# A Climatic Record from Searles Lake, California

*Abstract.* Data concerning past climatic conditions in arid California have been presented. Palynological and geological evidence points to the existence of past cooler moister climates and to climatic fluctuations. These have been tentatively correlated with late Pleistocene events in glaciated North America. The existence of a rather extensive woodland community at times of more favorable moisture conditions seems to be indicated.

The presence of dry lake basins in arid regions is strong evidence of a former rainfall/evaporation ratio much higher than at present (*1*). The sedimentary column in such basins should record this sequence both by inorganic and organic evidence, notably by changes in the content of fossil pollen derived from adjacent vegetation.

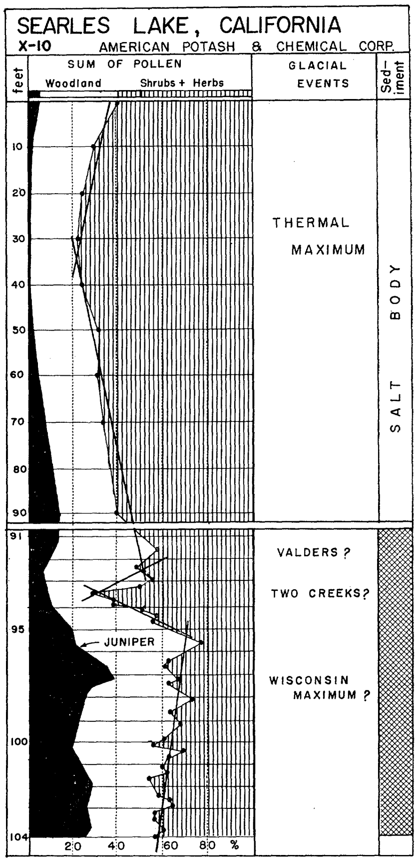

Fig. 1. Pollen diagram from Searles Lake, California. Depth in feet at left. Note change in scale at 90-foot level. All pollen percentages are measured from left (0 percent) of pollen diagram. Sediments generalized at right: 0 to 91.6 feet, salt body with thin layers of mud; 91.6 to 104.4 feet, parting mud. NAP maximum at 93 feet represents dry conditions during Two Creeks interstadial. Juniper maximum at 97 feet probably represents maximum precipitation/evaporation ratio for this basin, and should be correlative with the moisture peak of the Wisconsin maximum.

The most reasonable explanation of more humid conditions in the past is that they were associated with times of continental glaciation when precipitation was greater and temperature lower than is now the case. The analysis of sediment cores from such lakes is therefore of special interest to students of Pleistocene geology, climate, and vegetation.

The sediments in the basin of Searles Lake in the Mojave Desert of California are heavily saline as a result of intense and prolonged evaporation. Cores taken at site X-10 near the middle of the lake show an organic layer (parting mud) from about 104 to about 92 feet, while the upper 92 feet of deposit consists of saline material. This suggests that the organic layer is correlative with the most recent pluvial climate and that the salt above it is correlative with subsequent drier and warmer conditions (*2*).

Carbon-14 dating of the span of time represented by the organic deposit will, when available, confirm or discount this suggestion. Meanwhile the pollen analysis of the present core seems to exclude any other hypothesis (Fig. 1). Woodland species, save for one interesting fluctuation to be mentioned, are more numerous in the organic layer than above it, while the reverse is true of desert plants (shrubs and herbs).

Communities of woodland genera, essentially *Pinus* and *Juniperus,* do not, with one slight exception, now occur nearer the site than a distance of some 30 miles and an altitude of about 5000 feet. The core site is at altitude 1616 feet. The reasonable assumption is that vegetation zones have migrated up or down, away from or toward the basin, in response to appropriate climatic changes.

Details are reserved for later publication. Meanwhile attention is called to the woodland maximum just below 97 feet as indicative of a maximum precipitation/evaporation ratio. Further, a sharp decrease in this ratio is indicated above 94 feet, with a subsequent brief return to moister conditions. The position and character of this episode are exactly what should be expected if the episode were correlative with the Two Creeks interval of glacial retreat in the Great Lakes region, followed by an ice readvance. It further deserves notice that the Compositae, now represented by various shrubby species, reach a high level only in the upper saline deposit. A shift towards more intensified arid conditions above the 55-foot level is evidenced by a decrease in the percentage of *Artemisia* (sagebrush) and the dominance of chenopods (*3, 4*).

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### References and Notes

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2. ——— and W. A. Gale, "Wisconsin stratigraphy and radiocarbon dates at Searles Lake, California" (abstr.), *Bull. Geol. Soc. Am.* **66,** 1559 (1955).
3. W. D. Billings, "The shadscale vegetation zone of Nevada and Eastern California in relation to climate and soils," *Am. Midland Naturalist* **42,** 87 (1949).
4. The material reported on was obtained by Professor R. F. Flint through the courtesy of the American Potash and Chemical Corporation, to which I am indebted for assistance in field work. Many individuals contributed to the success of the field trips. Thanks are due to all of them, but especially to Dr. W. A. Gale. The analysis was made in the pollen laboratory of the botany department at Yale University. Dr. J. Gordon Ogden III prepared the graph, giving freely of his time. I am grateful to him, to Dr. Johannes Iversen for his counsel, and to Dr. Paul B. Sears for material aid and patient guidance.

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# Saturation Curves of Orthorhombic Sulfur in the System $S\text{-}Na_2S\text{-}H_2O$ at 25° and 50°C

As a part of an investigation of the physicochemical processes involved in the origin of mercury ore deposits and associated sulfur deposits (*1*), we have determined at 25° and 50°C the saturation curves of orthorhombic sulfur in the concentration range from 100 percent $H_2O$ to 80 percent $H_2O$. Previous work by Kuster and Heberlein (*2*) demonstrated that in $Na_2S$ solutions there is a marked increase of solubility of sulfur with increasing concentration of $Na_2S$. Kuster and Heberlein, however, did not make a complete determination of the equilibrium relations since they did not determine the final equilibrium concentrations of $Na_2S$. They allowed sulfur to react with $Na_2S$ solutions of known initial concentration until the solutions were saturated and then determined the equilibrium concentration of S in grams per cubic centimeter. Their data therefore do not make possible the determination of the exact position of the saturation curve in a triangular equilibrium diagram.

Baker reagent-grade powdered orthorhombic sulfur (99.95 percent) was used for all the solubility experiments. "Baker Analyzed" reagent-grade $Na_2S \cdot 9H_2O$ was rinsed with distilled water, and clear colorless material was set aside for use. Distilled water used to make up the experimental mixtures was boiled for at least 10 minutes to remove oxygen. The experimental samples were prepared by mixing orthorhombic sulfur, $Na_2S \cdot 9H_2O$, and boiled distilled water in Teflon (tetrafluorethane) bottles under an oxygen-free nitrogen atmosphere.

The Teflon bottles containing fine-grained orthorhombic sulfur and solutions of $Na_2S$ were rotated in constant temperature baths at 25.00° (±0.02°)