

Chemical analyses of ground water from test well L-1, Lucerne Dry Lake, California
[Analyses by U.S. Geological Survey, Denver, Colo.]

Test well-sample No.	Date sample collected	Sample depth (ft)	Specific conductance microhm/cm at 25°C	pH		Temperature, water (°C)		Specific gravity	mg/l																			
				Field	Lab	Hardness, total	Calcium (Ca)		Magnesium (Mg)	Sodium (Na)	Potassium (K)	Bicarbonate (HCO ₃)*	Alkalinity, total (CaCO ₃)	Sulfate (SO ₄)	Chloride (Cl)	Fluoride (F)	Iodide (I)	Silica (SiO ₂)	Solids, residue on evaporation at 100°C	Nitrite plus nitrate (N)	Phosphorus (P)	Boron (B)	Iron (Fe)	Lithium (Li)	Manganese (Mn)	Strontium (Sr)	Uranium (U)	
L-1-1	5/24/78	115	113,000	8.0	8.0	19.2	1.070	420	58	65	34,000	1,400	293	240	2,100	56,000	2.2	0.31	6,660.4†	91,200	94	0.20	8,500	50	2,800	240	4,600	650
L-1-2	5/24/78	335	9,541	7.6	8.0	21.2	1.012	1,100	190	140	1,600	67	146	120	140	2,300	.4	.03	15	5,940	2.5	.02	460	670	170	70	2,800	5.4

* Calculated.
† Determined on 1:200 dilution.

LITHOLOGIC LOG

Depth (feet)	DESCRIPTION
0 - 16	Clay, moderate-brown (5YR 4/4), calcareous
16 - 20	Clay, pale-olive (10Y 6/2), with 2 percent coarse to very coarse sand
20 - 26	Clay, variegated, pale-yellowish-brown (10YR 6/2) to moderate-yellowish-brown (10YR 5/4) calcareous, with less than 1 percent coarse sand
26 - 35	Clay, pale-greenish-yellow (10Y 8/2), calcareous
35 - 42	Clay, variegated, pale-yellowish-brown (10YR 6/2) and pale-greenish-yellow (10Y 8/2), calcareous, and very fine sand
42 - 44	Clay, moderate-brown (5YR 4/4) and pale-greenish-yellow (10Y 8/2), interbedded, calcareous
44 - 50	Clay, pale-greenish-yellow (10Y 8/2), calcareous
50 - 55	Clay, pale-olive (10Y 6/2), and 5 percent medium sand
55 - 60	Clay, dusky-yellow (5Y 6/4), calcareous, silty
60 - 65	Clay, dusky-yellow (5Y 6/4), calcareous, with interbeds of yellowish-gray (5Y 7/2) claystone
65 - 76	Clay and claystone. Lithology similar to 60-65 ft, but unit is moderate-yellowish-brown (10YR 5/4) and contains less claystone
76 - 80	Clay, pinkish-gray (5YR 8/1), calcareous, with claystone interbeds
80 - 85	Clay, light-olive-gray (5Y 5/2), very calcareous
85 - 90.5	Clay, pale-olive (10Y 6/2), calcareous, with some thin, pale-greenish-yellow (10Y 8/2) claystone interbeds
90.5 - 97	Clay and claystone. Lithology similar to 85-90.5 ft, but clay is grayish-orange (10YR 7/4) and claystone is very pale-orange (10YR 8/2)
97 - 101	Clay, greenish-gray (5Y 6/1), with thin interbeds of dark-yellowish-orange (10YR 4/6) clay. Some beds contain as much as 2 percent coarse sand and granules
101 - 105	Clay, moderate-yellowish-brown (10YR 5/4), slightly calcareous, with 5 percent silt
105 - 112	Clay, variegated, moderate-yellowish-brown (10YR 5/4) and dark-yellowish-brown (10YR 4/2), slightly calcareous, with minor amounts of fine sand and silt near base of unit
112 - 140	Sand, fine to very coarse, and granule and pebble gravel, with a moderate-yellowish-brown (10YR 5/4), noncalcareous, silt matrix. Unit composed of 25 percent sand and silt, and 15 percent granules and pebbles. Silt decreases near base of unit. Pebbles are as much as 50 mm across
140 - 150	Sand, coarse to very coarse, subangular to subrounded, composed of quartz and feldspar, with subangular to angular, fine-grained granite and rhyolite pebbles in a moderate-yellowish-brown (10YR 5/4), calcareous, silt matrix. Unit is intermixed and composed of 50 percent sand, 40 percent pebbles, and 10 percent silt
150 - 155	Gravel, sandy, silty. Lithology similar to 140-150 ft, but noncalcareous and pebbles comprise 75 percent of unit. Pebbles as much as 13 mm across
155 - 160	Gravel, sandy, silty. Lithology similar to 140-150 ft, but gravel with pebbles as much as 25 mm across, composed of splite, quartz monzonite, and fine-grained granodiorite comprises 85 percent of unit
160 - 195	Gravel, sandy, silty. Lithology similar to 155-160 ft, but composed mainly of quartz monzonite pebbles as much as 50 mm across. Matrix increases to 20 to 25 percent of unit
195 - 200	Sand and silt moderate-yellowish-brown (10YR 5/4) containing 5 percent pebbles and granules
200 - 215	Gravel, pebble and granule, clasts up to 25 mm, composed of quartz monzonite, diorite, and feldspar fragments in a noncalcareous silt matrix. Unit composed of 80 percent gravel and 20 percent matrix. Matrix decreases to 10 percent toward base of unit. Clast size increases to 70 mm cobbles near base of unit
215 - 220	Sand, gravel, and silt. Lithology similar to 200-215 ft, but composed of 70-80 percent medium to very coarse sand, 15-20 percent silt, and 5-10 percent gravel
220 - 225	Gravel, pebble, in a moderate-yellowish-brown (10Y 5/4) silt to very coarse sand matrix. Unit composed of 70 percent 4-50 mm pebbles and 30 percent silt and sand
225 - 245	Sand, coarse to very coarse, with granules and scattered angular pebbles as much as 50 mm across in a moderate yellowish-brown (10Y 5/4) silt matrix. Unit composed of 75 percent sand and granules, 15 percent pebbles, and 10 percent silt. Pebbles increase to 64 mm across near base of unit
245 - 250	Sand, gravel, and silt. Lithology similar to 225-245 ft, but composed of 40 percent sand, 35 percent pebbles, and 25 percent silt matrix
250 - 260	Silt, sandy, with pebbles. Lithology similar to 225-245 ft, but composed of 45 percent sand, 5 percent pebbles as much as 20 mm across and 50 percent silt, decreasing to 35 percent by 260 ft
260 - 265	Gravel, pebble and granule, 2-60 mm, composed of diorite, quartz monzonite, quartz, and tuff breccia fragments in a moderate-yellowish-brown (10Y 5/4) silt matrix. Unit composed of 90 percent clasts and 10 percent matrix
265 - 272	Sand, gravel, and silt. Lithology same as 225-245 ft
272 - 275	Silt, sandy, with pebbles. Lithology same as 250-260 ft
275 - 280	Sand, coarse with pebbles as much as 20 mm across, and 5 percent moderate-yellowish-brown (10Y 5/4) silt
280 - 285	Sand, pebbles, and silt. Lithology similar to 275-280 ft, but pebbles and cobbles composed of granite, quartz monzonite, and quartz diorite increase to 40-70 mm across
285 - 320	Sand, pebbles, and silt. Lithology similar to 280-285 ft, but also contains clasts of tuff breccia
320 - 330	Sand, pebbles, and silt. Lithology similar to 285-320 ft, but silt content increases to 10-25 percent
330 - 335	Sand, pebbles, and silt. Lithology same as 280-285 ft

INTRODUCTION

The Federal Land Policy and Management Act of 1976 (Public Law 94-579) directed the Secretary of the Interior to prepare and implement by September 1980 a comprehensive long-range plan for the management, use, development, and protection of public lands within the California Desert Conservation Area (CDCA). The responsibility to prepare this plan was assigned to the Bureau of Land Management's (BLM) California Desert Planning Staff. The BLM was directed to evaluate mineral as well as botanical, wildlife, cultural, and recreation resource data for effective multiple-use land planning. In turn, the BLM requested assistance from the U.S. Geological Survey (USGS) in defining the mineral resources.

In 1978 the USGS drilled 56 shallow test wells to depths of 50-600 ft to provide BLM with the requested mineral resource data. The lithologic, water quality, and geophysical data obtained from one of these test wells drilled on Lucerne Dry Lake, Calif., are presented in this report.

LOCATION AND DRILLING METHODS

Test well L-1 was drilled in NE1SE1/4, sec. 23, T. 5 N., R. 1 W., S34, California (lat. 34°30'45" N., long. 116°56'44" W.) on Lucerne Dry Lake (see index map). This test well was completed in May 1978 to a total depth of 335 ft by a contracted, truck mounted, reverse circulation drill rig. Drilling fluids, a mixture of air and water, were pumped down the outer annulus of dual-wall drill pipe to an open face insert bit. Drilling fluids mixed with sediment cuttings were forced up the inner annulus of the drill pipe to the surface where samples were collected. This drilling technique ensured recovery of uncontaminated sediment or ground-water samples because the return cuttings or ground water were not in contact with the bore wall. In situ ground water was used as a drilling fluid where possible; otherwise, a fine mist of imported freshwater and air was used.

A continuous lithologic log was completed during drilling. Sediment samples were collected at 5-ft intervals and were described in the field. Field lithologic descriptions were supplemented by microscopic study when the samples were returned to the laboratory. Sediment described in this report are those defined by Folk (1968). The rock-color chart (Goddard and others, 1948) was used to color classify deep to wet samples. Lithologic percentages are approximate.

Drill cuttings were analyzed for lithium (Li) by the USGS, in Denver, Colo. Lithium analyses are included in this report to complete the mineral resource appraisal on Lucerne Dry Lake.

WATER QUALITY

Ground-water samples were collected at the first aquifer having measurable flow into the borehole and at total depth of the test well by stopping drill rotation and pumping air through the drill string. The aquifer was allowed to flow for several minutes to remove drilling fluids and cuttings from the drill string before a ground-water sample was collected. Temperature and pH of raw, untreated samples and specific gravity of filtered samples were measured in the field. Chemical analyses of filtered samples collected from test well L-1 are listed in the chemical analyses table.

GEOPHYSICAL LOG

A gamma-ray logging survey was run from the surface to a drilled depth of 290 feet. The log was run through the drill string because the plays sediments would have squeezed in or collapsed and sealed the test well before conventional open-hole logs could have been run in the well. Before the log can be interpreted, corrections must be made for the effect of the drill pipe. The necessary data for the correction, described on Schlumberger Chart F38-E, are listed below. The corrected log will approximate the natural radioactivity, but quantitative measurement is not possible, inasmuch as the sonde was not calibrated.

Test well diameter: 4.5 in.	Total thickness of dual-wall drill pipe: 0.63 in.
Drill string inner diameter: 2.47 in.	Sonde outer diameter: 1.25 in.
Outer diameter: 4.5 in.	Logging speed: 17 ft/min

ACKNOWLEDGMENTS

G. Thomas Server supplemented field lithologic descriptions by laboratory study of sediment cuttings under binocular microscope. J. D. Vincent, U.S. Geological Survey, Denver, Colo., ran the geophysical log.

REFERENCES

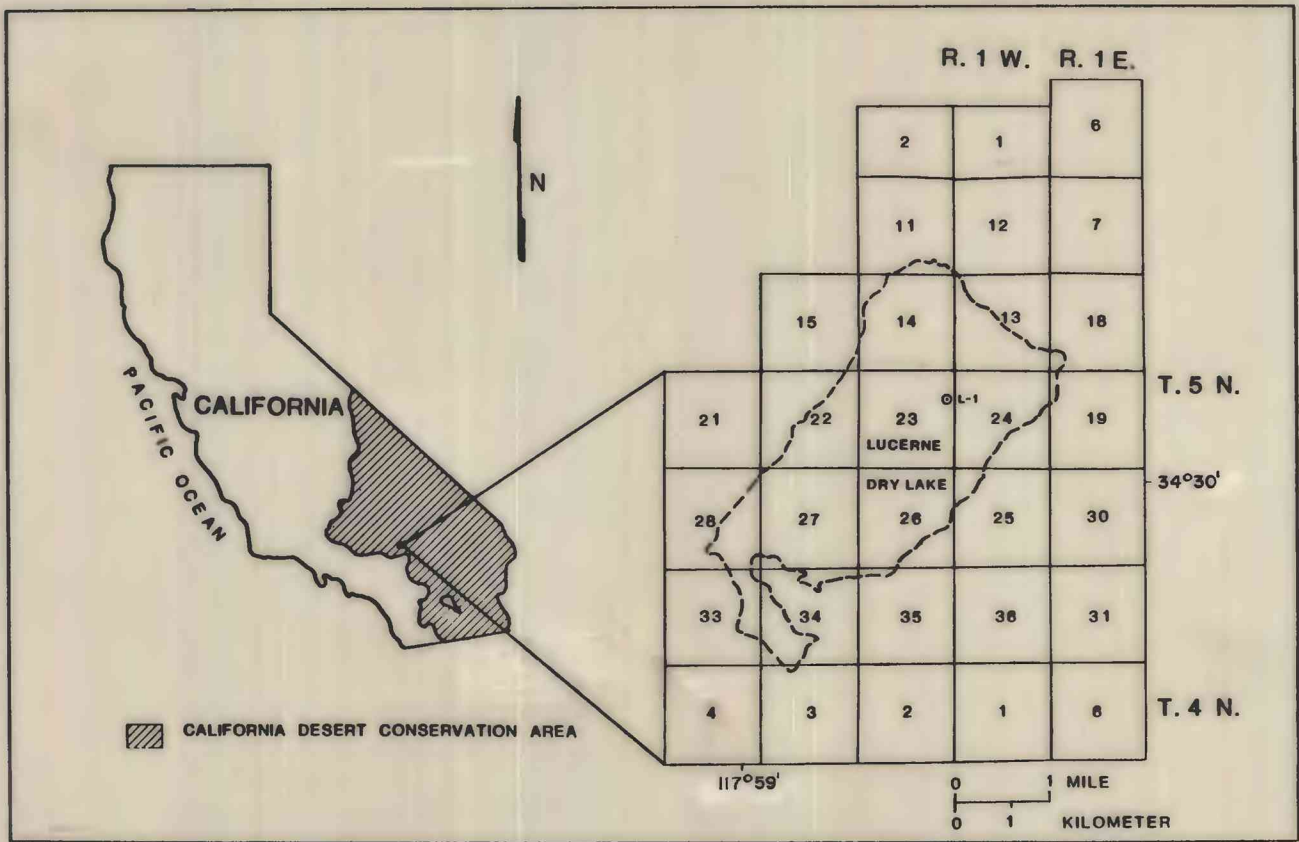
- Folk, R. L., 1968, Petrology of sedimentary rocks: Austin, University of Texas, 170 p.
- Goddard, E. H., chn., and others, 1948, Rock-color chart: National Research Council, reprinted by Geological Society of America, 1951, 1963, 1970, 6 p.

CONVERSION FACTORS

Multiply English unit	By	To obtain metric units
Inches (in.)	2.540	Centimeters (cm)
Feet (ft)	0.305	Meters (m)

This report has not been edited for conformity with U.S. Geological Survey editorial standards

INDEX MAP



GEOPHYSICAL, LITHOLOGIC, AND WATER-QUALITY DATA FROM LUCERNE DRY LAKE, SAN BERNARDINO COUNTY, CALIFORNIA

By
Roger D. Dockter