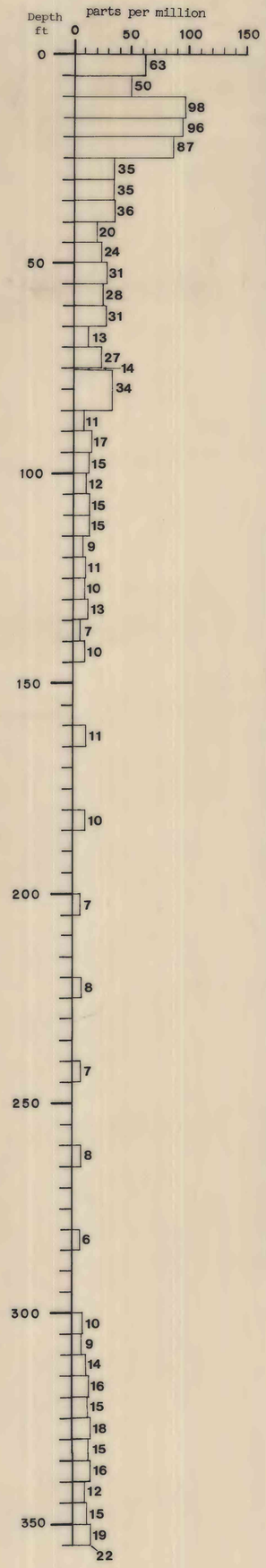
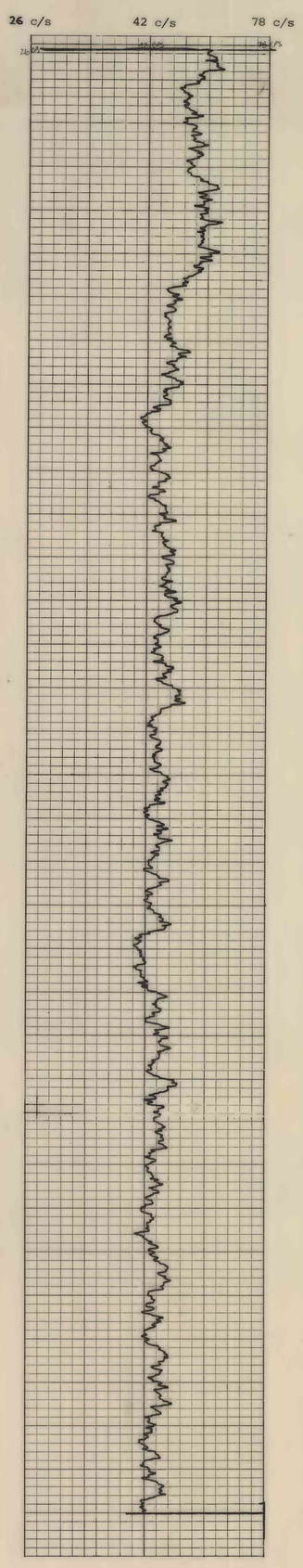
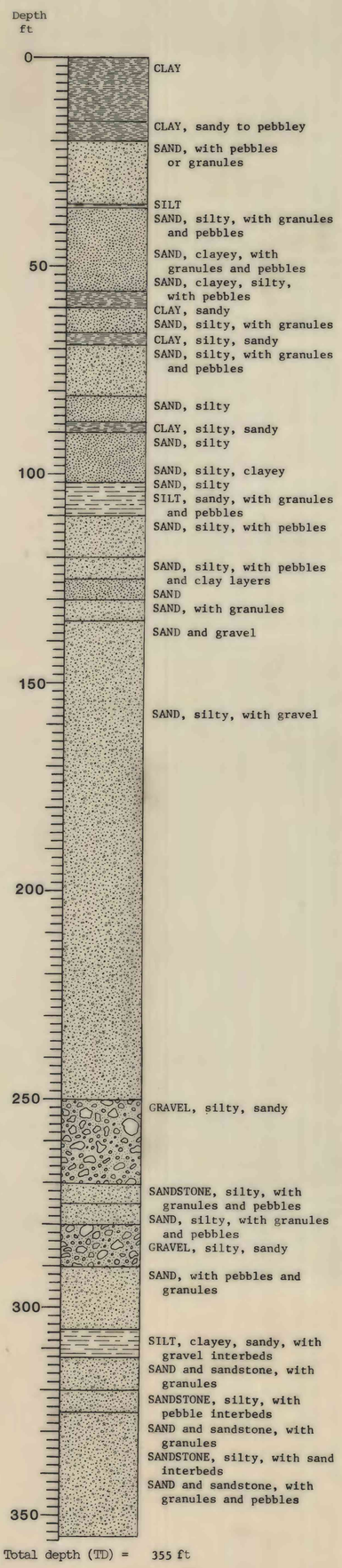
LITHIUM LOG
(J. D. Vine, 1978, written commun.)



GAMMA - RAY LOG
[c/s]



COLUMNAR SECTION



Total depth (TD) = 355 ft

LITHOLOGIC LOG

Depth (feet)	DESCRIPTION
0- 15	Clay, moderate-yellowish-brown (10YR 5/4 dry), calcareous
15- 20	Clay, moderate-yellowish-brown (10YR 5/4), calcareous, with 15 percent fine sand and occasional granules and pebbles as much as 20 mm across
20- 30	Sand, medium to coarse, with occasional pebbles in a calcareous, grayish-orange (10YR 7/4) silt matrix
30- 35	Sand, coarse to very coarse, with minor amounts of granules in a grayish-orange (10YR 7/4) calcareous clayey silt matrix
35- 36	Silt, grayish-orange (10YR 7/4), clayey
36- 50	Sand, coarse to very coarse, and granules with occasional pebbles in a moderate yellowish-brown (10YR 5/4) silt matrix. Unit composed of 50 percent sand, 40 percent granules, 5 percent pebbles as much as 20 mm across, and 5 percent silt. Matrix becomes clayey and comprises 15 percent of unit between 45-50 ft
50- 56	Sand, coarse to very coarse, and occasional pebbles in a dusty-yellow (5Y 6/4) calcareous clayey silt matrix. Some intervals are cemented by caliche. Unit composed of 85 percent sand and 15 percent matrix
56- 60	Clay, moderate-yellowish-brown (10YR 5/4), calcareous, with medium to very coarse sand. Unit composed of 80 percent clay and 20 percent sand
60- 66	Sand, medium to very coarse (mainly medium), and granules in a moderate-yellowish-brown (10YR 5/4) silt matrix. Unit composed of 90 percent sand, 5 percent granules, and 5 percent silt
66- 69	Clay, moderate-yellowish-brown (10YR 5/4), silty, with medium to very coarse sand. Unit composed of 60 percent silty clay and 40 percent sand
69- 81	Sand, medium to coarse, with granules and pebbles in a dark-yellowish-orange (10YR 6/6), calcareous, silt matrix. Unit composed of 50 percent medium sand, 10 percent coarse sand, 10 percent granules, 10 percent pebbles as much as 10 mm across, and 25 percent silt
81- 87	Sand, medium to coarse in a silty matrix. Unit composed of 50 percent sand and 50 percent matrix
87- 90	Clay, light-brown (5YR 5/6), silty, calcareous with 40 percent fine to coarse sand
90- 98	Sand, medium to very coarse, and moderate-yellowish-brown, (10YR 5/4) noncalcareous silt. Unit composed of 50 percent sand and 50 percent silt. Lower 2 ft of unit contains 65 percent sand
98- 99	Sand, medium to coarse in a moderate-yellowish-brown (10YR 5/4), silty clay matrix. Unit composed of 65 percent sand and 35 percent matrix
99-102	Sand, fine to coarse (predominantly medium) in a moderate-yellowish-brown (10YR 5/4) silt matrix. Unit composed of equal amounts of sand and silt
102-110	Silt, grayish-orange (10YR 7/4), calcareous, with medium to very coarse sand and granules and pebbles. Unit composed of 50 percent silt, 35 percent sand, and 15 percent granules and pebbles as much as 20 mm across
110-115	Sand, coarse to very coarse, with scattered pebbles as much as 40 mm across in a silt matrix. Unit composed of 90 percent sand, 5 percent pebbles, and 5 percent silt. Larger pebbles are composed of epidotized granodiorite. Sand contains abundant magnetite grains at 114 ft
115-120	Sand, coarse to very coarse, with occasional pebbles in a grayish-orange (10YR 7/4), calcareous silt matrix. Pebbles as much as 50 mm across. Unit composed of 80 percent sand, 5 percent pebbles, and 15 percent silt
120-125	Sand. Lithology similar to 115-120 ft except unit contains a few thin layers of grayish-orange (10YR 7/4), calcareous clay
125-130	Sand, coarse to very coarse, with a very fine to fine sand matrix. Unit composed of 60 percent coarse to very coarse sand and 40 percent matrix
130-135	Sand, coarse to very coarse and fine, with granules. Unit composed of 50 percent coarse sand, 20 percent fine sand, and 30 percent granules
135-140	Sand and gravel. Unit composed of 50 percent granules, with minor amounts of pebbles up to 30 mm across, 40 percent coarse to very coarse sand, and 10 percent fine sand
140-150	Sand, coarse to very coarse, with granules and pebbles as much as 30 mm across in a fine sand matrix. Unit composed of 65 percent coarse to very coarse sand, 10 percent fine sand, 22-23 percent granules, and 2-3 percent pebbles composed of granodiorite
150-155	Sand and gravel. Lithology similar to 140-150 ft except unit contains 50 percent granules and 40 percent coarse to very coarse sand. Pebbles are as much as 60 mm across and comprise less than 1 percent of unit
155-160	Sand, coarse to very coarse, with granules and pebbles in a silty matrix
160-170	Sand, medium to very coarse, in a silty to fine sandy matrix. Unit composed of 90 percent sand and 10 percent matrix. Unit contains occasional clasts of quartz diorite, as much as 30 mm across, between 165 and 170 ft
170-220	Sand. Lithology similar to 160-170 ft except unit is mainly medium sand and contains occasional cobbles as much as 80 mm across. Larger pebbles and cobbles are usually composed of quartz diorite, but between 200 and 205 ft they are andesite. Between 175 and 180 ft the unit contains 10 percent granules
220-225	Sand, medium to very coarse, with granules and pebbles in a silt to fine sand matrix. Unit composed of 70 percent sand, 5 percent granules, 15 percent pebbles as much as 50 mm across, and 10 percent matrix. Larger pebbles composed of quartz diorite
225-235	Sand, medium to very coarse, with granules and pebbles in a silt matrix. Unit composed of 50 percent sand, 25 percent granules, 20 percent pebbles, and 5 percent silt. Below 230 ft the sand increases to 80 percent and the granules and pebbles to 10 and 5 percent, respectively. Pebbles, as much as 50 mm across, are granodiorite or quartz diorite. Cemented sand layers, as much as 6.0 in. thick, occur below 230 ft

LITHOLOGIC LOG cont.

Depth (feet)	DESCRIPTION
235-240	Sand. Lithology similar to 225-235 ft except pebbles include clasts of quartz monzonite. Unit composed of 60 percent sand, 30 percent granules, 5 percent percent pebbles, and 5 percent silt
240-250	Sand, medium to very coarse, with granules and pebbles in a silt matrix. Larger pebbles 30-50 mm across, are quartz diorite, epidotized rhyolite(?), or andesite. Some sand layers are very coarse and well cemented. Unit composed of 80 percent sand, 15 percent granules and pebbles and 5 percent silt
250-270	Gravel, granule and pebbles, with coarse to very coarse sand in a silt to fine sand matrix. Locally cemented by calcium carbonate. Unit composed of 50 percent granules, 5 percent pebbles as much as 20 mm across, 40 percent coarse to very coarse sand, and 5 percent matrix. Below 260 ft the unit contains occasional quartzite pebbles as much as 40 mm across. At 267 ft is a 6.0 in. layer of caliche cemented coarse sand and pebbles composed of 80 percent sand, 10 percent pebbles, and 10 percent caliche
270-275	Sandstone, medium- to very coarse grained, with granules and scattered pebbles cemented by a calcareous, silty matrix interbedded with unconsolidated sand with similar composition. The beds are composed of 85-90 percent sand, 5 percent granules, and 5-10 percent matrix
275-280	Sand, medium to very coarse, with granules and pebbles in a silt matrix. Unit composed of 85 percent sand, 10 percent granules and occasional pebbles, and 5 percent silt matrix
280-290	Gravel, granule and pebble, with medium to very coarse sand in a silt to fine sand matrix. Unit composed of 50 percent granules, 5 percent pebbles as much as 20 mm across, 40 percent sand, and 5 percent matrix. Unit contains a thin bed of medium to coarse sand in a silty clay matrix at 288 ft
290-305	Sand, medium to very coarse, with granules and pebbles in a silt to fine sand matrix. Unit composed of 60 percent sand, 15 percent granules, 15 percent pebbles, and 10 percent matrix. Below 295 ft the composition changes to 45 percent sand, 20 percent granules, 20 percent pebbles, and 15 percent matrix
305-312	Silt, moderate-yellowish-brown (10YR 5/4), clayey, noncalcareous, with medium to very coarse sand interbedded with granule and pebble gravel in a fine to medium sand matrix. Silty beds composed of 60 percent clayey silt and 40 percent sand
312-320	Sand, coarse to very coarse, with scattered granules in a silt to fine sand matrix, and sandstone interbeds as much as 6 in. thick composed of medium- to very coarse grained sand with scattered granules in a noncalcareous silt matrix. Sand beds composed of 90 percent sand, 5 percent granules, and 5 percent matrix. Sandstone composed of 90 percent sand and 10 percent matrix
320-325	Sandstone, medium- to very coarse grained, well cemented in a silt matrix. Unit contains a few thin interbeds containing pebbles as much as 10 mm across. Sandstone composed of 50 percent sand and 50 percent matrix
325-330	Sand and sandstone. Lithology same as 312-320 ft
330-340	Sandstone. Lithology similar to 320-325 ft, but also contains interbeds of clean, medium to very coarse sand with occasional granules and 5 percent silt matrix
340-355	Sand and sandstone. Lithology similar to 312-320 ft, but with occasional pebbles as much as 20 mm across. Pebbles are granodiorite or quartz monzonite

CONVERSION FACTORS

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

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

LOCATION AND DRILLING METHODS

Test well SU-1 was drilled in NW¼SW¼SW¼ sec. 11, T. 31 S., R. 46 E., MDM, California (lat. 35°14'45" N., long. 117°01'40" W.) on Superior Dry Lake (see index map). This test well was completed in June 1978 to a total depth of 355 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 Superior 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 purging 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 SU-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 340 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

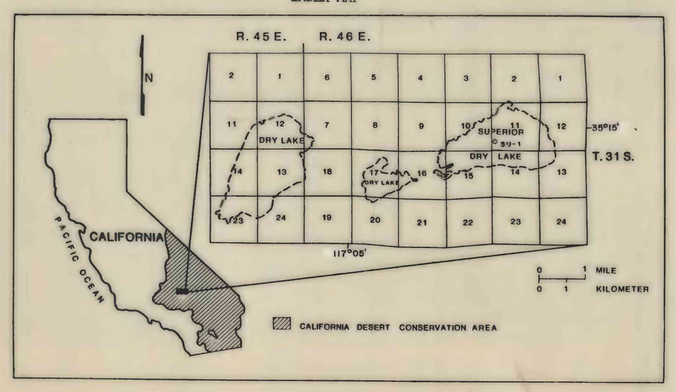
G. Thomas Server supplemented field lithologic descriptions by laboratory study of sediment cuttings under binocular microscope. J. D. Cathcart, U.S. Geological Survey, Denver, Colo., ran the geophysical log.

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.

INDEX MAP



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

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)	Nitrate 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)
SU-1-1	6/19/78	155	1,005	8.9	8.6	20.3	1.010	15	5.4	0.3	220	3.8	293	240	95	92	7.4	0.02	60	635	1.7	0.00	1,400	350	20	20	70	17
SU-1-2	6/19/78	355	4,512	8.4	8.2	20.2	1.010	330	25	64	950	9.0	232	190	320	1,300	9.4	.11	52	2,690	1.5	.00	3,700	50	20	50	390	13

* Calculated.

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

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

By

Roger D. Dockter

1980