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An Olivella Grooved Rectangle Bead Cluster from San Nicolas Island, California

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A survey on San Nicolas Island found a cluster of over 4,200 shell beads associated with Middle Holocene archaeological deposits eroded from a coastal dune at CA-SNI-12. Among the 12 bead types recovered were more than 146 Olivella Grooved Rectangle (OGR) beads, including a previously unknown subtype with diagonal grooves, >3,000 Olivella cap beads, and nearly 400 Olivella spire-removed beads. Direct AMS radiocarbon dates (~5,000 cal B.P.) on two bead fragments confirm the Middle Holocene age of the feature. Between approximately 5,400 and 4,400 cal B.P., California's southern Channel Islands appear to have been the focal point of OGR bead production and use, though these beads have been found in a variety of archaeological contexts across western North America. The broad distribution but short temporal duration of these beads makes them an important Middle Holocene indicator of bead production and exchange in California and the Great Basin.

The archaeological record of North America demonstrates that shell beads were widely used and traded by Native Americans and held a central role in pre-Colombian economies. Valued for its color, decorative potential, and workability, the purple olive shell played a central role in ancient trade networks in western North America (Arnold 1987, 2001; Arnold and Graesch 2001; Bennyhoff and Hughes 1987; King 1990). Although the scientific name for the purple olive shell has been changed to *Callianax biplicata* (Carlton 2007) we retain the use of Olivella (without italics) to discuss purple olive shell beads and associated debris because of its archaeological significance (i.e., the extensive classification of beads utilizing this name). The antiquity of Olivella shell-bead making appears to have coincided with the arrival of some of the region's first human settlers (Erlandson et al. 2005; Fitzgerald et al. 2005; Morris and Erlandson 1993; Vellanoweth et al. 2003). Olivella beads of the Early Holocene were generally simple, spire-removed varieties. By the Middle Holocene bead styles diversified and people began using the wall portion of the olive shell. Square or rectangular beads were some of the first to be made from the Olivella wall sections, including drilled varieties and a distinctive Olivella Grooved Rectangle (OGR) bead type found primarily on the southern Channel Islands, the adjacent mainland coast, and in the western Great Basin (Bennyhoff and Hughes 1987; Jenkins and Erlandson 1996; King 1990; Raab and Howard 2002; Vellanoweth 2001). Late Holocene bead production diversified further and greatly intensified, with beads made from the hard callus section of the shell used as a regional currency (Arnold 1995; Arnold and Munns 1994; Erlandson 1988; King 1990). For the people of the California Channel Islands, this proved to be an economic windfall. Their beaches were strewn with large quantities of easily accessible olive shells, and island rock types included high grade toolstone to work them. The market for bead consumption was readily available on the mainland, and the desire for beads seems to have increased through time, until the arrival of Europeans disrupted native economies.

Crafting OGR and other wall beads marks a significant change in how people perceived, manipulated, and incorporated Olivella shell beads into their personal, social, and economic lives. Wall beads increased the decorative potential of the olive shell and expanded the creative expression of the bead-makers and artisans who transformed them into ornamentation for clothing, regalia, baskets, and other goods. Middle Holocene Olivella bead industries included other types of beads as well, such as spire-removed and barrel-shaped varieties. The production of Olivella beads continued throughout the Middle Holocene, but people began to experiment by removing varying amounts of material from the top and bottom of the shell, in effect creating different bead styles, including oblique spire-lopped, barrel, cap, and other varieties. Removing material from different parts of the shell produced beads with different shapes, sizes, and profiles, allowing them to be sewn and strung in a variety of ways. This also greatly expanded the decorative and economic potential of Olivella beads, creating a medium for artistic expression and craft production. Changing bead styles in turn acted as a barometer of Middle Holocene personal and cultural aesthetics and of the market forces that bound them throughout western North America.

It is clear that Olivella beads were an integral part of Native American material culture, but it is less clear how or why changes in Olivella bead-making occurred. The answers to these questions are firmly rooted in the sociopolitical and economic interactions that developed during the Middle and Late Holocene, when trade increased between distant groups of people. Much of the archaeological evidence for these trade networks is based on the distribution of Olivella shell beads, which suggests trade between interior, coastal, and island peoples started over 10,000 years ago (Eerkens et al. 2005; Erlandson et al. 2005, 2011; Fitzgerald et al. 2005). However, long distance trade increased during the Middle Holocene, with some evidence for a socioeconomic interaction sphere involving people of the southern Channel Islands, southern California mainland, and northwestern Great Basin (Howard and Raab 1993; Jenkins and Erlandson 1996; Raab and Howard 2002; Sutton and Koerper 2009; Vellanoweth 1995, 2001).

In this paper, we share new data on Middle Holocene bead industries on the southern Channel Islands, based on the analysis of a cluster of over 4,200 Olivella beads and fragments found eroding out of a dune midden at CA-SNI-12 on San Nicolas Island, the most remote of California's Channel Islands. After describing the field context of this bead cluster, we present the results of our bead classifications and quantification along with direct AMS radiocarbon dates for two bead fragments. We conclude by summarizing the current state of knowledge on the occurrence and distribution of OGR beads.

BACKGROUND

San Nicolas Island

San Nicolas Island (58 km.^{2}) lies 98 km. from the Los Angeles County coast and 46 km. from the nearest point of land, the diminutive Santa Barbara Island (Fig. 1). San Nicolas is relatively arid, receiving only 20 cm. of precipitation annually. Springs, seeps, and vernal pools make water available in all seasons, though the scarcity of potable fresh water may have limited the island's carrying capacity in the past. Vegetation consists primarily of semi-arid coastal scrub, dune and wetland communities, and invasive grasses. Unregulated sheep ranching in the nineteenth and early twentieth centuries devastated native plant communities on the island. Probably due to its distance from the mainland, the island supports few terrestrial vertebrates. Marine habitats are rich, however—supported by extensive off-shore rocky reefs and broad kelp forests—and include a variety of economically important resident and seasonal species of finfish, shellfish, birds, and sea mammals. Intertidal habitats also support two species of olive shells, often found washed up on the numerous sandy beaches encircling the island.

The terminal Pleistocene and Early Holocene occupation of San Nicolas Island is not well understood due to the lack of sites dated to this time. At least 18 chipped stone crescents, a tool type produced during the terminal Pleistocene and Early Holocene (Erlandson et al. 2011), have been found, though not in association with any datable material (Davis et al. 2010). In contrast, numerous sites have been dated to the Middle Holocene,

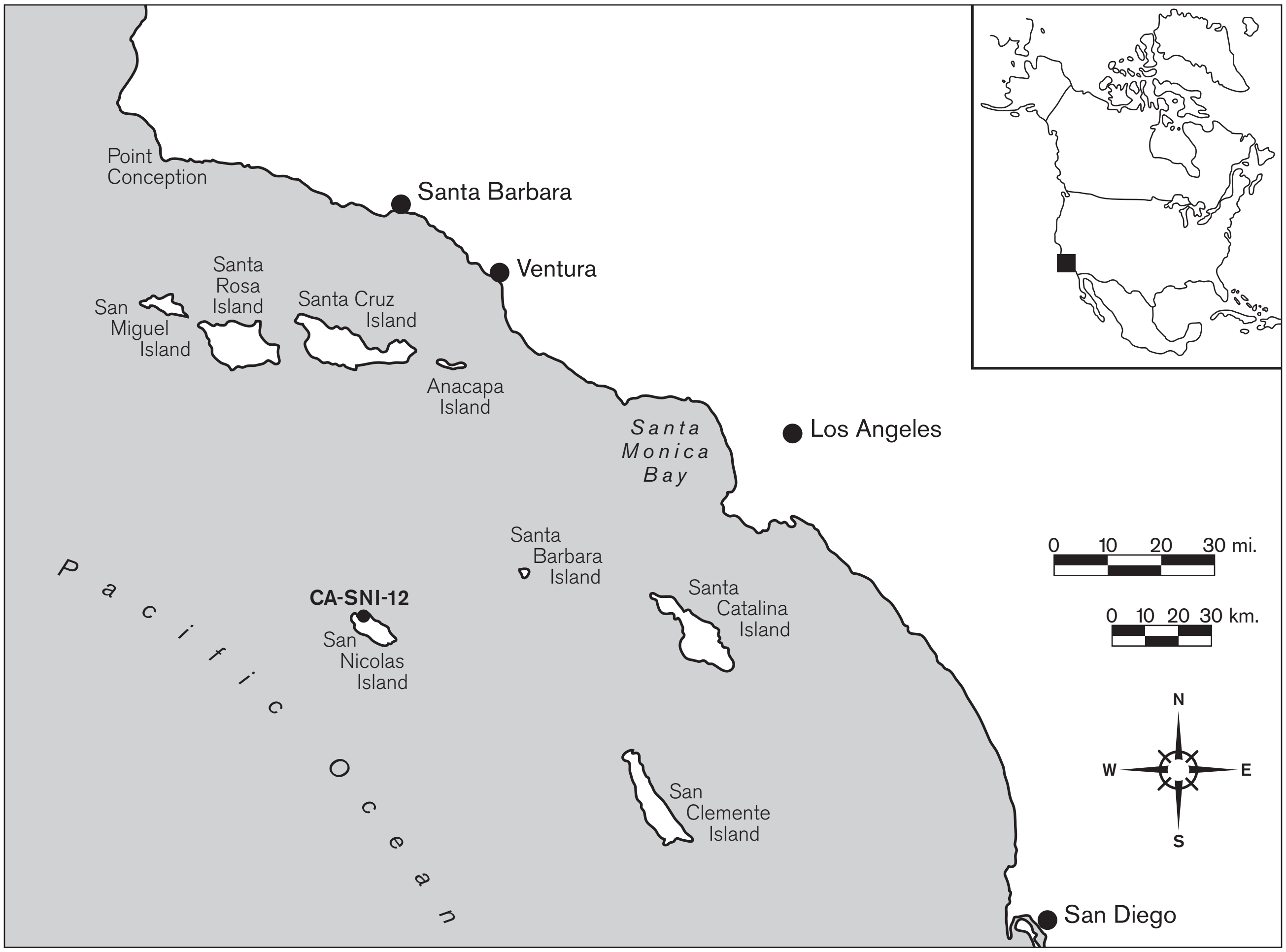

Figure 1. Map of the California Channel Islands and adjacent mainland coast showing the general location of CA-SNI-12.

including at least three (CA-SNI-12, CA-SNI-161, SNI Air Terminal) that contain OGR beads (Laughtner 1982; Rogers 1930; Vellanoweth 1995, 2001; Vellanoweth and Erlandson 1999). Populations greatly increased by the Late Holocene, when large villages formed and evidence for bead production is island-wide (Vellanoweth et al. 2002). Linguistic evidence suggests that the native people of San Nicolas Island spoke a dialect within the Takic group of Uto-Aztecan languages.

CA-SNI-12

Located on the extreme north end of San Nicolas Island, CA-SNI-12 is a large (~750 m. by 250 m.) shell midden found on the eroded surface and in subsurface soils in a deflated dune ridge (Fig. 2). The site overlooks a rocky headland adjacent to a large freshwater spring on the east side and a long, straight sandy beach to the west. Today, the heavily eroded site surface is strewn with shell midden debris, metavolcanic cores and flakes, bone and shell artifacts, asphaltum, pigment, and occasional human remains.

The site's location makes it particularly vulnerable to the prevailing northwesterly winds. Surface plant growth is sparse on the dunes, where the majority of the best preserved archaeological deposits remain, but is more substantial within deflated swales. Previous archaeological work included surface collections, surveys, and excavations, GPS mapping, and erosion assessment and monitoring (Kritzman 1977; Laughtner 1982; Meighan 1954; Meighan and Eberhart 1953; Rogers 1930; Simmons 1994; Woodward 1939). Regrettably, the site continues to be battered by high winds that are likely to cause further erosion and destruction of the site deposits in years to come.

During surface reconnaissance and site assessment at CA-SNI-12 in 2009, over 4,200 shell beads were

Figure 2. Overview of CA-SNI-12 showing surface deposits and erosion.

recovered from a surficial cluster eroding from the west-facing dune slope (Table 1). Scattered across an area approximately 4×4 m. wide, many of the beads were badly sand-blasted and sun damaged, suggesting surface exposure for a year or more (Fig. 3). The presence of scattered human bones suggests that the beads may have once been associated with a burial or small cemetery. Malcolm J. Rogers (1930) reported the presence of OGR beads associated with human burials at CA-SNI-12.

We were fortunate to find the beads when we did, as many of them were badly thinned, cracked, and broken due to exposure to the elements. AMS radiocarbon dating of a single OGR bead fragment produced a corrected and calibrated one-sigma age range of 4,960–4,840 cal B.P. (OS-83736; Table 2), and a cap bead fragment yielded a range of 4,920–4,820 cal B.P. (OS-83641, ΔR of 225±35). Previously, an OGR bead collected by Rogers was directly dated to ~4,400 cal B.P. (Vellanoweth 2001). These three dates suggest that the site was occupied between about 4,900 and 4,400 years ago.

THE BEADS: SURFACE COLLECTION OF CA-SNI-12

Shell artifacts were collected from the localized bead cluster on the surface of CA-SNI-12 through a combination of hand collection and the screening of surficial sands through an 1/8-inch mesh. More than 4,900 shell artifacts were recovered, including 3,851 complete shell beads, 414 bead fragments, and 648 pieces of bead-making debris. The vast majority (>99%) of beads and bead fragments were made from purple olive (*C. biplicata*) shells, though eight beads (<1%) were made from the nacreous portion of abalone (*Haliotis* sp.) and one from a cone shell (*Conus californicus*). Bead-making debris, which consisted of wall blanks and whole and fragmented shells, was only represented by *C. biplicata*.

Classifications and descriptions were based on typologies developed by Bennyhoff and Hughes (1987) and recently updated by Milliken and Schwitalla (2012); they include the following types: A1 spire-lopped,

Table 1

BEADS[a] AND BEAD MAKING DEBRIS COLLECTED FROM CA-SNI-12

Class and Type	Description	Size	Count	% Subtotal	% Total
Whole Beads					
A1a	Olivella spire-lopped	Small	307	7.97	7.20
A1b	Olivella spire-lopped	Medium	14	0.36	0.33
A2a	Olivella oblique spire-lopped	Small	38	0.99	0.89
A2b	Olivella oblique spire-lopped	Medium	3	0.08	0.07
A4a	Olivella punched spire-lopped	Small	15	0.39	0.35
A4b	Olivella punched spire-lopped	Medium	2	0.05	0.05
B2a	Olivella end-ground	Small	35	0.91	0.82
B2ao	Olivella oblique end-ground	Small	3	0.08	0.07
B3a	Olivella barrel	Small	11	0.29	0.26
B3b	Olivella barrel	Medium	6	0.16	0.14
B4a	Olivella cap	Small	1,770	45.96	41.50
B4b	Olivella cap	Medium	322	8.36	7.55
B4ao	Olivella oblique cap	Small	841	21.84	19.72
B4bo	Olivella oblique cap	Medium	307	7.97	7.20
G1	Olivella tiny saucer	NA	1	0.03	0.02
L2a2	Olivella rounded shelved small thick rectangle	NA	1	0.03	0.02
L2b2	Olivella rounded unshelved small thick rectangle	NA	6	0.16	0.14
N2	Olivella grooved rectangle	Small	139	3.61	3.26
N2d	Olivella grooved rectangle, diagonal variant	Small	7	0.18	0.16
O2a	Olivella punched whole shell	Small	5	0.13	0.12
O2b	Olivella punched whole shell	Medium	8	0.21	0.19
O2c	Olivella punched whole shell	Large	1	0.03	0.02
–	*Haliotis* nacre sequin	NA	8	0.21	0.19
–	*Conus californicus* bead	NA	1	0.03	0.02
Subtotal:			**3,851**	**100**	**90.29**
Bead Fragments					
A1	Olivella spire-lopped	–	1	0.24	0.02
A4	Olivella punched spire-lopped	–	1	0.24	0.02
B4	Olivella cap	–	370	89.37	8.68
N2	Olivella small grooved rectangle	–	32	7.73	0.75
–	*Haliotis* nacre sequin	–	9	2.17	0.21
–	Undifferentiated wall bead, broken	–	1	0.24	0.02
Subtotal:			**414**	**100**	**9.71**
Bead Making Debris					
–	Olivella whole shell	–	258	39.81	39.81
–	Olivella detritus	–	388	59.88	59.88
–	Olivella wall blanks	–	2	0.31	0.31
Subtotal:			**648**	**100**	**100**
Whole bead and bead fragment total:			**4,265**		
Bead and bead making debris total:			**4,913**		

[a]Bead identifications were based on Bennyhoff and Hughes (1987) and Milliken and Schwitalla (2012).

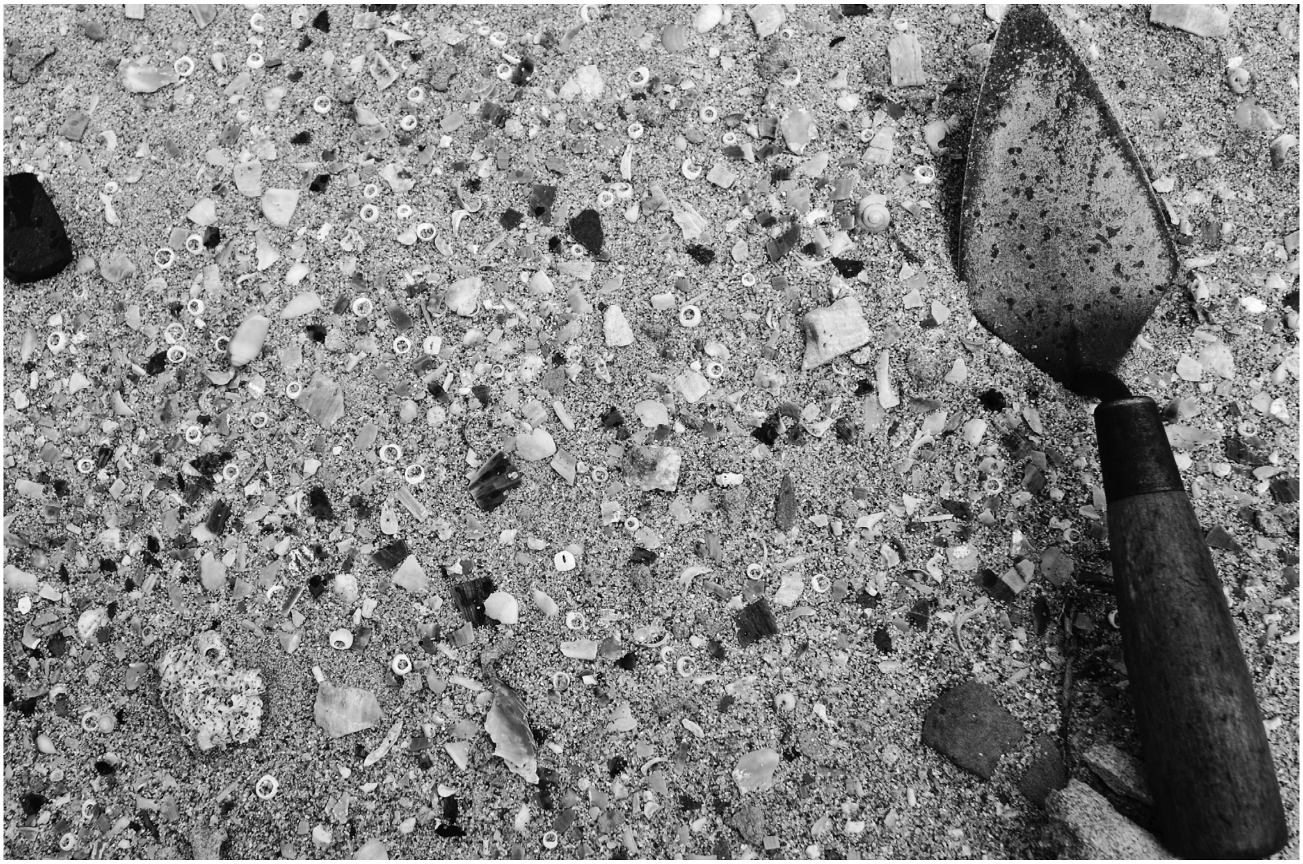

Figure 3. Olivella beads and archaeological materials exposed at CA-SNI-12 during the 2009 reconnaissance survey and surface collection.

Table 2

RECALIBRATED DIRECT RADIOCARBON DATES FOR OGR BEADS

Lab Number	Location	Site	Uncorrected ^{14}C Age (RYBP)	Adjusted Age Range (cal B.P., 1 sigma)	Adjusted Age Range (cal B.P., 2 sigma)	References
California						
Beta-115553	Bolsa Chica Site	CA-ORA-365	5,270 ± 50	5,458 : 5,313	5,554 : 5,281	Vellanoweth 2001
Beta-78677	Viscaino Point	CA-SNI-161	5,040 ± 60	5,233 : 5,008	5,285 : 4,887	Vellanoweth 2001
Beta-115552	Bolsa Chica Mesa	CA-ORA-85	5,070 ± 60	5,255 : 5,045	5,310 : 4,913	Vellanoweth 2001
Beta-115551	Encino	CA-LAN-43	4,990 ± 60	5,167 : 4,897	5,245 : 4,846	Vellanoweth 2001
Beta-253265	Border Field Site	CA-SDI-4281	4,960 ± 40	5,039 : 4,867	5,194 : 4,835	Shultz 2011
Beta-127333	Rincon Point	CA-SBA-119	4,940 ± 70	5,049 : 4,834	5,230 : 4,802	Vellanoweth 2001
OS-83736*	NW Coast Dunes	CA-SNI-12	4,910 ± 30	4,959 : 4,841	5,038 : 4,812	This paper
Beta-118254	Elk Hills Sites	CA-KER-5404	4,850 ± 40	4,919 : 4,794	5,003 : 4,697	Jackson et al. 1998
Beta-115555	NW Coast Dunes	CA-SNI-12	4,550 ± 60	4,561 : 4,364	4,679 : 4,243	Vellanoweth 2001
Nevada						
Beta-115550	Stillwater Marsh	Unknown	5,040 ± 60	5,233 : 5,008	5,285 : 4,887	Vellanoweth 2001
Oregon						
Beta-114174	Fort Rock Valley	35LK2758	4,980 ± 60	5,115 : 4,875	5,237 : 4,839	Vellanoweth 2001

Note: *Sample was processed at NOSAMS Woods Hole Oceanographic Institution and calibrated using CALIB 6.1.0 (Stuiver and Reimer 1993); all other Samples were processed at Beta Analytic Laboratories and recalibrated using CALIB 6.1.0 (Stuiver and Reimer 1993). A ΔR of 225 ± 35 was applied to all samples (see Kennett et al. 1997).

A2 oblique spire-lopped, A4 punched spire-lopped, B2 end-ground, B3 barrel, B4 cap, G1 tiny saucer, L2 small thick rectangle, N2 small grooved rectangle, and O2 punched whole shell (Fig. 4). Most of these bead types are further distinguished by the addition of a lower-case Arabic letter into three size classes based on measurements of the maximum bead diameter: small (a), medium (b), and large (c). Summary metrics, including ranges and means of diagnostic attributes for each bead type and class, are provided in Table 3.

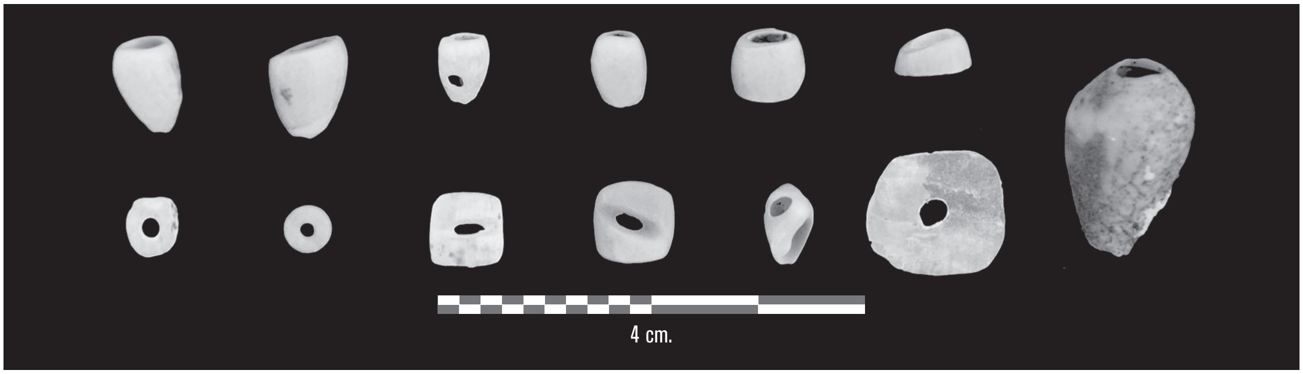

Figure 4. Bead types collected from CA-SNI-12 (left to right beginning with upper row): A1 Spire-lopped, A2 Oblique Spire-lopped, A4 Punched Spire-lopped, B2 End-ground, B3 Barrel, B4 Cap, F3 Small Saddle, G1 Tiny Saucer, N2 Small Grooved Rectangle, N2 Small Grooved Rectangle with diagonal perforation, O2 Punched Whole Shell, *Haliotis* sp. nacre sequin, and *Conus* sp. bead.

Table 3

SUMMARY METRICS FOR BEADS COLLECTED FROM CA-SNI-12

	Range (mm.)			Mean (mm.)		
Bead Class and Type	Diameter (Width)	Length (Height)	Perforation Diameter	Diameter (Width)	Length (Height)	Perforation Diameter
A1a	3.52–6.46	4.68–10.78	0.82–3.46	4.99	7.21	1.67
A1b	6.58–9.28	9.16–16.62	1.05–4.60	8.33	12.27	3.11
A2a	3.54–6.36	6.04–10.34	1.00–3.44	4.98	7.32	2.20
A2b	6.48–6.89	8.82–9.64	3.37–4.42	6.76	9.32	4.07
A4a	4.21–6.59	6.20–11.81	0.79–2.96	5.51	8.66	1.93
A4b	7.72–7.99	11.48–13.82	2.81–4.02	7.86	12.65	3.42
B2a	3.11–5.94	4.23–8.34	0.95–2.93	5.10	6.66	2.11
B2ao	4.93–5.66	5.57–6.91	1.56–2.73	5.29	6.42	2.29
B3a	4.33–6.26	3.25–4.64	1.76–3.14	5.44	4.03	2.78
B3b	6.51–7.49	4.20–6.46	2.57–3.55	6.82	4.99	3.00
B4a	3.76–6.50	1.60–3.72	1.60–4.34	5.46	2.51	2.79
B4b	6.51–8.22	2.00–5.04	2.60–4.80	6.98	3.30	3.45
B4ao	4.04–6.50	25.00–58.00*	1.66–4.19	5.40	0.66*	2.85
B4bo	6.51–8.30	25.00–59.00*	2.47–4.30	6.99	0.65*	3.39
G1	4.20	–	1.13	4.20	–	1.13
L2a2	4.47–5.17	5.13–5.78	1.21–2.08	4.67	5.40	1.66
L2b2	4.22	4.73	1.15	4.22	4.73	1.15
N2	4.71–9.13	4.73–7.78	0.81–3.82	5.78	5.88	2.53
N2d	5.73–8.58	5.74–7.62	1.62–3.71	7.13	6.92	2.74
O2a	3.44–6.36	5.98–9.86	1.68–3.18	4.90	7.38	2.15
O2b	7.03–9.16	11.48–16.06	2.05–4.52	8.30	13.94	3.75
O2c	9.64	16.40	4.36	9.64	16.40	4.36
Nacre sequins	0.49–0.44	0.39–0.35	1.61–2.25	0.44	0.36	1.96

*This number is the % difference between the two length measurements for each bead.

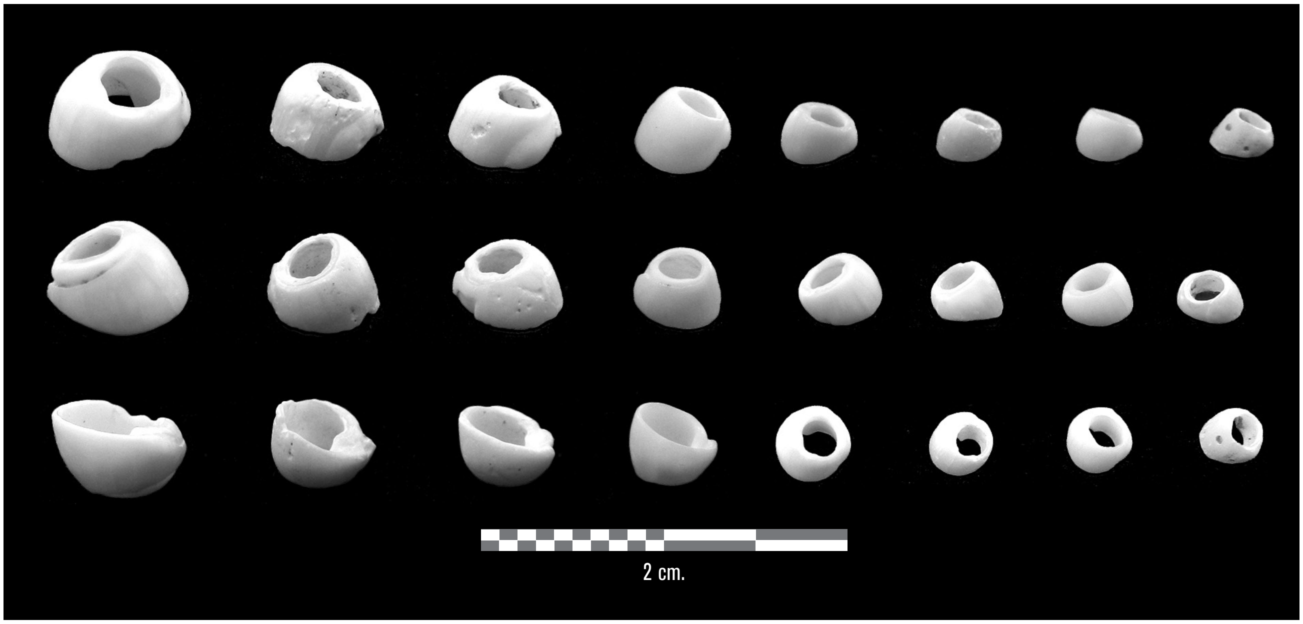

Figure 5. A sample of Olivella Oblique Cap beads (B4ao and B4bo) from CA-SNI-12.

Olivella Spire-removed, Barrel, and Cap Beads

This category includes Olivella beads manufactured by reducing varying amounts of the spire, the base (canal and fasciole), and body (aperture, outer lip, and columella), while retaining a portion of the body circumference of the shell. Olivella bead types in this designation from CA-SNI-12 include spire-lopped, oblique spire-lopped, punched spire-lopped, end-ground, barrel, cap, and whole punched beads.

Most of the collected beads were B4 Olivella cap beads (Bennyhoff and Hughes 1987:122; Milliken and Schwitall 2012:22). These were manufactured by removing all or most of the spire along with most of the aperture, leaving the majority of the upper one-third of the shell. A large proportion (~44%) of the cap beads from this assemblage are ground at a noticeable angle, diagonal to the long axis of the shell (Fig. 5). We designated this new slanted variant as B4o oblique caps, with the standard three sub-types delineating size. Unlike spire-lopped oblique (A2) beads, which can be difficult to differentiate because there is no flat base from which to measure slopes, lengths of oblique cap beads can be easily measured along both sides to reveal the percent difference creating the oblique angle. While our assemblage includes oblique cap beads of varying degrees, including slight and severe angles, we define B4o beads as cap beads having one side at least 25% larger than the other, creating a noticeable slant, or slope. The B4o beads in the assemblage include small and medium cap beads with a range of between 25% and 60% difference between sides. This is calculated by placing the height of the smaller side over the height of the larger side, creating a ratio, and taking the inverse of that percentage as the difference between sides (for example: 1.58 mm./2.79 mm. = 57%, one side being 43% larger than the other). For the most part, these beads were ground to create an oblique angle that follows the natural slope at the base of the spire. However, in some instances they were ground straight along the base of the spire and diagonally across the body of the shell. We include both types in the B4o sub-class. Cap beads that were too chipped or weathered to allow accurate side measurements were placed in the standard B4 classification. The feature contained 1,770 small Olivella cap beads (B4a), 322 medium cap beads (B4b), 841 small oblique cap beads (B4ao), 307 medium oblique cap beads (B4bo), and 370 broken cap beads. The relative percentage of cap beads that were ground diagonally is higher among medium sized cap beads (49%) than among small cap beads (32%).

Olivella spire-lopped varieties (A1; Bennyhoff and Hughes 1987:116–118; Milliken and Schwitalla 2012:15, 16), produced by removing varying amounts of the spire through chipping and grinding, were the second

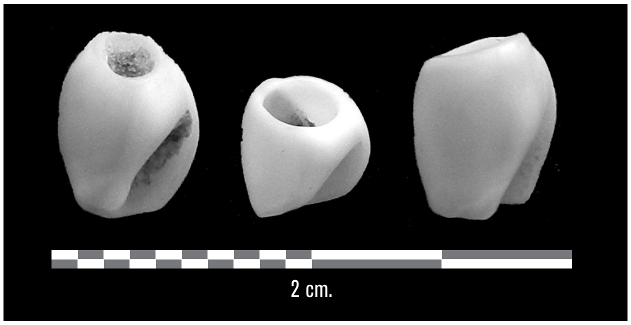

Figure 6. Olivella Oblique End-ground (B2ao) beads from CA-SNI-12.

most abundant bead type found at CA-SNI-12 with 371 examples. Small spire-lopped beads were preferred (A1a, n = 307), but medium spire-lopped beads (A1b, n = 14) were also manufactured. This bead type is not chronologically sensitive, as it was commonly made for over 9,000 years along the southern California coast and on the Channel Islands (Erlandson et al. 2005; King 1990). Oblique spire-lopped beads, distinguished by the diagonal angle at which their spires were removed (Bennyhoff and Hughes 1987:119; Milliken and Schwitalla 2012:17), were also identified in the assemblage, including 38 small oblique spire-lopped (A2a) and three medium oblique spire-lopped (A2b) beads.

Several other varieties round out the assemblage of spire-removed Olivella beads. B2 Olivella end-ground beads (Bennyhoff and Hughes 1987:121; Milliken and Schwitalla 2012:21) are represented by 38 specimens that were produced by grinding away the canal but retaining the circumference of the shell near the spire. All of the end-ground beads from this assemblage fit into dimensions described for small end-ground (B2a) beads. Some B2 beads were ground diagonally at the base of the spire, creating an oblique end-ground variant that we have designated as B2ao (Fig. 6). A4 punched spire-lopped beads include 17 specimens in which a portion of the spire has been removed and a perforation has been punched in the body whorl of the shell (Bennyhoff and Hughes 1987:119; Milliken and Schwitalla 2012:18). Both small (A4a, n = 15) and medium (A4b, n = 2) punched spire-lopped beads were recovered. Also recovered were 14 O2 Olivella punched whole shell beads (Bennyhoff and Hughes 1987:142; Milliken and Schwitalla 2012:74), made with a single unstandardized perforation punched in the body whorl. Five of these

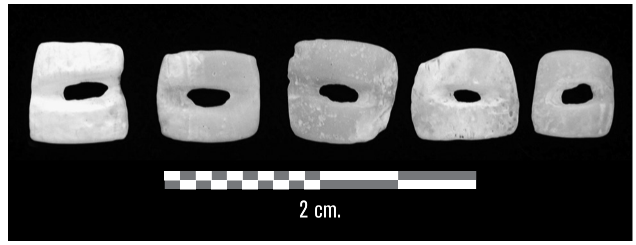

Figure 7. A sample of N2 Olivella Grooved Rectangle beads from CA-SNI-12.

beads fall into the small (O2a) size category, eight in the medium (O2b) size category, and one is classified as large (O2c). Seventeen B3 Olivella barrel (Bennyhoff and Hughes 1987:122; Milliken and Schwitalla 2012:21, 22) beads were recovered, including eleven small (B3a) and six medium (B3b) sized specimens. Barrel beads were produced through extensive grinding of the spire and base (canal end), with the maximum diameter retained at the middle of the bead.

Olivella Wall Beads

Wall beads from this assemblage include N2 small grooved rectangle, L2 small rectangle, and G1 tiny saucer beads. The L2 and N2 beads presented here include new sub-classifications.

Olivella grooved rectangle (OGR) beads are the most prevalent wall bead type in the sample (Fig. 7), which includes 146 complete small OGR beads (N2) (Bennyhoff and Hughes 1987:142; Milliken and Schwitalla 2012:73) and 32 fragments. This is currently the largest assemblage of OGR beads known from any one locality, especially when combined with the 103 OGR beads Rogers (1930:22, 33) recovered from CA-SNI-12. Although classified as Olivella grooved rectangles, OGR beads can be rectangular, square, or ovate (with rounded corners) in form. Their distinctive quality stems from the nature of the transverse perforation, which is formed by cutting or sawing across the dorsal surface rather than drilling, likely utilizing a simple flake tool of an abrasive stone material (Vellanoweth 1995, 2001). OGR beads were divided into two size classes (N1 and N2) by Bennyhoff and Hughes (1987:141–142) on the basis of length measurements. A third class (N3) involving the smallest known OGR beads was defined by Vellanoweth (1995; 2001). Interestingly, some of the OGR beads in our CA-SNI-12 sample contain a grooved diagonal

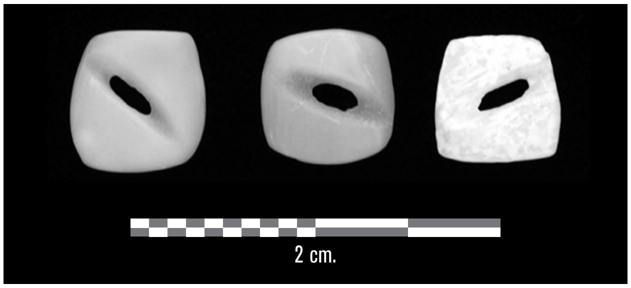

Figure 8. A sample of N2d Olivella Grooved Rectangle beads with diagonal perforations from CA-SNI-12.

perforation on the dorsal surface, extending between opposing corners, rather than a transverse perforation (Fig. 8). OGR beads distinguished by such diagonal perforations were given a sub-designation ending with a ‘d’ (i.e., N2d).

For the most part, the 3,851 whole beads collected from CA-SNI-12 fit within established Olivella bead classifications, but seven wall beads (Table 4, Fig. 9) do not easily fit into known bead types, geographic ranges, and chronologies. While some metric and non-metric attributes lead us to place these beads into a single category, others suggest they should be placed in a different class. Take for instance the first bead listed in Table 4: the width (4.22 mm.), perforation diameter (1.15 mm.), width/length index (0.89<1.00 mm.), and angle index (0.80, which falls within range = 0.77–0.84), all fit the defined characteristics of an F3b small narrow saddle (Milliken and Schwitalla 2012:42, 46–47), but it also closely resembles and fits within some parameters for a L2a shelved small thick rectangle (Milliken and Schwitalla 2012:65). The length and perforation diameter fall significantly below the accepted ranges for the L2a bead type, however, and the thickness is below the average for L class beads.

When these beads are quantified as a group, the average length and width falls within ranges for both F3b and L2 beads, but the average perforation width index is larger than the typical range for F3b specimens (0.13–0.23; Milliken and Schwitalla 2012:13), and the average thickness is far below that of L class beads (1.5 mm.; Milliken and Schwitalla 2012:63). The averages for both width/length and angle indices fall within defined ranges for F3 beads (<1.0 and 0.72–0.84; Milliken and Schwitalla 2012:46); but ranges for these attributes are not provided for L2 beads, precluding a detailed comparison with this bead class. Morphologically, these beads most closely resemble Items 6j-F3b1 and 6k-F3b2 (Milliken and Schwitalla 2012:47), except that the perforations are slightly larger for some of our specimens, and Item 8g-L2a (Milliken and Schwitalla 2012:65), which is described as an uncommon rounded variant of L2a beads that occur “in distinct populations with rounded L1a variants,” and “deserve a taxonomic category of their own.” However, no L1a beads were found in the large CA-SNI-12 assemblage, and detailed metrics are not provided for this “rounded variant” of L2 beads.

While not a perfect match, these beads most closely fit within classifications for L2 beads, except for two perforation diameters that fall below the known range (1.15 and 1.21 mm. vs. 1.5–2.5 mm.), and smaller thickness measurements (average thickness 1.0 mm. vs. 1.5 mm.).

Table 4

DETAILED METRICS FOR L2a2 AND L2b2 BEADS FROM CA-SNI-12

Length (mm.)	Width (mm.)	Perforation Diameter (mm.)	Longest Diagonal Length (mm.)	Thickness (mm.)	Width/ Length Index	Angle Index*	Diagonal Index	Perforation/ Width Index	Ventral Edge Grinding	Presence of Shelf
4.73	4.22	1.15	5.05	1.19	0.89	0.80	0.99	0.27	Yes	remnant
5.13	4.47	1.73	5.16	0.95	0.87	0.76	0.98	0.39	Yes	no
5.34	4.52	1.54	5.66	0.86	0.85	0.81	0.93	0.34	Yes	no
5.82	4.60	1.21	6.01	1.17	0.79	0.81	0.97	0.26	No	no
5.32	4.57	1.61	5.59	0.93	0.86	0.80	0.96	0.35	Yes	no
5.28	4.97	1.80	5.52	0.84	0.94	0.76	0.99	0.36	Yes	no
5.65	4.70	2.08	5.85	1.05	0.83	0.80	0.99	0.44	Yes	no
5.32	4.58	1.59	5.55	1.00	0.86	0.79	0.97	0.34	–	–

*Angle Index = $C/\sqrt{(A^2+B^2)}$ where A = bead width, B = bead length, C = longest diagonal length of bead (Milliken and Schwitalla 2012:12)

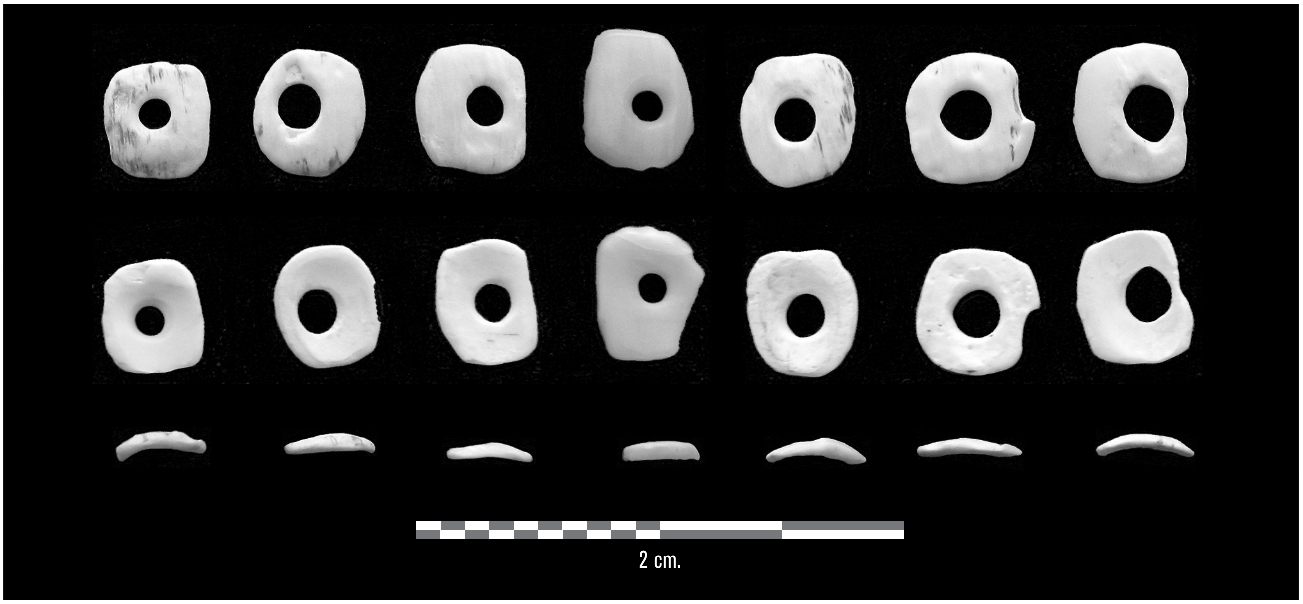

Figure 9. Dorsal, ventral, and profile views of L2a2 Rounded Shelved Small Thick Rectangle and L2b2 Rounded Unshelved Small Thick Rectangle beads from CA-SNI-12.

We placed them under new L2a2 and L2b2 classifications, indicating that they are rounded shelved small thick rectangles and rounded unshelved small thick rectangles. This leaves L2a1 and L2b1 to demarcate the normal variant of shelved and unshelved small thick rectangles. Thick rectangle beads are commonly acknowledged markers of the Early Period (Bennyhoff and Hughes 1987:149; Milliken and Schwitalla 2012:63–66), and recent direct dating of thick rectangle beads from central California places this type in the Early Period Bead Horizon at 4,050–2,550 cal B.P. (or 2,100–600 cal B.C.; see Groza et al. 2011:140, 144–5). This bead type is mostly known from central California contexts (Groza et al. 2011; Rosenthal and Meyer 2000), and their presence at CA-SNI-12 extends their known geographic range to the southern Channel Islands and their temporal range to several centuries earlier.

In addition, one G1 tiny saucer (Bennyhoff and Hughes 1987:132; Milliken and Schwitalla 2012:50, 51) bead, possibly intrusive from a later component, was recovered. These are typically very small saucer beads, which are uniformly circular in outline and almost flat when observed in cross section; they also have carefully ground edges and relatively large perforations. These beads are known from all Middle and Late Period phases in southern California (Milliken and Schwitalla 2012:51), though single specimens have been identified by King (1990:237) in the Early Period (Phases Ez and Eyb).

Classifications and typologies are extremely useful in archaeology, but they can impose arbitrary distinctions on material remains crafted by people who likely had very different notions about the objects they were manufacturing. The range of variation within and between bead classes and types extends along a continuous spectrum that is most apparent in large assemblages which contain a greater range of potential variability. In such cases, including CA-SNI-12, a small percentage of the beads recovered may not be easily categorized unless some arbitrary distinctions are imposed. Few Middle Holocene bead assemblages of this size have been found and analyzed in southern California; significantly, recent excavations at a large dune site (CA-SNI-40) on western San Nicolas Island are also yielding new evidence of Olivella bead variation during the Middle Holocene.

Other Shell Beads

In addition to beads made from purple olive shells (*C. biplicata*), small square sequin beads made of abalone nacre (*Haliotis* sp.) were also recovered, including eight whole nacre sequins and nine nacre sequin fragments. One cone (*Conus californicus*) shell with the tip of the spire removed may have been utilized as a bead, although these can be found on the beach with natural perforations and definitive proof of human modification is lacking for this specimen.

Bead-Making Debris

A total of 258 whole Olivella shells, 388 pieces of detritus, and two wall blanks were also collected with this assemblage. Whole shells and fragments are often referred to as possible manufacturing debris associated with the production of Olivella beads. We cannot be certain that all these whole shells and fragments were directly related to shell bead manufacturing at CA-SNI-12, although their association with this substantial bead assemblage indicates a likely connection. The angular breakage patterns and rough edges on most of the Olivella fragments also suggest that they were broken during or after the manufacturing process, as fragments collected from sandy beaches are often smoothed by water action over time.

DISCUSSION

The collection described here contains 3,853 formal beads attributed to 12 distinct types of varying sizes, along with 413 bead fragments from 5 bead types and 648 pieces of potential bead-manufacturing debris. Small and medium sizes of several bead types were encountered, along with a single bead falling into the large size category. Temporally-diagnostic beads include OGR beads, L2 variants, and the single G1 bead. In addition to comprising the largest known collection of OGR beads known from a single site, this assemblage includes a diagonally-grooved variation of this bead type that has not been previously identified. With the inclusion of previous counts of OGR beads from CA-SNI-12 (Rogers 1930), the total number of OGR beads collected from this site ($n=249$ whole beads + 32 fragments) now far exceeds the total known number of this bead type from all other sites combined ($n=193$) (see Table 5). San Nicolas Island continues to have the largest number of OGR beads reported for any single area, with 66% of all known specimens having been found on the island.

Even if OGR beads are not as abundant as spire-lopped, barrel, and cap beads, their unique style and rare occurrence makes them one of the most conspicuous and temporally diagnostic Olivella beads. Their significance as one of the earliest types of wall beads marks a turning point in the construction of shell beads in southern California, which had previously been fashioned by decreasing the length of a whole shell by grinding off one or both ends. As a departure from earlier styles, Middle Holocene bead makers began using the wall portion of the shell to construct smaller and more elaborate beads.

Origin and Distribution of OGR Beads

The known geographical range of OGR beads extends from the southern Channel Islands and adjacent coastline up into central and northeastern California, south-central Oregon, and western Nevada (Fig. 10). Great Basin researchers have uncovered OGR beads in archaeological deposits around the Carson Sink region of Nevada (Bennyhoff and Hughes 1987; Hattori 1982; Pendleton 1985) and in the Fort Rock Valley, Oregon (Jenkins and Erlandson 1996). Significant numbers of OGR beads have been reported for the southern Channel Islands (Howard and Raab 1993; Raab et al. 1994; Raab and Howard 2002; Salls et al. 1993; Vellanoweth 1995), adjacent mainland coasts (Gibson 1992a, 1992b; Macko 1998; King 1990), interior valleys (King 1990), and mountain passes (Bennyhoff and Hughes 1987; Jackson et al. 1998). OGR beads have also been reported for Alameda and San Mateo counties (McCrary 2011, personal communication 2012), in the San Francisco Bay area of north-central coastal California (Clark 1998; Milliken et al. 2007), and more recently in Santa Clara (Arrigoni et al. 2008; McCrary 2011) Kern (Jackson et al. 1998), and San Diego counties (Shultz 2011). Curiously no OGR beads have been found on the Northern Channel Islands.

Bead chronologies, based on stratigraphic associations, direct dating, and bead lot seriations, have been developed for western North America (Bennyhoff and Hughes 1987; Groza 2002; Groza et al. 2011; King 1990; Milliken and Schwitalla 2012). Although these chronologies have established good temporal and spatial parameters, the initial production of certain bead classes and types remains poorly defined. The timing for OGR bead production and use has been derived from direct and associated radiocarbon dates, which suggest they were manufactured between about 5,500 and 4,400 cal B.P. (Vellanoweth 2001). Currently, the number of

Table 5

DISTRIBUTION OF OLIVELLA GROOVED RECTANGLE BEADS[a]

Site Trinomial	Site Name	Location	Count	References
CA-KER-824	–	Kern County, CA	1	Bennyhoff and Hughes 1987:139
CA-KER-3166/H	–	Kern County, CA	2	Jackson et al. 1998
CA-LAN-43	Encino Village	Los Angeles County, CA	?	King 1990
CA-LAN-361	Vasquez Rocks	Los Angeles County, CA	?	King 1990
CA-ORA-64	–	Orange County, CA	1	Macko et al. 1998
CA-ORA-85	–	Orange County, CA	7	Howard and Raab 1993
CA-ORA-365	–	Orange County, CA	5	King 1990
CA-ORA-368	–	Orange County, CA	?	King 1990
CA-ORA-665	Irvine Ranch	Irvine, CA	1	Gibson 1992a
CA-ORA-667	Irvine Ranch	Irvine, CA	5	Gibson 1992a
CA-SBA-119	Eakins Site	Santa Barbara County, CA	1	Harrison 1964:147, 179;
CA-SBA-530	Honda Beach Site	Santa Barbara County, CA	1	Labow et al. 2007
CA-SBA-3404	Jonjonata	Santa Barbara County, CA	1	Hildebrandt 1999
CA-SBA-5404	–	Santa Barbara County, CA	2	Bennyhoff and Hughes 1987
CA-SCAI-17	Little Harbor Site	Catalina Island, CA	10	Meighan 1959; King 1990:11; Raab et al. 1994
CA-SCL-12/H		San Francisco Bay Area, CA	18	Arrigoni et al. 2008
CA-SCLI-1215	Nursery Site	San Clemente Island, CA	10	Raab et al. 1994; Salls et al. 1993
CA-SCLI-1215	Nursery Site	San Clemente Island, CA	39	Raab et al. 1994; Salls et al. 1993
CA-SDI-4281	Border Field Site	San Diego County, CA	1	Shultz 2011
CA-SMA-40	–	San Francisco Bay Area, CA	1	Clark 1998:Figure 17
CA-SNI-12	NW Coast Dunes	San Nicolas Island, CA	103	Rogers 1930:22, 33
CA-SNI-12	NW Coast Dunes	San Nicolas Island, CA	146	This paper
CA-SNI-161	Bird-Blind Site	San Nicolas Island, CA	12	Vellanoweth and Erlandson 1999; Vellanoweth 1995
SNI Air Terminal	Uncontrolled surface collection	San Nicolas Island, CA	31	Vellanoweth 2001; Laughtner 1982; Rogers 1930
26-CH-16	Hidden Cave	Great Basin, NV	17	Pendleton 1985; Bennyhoff and Hughes 1987:142
26-PE-67	Stillwater Marsh Dune Site	Great Basin, NV	2	Bennyhoff and Hughes 1987
26-WA-196	Kramer Cave	Great Basin, NV	5	Hattori 1982; Bennyhoff and Hughes 1987:141–142
26-WA-202	Shiner Site F	Great Basin, NV	1	Hattori 1982; Bennyhoff and Hughes 1987:141–142
–	Hesterlee Site	Great Basin, NV	1	Bennyhoff and Hughes 1987:141–142
–	Lovelock Cave	Great Basin, NV	16	Orchard 1975; Bennyhoff and Hughes 1987:141–142
35-LK-2758	DJ Ranch Site	Plateatu, OR	2	Jenkins and Erlandson 1996
Total:			**442**	

[a]Mostly compiled from McCrary 2011.

directly dated OGR beads is relatively small (*n*=11; Table 2), with no clear indication that the people of one particular island or region started producing them first. The majority of direct dates, including those from San Nicolas Island, tend to fall between 5,400 and 4,900 cal B.P. Radiocarbon dates for San Nicolas Island OGR beads, however, suggest that they may have continued to be produced for another 400 to 500 years after their use ceased on the other islands and mainland.

With regard to the origin of OGR beads, San Nicolas Island has produced the highest numbers of beads as well as the only evidence for OGR bead making, with beads found in different stages of manufacture (Vellanoweth 1995, 1996, 2001). That the vast majority of OGR beads, displaying the highest stylistic diversity and the longest chronological sequence, have been found on San Nicolas Island suggests that it was the center of production and innovation for this unique bead type. It is possible that

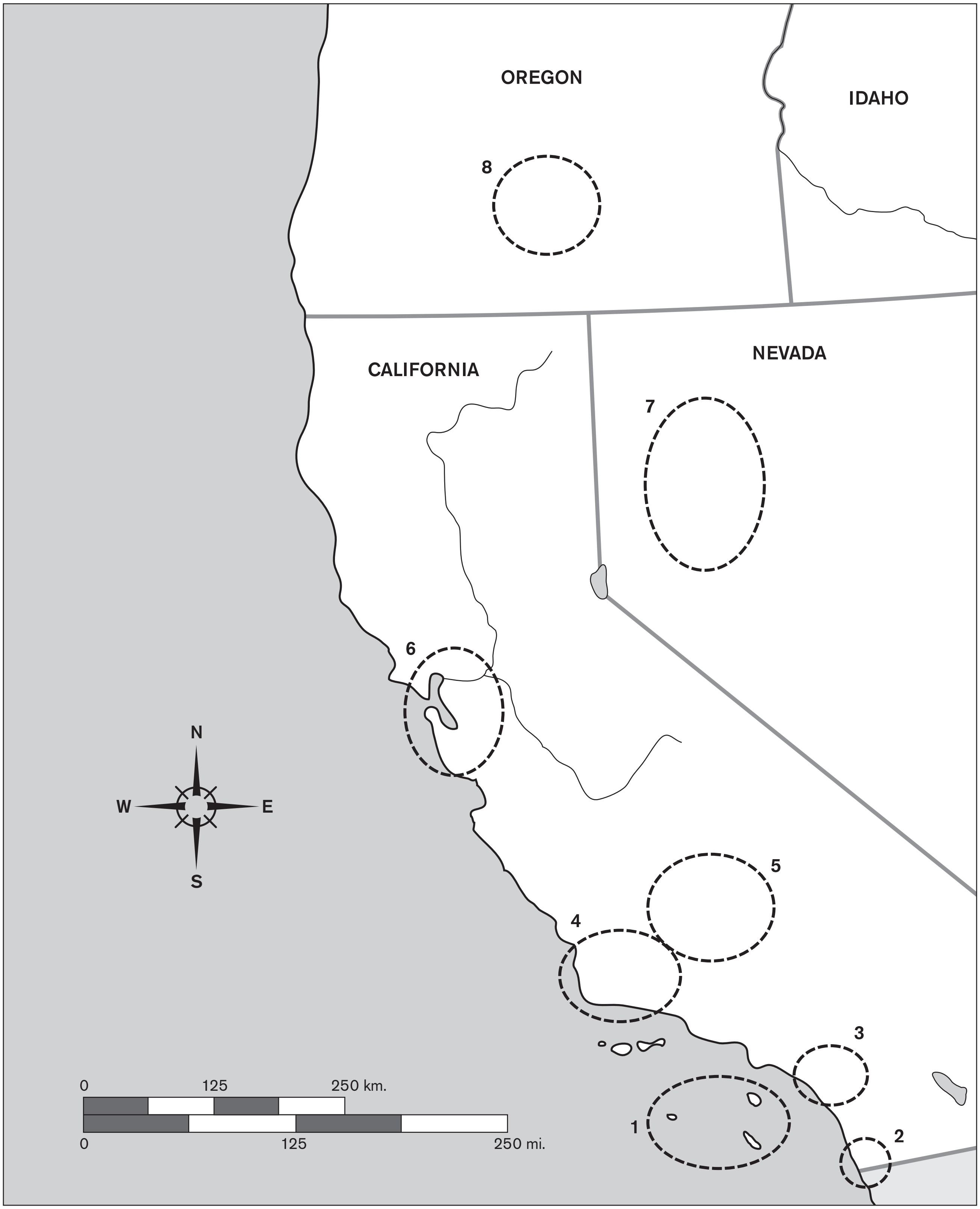

Figure 10. The known distribution for OGR beads in western North America: (1) San Diego County; (2) southern Channel Islands; (3) Orange County; (4) Los Angeles and Santa Barbara counties; (5) Kern County; (6) San Mateo and Santa Clara counties; (7) Great Basin/Nevada; (8) South-central Oregon; for further details see Table 3.

OGR beads did not originate on San Nicolas Island, but bead makers there appear to have continued the tradition long after others seem to have stopped. It could be that San Nicolas Island's relative isolation led bead makers to produce styles no longer in production elsewhere, even though drilled varieties of wall beads were also produced at this time and became the bead style of choice for the remainder of the Holocene. Whether OGR beads were strung together to make necklaces, bracelets, or anklets, sewn on to garments, or applied to other artifacts with asphaltum, they were clearly desired by coastal and interior peoples alike and were traded through an exchange network that might have been mediated by a common language, history, and heritage.

The beads found at CA-SNI-12 and described in this paper corroborate the known spatial and temporal distribution of OGR beads, and possibly represent this type's final phase of production. The addition of 178 OGR beads and bead fragments from CA-SNI-12 increases the total number originating from San Nicolas Island to 324 whole and broken beads, considerably more than any other island or mainland region. Direct dates for OGR beads from CA-SNI-12 range from around 4,900 cal B.P. to 4,400 cal B.P. (Table 2; see Vellanoweth 2001), representing the latest date for production of this bead type. Could this site be the resting place of a family, or clan, who maintained a distinct bead-making tradition that originated on a small isolated island and spread through trade or migration to other nearby islands, the mainland coast, and up into northeastern California, Oregon, and Nevada?

Although OGR beads have received the most attention among the Middle Holocene bead styles in southern California, it certainly was not the only type of bead produced during this time period. In fact, Olivella spire-lopped, barrel, and cap beads typically far outnumber OGRs when they are found together. The bead assemblage from CA-SNI-12 contained almost 5,000 beads, bead fragments, and and pieces of bead-making debris, with OGR beads making up less than 5% of the total number of beads found. Over 70% of the beads recovered were Olivella cap varieties, including a large number of newly-described oblique cap beads. Spire-lopped beads have a long history of production on the Channel Islands, and they have been found in archaeological contexts from throughout the Holocene. Cap beads first appeared in the Middle Holocene, although their occurrence and distribution have not been thoroughly studied. In addition to information on exchange networks, future research on associations between various bead types may provide insight into stylistic changes, including how and why certain styles changed or remained consistent through time. Understanding the mechanisms by which people decide to adopt and incorporate new bead styles reflects individual creativity and the economic forces underlying their continued production. Why OGR beads had a limited production and distribution remains unclear. It is possible that market forces and cultural aesthetics changed, and people desired drilled over grooved wall beads. Certainly the archaeological record attests to this pattern, although we may never know the specific reasons why it occurred. It is clear, however, that OGR beads must be examined within the context of other contemporaneous bead and ornament styles if the reasons behind their rise and decline are ever to be understood.

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