

Lake Cahuilla Research Coalition: Paleo Group

Group Participants:

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Grounding

Initial discussion where participants shared current ongoing activities connected to the Salton Sea and the Salton Trough:

Dr. Odigie gave a brief outline of his study, which will involve the taking of a number of sediment cores from across the sea, which will be used to improve our understanding of surface sediment redox processes of particular relevance to the sequestration of contaminants such as selenium. Dr. Bishop outlined a summary of past work by other workers around the Salton Sea, detailing the Quaternary sedimentological record of lacustrine episodes and how these might relate to global climate change.

Potential Avenues of Study

Most of the discussion centered on the potential application of geochemical proxies from Quaternary sediment samples to delineate past climate change in the Salton Trough and its relation to lake presence/absence. Both organic and inorganic proxies would be valuable.

Organic Geochemistry

Conventional hydrocarbon biomarker studies would offer important insights (e.g. applying steroid distributions to discern biomass inputs), but perhaps the greatest opportunity is afforded by studies on biolipids (e.g. GDGTs, carotenoids, tetrahymanol etc.) which include temperature, salinity, and biomass input proxies. The relative proportions of land plant to aquatic organic matter organic matter inputs is a critical piece of information, which can be readily characterized with organic geochemical analyses, with validation by isotopes and C/N ratios etc. GDGT characterization is not currently conducted at UCR, but the requisite LCMS equipment is available via the central analytical facilities provided by the chemistry department.

Inorganic Geochemistry

Various inorganic proxies will also be very valuable, including the standard analytical methods afforded by the Lyons Group. In particular, mass independent sulfur isotopes would help constrain the relative inputs of sulfate from fluvial and hydrothermal sources. Hydrothermal input is a consideration in the Salton Trough due to the large number of surface vents. Though not discussed in detail, a broad range of other isotope methods will be essential to any such geochemistry studies, including of course hydrogen, carbon and nitrogen. Carbonate clumped isotopes may also be useful. Radiocarbon dating will be essential to allow different sections from separate locations to be accurately correlated. As we also need to better constrain the sources of water to the Salton Trough through time, various provenance studies will be required, including both isotopic and classical heavy mineral type approaches.

Tree Ring Studies

In Southern California, it has been demonstrated that tree ring growth is strongly correlated with precipitation, as the primary constraint on tree growth here is access to water. Thus, tree rings afford a good opportunity to assess availability of local water input to the Salton Trough via drainage from the Peninsular Range to the west. Such data would complement the geochemical data from sediments in the Salton Trough.

Other Topics

There was a quick discussion on desert varnish and mega land-slips, relevant to specific interests of Bishop and Professor Barth, respectively. Desert varnish may allow past climate records to be determined on the basis of exposed rock surfaces in the desert, as well as estimates of duration of exposure. There are several examples of large land-slides around the Salton Trough, which might prove disastrous if such events occurred today, given the close proximity of housing to the mountain front. It is possible that there might be a linkage between climate conditions and such events during wetter periods, as has been proposed for major quakes on the San Andreas and filling of Lake Cahuilla. Thus, both of these topics compliment any past environmental studies in the Salton Trough and underscore the need for an effectively integrated approach.

Samples

Samples dating back ~3k years can be collected from dug trenches or river/creek incisions (latter prone to weathering). Soil augers might also be useful. Deeper cores, up to 100m, can be taken using water well equipment, enabling records back to ~30k years to be assessed. Deep boreholes (500+m) would probably require more expensive wells, like the State 2-14 borehole drilled in the 1980's. We should consider piggy-backing on groundwater well drilling to help offset some costs, but they might need extra funding to enable core samples to be taken.

Summary

The Salton Trough of significant importance given the environmental sensitivity and uncertainty with respect to the future of the Salton Sea. It also provides an excellent training opportunity for graduate students. Few locations are as readily accessible, providing a broad variety of different Quaternary environments from Alpine to Desert, all under the same regional climate conditions. A well-managed, coordinated program of research would be a great benefit to understanding the association of biogeochemistry and climate, with particular regard to arid regions.

Funding

Possible sources of funding include:

- NSF
- NASA
- California Department of Water Resources
- Berkshire Hathaway (owns CalEnergy, which operates the geothermal plants)