SHELLS BY THE SHORES: AN EXAMINATION OF MARINE INVERTEBRATES FROM THE SPINDRIFT SITE IN LA JOLLA, CALIFORNIA

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Marine invertebrate remains in archaeological contexts can be used to indicate environmental change and subsequent variations in prehistoric subsistence strategies. Recent excavations at the Spindrift Site in La Jolla have yielded substantial data for a close examination of various invertebrate species and other marine resources. Preliminary data has provided information regarding variations in species density and diversity, suggesting both climatic fluctuations over time and adaptive changes in prehistoric subsistence patterns. This data will be used to supplement our knowledge of the archaeology of the La Jolla area and our comprehensive view of prehistory in San Diego.

The Spindrift Site, located just south of popular La Jolla Shores beach and the La Jolla Beach and Tennis Club, is one of the first prehistoric village locations recorded in San Diego County (see Figure 1). Excavations at the site have been taking place over the last 75 years, mainly as the result of residential development. Recent data recovery programs at the site have yielded large quantities of data with which to supplement our ever-growing knowledge of the La Jolla area.

The Spindrift Site is currently bordered by La Jolla Shores Beach to the north and roughly La Jolla Cove to the south, with a gradual transition from a flat, sandy beach to remnant cliffs and terraces between. Evidence of the paleoenvironment remains in these cliffs and from seafloor core samples. Another method to determine prehistoric habitats is examining marine invertebrate remains in the archaeological record.

By discerning which marine species were present during a particular time period, the prehistoric habitat conditions can be determined. Prehistoric populations likely subsisted on the most readily available resources; therefore the shell species with the highest densities in the archaeological record represent the dominant habitats and environmental conditions. Because relatively little effort is required to collect shellfish (they cannot typically outrun humans), they make a fairly reliable subject of study as to the collective strategies of early coastal inhabitants.

The focus of this paper includes an examination of preliminary marine invertebrate data from the recent excavations, a brief summary of some previous studies, and the resulting implications regarding environmental and cultural change and adaptation. This study includes background information about the site, a short description of the natural setting and paleoenvironmental conditions, and a discussion of recent data and how it compares to previous research.

BACKGROUND

The majority of information we possess regarding the Spindrift Site (SDM-W-1/CA-SDI-39) comes from Malcolm Rogers, whose recordation of this particular site and immediate areas includes much detail and insight for the time. The 1920s and early 1930s were a booming time for construction around San Diego, especially in the La Jolla area. Rogers had the ability to recognize the cultural relevance of the area and recorded as much information as he could, often as buildings and residences sprang up around La Jolla Shores and what is now the Marine Room Restaurant.

In addition to recording culturally significant information regarding construction and excavation of individual lots and residences, Rogers took a broader perspective, including comments on soil stratigraphy, sea-level dynamics, and overall climatic change. These factors and data from the archaeological record shaped Rogers' conclusions about the early inhabitants of the area. Archaeology was still a relatively new field of study, and some of Rogers' techniques would be considered substandard

today. However, credit must be given for his descriptions, excavations, and collections, as they have helped shaped our understanding of this site as well as the attitude toward culturally significant sites during that time in history.

The only information Rogers (1929) provides for the relevance of this paper is a brief description (very brief) of relative overall shell densities between strata and a minimal list of a handful of genera from each "Operation," all of which took place in various strata. Operation 1 included data from Stratum 1, and Operation 2 (Lot 108) and Operation 3 occurred in Stratum 3.

> Lot 108 shell percentages: 1st: Donax. 2nd: Pismo. 3rd: Abalone. 4th: Pectin [sic].
>
> Operation 3 shell percentages: 1st: Abalone. 2nd: Donax.
>
> Oper. 1. Stratum 1. East side runs strongest to pectin and the west side to mussels.

In addition to this information, Rogers also presents a table of the relative volumetric analysis of culturally relevant material from all three stratigraphic layers.

Maximum Shell	Maximum Rock	Maximum Charcoal	Maximum Bone
No. 1	No. 3	No. 3	No. 3
No. 3	No. 1	No. 1	No. 1
No. 2	No. 2	No. 2	No.2

Reproduced from Rogers' Field Notes 1929, San Diego-Smithsonian Expedition, p. 6.

Based on these data, Rogers states that Stratum 2 (No. 2) "represents a long period of abandonment and is composed almost entirely of stratified sand washed down from the highlands. It carries an occasional shell, derived from the higher parts of No.1."

These data come from his observations during excavations for various properties and from an exposed cliff located south of the Spindrift Hotel (near what is now the Marine Room Restaurant). Rogers excavated a west-to-east-trending trench near the current beach access path on the southern end of the Marine Room, which was likely the only place where Stratum 1 was visible. He drew a stratigraphic map of the exposed cliff and determined Stratum 1 likely continued below the current sea level and that much of the site had eroded into the sea as the water level rose.

The information gleaned from Rogers' field notes is significant because a correlation can be made from this data between strata and shell populations and densities that can be tested against more recent excavations and data recovered from this site.

A current data recovery program at the Spindrift Site took place during 2005 and 2006 by Laguna Mountain Environmental, Inc. This relatively large-scale undertaking was a result of the identification of culturally significant material during construction monitoring along Princess Street and Spindrift Drive for a new underground utility transmission line. Twenty-six units (50 cm by 1 m) were placed along Spindrift Drive as part of the data recovery plan. All the material from each unit was water-screened through 1/8-in. hardware cloth and sorted manually in the laboratory. In addition to the units, all soil from 11 mainline trench segments of various lengths and depths was water-screened and manually sorted. All material from the units has been separated by 10-cm-incremental levels and sorted into main categories including lithics, ceramics, faunal bone, charcoal, fire-affected rock, special or unique items (such as projectile points and beads), and shell. The marine invertebrates have been further sorted into individual genera to the extent possible.

Since Rogers' first recordation of the Spindrift Site, multiple studies at various locations in the immediate vicinity have not yielded substantial data to supplement Rogers' findings. This is most likely due to the fact that residential development of the area occurred very quickly and many studies have been limited to single lots or residences. The large data recovery program conducted by Laguna Mountain has by far provided archaeologists with incredible amounts of data, especially regarding marine invertebrate remains.

ENVIRONMENTAL SETTING

The Spindrift Site is located along the La Jolla coastline, between the Beach and Tennis Club to the north and Torrey Pines Boulevard to the south. The eastern boundaries are still in question, as cultural material has been discovered at various locations along Spindrift Drive, Princess Street, Saint Louis Terrace, Roseland Drive, and throughout the general neighborhood. Malcolm Rogers first recorded the site at the Spindrift Hotel and included a sea cliff and associated terrace.

As discussed in Shumway, Hubbs, and Moriarty (1961), there was likely a gradual shift from a more rocky shore to a sandy beach environment over thousands of years. Figure 2 simplifies this major shift in environmental conditions. Much research has also been completed regarding local lagoons and the effects of creation and subsequent siltation on available marine resources. The results from these environmental changes likely included major shifts in productivity for local human populations and forced new cultural adaptations to new and varied marine resources.

The rocky shore environment contains little sand, and the marine invertebrates in this zone are adapted to dwelling on rocks, including fluctuations in the tides. This habitat was dominant along the La Jolla coast at least 8,000 years ago (Masters 2005). Common invertebrate genera in this zone include Mytilus (Mussel), Astraea (Wavy Turban Snail), Balanus (Barnacle), Haliotis (Abalone), Polisipes (Gooseneck Barnacle), Pseudochama (Reversed Jewel Box), Tegula (Top Snail), and various chitons (Ricketts et al. 1985).

The estuarine environment in this area appeared as fresh water from the major canyon near the Beach and Tennis Club encountered the salt water of the sea. The brackish water, sandy bottom, and marshy flats encouraged tide- and salinity-tolerant shellfish to populate this area. The development of this estuary began approximately 5,400 years ago (Masters 2005). Common genera in this habitat include Argopecten (Scallop), Chione (California Venus), and Ostrea (Oyster) (Ricketts et al. 1985).

The sandy beach environment developed as sand and sediment accumulated along the shore and eventually closed the estuary from the sea. La Jolla Shores beach extended toward the cove and successfully created remnant tidal flats and a deep pool, beginning approximately 4,400 years ago (Masters 2005). Common genera in the sandy beach zone include Donax (Bean Clam), Tivela (Pismo Clam), and Tagelus (Razor Clam) (Ricketts et al. 1985).

These major environmental changes are apparent in La Jolla today. The sandy beach (La Jolla Shores) north of the main site area is the result of thousands of years of gradual sedimentation filling the estuary under what is now the Beach and Tennis Club. The tidal flats and associated estuary existed into the twentieth century, although fronted by a dense sand bar (USGS 1905 edition of the La Jolla 15-minute quadrangle). The large pond at the Beach and Tennis Club is the remaining water from the estuary, as the surrounding area was filled in with sand and soil from a higher terrace. La Jolla Cove at the southern end of the site includes a very rocky shore with high cliffs and terraces. This major shift should also be reflected in the archaeological record, and gives researchers an idea as to which marine invertebrate species to expect.

CURRENT DATA

More than 20 archaeological studies have included portions of the Spindrift Site and the surrounding neighborhood, many of which involved testing and data recovery in addition to construction monitoring. The current Laguna Mountain Environmental excavations covered the area along Spindrift Drive north of the intersection with Princess Street to the Marine Room, and portions of Roseland Drive and St. Louis Terrace. Because the analysis for this project is ongoing, the focus will be on one test unit located at the southern end of the site. Unit 3 has produced the most shell data to date.

Test unit 3 is located near the intersection of Spindrift Drive and Princess Street, on a higher terrace area overlooking the Marine Room to the north. This 50 cm by 1 m unit was excavated to a depth of 120 cm below the current street surface. The abundance of marine invertebrate remains made

excavation difficult, especially between the first few levels. The dominant genus for this unit is Mytilus, which represents 77.62 percent of the shell recovered from all levels. Table 1 summarizes all genera observed for unit 3 and associated total weights for each.

Mytilus is clearly the dominant genus represented in the entire unit, distantly followed by Balanus, Chiton, and Haliotis. In the 40-50 cm level for this unit, the total weight of Mytilus was 2,814 g. These four dominant genera are uniquely adapted to a rocky shore environment, and adequately represent the prehistorically available resources in the area.

The comparison properties for this study are located throughout the recorded site boundaries (Rogers) and include 1900 Spindrift Drive, 1905 Spindrift Drive, 1876 Torrey Pines Road, 1949 Hypatia Way, and 7954 Roseland Drive. Comparison data for these studies is provided by Case, Carrico, and Serr (2007). Table 2 summarizes marine invertebrate data from these properties by dominant species and highest total percentage by weight.

Another studied property was the Oliver Gill lot, excavated in the mid-1960s by J. Moriarty. In an interview in 1993, Moriarty stated that "shellfish remains included, in descending order of abundance, pectin [sic], chione, mussel, and donax" (in Roth and Berryman 1993:24). Moriarty also obtained shell dates for his study area. The dates range between 1,270 years ago on Mytilus and 4,650 years ago on Tivela from a burial location (Roth and Berryman 1993).

Figure 3 demonstrates the dominant habitat type by shell species for each of the study properties described above. The pattern for the location of each habitat type appears to match the timeline for rocky shore, estuary, and sandy beach as stated previously. The correlation between these factors will be strengthened with additional research in the area.

DISCUSSION

Based on very preliminary data from Unit 3 at the Spindrift Site in La Jolla, some conclusions can be hypothesized. The marine invertebrate data from the site appear to indicate a pattern of horizontal stratigraphy, an accurate reflection of environmental change, and could indicate continuous prehistoric occupation at the site, contrary to Malcolm Rogers' initial conclusion.

The idea that the Spindrift Site could have been occupied over thousands of years is extremely important to the regional history of San Diego and Southern California. More analysis of the data is necessary, including radiocarbon dating of the marine invertebrates to essentially determine a cultural timeline for this site. Because significantly more data is necessary to complete our understanding of this site, and more data is available for analysis, further conclusions will be forthcoming.

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Table 1. Unit 3 Shell Genera By Weight.

TAXON	WEIGHT (G)	PERCENT OF TOTAL
Acanthina	0.9	0.01
Argopecten	243.2	1.86
Astraea	139	1.06
Balanus	466.6	3.57
Bursa	1.9	0.01
Cerithidea	0.4	0
Chione	319.2	2.44
Chiton	432.2	3.31
Conus	0.1	0
Crepidula	0.7	0.01
Crucibulum	0.6	0
Dentalium	0.1	0
Donax	51.7	0.4
Fissurella volcano	2.3	0.02
Glans	0.1	0
Haliotis	414	3.17
Helix	1	0.01
Kelletia	1.2	0.01
Laevicardium	2.7	0.02
Leptopecten	0.8	0.01
Lottia	4.3	0.03
Megathura crenulata	2.1	0.02
Melampus	0.1	0
Modiolus	0.5	0
Mytilus	10,138.10	77.62
Olivella biplicata	5.5	0.04
Ostrea	124.1	0.95
Polisipes	115.2	0.88
Protothaca	2.7	0.02
Pseudochama	83	0.64
Sand dollar	0.5	0
Saxidomus	12	0.09
Sea urchin	1.4	0.01
Semele	0.1	0
Septifer	24.4	0.19
Serpulorbis	8.1	0.06
Tagelus	155	1.19
Tegula	178.9	1.37
Tivela	54.3	0.42
Unidentified	71.9	0.55
TOTAL	13,061.20	100

Table 2. Comparison of Properties within the Recorded Spindrift Site Area.

Nearby Properties	Dominant Genus by Total Percentage
1876 Torrey Pines Road (Hazard Property)	Chiton 23.0%
1900 Spindrift Drive (Gordon Gray Lot)	Tivela 40.0%
1949 Hypatia Way	Haliotis 33.2%
7954 Roseland Drive (Hunt Property)	Pseudochama 27.6%
1905 Spindrift Drive (Malk Residence)	Tivela 24.1%

Reproduced from Case, Carrico, and Serr (2007).

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