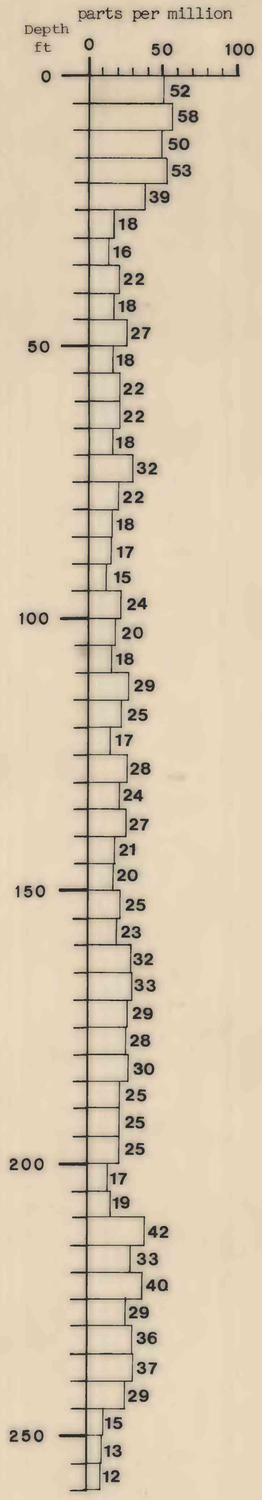
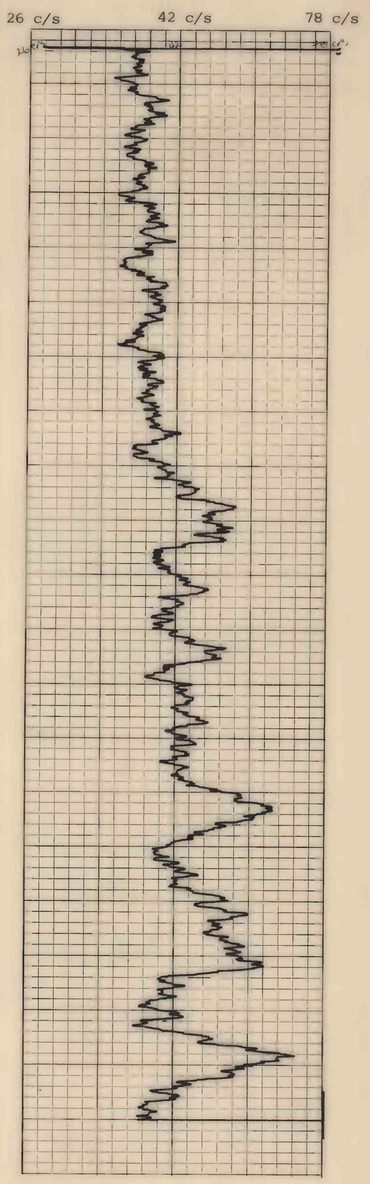
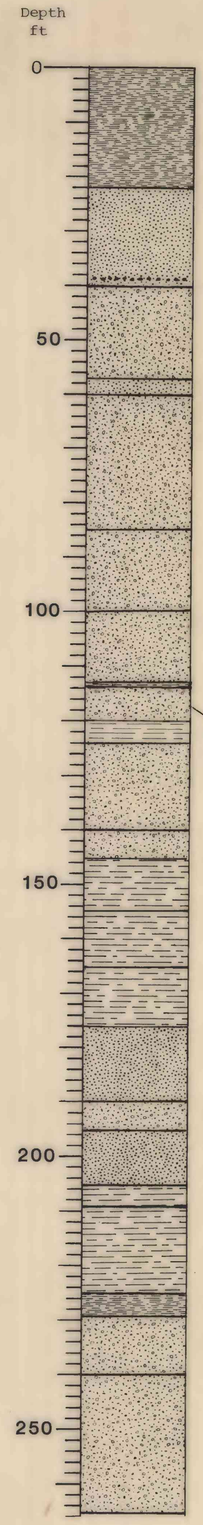
LITHIUM LOG
(J. D. Vine, 1978, written commun.)



GAMMA - RAY LOG
[c/s]



COLUMNAR SECTION



Total depth (TD) = 265 ft

LITHOLOGIC LOG

Depth (feet)	DESCRIPTION
0- 5	Clay, light-olive-gray (5Y 5/2 dry), calcareous
5- 13	Clay, grayish-olive (10Y 4/2), calcareous
13- 22	Clay, light-olive-gray (5Y 5/2), calcareous
22- 40	Sand, very fine to coarse, angular to subangular in a moderate-yellowish-brown (10YR 5/4) calcareous silty clay matrix. Matrix comprises up to 50 percent of unit. Unit is noncalcareous below 25 ft and contains a 2.0 in. interval with 10-15 percent angular to subangular, granules and pebbles at 39 ft
40- 57	Sand, very fine to coarse, with 10-15 percent subangular to angular pebbles in a moderate-yellowish-brown (10YR 5/4), noncalcareous, silt matrix. Pebbles decrease to 5-10 percent by base of unit and are as much as 20 mm across
57- 60	Sand, very coarse, angular to subangular in a moderate-yellowish-brown (10YR 5/4) silt matrix. Unit composed of 50 percent sand and 50 percent matrix
60- 80	Sand with silty matrix. Lithology similar to 57-60 ft, but contains 65-70 percent sand, 5-10 percent granules, and 25 percent matrix
80- 85	Sand, very coarse, angular to subangular, with scattered granules in a moderate-yellowish-brown (10YR 5/4) silt matrix. Unit composed of 45 percent sand, 10 percent granules, and 45 percent matrix
85- 95	Sand, with granules and pebbles in a silt matrix. Lithology similar to 80-85 ft, but with 5 percent quartz monzonite pebbles, as much as 20 mm across, replacing 5 percent of the granules
95-100	Sand, with granules and pebbles in a silt matrix. Lithology similar to 80-85 ft, but with 80-85 percent sand, 10 percent gravel, and 5-10 percent matrix
100-113	Sand, medium to coarse, with occasional pebbles, in a moderate-yellowish-brown (10YR 5/4), noncalcareous, silt matrix. Pebbles as much as 20 mm across, composed of 90-95 percent sand, 5-10 percent silt, and less than 1 percent pebbles. Between 105-110 ft matrix increases to 20-25 percent and pebbles are up to 40 mm across
113-114	Clay, silty
114-120	Sand, silty. Lithology same as 100-113 ft, but matrix increases to 50 percent of the unit by 120 ft and 60 percent by 124 ft
120-124	Silt, sandy, with pebbles. Unit contains 60 percent silt, 39-40 percent medium to coarse sand, and less than 1 percent pebbles
124-140	Sand, very coarse, angular to subangular, with a few scattered granules, in a noncalcareous, silt matrix. Unit contains 40-50 percent silt matrix that decreases to 20 percent by base of unit
140-145	Sand, very coarse, angular to subangular, and 2 percent gravel, in a noncalcareous, moderate-yellowish-brown (10YR 5/4) silt matrix. Unit composed of 78 percent sand, 20 percent matrix, and 2 percent pebbles. Pebbles composed of andesite fragments as much as 60 mm across and quartz monzonite fragments as much as 30 mm across
145-155	Silt, grayish-orange (10YR 7/4) and coarse to very coarse sand, with scattered pebbles and granules. Unit composed of 35 percent sand, 5 percent gravel, and 60 percent silt
155-165	Silt, clayey, with sand and gravel. Lithology similar to 145-155 ft, but matrix is clayey; clay content decreases by 165 ft, where little clay remains in the silt
165-176	Silt, with sand and gravel. Lithology same as 145-155 ft
176-190	Sand, fine to very coarse, angular to subangular, in a moderate-yellowish-brown (10YR 5/4) clayey silt matrix. Unit composed of 90-95 percent sand and 5-10 percent matrix.
190-195	Sand. Lithology same as 176-190, but unit contains occasional pebbles as much as 20 mm acres
195-205	Sand, medium to very coarse, angular to subangular, micaceous, in a noncalcareous moderate-yellowish-brown (10YR 5/4) silt matrix. Unit composed of 95 percent sand, 4-5 percent silt, and less than 1 percent mica
205-209	Silt, clayey, moderate-yellowish-brown (10YR 5/4), with minor medium to very coarse sand. Unit composed of 90 percent clayey silt and 10 percent sand
209-225	Silt, moderate-yellowish-brown (10YR 5/4), and coarse to very coarse sand, with minor pebbles pebbles and granules. Unit composed of 35 percent sand, 5 percent gravel, and 60 percent silt. Unit contains some layers of silt without sand at 215-220 ft
225-229	Clay, silty, moderate-yellowish-brown (10YR 5/4) with thin interbeds of medium to very coarse sand in a silty clay matrix. The thin interbeds are composed of 50 percent sand and 50 percent silty clay
229-240	Sand, medium to very coarse, angular to subangular, with granules in a grayish-orange (10YR 7/4) noncalcareous silt matrix. Unit composed of 65-70 percent sand (mainly medium), 5 percent granules, and 25-30 percent matrix. Matrix becomes very clayey between 233-240 ft
240-265	Sand, coarse to very coarse, composed mainly of quartz and feldspar fragments, with granules in a grayish-orange (10YR 7/4) silt to fine sand matrix. Unit occasionally contains quartz monzonite pebbles as much as 30 mm across. Unit composed of 85-90 percent sand and granules, and 10-15 percent matrix. Matrix decreases to 4-7 percent by 250 ft and 2-5 percent by 255 ft. Below 253 ft the sand and granules are oxidized and iron stained

INTRODUCTION

DISCUSSION

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 El Mirage Dry Lake, Calif., are presented in this report.

LOCATION AND DRILLING METHODS

Test well EM-1 was drilled in SW¼NW¼SW¼ sec. 34, T. 7 N., R. 7 W., SBM, California (lat. 34°39'04" N., long. 117°36'45" W.) on El Mirage Dry Lake (see index map). This test well was completed in June 1978 to a total depth of 265 ft by a contracted, track 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 names used in this report are those defined by Folk (1968). The rock-color chart (Goddard and others, 1948) was used to color classify damp 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 El Mirage Dry Lake.

WATER QUALITY

A ground-water sample was collected at the first aquifer having measurable flow into the borehole 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 the raw, untreated sample and specific gravity of the filtered sample were measured in the field. Chemical analyses of the filtered sample collected from test well EM-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 200 feet. The log was run through the drill string because the playa 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 POR-8, 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. Cathcart, 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. N., chm., and others, 1948, Rock-color chart: National Research Council; reprinted by Geological Society of America, 1951, 1963, 1970, 6 p.

CONVERSION FACTORS

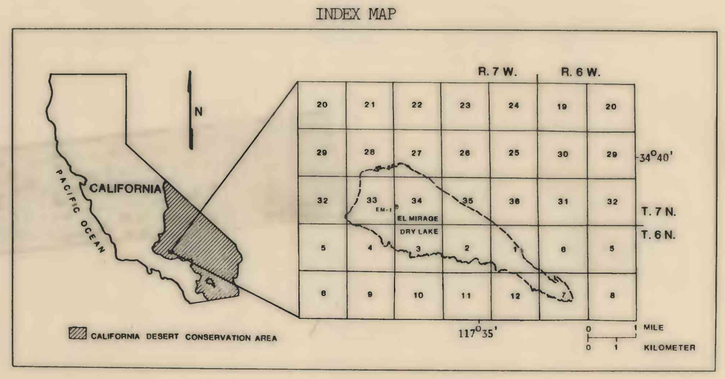
Multiply English unit	By	To obtain metric units
Inches (in.)	2.540	Centimeters (cm)
Feet (ft)	0.305	Meters (m)

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

Test well-sample No.	Date sample collected	Sample depth (ft)	Specific conductance (micromhos/cm at 25°C)	pH Field	pH Lab	Temperature, water (°C)	Specific gravity	Hardness, total (mg/l)	Calcium (Ca) (mg/l)	Magnesium (Mg) (mg/l)	Sodium (Na) (mg/l)	Potassium (K) (mg/l)	Bicarbonate (HCO_3)* (mg/l)	Alkalinity, total ($CaCO_3$) (mg/l)	Sulfate (SO_4) (mg/l)	Chloride (Cl) (mg/l)	Fluoride (F) (mg/l)	Iodide (I) (mg/l)	Silica (SiO_2) (mg/l)	Solids, residue on evaporation at 180°C (mg/l)	Nitrite plus nitrate (N) (mg/l)	Phosphorus (P) (mg/l)	Boron (B) (ug/l)	Iron (Fe) (ug/l)	Lithium (Li) (ug/l)	Manganese (Mn) (ug/l)	Strontium (Sr) (ug/l)	Uranium (U) (ug/l)
EM-1-1	6/14/78	175	1,218	7.5	8.5	22.4	1.010	150	45	9.7	220	2.2	63	52	270	220	0.8	0.04	15	818	1.0	0.00	200	40	50	60	670	2.4

* Calculated.

INDEX MAP



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

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

By

Roger D. Dockter

1980