San Diego Association of Geologists "ONE STOP WONDER" (OSW)

Geology Bucket List Short Field Trip

Meet: **10am Sunday March 9th - Christmas Circle, Borrego Springs (Link below)**

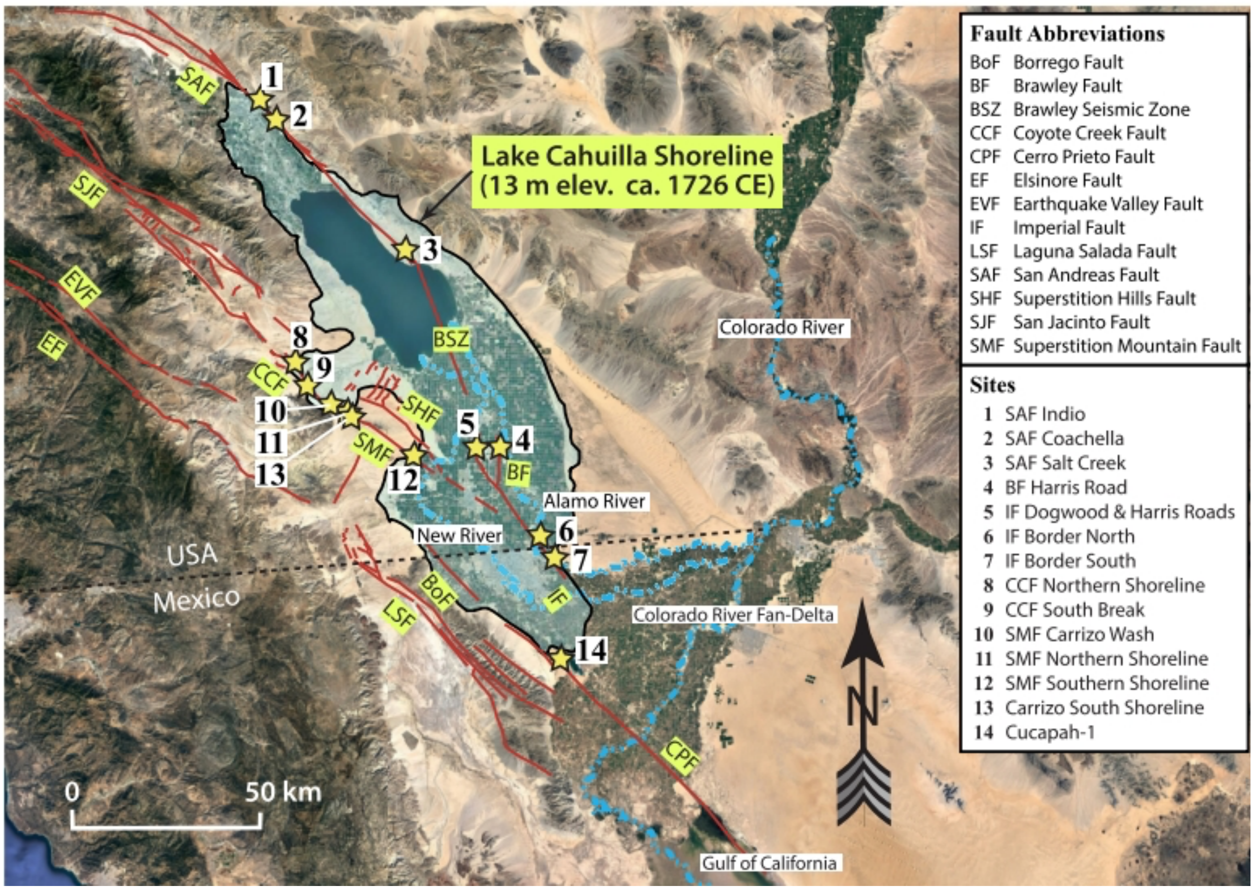
https://maps.app.goo.gl/rmKNghBjEjXk3KVr5

The Field Trip: **Lake Cahuilla/Salton Sea** - **Drive and Short Hikes**

Return: **Approx. 3pm to Christmas Circle**

Bring: **Lunch, 4x4 Vehicle (Necessary -sandy/rocky), Gas, FRS Radios**

Trip Leader: **John Peterson**



Graphic from Rockwell on infillings of Lake Cahuilla (see reference below)

Trip Leader: **John Peterson, petersonenv@hotmail.com 858-220-0877**

Stops include:

1) Overlook near the Lake Cahuilla high stand mark north of S-22 in the Ocotillo Wells State Recreational Park. This is near the ancestral beach of the Lake and has an elevation of +13 meters (39 feet) above sea level. We will be using this site to tell the tale of Lake Cahuilla and the Salton Sea.

2) West side of Highway 86 at Travertine Rocks, (definition of travertine is given below) elevation of ~+11 meters (-33 feet) above sea level. This site represents the "nearly full lake level" of Lake Cahuilla. We will also examine the deposits of travertine deposited on the old county rocks (granitic). These deposits were formed at the high stand of the ancestral lake. At this point the "full" lake was ~ 6 times larger than the current Salton Sea and covered ~2,200 square miles versus the current ~318 square miles (2023). Looking toward the north remember that WinCo and Home Depot on the I-10 was 50 feet under water from the Lake at high stand! Everything you see to the north was covered by water!
3) West side of Highway 86 along "pole line road", elevation of -18 meters (-54 feet) below sea level or -51 meters (-153 feet) below full lake level. Numerous fish traps exist in this area. The traps were only used during the spawning periods for the razorback sucker and the bonytail chubs (this has been identified from midden deposits and human coprolites). **Please remember that this is an archaeology site. Please do not move or disturb the resources in this area. These are protected resources.**

Interesting facts from Salton Sea/Lake Cahuilla:

Lake Cahuilla:

- The delta formed from the Colorado River created a "barrier" also called the "sill" that separates the Gulf of California from the "trough" that is currently the Salton Sea. The barrier, (sill) is about 13 meters (39 feet) above sea level. This level has varied from various high stands, however there is no evidence to support that it was higher than this level at any point in the past.
- At its maximum extent the lake rose to the sill height of ~ 13 meters (high thirty feet) above sea level and covered 2,200 square miles. This is 6 times bigger than the current Salton Sea.
- Remember Lake Cahuilla has always been fresh water, not sea water. which was provided periodically from the Colorado River. Water flow has always been toward the south into the Gulf of California and not south to north.
- During earlier phases (early Pleistocene ~2 million years ago) it was even higher at 102 to 171 feet above sea level as compared to the existing "sill" of ~39 feet above sea level.

- When "full" the lake overflowed the "dam or sill" into the Cerro Prieto and then into the Rio Hardy and eventually draining into the Gulf of California.
- It has been shown (Rockwell 2018) that greater than 90% of the water infill into Lake Cahuilla was from flow originating from the Colorado River.
- When full the Lake extended north into the southern portion of Indio. The WinCo and Home Depot off Jackson Drive was 50 feet underwater!
- During the last 2 thousand years there has been 7 lake high stands: 612-5 BCE, 930-966 CE, 1007-1070 CE, 1192-1241 CE or1118-1165 CE, 1486-1803 CE, 1618-1636 CE, 1731-1733 CE (from Rockwell, reference is given below). But remember it was totally dry when the settlers were traveling out to California. When the "49er's" were heading to the gold fields it was a difficult crossing over a dusty old dry lake bed. Also the Anza expedition of 1774 did not describe any lake in the area and they described that they had a difficult time finding drinking water.
- The current Salton Sea was artificially created in 1905. In 1900 an irrigation ditch was constructed to provide irrigation water from the Colorado River to irrigate Imperial Valley farming fields. The irrigation ditch originated at the breach known as the Lower Mexican Intake. The breach and did not have any headworks or control system at the connection to the River. A significant flood occurred in early 1905 and the entire river switched course to the irrigation ditch! As a result, the river below the irrigation ditch went dry and the entire water flow was directed into the Salton Sea Basin. This flood into the dry lakebed lasted almost two years before the authorities were able to obtain control of the river again. During this interval (2 years) the Colorado River almost entirely filled the basin back to high stand.
- During most of the 1900's the water level in the Sea was maintained artificially by irrigation return flows from the agricultural fields surrounding the Sea due to excess irrigation practices. However, with significant water conservation measures taken within the last 30 years this inflow has greatly decreased. As a result, the Sea has been undergoing significant water level declines, with resulting water quality declines and substantial environmental impacts. The current Sea surface is approximately -68 meters (204 feet) below sea level or -81 meters (~243 feet) below high Lake level.

Archeological Highlights (fish traps):

- Lake Cahuilla was occupied by three different ethnolinguistic groups. The Cahuilla occupied the northernmost portion of the basin, the

Kumeyaay inhabited the southern basin, and the Cocopah settled in the delta near the mouth of the Colorado River.

- The fish traps were primarily used to trap razorback suckers and bonytail chubs (as identified by midden deposits and human coprolites). Although as many as 40 different species have been identified within the record for the Lake. Entrapment (use of the fish traps) occurred during the spawning season for these two primary species.
- Most of the traps are "J" shaped versus "U' or "V" shaped. Their "open end" normally points to the northwest. The open net was blocked by a net or a basket.
- The Razorback sucker spawning season runs from January to April while the Bonytail chub spawning season is shorter from April to May. The vast majority of evidence (>99%) points to the fact that these two species were being harvested from the traps. Outside of the spawning season the traps were not used.
- Evidence points to the fact that the traps were used during declining lake levels versus while the lake was being filled.

Definitions:

1) Travertine: is a terrestrial deposited limestone frequently formed in mineral springs, hot springs and shallow lakes from the rapid precipitation of calcium carbonate.

Additional Resources regarding Lake Cahuilla and the Fish Traps;

Professional papers include:

1) This is a professional paper titled: *Shorelines in the Desert: Mapping Rish Trap Features along the Southwest Coast of Ancient Lake Cahuilla*. (Thanks to Tom Rockwell PhD. who provided the paper to me.)

Abstract: *Shorelines in the Desert: Mapping Fish Trap Features along the Southwest Coast of Ancient Lake Cahuilla, California Anjali Phukan, Todd J. Braje , Thomas K. Rockwell , and Isaac Ullah ABSTRACT In the desert of southeastern California, the geological and archaeological remnants of a once massive lake, Lake Cahuilla, are still visible. One of the most distinctive features marking Lake Cahuilla's relic shorelines is a series of rock fish trap features that, in some cases, stretch across thousands of square meters. These fish traps are severely understudied, and systematic archaeological survey can help scientists reconstruct the dynamic human-environmental history of the region. The large number of fish traps along with the rocky desert terrain, however, make traditional pedestrian archaeological surveys both*

difficult and inefficient. We used unmanned aerial vehicle (UAV) technology along with traditional archaeological methods to conduct surveys and identify patterning in the shapes, orientations, and frequencies of fish traps. Our study demonstrates the potential of emerging archaeological field technology to better understand the nature of human-environmental ecodynamics through time and space.

Hotlink to the paper is: Phukan%20et%20al.%202019%20AAP

2) This is a professional paper titled: *The late Holocene History of Lake Cahuilla: Two thousand years of repeated fillings within the Salton Trough, Imperial Valley California.* (Thanks to Tom Rockwell PhD. who provided the paper to me).

Abstract: *To constrain the timing of the past seven lake highstands in the Salton Trough, we compiled 423 radiocarbon dates, of which 284 are reliable and have good stratigraphic control, from paleoseismic and archeological sites in the basin. We developed two OxCal models that assume most charcoal, wood, seeds, and twigs recovered from organic mats at or near the shoreline are derived from material that grew within the lake footprint, and therefore date a dry period between lakes. Charcoal samples collected from lacustrine clastic strata may have also been derived from fires burned during a dry period. As an initial constraint, we assume that samples older than those in earlier lake deposits have age inheritance. Assuming the dates are accurately described by their respective 2s uncertainties, we ran all dates that would run in a preliminary OxCal model, and then removed those with a poor agreement index as defined in OxCal. From this, of the 423 total dates in the compilation, 151 dates are used in the base model and 149 dates are used in an alternative model, with the differences in the models resulting from choices of whether to include or exclude specific dates that may or may not be representative of a particular dry period between lakes. Where the two models agree, the results are robust, but where the models differ, any differences are taken as uncertainty in the lake ages. Historical accounts and a highresolution paleohydrologic reconstruction allow us to refine some lake ages. The age windows for the past seven Lake Cahuilla highstands are 1731e1733 CE (Lake A), 1618 e1636 CE (Lake B), 1486e1503 CE (Lake C), 1118e1165 or 1192e1241 CE (Lake D), 1007e1070 CE (Lake E), 930e966 CE (Lake F), and 612e5 BCE (Lake G). These ages represent the maximum allowable ranges during which a lake may have filled the basin up to the þ13 m highstand elevation; the basin may have been dry for significant portions of each time window, though the lake filling and desiccation episodes may have extended beyond the stated highstand age range for each lake. If the*

paleohydrologic constraints are ignored, some of the lakes may have initiated earlier, by up to three decades. Additional dates would be needed to further bracket the ages of the earlier lakes. Notably, 120 of the original 284 reliable dates were rejected because they clearly violate stratigraphic ordering, implying that more than 40% of all radiocarbon dates in the Salton Basin exhibit statistically significant age inheritance.

Hotlink to the paper is:

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Geography

[Lake Cahuilla]


The Salton Trough and Colorado River Delta from space

Present day drainage system of the Salton Sea


The present-day Alamo River

New River and Alamo River[