The Role of *Olivella* Shell Currency in a Burgeoning Prehistoric California Economy

A. Rowan Gard

Writer's Comment: I have had the good fortune of working as an undergraduate research assistant in Dr. Jelmer Eerkens' archaeology laboratory at UC Davis for the previous two years. While studying the chemical isotopic signatures of prehistoric California *Olivella* shell bead currency, I realized that a balanced perspective is essential not only when one is analyzing the past, but also in writing. As the burgeoning field of archaeometry within archaeology offers ever more impressive and exact scientific insights into the past, it is vital that the humanity of the equation not be minimized, rather it become the more illuminated solution we seek at the conclusion of the research. While writing this piece, which served as the core of my senior honors thesis, I struggled with maintaining a structural balance between the cultural framework and the scientific nature of the research itself. Writing in a style that conveyed the detailed scientific data in a manner that was more easily accessible also proved a challenge, but a most worthy challenge, for I believe the transmission of knowledge, particularly to the general public, is the greatest responsibility and privilege of all those in academia.

—A. Rowan Gard

Instructor's comment: Ms. Gard's paper explores shell bead production and exchange among Native Californians in prehistory. Her work is exemplary of modern archaeological practice where techniques from the hard sciences, such as mass spectrometry, are used to tackle issues traditionally the domain of the humanities and social sciences. This new bridging field, broadly referred to as "Archaeometry," is sure to produce many exciting finds to expand our understanding of ancient societies. Rowan's work is at the leading edge of this wave and demonstrates her ability to distill complex data from carbon and oxygen isotopes in shells into information about how the system of using beads as a type of currency developed in prehistoric California. We look to more inventive archaeometric work from Ms. Gard as she transitions to graduate school this coming fall.

—Jelmer W. Eerkens, Anthropology Department

Introduction

In prehistoric times the Chumash, whose name refers to a family of three distinct but related languages, inhabited the present-day central and southern California of Northern America, living in villages along the California coast and adjacent inland area stretching from the present-day city of Malibu to the town of San Luis Obispo (Glassow 1996:13). In addition to the coast and coastal islands of the Santa Barbara Channel, the Chumash peoples, whose population was estimated to have been approximately 18,500 at the time of contact with Europeans in the late 1700s (Glassow 1996:13), inhabited the inland plateaus, valleys, and low-lying mountain ranges as far as 68 km from the coast.

The Chumash settlement patterns, seasonal rounds, social organization, and *Olivella* shell bead currency were indelibly intertwined through a maritime based economy. As is common with hunter-gatherers the world over, the Chumash engaged in a semi-sedentary seasonal round, and subsisted on a wide variety of plants and animal resources. The archeological record and additional historical documentation indicates that the maritime Chumash were avid and skilled fishermen, but they also relied on non-marine food plants, such as the acorn, sage seeds, Brodiaea bulbs, juniper berries and pine nuts, and on non-marine animals, such as deer, rabbit, squirrel, gopher, badger, quail, duck, goose, and dog (King 1990:54). Clearly, given the topography and climate of the Channel Islands, the island Chumash would have needed to trade with the mainland Chumash for many of their resources. Archaeological evidence shows that they practiced a semi-sedentary settlement pattern, with members of the immediate community traveling modest distances to procure the resources needed. Through specialization of labor and trade, the Chumash thus provided themselves with insulation against such catastrophes as the El Niño Southern Oscillation (ENSO), which increases water temperature and lowers the availability of fish and other marine animals. The islanders who were able to trade other goods, such as shell beads made from the intertidal sea snail, *Olivella biplicata*, would have had considerably more protection from such unforeseeable events, as *Olivella* beads were widely recognized as a form of currency among many native peoples of prehistoric California and Great Basin areas and traded for seeds and large game meat (Johnson 2000:263). Previous researchers have hypothesized that as the trade of *Olivella* beads increased through time, new production centers arose to meet burgeoning demands, and that four such production centers existed throughout prehistory: Southern California in the Santa Barbara region, Central California within Monterey Bay, Northern California within Bodega Bay, and extreme Northern California.

Our study tested that hypothesis by using mass spectrometry analysis of stable isotopes from *Olivella* beads retrieved at various archaeological sites in Northern California. Previous studies have shown that stable isotopes can be used to indicate where a shell originated along the Pacific Coast—in particular, whether they grew north or south of Point Conception. Our results demonstrate that, though shells were discovered in both Bay Area and Delta archaeological sites (Alameda, Contra Costa, Colusa, Santa Clara, Solano, and Yolo counties), several bead types—including Saddles (F2) and Sequins (M1) that are only found in northern California, and others such as Saucers (G) that are found in both southern and northern California—appear to correlate with isotopic signatures of southern California *Olivella.* These findings thus suggest that the Chumash traded extensively, over hundreds of miles of Pacific Coast, as part of a richly complex monetary economy.

Materials and Methods

The Basics of Shell Bead Production

Olivella biplicata is an intertidal sea snail found clinging to rocks in the intertidal zone along the western coast of the United States, stretching from northern Washington state along the Canadian border to northern Baja California (Stohler 1969:259) (see Figure 1). During winter months shells often wash up on shore, so that *Olivella* can easily be gathered by almost anyone with an inclination. The prehistoric Chumash collected and dried the shells, removed the organic remains, then selected whole shells for shell bead manufacturing. Initially, they would have smashed the shell into smaller pieces to expedite the bead making process, then used a pump-drill to refine different pieces of the shell for various types of beads.

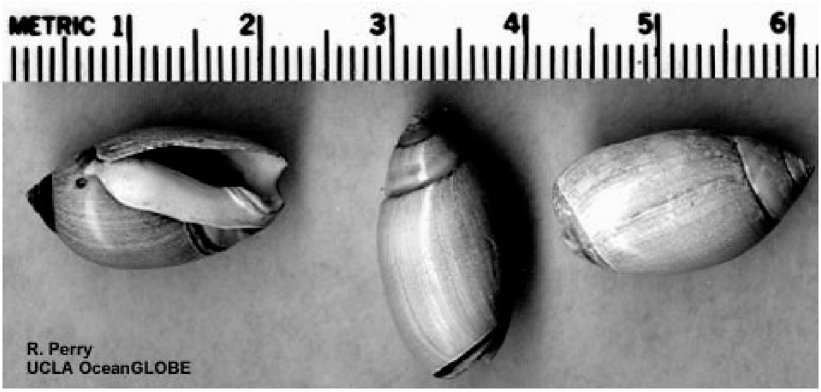

Figure 1. Photograph of *Olivella biplicata*, common name Purple Olive Snail (courtesy of the UCLA Ocean Globe Project <www.msc.ucla.edu/oceanglobe/photos.html>).

Significantly, different parts of the shell were associated with varying degrees of value (King 1990:104-5; King 1978:61). For example, the outer lip of the shell was considered more valuable due to the restricted shell area and increased labor needed to procure the final bead product, whereas beads taken from the wall of the shell were worth less due to the larger surface area of the shell wall and reduced amount of fine labor required to produce a single wall bead. After the general extraction of the roughed-out circular disk from the shell, a hole was drilled through the center of each bead. All beads were then strung on a piece of sinew and ground to a smooth, circular shape.

Sourcing Shell Beads

Studies of prehistoric marine mollusks from identified oceanic environments indicate that oxygen and carbon isotopic analysis is an effective method for sourcing shell to specific regions of an aquatic body (Classen 1993:333-47). One study of particular interest effectively sourced *Spondylus* sp. shell artifacts from selected archeological sites in Central Europe to the particular stretches of Black Sea coast (Shackleton 1970:1062-5). More recently, studies have been undertaken to source marine mollusks to identifiable locations along the Pacific coast, using differences in paleoceanic sea surface temperature and salinity (Eerkens et al. 2005). This present study is a portion of further research being conducted by Dr. J. Eerkens, Anthropology Department, UC Davis, and primarily relies upon stable isotope mass spectrometry analysis. As the $^{18}O/^{16}O$ ratio in mollusk shells, such as *Olivella biplicata,* is sensitive to changes in water temperature, they are amenable to stable isotopic mass spectrometry analysis (Wefer 1991:207-48). Furthermore, Dr. Eerkens' experiments have shown that "the oxygen isotope ratio ($\delta^{18}O$) of biogenic carbonates such as aragonite strongly depends on calcification temperature and the $\delta^{18}O$ of the seawater ($\delta^{18}O_{sw}$) in which the organism precipitated its shell . . . [and therefore these] $\delta^{18}O$ relationships can be used to reconstruct environmental seawater temperatures during the life of an organism" (2005:3). This geochemical relationship has been effectively employed to determine whether an individual *Olivella* shell originated in warmer southern California waters or colder northern California waters based on $\delta^{18}O$ within a given organism's shell. Dr. Eerkens has also identified a second geochemical relationship—$\delta^{13}C$—that can be used to source mollusk shells. Waters containing depleted levels of $\delta^{13}C$ are typically associated with upwelling, which occurs in California primarily from April to July, thus "patterns in $\delta^{13}C$ can be used in combination with $\delta^{18}O$ to isotopically fingerprint shells" (Eerkens 2005:5).

Mass Spectrometer Analysis

A Micromass Optima isotope ratio mass spectrometer (IRMS) was used to analyze the $\delta^{18}O$ and $\delta^{13}C$ ratio present within shell samples. The technique is illustrated in Figure 2 and works as follows: First, a common acid bath liberates the Ca and CO_3 from the organic matrix; second, the carbon and oxygen isotopes are separated and introduced into the IRMS in an ionized vapor state. Third, the ions are then accelerated to the same level of kinetic energy and deflected by a magnetic field down a corridor under vacuum. The rates of deflection correspond to the mass of the ion—that is to say, the lighter the ion, the more it is deflected. Fourth, the ion stream splatter is detected and recorded at the end of the corridor. Lastly, an output diagram can then be generated based on the varying mass/charge ratios present in the ions (Eerkens 2005: 5; Russ 1989:90-140).

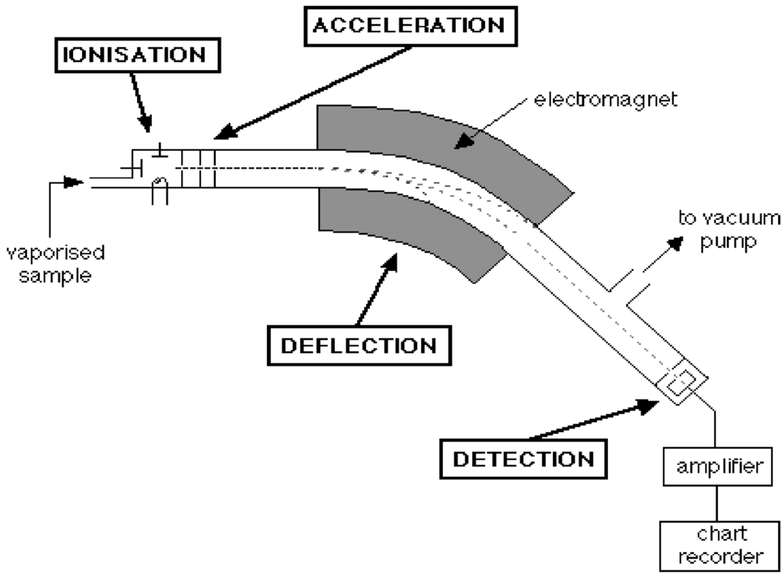

Figure 2. Illustration of the basic inner workings of a mass spectrometer. Courtesy of *The United Kingdom Chemistry Guide*. Available online at <www.chemguide.co.uk>.

A total of 195 oxygen isotopic measurements were obtained from two prehistoric *Olivella* shells and 41 shell beads. All shells were cleaned and rinsed with deionized water to remove adhering midden soil and visible organic matter. In the case of whole *Olivella biplicata* shells, incremental powdered samples were drilled from the shell's surface parallel with the spiral growth axis and resulting growth bands (see Figure 3). Sampling commenced at the lip of each Olivella shell and proceeded inward to the parietal callus so that the most recent growth was drilled first. Where possible, one whole whorl revolution was sampled, enabling each shell to be microsampled over the course of its lifetime. In the case of shell beads, the axis of growth was first determined, then the shell was oriented to take samples across consecutive growth bands. The shallow grooves, less than 0.3 mm in depth, were the product of drilling with a 0.5 mm bit head attached to a hand-held drill. The resulting particulate samples were then measured and weighed to ensure that they ranged from 15 to 120 micrograms and placed in small "boat" containers in racks for mass spectrometry analysis.

The powdered aragonite samples were heated to 75° C under vacuum for a half hour to remove organic compounds. Following this, samples were introduced to the mass spectrometer, where they were reacted in orthophosphoric acid at 90° C, using an ISOCARB automated common acid bath system. The oxygen isotopic ratio of the evolved CO_2 was measured using mass spectrometry at the Department of Geology, UC Davis. Water temperatures were calculated based on gathered surface seawater temperature and salinity data for five locations along the California coast from previous work (Eerkens et al. 2005). In addition to the oxygen isotope analyses, 40 shells were radiocarbon dated using Accelerator Mass Spectrometry radiometric techniques. Radiocarbon dates were converted into calendric dates with sample ages ranging from 493 to 2,159 radiocarbon years before present (RCYBP).

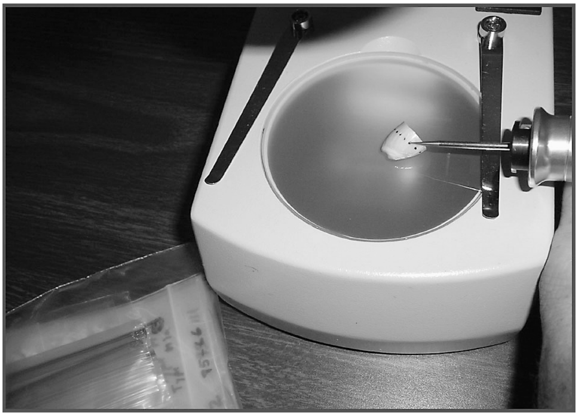

Figure 3. Photograph of *Olivella* shell with drill on microscope base in UC Davis Archaeology Lab. By Dr. Jelmer Eerkens, Dept. of Anthropology, UC Davis.

Exploration of the Samples

For this study we microsampled 41 *Olivella biplicata* shells from eleven archaeological sites in Alameda, Contra Costa, Santa Clara, Solano and Yolo counties. Table 1 is a compilation of all sample bead types and archaeological site locations.

Table 1

Bead Type	Number Sampled	Age	Distribution	Counties
F2a	5	1518	Middle Period, Intermediate Phase	Alameda, Contra Costa & Solano
F2b	3	1518-1531	Middle Period, Intermediate Phase	Alameda & Contra Costa
F3a	8	874-1531	Middle Period, Late Phase	Alameda
F3b	2	966-1075	Middle Period, Late Phase	Alameda
G2a	2	966-1247	Middle Period, Early Phase	Alameda & Colusa
G2b	7	551-2159	Middle Period, Early Phase	Alameda & Santa Clara
G3	1	1518-1806	Middle Period	Contra Costa
G5	2	1675-1871	Middle Period	Contra Costa
M1a	9	239-1036	Late Period, Phase 1	Alameda
M2a	2	548-926	Late Period, Phase 1	Alameda & Yolo

Results

As *Olivella biplicata* is a shallow-water mollusk species, a direct relationship exists between its oxygen isotopic signature and the sea-surface temperatures of its area of origin. Lower and thus more negative $\delta^{18}O$ values recorded in the snail shell indicate lower water temperatures, with the inverse holding true for more positive values of $\delta^{18}O$. As sea-surface temperature and $\delta^{13}C$ upwelling fluctuate seasonally along the California coast, shells from different regions should, according to Eerkens, "contain distinct paired carbon and oxygen isotope values that can be used to fingerprint the shell source" (2005:7). (Figure 4 shows the seasonal variations of $\delta^{18}O$ fluctuations over several decades, and the expected differential markers between northern and southern California locations.) The microsampling data from the present and previous work confirms that *Olivella biplicata* accurately records the seasonal variation of its aquatic environment via $\delta^{18}O$ fluctuations (Eerkens et al 2005). In combination with $\delta^{13}C$ upwelling fluctuations, this data provides a viable foundation for isotopically fingerprinting a shell bead.

Previous work in the region suggests isotope values fall into three main clusters reflecting geographic origin: Santa Cruz Island, Santa Barbara mainland and Santa Rosa Island, and Northern

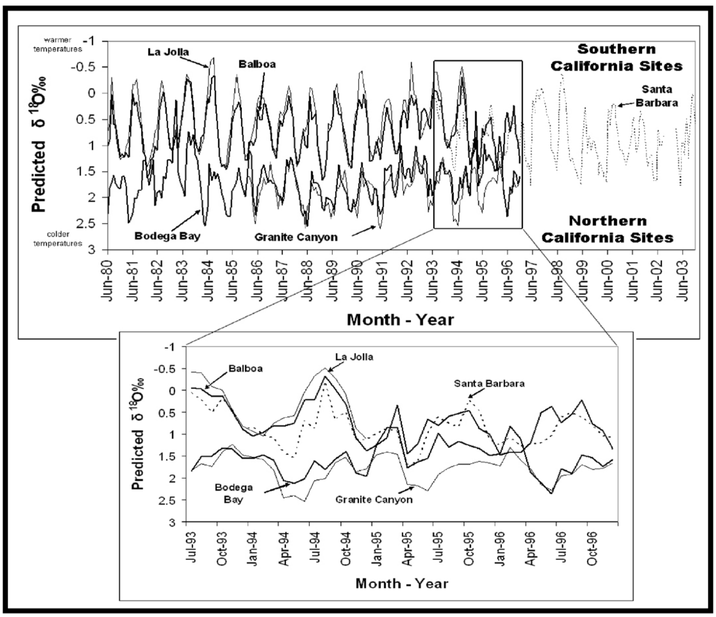

Figure 4. Graph of predicted aragonitic $\delta^{18}O$ based on salinity and temperature at five California locations. Provided by Dr. Jelmer Eerkens, Dept. of Anthropolgy, UC Davis.

California and Southern Oregon, with Point Conception serving as a natural break between southern and northern clusters (Eerkens 2005:7-8). The 41 prehistoric *Olivella* beads, from eleven northern California archaeological sites, correlated with isotopic regional values of Southern California and the Santa Barbara Channel Island areas, with minimal overlap in other regional isotopic signature zones. (Figure 5 is a graphic representation of the isotope values recorded on all 41 beads in this study, along with the aforementioned regional isotopic signature zones.) Due to the small size of certain beads, only one to three isotopic samples could be taken across growth bands; however, most beads yielded five to ten isotopic samples. Clearly, lower rates of confidence are ascribed to beads with limited growth band sampling, while higher rates of confidence are ascribed to beads with more comprehensive growth band sampling. (Table 2 is a compilation of carbon and oxygen isotopic values for all samples.)

The most striking feature of the mas spectrometry results (Figure 5) is the high percentage of isotopic samples sourcing to southern California. This data indicates that the source shells for these beads were likely harvested in the warmer waters south of Point Conception, far from the northern and Delta archaeological sites in which they were found. This data is in keeping with ethnographic evidence that indicates that the prehistoric Chumash people of the Santa Barbara area were significantly involved in shell bead production (Arnold 1991:953-62). Regardless, though, of who is attributed with producing these shell beads, the fact remains that they originated hundreds of miles away and were traded inland, which further underscores the complex exchange system in place in pre-contact California.

Beads which cannot be ascribed to one of the three main regions discussed above, found in the lower left quadrant of Figure 5, source to an origin presently unknown. One possible explanation for these outlying beads could be the result of the highly sensitive Santa Barbara Basin responding to an ENSO event. Consider that "during an El Niño year, maximum SST in the Basin can increase as much as 2-3° C (=0.5 to 0.75% reduction in shell $\delta^{18}O$) while the $\delta^{13}C$ of the dissolved CO_2 increases because of a reduction in local upwelling" (Eerkens 2005:10). However, it is much more likely that these outlying beads are sourcing to a presently unknown regional source area, such as San Francisco Bay, which regularly receives large amounts of freshwater run-off. High levels of freshwater admixture could account for these presently distinctive isotopic values so out of keeping with the other sample values.

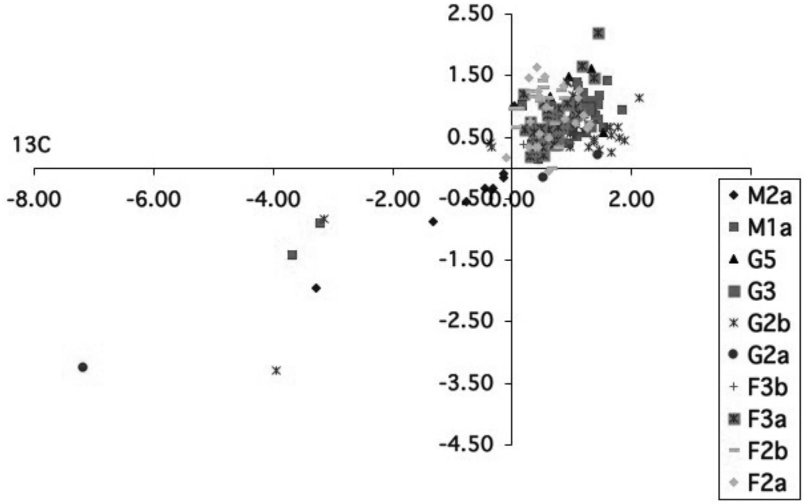

Figure 5. Graph of mass spectrometry chemical "fingerprint" analysis (based $\delta^{13}C$ and $\delta^{18}O$ ratios) for all tested bead types, with their correlating geographical place of origin. Provided by the author and based on the data collected from mass spectrometry analysis completed at the Stable Isotope Lab, Department of Geology, UC Davis.

An understanding of the climate shifts in SST of the time periods in which the shell beads in this study were generated may also be gleaned from paleoenvironmental SST data from deep-sea cores, taken from the Santa Barbara Basin. This data, according to Kennet, "has provided one of the highest-resolution marine Holocene climate sequences in the world . . . because of rapid sedimentation rates, lack of bioturbation, continuous abundance of foraminifera, and a highly sensitive environmental setting"(2005:64). Marine environment and current shifts occurred throughout prehistory and apparently these shifts could account for the southern California isotopic signatures of these more outlying beads, or that is to say, these beads could be in actuality northern California beads taken at a time when the northern coastal SST were elevated (Kennett 2005:62-9).

Table 2

Bead Type	Bead Number	Site	Approx. Calibrated Age	# of Samples Taken	δ^{13} C Range	δ^{18} O Range
F2a	B1	SCL-732	Unknown	5	[0.55, 0.28]	[1.63, 1.17]
F2a	B2	CCO-269	1518	10	[1.30, -0.09]	[0.99, 0.17]
F2a	B3	ALA-413	1518	3	[0.87, 0.45]	[1.32, 0.34]
F2a	B4	ALA-329	1518	1	0.61	-0.04
F2a	B5	SOL-355	1518	3	[1.25, 1.11]	[1.28, 0.64]
F2b	B6	CCO-269	1323-1518	9	[0.87, 0.31]	[1.42, 0.96]
F2b	B7	CCO-269	1531	4	[0.59, 0.03]	[1.15, 0.67]
F2b	B8	ALA-413	1531	3	[0.77, 0.67]	[0.73, 0.0]
F3a	B9	ALA-413	1399-1531	5	[1.36, 0.77]	[1.46, 0.85]
F3a	B10	ALA-329	1399-1496	5	[0.94, 0.53]	[1.05, 0.75]
F3a	B11	ALA-46	1496	4	[1.18, 0.22]	[1.65, 0.43]
F3a	B12	ALA-46	874-981	10	[0.66, 0.31]	[0.85, 0.18]
F3a	B13	ALA-329	955	3	[0.49, 0.35]	[0.65, 0.33]
F3a	B14	ALA-329	955	4	[0.85, 0.18]	[1.19, 0.46]
F3a	B15	ALA-329	955-1075	6	[1.44, 0.36]	[2.20, 0.39]
F3b	B16	ALA-343	1075	2	[0.94, 1.10]	[0.55, 1.09]
F3b	B17	ALA-343	966-1075	5	[1.21, 0.20]	[0.81, 0.38]
G2a	B18	ALA-413	966	1	- 7.18	- 3.26
G2a	B19	COL-247	966-1247	2	[1.43, 0.53]	[0.20, -0.15]
G2b	B20	ALA-413	551-2159	8	[1.88, 1.28]	[0.67, 0.25]
G2b	B21	ALA-413	1531-2159	4	[1.10, 0.92]	[1.40, 1.13]
G2b	B22	ALA-413	1531	4	[2.13, 1.37]	[1.15, 0.42]
G2b	B23	ALA-413	1451-1531	10	[1.20, 0.74]	[0.76, 0.33]
G2b	B24	ALA-413	1518	1	0.77	0.61
G2b	B25	SCL-732	1518	2	[-3.15, -3.96]	[-0.83, -3.29]
G2b	B26	SCL-732	1518	5	[0.42, 0.37]	[0.51, 0.19]
G3	B27	CCO-601	1518-1806	4	[1.31, 1.20]	[0.68, 0.99]
G5	B28	CCO-269	1871	1	1.52	0.57

Bead Type	Bead Number	Site	Approx. Calibrated Age	# of Samples Taken	δ^{13} C Range	δ^{18} O Range
G5	B29	CCO-269	1675-1871	5	[1.33, 0.64]	[1.61, 0.88]
M1a	B30	ALA-42	1036	3	[0.73, 0.32]	[0.70, 0.39]
M1a	B31	ALA-42	239	4	[0.81, 0.52]	[0.87, 0.47]
M1a	B32	ALA-42	239-910	3	[0.94, 0.44]	[0.44, 0.14]
M1a	B33	ALA-42	899-910	5	[0.77, 0.64]	[1.00, 0.70]
M1a	B34	ALA-329	891-899	6	[1.85, 1.08]	[1.40, 0.94]
M1a	B35	ALA-329	764-899	8	[1.36, 0.18]	[1.10, 0.52]
M1a	B36	ALA-42	685-764	2	[1.60, 1.44]	[1.42, 1.03
M1a	B37	ALA-42	685	6	[1.52, 1.04]	[1.10, 0.67]
M1a	B38	ALA-329	685-854	2	[-3.69, -3.22]	[-1.40, -0.90]
M2a	B39	YOL-187	854-926	2	[0.18, 0.03]	[1.09, 1.00]
M2a	B40	YOL-187	619-926	7	[-0.14, -3.27]	[-0.15, -1.94]
M2a	B41	ALA-42	548	1	0.95	0.40

The inconclusive nature of this part of the data further underscores the value of continued research, not only in the paleoceanic record, but also in the *Olivella biplicata* lifecycle where it inhabits areas with high levels of freshwater admixture. Several biological factors need to be taken into account when interpreting the geochemistry of *Olivella* shell beads. First, gastropods are not inert components in their environment; they are living creatures, interacting with their surroundings, and thus their growth rates can fluctuate over the course of a given lifespan (Gaspar 2004:371-7). Second, while most mollusks are infaunal or permanently affixed to their place of origin, some larger mollusks are mobile, traveling to various water depths with varying degrees in temperature depending on the season, which might obscure any isotopic signature, while still other species adhere themselves to sea flotsam and travel great distances before becoming dislodged in new habitats. For *Olivella biplicata,* the migratory pattern consists of one to two kilometers within its lifespan, all the while maintaining similar water depths (Edwards 1968:297-304). Third, *Olivella* shell is composed primarily of three composite layers of aragonite and calcite. Since each aragonite layer has a different $\delta^{18}O$ ratio based on fractionation between the aragonite and calcite, “care must be taken when directly comparing calcite and aragonite bead $\delta^{18}O$ values for provenance analysis, and one must drill samples from the same mineralogic layers in species with complex mineralogies” (Eerkens 2005:11). For this reason standardizing bead growth orientation and serial sampling is particularly vital to ensure that sampling errors, as a result of drilling varying layers of the *Olivella* shell, are avoided.

Conclusions & Implications

This research project, within the framework of work completed by Dr. J. Eerkens, indicates that sourcing *Olivella biplicata* shell beads from the California coast via stable isotope fingerprinting has great potential (Eerkens et al. 2005). At present, though, the regional isotopic signature zones for *Olivella* are larger and more inclusive than other archaeological chemical sourcing zones, such as obsidian or chert sourcing for projectile points. However, this recent research on the major isotopic regional sourcing zones of *Olivella,* the most common type of shell bead found in California archaeological sites, is not to be unduly dismissed, as it will benefit the California archaeological community and serve as an important reference resource to further flesh out the complex prehistoric patterns of shell bead production and exchange throughout the west coast of North America. A more comprehensive sampling of prehistoric and modern *Olivella* geochemistry is needed along the Pacific coastline and is presently being undertaken by Dr. J. Eerkens.

Taking the data generated from the sourcing of the prehistoric *Olivella* shell beads and placing it within an ethnographic context suggests that the Chumash were much more instrumental in the production of money beads than previously assumed. And this, in turn, suggests that their social and economic structure was more complex than has previously been recognized. As Arnold points out, the societal invention of currency is “a symbolic device in exchange, necessary for an economy in the process of shifting from simple household production to more complex levels of production and distribution” and is a significant organizational and conceptual revolution in any economic exchange system (1987:47). The use of currency represents a profound shift in the way people interact with their environment and the power of the individual within a society, to the point that currency is considered a vital component in the rise of social complexity and the foundation of any capitalist economy (Arnold 1987:1-6, 47-8).

Among the Chumash, wealth and social positions of status were maintained and enhanced through trade, while the importance of an individual was expressed and maintained through the exhibition of bracelets, earrings, and necklaces. Evidence of the importance of wealth and personal objects of wealth can be found in archaeological sites containing the remains of Chumash cemeteries. Examinations of plots containing grave goods show a slow shift in the frequency and disruption of personal effects and *Olivella biplicata,* or money beads, resulting in a "haves"/"have-nots" division. Archaeologists have speculated that this shift in use of beads as money by most common people, with a corresponding increase in the use of beads as decoration, was to validate a socio-political agenda. The transition in grave goods in later periods may also indicate the transition from a relatively egalitarian to a non-egalitarian society, ultimately "resulting in a decrease in importance of the economic system as a means of attaining political power as inherited wealth and political titles increased in importance" (King 1990:96). Energy expended by the Chumash peoples in maintaining an egalitarian currency exchange system was directed into validating a few select members of various communities with elevated degrees of political leadership. One might even interpret this shift as the first awkward step toward a fledgling capitalist society, as the material goods shift signifies a transition toward a centrally organized system where economic exchange became increasingly controlled by hereditary political leaders.

Finally, the aim of this ongoing research project is to enhance understanding of the multifaceted nature of prehistoric native cultures within California, and to provide further physical evidence that these people traded extensively, over hundreds of miles of Pacific Coast, as the byproduct of a richly complex monetary economy in place long before European contact.

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