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Obsidian Evidence for San Clemente Island and the Establishment of a Tentative Hydration Rate

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Introduction

Eighty-three obsidian artifacts ranging from small flakes to large knives have been recovered from various sites on San Clemente Island. They are of particular interest as they represent extraneous items which reached the island through exchange or trade.

The data included in this analysis were developed during seven field seasons commencing with the UCLA 1983 Summer Field School and terminating with the 1990 Field School sponsored by California State University, Northridge. Seventeen sites were investigated with various degrees of thoroughness, ranging from small test explorations to extensive excavations of up to 95 cubic meters. A total of 83 obsidian pieces (artifacts and chipping waste) are included in the data base; one-fourth of them were found associated with burials.

Obsidian Distribution In San Clemente Island Sites

Seven of the 17 sites yielded obsidian. Due to its relative scarcity, it was most likely to be found in sites where larger amounts of excavation took place. If consideration is limited to excavations in excess of 5 cubic meters, only one site lacked obsidian. Consequently, the size of the excavation sample offers a possible explanation for obsidian distribution. Limited test excavations were confined to small, slightly used, temporary camp sites, which reduces the probability of finding artifacts used by a resident group. It is quite possible, of course, that had more excavation been done at these types of sites, more of them may have contained obsidian. However, findings at Xantusia Cave, discussed below, argue against this conclusion. Data suggest that obsidian was confined to sites of extensive use, either residential, ceremonial, or burial.

Xantusia Cave appears to have been used intermittently for food procurement and temporary shelter. Its proximity to the ocean (less than 50 meters distant) and the items recovered during excavation attest to its use as a temporary camp site. Of 768 items catalogued in the 1984/85 field seasons, 354 are faunal remains and 216 are debitage. Fifty artifacts relate to fish procurement and an additional 50 are classified as chipped stone. Seven beads and one pendant are the only items of possible socio-ceremonial significance, although these types of artifacts are prevalent in most other sites on the island. The Ledge Site, for example, has almost 20,000 such items. As noted above, Xantusia Cave yielded no obsidian in spite of its relatively large excavation sample, suggesting that it

Fig. 5.1. Obsidian blades from Eel Point C (scale in centimeters).

may have been occupied before the obsidian trade with the mainland commenced.

On the other hand, the Eel Point C Site has a relative abundance of obsidian. This site yielded the highest ratio of obsidian per cubic meter of excavated material among all the sites included in the data base, a ratio of two grams of obsidian per cubic meter of excavation (Fig. 5.1). Eel Point C is located in a sand dune area containing extensive midden deposits. Eleven burials were excavated during the time span covered by this analysis. In contrast with Xantusia Cave, Eel Point C has 3,800 beads and numerous other socio-ceremonial items. Included among the more than 2,300 catalog entries are pendants, effigy figures, and pipes.

A relatively small amount of obsidian was found in the Nursery Site, a ratio of only one gram of obsidian per three cubic meters of excavation (Table 5.1). Although the type of site appears to be a predictor of whether obsidian will be present, the relative abundance of this material seems to be determined by other factors. The most likely of these may be chronological fluctuations in trade with the mainland obsidian sources. In general, obsidian is not present in sites older than about 5,000 years on the southern coast of California. It is also rare in very recent sites, having been largely replaced by fused shale. This simple picture is complicated by the re-use of obsidian in very recent sites.

In-site Obsidian Distribution

The distribution of the obsidian within sites likewise yields interesting results when distinguished according to context, artifact type, and weight. As Tables 5.2 and 5.3 indicate, tools are just as likely to be found in middens as in burials, but debitage was six times more likely to be found in a midden context. Of the total number of obsidian artifacts analyzed, 83 (approximately 30 per cent) are tools and tool fragments; however, they account for over 75 per cent of the total gram weight. All of the chipping waste flakes weigh less than 4 gm, 85 per cent weigh less than 2 gm, and some are as small as 0.05 gm When considering these data, it is suggested that only finished tools were imported to San Clemente Island. Debitage resulted from the re-use of broken or discarded artifacts, or from tool maintenance and refurbishing. The fact that fragmented tools were associated with grave goods suggests the value placed on this commodity.

Table 5.3 presents a summary of this information for the purpose of comparison.

Table 5.1. Obsidian from San Clemente Sites excavated by UCLA since 1983.

Site	Site type	Obsidian	m^3 of excavation	Qty obsidian (gm)	Ratio: excavated obsidian present (gm) to m^3 of excavation
Ledge (SCLI-126)	Ceremonial	Yes	52.68	7.5	1/9
Eel Point (SCLI-43B)	Midden/burial	Yes	53.94	5	1/10
Eel Point (SCLI-43C)	Cemetery/midden	Yes	69.3	140.45	2/1
XantusiaCave (SCLI-1178)	Midden	No	23.88	-	-
Nursery (SCLI-1215)	Residential/cemetery	Yes	94.59	37.75	1/3
Big Dog Cave (SCLI-119)	Shelter/burial	No	2.3	-	-
Old Airport (SCLI-1487)	Ceremonial	Yes	24.3	2.3	1/10
Columbus (SCLI-1492)	Residential	Yes	6.3	0.5	1/10
Lemon Tank (SCLI-1524)	Ceremonial	Yes	12.38	0.8	1/15
Target (SCLI-1446)	Midden	No	2.3	-	-
Flasher (SCLI-16E)	Midden	No	1.4	-	-
Gar (SCLI-16S)	Midden	No	2.45	-	-
Horton (SCLI-1591)	Midden	No	0.3	-	-
Eel Cove (SCLI-703)	Rock shelter/burial	No	1.5	-	-
SCLI-1318	Midden	No	4.1	-	-
SCLI-1319	Midden	No	7.6	-	-
SCLI-1325	Midden	No	0.6	-	-

Hydration Band Readings

Table 5.4 presents the results of hydration band readings taken from 60 thin-sectioned hydration samples. As discussed in the final section of this study, it is suggested that a hydration reading of one micron represents a duration in time of about 458 ± 92 years (360-550 yrs/micron). Using this tentative hydration rate, and plotting the frequency of band readings, it is possible to make some assumptions concerning temporal patterns of obsidian importation to the island.

The smallest micron readings are taken from the most recently imported obsidian and the largest numbers represent the oldest obsidian. For example, three of the largest obsidian rinds have hydration readings from 7.6-7.9 microns (3 rinds). Based on the suggested rate, the 0.3 micron range covers a time span of approximately 140 years. The largest cluster of readings includes 49 rinds with band measurements ranging from 5.0 to 7.3 microns. This indicates a long-term continuous importation of obsidian during a period of about 1,100 years. This time span appears to have been followed by a 650 year hiatus during which no obsidian was imported, based on the absence of any hydration readings in the 3.7-5.1 micron range. A second, shorter, hiatus may have followed the longer one as suggested by the lack of readings in the 2.4 through 2.7 micron range. Two explanations seem possible for these phenomena: either there was a break in exchange relationships, or the island was uninhabited for several periods. Further excavation may provide obsidian samples to fill in these gaps, but it seems fairly assured that the time span of relatively

heavy importation will not be changed by additional readings.

Breaks in the C^{14} intervals coincide with the hydration results. When examining the radiocarbon evidence for Eel Point C, an 1100 year gap becomes apparent. Three C^{14} dates range from 1050 to 1450 BP and 10 C^{14} dates range from 2550 to 3700 BP. These coincide with the break between the majority hydration band cluster and the 2.8-3.7 cluster. Older C^{14} dates are

Table 5.2. Volume of obsidian artifact types from sites on San Clemente Island.

Site	Context	Tool type	Tool weight	No. of debitage	Debitage weight
Ledge	Midden	Biface	4.3	6	3.2
Eel Point B	Midden			2	5
Eel Point C	Midden	Drill point	1.5	17	18.61
	Midden	Knife	8.1		
	Midden	Point	2.5		
	Midden	Point	2.2		
	Midden	Point fragment	2.7		
	Midden	Point	3.3		
	Burial	Knife	18.7	7	5.55
	Burial	Knife	11		
	Burial	Knife	19.4		
	Burial	Knife	9.15		
	Burial	Knife	17.4		
	Burial	Knife	24.3		
	Burial	Point tip	0.6		
	Burial	Point fragment	6.8		
	Burial	Point base	1.2		
	Burial	Point fragment			
Nursery	Midden	Biface fragment	0.7	14	8.95
	Midden	Scraper	1		
	Midden	Scraper	4.5		
	Burial	Utilized flake	1.4	1	0.15
	Burial	Knife fragment	1.2		
	Burial	Biface fragment	15.5		
	House Pit	Point tip	0.35	5	4
Old Airport	Midden			4	2.3
Lemon Tank	Midden	Point fragment	0.51		
	Midden	Utilized flake	0.32		
Columbus	Midden			1	0.5

Table 5.3. Context summary of San Clemente Island obsidian.

Material	Burial	Midden
Total tools	13	13
Tool weight (gm)	140.5	31.98
No. of debitage flakes	8	49
Debitage weight (gm)	5.7	42.5

available for the island but they appear to be from a period prior to the first importation of obsidian.

Source Of Obsidian

Locations of the 30 obsidian sources exploited by California Indians are shown on the map in Figure 5.2. In order to determine the exact source of the obsidian present at Eel Point C, 17 samples were submitted for source analysis to Dr. Paul Bouey at Far Western Anthropological Research (Chapter 6). As indicated in Table 5.5, fourteen of the seventeen samples submitted for analysis are from the West Sugarloaf subsource, part of the Coso volcanic field. Sample 1107 was from an unknown source, and probably represents an "apache tear," a small amount of obsidian washed out from a source no longer extant. The other two are classified as undifferentiated Sugarloaf and generic Coso.

Establishment Of A Tentative Hydration Rate

Table 5.6 indicates the calibrated and adjusted C^{14} dates for Eel Point C and the hydration band measurements for material from the West Sugarloaf subsource. Unfortunately, none of the obsidian measurements can be directly correlated with specific C^{14} dates. The closest association between the two is the 2960 BP date on bone collagen taken from burial 3 in the main cemetery area, the locale of most of the recovered obsidian. Consequently, only a preliminary and tentative rate can be suggested at this time.

Table 5.4. Obsidian hydration readings, San Clemente Island.

Hydration microns	Number of samples
1.8-2.0	2
2.0-2.2	3
2.2-2.4	1
2.4-2.6	
2.6-2.8	
2.8-3.0	1
3.0-3.2	1
3.2-3.4	1
3.4-3.6	1
3.6-3.8	1
3.8-4.0	
4.0-4.2	
4.2-4.4	
4.4-4.6	
4.6-4.8	
4.8-5.0	
5.0-5.2	1
5.2-5.4	4
5.4-5.6	5
5.6-5.8	2
5.8-6.0	5
6.0-6.2	5
6.2-6.4	11
6.4-6.6	5
6.6-6.8	4
6.8-7.0	1
7.0-7.2	2
7.2-7.4	1
7.4-7.6	
7.6-7.8	2
7.8-8.0	1

In order to establish a tentative rate, the C^{14} dates were averaged together, eliminating the largest and smallest from the calculations. A similar procedure was followed with the hydration band information. As a result, an average C^{14} date of 2839 BP and an average band measurement of 6.2 were obtained. This resulted in a rate of 458 ± 92 years per micron. This is a much slower rate than Meighan's 220 ± 44 (Meighan 1978b) for Coso obsidian from the Malibu Site (LAN-264) and slower than Ericson's rate of 344 ± 68 (Ericson 1978) for obsidian from the Coso Hot Springs area. The 220 year rate was from obsidian considered as generic Coso without subsource identification. The original calculations for the 344 year rate may be associated with the Sugarloaf Mountain subsource as suggested by Hughes (1988). He indicates that the Sugarloaf Mountain subsource should be the "fastest" hydrating of any of the subsources based on the chemical index data. Hughes further notes, based again on chemical index data, that West Sugarloaf should have a significantly "slower" rate than Sugarloaf Mountain. This may partially explain the slow 458 year per micron rate indicated by the San Clemente Island data.

It should be stressed that this rate is tentative and perhaps slower than the actual rate; however, until more data are collected, it will be difficult to establish a more secure rate. What is needed at this point is to make thin sections from a couple of the knives found in association with burial 3. We've hesitated to do this, hoping to keep them intact, but it seems necessary in order to refine the obviously tentative nature of the suggested hydration rate.

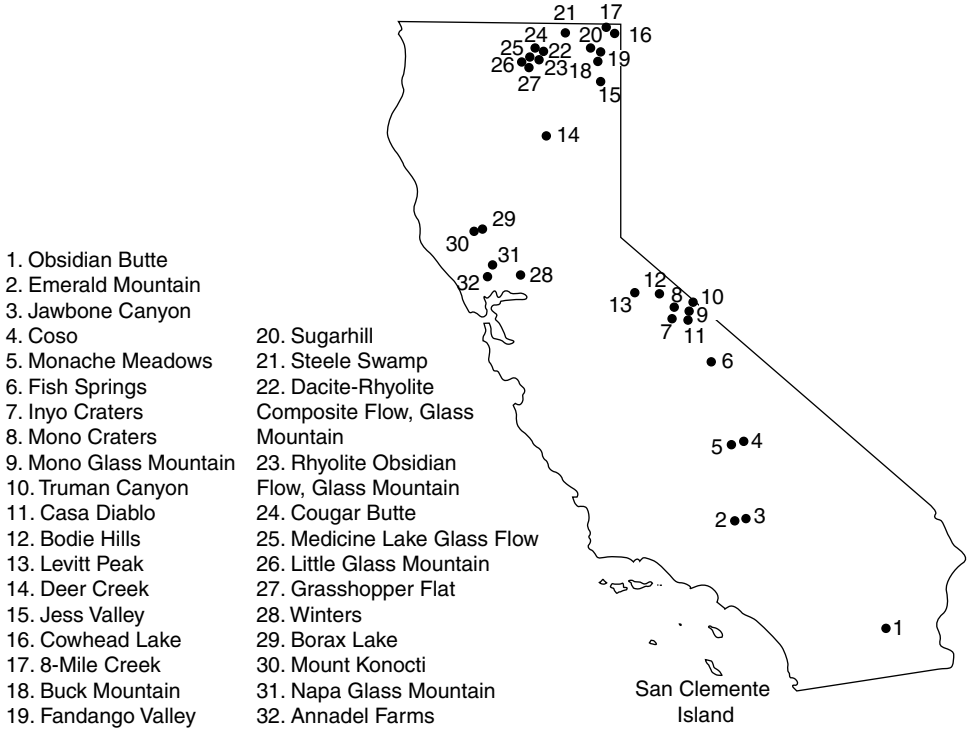

Fig. 5.2. California obsidian sources (after Ericson).

Table 5.5. Trace element values of obsidian specimens from SCLI-43C.

Sample No.	Rubidium	Strontium	Zirconium	Iron/ Manganese	Source
1107	285.13	9.61	87.92	20.3	?
EC318	293.01	12.25	134.66		West Sugarloaf
EC594	418.81	13.99	179.74		Coso
299A	320.63	14.67	152.82		West Sugarloaf
299B	316.78	11.47	152.15		West Sugarloaf
299C	317.55	12.49	155.94		West Sugarloaf
299D	300.14	9.61	139.49		West Sugarloaf
299E	282.19	11.85	134.54		West Sugarloaf
299F	287.54	11.41	138.96		West Sugarloaf
E21	329.56	15.75	160.58		West Sugarloaf
E155	271.49	9.61	103.07		Sugarloaf
E157	319.76	13.44	155.88		West Sugarloaf
E755	320.72	15.57	154.22		West Sugarloaf
E763	268.78	12.42	131.53		West Sugarloaf
E841	313.1	9.61	142.66		West Sugarloaf
E868	301.08	9.61	126.52		West Sugarloaf
E870	331.13	9.61	136.6		West Sugarloaf

Table 5.6. C^{14} and Obsidian Hydration Data from SCLI-43C.

C^{14} Dates			Hydration Measurements	
I.D. No.	Calibrated/ reservoir	OHL catalog adjusted dates	Source number	Micron measurement
2574	4300 YBP	10249	West Sugarloaf	5.8
2735A	2960 YBP	10256	West Sugarloaf	7.0
2757A	1120 YBP	10257	West Sugarloaf	5.5
2757B	1050 YBP	10258	West Sugarloaf	5.4
2757C	2950 YBP	10301	West Sugarloaf	5.2
2757D	2950 YBP	10316	West Sugarloaf	6.4
2757E	3100 YBP	11447	West Sugarloaf	6.4/7.6
2757F	3400 YBP	11448	West Sugarloaf	6.0
2757G	3005 YBP	11449	West Sugarloaf	6.1
2757H	3150 YBP	11450	West Sugarloaf	6.3
		11451	West Sugarloaf	6.2
		11452	West Sugarloaf	6.4
		11453	West Sugarloaf	6.6