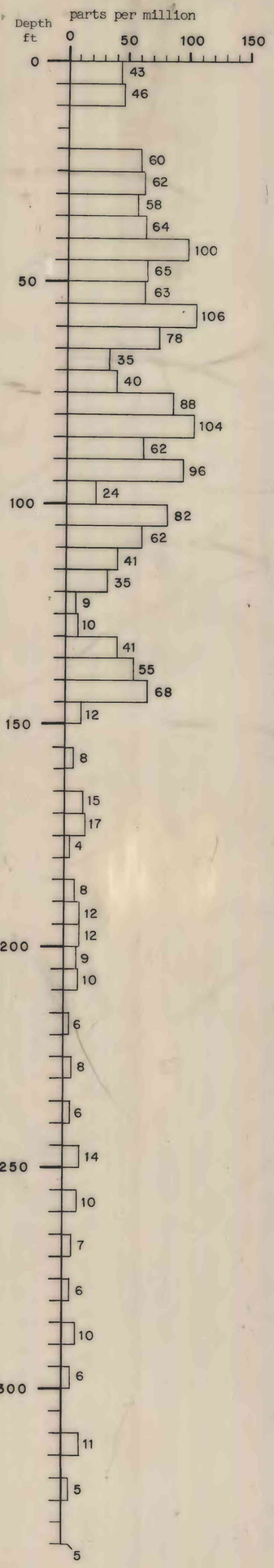
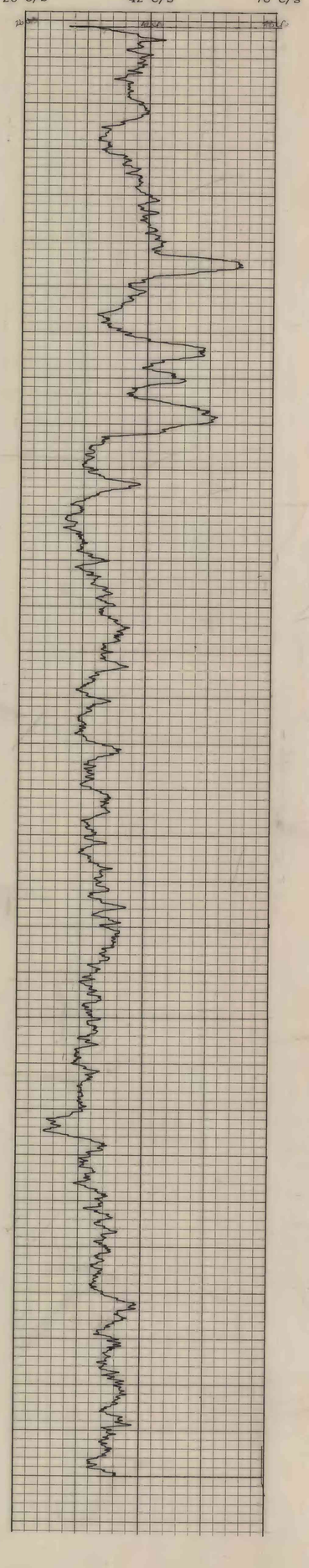
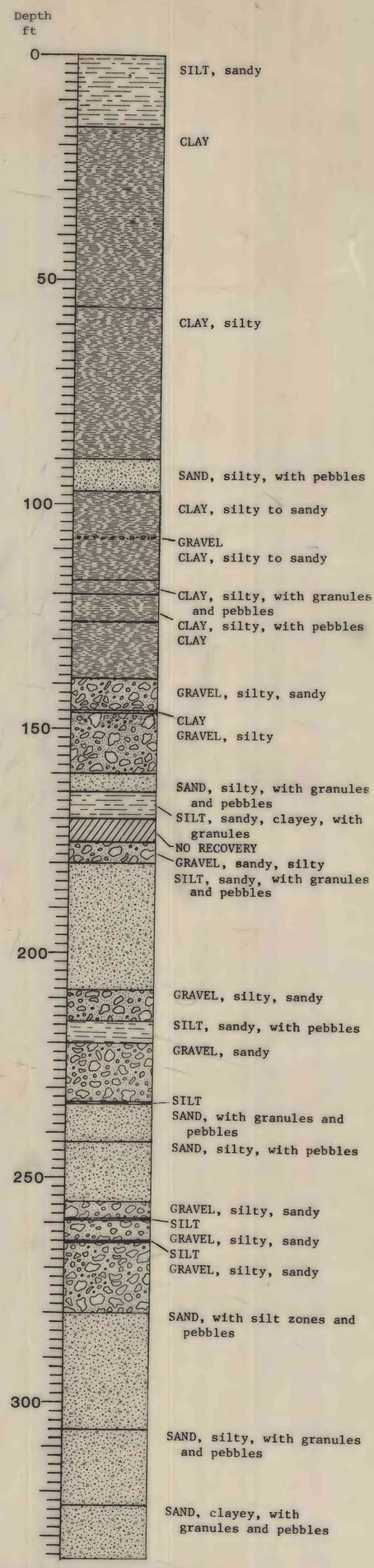
LITHIUM LOG
(J. D. Vine, 1978, written commun.)



GAMMA - RAY LOG
[c/s]



COLUMNAR SECTION



Total depth (TD) = 335 ft

LITHOLOGIC LOG

Depth (feet)		DESCRIPTION
0	- 16	Silt, sandy, moderate-yellowish-brown (10YR 5/4 dry), calcareous. Sand is very fine
16	- 26	Clay, variegated, dark-yellowish-brown (10YR 4/2), to moderate-yellowish-brown (10Y 6/2) and pale-olive (10Y 6/2), calcareous
26	- 56	Clay, grayish-black (N 2), calcareous, organic rich. Color changes from grayish-black (N 2) to black (N 1) from 30-56 ft
56	- 60	Clay, silty, light-olive-gray (5Y 5/2), calcareous. Unit contains 25-40 percent silt
60	- 65	Clay, silty, moderate-yellowish-brown (10YR 5/4). Unit contains 20-25 percent silt
65	- 72	Clay, silty, light-olive-gray (5Y 5/2). Unit contains 10 percent silt
72	- 76	Clay silty light-grayish-green (5G 6/2), calcareous. Unit contains 5 percent silt
76	- 90	Clay, silty, greenish-gray (5GY 6/1) and black (N 1), interbedded, calcareous. Unit contains 10-15 percent silt
90	- 97	Sand, medium to very coarse, subrounded, with pebbles, 20-30 mm across, subrounded, in a dusky-yellow (5Y 6/4) silt matrix. Unit is composed of 60 percent quartz and feldspar sand, 5 percent andesite and quartzite pebbles, and 35 percent silt
97	- 107	Clay, pale-olive (10Y 6/2), calcareous, with some silt and fine sand. Unit is composed of 80 percent clay, 10 percent silt, and 10 percent sand. At base of unit is a 6 in. thick layer of pebble gravel
107	-120	Clay, dark-yellowish-brown (10YR 4/2), silt, and fine sand. Unit contains 70 percent clay and 30 percent silt and sand. At 113 ft are minor amounts of medium to coarse sand. At 117 ft the unit contains 20 percent granules and pebbles 2-20 mm across
120	-126	Clay, silty, moderate-yellowish-brown (10YR 5/4), gritty, with minor amounts of coarse sand and pebbles. Pebbles, as much as 30 mm across, are quartz monzonite (75 percent), quartzite (17 percent), and micaceous sandstone (8 percent)
126	-130	Clay, moderate-yellowish-brown (10YR 5/4), calcareous, dry, sticky when wet, very finely laminated
130	-135	Clay. Lithology similar to 126-130 ft, but moderate-olive-brown (5Y 4/4)
135	-139	Clay. Lithology similar to 126-130 ft, but pale-olive (10Y 6/2)
139	-146	Gravel, granule and pebble, 2 mm to 15 mm across, angular, in a silt to fine sand, dusky-yellow (5Y 6/4), noncalcareous matrix. Silt content decreases toward base of unit
146	-146.5	Clay, moderate-brown (5Y 3/4)
146.5	-160	Gravel, subangular to subrounded, composed of quartzite and volcanic rock fragments as much as 13 mm across in a dusky-yellow (5Y 6/4) silt matrix. At 157 ft the unit changes to coarser subangular to angular gravel as much as 30 mm across of quartz monzonite (50 percent), quartzite (40 percent), and volcanic rock fragments (10 percent)
160	-164	Sand and silt, moderate-yellowish-brown (10YR 5/4), calcareous, with minor granules and pebbles. Unit is composed of 60 percent sand, 30 percent silt, and 10 percent granules and pebbles as much as 5 mm across
164	-170	Silt, moderate-yellowish-brown (10YR 5/4), and minor amounts of sand, clay, and granules as much as 3 mm across. Unit is composed of 75 percent silt, 10 percent sand, 10 percent clay, and 5 percent granules
170	-175	No recovery
175	-179	Gravel, with slight amounts of sand and silt. Unit composed predominantly of feldspar and quartzite granules
179	-208	Silt, sandy, moderate-yellowish-brown (10YR 5/4), calcareous, and minor amounts of pebbles and granules. Unit composed of 50 percent silt, 45 percent sand, and 5 percent pebbles (as much as 10 mm across) and granules. Silt increases to 75 percent, and sand and pebbles decrease to 20 percent and 5 percent, respectively by 190 ft
208	-215	Gravel, angular to subangular clasts of quartz monzonite, quartzite, diorite, and andesite, in a silt and sand matrix. Unit is composed of 50 percent pebbles and granules, 25 percent sand, and 25 percent silt
215	-220	Silt, sandy, moderate-yellowish-brown (10YR 5/4), with scattered angular to subangular pebbles. Unit is composed of 70 percent silt, 25 percent sand, and 5 percent pebbles
220	-233	Gravel, pebble and granule, with coarse sand. Unit is composed of 90 percent gravel and 10 percent sand. Sand averages 1 mm in diameter and gravel 3-5 mm across, but as much as 20 mm across. Sand content increases to 60 percent and gravel to 40 percent by 233 ft
233	-233.5	Silt, moderate-yellowish-brown (10YR 5/4)
233.5	-242	Sand, very coarse, with subangular granules and pebbles. Pebbles, as much as 30 mm across, are quartzite, quartz monzonite, or epidote. Clasts become more angular toward the base of the unit
242	-250	Sand, silty, moderate-yellowish-brown (10YR 5/4), medium, with pebbles. Pebbles are 2-4 mm across
250	-255	Sand, silty, with pebbles. Lithology similar to 242-250 ft, but increased silt and coarse sand as much as 1 mm in diameter
255	-280	Gravel, pebble and granule, subrounded to subangular clasts up to 6 mm across, composed of quartz monzonite with a fine sand and silt matrix. Two 6 in. beds of silt occur at 259 ft and at 264 ft. Pebbles increase to 10 mm across by 267 ft. Silt content increases to 10 percent by 272 ft and then decreases until absent at 280 ft
280	-292	Sand, coarse and 1-10 mm andesite and quartz monzonite pebbles with minor silty zones. Lower 6 in. composed predominantly of silt
292	-306	Sand, pebbles, and silt. Same lithology as 280-292 ft, but pebbles are 15-20 mm across, composed of angular feldspar fragments. A silt zone 6 in. thick occurs at 297 ft
306	-323	Sand, and gravel. Fine to medium sand, with minor amounts of silt and gravel. Unit composed of 90 percent sand, 5 percent silt, and 5 percent gravel (pebbles and granules). Pebbles as much as 7 mm across, and granules, 3-4 mm across, increase to 80 percent of unit by 318 ft
323	-335	Sand, fine to medium, with pebbles, as much as 6 mm across and granules in an indurated clay matrix. The lower 5 ft was not sampled, but was noted as having the same lithology

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 Emerson Dry Lake, Calif., are presented in this report.

LOCATION AND DRILLING METHODS

Test well E-2 was drilled in NE¼NW¼SE¼ sec. 7, T. 4 N., R. 6 E., SBM, California (lat. 34°26'45" N., long. 116°23'22" W.) on Emerson Dry Lake (see index map). This test well was completed in May 1978 to a total depth of 335 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 Emerson 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 E-2 are listed in the chemical analyses table.

GEOPHYSICAL LOG

A gamma-ray logging survey was run from the surface to a drilled depth of 320 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.

NOTE

Data from test well E-1, NE¼SE¼NE¼ sec. 12, T. 4 N., R. 5 E., SBM, are published in Open-File Report 80-869.

CONVERSION FACTORS

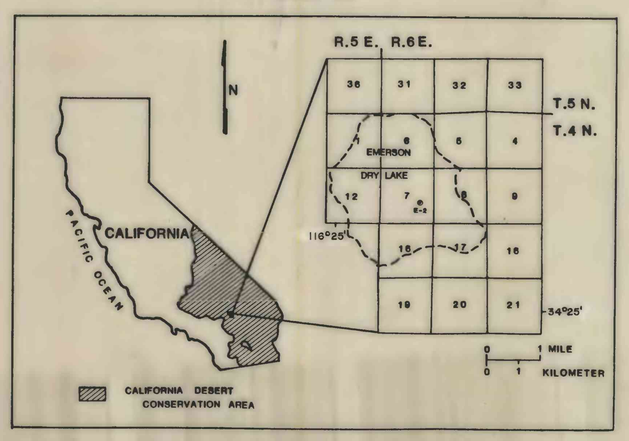
Multiply English unit	By	To obtain metric units
Inches (in.)	2.540	Centimeters (cm)
Feet (ft)	0.305	Meters (m)

Chemical analyses of ground water from test well E-2, Emerson Dry Lake, California
[Analyses by U.S. Geological Survey, Denver, Colo. —, no data.]

Test well-sample No.	Date sample collected	Sample depth (ft)	Specific conductance (microhms/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) (µg/l)	Boron (B) (µg/l)	Iron (Fe) (µg/l)	Lithium (Li) (µg/l)	Manganese (Mn) (µg/l)	Strontium (Sr) (µg/l)	Uranium (U) (µg/l)
E-2-1	5/13/78	90	130,000	9.0	9.1	22.4	1.105	7	1.0	1.0	53,000	150	13,908	11,400	17,000	63,000	110	0.90	12†0.4†	132,000	0.14	40	54,000	840	20	250	—	—
E-2-2	5/13/78	335	5,229	7.8	7.7	25.4	1.010	660	180	51	950	10	115	94	570	1,300	.9	.08	24	3,120	.28	.00	1,200	1,400	110	70	3,700	29

* Calculated.
† Determined on 1:200 dilution.

INDEX MAP



GEOPHYSICAL, LITHOLOGIC, AND WATER-QUALITY DATA FROM TEST WELL E-2 EMERSON DRY LAKE, SAN BERNARDINO COUNTY, CALIFORNIA

By

Roger D. Dockter

1980