UNITED STATES
DEPARTMENT OF THE INTERIOR
GEOLOGICAL SURVEY

Technical Letter
Dribble-15
January 17, 1962

Federal Center, Denver 25, Colorado

Mr. James Reeves
Assistant Manager for Test Operations
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Dear Mr. Reeves:

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TECHNICAL LETTER: Dribble-15

GEOLOGY OF CORE HOLE WP-1
TATUM DOME, LAMAR COUNTY,
MISSISSIPPI

By

D. H. Eargle

January 17, 1962

USGS-474-278

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Sincerely yours,

W S Twenhofel

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Program Supervisor
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GEOLOGY OF CORE HOLE WP-1
TATUM DOME, LAMAR COUNTY,
MISSISSIPPI

By

D. H. Eargle

INTRODUCTION

Core hole WP-1 was drilled on the crest of Tatum salt dome, Lamar County, Mississippi, as an exploratory and pilot hole in the initiation of the operations on Project Dribble of the Atomic Energy Commission's Vela Uniform program. Core hole WP-1 is in the southeastern part of sec. 11, T. 2 N., R. 16 W. (see fig. 1), and has the Holmes and Narver coordinates 10,167 N., 8,041 E.; it is 167 feet north and 1,959 feet west of the common point of sections 11, 12, 13 and 14 of the township (this common point has the Holmes and Narver coordinates 10,000 N., 10,000 E.). The ground level at the site is 270.53 feet above sea level, and the datum for electrical logging and the core depths is the rotary drive bushing, 278.61 feet above sea level (these elevations were rounded out to 271 for ground level and 279 for the rotary bushing for plotting). The hole was spudded in on February 4, 1961, and was completed at a total depth of 3,509 feet on June 28, 1961.

Coring began at 33 feet below the surface and was carried on continuously to 2,713 feet, except for 68 feet in the anhydrite caprock

FIGURE 1.— LOCATION MAP FOR AEC HOLES ON AND NEAR TATUM DOME, LAMAR COUNTY, MISSISSIPPI

From "Tatum Dome Test Holes Location Plan," September 1961
US G S December, 1961

in several sections in the interval between 1,055 and 1,449 feet, and 1 foot in the salt, from 2,331 to 2,332 feet. From 33 to 1,513 feet, or about 3.5 feet below the top of the salt stock, NX cores, 2-1/8 inches in diameter, were recovered. From 1,513 to 2,713 feet (driller's measurements) 4-15/16-inch cores were recovered. Salt cores of the larger diameter were required chiefly for physical tests. From 2,713 to 3,509 feet the hole was not cored and no samples were recovered; the hole was bottomed in salt.

The cores were examined megascopically, and at close intervals samples were studied under the binocular microscope for texture, mineral content, and for accessories such as plant matter and fossils. Not all of the anhydrite and salt cores were studied, but they were studied at such intervals as were convenient when the cores were being chosen for physical tests. The salt cores were studied using transmitted as well as reflected light. The use of transmitted light brought out many features of structure, texture, and mineral fabric not observable in reflected light.

A log of WP-1, that records all operations in the drilling, logging, and casing of the hole, prepared by E. L. Herbst, of Holmes and Narver, Inc., Engineers-Contractors for Project Dribble, and daily reports of the engineers on the site were utilized in summarizing the operations and the condition of the hole. The courtesies extended to the personnel of the Geological Survey by that company, by the Reynolds Electric and Engineering Co., who furnished equipment, supplies, and quarters for the work, and by the officials of the Atomic Energy Commission, especially Ray C. Emens, Engineer-in-Charge, are gratefully acknowledged.

GEOLOGY

The geology of core hole WP-1 was determined by examination of cores and cuttings and was inferred from study of the geophysical logs. Figure 2 shows (1) the trace of the electrical log from the surface to the 1,435-foot depth and the trace of the sonic log from the surface to 1,700 feet; (2) a schematic log showing the generalized lithologic character of the rocks, determined from core and sample examination, from interpretation of geophysical logs, and from Hycalog. Appendix 1 is a lithologic description of the beds; Appendix 2 is a table showing core depths, length of core recovered, and drilled intervals; Appendix 3 is a list of fractures, most of which are slickensided, that were observed in the anhydrite caprock; Appendix 4 is a list of in-hole surveys and logs produced.

Core recovery from the sedimentary section overlying the caprock and from the limestone and gypsum caprock was poor. The description of the lost-core sections are largely from Hycalog, and the boundaries of many of the beds have been interpreted from the geophysical logs.

The cores are stored in the warehouse of the Atomic Energy Commission at Hattiesburg, Miss. They were examined there, generally a week or more after they were received from the drill site. The cores of the sedimentary section overlying the caprock were examined by Clarence A. Armstrong, Thad Shows, and the writer. The caprock and salt cores were examined by Julius Schlocker and the writer.

Stratigraphy

The materials penetrated by WP-1 are classified under three headings: (1) sediments overlying the caprock; (2) caprock; (3) salt. The following

is a generalized description of these formations as revealed in the cores. A more detailed description of the beds, summarized from core descriptions, Hycalog, and from interpretation of geophysical logs, is recorded in the lithologic log in Appendix 1 of this report.

Sediments Overlying the Caprock

Pascagoula and Hattiesburg clays, undifferentiated.-- Unconsolidated calcareous silt and clay of the Pascagoula and Hattiesburg clays, undifferentiated, of Miocene age, underlie the surface at WP-1. These formations are similar in lithologic character and, perhaps because they have not been studied in detail, have not been satisfactorily differentiated in the subsurface of southern Mississippi. In down-dip areas they are believed to have been formed under similar conditions and from materials from the same source area, thus accounting for their similar lithology. The two formations are here, therefore, considered as a single unit that extends from the surface to a depth of 680 feet.

The unit in the Tatum dome area consists of interbedded, greenish-gray, bluish-green, and olive silty clays, bluish silt, and gray, fine-grained, loose sand. A few beds of smooth clay containing only a small percentage of silt were encountered.

Much of the silt and silty clay contains disseminated mica flakes, pyrite crystals, and, locally, pyrite nodules; some clays are calcareous and locally contain carbonate concretions. The more clayey beds are internally slickensided with the types of slickensiding that results chiefly from compaction; some slickensides may have resulted from faulting. The clays are generally thick bedded and massive, and are

not distinctively laminated. A few clays contain carbonaceous matter, generally finely divided.

The sands are cross bedded to massive and are chiefly quartz with only minor proportions of heavy minerals. Some of the sands are gravelly, with pebbles as much as a half an inch in diameter, consisting chiefly of chert and some quartzite. The sands contain fresh water and are considered to be excellent aquifers.

Catahoula sandstone.--The Catahoula sandstone consists of greenish-gray silt, silty clay, and clay, interbedded with gray loose sand. The beds superficially resemble those of the overlying Pascagoula-Hattiesburg, but several differences have been noted. The silts and clays of the Catahoula are generally of lighter greenish gray, are more carbonaceous, and are generally less calcareous than the overlying formations. The clays are similar, however, in that they contain disseminated pyrite, mica, and some calcareous nodules. A zone of mottled greenish-gray and reddish-brown clay was noted from 716 to 738 feet.

In a zone of clayey silt from 738 to 754 feet fossil pelecypods and foraminifera were found. Ruth Todd, USGS, reports that the foraminifera are chiefly of one species, Streblus beccarii (Linné) parkinsoniana (d'Orbigny), several thousand specimens of which were recovered from a sample she studied, with one specimen of Elphidium cf. poeyanum (d'Orbigny). These fossils have been found in Miocene and younger beds in the Gulf and Atlantic Coastal Plains. She interprets the environmental conditions under which this assemblage accumulated as shallow, brackish, or swampy.

The sands of the Catahoula are very fine grained near the top of the formation but in approximately the lower 100 feet a few beds are

coarse grained and gravelly. The gravel is chiefly rounded chert pebbles as large as a half an inch in diameter.

At the base of the Catahoula section, from the 892-foot depth to the top of the caprock at about 929 feet, is a fossiliferous sand containing about a 4-foot section of hard limestone conglomerate. The sand is generally fine grained, but at the bottom, below the limestone conglomerate, is medium to coarse grained. It contains shells and fragments of thin-shelled pelecypods. The limestone conglomerate is coarsely crystalline, white to brown, cavernous, fossiliferous, and locally contains open solution channels.

The basal Catahoula sandstone, medium to coarse grained, lies with apparent unconformity on caprock limestone at a depth of approximately 929 feet.

Caprock

The caprock has three zones, typical of many salt domes, in descending order: limestone, gypsum, and anhydrite. The limestone zone consists of bands of white to light-brown, coarsely crystalline calcite, alternating with bands of nearly black calcite. The bands are thin and irregular.

From 929 to 940 feet only 0.2 feet of core consisting of brownish-gray vuggy limestone was recovered. From 940 to 979 feet no core was recovered.

Below 979 feet two types of material were encountered. From 979 to about 1,005 feet, represented by only 4 feet of core, the limestone is medium gray, finely crystalline calcite, with only some of the crystals

cemented, giving granular porosity. Vugs, obviously solution channels, are common. The proportion of rock cemented with calcium carbonate increases with depth. Some of the lower part of the core contains steeply dipping bands of dark calcite.

From 1,005 to 1,048 feet the limestone, represented by 9 feet of core, consists of white and brownish-white bands alternating with grayish-black bands. The bands are irregular in width, ranging from an eighth to a half an inch in width, and are generally horizontal. The white bands consist of both equigranular calcite and acicular radiating crystals of strontianite and celestite (J. Schlocker, personal communication) and the black bands are mostly calcite. The core shows that the section has been subjected to leaching and vugs are common; they are more abundant in the white layers and are both larger and more abundant with depth. The vugs are lined with drusy white to brown calcite crystals. The lower part of the core is very irregularly banded and is coarsely vuggy. The limestone fragments, rounded during drilling, have a fetid odor when broken.

No core was recovered from the gypsiferous zone of the caprock, which extends from approximately 1,048 to 1,054 feet (determined from the geophysical logs and from Hycalog). Hycalog, however, reports, from an analysis of the drilling time and from an examination of the cuttings, that the material encountered in that section was limestone and gypsum.

The anhydrite caprock, extending from 1,054 to 1,509.5 feet, consists of dense firm medium- to light-gray crystalline anhydrite. The upper few feet are banded with gypsum veins, nearly horizontal or inclined as much as 25 degrees. The gypsum is generally light gray, firm, and in lenses

as much as an inch thick. The gypsiferous section grades downward with decreasing width and frequency of veins into solid anhydrite. The anhydrite consists of medium-sized, interlocking, randomly oriented crystals about 1 mm in diameter, rarely as much as 2-1/2 mm in diameter. A few tiny crystals of calcite are scattered throughout most of the anhydrite and rare yellow crystals of sulfur have been found. When wet the anhydrite appears to be banded with light-gray irregular bands several inches thick; some of these bands are richer in calcite than the darker bands, and the contacts between them are generally sharp.

The lower 2.5 feet of the anhydrite zone consists of sugary unconsolidated to poorly consolidated discrete crystals of anhydrite. The crystals appear to be of about the same size as those in the indurated section. The upper and lower contacts of this zone are sharp. The anhydrite caprock is 455.5 feet thick.

Within the anhydrite section are numerous fractures, many of which are slickensided and smeared with glossy gypsum. In the upper part of the anhydrite caprock the slickensides are bordered on both sides with a zone of gypsum about half an inch thick. Some of the slickensides contain abundant sulfur smeared along the plane. In the lower part of the caprock the slickensides contain some asphalt (?); some fractures that are not slickensided also contain this dull coating of asphalt (?). As many as 28 individual fractures or slickensides were counted in the section (listed in Appendix 3), in addition to one zone of abundant fractures, which is possibly a fault zone, at about 1,397 feet. The dip of the fractures in the anhydrite range from horizontal (about

one-third of the total) to as much as 40 degrees from the horizontal.

Salt

The salt stock of WP-1 is medium-gray and medium-light-gray to clear crystalline salt, consisting of bands of nearly pure halite alternating with bands of anhydrite-rich halite, at a nearly vertical attitude. The bands average 1 inch to 3 inches in thickness. The halite crystals range from about 2 mm to 27 mm (about 1 inch) in diameter, are interlocked, and are generally somewhat elongate. The boundaries between the crystals are usually distinct, and, although irregular, generally show an elongate orientation of the crystals dipping about 40 to 50 degrees from the horizontal, thus cutting obliquely across the nearly vertical banding (80 to 90 degrees) of the salt stock. Some of the halite crystals in the anhydrite-poor bands contain nearly transparent discrete crystals of anhydrite, and rhombs of dolomite.

The anhydrite-rich bands are cloudy and translucent to shadowy. Some of the bands are discontinuous, but they generally persist throughout the length of cores several feet long. The boundaries with the more pure halite layers are generally distinct, but not sharp. The continuity of the anhydrite-rich bands is in many places disturbed by more pure salt along the 40 to 50 degrees oriented elongation of the salt crystals.

Salt was encountered in the core hole at 1,509.5 feet, and persisted with little change in character to total depth. Variations in character and attitude of banding and crystal orientation are shown in the descriptions of individual cores in Appendix 1.

CONDITION OF CORES

The geologic information obtained from the cores is in direct relation to the percentage of core recovery and the condition of the cores as they were received at the warehouse where the cores were studied. In general, the recovery of core from the sediments overlying the caprock (32.4 percent recovery), and of the limestone (11.4 percent) and gypsum (0 percent) zones of the cap rock was very poor. This was chiefly due to the unconsolidated nature of the sediments and to the poor consistency of the upper part of the caprock, the recovered material of which consists only of hard limestone in lengths of not more than a few inches. The lithologic descriptions in Appendix 1, of sections where core recovery was poor and where the cores have been improperly handled, are from much less reliable cuttings or from interpretation of the geology from geophysical logs and from Hycalog. Core recovery of the anhydrite and salt, on the other hand, was near 100 percent. Errors and deficiencies in labeling of boxes containing anhydrite cores and the lack of regular order in which some of the anhydrite cores were found to be placed in insufficiently labeled boxes makes unreliable some of the information on those cores. The cores of the salt, on the other hand, were generally in excellent order and condition.

GEOLOGY INFERRED FROM LOGGING

The logs resulting from in-hole surveys are listed in Appendix 4.

A "mud log" prepared by Hycalog, Inc., of Shreveport, La., during the coring and drilling of WP-1 records drilling time, generalized lithology, and results of continuous analyses of mud and cuttings for gases.

The log was prepared from tests of drilling mud that contained the drill cuttings, in a mobile laboratory housed in a trailer at the well site. The laboratory was connected with the mud line, from which cuttings were collected at a tap above the laboratory sink, were washed, dried, and examined under a binocular microscope. From this the log showing generalized lithologic characteristics, grain size, mineralogy, and fossil content, was prepared. The Hycalog also records the depth of each core. The drill mud and cuttings were analyzed for gas in a Chronofrac, an instrument designed to determine both nature and volume of gas encountered in drilling. No gases indigenous to the rocks were encountered in these tests, although the odor of hydrogen sulfide was detected in several places in the caprock section. Drill depths and time were recorded by a Geolograph, from which the drilling rate was calculated in feet per minute.

The electrical log of WP-1 shows highly variable resistivity in the sedimentary section overlying the caprock, and only slightly variable self-potential. The aquifers bear only fresh waters and are extremely high in resistivity; the curves, therefore, are deflected strongly outward through the zones of these aquifers. The little variation in the self-potential is inward (toward the right, or the plus side of the curve) on the sandy aquifers, with respect to the clays; this response is believed to represent a higher resistivity of the formation water than of the drilling mud.

The electrical log of the section through the limestone caprock also shows high resistivity and low self-potential. Through the anhydrite,

however, the log shows extremely high resistivity, but a variable self-potential from very low in the upper 70 feet or more of the section, gradually rising to a peak at about 100 feet below the top. The electrical log, made on April 8, 1961, extends from 206 to 1,435 feet, and ends approximately 75 feet above the contact of the salt and the anhydrite.

The gamma ray-neutron log shows, for the sediments overlying the caprock, the natural gamma-radioactivity of clays to be higher than that of sands. The neutron curve is generally featureless in this section, except for a peak area between 640 and 670 feet. A high gamma-ray radioactive anomaly with a peak at 680 feet is thin and abrupt, several times that of background, and extends from 676 to 682 feet. The radioactivity of the limestone caprock is somewhat variable, but is generally less than that of the overlying sediments, whereas the neutron activity in that zone is higher. A zone of slightly higher radioactivity and low neutron activity exists from 1,176 to 1,188 feet. The anhydrite and salt are uniformly low in radioactivity but are higher in neutron activity than the overlying section. The gamma-ray activity of anhydrite and salt is relatively featureless, but the neutron activity is somewhat greater in anhydrite than in salt.

The sonic log shows zones of moderately variable velocities in the sedimentary section of the hole, highly variable in the limestone caprock, but uniform in the anhydrite and salt. The following are the more conspicuous zones and their average velocities in feet per second, estimated from the log from 206 to 3,504 feet. The velocity values are converted from microseconds per foot, as shown on the log, to feet per second.

Table 1.--Velocity Zones in Hole WP-1

Zone		Feet per second, approximate
206-340	) (sediments)	6,250
340-440		5,250
440-500		6,000
500-600		5,600
600-670		5,400
670-900	) (limestone)	6,500
900-1,054		8,700
1,054-1,504		19,230
1,504-3,504	(salt)	14,700

The caliper log from 206 to 2,501 feet shows that, for the sedimentary section overlying the caprock, the diameter of the hole is irregular but averages about 10 inches in the clayey zones to about 16 inches in the sandy ones. In the thick, massive, loose, sandy section of aquifer 2, however, for a total of at least 37 feet, from 832 to 861, and 899 to 907 feet, the caliper log shows a uniform maximum diameter of 19 inches. This is believed to be the limit of the capacity of the instrument, and the hole in these intervals may be considerably larger. In the limestone caprock section the caliper log shows a variation in diameter from slightly more than 10 to a maximum of 16 inches. A wide zone, probably representing a cavity, exists from 1,024 to 1,030 feet. A zone ranging from 12 to 16 inches in diameter exists in the anhydrite caprock from 1,158 to about 1,190 feet. Below this the hole in the anhydrite is slightly more than 10 inches wide from 1,200 to 1,446 feet, below which the hole is a little more than 8-1/2 inches in diameter. At 1,508 the hole abruptly widens to 10-1/2 inches, at the top of the

salt. From 2,000 to 2,220, in the salt, the hole gradually bulges to a maximum of 14 inches at 2,162 feet, but narrows to about 8 inches at 2,331, which diameter is maintained to the bottom depth of the log at 2,500 feet.

Two temperature surveys were run by Schlumberger; one on May 17, 1961, from 20 to 1,447 feet, and another on June 15, 1961, from 1,300 to 2,707 feet. The first survey showed a maximum temperature of 86°F at the bottom of the hole, which was filled up to 20 feet from the surface with drilling mud containing lost circulation material with a resistivity of 1.3 ohmmeters. The second survey showed a bottom-hole temperature of 129°F when the hole was filled with salt gel with a resistivity of 0.034 ohmmeters. The surveys were continuous, but several zones of differing temperature gradients are shown on the logs. The following table shows these zones in the two surveys.

Table 2.--Temperature and gradients in Core Hole WP-1

Survey date	Depth, feet	Temperature, degrees	Change, ft/degree
5-17-61	70	78	-
	350	82	70
	570	82	0
	1,300	85	243
6-15-61	1,300	114	-
	2,220	122	115
	2,700	130	60

Two directional surveys were run; a complete survey from the surface to total depth by the Sperry-Sun Well Surveying Co., Brookhaven, Miss.,

and a partial log by the Schlumberger Well Surveying Corp., Columbia, Miss. Data from the Sperry-Sun survey from 0 to 3,502 feet (first reading was at 36 feet, with a zero deviation) show both angle and direction of deviation from the vertical, at approximately 50-foot intervals. The surveys were made during the drilling operations. At the conclusion of the drilling, the final in-run measurement showed that the displacement of the bottom of the hole is 45.98 feet S. 40° 40' W. of the top of the hole, and the out-run measurement showed the bottom to be 43.85 feet S. 41° 48' W. of the top. The surveys show that the hole describes about two-thirds of a complete clockwise spiral from 0 to about 2,100 feet, with deviations generally less than 1 degree; below that point the trace of the hole shows a broad counter-clockwise spiral of about one-fourth of a complete circle, with deviations ranging generally from 1 degree to 2-1/2 degrees. The maximum deviation of 2-1/2 degrees was recorded in the interval from 2,631 to 2,814 feet.

The Schlumberger directional log was run showing the vertical deviation at 200-foot intervals from 250 to 1,250 feet, and at 100-foot intervals from 1,250 to 2,450 feet. Deviations range from 30 minutes at the top to 1° 45' at the bottom, except for zero declination from 1,550 to 1,850. The azimuth of these deviations, measured only in the section from 1,950 to 2,450 feet, is from S. 44° W. at the top of that section to S. 75° W. at the bottom. The results of this survey, in general, are very similar to those of Sperry-Sun.

APPENDIX 1

Lithologic Log

AEC Vela Uniform Hole WP-1

Tatum Dome, Lamar County, Mississippi

Coordinates: Sec. 11, T. 2 N., R. 16 W. (167 feet N., 1,959 feet W. of SE corner of section). Holmes and Narver coordinates 10,167N, 8,041E.

Elevation: Ground level, 271 feet above sea level.

Datum: Rotary drive bushing, elevation 279 feet.

Lithology from Hycalog and core descriptions; boundaries determined chiefly from electrical, sonic, and caliper logs. Cores of sediments overlying cap rock examined megascopically and under binocular microscope by C. A. Armstrong, Thad Shows, and D. H. Eargle; cores of cap rock and salt examined by D. H. Eargle and J. Schlocker.

Descriptions summarized and coordinated by D. H. Eargle.

Electrical log of section from 1 to 200 feet, Widco log by Billy Wasson, USGS; section from 200 to 1,342 feet by Schlumberger Well Surveying Corp. Hole begun February 4, 1961; completed June 28, 1961.

Description	Thickness (feet)	Depth (feet)
Pascagoula and Hattiesburg clays, undifferentiated		
Soil and variegated clay-----	5	0-5
Silt, calcareous, greenish-gray, small amounts of pyrite and mica; thin beds of greenish-gray clay interbedded-----	30	5-35
Sand, gravelly, medium-grained, contains abundant brown gravel, rounded chert-----	2	35-37
Clay, silty, and clayey silt, grayish-green, slightly calcareous, minor amounts of gray silty and sandy clay containing a few calcareous concretions, 2-5 mm diameter. Less than 1 percent muscovite, less than 1 percent iron sulfides, slightly bentonitic-----	63	37-100

Lithologic log of AEC Vela Uniform Hole WP41--continued

Description	Thickness (feet)	Depth (feet)
Sand, slightly calcareous; gray clay streaks----	8	100-108
Clay, silty and slightly sandy, light-gray to greenish-gray-----	22	108-130
Sand, white to gray, silty; very fine to coarse and gravelly at base; partly consolidated. Gravel consists of polished black chert and some quartzite pebbles, sub-rounded, averaging 1 by 1/2 inch-----	18	130-148
Silt, silty clay, dusky-yellow to olive, and clay, grayish-green; massively bedded in at least 3-foot beds. Clays have a few concretions of calcium carbonate and as much as 1 percent pyrite as disseminated crystals. Clays are internally sheared. Smooth-shelled ostracods rarely present-----	28	148-176
Clay, silty, grayish-green and dusky-yellow clayey silt; iron sulfide concretions, as much as 1/2 inch in diameter. Some mica and earthy calcite streaks. Massive bedding.-----	12	176-188
Silt, sandy to clayey, yellowish-gray. Massive bedding-----	10	188-198
Sand, green, very fine to fine-grained, slightly clayey in places-----	10	198-208
Silt, clayey and sandy, greenish-gray; very low-angle cross bedding; grayish olive from 213 to 218 feet; bluish-greenish-gray from 218 to 223 feet.-----	16	208-224
Clay, silty, greenish-bluish-gray-----	6	224-230
Sand, olive-green, fine to very fine-grained; lower part fine to medium-grained-----	20	230-250
Clay, silty, greenish-bluish-gray, some pyrite--	5	250-255

Lithologic log of AEC Vela Uniform Hole WP-1--continued

Description	Thickness (feet)	Depth (feet)
Silt, clayey, greenish-bluish-gray, and some very fine sand and silty clay; some carbonaceous material and pyrite from 255 to 266 feet; sandy-clayey silt with calcareous nodules and some calcareous cement, and very fine sand from 283-291 feet; slickensides from 296 to 306 feet; silty clay, greenish-gray to reddish-brown from 327 to 334 feet-----	79	255-334
Sand, fine- to very-fine-grained, loose to poorly consolidated-----	88	334-422
Clay, silty, gray, micaceous, slightly calcareous; trace of dark-brown clay-----	12	422-434
Silt, clayey, greenish- to olive-gray; some pyrite; trace crystalline calcite and quartz grains-----	28	434-462
Sand, fine-grained, poorly consolidated-----	8	462-470
Silt and clay, olive- to greenish-gray; mica and rare pyrite; some calcareous nodules-----	32	470-502
Sand, gray-green, fine- to very fine-grained, unconsolidated-----	16	502-518
Clay, silty, brownish-gray with thin silt beds; well bedded, nearly horizontal-----	6	518-524
Sand, brown, fine-grained, trace brown limestone and pyrite-----	20	524-544
Silt, clayey, brownish-gray, slightly carbonaceous; contains small fragments of lignite; some brownish-gray micaceous silty clay-----	28	544-572
Sand, grayish-green, fine- to very fine-grained, poorly consolidated; medium- to coarse-grained sand below 590 feet, gravelly from 676 to 680 feet-----	108	572-680

Lithologic log of AEC Vela Uniform Hole WP-1--continued

Description	Thickness (feet)	Depth (feet)
Catahoula sandstone		
Silt, clayey and sandy, bluish-greenish-gray; minor pyrite and mica-----	14	680-694
Sand, gray, very fine-grained; contains beds of greenish-gray micaceous silty clay and clayey and sandy silt, and some calcareous nodules and brown clay streaks toward bottom-----	22	694-716
Clay, greenish-gray and reddish-brown; several calcareous layers-----	22	716-738
Silt, slightly clayey, greenish-gray, micaceous, grading down to clayey silt, dark-greenish- gray, micaceous and pyritic; contains fossil pelecypods and foraminifera. Foraminifera are chiefly <u>Streblus beccarii</u> (Linné) <u>parkinsoniana</u> (d'Orbigny); among several thousand specimens of <u>Streblus</u> was found one specimen of <u>Elphidium</u> cf. <u>poeyanum</u> (d'Orbigny). (Report on Foraminifera by Ruth Todd, USGS, who reports that these fossils are of Miocene or younger age and that they indicate shallow, brackish, or swampy conditions)-----	16	738-754
Silt, greenish-gray, dips 5° to 10°, with thin clay interbeds; grades into silty clay and silty and clayey light-gray sand-----	10	754-764
Clay, silty, greenish-gray, micaceous, grades down into olive-gray silt interbedded with thin clay beds. Thin-bedded silt and clay 1/10 inch to 1 inch, average less than 1/4 inch, beds at angles of 5° to 10°.-----	36	764-800
Sand, gravelly; coarse sand, chert gravel-----	62	800-862
Clay, silty, gray, pyritic, micaceous, carbon- aceous, well bedded; some beds tilted at about 30 degrees; sandy silt and less carbon- aceous with depth-----	26	862-888

Lithologic log of AEC Vela Uniform Hole WP-1--continued

Description	Thickness (feet)	Depth (feet)
Clay, silty, greenish-gray, micaceous-----	4	888-892
Silt, sandy, light-greenish-gray, micaceous, contains fossil shells, grades down into dark-greenish-gray clay-----	16	892-908
Limestone-pebble conglomerate, white to brown, cemented with calcium carbonate, vuggy (2.5 feet recovered)-----	3	908-911
Sand, silty, clayey, gray, fine-grained, calcareous; contains abundant fossil shells and shell frag- ments; sand grades down into medium to coarse grained (11 inches recovered)-----	12	911-923
Core lost-----	6	923-929
Limestone caprock		
Most of core not recovered. A fragment two-tenths of a foot long is limestone, brownish-gray, vuggy-----	11	929-940
Core lost-----	39	940-979
Limestone, medium-gray, made up of subhedral to euhedral calcium carbonate; mostly finely cry- stalline, equidimensional, a few coarse crystals; crystals randomly oriented, cemented only locally to give granular porosity. Some vuggy porosity, increasing with depth. In lower part of core thin bands of dark calcite dipping at 35° angle from horizontal. Frag- ments only 1 inch or less to 4 inches long recovered. Core recovery: 4 feet, or 18 percent-----	22	979-1,001
Core lost-----	7	1,001-1,008
Depth correction: 1,008 = 1,005		

Lithologic log of AEC Vela Uniform Hole WP-1--continued

Description	Thickness (feet)	Depth (feet)
<p>Limestone, white and brownish-white bands alternating with grayish-black bands 1/8 inch to 1/2 inch wide, irregular, but generally horizontal; vugs chiefly along white layers lined with drusy white to brown calcite. Much of white bands consist of fine-grained equigranular to radial horizontal acicular crystals of stromatolite ^{stromatolite}. Core is broken generally horizontally into fragments about 1 inch to 2 inches thick. Lower part of core is very irregularly banded and coarsely vuggy. Lower part of core has fetid odor when broken. Core recovery:</p>	40	1,005-1,045
<p>Core lost. Probable top anhydrite 1,054 (sonic log)-----</p>	10	1,045-1,055
<p>No core; section was drilled. Lost circulation reported at 1,056 feet. Caliper log shows possible cavity at 1,026 feet. Hycalog reports the following:-----</p>	6	1,055-1,061
Gypsum caprock		
Limestone and gypsum-----1,048-1,054		
Anhydrite caprock		
<p>Anhydrite, gypsiferous, white, with gypsum veins; grading down into anhydrite. Lost circulation at 1,056 feet-----1,054-1,061</p>		

Lithologic log of AEC Vela Uniform Hole WP-1--continued

Description	Thickness (feet)	Depth (feet)
Anhydrite, medium-gray, hard, crystalline; banded with gypsum veins; crystals average about 1 mm across; tough, dense, rings when struck; crystals at random orientation; inter- locked. Banding consists of irregular lensing segregations of dark anhydrite with sharp, flat top and irregular bottom, 1 inch horizon- tal to 1/4 inch vertical, to persistent bands 1/8 inch to 1 inch thick; bands are horizontal to inclined as much as 25 degrees. Adjacent bands may dip in separate directions. Most anhydrite is medium gray, but 1/8 inch white gypsum layers spaced every 1/4 inch to 1 inch are present. Small crystals of calcium car- bonate are disseminated throughout the anhy- drite fracture planes, many of which are coated with gypsum (see appendix 2 for list). Some fractures show traces of free sulfur, and some are black (tar?) coated-----	15	1,061-1,076
Anhydrite, gray to white, dense, massive, gypsi- ferous, calcitic; traces of free sulfur on fractures and odor of H ₂ S on fresh breaks-----	4.5	1,076-1,080.5
Anhydrite, medium-gray, hard, faintly banded with slightly lighter shades. A few zones show slightly different material-----	425.5	1,080.5-1,506
Anhydrite, medium-gray, slightly lighter banding, maximum 1 inch wide, between 1,117 and 1,117.5---1,116.5-1,119		
Caliper log shows wide hole. Poss- ible cavity or effect of whip- stocking operations-----1,158-1,190		
Alternating bands about 1 cm wide of darker-gray and lighter-gray anhydrite. Cut by dark, thin streak (healed fracture?) at about 45 degrees-----1,439.5-1,441.5		
Anhydrite, massive, gray, crystalline-----1,474-1,506		

Lithologic log of AEC Vela Uniform Hole WP-1--continued

Description	Thickness (feet)	Depth (feet)
Anhydrite, alternating bands from medium-gray to light-gray, more or less horizontally banded; bands ranging from 2 mm to 20 mm. Sharp boundaries on top of band in some places, at bottom of others, other side of band generally irregular. Bands are somewhat lenticular. Anhydrite is tough and hard, finely crystalline; crystals are well knit. Unit has sharp lower, but irregular, more or less horizontal boundary-----	1	1,506-1,507
Anhydrite, very light-gray, sugary texture, partially indurated, less indurated than unit above, very porous, salty. Crystal size about same as rock above; has rare phenocrysts that are equant $2\frac{1}{2}$ mm. Most other crystals elongate $1\frac{1}{2}$ mm to $1\frac{1}{2}$ mm long. Some have segregations of dark gray to brown crystals. Generally horizontally layered, breaks along layers, layers are alternating harder and softer bands. Lower contact is wavy, with $1\frac{1}{2}$ inch relief; sharp contact-----	2	1,507-1,509
Salt stock		
Salt, crystalline, medium-gray to medium-light-gray, consisting of clear halite crystals 2 mm to at least 27 mm in length; boundaries between crystals straight to irregular. Faint layering apparent in transmitted light, probably parallel to cleavage, at about 45 degrees. Cloudy anhydrite-rich bands about $1\frac{1}{2}$ to 1 cm thick, at about 80 degrees attitude. Anhydrite crystals elongate, 2 to 1 to 4 to 1, more or less parallel to banding-----	4	1,509-1,513

Lithologic log of AEC Vela Uniform Hole WP-1--continued

Description	Thickness (feet)	Depth (feet)
Salt, medium-dark-gray, banded, anhydrite-rich bands as much as 3 to 20 mm wide, alternating with anhydrite-poor bands 5 mm to 10 mm wide. Angle about 85 degrees with horizontal. Cross-grain making a less distinct banding than the 85 degree banding at 40 to 50 degrees. Halite crystals are 3 mm to 22 mm, average about 10 mm diameter-----	1.5	1,514.5-1,516
Salt, medium- to medium-light-gray, composed chiefly of anhydrite-poor halite of large crystals. Crystals average about 20 mm, ranging from 8 mm to 42 mm. Anhydrite-rich bands 5 cm wide, compound, composed of three anhydrite-rich bands about 13 mm wide, separated by clearer halite 6 mm to 10 mm-----	2	1,527-1,529
Clear salt in contact with darker salt, about 85° dip-----	1	1,534-1,535
Medium-dark-gray salt, banded, about 85 degrees-----	0.5	1,593-1,593.5
Gray salt, contains indistinct cloudy bands, 2-1/2 inches wide (anhydrite) grading into clear salt; one clear salt band 1 inch to 1-1/2 inches wide with irregular hazy contact, averaging 85° dip. Salt crystals average 1/2 -inch-long diameter-----	1.2	1,593.5-1,594.7
Light-gray salt, in contact with darker, faintly banded salt; hazy contact, 85 degrees-----	0.5	1,637-1,637.5
Gray salt, one-half of the core, in contact with clearer salt, but still somewhat clouded; angle of contact 80 degrees-----	1.2	1,648.6-1,649.8
Moderately milky salt, with darker cloudy bands at 70 degrees: crystals oriented at 40 degrees. Crystals less than 1/2 -inch diameter-----	1.2	1,657.3-1,658.5

Lithologic log of AEC Vela Uniform Hole WP-1--continued

Description	Thickness (feet)	Depth (feet)
Milky, coarsely crystalline salt, with faint- ly darker 1/2 inch band, average 80° dip, 45° crystal orientation. 1/2 inch by 3/4 inch crystals-----	1.3	1,672.3-1,673.6
Moderately-gray salt with sharply contrasting clear band 2 inches wide at 80° dip; crystal axes at 30 degrees-----	1.2	1,681-1,682.2
Gray salt, one very light gray, almost clear band about 1 inch wide at 85 degree angle-----	1	1,683-1,684
Very-pale-gray salt with slightly darker bands at 85 degrees-----	1.1	1,697.4-1,698.5
Dark salt with small band on one end of core at 85 degrees-----	1.5	1,701-1,702.5
Clear crystalline salt, slightly darker thin bands at 75° dip, crystal axes 55 degrees. Maximum crystals average 1/2 inch by 1 inch---	1.5	1,708-1,709.5
Moderately clear crystalline salt, very faint banding of slightly cloudy discontinuous zones at about 75 degrees. Faint lineation of cry- stals at about 40 degrees-----	1.2	1,713-1,714.2
Gray salt, banding at 75° dip. Bands are 1-1/4 inches apart, about an inch wide, dif- fused on edges. Dark knots of anhydrite-rich salt. Crystal orientation at about 15 degrees to 20 degrees. Salt is quite impure. Re- crystallization of halite has offset primary banding, producing a secondary banding, almost at right angles to the primary banding-----	3.5	1,716.5-1,720
Clear crystalline salt, with 1 inch wide tapering bands at 80 degrees, crystal orientation, 20 degrees-----	1.5	1,720-1,721.5
Dark salt, with band on one side, minimum of 3 inches wide, at 80° dip-----	1.5	1,726-1,727.5

Lithologic log of AEC Vela Uniform Hole WP-1--continued

Description	Thickness (feet)	Depth (feet)
Light-gray salt-----	0.7	1,736-1,736.7
Moderately clear salt with one darker 1 inch-wide band at 85° dip. Angle on crystallinity 35 degrees-----	1.5	1,815.5-1,817
Light-gray salt, no obvious banding-----	0.5	1,832-1,832.5
Very light-gray salt; slightly darker on one side	0.5	1,937-1,937.5
Dark salt, faintly banded with 85° dip-----	1.5	2,018-2,019.5
Medium-dark-gray salt, faintly banded; about 85° dip-----	0.6	2,036.4-2,037
Clear, coarsely crystalline salt, slightly darker discontinuing band at 85° dip, crystal orienta- tion - about 50 degrees. Crystals 3/8 inch by 3/4 inch-----	1.3	2,083-2,084.3
Very-light-gray salt, coarse crystals averaging 1/2 inch by 1/4 inch; crystals faintly oriented with about 40° dip. Slightly darker bands with dips averaging 80° to 85°.-----	1.7	2,097.3-2,099
Half, moderately gray; half, very light gray; hazy contact, 80° dip; crystals average 1/4 inch to 1/2 inch long, slightly longer than wide; cry- stal orientation at about 40° to 45° dip-----	1.2	2,115-2,116.2
Clear, very coarsely crystalline salt, faintly darker bands at 70° dip. Crystals as large as 1-inch by 1/2-inch diameter-----	0.3	2,126.7-2,127
Darker-gray salt in 80 degree contact with lighter-gray, a few thin hazy bands of darker- gray salt in the lighter-gray. Crystal orientation about 55 degrees to 60 degrees----	1.7	2,151.8-2,153.5
Gray salt with 1 inch darker band at about 80 degrees-----	1.2	2,158.8-2,160

Lithologic log of AEC Vela Uniform Hole WP-1--continued

Description	Thickness (feet)	Depth (feet)
Clear, coarsely crystalline salt in 75 degree contact with gray salt. Salt crystals faintly oriented about 40° dip-----	0.7	2,167.5-2,168.2
Light-gray salt in contact with darker salt at about 65 degrees-----	1.5	2,179.3-2,180.8
Very-pale-gray salt in 80 degree fuzzy contact with medium-gray salt; crystals faintly oriented at about 40° dip-----	1.5	2,196.5-2,198
Contact between lighter and darker salt dips 75°; crystallinity, about 50 degrees-----	1	2,223.5-2,224.5
Gray salt, transmits very little light; but has faint bands at 85° dip-----	1.7	2,239.8-2,241.5
Milky salt, moderately coarsely crystalline, with slightly darker side, slightly curved contact averaging nearly 90 degrees. Crystallinity indistinct-----	1.7	2,252.2-2,253.7
Milky coarsely-crystalline salt, slightly darker band about 1 inch wide at 85° dip. Crystallinity indistinct-----	1.3	2,253.7-2,255
Darker- and lighter-gray salt banded, 75° dip on banding about 50° on crystal orientation	0.8	2,260-2,260.8
Moderately murky salt, slightly clearer, irregularly cut, averaging about 80 degrees, crystal-axes about 50 degrees-----	1.5	2,261-2,262.5
Milky coarsely-crystalline salt with 2-1/2 inch-wide darker band at 85 degrees. Crystallinity indistinct orientation-----	1.7	2,262.5-2,264.2
Mostly darker-gray band on one edge of core, 85° dip. Light-gray salt. Faint crystal orientation about 50 degrees-----	1	2,266-2,267

Lithologic log of AEC Vela Uniform Hole WP-1--continued

Description	Thickness (feet)	Depth (feet)
Moderately clear but somewhat milky coarsely-crystalline salt with faint darker band at 90° dip, rough alignment of crystals at about 40 degrees. Core badly fractured. Crystals 1/4-inch diameter, equidimensional, to 1 inch by 3/4 inch---	1.1	2,271-2,272.1
Fairly dark salt with about 80° dip on faint banding-----	0.7	2,283-2,283.7
Toward top, lighter 1-1/2 inch banding in darker-gray salt about 80° dip, crystallinity about 60 degrees. Toward bottom, 55 degrees to 60 degrees on banding-----	1.8	2,287.2-2,289
Mostly little-transparent salt, slightly lighter on one side, at 80 degree angle. Crystallinity alignment indistinct-----	1.7	2,290.8-2,292.5
Light-gray salt, one dark salt streak 1 inch wide through middle of core, 85° dip. Angle of crystallinity, 50 degrees-	1.2	2,293-2,294.2
Medium-dark salt, banded at about 80 degrees, 55 degrees crystallinity-----	1.8	2,294.2-2,296
Clear coarsely-crystalline salt with cloudy discontinuous bands and one straight cloudy band at 80 degrees. Crystal-orientation at about 50 degrees. 1/4 inch to 3/4 inch in length, 1/4 inch to 1/2 inch width-----	0.7	2,315-2,315.7
Medium-dark salt, banded with slightly-lighter salt, dip 75° to 80°. Crystallinity 50 degrees.	1.5	2,315.7-2,317.2
Slightly-cloudy salt with darker discontinuous bands at about 80° dip, crystal-orientation at 40 degrees-----	0.2	2,322.8-2,323

Lithologic log of AEC Vela Uniform Hole WP-1--continued

Description	Thickness (feet)	Depth (feet)
Moderately clear coarsely-crystalline salt with wispy banding of slightly-darker cloudy salt, about 70° dip. Crystallinity averages about 45 degrees-----	1.3	2,325-2,326.3
Moderately clear salt with faint bands at 75° dip, crystallinity 50 degrees-----	1	2,328.5-2,329.5
Moderately clear salt, with thin wispy darker bands 80° dip. Crystallinity 60 degrees-----	1	2,330-2,331
Clear salt, crystals average 3/8-inch to 3/4-inch diameter, roughly oriented; axis dips 20° to 30°. Contains cloudy band averaging about 85 degrees. One dark inclusion more inclined toward direction of crystal axes-----	1	2,332-2,333
Clear salt in contact with medium-gray salt, 75 degrees to 80 degrees, crystallinity 50 degrees-----	1.7	2,335.5-2,337.2
Gray murky salt, with slightly lighter 1 inch band, at 85 degrees. Faint crystal-axis orientation at about 50° dip-----	1.4	2,337.1-2,338.5
Moderately cloudy salt with darker bands. At 85° dip, crystal orientation 40 degrees---	1.8	2,346.7-2,348.5
Medium coarsely-crystalline salt, slightly milky, gray, with lower half of core darker gray; 85° dip on the contact, crystal axes at 50 degrees-----	0.7	2,349.5-2,350.2
Milky salt with darker cloudy bands; 85° dip, 35 degrees to 40 degrees crystallinity. 1/2 inch by 3/4 inch crystals-----	1.1	2,366.4-2,367.5
Light milky salt with faint murky bands, dip 80°, crystal orientation 1/2 inch by 3/4 inch crystals-----	1.1	2,384.9-2,386

Lithologic log of AEC Vela Uniform Hole WP-1--continued

Description	Thickness (feet)	Depth (feet)
Milky salt, with discontinuous darker hazy area of about 85° dip. Crystal orientation indistinct-----	1.6	2,389.4-2,391
Moderately clear salt with cloudy bands at 85° dip; excellent crystal-orientation pattern at 40 degrees-----	1.7	2,398.8-2,400.5
Slightly milky salt in contact with darker band. Dip 80°. Crystal orientation 35 degrees. Crystals 3/8 inch or 1/2 inch by 3/4 inch-----	1.2	2,406-2,407.2
Milky salt, with distinct cloudy thin bands at 85° dip. Excellent crystal orientation 40 degrees; crystals 1/2 inch by 1 inch--	1.5	2,407.5-2,409
Moderately murky salt; indistinct bands average 85° dip, crystal orientation 40 degrees-----	1	2,414.5-2,415.5
Moderately murky salt with bands at about 80° dip, crystal orientation at about 40 degrees. Larger crystals 1/2 inch by 3/4 inch-----	1.1	2,422-2,423.1
Clear coarsely-crystalline salt with faint cloudy bands at 80 degrees, crystallinity indistinct, but about 40 degrees. 1/4 inch by 1/2 inch crystals-----	1.4	2,434-2,435.4
Gray banded salt with slightly lighter bands 85° to 90° dip, crystals 40 degrees. 1/4 inch to 1/2 inch crystals-----	1.8	2,453.2-2,455
Milky salt with darker bands at 85 degrees. Indistinct crystal orientation. Crystals up to 1/2 -inch diameter-----	1.8	2,456.7-2,458.5
Moderately cloudy salt with some banding and lighter salt at 87° dip. Orientation indistinct, 1/4 inch to 1/2 inch crystals--	1.7	2,463.8-2,465.5

Lithologic log of AEC Vela Uniform Hole WP-1--continued

Description	Thickness (feet)	Depth (feet)
Milky salt with faint banding of darker salt, 85° dip. Crystallinity - indistinct. Cry- stals 1/4 inch by 1/2 inch-----	1.5	2,475-2,476.5
Moderately gray salt, darker bands, 85° dip. 1/4-inch to 3/4-inch wide crystals-----	1.5	2,479-2,480.5
Clear to pale-gray salt, banded, at 87° dip; 50 degrees on crystal-orientation-----	1	2,483.2-2,484.2
Mostly cloudy salt with clear bands, 1 inch to 2 inches wide at 87° dip. Moderately coarsely-crystalline (about 1/2-inch dia- meter)-----	1.7	2,484.8-2,486.5
Clear salt with faint cloudy bands about 1 inch wide, discontinuous, at 87 degrees. Crystals average about 1/2 inch-----	1.5	2,486.5-2,488
Clear salt, about one-half of core, 87° dip on faint bands of darker salt in rest of core. Crystals 1/4-inch to 1/2-inch diameter-----	1.1	2,489.5-2,490.6
Clear salt with 1-1/2 inch band; 87° dip. 1/4 inch to 1/2 inch crystals-----	2.2	2,494.3-2,496.5
Clear salt with faint thin bands, vertical; crystals 1/2 inch-----	1.8	2,496.5-2,498.3
Clear salt with crystals about 1/2-inch diameter. Very little darker material in a faint band-----	0.5	2,498.3-2,498.8
Clear crystalline salt, crystals average about 1/2 inch diameter, no preferred orientation noted. One faint darker band through center of core, vertical----	1.3	2,501.7-2,503
Clear, coarsely-crystalline salt, 1/4 inch to 3/4-inch wide. Very faint thin band at about 85° dip-----	1.5	2,506-2,507.5

Lithologic log of AEC Vela Uniform Hole WP-1--continued

Description	Thickness (feet)	Depth (feet)
Clear salt in fairly sharp contact with dark salt; about 87° dip-----	1.5	2,509.5-2,511
Clear salt with 1-inch to 3-inch cloudy band nearly vertical. Crystal axes at about 50 degrees-----	1.5	2,515-2,516.5
Clear salt with indistinct cloudy band about 2 inches wide slightly folded, 85 degrees to 90 degrees. Crystals medium-coarse (average 1/2 inch)-----	1.5	2,518.5-2,520
Clear salt with slightly darker band at about 85 degrees. Coarsely crystalline 1/2 inch by 3/4 inch crystals-----	1.1	2,520.3-2,521.4
Very clear salt, medium-coarse crystals, very faint crystalline orientation, dipping about 30° to 40°-----	1.5	2,522-2,523.5
Clear salt, crystals average about 1/2-inch diameter-----	0.5	2,523.5-2,524
Pale-gray salt with cloudy bands, vertical. Crystalline orientation at about 40 degrees-----	1.9	2,526.6-2,528.5
Gray salt, cloudy bands averaging 85° dip, crystal axes average 50 degrees. 1/4 inch to 1/2 inch crystals-----	0.8	2,528.5-2,529.3
Pale-gray salt with minor clear salt along edges. Coarsely crystalline, especially in clear salt-----	2	2,533.5-2,535.5
Moderately cloudy salt with some clear bands dipping about 87°. Crystal-axes about 55 degrees. Maximum crystal size in clear bands 3/4 inch by 1 inch. All crystals average 1/4 inch to 1/2 inch-----	1.7	2,540.8-2,542.5

Lithologic log of AEC Vela Uniform Hole WP-1--continued

Description	Thickness (feet)	Depth (feet)
Light-gray fairly clear salt with darker band about 1-inch wide, 85° dip. Crystal orientation 35 degrees to 40 degrees-----	1	2,542.5-2,543.5
Cloudy-gray salt, banded about vertical, crystal axes 50 degrees-----	1.2	2,550.5-2,551.7
Clear salt with faintly darker bands, 83° dip, crystalline orientation 40 degrees. Average size of crystals, 1/2 inch-----	1	2,566-2,567
Gray salt, banded and wispy segregations of fairly dense anhydrite, 85° dip, 60 degrees on crystal orientation, medium coarse crystals-----	1.7	2,571.8-2,573.5
Clear salt with faint gray anhydrite segregation, not well aligned. Coarsely-crystalline, 1/2 inch by 3/4 inch, maximum length crystals-----	1.3	2,584-2,585.3
Clear salt with faint darker zone about 88° dip. Crystals about 1/2 inch by 3/8 inch.	1.5	2,594-2,595.5
Clear salt with faint darker zone, about vertical, about 1/2 inch crystals-----	0.8	2,598.2-2,599
Clear salt with faint darker zone, almost vertical medium-coarse crystals-----	1.6	2,602.4-2,604
Clear salt with faint darker streak about 1 inch wide dips 87°, 40 degree crystalline orientation. Crystals up to 1/2-inch diameter-----	1.2	2,611-2,612.2
Very-light-gray salt with slightly darker bands at 85° dip. Crystals about 1/2 inch to 3/8 inch-----	1.2	2,629.3-2,630.5
Medium-light-gray, 85° dip on faintly darker bands, 3/8 inch to 1/2 inch crystals-----	0.5	2,635-2,635.5

Lithologic log of AEC Vela Uniform Hole WP-1--continued

Description	Thickness (feet)	Depth (feet)
Very light-gray salt to clear, about 87° dip on very faint bands, about 1/4 inch to 3/8 inch-----	1.5	2,638-2,639.5
Very light-gray clear coarsely-crystalline salt with faint discontinuous cloudy anhy- drite bands, 1/4 inch to 1/2 inch-----	0.5	2,648.5-2,649
Light-gray salt in contact with clear salt, crystals up to 1/2-inch long, 85° dip on faint bands-----	1	2,656-2,657
Clear to very light-gray salt, contact at 87 degrees, 3/8 inch crystals-----	2.7	2,659.8-2,662.5
Clear to very light-gray, coarsely-crystal- line salt, faint cloudy vertical bands---	1.4	2,663-2,664.4
Clear to very light-gray, coarsely-crystal- line salt, faint cloudy vertical bands, very wispy clouds of anhydrite, dip not definite-----	1.2	2,669.8-2,671
Clear coarsely-crystalline salt with slightly darker band, bends from 85 degrees at top to 80 degrees at bottom. Crystals up to 1/2 inch-----	1.7	2,680.3-2,682
Very light-gray salt, not distinctly banded, crystals 1/4 inch to 3/8 inch-----	1.8	2,683.7-2,685.5
Very light-gray salt, no anhydrite segrega- tion, about 1/4 inch to 3/8 inch crystals	1	2,685.5-2,686.5
Very coarsely-crystalline salt, with very little darker salt-----	2.3	2,689.5-2,691.8
Light-gray salt, few very light segrega- tions not oriented, 1/4 inch to 1/2 inch crystals. Crystal orientation 50 degrees	1.9	2,693.1-2,695

Lithologic log of AEC Vela Uniform Hole WP-1--continued

Description	Thickness (feet)	Depth (feet)
Clear to darker anhydrite-rich salt. Moderately coarsely crystalline up to 1/2 inch-----	1.3	2,695-2,696.8
Clear coarsely-crystalline salt, up to 1/2 inch-----	2.5	2,703-2,705.5
Very light-gray salt with few segregations of anhydrite-----	1	2,705.6-2,706.5
Light-gray salt with clearer salt. Light- gray bands are discontinuous, about 85° dip, crystals up to 3/8 inch-----	1.5	2,703-2,709.5
Clear salt with 1/2 inch light-gray band bending from 70 degrees at bottom to 80 degrees at top. Crystals in clear salt as long as 1/2 inch-----	1.5	2,711.5-2,713
No cores. Sonic log indicates salt-----	796	2,713-3,509(T.D.)

APPENDIX 2

CORE RECORD ON TATUM WP-1 CORE HOLE, PROJECT DRIBBLE

(Drilling, coring begun February 4, 1961; completed June 21, 1961)

Depth datum is rotary table, 279 feet above sea level

Core no.	Interval (Depth-Feet)	Thickness	Core Recovered (Feet)	Percent recovery	Remarks
	0-33	30	--	--	Drilled
1	-53	20	0	0	2-1/8-inch diameter core to 1,513-foot depth
2	-60	7	2.75	37	
3	-80	20	10	50	
4	-90	10	0.2	20	
5	-111	21	5	24	
6	-117	6	6	100	
7	-137	20	3.25	16	
8	-142	5	0	0	
9	-156	14	1	7	
10	-164	8	0	0	
11	-169	5	4	80	
12	-174	5	4	80	
13	-178	4	4	100	
14	-188	10	10	100	
15	-208	20	15	75	
16	-213	5	4	80	
17	-218	4	4.25	106	

Core record on Tatum WP-1 core hole--continued

Core no.	Interval (Depth-Feet)	Thickness	Core recovered (Feet)	Percent recovery	Remarks
18	-223	5	4	80	
19	-235	12	9	75	
20	-245	10	1.5	15	
21	-250	5	3.5	70	
22	-255	5	3.5	70	
23	-266	11	6.75	61	
24	-273	7	6.75	96	
25	-283	10	7.25	73	
26	-291	8	8	100	
27	-296	5	5	100	
28	-306	10	9.25	93	
29	-321	15	15	100	
30	-327	6	3.5	58	
31	-337	10	6.5	65	
32	-357	20	1	5	
33	-374	17	0	0	
34	-387	13	0	0	
35	-402	15	3	20	
36	-415	13	0	0	
37	-431	15	3	20	
38	-445	14	3	21	
39	-457	12	9.5	79	

Core record on Tatum WP-1 core hole--continued

Core no.	Interval (Depth-Feet)	Thickness	Core recovered (Feet)	Percent recovery	Remarks
40	-471	10	2	20	
41	-480	9	4.75	53	
42	-490	10	10	100	
43	-500	10	8	80	
44	-510	10	2.75	28	
45	-520	10	2.5	25	
46	-530	10	4	40	
47	-540	10	0.75	8	
48	-551	11	3.25	30	
49	-561	10	2.75	28	
50	-571	10	1.75	18	
51	-581	10	0	0	
52	-591	10	0	0	
53	-608	17	0	0	
54	-618	10	0	0	
55	-634	15	0	0	
56	-649	15	0	0	
57	-664	15	0	0	
58	-680	16	0	0	
59	-693	13	9.5	73	
60	-709	16	6	38	
61	-724	15	7.75	52	

Core record on Tatum WP-1 core hole--continued

Core no.	Interval (Depth-Feet)	Thickness	Core recovered (Feet)	Percent recovery	Remarks
62	-739	15	8	53	
63	-753	14	8.25	59	
64	-769	16	8.75	55	
65	-784	15	4.75	32	
66	-800	16	10.75	67	
67	-816	16	10.5	66	
68	-836	20	0	0	
69	-846	10	0	0	
70	-861	15	0	0	
71	-877	16	10.5	66	
72	-892	15	1.75	12	
73	-908	16	2.5	16	
74	-923	15	3.5	23	Top of limestone conglomerate, 908 feet
75	-929	6	0	0	Approximate top of limestone caprock, 929 feet
76	-940	11	0.2	2	
77	-950	10	0	0	
78	-970	20	0	0	
79	-974	4	0	0	
80	-979	5	0	0	
81	-989	10	1.25	13	
82	-994	5	1.75	35	

Core record on Tatum WP-1 core hole--continued

Core no.	Interval (Depth-Feet)	Thickness	Core recovered (Feet)	Percent recovery	Remarks
83	-1,001	7	1	14	
84	-1,008	7	0	0	
Depth correction: 1,008 = 1,005					
85	1,005-1,020	15	1.25	8	
86	-1,025	5	0.75	15	
87	-1,045	20	7	35	Top of gypsum, approximately 1,048 feet
88	-1,055	10	0	0	
	-1,061	6	--	--	Drilled. Lost circulation at 1,056 feet in approximate top 2 feet of anhydrite
89	-1,081	20	19.5	98	
90	-1,101	20	20	100	
91	-1,102	1	0.5	50	
92	-1,123	21	21.5	104	
	-1,158	35	--	--	Drilled
93	-1,172	14	14	100	
94	-1,186	14	14	100	
95	-1,236	50	50	100	
96	-1,286	50	50	100	
	-1,311	25	--	--	Drilled

Core record on Tatum WP-1 core hole--continued

Core no.	Interval (Depth-Feet)	Thickness	Core recovered (Feet)	Percent recovery	Remarks
97	-1,325	14	13.8	99	
98	-1,340	15	7.6	51	
99	-1,352	12	12	100	
100	-1,367	15	15	100	
101	-1,387	20	20	100	
102	-1,397	10	10	100	
103	-1,447	50	50	100	
	-1,449	2	--	--	Drilled
104	-1,474	25	25	100	
105	-1,513	39	39	100	Top of salt
106	-1,535	22	22	100	1,509.5 feet
					4-15/16-inch
					core from
					1,513 to 2,713
					feet
107	-1,557	22	22	100	
108	-1,579	22	22	100	
109	-1,601	22	22	100	
110	-1,623	22	22	100	
111	-1,645	22	23	104	
112	-1,670	22	22	100	
113	-1,692	22	22	100	
114	-1,714	22	22	100	
115	-1,728	14	14	100	
116	-1,749	21	21	100	

Core record on Tatum WP-1 core hole--continued

Core no.	Interval (Depth-Feet)	Thickness	Core recovered (Feet)	Percent recovery	Remarks
117	-1,766	17	17	100	
118	-1,788	22	22	100	
119	-1,810	22	22	100	
120	-1,832	22	22	100	
121	-1,855	23	23	100	
122	-1,878	23	23	100	
123	-1,899	21	18	86	
124	-1,920	21	21	100	
125	-1,942	22	22	100	
126	-1,965	23	22	95.6	
127	-1,986	21	21	100	
128	-2,006	20	4.7	100	
129	-2,013	7	22	100	
130	-2,035	22	22	100	
131	-2,057	22	22	100	
132	-2,079	22	22	100	
133	-2,102	23	23	100	
134	-2,127	25	25	100	
135	-2,150	23	22	95.6	
136	-2,172	22	21	95.3	
137	-2,195	23	23	100	
138	-2,218	23	23	100	

Core record on Tatum WP-1 core hole--continued

Core no.	Interval (Depth-Feet)	Thickness	Core recovered (Feet)	Percent recovery	Remarks
139	-2,238	20	18	90	
140	-2,260	22	21	96	
141	-2,282	22	22	100	
142	-2,305	23	23	100	
143	-2,308	3	3	100	
144	-2,330	22	22	100	
Depth correction: 2,330 = 2,331					
	2,331-2,332	1	--	--	Drilled
145	-2,355	23	23	100	
146	-2,377	22	22	100	
147	-2,397	20	20	100	
148	-2,420	23	23	100	
149	-2,444	24	23	95.8	
150	-2,466	22	12.5	57	
151	-2,479	13	13	100	
152	-2,503	24	24	100	
Depth correction: 2,503 = 2,501					
153	2,501-2,525	24	24	100	
154	-2,549	24	23.7	99	
155	-2,573	24	24	100	
156	-2,597	24	24	100	
157	-2,621	24	24	100	

Core record on Tatum WP-1 core hole--continued

Core no.	Interval (Depth-Feet)	Thickness	Core recovered (Feet)	Percent recovery	Remarks
158	-2,645	24	24	100	
159	-2,668	23	23	100	
160	-2,691.5	23.5	23.5	100	
161	-2,713	21.5	21.5	100	
	-3,509	796	--	--	Drilled

APPENDIX 3

TATUM DOME CORE HOLE WP-1, SLICKENSIDES AND FRACTURES IN ANHYDRITE CAPROCK

Depth	Degrees from Horizontal	Description
1,061	30	thin film of gypsum
1,069	40	do
1,071	30	do, zone of gypsum 1/2-inch wide
1,074.5	15	do
1,094.5	30	
1,097.5	15	gypsum zone, 2 mm thick
1,100.3	35	warped
1,108.5	30	thin gypsum film
1,111.5	0	warped, dark anhydrite-coated
1,112.5	0	dark anhydrite-coated
1,120.5	0	fibrous anhydrite, thin layer
1,158.5	0	smooth anhydrite-coated
1,253.5	0	dark anhydrite-coated
1,280	0	yellow-coated anhydrite grains (sulfur?)
1,333	10	fibrous black anhydrite-coated
1,355	0	gray fibrous anhydrite-coated
1,358	10	warped, black-coated
1,364.5	5	fibrous anhydrite-coated
1,366.8	30	asphalt-coated
1,373	5	black crystalline anhydrite-coated
1,374	5	
1,374.5	5	black anhydrite-coated
1,378.5	10	dull black coated (tar?)
1,379	15	do
1,380	15	do
1,383	0	do
1,397		broken core, possible multiple fractures or faults
1,423.5	0	aligned anhydrite crystals
1,449.3	35	warped, smooth

APPENDIX 4
IN-HOLE SURVEYS AND LOGS PRODUCED

Company or organization	Type of Log	Interval (depths in feet below surface)	Scale of log
Hycalog	Mud Log	16-3,510	5" = 100'
USGS (Widco)	Electrical	0-200	5" = 100'
Schlumberger	Electrical	206-1,435	2" and 5" = 100'
Schlumberger	Gamma ray-Neutron	20-1,446	5" = 100'
Schlumberger	Gamma ray-Neutron	1,446-2,712	5" = 100'
Schlumberger	Sonic	206-1,443	5" = 100'
Schlumberger	Sonic	1,443-2,708	5" = 100'
Schlumberger	Sonic	2,708-3,504	5" = 100'
Schlumberger	Caliper	206-1,446	5" = 100'
Schlumberger	Caliper	1,447-2,500	5" = 100'
Schlumberger	Temperature	20-1,447	2" = 100'
Schlumberger	Temperature	1,200-2,706	2" = 100'
Schlumberger	Directional	1,350-2,450	Spacing 100' and 200'
Sperry-Sun	Gyro-Deviational, Directional	0-3,502	Approx. 60' spacing
USGS	Lithologic	33-2,706	5" = 100'

Core Hole WP-1

Location: Section 11, T. 2 N., R. 16 W.
Coordinates: 10,167 N, 8,041 E (167 feet N, 1,959 feet W of NE corner of section)
Elevation: Ground level, 271 feet above sea level
Datum: Rotary drive bushing, elevation 279 feet above sea level
Lithology from Hycalog and core descriptions and from interpretation of geophysical logs

FIGURE 2.- LOG OF CORE HOLE WP-1, TATUM DOME, LAMAR COUNTY, MISSISSIPPI