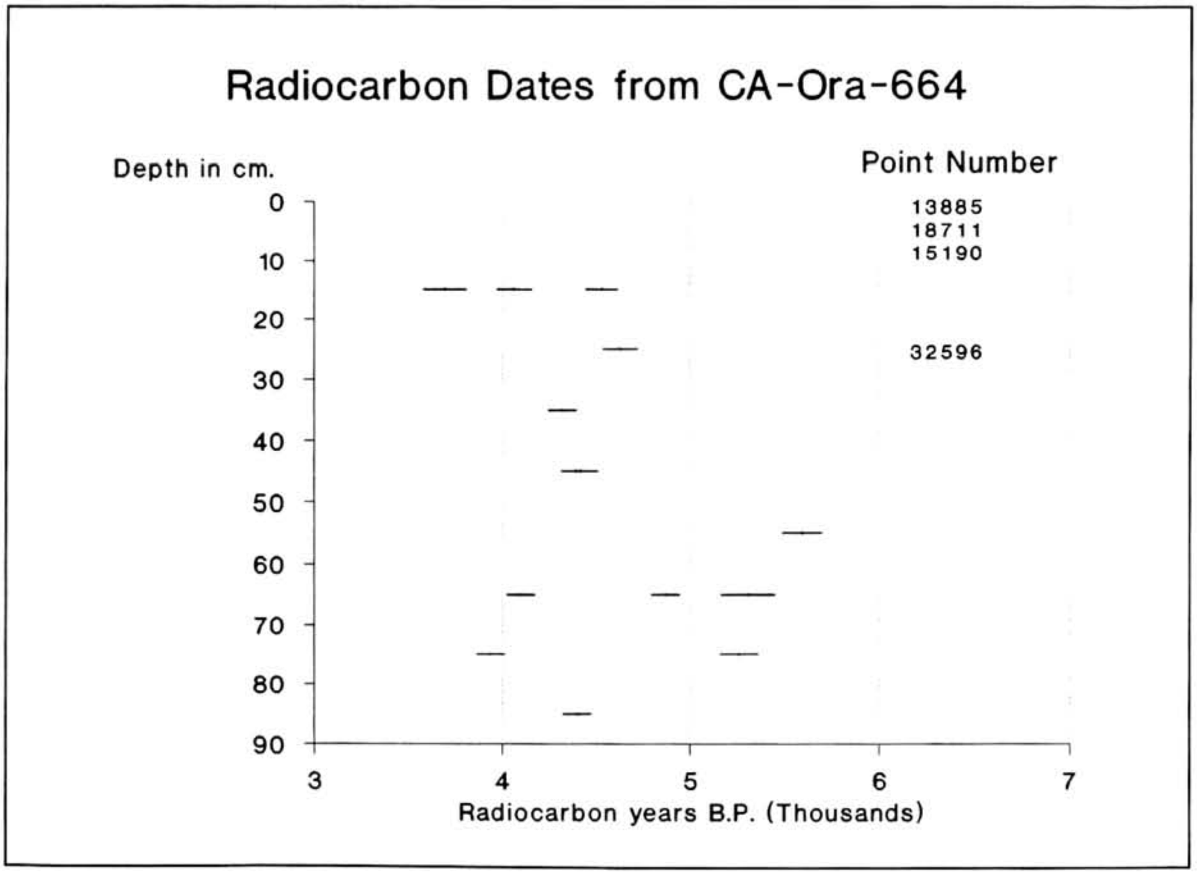

Fig. 4. Calibrated radiocarbon dates and projectile point depths for CA-Ora-664.

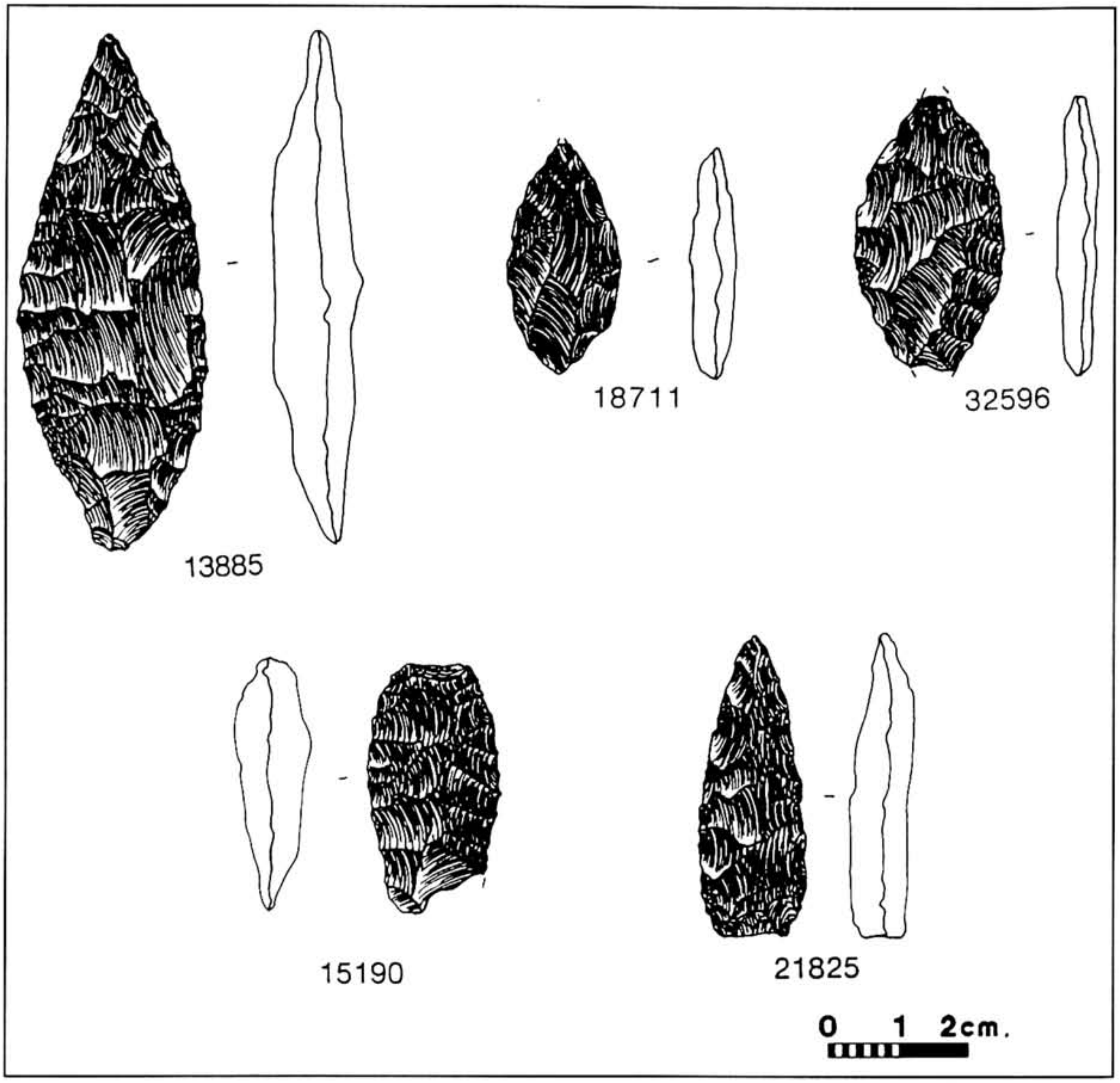

Fig. 5. Projectile points and drill from CA-Ora-664.

with lenticular medial and lateral cross section forms. One corner of the base is broken off with a bending fracture. One side of the blade exhibits oblique parallel flaking, and the opposing face exhibits scaler pressure flaking. The last leaf, No. 664-32596, is also made of banded material from the Monterey formation and is a small leaf. It exhibits scaler pressure flaking along the lateral margins of both faces and was probably heat treated.

The fourth dart point, No. 664-15190, is classified as belonging to the Humboldt series using the Great Basin Key. The point is made of fused shale, probably from the Grime's Canyon source in southern Ventura County (Demcak 1981). The tip is missing due to impact breakage, as evidenced by the tip flute (Titmus and Woods 1986), and one corner of the base is broken off with a perverse fracture; probably both fractures occurred at the same time. The reworked concave base retains a notching flake scar on one face; the opposing basal face concavity exhibits small marginal pressure flake scars which would have obliterated any notching flake scar. The point may have been used as a thrusting spear or knife, but the impact scars suggest first use as a projectile (Woods 1988).

Another artifact from the site that is of interest is a projectile reworked and used as a drill. The drill, No. 664-21825, has a triangular cross section (Fig. 5). The base broke with a bending fracture, and remnants of indentations are observable near the break. The drill is of an appropriate shape and size for making sockets in mainshafts for compound darts. This documents lateral recycling of projectile points into other tools and may help to account for the lack of numerous points at many sites.

The assemblage of points from CA-Ora-664 includes large leaf points and a Humboldt point. The site was occupied between 3,693 and 5,596 calibrated years B.P.

CA-Ora-665

At CA-Ora-665, eight radiocarbon dates were obtained from seven shellfish aggregate samples and one sample (Beta-42030) of a single *Mytilus* valve from Feature 6 (Table 1). One of the aggregate dates (Beta-42031) was drawn from Feature 3 (see Mason et al. [1992a] for a description of the feature). The dates for the occupation of the site range from 4,590 to 5,010 RCYBP. Secular variation and upwelling corrections yield a range of dates of 5,227 to 5,647 calibrated years B.P. (Fig. 6) (Mason and Peterson 1994).

Of the 13 dart points from CA-Ora-665 (Fig. 7), most (n = 9) do not fit the Great Basin Key and none fits the Mojave Desert Key. Four (Nos. 665-20455.02, 665-20887, 665-22203, and 665-31008) are stemmed points with the extreme base missing. All appear to have slight shoulders and a minimum of flaking for shaping. The shoulders preclude the placement of these points in the leaf point category. No. 665-22203 may be a coastal version of the Gypsum Cave point, but could also be termed a "bi-point." The rest are similar to points termed "Pinto Sloping-shoulders" by Harrington (1957:50-51), but lack the concave base. All four are made of quartz, and the lithic material type may account for the lack of detailed pressure flaking, as well as the shape. No. 665-20455.02 has chevron flaking near the tip on one face and what may be notching flake scars at the break. No. 665-20887 is a mid-section with both the extreme tip and base missing with bending fractures. No. 665-22203 exhibits an impact fracture at the tip and a burination at the base; No. 665-31008 also exhibits burinations along the lateral margins of the base, as well as missing the extreme base. The fractures on all four points are indicative of breakage during use as projectiles.

Two other point bases have been designated as Pinto points, based in part on Harrington's classification. No. 665-30472 would be classified as a Pinto One-shoulder (Harrington 1957:52-53). The quartz point split laterally, and the lateral split was reshaped into a straight edge. This point is classified as a Gatecliff Contracting stem type in the Great Basin Key, but drops out of the Mojave Desert Key.

No. 665-31137 is a Gatecliff Split-stem in the Great Basin Key and probably would be included in the Pinto Group IIx in the Mojave Desert Key. However, only the basal portion is present, and although the distal end of the base is outcurving, the original form may have been any one of several shapes.

Five of the points are side-notched points made of the banded chert from the Monterey formation; none of them fits either key. Nos. 665-30462, 665-31068, and 665-30934 appear to be Elko Side-notched points. The other two, Nos. 665-31069 and 665-31149, are Northern Side-notched points (Jennings 1986). Two are

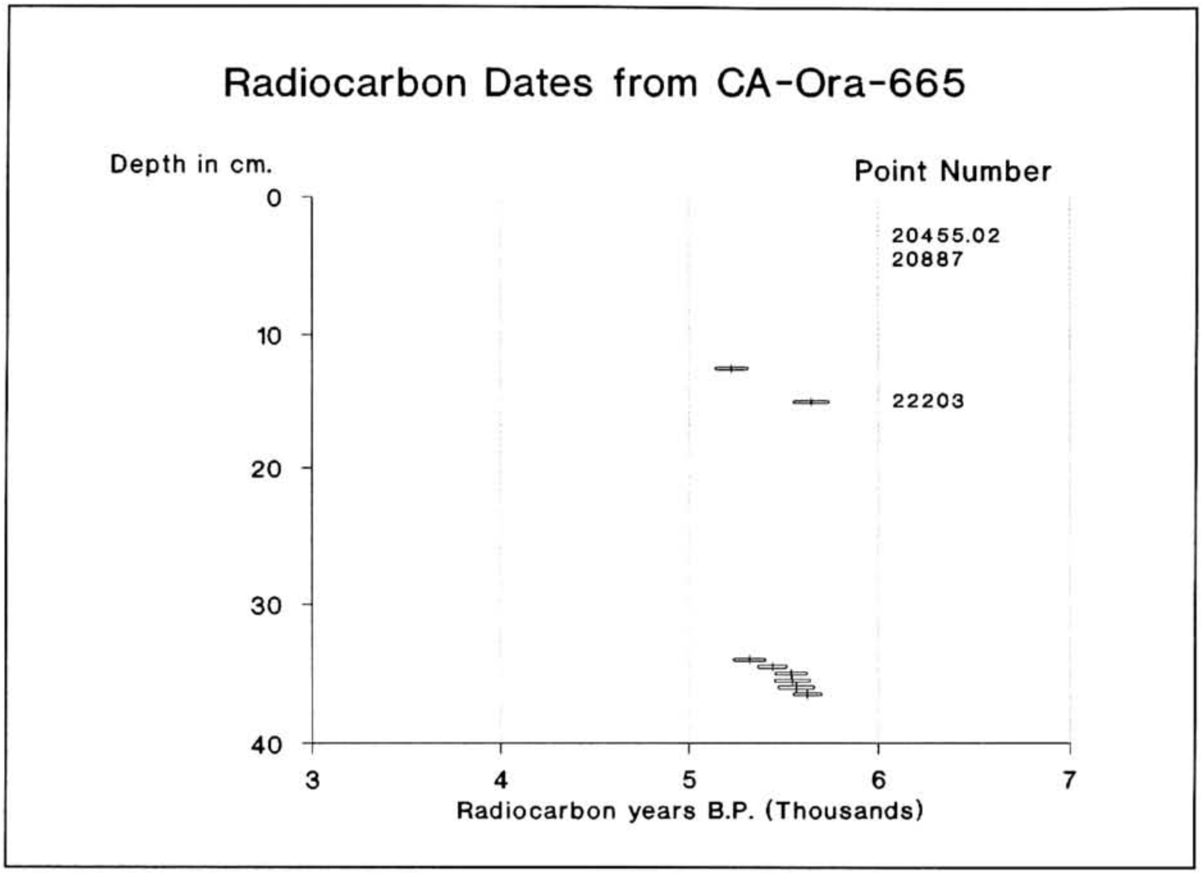

Fig. 6. Calibrated radiocarbon dates and projectile point depths for CA-Ora-665. All other projectile points are between 0 and 45 or 50 cm., from units without level control.

basal fragments, Nos. 665-31068 and 665-31069. On 665-31069, the point broke across the notches, a break that could have occurred either during manufacture or use (Titmus 1985). On No. 665-31068, the tip broke off with a bending fracture that probably occurred during impact; a large flake that originates at the break was removed from one face. No. 665-30462 is missing the corner of the base.

Two of the complete side-notched points, Nos. 665-30934 and 665-31149, are 10 mm. thick. No. 665-30934 has collateral pressure flaking on one face and chevron flaking merging with collateral flaking on the reverse. Large notching flake scars are present at the side notches, and the base was formed by the removal of small pressure flakes. No. 665-31149 is similar, but the pressure flaking is less regularized. One tang is missing, and the blade appears to have been resharpened several times.

Two points are considered dart points based on their size. No. 665-30994 is a large triangular point with a concave base. The weight of 5.7 grams places it in the dart point category. Although remnant notching indents appear to be present from a cursory examination, no notching flake scars are present, and the indents appear to be the result of pressure flaking thinning errors. Biface No. 665-30448 could be either a knife or a large leaf projectile point. It is made of a local metasedimentary rock known to have been used for both. The tip is broken off with a bending fracture, suggesting use as a projectile (see Woods 1987, 1988).

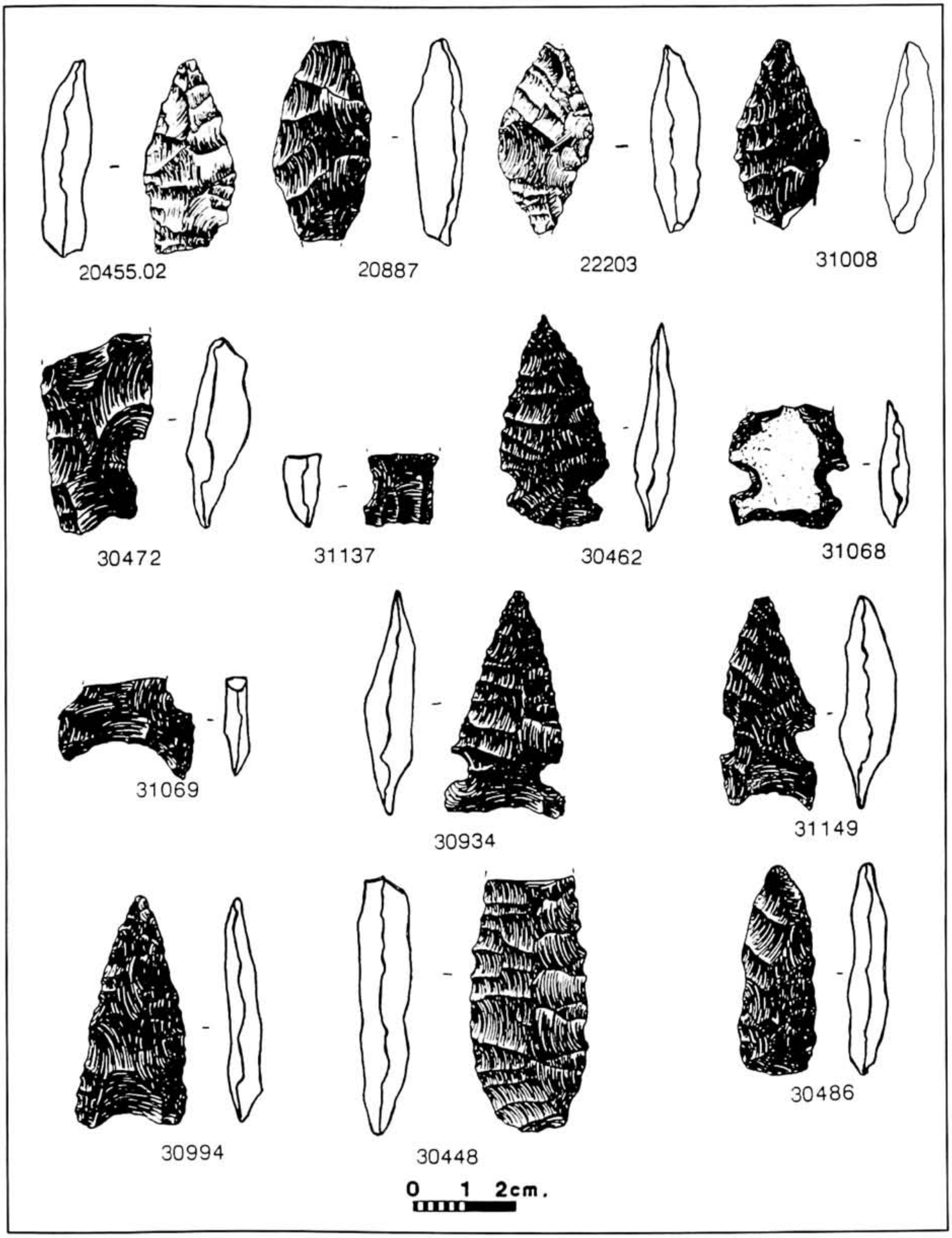

Fig. 7. Projectile points and drill from CA-Ora-665.

Biface No. 665-30486 may have been a projectile point but was last used as a drill (Fig. 7). As with the drill previously discussed, it has the appropriate size and shape to make sockets in dart mainshafts.

The point types present at CA-Ora-665 include Gypsum Cave, Pinto, Elko Side-notched, Northern Side-notched, large triangular, and leaf points. The occupation of the site ranged from 5,227 to 5,647 calibrated years B.P.

CA-Ora-667

Twenty-five radiocarbon assays make CA-Ora-667 the most thoroughly dated Middle Holocene site within the NCAP (Table 1). Thirteen of these dates were each specially collected single *Haliotis* specimens from seven different features (see Mason et al. [1992b] for feature descriptions). The remaining samples were bulk-sampled, aggregate *Mytilus* samples submitted to two different laboratories. The dates span the interval from 3,390 to 5,025 RCYBP, and 3,580 to 5,657 calibrated years B.P. with the Suess Curve and marine reservoir corrections (Fig. 8) (Mason and Peterson 1994).

Eighteen points or point fragments were considered complete enough to include in the dart point analysis (Figs. 9 and 10). Three other bifaces, Nos. 667-35595, 667-35475, and 667-13579, may have been dart points, but these have been reformed into drills (see Fig. 9, top row). The first two could have been used in mainshaft manufacture. The third drill, No. 667-13579, lacks the long bit. The 18 dart points include three Large Side-notched points, five Pinto points, three large leaf points, a large triangular point, two Silver Lake points, two points from the Humboldt series, and two concave stems that may be points of the Humboldt series.

The three side-notched points, Nos. 667-14351, 667-35558, and 667-35417, are classified as Large Side-notched points in the Great Basin Key. No. 667-14351 is an Elko Side-notched point made of chalcedony. It has transverse parallel flaking on the blade and a concave base formed by small pressure flakes. A remnant of the original flake scar remains on one face. The second, No. 667-35558 made of a rare red quartzite, is also an Elko Side-notched point. It has chevron flaking on one side of the blade and a notching scar on the base. It also has a remnant of the original flake scar on one side of the base. The third Large Side-notched point, No. 667-35417 of Monterey chert, would be considered a Northern Side-notched by Jennings (1986). The extreme tip and part of the corner are missing, and one barb has been damaged, either during manufacture or use.

The two Humboldt bifaces, No. 667-35581 and 667-35582, are made of chert from the Monterey formation. Remnants of notching scars remain at the base on both bifaces. No. 667-35581 was formed with transverse parallel flaking but exhibits chevron flaking at the tip. No. 667-35582 is a concave base with straight parallel sides. One lateral margin is partially burinated, and the impact removed a small flake along the side that looks like a notch but is instead part of the damage from impact. The biface broke with a bending fracture. Two bases, Nos. 667-14083 and 667-21059.02, also of Monterey chert, may also have been Humboldt bifaces. Neither appears to have had shoulders.

Five points are classified as belonging to the Pinto series: Nos. 667-11578, 667-30593, 667-35578, 667-35612, and 667-35586 (Fig. 10). No. 667-11578 is classified as an Elko Eared point using the Great Basin Key and as a Pinto Group 1b using the Mojave Desert Key. The base retains remnants of a notching scar on one face. Nos. 667-30593 and 667-35578 classify as Gatecliff Split-stem using the Great Basin Key and as Pinto Group IIx using the Mojave Desert Key. No. 667-30593 is made of fine-grained basalt and No. 667-35578 of dark

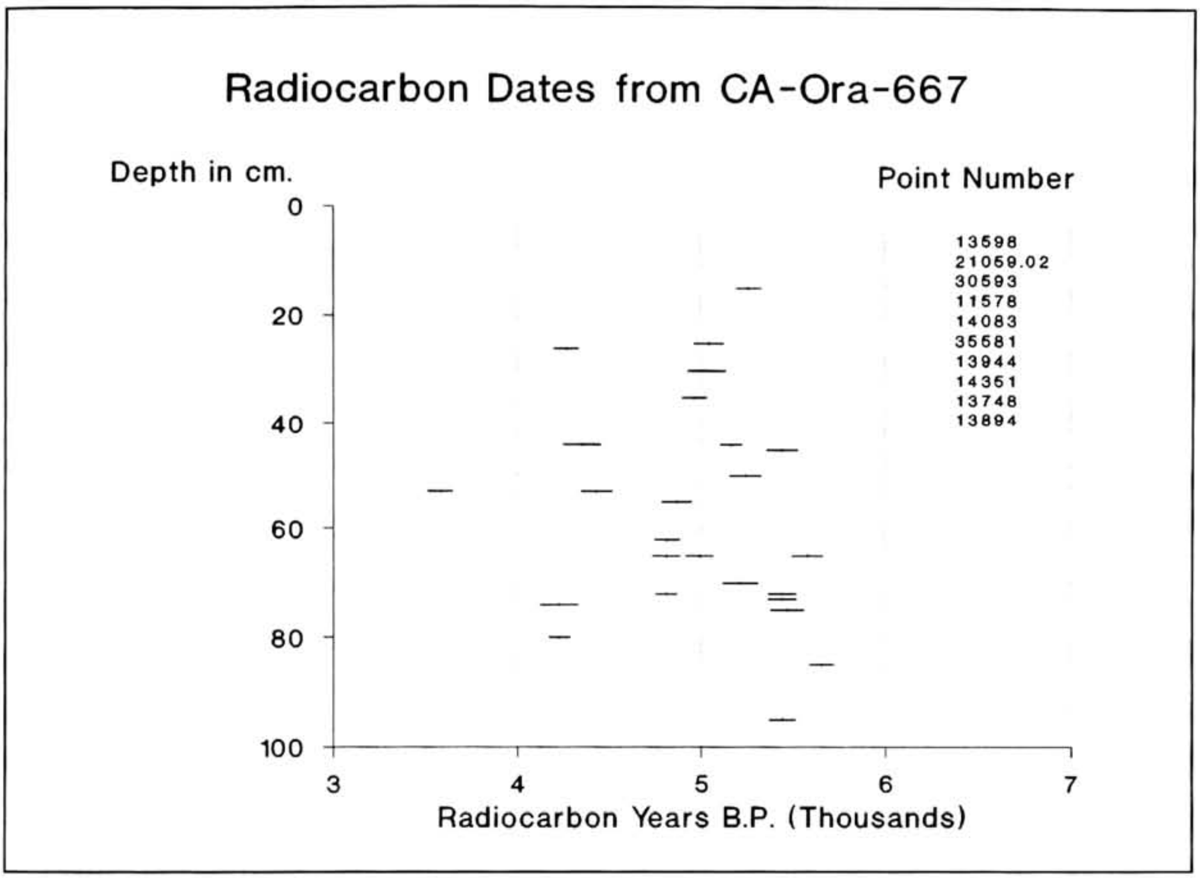

Fig. 8. Calibrated radiocarbon dates and projectile point depths for CA-Ora-667. All other points are between 0 and 30 or 40 cm., from units without level control.

metasedimentary rock, probably from the Bedford Canyon formation. No. 667-35578 exhibits an impact fracture on the extreme tip, and the base was thinned with a flute on one side.

The other two Pinto points, Nos. 667-35612 and 667-35586, fail to classify using either key; however, using Harrington's (1957) classification, these would be termed "Pinto Sloping-shoulders." Both are made of Monterey chert. No. 667-35612 has a corner of the base broken off, and the extreme tip was removed with an impact fracture; these probably occurred at the same time. No. 667-35586 was formed with transverse parallel pressure flaking and is also missing the extreme tip.

Three are large leaf points, Nos. 667-13598, 667-13894, and 667-35577, and are placed in the dart point category based on weights of 12.7, 6.2, and 5.7 grams, respectively. No. 667-13598, made of quartzite, has a somewhat squared base from a bending fracture and exhibits chevron flaking near the tip on one face. No. 667-13894, made of a light grey/tan metasedimentary rock, retains a large portion of the original flake scar, and the extreme base is missing. No. 667-35577, a basalt biface, exhibits minimal pressure flaking.

One triangular point, No. 667-35592, made of metavolcanic rock, also is placed in the dart category based on weight (4.5 grams). The lateral margins exhibit slight concavities near the base that may be the remnants of side notches.

Two points made of chert from the Monterey formation are classified as Silver Lake points based on the description of Warren and Crabtree (1986). No. 667-13748 is the convex

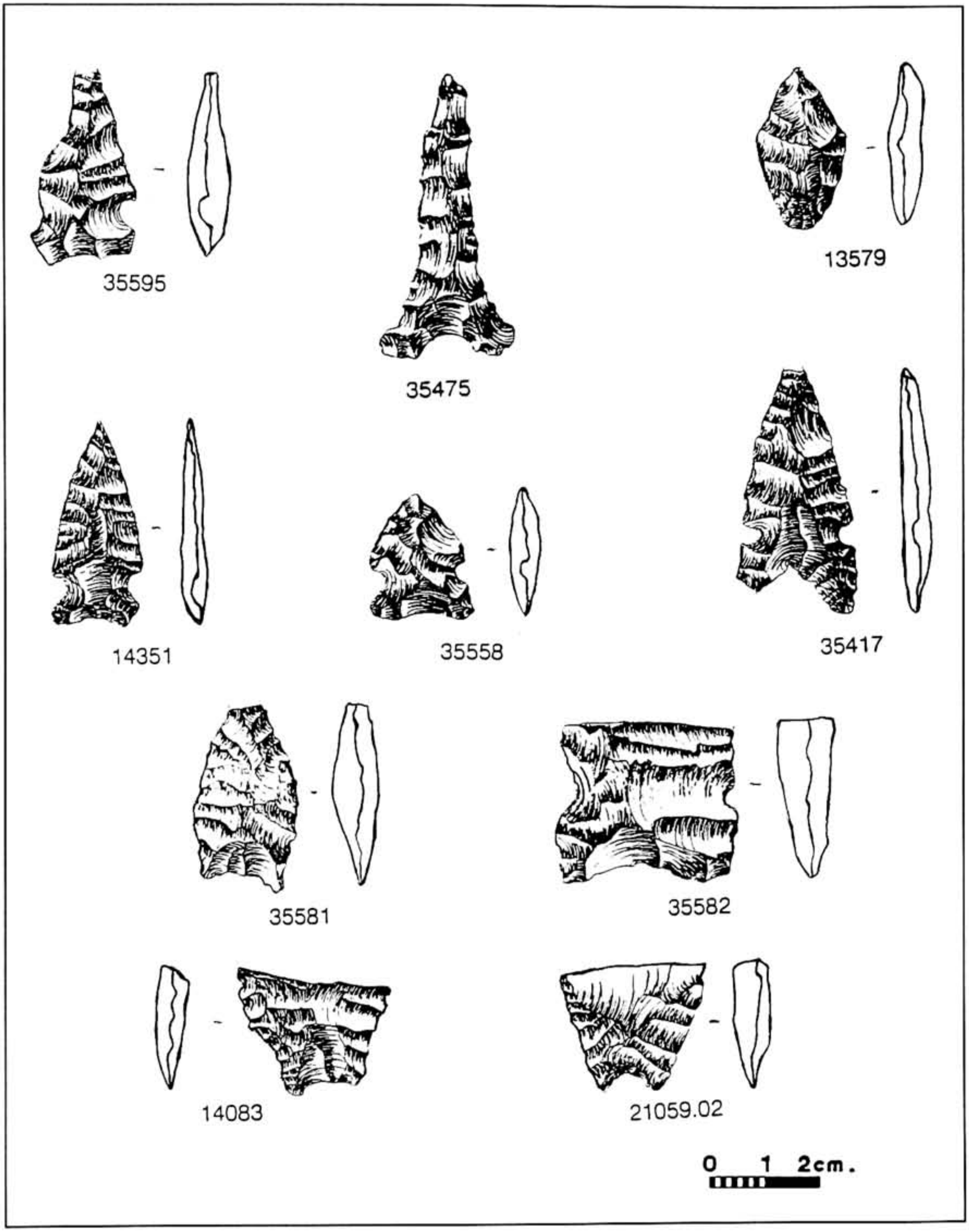

Fig. 9. Drills and projectile points from CA-Ora-667.

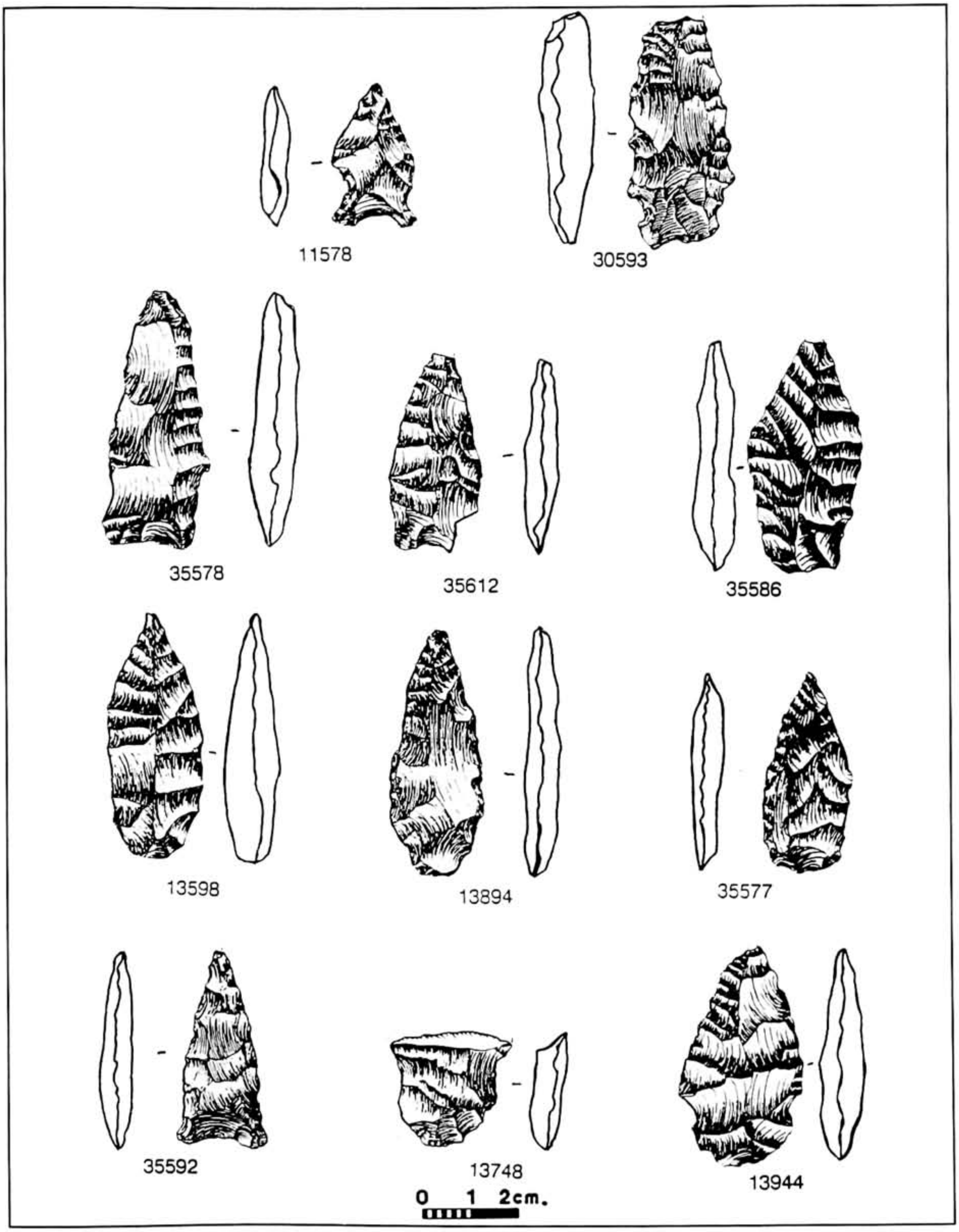

Fig. 10. Projectile points from CA-Ora-667.

stem of a point broken from the blade with a perverse fracture. No. 667-13944 is more complete; only the extreme tip is missing. Remnants of two notching scars are present on the neck. Using the Great Basin Key, it would be classified as an Elko Corner-notched point.

CA-Ora-929

Seven bulk-collected, aggregate *Mytilus* samples yielded a range of 3,990 to 5,640 RCYBP for the occupation of CA-Ora-929 (Table 1). When the secular variation and marine reservoir corrections are calculated, the range is 4,400 to 6,324 calibrated years B.P. (Fig. 11) (Mason and Peterson 1994). The six points from CA-Ora-929 complete enough for classification include a Pinto point, a large leaf, two stemmed points classified as Pinto Sloping-shoulder, a Gypsum Cave point, and a Humboldt Basal-notched biface (Fig. 12).

The Pinto point, No. 929-17511, is classified as a Gatecliff Split-stem in the Great Basin Key and as a Pinto Group IIx in the Mojave Desert Key. The tip broke off with an impact fracture and the base exhibits a notching flake scar on one face. No. 929-13578, made of quartz, is a leaf point that lacks both the extreme tip and the extreme base. Two points are tentatively identified as Pinto Sloping-shoulders; neither is complete. No. 929-14235, also made of quartz, lacks the extreme base. No. 929-13944A, which lacks both extremities, is made of Piedra de Lumbre "chert," a material imported from northern San Diego County (Pigniolo 1992).

No. 929-18009 has been classified as a Gypsum Cave point based on the contracting stem, although the length of the stem is somewhat shorter than normal. The point, however, is broken at the stem and at the barbs, and could have been one of the Elko or Pinto series points prior to that breakage.

No. 929-15266 is a base included because its parallel sides and notched base are suggestive of the Humboldt Basal-notched points. It also is made of the Piedra de Lumbre "chert" from San Diego County (Pigniolo 1992).

CONCLUSIONS

The Middle Holocene co-occurrence of so many morphological forms, including several recognized types, dilutes the utility of atlatl dart points as temporal markers in Orange County. According to the NCAP data, in Orange County, points classified as Pinto and Elko series were in use within the span from 3,580 to 6,535 years B.P.; Northern Side-notched points within the span from 5,227 to 5,647 years B.P.; Gypsum within the span from 4,400 to 6,324 years B.P.; Humboldt series within the span from 3,580 to 6,324 years B.P.; and Silver Lake points within the span of 3,580 to 6,535 years B.P. This is not to say that these were the only times the points occurred; they could also have been in use earlier or later. We can at least say, however, that they were in use within these spans.

The NCAP data provide no clear, precise temporal markers. Rather, these data offer only a general picture of a variety of forms for the Middle Holocene. These findings are at variance with the optimistic interpretation offered in Koerper and Drover (1983:9) that, for instance, Elko-Eared points might be generally separated in time from stemmed projectiles, as suggested by the spatial relationships of the two categories at CA-Ora-119-A. Both kinds of points were erroneously confined to the Late Holocene. NCAP data indicate that the Koerper and Drover (1983) scheme is flawed, and presently, Orange County sites cannot be cross dated using the Great Basin/Mojave Desert point typologies. Accordingly, it is not possible to describe any general correspondence between desert and local coastal chronologies.

The Middle Holocene co-occurrence of so many morphological forms, including numerous recognized types, may be due to several pos-

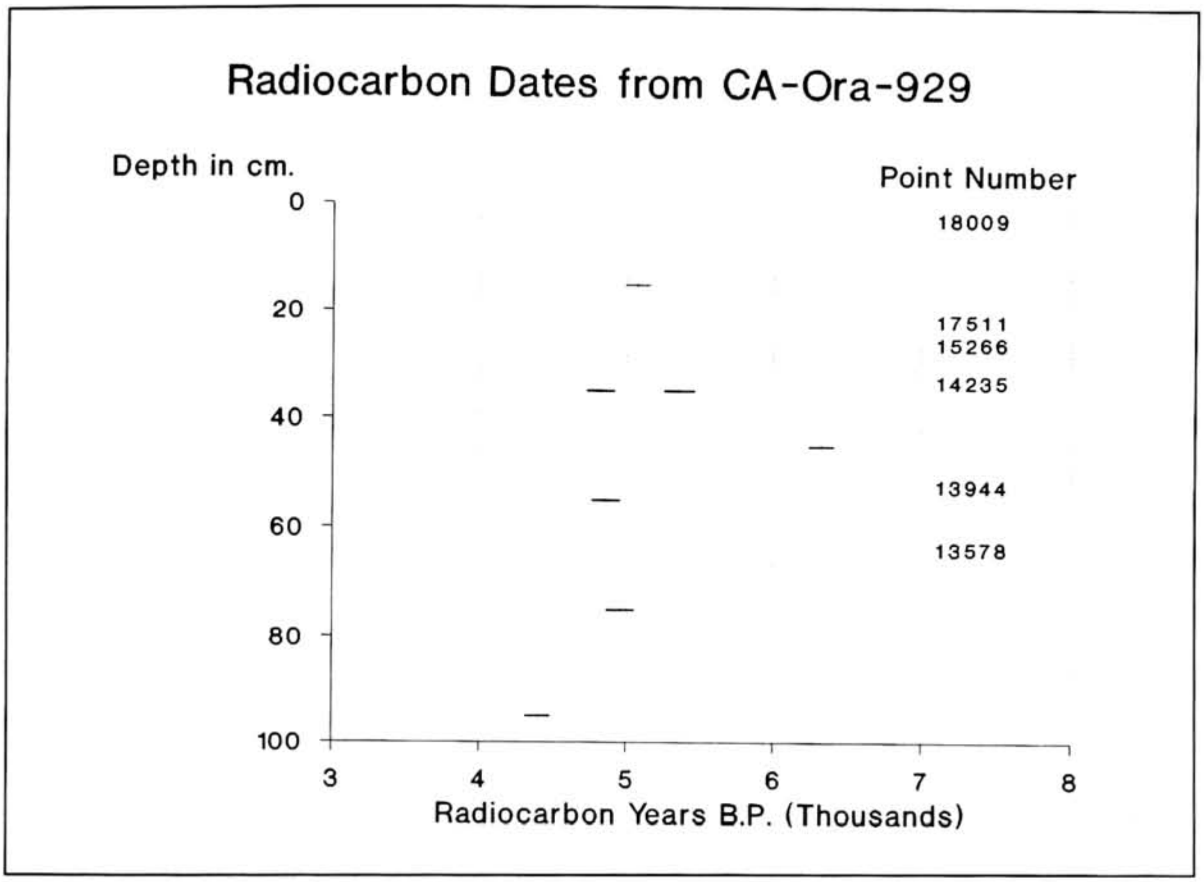

Fig. 11. Calibrated radiocarbon dates and projectile point depths for CA-Ora-929.

sible factors. Much of the variety probably can be accounted for by rejuvenation. Almost all of the broken points described herein exhibit damage from impact, including tip flutes, bending fractures, and burinations (Table 3). Chevron flaking near the tip of a point could be the outcome of rejuvenation of a square edge resulting from breakage of the tip (Schroth 1993), or rejuvenation of a tip while the point was still affixed to a foreshaft (J. Flenniken, personal communication 1993). Several points lack diagnostic traits, but retain portions of notching scars along the lateral margins suggestive of rejuvenation or reshaping of the base. Most of the dart points from these sites, then, are best described as discards or "used up" projectiles. Although some points retain shapes that appear to be useable, 72.7% lack the mass necessary for efficiently propelling a dart shot from an atlatl. According to Perkins (1992), dart points weighing less than 7.0 grams are inefficient in that they fail to travel as far as those weighing more than 7.0 grams. If rejuvenation or resharpening of the points significantly accounts for the variety of atlatl dart point forms (Flenniken and Wilke 1989), then the pattern of spatial relationships that was used to infer temporal relationships of atlatl points at CA-Ora-119-A may have been largely fortuitous, merely a sampling phenomenon.

There may be additional explanations for why Archaic point types cannot be used for segregating the Middle Holocene into discrete temporal segments. Curation is an unknown factor. In addition, there may have been a variety of point forms in use at any one time, with several

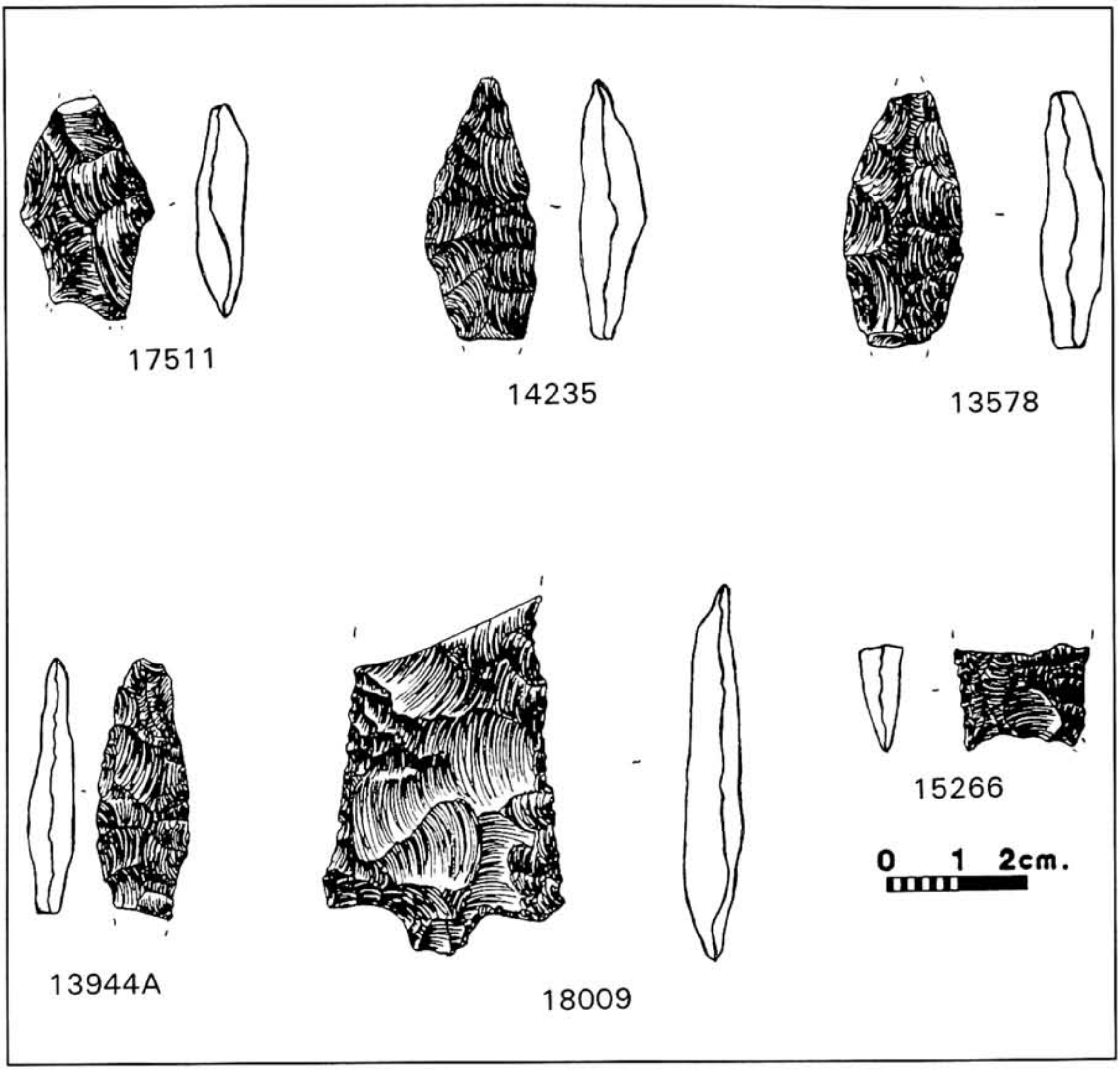

Fig. 12. Projectile points from CA-Ora-929.

forms co-occurring; there are no data to indicate that the prehistoric knapper was compelled to form one particular type of projectile point. Given the difficulty of knapping most of the lithic materials found at these sites, any useable morphological point form may have been acceptable. Further, the NCAP data do not offer the degree of temporal resolution to identify possible time-sensitive types. With the exception of CA-Ora-665, the range of dates for each site is considerable, and bioturbation is an ever-present problem on the coast.

In spite of these problems, one definite conclusion can be formulated from the data presented herein. The data indicate that the Great Basin Key, the Mojave Key, and the Great Basin classifications in general cannot be indiscriminately applied for chronological control to coastal atlatl dart projectile points (Fig. 13). In particular, the temporal spans for Silver Lake points, Elko series, and Gypsum points do not correlate well with the desert temporal schemes.

Table 3
PROJECTILE POINT TYPES AND BREAKAGE PATTERNS

Catalog No.	Point Type	Rejuvenation and/or Breakage Patterns
660-10361	Silver Lake[a, b]	Chevron flaking pattern
660-10395	Pinto Shoulderless[c]	Chevron flaking pattern
660-12456	Elko Corner-notched[d]	Chevron flaking pattern, extreme tip and tang broken off with bending fractures
664-13885	Leaf	Chevron flaking pattern
664-15190	Humboldt series[d]	Tip flute, one corner of base missing with perverse fracture
664-18711	Leaf	One corner of base missing
664-32596	Leaf	Small tip flute, extreme base missing
665-20455.02	Pinto Sloping Shoulder[a]	Chevron flaking pattern, bending fracture at tip, perverse fracture at base
665-20887	Pinto Sloping Shoulder[a]	Bending fractures, tip and base
665-22203	Gypsum	Tip impact, chevron flaking pattern, base burination
665-30448	Leaf	Bending fracture at tip
665-30462	Elko Side-notched[b]	Corner of base missing, perverse fracture (?)
665-30472	Gatecliff Contracting Stem[d] Pinto One-Shoulder[c]	Bending fracture at midsection, reworked burination of lateral margin
665-30934	Elko Side-notched[b]	Chevron flaking pattern near tip
665-30994	Triangular with concave base	Chevron flaking pattern, one corner of base broken from impact
665-31008	Gatecliff Contracting Stem[d] Pinto Sloping Shoulder[a]	Burination of lateral margin of base and extreme base missing
665-31068	Elko Side-notched[e, b]	Tip missing with bending fracture
665-31069	Northern Side-notched[b]	Broken across notches with perverse fracture
665-31137	Gatecliff Split-stem[d] Pinto Group IIx[f]	Base portion only, bending fracture at midsection, one tang missing
665-31149	Northern Side-notched[b]	One barb missing with impact fracture
667-11578	Elko Eared[d] Pinto Group Ib[f]	Burination from tip down lateral margin
667-13598	Leaf	Chevron flaking pattern, bending fracture at base
667-13748	Silver Lake[a]	Perverse fracture
667-13894	Leaf with square base	Extreme base missing
667-13944	Elko Corner-notched[d] Silver Lake[a]	Remnants of notching flake scars on lateral margins
667-14083	Humboldt series[d] [Concave-base]	Bending fracture
667-14351	Elko Side-notched[e]	Chevron flaking pattern, corner of tang missing
667-21059.02	Humboldt Concave-base	Bending fracture
667-30593	Gatecliff Split-stem[d] Pinto Group IIx[f]	Tip impact fracture (tip flute), tang missing
667-35417	Northern Side-notched[b]	Tip and one tang missing
667-35558	Elko Side-notched[e]	Chevron flaking pattern
667-35577	Leaf with straight base	One section of lateral margin missing (burinated?)
667-35578	Gatecliff Split-stem[d] Pinto Group IIx[f]	Tip impact (flute)
667-35581	Humboldt series[d] [Basal Notched]	Bending fracture at tip, chevron flaking pattern
667-35582	Humboldt Basal-notched	Burination along lateral margin, bending fracture at midsection
667-35586	Pinto Sloping Shoulder[c]	Tip missing, bending fracture
667-35592	Triangular with concave base	Reworked lateral margins, notch scar remnants remain
667-35612	Pinto Sloping Shoulder[c]	Tip impact, corner of base missing
929-13578	Leaf	Extreme tip and base missing
929-17511	Gatecliff Split-stem[d] Pinto Group IIx[f]	Impact at tip, notching flake scars on lateral margins, tang missing
929-18009	Gypsum[e]	Stem and barbs missing, bending fracture at midsection
929-15266	Humboldt Concave-base[b]	Bending fracture
929-14235	Pinto Sloping Shoulder[c]	Base broken off, tip impact fracture
929-13944A	Pinto Sloping Shoulder[c]	Extreme base and tip missing

[a] Warren and Crabtree (1986); [b] Jennings (1986); [c] Harrington (1957); [d] Thomas (1981); [e] Heizer and Hester (1978); [f] Vaughan and Warren (1987).

The spans of point usage given herein for the Orange County coast should be used with caution. No stratigraphically defined levels for initiation or cessation of a point type have been identified in Orange County. Although the morphological types as "names" could be retained, the temporal associations as used in the Great Basin and Mojave Desert are not applicable. What is needed is a coastal point typology based on well-stratified sites with numerous points and great time depth; a highly unlikely set of circumstances.

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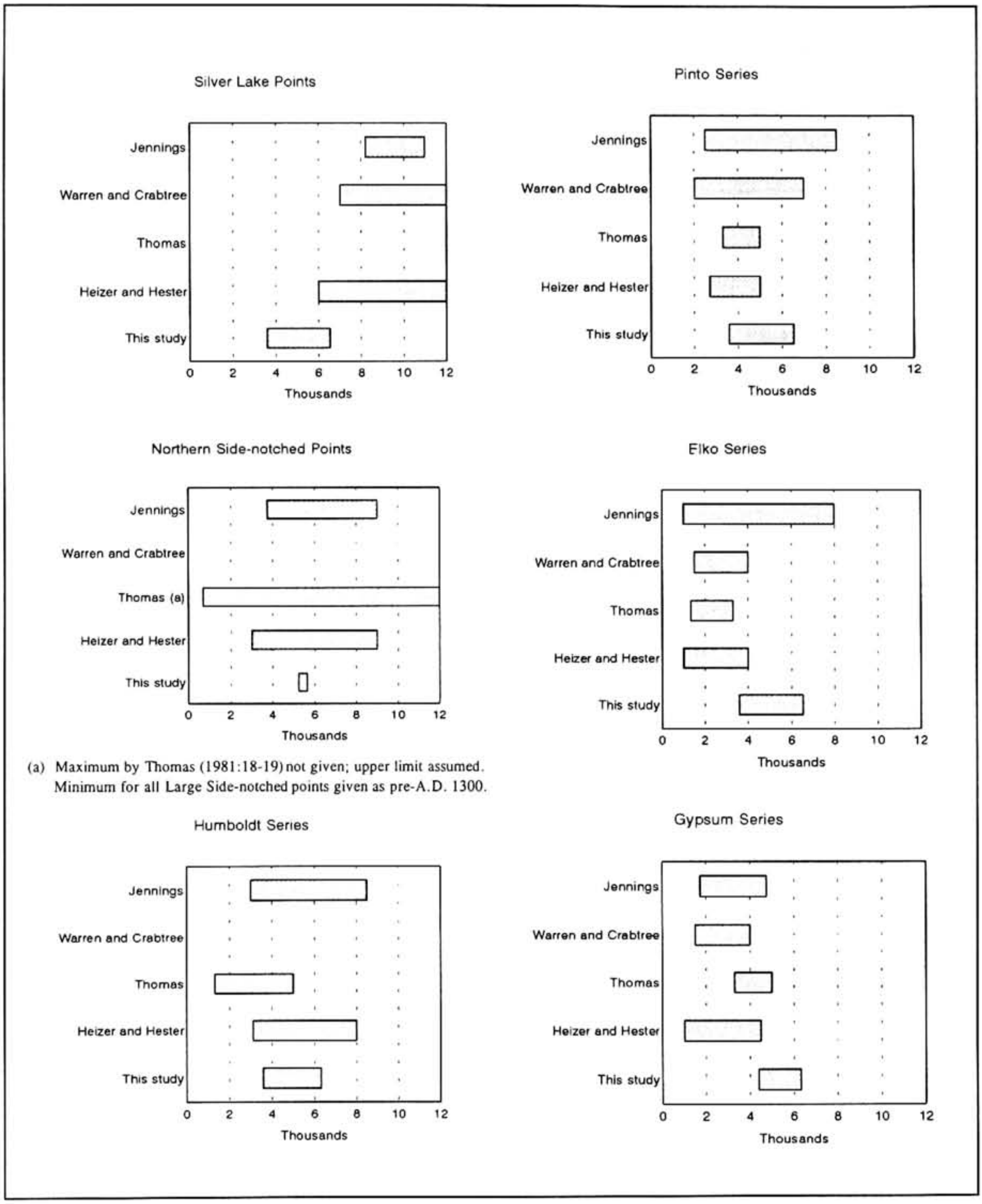

Fig. 13. Comparison of NCAP data with Great Basin and Mojave Desert Archaic point chronologies.

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REFERENCES

Bettinger, Robert L., and R. E. Taylor
1974 Suggested Revisions in Archaeological Sequences of the Great Basin in Interior Southern California. Reno: Nevada Archaeological Survey Research Paper No. 5:1-26.

Bettinger, Robert L., James F. O'Connell, and David H. Thomas
1991 Projectile Points as Time Markers in the Great Basin. American Anthropologist 93(1):166-172.

Bordes, Francois
1961 Typologie du Paléolithique: Ancien et Moyen. Publications de l'Institut de Préhistoire de l'Université de Bordeaux Mémoire No. 1. Bordeaux: Imprimeries Delmas.

Boxt, Matthew A., and Robert B. Rechtman
1981 Archaeological Investigations at LAn-711. Journal of New World Archaeology 4(4): 8-29.

Cottrell, Marie G.
1985 Tomato Springs: The Identification of a Jasper Trade and Production Center in Southern California. American Antiquity 50(4):833-849.

Cottrell, Marie G., and Kathleen C. Del Chario
1984 Archaeological Investigations of the Tomato Springs Sites. Pacific Coast Archaeological Society Quarterly 20(2):1-76.

Cottrell, Marie G., Constance Cameron, Vada Drummy-Chapel, Theodore G. Cooley, and Adella Schroth
1985 Archaeological Investigations Conducted at the Newland House Site (CA-Ora-183), Huntington Beach, California. Pacific Coast Archaeological Society Quarterly 21(1):1-74.

Crabtree, Don E.
1982 An Introduction to Flintworking. Occasional Papers of the Idaho Museum of Natural History No. 28.

Demcak, Carol
1981 Fused Shale as a Time Marker in Southern California. Master's thesis, California State University, Long Beach.

Drover, Christopher E., Henry C. Koerper, and Paul E. Langenwalter II
1983 Early Holocene Human Adaptation on the Southern California Coast. Pacific Coast Archaeological Society Quarterly 19 (3&4):1-84.

Fenenga, Franklin
1953 The Weights of Chipped Stone Points: A Clue to Their Functions. Southwestern Journal of Anthropology 9(3):309-323.

Flenniken, J. Jeffrey
1985 Stone Tool Reduction Techniques as Cultural Markers. In: Stone Tool Analysis: Essays in Honor of Don E. Crabtree, Mark G. Plew, James C. Woods, and M. G. Pavesic, eds., pp. 265-276. Albuquerque: University of New Mexico Press.

Flenniken, J. Jeffrey, and Anan W. Raymond
1986 Morphological and Projectile Point Typology: Replication Experimentation and Technological Analysis. American Antiquity 51(3):603-614.

Flenniken, J. Jeffrey, and Phillip J. Wilke
1989 Typology, Technology, and Chronology of Great Basin Dart Points. American Anthropologist 91(1):149-158.

Fowler, Donald D., and John F. Matley
1979 Material Culture of the Numa: The John Wesley Powell Collection, 1867-1880. Smithsonian Contributions to Anthropology No. 26.

Harrington, Mark R.
1933 Gypsum Cave, Nevada. Southwest Museum Papers No. 8.

1957 A Pinto Site at Little Lake, California. Southwest Museum Papers No. 17.

Heizer, Robert F., and Thomas R. Hester
1978 Great Basin. In: Chronologies in New World Archaeology, R. E. Taylor and Clement W. Meighan, eds., pp. 147-199. New York: Academic Press.

Hester, Thomas R., and Robert F. Heizer
1973 Review and Discussion of Great Basin Projectile Points: Forms and Chronology. Berkeley: Contributions of the University of California Archaeological Research Facility.

Jennings, Jesse D.
1986 Prehistory: Introduction. In: Handbook of North American Indians, Vol. 11, Great Basin, Warren L. d'Azevedo, ed., pp. 113-119. Washington: Smithsonian Institution.

Jones, Terry, and Mark Hylkema
1988 Two Proposed Projectile Point Types for the Monterey Bay Area: Año Nuevo Long-stemmed and Rossi Square-stemmed. Journal of California and Great Basin Anthropology 10(2):163-186.

Koerper, Henry C., and Christopher E. Drover
1983 Chronology Building for Coastal Orange County: The Case from CA-Ora-119-A. Pacific Coast Archaeological Society Quarterly 19(2):1-34.

Mason, Roger D., and Mark L. Peterson
1994 Radiocarbon Chronology and Regional Site Development: Newport Coast Archaeological Project. Report on file at South Central Coastal Archaeological Information Center, University of California, Los Angeles.

Mason, Roger D., Brant A. Brechbiel, Mark L. Peterson, Clay A. Singer, Paul E. Langenwalter II, Lisa Panet Klug, Tony Morgan, and Robert O. Gibson
1992a Newport Coast Archaeological Project: Results of the Data Recovery at the Golf Course Sites, CA-Ora-660, CA-Ora-1234, and CA-Ora-1208. Report on file at South Central Coastal Archaeological Information Center, University of California, Los Angeles.

Mason, Roger D., Brant A. Brechbiel, Clay A. Singer, Wayne H. Bonner, Robert O. Gibson, and Mark L. Peterson
1992b Newport Coast Archaeological Project: Results of the Data Recovery at the CA-Ora-667. Report on file at South Central Coastal Archaeological Information Center, University of California, Los Angeles.

McCarthy, Daniel F., with contributions by Chester D. King and Robert M. Yohe II
1987 Archaeological Studies at Wildomar, CA-Riv-2769, Riverside County, California. Pacific Coast Archaeological Society Quarterly 23(1):1-46.

McDonald, Meg, Philip J. Wilke, and Andrea Kaus
1987 McCue: An Elko Site in Riverside, California. Journal of California and Great Basin Anthropology 9(1):46-73.

Perkins, William R.
1992 The Weighted Atlatl and Dart: A Deceptively Complicated Mechanical System. Archaeology in Montana 33(1):65-78.

Pigniolo, Andrew Robert
1992 Distribution of Piedra de Lumbre "Chert" and Hunter-Gatherer Mobility and Exchange in Southern California. Master's thesis, San Diego State University.

Schroth, Adella
1993 Preliminary Report on the Replication of Pinto Points. Paper presented at the annual meetings of the Society for California Archaeology, Asilomar.

Stuiver, Minze, G. W. Pearson, and Tom Braziunas
1986 Radiocarbon Age Calibrations of Marine Samples to 9000 CAL YR BP. Radiocarbon 28(26):980-1021.

Swope, Karen K., and Michelle Puffer
1989 Flaked Stone Artifacts. In: Data Recovery at the Cole Canyon Site (CA-RIV-1139), Riverside County, California, by Jean Salpas Keller and Daniel F. McCarthy, pp. 27-36. Pacific Coast Archaeological Society Quarterly 25(1).

Thomas, David H.
1970 Archaeology's Operational Imperative: Great Basin Projectile Points as a Test Case. Los Angeles: University of California Archaeological Survey Annual Report 19:27-60.

1976 A Diegueño Shaman's Wand: An Object Lesson Illustrating the "Heirloom Hypothesis." The Journal of California Anthropology 3(1):128-132.

1981 How to Classify the Projectile Points from Monitor Valley, Nevada. Journal of California and Great Basin Anthropology 3(1):7-43.

1983 The Archaeology of Monitor Valley 2. Gatecliff Shelter. American Museum of Natural History Anthropological Papers 59(1).

1986 Points on Points: A Reply to Flenniken and Raymond. American Antiquity 51(3): 619-627.

Titmus, Gene L.
1985 Some Aspects of Stone Tool Notching. In: Stone Tool Analysis: Essays in Honor of Don E. Crabtree, Mark G. Plew, James C. Woods, and Max G. Pavesic, eds., pp. 243-264. Albuquerque: University of New Mexico Press.

Titmus, Gene L., and James C. Woods
1986 An Experimental Study of Projectile Point Fracture Patterns. Journal of California and Great Basin Anthropology 8(1):37-49.

Vaughan, Sheila J., and Claude N. Warren
1987 Toward a Definition of Pinto Points. Journal of California and Great Basin Anthropology 9(2):199-213.

Villanueva, Jeannie C.
1981 Archaeological Investigations at LAn-712. Journal of New World Archaeology 4(4): 30-49.

Warren, Claude N., and Robert H. Crabtree
1986 Prehistory of the Southwestern Area. In: Handbook of the North American Indians, Vol. 11, Great Basin, Warren L. d'Azevedo, ed., pp. 183-193. Washington: Smithsonian Institution.

Wilke, Phillip J., and J. Jeffrey Flenniken
1991 Missing the Point: Rebuttal to Bettinger, O'Connell and Thomas. American Anthropologist 93(1):172-173.

Woods, James C.
1987 Manufacture and Use Damage on Pressure-Flaked Stone Tools. Master's thesis, Idaho State University, Pocatello.

1988 Projectile Point Fracture Patterns and Inferences about Tool Function. Idaho Archaeologist 11(1):3-7.