Lake Cahuilla’s Little Sister: Exploring the Role of Laguna Macuata in Colorado Desert Prehistory

Don Laylander, Antonio Porcayo Michelini, and Julia Bendímez Patterson

Abstract

Laguna Macuata is a southwestern branch of the Colorado River’s delta. It lies between the Peninsular Ranges’ Sierra Juárez to the west and the lower-elevation Sierra Cucapá and Sierra Mayor to the east. Like the much larger Salton Basin immediately to its north, Laguna Macuata’s floor extends below sea level, and it has been flooded at intervals with waters from the Colorado River and possibly also from the Gulf of California. The importance of Laguna Macuata in the prehistory of the Colorado Desert still remains largely unexplored. The modern characteristics of the basin, its early historic record, its ethnographic record, and the archaeological evidence available so far are reviewed here, and some research opportunities are suggested. Laguna Macuata’s likely role in Colorado Desert prehistory is compared and contrasted with that of its neighbor to the north, Lake Cahuilla. Both lakes offer important research opportunities for case studies of aboriginal adaptations to productive but exceptionally unstable natural environments.

The Modern Basin

The Laguna Macuata basin lies immediately south of the U.S./Mexico border (Figure 1). Its name has been spelled as Laguna Maquata or Laguna Maguate, and it is also known as Laguna Salada and the Pattie Basin, Ha wi mək in Cocopa, Ha ’ša ai or Ša in Tipai, and ’Ha si in Paipai (Kelly 1977:40; Hohenthal 2001:72, 316). The basin is situated between the Sierra Juárez on the west, with crest elevations generally in the 1,300–1,600 m range, and the Sierra Cucapá and its southern continuation, the Sierra Mayor, with crests typically at elevations of 600–900 m, on the east. To the north the low Yuha Desert separates the Laguna Macuata basin from the larger Salton Basin. In the south, a broad, low gap between the Sierra Mayor and the Sierra Las Pintas to the south opens the basin to the lower Colorado River delta. Like the Salton Basin, it is a fault-bounded tectonic graben. When Laguna Macuata is present, its dimensions are more similar to those of the modern Salton Sea than to those of prehistoric Lake Cahuilla (Table 1).

At present the Laguna Macuata basin is dry. Precipitation is extremely low, and little runoff from the Sierra Juárez reaches the bottom of the basin, where in any case it would quickly evaporate. Most of the Colorado River’s modern flow has been artificially diverted, so it is unlikely that any spontaneous meandering within the delta would now replenish Laguna Macuata. However, the lake has been resurrected intermittently since the 1970s, when a canal into the basin was constructed to manage flooding of the delta’s agricultural fields.

Seawater from the Gulf of California may have entered the basin during episodes of extremely high tides. Tides at the head of the gulf are reported to have reached as high as 5 m above msl and as low as 5 m below msl (Filloux 1973), while the lip of the basin is about 4 m above msl.

A series of palm canyons descend from the Sierra Juárez on the western margin of the Laguna Macuata basin. Notable canyons include Palmas de Cantú, Tajo
Figure 1. Map of the Laguna Macuata basin and its vicinity. (The plotted location of Agua de las Mujeres follows the maps by Godfrey Sykes in MacDougal [1907:704] and the map in Kniffen [1931], which do not match the textual description by MacDougal.)
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Canyon, Guadalupe Canyon, and Palomar Canyon. Archaeological sites are present near the mouths of the canyons, but the sites’ occupations were not necessarily related directly to Laguna Macuata; the canyons provided their own sources of fresh water and biotic resources, and the sites may have been occupied both when the lake was present and when it was absent.

Modern impacts to the Laguna Macuata basin and its prehistoric archaeological sites were summed up in 2002:

The eastern portion of the Sierra de Juárez presents a very important series of sites and camps that are found untouched. The advance of human impacts is almost nil, due to the extreme heat and such restricted communication. For that reason, today this is the only area [of the municipio, or county, of Mexicali] that is saved from destruction. The northern portion of the Laguna Salada, near the [U.S./Mexico] boundary line, is found to be seriously affected by works of infrastructure, from which it is possible to perceive various scars on the land, as in the cases of the Gasducto Bajanorte, the Petróleos Mexicanos pipeline, the Colorado River-Tijuana aqueduct, the Comisión Federal de Electricidad’s pylons, the highway, and sandpits [Serrano González 2008:35–36; translated from Spanish].

Additional impacts have come from recreational uses of the basin, notably from off-road vehicle races. The Instituto Nacional de Antropología e Historia has coordinated with state and local governmental agencies and event organizers in efforts to avert damage to archaeological sites from these races.

Table 1. Dimensions of Laguna Macuata, Lake Cahuilla, and the Salton Sea.

<table>
<thead>
<tr>
<th></th>
<th>Laguna Macuata</th>
<th>Lake Cahuilla</th>
<th>Salton Sea</th>
</tr>
</thead>
<tbody>
<tr>
<td>Length</td>
<td>82 km</td>
<td>180 km</td>
<td>55 km</td>
</tr>
<tr>
<td>Maximum width</td>
<td>29 km</td>
<td>50 km</td>
<td>25 km</td>
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<tr>
<td>Surface area</td>
<td>820 km²</td>
<td>5,500 km²</td>
<td>890 km²</td>
</tr>
<tr>
<td>Volume</td>
<td>5.7 km³</td>
<td>232 km³</td>
<td>7.4 km³</td>
</tr>
<tr>
<td>Minimum elevation of the basin</td>
<td>–10 m</td>
<td>–84 m</td>
<td>–84 m</td>
</tr>
<tr>
<td>Elevation of the basin’s lip</td>
<td>+4 m</td>
<td>+12 m</td>
<td>–</td>
</tr>
<tr>
<td>Maximum depth of the lake</td>
<td>14 m</td>
<td>96 m</td>
<td>13 m</td>
</tr>
<tr>
<td>Modern annual evaporation</td>
<td>242 cm</td>
<td>182 cm</td>
<td>182 cm</td>
</tr>
<tr>
<td>Estimated minimum filling time</td>
<td>0.3 year</td>
<td>18 years</td>
<td>0.4 year</td>
</tr>
<tr>
<td>Duration of full stands</td>
<td>probably very brief</td>
<td>possibly either long or moderately brief</td>
<td>–</td>
</tr>
<tr>
<td>Estimated minimum recession time</td>
<td>6 years</td>
<td>56 years</td>
<td>–</td>
</tr>
</tbody>
</table>

Note: The surface dimensions of Laguna Macuata are taken from mapping in Topography International (1986). Laguna Macuata elevations are based on Google Earth data. The volume of Laguna Macuata has been roughly estimated as its area times half its depth. The evaporation rate for the Laguna Macuata basin is based on Compean Jiménez et al. (1984). Lake Cahuilla statistics are based on Laylander (1997). The Salton Sea’s dimensions have fluctuated since its creation in 1905.
The Basin during the Early Historic Period

Written records for the Colorado River delta region began in 1539, when a maritime expedition under Francisco de Ulloa reached the head of the Gulf of California. In 1540 another maritime expedition under Hernando de Alarcón traveled up the Colorado River at least as far as the site of present-day Yuma. In the same year an overland expedition from Sonora under Melchor Díaz reached the lower Colorado River and crossed it to the west at an undetermined point, possibly in the delta.

Laguna Macuata made its most notorious contribution to world history in the early seventeenth century. An overland expedition from New Mexico under Juan de Oñate descended the Colorado River to its mouth in 1604–1605. Francisco de Escobar, a somewhat credulous Franciscan friar who had taken part in the expedition, delivered a written report of its observations to the Spanish viceroy in Mexico City in the latter year. On January 25, 1605, according to Escobar,

We reached, to our great joy, the Sea or Gulf of California, where, according to some seamen, we saw the finest bay or port (either name will do) that any of them had seen … which the Río de Buena Esperanza [Colorado River] forms as it enters the sea three or four leagues [about 15–20 km] wide at its mouth, in the opinion of some seamen who saw it when I did. The river mouth is divided in two by a small islet that lies halfway across it, a league and a half or two leagues in length, lying southeast to northwest and very effectively protecting the bay, with each mouth a league and a half or two in width.

The Río de Buena Esperanza runs into the sea from west to east along the foot of some mountains [the Sierra Cucapá and Sierra Mayor] that stretch almost north to south or north-northwest to south-southeast toward the sea, where one promontory projects for about six leagues into the bay. It ends in three low rounded promontories, the last higher than the other two; beyond these, toward the land, it forms a higher promontory, from which the mountains form a sharp crest that runs for more than 20 leagues north-northwest south-southeast, according to what I could judge from a distance about how the mountains enter the sea, which along this coast lies from east to west and bends around behind these mountains to the north and northeast, according to what all the Indians said, none of them knowing where it ends.…

[An Indian chief] told us about all the people who live along the Río de Buena Esperanza as far as its source, indicating that it lies to the northwest by the sea, he and many others all stating that the Gulf of California curves around that far [Caso et al. 2014:9–10; translated from Spanish].

Thus, according to the Oñate expedition’s understanding, the Gulf of California in 1605 extended beyond the mouth of the Colorado River, around the southern end of the Sierra Mayor, and into the Laguna Macuata basin (Table 2). It is possible that at this time the sediments forming the lip of the basin had not yet built up as high as they subsequently would and that the gulf did indeed continue into the basin. Alternatively, it is possible that fresh water from the Colorado River rather than salt water from the gulf extended into the basin in 1605.

The expedition’s belief that the gulf continued far to the north created substantial confusion among European geographers for more than a century (Polk 1991; Laylander 2004a). Following the earlier maritime expeditions under Ulloa and Alarcón, mapmakers in the late sixteenth and early seventeenth centuries had
agreed that the Gulf of California ended at the mouth of the Colorado River and that Baja California was a peninsula. The Oñate expedition’s contrary conclusion was propagated textually in the early decades of the seventeenth century by friar Antonio de la Ascención, a participant in Sebastián Vizcaíno’s 1602–1603 west coast expedition. It was spread graphically through a Spanish map that fell into the hands of Dutch pirates and was published by an English cartographer in 1625. Until well into the eighteenth century, numerous European maps would depict in detail the imaginary north-eastern and northern coasts of the island of California (León-Portilla 2001). This misunderstanding was due in considerable part to Laguna Macuata.

In September 1771 Franciscan missionary-explorer Francisco Garcés, traveling west from the Colorado River delta, reached the Sierra Cucapá. “He was … told of Indians near a large body of water, three days west and beyond the Sierra, and he determined to find them. The people, or the water, or both, he was not sure which, were called Maqueque, or Maquete,” a name evidently retained by Laguna Macuata (Bolton 1917:326). Despite his efforts, Garcés was unable to reach the lake.

In March 1774 the first of Juan Bautista de Anza’s two expeditions linking Sonora with Alta California entered the northern edge of the Laguna Macuata basin. The episode was described in the diaries of Garcés and another Franciscan, Juan Díaz, as well as that of Anza.

Garcés wrote about reaching a dry lake, which covers almost an entire valley, having many fish of various sizes on the beach. All of us were of the opinion that this lake had communication with the sea and was the same as the Agua Amarilla [Laguna Macuata] of which I make mention in my diary on the 21st of September [1771]. Since the soil of these lands is very salty … it may be that this is the reason why the large fish come up from the sea to this lake. Not so many come up the Colorado River, for in my last journey when I asked for the large fish,

<table>
<thead>
<tr>
<th>Date</th>
<th>Condition</th>
<th>References</th>
</tr>
</thead>
<tbody>
<tr>
<td>January 1605</td>
<td>Lake or sea lagoon (?)</td>
<td>Caso et al. 2014</td>
</tr>
<tr>
<td>September 1771</td>
<td>Lake (?)</td>
<td>Bolton 1917</td>
</tr>
<tr>
<td>March 1774</td>
<td>Dry</td>
<td>Bolton 1930(2)</td>
</tr>
<tr>
<td>April 1785</td>
<td>Dry</td>
<td>Ives 1984</td>
</tr>
<tr>
<td>October 1796</td>
<td>Dry</td>
<td>Arrillaga 1969</td>
</tr>
<tr>
<td>February 1828</td>
<td>Dry</td>
<td>Pattie 1831</td>
</tr>
<tr>
<td>August 1884</td>
<td>Large lake with abundant large fish</td>
<td>Orcutt 1891</td>
</tr>
<tr>
<td>January, February 1890</td>
<td>Dry</td>
<td>Orcutt 1891</td>
</tr>
<tr>
<td>Summer 1890</td>
<td>Lake full</td>
<td>Orcutt 1891</td>
</tr>
<tr>
<td>October 1890</td>
<td>Saline remnant of the lake</td>
<td>Orcutt 1891</td>
</tr>
<tr>
<td>1893</td>
<td>Lake full</td>
<td>MacDougal 1907</td>
</tr>
<tr>
<td>April 1905</td>
<td>Inflowing waters</td>
<td>MacDougal 1907</td>
</tr>
<tr>
<td>1907</td>
<td>Receding lake</td>
<td>MacDougal 1907</td>
</tr>
</tbody>
</table>

Table 2. Early Historic-Period Reports on the Basin.
the Indians always answered me by pointing below the sierra. They also have said that a sierra enters the sea and is greatly cut up, the water communicating from one part to another. And so it may be true that behind the sierra and this estuary the sea comes farther up than at the place where the Colorado River empties, and it is possible that this estuary or lagoon which we passed has no connection with the sea in the dry season, although it was miry [Bolton 1930(2):335–336].

Similarly, Díaz wrote in his diary:

The lake which is near here extends the whole length of a valley formed by the sierra of San Geronimo [Sierra Cucapá] and another chain of very high mountains [Sierra Juárez] which comes from California…. In the same valley, ten or twelve leagues farther down, is the place where the reverend father Fray Francisco Garcés saw the Agua Amarilla, as he says in his diary. From this information and from a very large school of sea-fish which we have found on the beach in this place all along the banks of the lake, together with many other signs which show clearly that it is water from the sea which it has received at some other time, we have inferred that the Agua Amarilla of the father is some large estuary formed in time of heavy rains, or perhaps by the sea during some extraordinary overflow, aided by the drainage of these mountains, and that it extends the full length of this valley and afterwards returns to its regular state [Bolton 1930(2):277–278].

In April 1785 California Governor Pedro Fages and the soldier José Velásquez headed east from the Dominican mission and military center of San Vicente in northwestern Baja California. They hoped to reopen the land connection with Sonora in the aftermath of the 1781 Quechan revolt. Traveling north from Arroyo Grande between Sierra Las Pintas and Sierra Las Tinajas to Sierra Mayor, they found the southeastern bed of Laguna Macuata to be a dry plain (Ives 1984:186–189)

In October 1796 another Spanish soldier, José Joaquín de Arrillaga, scouted the Colorado Desert to look for a possible mission site that might link the Dominican missions of northwestern Baja California with the Colorado River. His travels took him across the mouth of the Laguna Macuata basin and up its western edge. He described the area as a plain, “arid and dry, which is nothing but sand, and does not even have pasture” (Arrillaga 1969:92).

James Ohio Pattie provided the first account of the basin by travelers from the United States. In February 1828 Pattie, his father, and a group of other American fur trappers traveled from the Colorado River delta to the Dominican missions in northwestern Baja California. In a book narrating his adventures in the Far West, Pattie described the group’s harrowing passage through the dry basin that would later be named after Pattie or his father as the Pattie Basin (Pattie 1831:158–164).

Additional records of the dry or flooded basin were provided by observers during the late nineteenth and early twentieth centuries, in the period prior to the complete harnessing of the Colorado River’s flow by dams and irrigation canals. For instance, the naturalist Charles Russell Orcutt (1891) heard about the lake in 1884 and made visits to the basin in 1890, reporting for various times its dry, full, and partial lake stands.

According to D. T. MacDougal (1907:14), “The inundation begins ordinarily in late May or early in June and lasts two months or more.” Concerning the rate of the lake’s recession, he reported,
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The winter floods of 1905–1906 … filled the Laguna Maquata to a high level, and this had receded at such a rate that at the time of our visit [1907] it had less than a third of its recent maximum area. Another year or two without accession from the delta and its floor would again be dry [MacDougal 1907:15].

Ethnographic Accounts of Activity in the Basin

Twentieth-century observers and ethnographers reported the activity of Native groups in visiting the Laguna Maquata basin, or more frequently in hurriedly crossing it to reach other destinations. MacDougal reported information on travel routes and way-stations:

The Cucopa Indians who have inhabited the lower part of the delta about the mouth of the Hardy for some time, singularly enough, hold the closest communication and intermarry with the tribes inhabiting the mountains to the westward of the basin. Two main trails are used. One crosses the Cucopa Mountains in the vicinity of the Borrego Peak … The main ridge is crossed through a low pass, and then the way leads through granite, volcanic and clay ridges to where, among the bad lands, a seepage in a sand wash, known as Agua de las Mujeres, furnishes a small but unfailing supply. From here a blind trail leads, straight as may be, due west across the valley to the mouth of the Palomar Cañon, up which, at a distance of about three miles, running water and the grateful shade of groves of palms may be encountered.…

The trail from Agua de las Mujeres to Palomar Cañon passes to the south of Laguna Maquata, and it makes a distance of about 30 miles across a desert plain, baking in the vertical rays of a tropical sun. The route is found entirely by directions or ranges on somewhat indefinite topographical features, and it requires experience and a stout heart to dare the journey in midsummer. The great sheet of the flood which fills the Laguna at times moves across a section of this trail several miles in length, covering it to a depth of a few inches or a few feet … [MacDougal 1907:724–726].

An alternative aboriginal route from the delta into the mountains passed south of the Laguna Maquata basin.

The geographer Fred B. Kniffen conducted fieldwork in the Colorado River delta in 1927–1930, making ethnographic and archaeological observations as well as geographical ones. According to Kniffen:

Annually the Cocopa made trips to the Sierra Juarez….The purpose of the trips was to gather piñon nuts and acorns, and to trade with the Paipai for wild sheep skins.

The trip to the mountains, across the dry and desolate Pattie Basin, was a difficult one, and the routes followed had to be so chosen as to take full advantage of the available water. As a result certain trails became established.…

[In addition to the trail discussed above by MacDougal 1907:724–726,] another trail led across the low range north of Sierra Mayor and passed directly across Pattie Basin to the Sierra Juarez. Still another passed around the southern point of Mayor in Pozo Coyote.… From Pozo Coyote the trail divided, one branch going to Pozo Cenizo…. The Cocopa say that they carried no water on these trips but did carry fire [Kniffen 1931:53].

Based on fieldwork conducted between 1940 and 1952, ethnographer William H. Kelly (1977:21) reported that “during those years when the conditions of flood and tide forced fresh water from the [Río] Hardy
into this basin, certain sections along the main slough could be farmed. Some western Cocopa planted crops there, but there were no permanent habitations.” According to Kelly (1977:40), east-west travel across the Laguna Macuata basin created significant economic opportunities. For the delta-based Cocopa, the eastern slopes of the Sierra Juárez offered cactus fruits and agave, and its summit offered pine nuts. For the mountain-based Tipai and Paipai, travel to the delta offered access to its agricultural products.

To go to the mountains from Wi Ahwir territory [in the Río Hardy area of the south-western Colorado River delta], … the party traveled through the Cocopa Mountains at a pass called yamečus wanya, crossed the Laguna Salada Basin (ha wi ma—water on the other side of the mountain), and passed through the sand hills to a water hole called haspai haməol. From there, the trail led into the foothills and then up the face of the escarpment to the pine country [Kelly 1977:40].

Antonio Porcayo Michelini conducted extended ethnographic interviews in 2013–2015. One was with a Cocopa man, Rosario García González (Don Chayo), now deceased, who lived in the northern Sierra Cucapá. As a young man, Don Chayo had crossed the Laguna Salada basin on horseback with his parents to Pozo Cenizo and Guadalupe Canyon in order to attend an interethnic celebration at the Tipai settlement of La Huerta in northwestern Baja California. Previously, Don Chayo was a fisherman on Laguna Macuata, which was said to have provided an inexhaustible supply of fish for food. The lake’s presence meant periods of great abundance for the Cocopa who frequently recall them. Another Cocopa, Antonio Torres González (Muñeco), similarly recalled to Porcayo the annual horseback trips from El Mayor and El Galletal across the Laguna Macuata basin to Guadalupe Canyon and on to La Huerta. A Paipai woman, Teresa Castro Álvarez, reported traveling on horseback east from the Sierra Juárez to Cerro El Capirote in the Sierra Las Tinajas and on to the lower Colorado River area. That journey was evoked in a traditional Paipai song that told of a little old woman who broke her olla in a tinaja (natural water tank) at Cerro El Capirote.

The ethnographic and ethnohistoric record of Cocopa activity relevant to the Laguna Macuata basin has also been reviewed in some detail by Anita Álvarez de Williams (1975, 1987) and Agustín Ortega Esquinca (2004).

Prehistoric Archaeology

Observations and Interpretations

The archaeological record for Laguna Macuata and its vicinity represents more than a century of observations made by a variety of investigators. However, archaeological knowledge of Laguna Macuata remains sketchy in many respects.

Non-archaeologists made some of the early observations. Orcutt (1891:161) noted the shells of venus clams (cf. Chione sp.) and horn shell (Cerithidea sp.) at locations above the Laguna Macuata shoreline. He interpreted them as natural remnants from a past extension of the Gulf of California into the basin, but they may have represented archaeological remains. Kniffen reported that “about Pozo Cenizo and Pozo Coyote … there are numerous potsherds and bits of charred wood” (Kniffen 1931:49).

Pioneering archaeologist Malcolm J. Rogers and his associates at the San Diego Museum of Man documented numerous archaeological sites throughout southern California, Baja California, and adjacent regions in the 1920s and 1930s (Laylander and Bendímez Patterson 2013). Included were a scattering of sites in the Laguna Macuata basin. Rogers discussed his interpretations of the prehistoric basin in two main
publications (Rogers 1939, 1945). He suggested that the Malpais industry (later renamed San Dieguito I) “extends south into the Pattie Basin” (Rogers 1939:6). The initial phase of late prehistoric (i.e., pottery-using) activity in the broader region, termed Yuman I, was restricted to the lower Colorado River valley, but occupations during Yuman II times (ca. AD 1050–1500, according to Rogers’s interpretation) extended to include the Laguna Macuata basin as well as the shores of Lake Cahuilla (Rogers 1945:184).

Adan Treganza (1942) reported the results of an archaeological reconnaissance of portions of northeastern Baja California and southeastern California. His findings included five “major sites” located on or near the northern and western shorelines of Laguna Macuata. In Treganza’s terms, “major sites” were “characterized by an abundance of pottery sherds, stone chips, flake cores, bedrock mortars, manos and metates, and burnt bone and ash. In most cases, the location of the site is determined by the presence of permanent water and availability of food” (Treganza 1942:154).

An avocational archaeologist, Joseph S. Fontaine (1967, 1970), documented his observations of 10 prehistoric sites in the palm canyons on the western edge of the Laguna Macuata basin. At the sites in Palmas de Cantú, Guadalupe Canyon, and Palomar Canyon, he recorded geometrical and anthropomorphic petroglyphs and pictographs, numerous bedrock mortars and metates, rock shelters, a possible hunting blind, flaked lithics (projectile points and debitage), portable ground stone artifacts, abundant pottery, and midden soil.

Jorge Serrano González (2008) summarized a decade of observations at five rock art sites along or near the eastern base of the Sierra Juárez: Palmas de Cantú, Guadalupe Canyon, Tinaja Partida, La Cueva, and Cañón de la Víbora. Serrano also noted Cerrito de los Senderos, a site with snake-like geoglyphs to the north of Laguna Macuata.

Investigators including Ronald V. May, Gena R. Van Camp, Michael R. Waters, and Antonio Porcayo Michelini followed up on Rogers’s investigations of Yuman ceramics. May (1978, 2001, 2013) reanalyzed the collections of Rogers and others, focusing primarily on brown ware rather than buff ware. For the region’s brown ware he distinguished a Gulf series that was represented “in the northern Cocopa Mountains, along the base of the Peninsular Mountains south through the Laguna Salada… The types are generally medium walled, although the types in Laguna Salada tend to be very thin” (May 1978:8–9).

Van Camp synthesized information from Rogers, noting that archaeological sites “are especially plentiful in the canyons leading out from the eastern flanks of the Sierra Juarez Mountains into the basin of the Laguna Salada, and nearly every style of pottery to be found in Southern California can be found there” (Van Camp 1979:38). A map showed at least seven sites with painted and incised wares on the western margin of Laguna Macuata (Van Camp 1979:opposite p. 72).

Waters (1982a, 1982b) analyzed ceramic collections from six sites on the western margin of the Laguna Macuata basin. According to Waters’ classification and chronology, the sherds overwhelmingly belonged either to the Colorado Buff type (dated from ca. AD 1500 to post-1900) or Tizon Brown (not chronologically diagnostic). However, Waters also reported a single Black Mesa Buff sherd, a type he dated to ca. AD 700–1000.

Porcayo (2013a) reported information on pottery that was collected from sites in the municipio of Mexicali during his 2006–2007 field seasons (see also Téllez et al. 2015). For the northwest division of the municipio of Mexicali, including six subregions in the Laguna Macuata basin, surface collections or excavations at 31 sites recovered 364 rim sherds and 1,505 body sherds. At each site, either Tumco Buff (as defined by Waters 1982a and dated by him to AD 1000–1500) or Salton Brown (after May 1978) was reported the predominant
type present. Contrary to expectations, the oldest radio-carbon dating for ceramics in the region at ca. AD 800 was found in the south, in the Sierra Las Pintas.

Since 2006, Porcayo has directed a series of nine archaeological field seasons involving surveys and excavations at sites in the Laguna Macuata basin and adjacent areas (Porcayo Michelini 2007, 2008, 2015; Porcayo Michelini and Rojas Chávez 2009, 2010, 2011, 2012, 2013, 2014, 2015). On the northern and northeastern margin of Laguna Macuata and in the adjacent canyons of the Sierra Cucapá, Porcayo and his associates recorded late prehistoric sites with ceramics, obsidian artifacts, sleeping circles, and trails, as well as apparently older lithic workshops with darkly patinated artifacts (Figure 2).

Similarly, during investigations near the southeast shore of Laguna Macuata and on the southern and western edges of the Sierra Mayor, Porcayo identified sites where the sierra meets the lake, as well as in nearby foothills, dunes, and canyons. At least two prehistoric periods seem to be represented: an early but undated occupation with sleeping circles and lithic workshops and late prehistoric occupations with habitation shelters, sleeping circles, a lithic quarry, and trails. Two excavated sites, El Galletal 6 and El Mayor 2, shed light on the opening or disruption of travel routes to the west and south by Laguna Macuata’s cycles, as reflected in obsidian, shell, and marine fish. The latter included corvina (*Cynoscion* sp.), which might have spent a portion of its life cycle in Laguna Macuata (Porcayo et al. 2015).

Investigations in the Sierra Las Pintas on the basin’s southern margin found extensive evidence of lithic workshop activity involving both silicified rhyolite and obsidian, the latter being of particular archaeological interest (Panich et al. 2012, 2015). The Lágrimas de Apache source in this range sent material at least briefly to a site in the Sierra Mayor and around Laguna Macuata, while further north in the Sierra Cucapá that source was displaced by obsidian coming from Obsidian Butte, near the modern Salton Sea. An obsidian source that was extensively used in prehistoric Baja California but whose precise geographical origin has not yet been identified is termed Unknown Santa Catalina. This material has been documented at sites throughout the Sierra Juárez, as well as in the Sierra Las Pintas and Sierra Mayor. Its earliest dated occurrence, ca. AD 800, is in the Sierra Las Pintas, and the search for its source location is now focusing, in part, on the Sierra Las Tinajas, west of the Sierra Las Pintas and on the southwestern margin of the Laguna Macuata basin.

Figure 2. Archaeological site on the northeast shore of Laguna Macuata, looking southwest across the dry playa toward the Sierra Juárez (photo by Antonio Porcayo Michelini).
Initial excavation at the Gran Abrigo site (Figure 3) in the Sierra Las Pintas in 2015 identified a stratified habitation deposit with excellent integrity. The cultural deposit is the deepest one yet found in the municipio of Mexicali, and it includes both late prehistoric and earlier strata.

In and near the canyons on the eastern margin of the Sierra Juárez, Porcayo recorded sites in addition to those reported by previous investigators. He also worked in the field with Jon Harman to apply Harman’s DStretch digital program to enhance images of the previously recorded petroglyphs and pictographs, which, within the basin, are found only at these sites (Porcayo and Harman 2009). One newly identified site, La Biznaga (Figure 4), with both petroglyphs and pictographs, included the so-called “La Roca de las Constelaciones,” a large granitic outcrop displaying a
unique pattern of interlaced pits and grooves associated with bedrock mortars (Porcayo and Rojas 2014, 2015).

At La Salada, a site on the northern shoreline of Laguna Macuata, a small sample of faunal remains was dominated by *Chione* sp. (number of identified specimens = 35). The marine gastropod *Conus cf. regularis* was also present. Notably, no freshwater mollusks or fish and only a single unidentified bird bone were included (Guía 2007). A concentration of marine shell at this Laguna Macuata site, located about 145 km north of the present head of the Gulf of California, adds some support to the hypothesis of a marine extension into the basin.

Cerro Pinto, a wonderstone quarry, workshop, and habitation site on the basin’s northern margin, was studied by Porcayo, William T. Eckhardt, and Juan Martín Rojas Chávez (Eckhardt and Porcayo 2013; Porcayo 2013b). The site’s large bifaces were interpreted as representing the early Holocene San Dieguito complex. The site’s silica-rich rock was characterized chemically by x-ray fluorescence to facilitate future sourcing studies. The material was found in archaeological contexts at Laguna Macuata and Lake Cahuilla. Farther south in the same range, a brown, glassy scoria, also exploited prehistorically, was identified.

**Archaeological Prospects**

Future archaeological and geological studies have the potential to expand greatly the understanding of Laguna Macuata’s role in Colorado Desert prehistory. The area’s arid climate, its particular sedimentary processes, including lacustrine deposition and sand dune formation, and its relative remoteness from modern disturbances have made it a favorable setting for the preservation of prehistoric remains and for their scientific recovery.

Geological field investigations of the basin’s terminal Pleistocene and Holocene sedimentary geology may shed considerable light on the basin’s natural history. For instance, dateable water-deposited strata may contain chemical signatures in their evaporites that will make it possible to determine whether the basin’s waters during specific episodes were derived from the Colorado River, the Gulf of California, or runoff from the Sierra Juárez.

Dry sand dunes around the lake’s shoreline seem well suited to have preserved cultural faunal refuse, including the bones of freshwater or marine fish and aquatic birds. Such remains may shed light on the natural condition of the basin during various stages of the Holocene period, the extent to which its resources were foci of aboriginal exploitation, and the seasons during which such exploitation occurred. Studies presently under way are using isotopic analysis of fish bone from archaeological sites to identify water conditions and season of capture.

The same conditions in the basin may also have been conducive to the preservation of floral remains, for instance, in the form of charcoal or within human coprolites. An important unresolved issue in Colorado Desert prehistory concerns the chronological and geographical ranges of prehistoric agriculture within the region. In the lower Colorado River’s floodplain and its delta, erosion and modern agricultural development have seemingly obliterated or obscured most of the evidence concerning prehistoric settlement and agriculture, but sites in the Laguna Macuata basin may have preserved such evidence.

Further analyses of ceramic artifacts from the basin may help investigators to determine whether the area was used primarily by delta-based Yumans who were coming from the east or by mountain Yumans descending from the west, or whether, like Lake Cahuilla, it drew people from both directions to its opposite shores.
Laguna Macuata and Lake Cahuilla: Differences and Similarities

Differences

As compared with Lake Cahuilla, Laguna Macuata’s smaller size and its dissimilar configuration contributed to differences in its role in the lives of the Colorado Desert’s prehistoric inhabitants. Differences in size produced differences in time scale. To fill Lake Cahuilla probably took at least 18 years, or a human generation. Subsequently, after the Colorado River had diverted itself back away from the Salton Basin, a minimum of another 56 years would probably have been needed for the lake to evaporate away completely—in human terms, a matter of several generations (Laylander 2006:60). In contrast, Laguna Macuata might have been filled by the river in a few months, and once filled, it might have disappeared again after about six years, assuming the diversion of the river’s total flow first into the basin and then away from it.

Lake Cahuilla’s large volume and its drawn-out period of desiccation meant that recessional shorelines were successively occupied through several decades as the lake shrank and its salinity gradually increased (Laylander 1997). The smaller size of Laguna Macuata probably made its use during recessions minimal.

The size and relative longevity of Lake Cahuilla were also associated with investments in the construction of large numbers of rock-foundation fish traps on its maximal and recessional shores (see, for example, White and Roth 2009). No similar features have been reported at Laguna Macuata.

Other contrasts would have arisen as a consequence of differences in the two basins’ configurations. Lake Cahuilla would have been filled through a channel running from east to west, along a route now followed by the Alamo Canal. When the lake was full, it would have overflowed south of Cerro Prieto into the Río Hardy and the lower delta through an outlet about 30 km to the southwest of its inlet. This means that a sustained flow of freshwater from the Colorado River could have flushed out much of the salt and kept the lake’s water fresh. It also means that the channel into the lake might have been able to maintain itself for an indefinite period. It has been argued elsewhere (Laylander 2006:61) that once the lake was full its inlet channel likely silted up again fairly rapidly, causing the river to divert its course to the south, away from the lake. However, presently available radiocarbon dating is not sufficiently precise to determine how long the various full stands of Lake Cahuilla lasted.

At Laguna Macuata, in contrast, the inlet and outlet channels would have been in the same location, and the slope gradient into the basin was low. Thus the river would have been likely to quickly divert its course away from that channel once the basin was filled. Along with the basin’s small volume, this would also have tended to make the cycles of Laguna Macuata much shorter than those of Lake Cahuilla.

Lake Cahuilla’s cycles were long enough for the establishment of sustained populations of freshwater fish, for regular use of the lake by a variety of species of migratory or residential water birds, and for the development of extensive stands of vegetation on the shoreline or in nearby areas that benefited from the elevated water table. Laguna Macuata’s shorter cycles may not have been sufficient to produce equal biotic changes.

Ethnographic evidence indicates that portions of the Laguna Macuata basin were used to plant agricultural crops. Archaeological evidence from Lake Cahuilla has not yet confirmed any prehistoric agricultural use of that basin.

At times during the middle and/or late Holocene, Laguna Macuata may have received influxes of sea water at episodes of very high tides. Alternatively, the basin may have contained a permanent marine
embayment if its lip was at a lower elevation in the past, prior to a subsequent build-up of deltaic sediments or before some tectonic uplift. Although the Salton Basin held ocean waters in the distant geologic past, that basin is not thought to have received any influx of sea water during the time span of human presence in the region.

There is still debate as to whether human occupation of the Lake Cahuilla shorelines involved relatively permanent base settlements or whether occupation was only seasonal or episodic (Schaefer and Laylander 2007:250). Treganza (1942:153, 155) reported what he considered to be major camps on the Laguna Macuata shoreline. However, given the probable shortness of the lake cycles, it seems unlikely that relatively permanent settlements would have been established there. On the other hand, if the Gulf of California extended into the basin during the middle or late Holocene, the shoreline may have been more permanent, and major habitation bases might have been established where fresh water was accessible from nearby springs. It is also conceivable that during the terminal Pleistocene higher runoff from the Sierra Juárez and a lower evaporation rate in the basin might have been sufficient to create a permanent freshwater lake with attractions for human settlement.

The effects of Lake Cahuilla cycles, both within the Salton Basin itself and in the lower Colorado delta, may have been sufficient to help produce significant ethnic shifts reflected in the contact-era linguistic geography of southern California, northern Baja California, and western Arizona (Laylander 2006, 2010, 2015). Unless the prehistoric occupation of the Laguna Macuata basin occurred on a more sustained basis than now seems likely, its cycles probably did not result in any similar shifts.

Lake Cahuilla’s most recent stand, in the seventeenth century, lay just on the horizon of the Native groups’ collective cultural memory when that memory was documented in the early twentieth century (Laylander 2004b). In contrast, cycles of Laguna Macuata were phenomena that lay within the living memory of individuals in those groups.

Similarities

Despite their differences, there were some notable similarities between Lake Cahuilla and Laguna Macuata with regard to their implications for prehistoric human geography.

The resources offered by the two freshwater lakes may have been similar or identical. They potentially included sources of potable water situated amid otherwise extremely arid settings, as well as biota such as fish, shellfish, and riparian plants. The use of water birds was also important at Lake Cahuilla (Laylander 1997), although it has yet to be determined archaeologically whether they were exploited at Laguna Macuata.

The Laguna Macuata and Lake Cahuilla basins lay on the paths of important travel routes between the lower Colorado River to the east and the Peninsular Ranges and Pacific coast to the west. When the lakes were present, they created both significant barriers and valuable way stations. Without the use of watercraft, some direct paths across the Colorado Desert were blocked by the lakes’ presence, but their shorelines offered fresh water to sustain travelers on otherwise desolate jornadas.

The two bodies of water, when they were present, hindered the use of certain resources. Lake Cahuilla submerged the regionally important obsidian source at Obsidian Butte. Laguna Macuata may have blocked or hindered access to and from Lágrimas de Apache obsidian in the Sierra Las Pintas, perhaps to Unknown Santa Catalina obsidian, and to marine resources at the head of the Gulf of California.
Modern experience suggests that Laguna Macuata’s cycles were much briefer but also much more frequent than Lake Cahuilla’s cycles. If that is correct, then responses to the episodes of Laguna Macuata may have preadapted the cultures in the Colorado River’s delta and parts of the Peninsular Ranges to respond more quickly and successfully to the greater opportunities of Lake Cahuilla’s presence and the greater challenges of its disappearance.

Like the cycles of Lake Cahuilla, the episodes of Laguna Macuata’s filling and recession represented events that were large-scale, intermittent, and unpredictable. Further archaeological study of those events may offer important insights into prehistoric strategies for adapting to erratic instability in the natural environment and inconsistency in the availability of its resources.

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