

Evidence for a Hypersaline Paleodepositional Environment, San Elijo Lagoon, California

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Extensive data — including lithologic information and pore-water samples — have been collected from beneath the San Elijo Lagoon near San Diego, California, during installation of a production test well. Lithologic information was compiled from descriptions of drill cuttings. Drill cores collected from the top 35 meters (m) of sediment during the construction of the test well were squeezed to obtain pore-water samples. Whereas pumped water samples integrate over substantial stratigraphic intervals, pore-water samples provide details about water quality at specific depths. The analytical protocol for the pore-water samples included major ions and stable isotopes of hydrogen, oxygen, and strontium. These data were combined with 19th-century United States Coastal Survey maps of the Southern California coast to better understand how the wetlands functioned under predevelopment conditions over geologic time.

Lithologic information indicated fill material from 0 to 8 m; Quaternary lagoonal deposits from 8 to 23 m; Quaternary terrestrial deposits from 23 to 31 m; and Quaternary beach deposits from 31 to 37 m. Chloride concentrations of the pore water beneath the San Elijo Lagoon ranged from about 8,000 mg/L to over 73,000 mg/L. Isotopic compositions of hydrogen and oxygen in pore-water samples ranged from -34.9 per mil to -1.37 per mil and from -4.73 per mil to 1.01 per mil, respectively, with the pore water becoming more isotopically enriched with depth. Strontium isotope ratios ranged from about 0.70862 to 0.70954. The high salinity of the pore-water samples, along with the enriched stable isotopic values and strontium isotope ratios close to the strontium ratio of seawater, provide evidence hypersaline conditions persisted during periods of deposition of the sediment beneath the San Elijo Lagoon. The T-sheet for San Elijo Lagoon shows the natural condition of this area during the 19th century consisted of seasonally-flooded salt flats and did not appear to have had deep or permanent open water. This information and the evidence provided by the extensive data presented here suggest the lagoon functioned like this for many tens-of-thousands of years. By having a better understanding of the natural conditions of these wetlands over geologic time, scientists, managers, and the public are better informed of the type of wetland habitats and functions which should be targeted during the restoration process and the historical biogeography of the region..