Pearl Ornaments from the Covacha Babisuri Site, Espíritu Santo Island, Baja California Sur, Mexico

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Abstract

The discovery of grooved pearls in the Covacha Babisuri site, on Espíritu Santo Island, Baja California Sur, suggests that the custom of modifying pearls for use as ornaments may have had a long tradition in the region, potentially beginning around 10,000 years ago. We present quantitative and morphometric analysis of 15 grooved pearls from the Covacha Babisuri site, one of the oldest known archaeological deposits on the Baja California peninsula and islands.

Identifications based on their nacreous characteristics suggest that 14 ornaments were manufactured from pearls of the pearl oyster (Pinctada mazatlanica). One, however, appears to have been crafted from a chocolate clam (Megapitaria sp.) pearl. All pearls show signs of having been gently smoked, or heated, in some manner, and all exhibit one or two grooves encompassing their circumference, indicating they were likely strung and used as items of adornment.

Experimental studies comparing measurements of serrated blade thickness for 75 shark teeth from the most common species inhabiting the La Paz Bay (blue shark [Prionace glauca], gambuzo shark [Carcharhinus obscurus], and tiger shark [Galeocerdo cuvier]) with shape and width dimensions of the pearl grooves support the possibility that shark teeth were used as engraving tools on these artifacts. We discuss the idea that a grooving technique and tradition was practiced by early inhabitants of the southern part of the Baja California peninsula, possibly beginning in the Early Holocene and continuing into the historic era.

Background

Introduction

The luster and smooth surface of pearls have garnered high esteem in widespread cultures for at least thousands of years, though the dearth of archaeological examples limits our knowledge of the development and extent of past human use of pearls. Our time frame regarding the modification of pearls is hampered by the challenges of uncovering very small items in archaeological contexts in general and is exponentially problematic the further we look into the past. The paucity of pearl discoveries in archaeological deposits may be due to the lack of fine-mesh screens when sieving archaeological materials (Charpentier et al. 2012). Fortunately, the use of 1 mm mesh screens during excavations at the Covacha Babisuri site revealed the presence of 15 modified pearls in archaeological deposits representing intermittent human occupations of the rockshelter during the Early and Middle Holocene.

A brief review of the published literature on the earliest examples of pearls from the prehistoric record provides some context for considering the modification of pearls during the Early Holocene in Baja California Sur. Historic accounts describe the use of pearl ornaments by Indigenous peoples of the southern part of the peninsula from the late sixteenth century, suggesting continuity of this practice into the historic era. Comparisons of archaeological and ethnographic examples of pearl use in Alta California reveal similarities between these neighboring regions and evoke the notion that this practice may have been more widespread in the past.
Archaeological Pearls

The Persian Gulf contains the earliest known evidence for pearling. Natural pearls have been uncovered in human burial contexts dated to ca. 7,500 years ago, and perforated pearls are known from not long after in the same region (Charpentier et al. 2012; Carter 2012; Drusus 2012). Though relatively rare, pearls appear to be an important component of Neolithic funerary practices in Arabia and Mesopotamia, having been found in at least six cemetery contexts dated ca. 7,500–5,400 years ago and an additional eight “settlement sites” that were occupied during the same time period (Charpentier et al. 2012:Table 1). Perforated pearls (n = 62) appeared in funerary contexts at the Jebel Bahaism 18 site (ca. 5,200–4,000 BC) in the United Arab Emirates. Analysis of these Neolithic pearls suggests that the nature of pearl perforations may have been indicative of sex based differences, as those found in male burials are only “semi-perforated,” in contrast to the fully perforated pearls found in female burials (Charpentier et al. 2012).

The oldest natural pearl found in Japan was uncovered at the Torihama site, in Fukui, with estimated occupations at ca. 5,500 years ago (Ohoka 2012). Additionally, a perforated pearl was uncovered in the Chazu site in Hokkaido, Japan, in deposits dated to about 4,000 years ago (Ohshima 2010). Chinese artifacts crafted from mother-of-pearl and pendants decorated with pearls are common in Jin dynasty (AD 265–420) tombs, perhaps the earliest evidence of pearl modification and adornment in mainland East Asia (Landman and Mikkelsen 2001). In West Asia unmodified fresh water pearls are found in archaeological deposits associated with farming communities from the Neolithic Chalcolithic and early Bronze Age periods (6,000–3,000 BC), mainly in Anatolia and Syria (Reese 1990). Unmodified salt water pearls and fresh water pearls have been uncovered in archaeological contexts corresponding to the Neolithic and early Iron Age periods in Jerusalem, with fresh water pearls appearing more frequently (Landman and Mikkelsen 2001; see also Carter 2012).

Though not abundant, gastropod pearls have been noted in several archaeological contexts on the islands off California’s mainland coast. Holmes (1997:74,195) reported that the Reverend Stephen Bowers found two perforated abalone (Haliotis spp.) pearls in association with human burials on San Miguel Island, the most westerly northern Channel Island. Heye (1921:120–121, Plate LXXVI) reported on abalone “blister pearls” also from San Miguel Island, which were ground, flattened, and smoothed before being perforated for suspension. He notes that the more circular pearls tended to be centrally perforated, while pearls of irregular forms were generally drilled closer to one end. Cannon (2006:147, 148) reported the discovery of a grooved spherical pearl from a Late Holocene San Nicolas Island village (CA-SNI-25). In addition, Ainis et al. (2017) described a perforated and grooved baroque abalone pearl from the Redwood Box Cache (CA-SNI-14). On California’s mainland coast, 10 unmodified bivalve pearls were uncovered during excavations at two Orange County sites (CA-ORA-83 and CA-ORA-85) with dated contexts, respectively representing the pre-Late Holocene and the latter half of the Middle Holocene to the first third of the Late Holocene (Koerper and Desautels-Wiley 2010).

Pearls were highly esteemed as ornaments by Native peoples of Mexico at the time of Spanish invasion, with accounts indicating that Montezuma’s cloak and sandals were “sprinkled with pearls and precious stones,” that “handles of [canoe] paddles were inlaid with small pearls,” and so forth (Kunz 1890:241–242). However, although there are sufficient ethnohistoric references (i.e., see Kunz 1890) to Native use of pearls along the Pacific coast of Mexico, as far as we are able to determine, worked pearl ornaments have not been reported from archaeological contexts in the region other than as funerary objects in royal burials (Fitzsimmons 2009:11, 83). In addition, though pearls have
been found relatively frequently in a number of Mesoamerican sites, demonstrating their value in Mayan, Zapotec, and Olmec cultures, worked pearl ornaments from archaeological contexts in Mexico are generally found in deposits from a much later time period than those uncovered at the Covacha Babisuri site.

In Chiapas, funerary objects of King Pacal of Palenque from the seventh century included two large (= 35 mm) artificial baroque style pearls crafted from mother-of-pearl to resemble “gigantic pearls” (Ruz 1973:200, Figures 231, 232; Drake 2010:35). High-status males (i.e., “the governor”) were interred with ear ornaments, necklaces, and other jewelry fashioned of jadeite and pearls at the sites of Calakmul in Campeche and El Diablo in Guatemala (see Bajkova 2014:107; Houston et al. 2015). Pearl ornaments associated with female burials have also been noted at several sites and include a *Spondylus* shell incrusted with jade and natural pearls found in a tomb in Quintana Roo (AD 250–450) (Bajkova 2014:105). Also, the “Reina Roja” was interred with a bone needle, jade, pearls, and other shells at Palenque, Chiapas (AD 672) (González Cruz 2015:50). Recently in Quintana Roo, north of Cancún, a perforated pearl was found in the Post Classic site (AD 900–1,535) of El Meco (Emiliano Melgar, personal communication 2010).

In the Cape Region of Baja California Sur, unmodified pearls and modified pearls, including grooved specimens, have been found in at least seven archaeological sites with dated components ranging from ca. 4,800 to 600 years ago (Rosales and Fujita 2000; Martos 2002; Rosales and Sánchez 2004; Fujita 2007, 2008a, 2008b; Karim Bulhusen, personal communication 2015; García et al. 2015; Alfonso Rosales, personal communication 2016; García et al. 2016). Single pearls were uncovered in most of these sites, but two pearls were found at the El Conchalito site and 66 pearls at the Ensenada de los Muertos site, including 23 that displayed signs of having been worked and modified (Alfonso Rosales, personal communication 2016). These data indicate that pearl ornaments are not uncommon to the region in archaeological sites dated to at least the past ca. 4,800 years and up to several hundred years ago. Ethnohistoric accounts from over 400 years ago indicate continuity of this practice into the historic era.

Based on these few discoveries, it appears that most pearl ornaments uncovered in archaeological contexts were modified with perforations of some sort. Pearl ornaments modified with grooves, however, have only been described from San Nicolas Island, California (Cannon 2016; Ainis et al. 2017), Espíritu Santo Island, and the La Paz area in the Cape Region of Baja California Sur. Though the origin of this practice is impossible to ascertain, there is the potential that it originated in the Cape Region, possibly at the Covacha Babisuri site, which currently contains the oldest context for these artifacts.

**Historic Pearl Ornaments in Baja California Sur**

The Gulf coast of Baja California was the most important pearl-fishery on the North American continent during the late 1500s, when Hernando Cortés took possession of the pearl fisheries and sent exquisite specimens to the Queen of Spain (Kunz 1890:218–219). Early historic accounts describe the presence of grooved pearls in Baja California, including on Espíritu Santo Island, where pearl ornaments were observed by expeditionary members and Jesuit fathers, mostly in the Cape Region. In 1596 a local chief near San Sebastián (Cabo San Lucas area) gifted a necklace containing 11 pearls to Sebastián Vizcaíno (Mathes 1970:267).

Captain Juan de Iturbe hunted for pearls along more than 300 leagues (=1,500 km) of the eastern coastline of the Baja California peninsula. In 1615 he reported that grooved pearls were worn on necklaces in the La Paz area and were also bound by a string and hung...
from the ears (Mathes 1970:22–30). In 1632 Captain Francisco de Ortega, who traded knives and other objects with Native people in the southern part of Espiritu Santo Island for smoked and grooved pearls, reported that pearls were used by the local people to form components of necklaces and bracelets (Mathes 1970:421).

Multiple historic documents note employments of pearls in the Cabo San Lucas area, including bird feathers and pearls intertwined in hair (Barco 1973:183). In 1644 the explorer Porter y Casanate noted that pearls were hung from the noses of Native people in this area (Vetancurt 1961:66); Captain Alonso Gonzáles Barriaga provided descriptions of pearls being bound and hung as human adornments during the same time period, reporting that grooving of pearls was accomplished with a stone tool (Mathes 1980:49). Woodes Rogers, who visited Cabo San Lucas between December 1709 and January 1710, observed necklaces and bracelets made of two or three large pearls, alternated with colorful fruits, twigs, and pieces of shell. Interestingly, he also reported that there was no drilling of pearls, which suggests that perhaps pearls were being grooved (Mathes 1980:53, 55). Native people clearly had perforated shells to make fishhooks and ornaments for thousands of years. Perhaps drilling was used for pearls but not witnessed by Rogers.

A Guaycura chief in La Paz possessed a stick encrusted with four pearls on one end. This wand-like artifact, given to Father Jaime Bravo in 1720 (Bravo et al. 1970:50), might be similar to the “digging sticks” with abalone pearl insets reported among the Ventureño Chumash (see Koerper and Desautels-Wiley 2010:74). Two pin-like or wand-like objects believed to have come from San Clemente Island had abalone pearls displayed on one end (see Koerper and Desautels-Wiley 2010:74).

Unsurprisingly, there are discrepancies between historical accounts. For instance, Father Miguel del Barco described the absence of pearl ornaments in the central and northern regions of the Baja California peninsula (Venegas 1944:76; Barco 1973:184), and Francisco de Ortega in 1633 reported that pearl oysters were not known to the Indigenous people at Carmen and Danzante Islands in the south central region of the peninsula (Mathes 1970:444). However, the presence of grooved pearls on San Ildefonso and Tortuga islands in the northern region of the peninsula, as described by Francisco de Ortega in 1636 (Mathes 1970:461, 462, 465), attests to the use of pearl ornaments. It seems highly probable that the padres were unaware of trade in certain objects between peoples of southern, central, and northern regions of the peninsula.

The Covacha Babisuri Site

The Covacha Babisuri site is a medium-sized rock-shelter located on the southwest coast of Espiritu Santo Island, adjacent to La Paz Bay, in the southern Gulf of California (Figure 1). It contains fairly dense archaeological assemblages and evidence of multiple occupations spanning the Holocene. There is a plethora of faunal and floral remains and primarily utilitarian artifacts made of different lithic materials, marine shell, coral, and bone. Modified pearls were uncovered in the lower and middle strata (Figures 2–4) corresponding to the Early and Middle Holocene periods (Table 1). One hundred three samples of marine shell, charcoal, and faunal bone were submitted for both conventional and accelerator mass spectrometry (AMS) radiocarbon dating, revealing multiple occupations beginning at roughly 12,000 years ago and continuing to the historic era.

The Covacha Babisuri site was recorded in 1994 (Fujita 1995) and tested in 1996 (Fujita 1997) with extensive excavations led by the senior author between 2001 and 2006. These excavations removed almost 42 m² of sediment and archaeological materials in 5 cm levels within stratigraphic distinctions until bedrock.
Figure 1. Location map.
Figure 2. North profile of B line units.

Figure 3. North profile of D line units.
was encountered (Fujita 2002, 2004, 2007, 2008a). Three primary cultural strata were identified, being differentiated primarily by shifts in dominant shell taxa (Figures 2–5). A grid system was established, demarcating the excavated area into 1 × 1 m units (Figure 6), and all excavated materials were screened through 1 mm and 5 mm mesh.

The lowest stratum (stratum III) was composed of fine sand, silt, gravels, and angular rocks of various sizes. Much of the angular rock was consistent with the conglomerate that formed the rockshelter, suggesting it had fallen from the ceiling and/or sloughed off the walls. This stratum was identified throughout the site, suggesting fairly extensive human use of the rockshelter during these initial occupations. The predominant color of the sediment was grayish yellow-brown (10YR 5/2 and 6/2), with medium and low level compaction, depending on the units and levels. This stratum was encountered higher up in the eastern portion of the site, which is the front of the rockshelter, and lower in the western and southern portions. This suggests archaeological materials were deposited on a downward slope from east to west/southwest following the natural slope of the rockshelter, except in the central portion, where deposited assemblages sloped downward from west to east (Figures 2 and 3). The maximum depth of the lower stratum ranged between ≈ 75 cm below surface in the front, or easterly portion of the rockshelter, and ≈ 130 cm below surface in the rear, or southwestern area of the site, which extended beyond the rock overhang.
Table 1. A Chronology for the Covacha Babisuri Site, Espíritu Santo Island, BCS, Mexico.

<table>
<thead>
<tr>
<th>Lab No.</th>
<th>Unit and Level</th>
<th>Depth (cm)</th>
<th>Stratum</th>
<th>Material Dated</th>
<th>Uncorrected $^{14}$C Date Range</th>
<th>Adjusted Age Range (cal BP, 2 σ)$^a$</th>
<th>Provenience of Fluted Pearl (unit, stratum and level)$^b$</th>
<th>Catalogue No. of Fluted Pearl</th>
</tr>
</thead>
<tbody>
<tr>
<td>INAH-1752</td>
<td>Pit 1$^c$ level a</td>
<td>0–10</td>
<td>I, upper</td>
<td>Chama frondosa</td>
<td>1089±79</td>
<td>601:300</td>
<td>–</td>
<td>–</td>
</tr>
<tr>
<td>INAH-2279</td>
<td>G1 II d</td>
<td>15–20</td>
<td>II, middle</td>
<td>Chama frondosa</td>
<td>2393±76</td>
<td>1911:1538</td>
<td>–</td>
<td>–</td>
</tr>
<tr>
<td>INAH-2455</td>
<td>H2 II i</td>
<td>40–45</td>
<td>II, middle</td>
<td>Chama frondosa</td>
<td>3651±72</td>
<td>3059:3442</td>
<td>I4 II j</td>
<td>376z</td>
</tr>
<tr>
<td>INAH-2283</td>
<td>H5 II f</td>
<td>25–30</td>
<td>II, middle</td>
<td>Chama frondosa</td>
<td>3838±74</td>
<td>3583:3989</td>
<td>H4 II j</td>
<td>436z</td>
</tr>
<tr>
<td>INAH-2446</td>
<td>E2 II i</td>
<td>40–45</td>
<td>II, middle</td>
<td>Lobatus galeatus</td>
<td>6277±75</td>
<td>6285:6625</td>
<td>F3 II h</td>
<td>284z</td>
</tr>
<tr>
<td>INAH-2030</td>
<td>B2 II i</td>
<td>43.6–50.3</td>
<td>II, middle</td>
<td>Hyotissa hyotis</td>
<td>6861±78</td>
<td>6930:7303</td>
<td>E3 II i</td>
<td>348z</td>
</tr>
<tr>
<td>INAH-2028</td>
<td>B2 II g</td>
<td>35.3–39.5</td>
<td>II, middle</td>
<td>Hyotissa hyotis</td>
<td>6939±83</td>
<td>7011:7396</td>
<td>E3 II o</td>
<td>787z</td>
</tr>
<tr>
<td>INAH-2447</td>
<td>E2 II m</td>
<td>60–65</td>
<td>II, middle</td>
<td>Nodipecten subnodosus</td>
<td>7967±79</td>
<td>8346:8001</td>
<td>–</td>
<td>–</td>
</tr>
<tr>
<td>Beta-211115</td>
<td>F1 III g</td>
<td>82–85</td>
<td>III, lower</td>
<td>Chama frondosa</td>
<td>8640±60</td>
<td>8756:9187</td>
<td>–</td>
<td>–</td>
</tr>
<tr>
<td>Beta-259393</td>
<td>F1 III k</td>
<td>100–105</td>
<td>III, lower</td>
<td>Saccostrea palmula</td>
<td>8690±50</td>
<td>8921:9240</td>
<td>F2 III k, F2 III j</td>
<td>1021z, 1010z</td>
</tr>
<tr>
<td>INAH-2451</td>
<td>E6 III d</td>
<td>65–70</td>
<td>III, lower</td>
<td>Nodipecten subnodosus</td>
<td>9131±75</td>
<td>9391:9764</td>
<td>E2 III h(2), F6 III b, F4 III b</td>
<td>976z, 984z, 609z, 199z</td>
</tr>
<tr>
<td>INAH-2457</td>
<td>H2 III k</td>
<td>100–105</td>
<td>III, lower</td>
<td>Hyotissa hyotis</td>
<td>9280±75</td>
<td>9516:10,004</td>
<td>–</td>
<td>–</td>
</tr>
<tr>
<td>Beta-211120</td>
<td>G6 III f</td>
<td>75–80</td>
<td>III, lower</td>
<td>Hyotissa hyotis</td>
<td>9460±60</td>
<td>9789:10,182</td>
<td>G2 III i, G2 III k, G2 III m, E4 III f</td>
<td>1003z, 1015z, 1054z, 911z</td>
</tr>
<tr>
<td>Beta-211113</td>
<td>D6 III d</td>
<td>65–70</td>
<td>III, lower</td>
<td>Spondylus crassiquama</td>
<td>9700±70</td>
<td>10,160:10,491</td>
<td>–</td>
<td>–</td>
</tr>
<tr>
<td>INAH-2460</td>
<td>H5 III e</td>
<td>70–75</td>
<td>III, lower</td>
<td>Lyropecten subnodosus</td>
<td>9868±77</td>
<td>10,261:10,684</td>
<td>–</td>
<td>–</td>
</tr>
<tr>
<td>Beta-236259</td>
<td>H2 III n</td>
<td>115–119</td>
<td>III, lower</td>
<td>Turbo fluctuosus</td>
<td>10970±60</td>
<td>11,886:12,445</td>
<td>–</td>
<td>–</td>
</tr>
</tbody>
</table>

Note. This table includes a representative selection of the more than 100 conventional and AMS $^{14}$C dates for this site.  
$^a$ All dates were calibrated using Calib 7.0.4 (Stuiver and Reimer 1993, 2014), and adjusted with a ΔR of 250 ± 20.  
$^b$ The age of the fluted pearls can be estimated using comparisons with the nearest dated units and levels.  
$^c$ Pit 1 was excavated using levels of 10 cm in 1996. This level was later identified as stratum I.  

Figure 5. South profile of unit B7.
Although cultural activity in stratum III has been dated to between ca. 12,000 and 8000 cal BP (Fujita 2010, 2014), fossil shells dated between > 47,500 and 35,500 cal BP were uncovered in relatively high densities and appear to have been used as tools and containers (Fujita and Melgar 2014). Non-fossilized shells and faunal remains representing dietary refuse, lithic tools and debris, shell tools (including fishhooks, scrapers, drills, and worm shell straws or pipes), containers, and ornaments (including grooved pearls and *Olivella* spire-looded beads), coral abraders, and a bone awl were also found in this lowermost stratum.

A potential fishhook preform fragment was directly dated to 8380 ± 50 RCYBP (8750–8500 cal BP; Beta-236254), indicating that shell fishhooks were likely manufactured on Espíritu Santo Island during the Early Holocene (Fujita 2014). Though this date
is somewhat younger, it shows similarity with the J-shaped shell fishhooks found on Cedros Island, along the Pacific coast of the Baja California peninsula (Des Lauriers 2010). It seems that fossilized pearl oyster shells were not used for fishhooks, perhaps due to their structure, which is rather brittle and not conducive to being pecked and flaked. Alternatively, fossilized pearl oyster shells do not have an iridescent quality, which was likely beneficial in attracting fish as a lure.

Lithic artifacts found in stratum III included flakes, cores, blades, knives, projectile points, end-scrapers, and side-scrapers. Ground stone artifacts were also uncovered in this stratum, including milling and hand stones. Though it is fairly evident that the early occupants of the rockshelter collected fossil shells for use as containers and as materials for the manufacture of tools, there is no indication of an in situ fossil shell deposit at this site. The presence of fossilized shells in the lowest archaeological component of the Covacha Babisuri site appears to be a result of transport to this location for use as containers and for manufacturing a variety of artifacts.

The middle cultural stratum has a relatively large approximate date range of ca. 8000 to 2000 cal BP. Stratum II/II' consisted predominantly of smaller and more fragmented dietary shell refuse, with the formerly common fossilized shells no longer present. It is possible that the fossil location that was quarried during the Early Holocene was no longer available at this time due to rising sea levels, which inundated the land bridge between the peninsula and Espíritu Santo Island roughly 8,000 years ago (Fujita and Melgar 2014:113, Figure 1).

The middle stratum was divided into two substrata (II and II'). Substratum II was assigned to the interior units in the central, western, and southwestern portions of the rockshelter where it was visible on the surface, and substratum II' was assigned to the middle stratum below the large accumulation of pearl oyster shells that composed the uppermost stratum (stratum I) along the eastern portion of the rockshelter. The upper depth range for this stratum was between approximately 25 cm below surface in the eastern portion, or entrance of the rockshelter, and about 90 cm below surface in the southwestern part of the site. Both substrata were characterized by fine sand and silt of a predominantly grayish yellow-brown (10YR 5.2, 6.2) color. In spite of the ca. 6,000 year date range identified in stratum II/II', shellfish taxa and density and the majority of lithic artifact types and relative densities do not show significant differences within these assemblages.

The uppermost stratum, catalogued as stratum I, was characterized by an abundance of complete pearl oyster shells, likely representing food remains. This stratum was present in the eastern portion of the rockshelter only, where it covered roughly half of the site and was characterized by sandy, silty soils. The depth range for this stratum was between about 15 and 30 cm below surface. Other than shell, faunal remains and artifact densities decrease in stratum I when compared to the two lower deposits (strata II/II' and III). No modified pearls or circular shell fishhooks were found in this stratum, which dated between roughly 2,000 and 300 years ago (see Table 2).

Deposits in the north central portion of the rockshelter showed signs of disturbance where a pit was dug; however, it appeared to be fairly localized (see Figure 2a). An adult male skeleton was found in a flexed position associated with metal objects and two serrated “Comondú” type projectile points in the area encompassing unit B4 and the northern half of unit C4 (Fujita 2010; Fujita and Melgar 2014:114). A human bone sample was dated to 800 ± 40 RCYBP, or AD 1180 to 1280 (Beta-159194), indicating that the body was interred during the Late Period. Though this part of the site shows disturbance, it is not extensive, and none of the pearl artifacts were uncovered from the
### Table 2. Characteristics and Morphometrics of Pearl Artifacts from the Covacha Babisuri Site.

<table>
<thead>
<tr>
<th>Cat. No</th>
<th>Unit, Stratum, Level</th>
<th>Depth (cm):</th>
<th>Major Axis (mm) ±SD:</th>
<th>Minor Axis (mm) ±SD:</th>
<th>Circumference (mm) ±SD:</th>
<th>Distance from Channel to One End (mm) ±SD:</th>
<th>Distance from Channel to the Other End (mm) ±SD:</th>
<th>Width of Channel at the Base (mm) ±SD:</th>
<th>Upper Channel Width (mm) ±SD:</th>
<th>Color: Shape: Smoked:</th>
</tr>
</thead>
<tbody>
<tr>
<td>284 z</td>
<td>F3, II, h</td>
<td>35-40</td>
<td>9.7</td>
<td>8.6</td>
<td>30.5</td>
<td>3.8±0.04</td>
<td>2.7±0.08</td>
<td>0.6±0.1</td>
<td>1±0.06</td>
<td>white spherical yes slightly</td>
</tr>
<tr>
<td>348 z</td>
<td>E3, II, i</td>
<td>40-45</td>
<td>11.2</td>
<td>11</td>
<td>36.8</td>
<td>7.2±0.06</td>
<td>3.7±0.07</td>
<td>0.4±0.05</td>
<td>1±0.08</td>
<td>golden oval yes slightly</td>
</tr>
<tr>
<td>376 z</td>
<td>I4, II, j</td>
<td>45-50</td>
<td>8.7</td>
<td>8.6</td>
<td>28</td>
<td>4.2±0.03</td>
<td>3.9±0.04</td>
<td>0.5±0.07</td>
<td>1.3±0.05</td>
<td>light golden spherical yes</td>
</tr>
<tr>
<td>436 z</td>
<td>H4, II, k</td>
<td>50-55</td>
<td>11.5</td>
<td>10.9</td>
<td>36.6</td>
<td>5.9±0.01</td>
<td>1.9±0.03</td>
<td>1±0.05</td>
<td>1.4±0.09</td>
<td>white irregular no</td>
</tr>
<tr>
<td>787 z</td>
<td>E3, II, o</td>
<td>70-75</td>
<td>9.1</td>
<td>8.3</td>
<td>28.9</td>
<td>2.8±0.01</td>
<td>5.5±0.06</td>
<td>0.6±0.03</td>
<td>1.3±0.03</td>
<td>golden irregular yes</td>
</tr>
<tr>
<td>199 c</td>
<td>F4, III, b</td>
<td>58-60</td>
<td>10</td>
<td>9</td>
<td>8.9</td>
<td>4.9±0.02</td>
<td>1±0.06</td>
<td>0.3±0.06</td>
<td>0.5</td>
<td>light golden spherical yes</td>
</tr>
<tr>
<td>609 z</td>
<td>F6, III, b</td>
<td>55-60</td>
<td>9.2±0.35</td>
<td>8.2±0.49</td>
<td>29±1.32</td>
<td>5.1±0.06</td>
<td>2.8±0.53</td>
<td>0.7±0.01</td>
<td>0.9±0.13</td>
<td>white spherical yes slightly</td>
</tr>
<tr>
<td>911 z</td>
<td>E4, III f</td>
<td>75-80</td>
<td>12</td>
<td>10.9</td>
<td>38</td>
<td>5.6±0.12</td>
<td>5.9±0.11</td>
<td>1.1±0.07</td>
<td>white spherical yes slightly</td>
<td></td>
</tr>
<tr>
<td>984 z</td>
<td>E2, III h</td>
<td>85-90</td>
<td>4.1</td>
<td>3.6</td>
<td>12.5</td>
<td>2.6±1.1</td>
<td>0.9±0.09</td>
<td>0.6±0.03</td>
<td>white spherical no</td>
<td></td>
</tr>
<tr>
<td>976 z</td>
<td>E2, III, h</td>
<td>85-90</td>
<td>3.9</td>
<td>3.7</td>
<td>12.6</td>
<td>2.5±0.02</td>
<td>1±0.06</td>
<td>0.3±0.06</td>
<td>0.5</td>
<td>light golden spherical yes</td>
</tr>
<tr>
<td>1003 z</td>
<td>G2, III, i</td>
<td>90-95</td>
<td>9.2</td>
<td>8.2</td>
<td>29.1</td>
<td>4.9±0</td>
<td>4.1</td>
<td>0.9±0.06</td>
<td>light brown spherical yes</td>
<td></td>
</tr>
<tr>
<td>1010 z</td>
<td>F2, III, j</td>
<td>95-100</td>
<td>5.7±0.1</td>
<td>5.5±0.13</td>
<td>18.3±1</td>
<td>2.5±0.03</td>
<td>2.7±0.03</td>
<td>0.4±0.05</td>
<td>1±0.05</td>
<td>light golden spherical yes</td>
</tr>
<tr>
<td>1015 z</td>
<td>G2, III, k</td>
<td>100-105</td>
<td>7.6</td>
<td>7.5</td>
<td>25.1</td>
<td>2.5±0.06</td>
<td>4.1±0.13</td>
<td>0.4±0.13</td>
<td>1.2±0.29</td>
<td>light golden spherical yes</td>
</tr>
<tr>
<td>1021 z</td>
<td>F2, III, k</td>
<td>100-105</td>
<td>4.8±0.43</td>
<td>4.2±0.36</td>
<td>14.8±1.35</td>
<td>3±0.12</td>
<td>2±0.15</td>
<td>0.5</td>
<td>0.9±0.04</td>
<td>white spherical no</td>
</tr>
<tr>
<td>1054 z</td>
<td>G2, III, m</td>
<td>110-115</td>
<td>9</td>
<td>6.8</td>
<td>27.3</td>
<td>6.4±0.17</td>
<td>2.1±0.18</td>
<td>1.5±0.09</td>
<td>golden spherical yes</td>
<td></td>
</tr>
</tbody>
</table>

Note. For specimens 348z and 376z, two different values are shown because of the presence of two incision lines. The values for specimen 199c are based on Fujita (2006).
disturbed area (all pearl artifacts were found in units of the E-I transects) (see Figures 2, 3, 4, 6). In addition, evidence of krotovina indicates the potential for minor disturbance of deposits.

Over 100,000 bivalves from 41 taxa and almost 60,000 gastropods belonging to 47 taxa were recovered (Fujita 2002, 2004, 2007, 2008a). Palmate oyster (Saccostrea palmula) was the most abundant species of bivalve, comprising about 68 percent of bivalve remains (calculated as MNI), followed by pearl oyster (Pinctada mazatlanica), which made up about 9 percent of bivalve remains. Other common bivalve species include cardita clam (Carditamera affinis), California venus clam (Chione californiensis), frilled venus clam (Chione undatella), and lucine clam (Codakia distinguenda). The most abundant gastropods were Mexican turbo snail (Turbo fluctuosus), Eastern Pacific fighting conch (Strombus gracilior), rough-ribbed nerite (Nerita scabricostata), and granulated conch (Persististrombus granulatus), collectively accounting for the majority (86 percent of MNI) of gastropod remains.

The tradition of grooving pearls appears to have continued from the Early Holocene into the Middle Holocene in conjunction with a distinct set of other artifacts that includes Olivella spire-lopped beads, pearl oyster circular fishhooks, coral abraders, coral drills, and gastropod drills. Primary differences in artifact assemblages between the lowest and middle strata include the lack of fossil shells as a material for tool production in stratum II/II’ and the character of the projectile point assemblage, which revealed different types in this stratum, including a broken La Paz stemmed point (see Massey 1955). Although lithic tools do not show much difference between the Early and Middle Holocene components, there are differences in relative abundances of primary tool types. Stratum III contained higher numbers of scrapers; cutting tools, abraders, milling stones, and hand stones were more prevalent in stratum II/II’.

Pearl oyster (Pinctada mazatlanica) shells are present in all site components; however, their densities vary between strata, with higher values in the Middle and Late Holocene components. Correspondingly, relative densities for most of the primary shell taxa that were harvested as a dietary resource increased during the Middle Holocene (stratum II/II’). The notable decrease of the heavier, fossilized shells of dosinia clam (Dosinia ponderosa), bittersweet clam (Glycymeris gigantea), giant Pacific cockle (Laevicardium elatum), and Mexican flat scallop (Euvola vogdesi), which were used as containers and in tool production, helps distinguish Early Holocene from Middle Holocene deposits. These mollusk species are also found in stratum II/II’, where they are not fossilized and their numbers are greatly diminished, indicating they were gathered live as food. In addition, the majority of the shell remains in the Middle Holocene layer are more heavily fragmented when compared to those in the Early Holocene deposit.

Pearl Ornaments from the Covacha Babisuri Site

Fourteen grooved pearls from pearl oysters (Pinctada mazatlanica) and one pearl from a chocolate clam (Megapitaria sp.) (1003z) were recovered during excavations at the Covacha Babisuri site (Table 2, Figure 7). No modified pearls were present in the uppermost cultural deposit (stratum I), which represents Late Holocene occupations. Seven pearls were complete or nearly complete, and the remaining pearls were fragments exhibiting various degrees of exfoliation. The majority were spherical; however, slightly oval and rectangular forms were also present. The predominant color was “golden” according to the Shirai (1994) color classification; however, there were also white pearls, and most pearls appeared to be slightly smoked.

This “smoky” coloration may be a result of the mollusks being placed in a fire, a technique for opening them. This practice was described by several men
Figure 7. Grooved pearls from the Covacha Babisuri site. Specimen 1003 Z is a chocolate clam pearl; all other specimens are pearl oyster pearls.
sent by Vasco Nuñez de Balboa to collect the pearls from Native divers before the pearls were “… injured by heat like those collected by the Indians, who opened the shells by putting them in a fire …” (Kunz 1890:241). A more thorough description was given by Inca de la Vega who noted that a bonfire was made and reduced to coals upon which oysters were placed: “they quickly opened with the heat … [and the pearls] were of a fine quality, but somewhat discolored by the fire and smoke” (Kunz 1890:244–245). Another account suggests that pearls were “… bored by means of fire, which had discolored them …” (Kunz 1890:244), again suggesting slight discoloration from contact with smoke and fire.

The lone chocolate clam (*Megapitaria* sp.) pearl was identified by its porcelainous surface, which is formed by flame structure crystals composed of calcium carbonate (Landman and Mikkelsen 2001). It was one of 10 modified pearls found in the lower deposit, stratum III. This pearl has a very homogeneous and clear groove encompassing the entire circumference nearer to one end of the pearl. This slightly teardrop-shaped pearl also appears to have been smoked, accounting for its slightly brownish color. This is the only clam (*Megapitaria* sp.) pearl found to date in archaeological contexts on the island; however, an additional specimen was recently uncovered at the Ensenada de los Muertos site, approximately 50 km east of La Paz (Alfonso Rosales, personal communication 2016).

No pearls were subjected to AMS radiocarbon assay. Ten modified pearls were uncovered in the Early Holocene cultural stratum (stratum III), and five were found in stratum II, which was dated between ca. 8000 and 3000 cal BP (Table 1). The cultural strata appear to have been fairly intact in the units from which these artifacts were recovered, suggesting the likelihood they retained good chronological context. We cannot, however, completely rule out the possibility that one or more of the pearls had slipped into lower levels.

**Pearl Morphology**

Morphometric analyses were conducted on 14 of the 15 modified pearls, and results were statistically compared (Tables 2 and 3). Unfortunately, one of the modified pearls (Specimen 199c) is missing; however, the morphometric data acquired from previous analysis of this specimen is presented in Table 2. The pearls were photographed, and morphometric measurements were taken, including the maximum and minimum axes and the distance from the groove to both ends of the pearl. The width of the groove was measured with an accuracy of 0.01 mm using the software SigmaScan Pro5®.

Analysis of variance tests (one-way ANOVA) were conducted to investigate potential similarities in size and shape of selected pearl specimens (Table 3). An analysis of variance comparing the shapes of the pearl artifacts using maximum and minimum axis measurements showed no significant difference (F (1, 28) = 0.58, \( p = 0.45 \)) between these values, suggesting similarity in the ratio of “length” and “width” measurements of pearls in this assemblage and implying a predominantly spherical shape overall. However, a comparison of pearl sizes, using circumference and maximum and minimum axis values, showed highly significant differences (F (2, 39) = 53.07, \( p < 0.001 \)) in size between pearls. These tests demonstrate relatively large variation in sizes of selected pearls with a general uniformity of shape in selected specimens, suggesting perhaps they were selected for their roughly spherical shapes rather than their sizes.

Five worked pearls have grooves encompassing their entire circumference, and the remainder are only partially grooved (Table 2, Figure 8). Mean maximum and minimum values for the axes of the pearls are similar, suggesting relative homogeneity in the ratios of length versus width measurements (Tables 3, 4) and contributing to the hypothesis that they were selected for their similarity in being of relatively spherical shape. Due to the “V” shape of pearl grooves, two
Table 3. Results of Analysis of Variance (One-Way ANOVA) Tests.

<table>
<thead>
<tr>
<th></th>
<th>Degrees of Freedom (DF)</th>
<th>Sum of Squares (S)</th>
<th>Mean Square</th>
<th>F-Value</th>
<th>Significance</th>
</tr>
</thead>
<tbody>
<tr>
<td>Pearl shape(^a)</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Between groups</td>
<td>1</td>
<td>3.8163333</td>
<td>3.8163333</td>
<td>0.58</td>
<td>0.4509</td>
</tr>
<tr>
<td>Within groups</td>
<td>28</td>
<td>182.7773333</td>
<td>6.5277619</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Total:</td>
<td>29</td>
<td>186.5936667</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Pearl size(^b)</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Between groups</td>
<td>2</td>
<td>3130.220476</td>
<td>1565.110238</td>
<td>53.07</td>
<td>&lt;.0001</td>
</tr>
<tr>
<td>Within groups</td>
<td>39</td>
<td>1150.184286</td>
<td>29.491905</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Total:</td>
<td>41</td>
<td>4280.404762</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Note. One-way ANOVA tests were run using SAS statistical software.
\(^a\) Defined as differences between mean maximum axis (length) and minimum axis (width) measurements for 14 pearls (all 15 pearls were included in this analysis).
\(^b\) Defined as differences between mean circumferences, mean maximum axis (length), and mean minimum axis (width) measurements of 14 pearls (Cat. No. 199c was excluded due to missing circumference value).

Table 4. Mean Pearl Morphometrics.

<table>
<thead>
<tr>
<th></th>
<th>Major Axis</th>
<th>Minor Axis</th>
<th>Distance to One End</th>
<th>Distance to Other End</th>
<th>Channel Width</th>
</tr>
</thead>
<tbody>
<tr>
<td>( \mu \pm SE )</td>
<td>8.26 ± 1.94</td>
<td>7.57 ± 1.74</td>
<td>4.23 ± 0.72</td>
<td>3.09 ± 0.61</td>
<td>0.69 ± 0.46</td>
</tr>
<tr>
<td>( n )</td>
<td>14</td>
<td>14</td>
<td>14</td>
<td>14</td>
<td>14</td>
</tr>
<tr>
<td>( \sigma )</td>
<td>2.60</td>
<td>2.46</td>
<td>1.58</td>
<td>1.49</td>
<td>0.52</td>
</tr>
<tr>
<td>( CV )</td>
<td>31%</td>
<td>32%</td>
<td>37%</td>
<td>47%</td>
<td>46%</td>
</tr>
</tbody>
</table>

Note. All measurements are in mm. Pearl average sizes (\( \mu \)) using maximum and minimum axes, standard error (SE), number of pearl artifacts measured (\( n \)), standard deviation (\( \sigma \)), and Pearson variation coefficient (CV) expressed as a percentage.

Figure 8. Example of grooved channels on pearl artifact; the "V" shape of grooved channels and their characteristics correspond to shark tooth structure and shape.
width measurements were taken of each groove, one at the base of the groove and one at the top of the groove (i.e., pearl surface). Frequency analysis identified a bimodal distribution of groove width measurements, with modes at 0.5 ± 0.01 mm (n = 11) and 1.01 ± 0.03 mm (n = 3), in addition to one outlier containing a fairly thick groove of 1.5 mm (Figure 9). This frequency distribution suggests two primary clusters of groove width. It is possible that different types of fibers were intended for the various sized grooves (i.e., human hair and vegetal fibers). This is, however, a relatively small sample, and the two modes are separated by only a fraction of a millimeter, minimizing the significance of this difference.

Groove position was found to be perpendicular to either the major or minor axis, although on more circular specimens it is fairly impossible to measure (see Figure 7). Groove placement was quantified by measuring the distances from the center of the groove to either end of the pearl. These distance measurements were then transformed into spherical percentages using the maximum and minimum axes to determine the relative position of the groove (Table 5). Modified pearls in this assemblage exhibited grooves situated in one of two distinct locations, either roughly in the center of the pearl or nearer to one end of the pearl. Four pearls displayed a centrally placed groove, nine displayed grooves located nearer to one end of the pearl, and one specimen contained two grooves, one in the center and the other nearer to one end (specimen No. 376z), suggesting purposeful carving of grooves closer to the “top” of the specimen. The Early Holocene assemblage (stratum III) is comprised of six pearls containing grooves located nearer to one end (i.e., “top”) of the pearl, and three exhibiting centrally placed grooves. The Middle Holocene component (stratum II) contained three pearls displaying four grooves located nearer to one end and two pearls exhibiting centrally placed grooves. The missing pearl, specimen 199c, was not included in this analysis. A simple T-test showed no significant difference ($t = -0.707, p = 0.276, \alpha = 0.05$) in the relative abundances of the two groove locations between the Early and Middle Holocene components at this site.

**Possible Tools Used for Grooving Pearls**

The widths of grooved channels carved into the pearl artifacts in this assemblage show relative homogeneity (CV = 46 percent) (Table 4), suggesting that a specialized tool was used for making the incisions. We propose that surface abrasion and the thinness of the groove suggests the use of a serrated cutting object. In our search for naturally occurring elements with a serrated edge, we encountered shark teeth. Average
hardness values of shark teeth (≈ 7 on the Mohs scale) and pearls (2–3 on the Mohs scale) indicate shark teeth would be effective for grooving pearls (Gilbert 1977; Landman and Mikkelsen 2001; Whitenack et al. 2010; Enax et al. 2012).

An initial experiment with non-serrated shark teeth (i.e., *Isurus oxyrinchus*, Mako shark) was unsuccessful because the smooth edges of the teeth made them slippery and inadequate for incising. However, the use of serrated shark teeth produced a groove similar to those seen on the archaeological pearls. Cabo San Lucas area historical documents from 1644 mention the use of lithic tools to groove pearls as observed by Captain Alonso Gonzáles Barriaga (Mathes 1980:45). In the early 1700s Woodes Rogers reported the use of shark teeth as cutting tools in the same area (Mathes 1980:55). To test the potential of serrated shark teeth to groove pearls, we first obtained and measured serrated teeth of species commonly found in La Paz Bay—blue shark (*Prionace glauca*), gambuzo shark (*Carcharhinus obscurus*), and tiger shark (*Galeocerdo cuvier*).

The serrated edge thicknesses of 75 teeth from the three species were measured using an electronic caliper with 0.01 mm precision, resulting in a mean hardness of 7.3 ± 0.4 on the Mohs scale. These values were then compared to the hardness of pearls (2–3 on the Mohs scale). The results indicated that shark teeth are effective for grooving pearls, as seen in the archaeological specimens.

### Table 5. Groove Positions on Pearl Artifacts from the Covacha Babisuri Site.

<table>
<thead>
<tr>
<th>Componenta</th>
<th>Catalog No.</th>
<th>Distance % to One Endb</th>
<th>Distance % to the Other Endb</th>
<th>Remaining % Valueb</th>
<th>Derived Position</th>
</tr>
</thead>
<tbody>
<tr>
<td>Str. II, Middle</td>
<td>284z</td>
<td>39</td>
<td>28</td>
<td>33</td>
<td>Center</td>
</tr>
<tr>
<td>Str. II, Middle</td>
<td>348z</td>
<td>64</td>
<td>33</td>
<td>3</td>
<td>Top</td>
</tr>
<tr>
<td>Str. II, Middle</td>
<td>376z</td>
<td>49</td>
<td>45</td>
<td>6</td>
<td>Center</td>
</tr>
<tr>
<td>Str. II, Middle</td>
<td>376z</td>
<td>62</td>
<td>36</td>
<td>6</td>
<td>Top</td>
</tr>
<tr>
<td>Str. II, Middle</td>
<td>436z</td>
<td>52</td>
<td>17</td>
<td>41</td>
<td>Top</td>
</tr>
<tr>
<td>Str. II, Middle</td>
<td>787z</td>
<td>30</td>
<td>60</td>
<td>10</td>
<td>Top</td>
</tr>
<tr>
<td>Str. III, Lower</td>
<td>609z</td>
<td>55</td>
<td>30</td>
<td>15</td>
<td>Top</td>
</tr>
<tr>
<td>Str. III, Lower</td>
<td>911z</td>
<td>47</td>
<td>49</td>
<td>4</td>
<td>Center</td>
</tr>
<tr>
<td>Str. III, Lower</td>
<td>976z</td>
<td>65</td>
<td>25</td>
<td>10</td>
<td>Top</td>
</tr>
<tr>
<td>Str. III, Lower</td>
<td>984z</td>
<td>64</td>
<td>21</td>
<td>15</td>
<td>Top</td>
</tr>
<tr>
<td>Str. III, Lower</td>
<td>1003z</td>
<td>54</td>
<td>45</td>
<td>1</td>
<td>Center</td>
</tr>
<tr>
<td>Str. III, Lower</td>
<td>1010z</td>
<td>45</td>
<td>48</td>
<td>7</td>
<td>Center</td>
</tr>
<tr>
<td>Str. III, Lower</td>
<td>1021z</td>
<td>63</td>
<td>41</td>
<td>4</td>
<td>Top</td>
</tr>
<tr>
<td>Str. III, Lower</td>
<td>1015z</td>
<td>33</td>
<td>54</td>
<td>13</td>
<td>Top</td>
</tr>
<tr>
<td>Str. III, Lower</td>
<td>1054z</td>
<td>71</td>
<td>23</td>
<td>6</td>
<td>Top</td>
</tr>
</tbody>
</table>

Note: Stratum II, the Middle Component, corresponds roughly with Middle Holocene occupations of the site; and stratum III, the lower component, corresponds roughly with Early Holocene occupations. Detailed provenience for each specimen, including unit and level are provided in Tables 1 and 2.

b This table displays distances from the center of the channel to both ends of the pearl, transformed into percentages using major and minor axis measurements (see Table 2) to elucidate the channel position. As these pearls are not perfectly circular spheres and channel grooves are not perfectly perpendicular or equally placed around the pearls, the derived percentages represent a fundamentally theoretical circular shape resulting in inconsistencies in the sum of percentages, which do not always equal 100%. The missing values (identified as “remaining % value” on this table) are a result of variation in sphericity and fragmentation of specimens (see Figure 5).

c Specimen No. 376z contains two grooves. Specimen No. 348z also displays two grooves; however, it is partially fragmented precluding exact measurements, so was not included in this table.
measurement of 0.68 ± 0.01 mm. All shark tooth measurements were taken at the base of the dentition, approximately 2 mm from the edge of the tooth (Figure 10). Figure 11 displays the width dimensions of pearl grooves and shark tooth edge measurements. Fourteen of the 15 measured pearl groove widths fall within the range of shark tooth width measurements, supporting the hypothesis that serrated shark teeth may have been used as tools for grooving pearls. In addition, these pearl grooves display a slightly triangular shape, or “V” shape, in that the base of the channel is narrower than the upper, or surface, width measurement. The triangular shape of shark tooth dentation implies it would produce a grooved channel of similarly variable widths, with the base of the groove corresponding to a thinner width at the very edge of the dentation and the upper width of the groove corresponding to larger widths at the base of the shark tooth dentation.

A preliminary experiment was conducted to test the hypothesis that serrated shark teeth may have been pearl-grooving tools. This study showed it was possible to create a groove in a pearl measuring 0.53 mm in width at its base after about 20 minutes of hand sawing with a serrated tooth of a tiger shark. This fine groove allowed pearls to be attached with human hair (Figure 12g) as described in historical accounts from the southern part of the Baja California peninsula (Barco 1973:183). Pearls with wider grooves, including most of the pearl artifacts in this assemblage, could not be strung with human hair and were likely attached to bracelets and necklaces with vegetable fibers as described in additional historic records (Mathes 1980:53). Based on these analyses, we suggest that serrated shark teeth were likely used to create grooves on pearls, allowing them to be hung as items of adornment. If so, then perhaps various forms of grooving tools were employed for this purpose, including serrated shark teeth and lithic flakes.

**Summary and Final Considerations**

Archaeological investigations at the Covacha Babisuri site on Espiritu Santo Island show the presence of pearl...
ornaments in deposits dated to the Early and Middle Holocene. There are numerous historic accounts describing pearls as ornaments, suggesting they were much esteemed among the ancient Californians in the Cape Region. Of the 15 pearl ornaments recovered from this rockshelter site, 14 are pearl oyster (*Pinctada mazatlanica*) nacre pearls, and one is a chocolate clam (*Megapitaria* sp.) pearl. There are no defining characteristics demarcating the Early from the Middle Holocene pearl artifact assemblages, suggesting relative continuity in type and style through time.

Ten pearls exhibit partial grooving, and five pearls reveal grooves that encompass the entirety of their circumference. There are two types of grooving positions on these pearl ornaments; some ornaments possess a centrally located groove, and others have a groove located nearer to one end of the pearl. Spatial and temporal analyses do not imply a distinction in groove type between components, suggesting that both groove locations occurred throughout the sequence.

Experimental studies suggest that groove width may relate to the width of the materials used to bind them, including strings of vegetable fiber or human hair as described in historic accounts. Preliminary experimental analysis showed that serrated shark teeth are effective tools for grooving pearls, and ethnohistoric accounts suggest that thin lithic flakes were also utilized for this purpose. In the future we hope to conduct experimental studies using thin flakes of various local lithic materials. In addition, we plan to conduct use-wear analysis of experimental pearls using scanning electron microscopy (SEM) imaging.

Morphometric analysis suggests distinct criteria were employed in the selection of pearls for grooving. Pearls appear to have been selected because they...
Figure 12. Photos regarding the experimental grooving of pearls: a) blue shark (*Prionace glauca*) tooth, b) gambuzo shark (*Carcharius obscurus*) tooth, c) tiger shark (*Galeocerdo cuvier*) tooth, d) "V" shaped groove on mother-of-pearl shell, e and f) experimental grooving on pearls, g) experimentally grooved pearl bound in human hair.
displayed a roughly spherical shape; size seems not to have been significant. In addition, smoking or lightly heating pearls may have been part of the modification process or might have resulted from placing fresh mollusks on coals or in fire to open them.

Based on historic accounts, the primary employments of pearl artifacts were as components for necklaces and bracelets as well as for hair adornment. Pearls were also hung from the nose and ears and used to decorate the tip of the power stick, or wand, of a Guaycura chief (Bravo et al. 1970:50). These historical testimonies support the notion that pearls were utilized and esteemed by the Indigenous people of the southern part of the Baja California peninsula during the historic era; the archaeological discoveries reported here suggest the potentiality that this practice may have been employed by some of the earliest inhabitants of the peninsula during the Early Holocene time period.

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