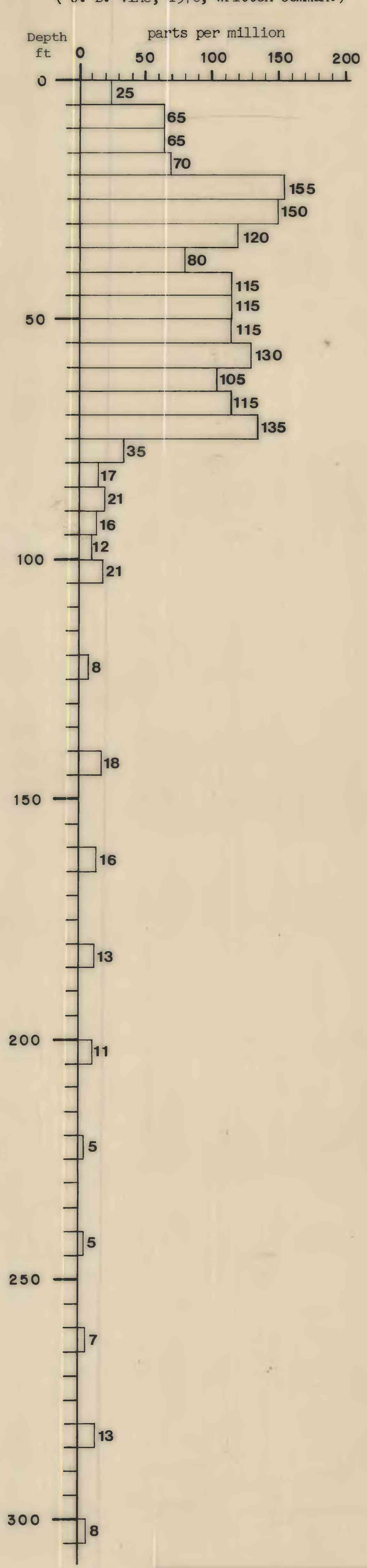
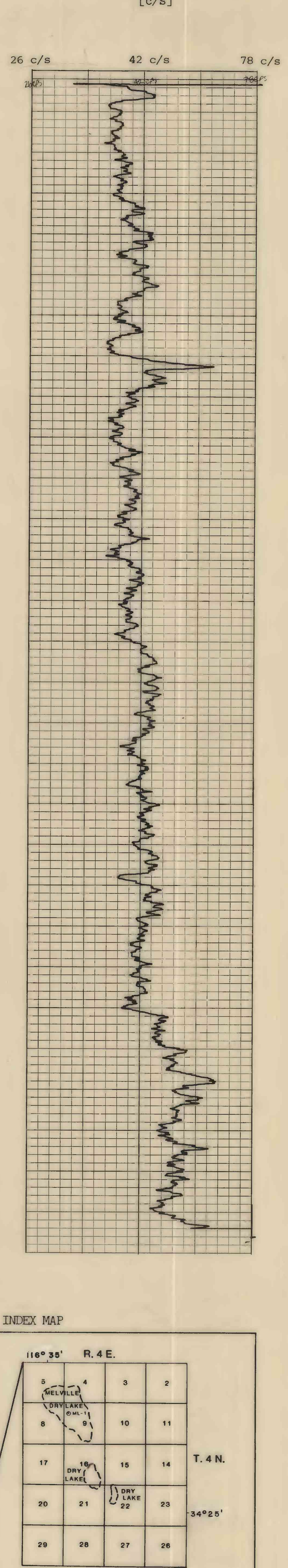
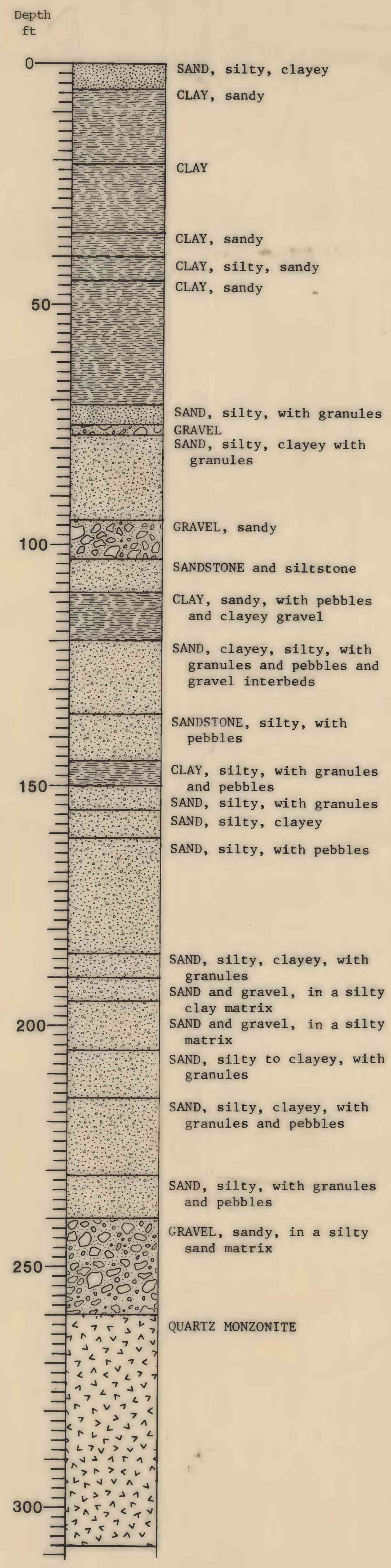
LITHIUM LOG
(J. D. Vine, 1978, written commun.)



GAMMA - RAY LOG
[c/s]

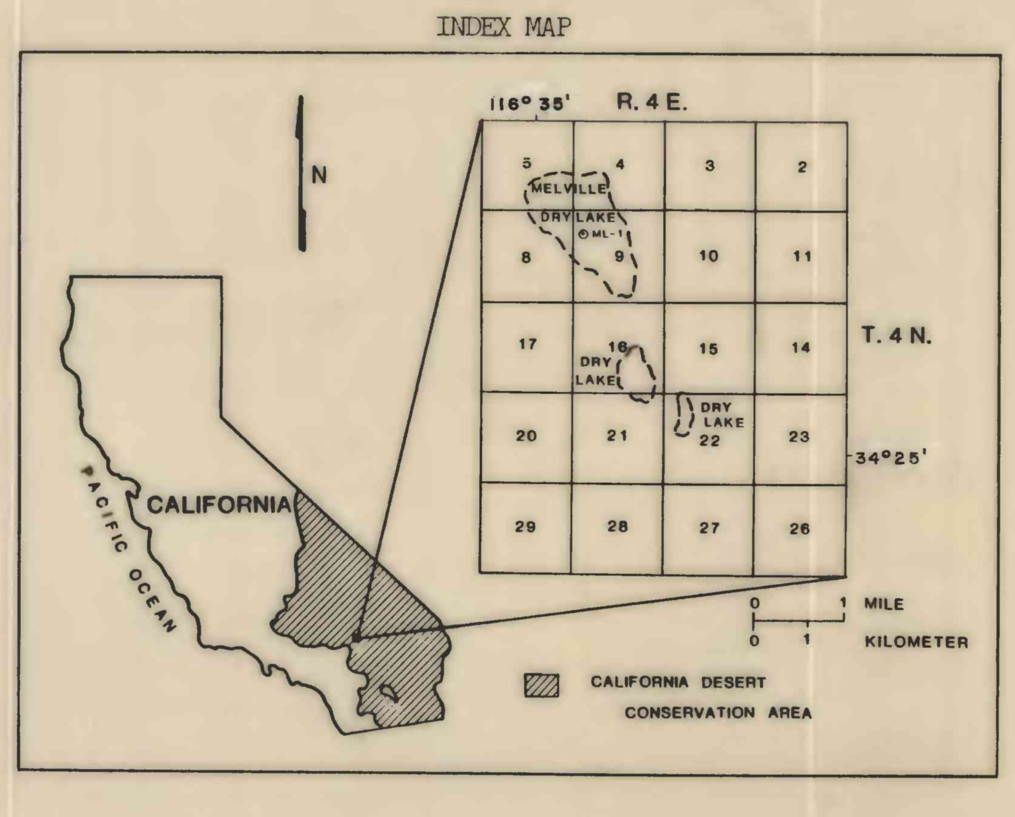


COLUMNAR SECTION



Total depth (TD) = 308 ft

INDEX MAP



LITHOLOGIC LOG

Depth (feet)	DESCRIPTION
0 - 5	Sand, fine to medium, light-olive-gray (5Y 6/1 dry) to moderate-yellowish-brown (10YR 5/4 dry), in a very calcareous, silt and clay matrix. Clay content increases toward base of unit
5 - 10	Clay, pale-olive (10Y 6/2), micaceous, calcareous, with fine to medium sand and occasional very coarse sand. Sand composed predominantly of quartz and feldspar. Unit is composed of 70 percent clay and 30 percent sand
10 - 15	Clay. Lithology similar to 5-10 ft, but clay is light-olive-gray (5Y 5/2) and sand content is lower. Clay also becoming very calcareous
15 - 21	Clay, dusky-yellow (5Y 6/4), very calcareous, with 10 percent fine to medium sand
21 - 35	Clay, moderate-yellowish-brown (10YR 5/4), very calcareous
35 - 40	Clay, greenish-gray (5GY 6/1), calcareous, with 2 percent fine sand
40 - 45	Clay. Lithology similar to 35-40 ft, but clay is grayish-orange (10YR 7/4) with a thin silty layer at 42 ft
45 - 50	Clay, dusky-yellow (5Y 6/4), calcareous, with zones containing as much as 10 percent very fine to fine sand
50 - 55	Clay. Lithology similar to 45-50 ft, but clay is moderate-yellowish-brown (10YR 5/4). Sand comprises only 1-2 percent of unit
55 - 71	Clay (variegated), moderate-yellowish-brown (10YR 5/4) and pale-greenish, yellow (10Y 8/2), calcareous, with minor amounts of fine sand. Unit contains some silt from 68 to 71 ft
71 - 75	Sand, moderate-yellowish-brown (10YR 5/4), medium, with granules in a calcareous, silt matrix. Unit is poorly consolidated
75 - 77	Gravel, pebble, well-sorted, subrounded, with clasts as much as 6 mm across
77 - 80	Sand, fine, micaceous, with occasional granules in a moderate yellowish-brown (10YR 5/4) calcareous silty clay matrix
80 - 94.5	Sand, with granules in a silty clay matrix. Lithology similar to 77-80 ft, but silty clay is grayish-orange (10YR 7/4), only slightly calcareous, and includes 10 percent pebbles, 4-10 mm across between 90-94.5 ft
94.5-103.5	Gravel, granule and pebble, 4-13 mm across, subrounded, composed of granite and volcanic rock fragments in a moderate-yellowish-brown (10YR 5/4), fine-grained, moderately calcareous, sandstone matrix. Unit is composed of 60 percent clasts and 40 percent matrix
103.5-110	Sandstone and siltstone (interbedded), moderately-yellowish-brown (10YR 5/4), calcareous. Color changes to grayish-orange (10Y 7/4) and unit is less calcareous from 105 to 110 ft
110 -120	Clay, moderate-yellowish-brown (10YR 5/4) and minor amounts of pale-orange (10YR 8/2), noncalcareous, with subangular to angular, fine sand to pebbles. Gravel content increases toward base of unit. Upper part of unit composed of 80 percent clay and 20 percent clasts. At base of unit the composition is 20 percent clay and 80 percent 4-22 mm clasts of quartz and feldspar
120 -125	Sand, fine to very fine, interbedded with granules and pebbles, both in a moderate-yellowish-brown (10YR 5/4), slightly calcareous, silty clay matrix. Unit composed of 50 percent clasts and 50 percent silty clay
125 -140	Sand, fine, and pebbles as much as 4-22 mm across in a moderate-yellowish-brown (10YR 5/4) clay matrix. Unit composed of 80 percent clasts and 20 percent clay
140 -145	Sandstone, medium- to very coarse-grained, but predominantly very coarse-grained, with pebbles in a calcareous, very fine sand and silt matrix. Unit composed of 50 percent matrix and 50 percent clasts
145 -150	Clay (variegated), grayish-orange (10YR 7/4) to very-pale-orange (10YR 8/2), silty, with interbeds of medium sand, granules, and pebbles as much as 0.62 mm across. Unit composed of 70 percent silty clay and 30 percent clasts composed of granite and aplite
150 -155	Sand, very coarse, composed of quartz, feldspar, and mica, with granules in a grayish-orange (10YR 7/4) to very pale to orange (10YR 8/2), noncalcareous, silt to fine sand matrix. Unit composed of 85-90 percent clasts and 10-15 percent matrix
155 -161	Sand, in grayish-orange (10YR 7/4) to very-pale-orange (10YR 8/2) silty clay matrix. Unit is composed of 50 percent sand and 50 percent matrix
161 -170	Sand and pebbles in a silt to fine sand matrix. Lithology similar to 150-155 ft, but contains larger pebbles 4-8 mm in a grayish-orange (10YR 7/4) matrix
170 -177	Sand and scattered pebbles in a silty sand matrix. Lithology similar to 161-170 ft, but contains predominantly coarse to very coarse sand in a moderate-yellowish-brown (10YR 5/4) matrix
177 -185	Sand and pebbles in a silty sand matrix. Lithology similar to 170-177 ft, but unit composed of 80 percent clasts and 20 percent matrix
185 -190	Sand, coarse, and granules in a pale-greenish-yellow (10Y 8/2) silty clay matrix. Unit composed of 80 percent clasts and 20 percent matrix
190 -195	Sand and gravel in a silty clay matrix. Lithology similar to 185-190 ft, but unit composed of 95 percent clasts and 5 percent matrix. Clasts include subangular pebbles, as much as 15 mm across, composed of quartz and feldspar
195 -205	Sand and gravel in a silty matrix. Lithology similar to 190-195 ft, but matrix is silty and clasts are as much as 50 mm across, composed of quartz monzonite. Unit contains two 6 in. layers of well-cemented sand at 197 and at 202 ft
205 -215	Sand and granules in a silty clay matrix. Lithology similar to 185-190 ft, but matrix is grayish-orange (10YR 7/4)
215 -231	Sand, granules, and pebbles in a silty clay matrix. Lithology similar to 190-195 ft, but matrix is olive-gray (5Y 4/1), micaceous, and increases to 20 percent of unit at 220 ft, but then decreases to 10 percent of unit below 220 ft
231 -240	Sand, granules, and pebbles in a silty matrix. Lithology similar to 185-190 ft, but pebbles only 6 mm across and composed of quartz monzonite and andesite fragments
240 -260	Gravel, granule, with medium to very coarse subangular to angular sand in a micaceous fine sand and silt matrix. Unit composed of 95 percent granules and 5 percent matrix. Unit well cemented by calcium carbonate near base
260 -308	Quartz monzonite to quartz diorite, well weathered, crumbly

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

LOCATION AND DRILLING METHODS

Test well ML-1 was drilled in SE¼NW¼NW¼ sec. 9, T. 4 N., R. 4 E., SBM, California (lat. 34°27'07" N., long. 116°34'27" W.) on Melville Dry Lake (see index map). This test well was completed in May 1978 to a total depth of 308 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 Melville 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 ML-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 284 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)

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

Chemical analyses of ground water from test well ML-1, Melville 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 (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) (µg/l)	Iron (Fe) (µg/l)	Lithium (Li) (µg/l)	Manganese (Mn) (µg/l)	Strontium (Sr) (µg/l)	Uranium (U) (µg/l)
ML-1-1	5/17/78	95	5,641	9.1	8.9	19.2	1.015	33	10	1.9	1,300	30	232	190	990	1,200	6.8	0.10	11	3,580	0.36	0.01	3,400	1,300	150	30	280	—
ML-1-2	5/17/78	308	6,913	9.6	9.2	21.4	1.015	15	4.9	.7	1,600	11	939	770	1,200	1,000	26	.19	10	4,480	.11	.41	18,000	20	30	10	270	46

* Calculated.

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

By

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1980