CORE LOGS FROM FIVE HOLES NEAR KRAMER, IN THE MOJAVE DESERT, CALIFORNIA

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ABSTRACT

In 1957, five test holes were drilled near Kramer, California, in the western Mojave Desert. The drill sites are in topographic basins where gravimetric and geologic surveys indicated the presence, beneath alluvium, of a thick section of Quaternary and Tertiary sedimentary and volcanic rocks.

Two holes which were deeper tests at sites drilled in 1954 cored only silts, sands and gravels: Four Corners test hole No. 1 was drilled in sec. 20, T. 10 N., R. 6 W., to a depth of 3,500 feet. Four Corners No. 2, in sec. 5, T. 10 N., R. 8 W., was drilled to 2,328 feet.

Three holes which were drilled at new sites north of the intersection of U. S. Highways 395 and 466, locally known as Four Corners, encountered colemanite-bearing sediments. The locations and total depths of these holes are as follows: Four Corners No. 3, sec. 18, T. 11 N., R. 6 W., depth 2,568 feet; Four Corners No. 4, near northern edge of sec. 30, T. 11 N., R. 6 W., depth 3,500 feet; Four Corners No. 5, near southern edge of sec. 30, depth 1,604 feet. The sections of rocks encountered in these three holes are similar. In each, the colemanite is in fine-grained sediments that lie below sands and gravels, which are about 600 to 800 feet thick, and are underlain by sandstones and conglomerates.

Colemanite is most abundant in the cores from Four Corners test hole No. 5, particularly in the 76 feet of core recovered between depths of 1,051 and 1,131 feet. Chemical analysis shows that in this section of core the average content of B_2O_3 is above 14 percent. In addition to colemanite, the cores contain sulfides of arsenic, an unusual iron sulfide, and zeolites. This mineralogy of the colemanite-bearing sediments north of Four Corners, together with the general lake bed lithology and the occurrence as a tilted section of beds below sands and gravels, supports correlation with the upper or marginal parts of the borate-bearing sediments at the Kramer borate mining district, which have similar features. There is, however, no evidence that any beds are exactly equivalent in age.

Introduction

The chief purpose of this report is to describe the cores obtained from five test holes which were drilled for the U. S. Geological Survey near the Kramer sodium borate district, in the Mojave Desert, California, during the period January-May 1957. Among the holes, three that are grouped in an alluvial-covered area about 6 miles east of Kramer encountered the calcium borate colemanite. Since May 1957, borate prospectors have drilled additional test holes in the same area, and there are strong indications that prospecting for borates there and in other parts of the desert will continue. Because of this interest in prospecting, this report includes a brief summary of the factors considered to be significant in the selection of these drill sites, and a map showing the geology and gravimetric data in the area drilled.

The Kramer-Four Corners area is a typical part of the surrounding western Mojave Desert in topography and main geologic features. The topography is of the basin and range type; the ranges are relatively small and of low or moderate relief, and the intermontane basins are very broad. The desert vegetation is sparse and the soil thin. Prospectors searching for mineral values in the ranges find the rocks there well-exposed or within easy reach, but in the more extensive basins the prospector must deal with the alluvium of the desert washes and dry lakes or playas, and a search for mineral values below the alluvium generally requires test drilling.

The importance of drilling is emphasized by the history of the Kramer district, which has been the world's most productive source of borax ever since large-scale mining began there in 1927. The Kramer borates were completely covered by alluvium, and their existence was discovered by accident when a hole was drilled for water in 1913. The borates of greatest value were located only after 12 years of additional drilling. Exploration for borates by drilling in other basins, either near the Kramer basin or more distant, has not been thorough or systematic. This is, of course, because test holes are expensive and, in the absence of any positive guide to ore, they are highly speculative ventures. Nevertheless, there are several reasons why the region remains attractive to prospectors who are able to drill: 1) The Kramer example suggests the potential reward for discovery of a new borate field is very great. 2) The sought-for ore body is expected to be a half mile or more wide, a target large enough to be suitable for exploration by drilling. 3) The areas that are most likely to contain hidden borate deposits, if any exist, are better defined as knowledge of the local subsurface geology and of borate deposits in general is advanced by drilling and geologic investigations.

Location of the area

In this report, Kramer is used for the borate mining district, which was named for a small station on the Atchison, Topeka and Santa Fe Railway, but the largest community in the vicinity now is Boron, population about 500, which lies about halfway between the town of Mojave and Barstow. (See index map, fig. 1). Local usage has established the name

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Figure 1. Index map showing location of five holes near Kramer, in the Mojave Desert, California.

Four Corners for the junction of U. S. Highways 466 and 395, which is 6 miles east of Boron. Directions for reaching the Survey drill sites are most conveniently referred to this junction, and the U. S. Geological Survey test holes drilled in the area are identified as Four Corners No. 1 to No. 5. The accompanying map of the Kramer-Four Corners area (fig. 2) shows details of local roads on a planimetric base taken from several

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Figure 2. Map of the Kramer-Four Corners area, California, showing geology and gravimetric data.

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recently issued 15-minute quadrangles: Fremont Peak, Boron, Castle Butte, Rogers Lake, Kramer, and Hawes. All these sheets are of scale 1:62,500.

Acknowledgments

The drilling near Kramer is part of an investigation of the geology of borate deposits in the Mojave Desert and adjacent parts of southeastern California, conducted by the U. S. Geological Survey since 1952, in part supported by funds of the Bureau of Aeronautics of the Navy. The drilling was done for the U. S. Geological Survey by Miller and York, Bakersfield, California, under contract. Many members of the U. S. Geological Survey have contributed to the general program and several specifically to the work near Kramer. In the western Mojave Desert, the geology was mapped by T. W. Dibblee, Jr., geophysical surveys were made by D. R. Mabey and others, and data on the boron content of groundwater were gathered by R. S. Stone. The Kramer borate deposit was examined chiefly by S. J. Muessig. These surveys developed a background of both regional geology and local detail that was valuable in the drilling program.

The logs that make up the bulk of this report were prepared by William K. Benda, who did the preliminary logging in the field while he directed the drilling operations. He gratefully acknowledges the generous help given during the early stages of this field work by A. M. Bassett, T. W. Dibblee, Jr., D. V. Haines, and G. I. Smith. J. C. Thomas assisted Benda during field work. R. C. Erd joined Benda in the more detailed core logging done in the laboratory, and is particularly responsible for mineral identifications. Ward C. Smith supervised the investigations of which this drilling is part, and drafted the sections of this report that precede the detailed logs.

Published geologic reports

Bibliographies that cover much of the general subject of borates and the borate industry appear in the history of borax production by Ver Planck (1956) and in the article on boron by Arundale (1956). (Full titles for these and other reports to which reference is made are listed at the end of this section). Among reports that describe local geologic features, that of Gale (1946), on the Kramer borate deposit, is especially valuable as background for borate exploration in the vicinity. Gale assembled all available local information and added many notes on the regional geology that he had gathered during his years in the Mojave Desert. Gale took pains to point out in his report the geologic factors most important to prospectors. Details of local geology in part of the Kramer Hills, southeast of Four Corners Hole No. 1, are described in Bowen's report on the Barstow quadrangle (1954).

Reports based on the U. S. Geological Survey's Mojave Desert investigations since 1952 are being prepared for publication at the time this report is being written. Those already published in the regular series of the Survey and in scientific journals appear in the accompanying list, together with certain preliminary reports made available to the public by placing them in open file. Among the published reports is that of Dickey (1957), which describes the cores from two shallow holes drilled by the Survey in 1954-55 at the same sites as Holes No. 1 and No. 2 of this report.

Dibblee's geologic maps of the region have been mentioned already. It should be added here that two compilations of his data were placed "in open file" at certain Survey offices in 1957, in order to make them available for public inspection more quickly than is possible with the regular printed series. One compilation is a map sheet showing a simplified geologic map of the Western Mojave Desert, scale 1:250,000. The other consists of similar simplified geology on scale 1:62,500 for parts of the Mojave, including the Kramer-Four Corners area, on sheets used as base maps in the report on boron in groundwater by Stone (1957).

Selected References

Arundale, J. C., 1956, Boron in Mineral Facts and Problems: U. S. Bureau of Mines Bull. 556, p. 137-141.

Bowen, O. E., Jr., 1954, Geology and mineral deposits of Barstow quadrangle, California: Calif. Div. Mines Bull. 165, p. 76-88.

Dibblee, T. W., Jr., 1958, Tertiary stratigraphic units of the western Mojave Desert, California: Am. Assoc. Petroleum Geologists Bull., v. 42, no. 1, p. 135-144.

_____, 1957, Simplified geologic map of the western Mojave Desert, California: U. S. Geol. Survey, (open file report available for consultation in the Geological Survey Libraries, Federal Center, Denver, Colo., Menlo Park, Calif., and Washington, D. C.; Geological Survey offices at 116 North Alexander Ave., Claremont, and 1031 Bartlett Bldg., Los Angeles, Calif.; and in the Office of the Chief, Calif. Div. of Mines, Ferry Bldg., San Francisco, Calif.) Map released for public inspection October 28, 1957.

Dickey D. D., 1957, Core logs from two test holes near Kramer, San Bernardino County, California: U. S. Geol. Survey Bull. 1045-B, p. 63-79, pl. 2, fig. 3.

Gale, H. S., 1946, Geology of the Kramer Borate District, Kern County, California: Calif. Jour. Mines and Geology, v. 42, p. 325-378.

Goddard, E. N., (chm.) and others, 1948, Rock-color chart: Washington, D. C., Natl. Research Council (republished by Geol. Soc. America, 1951).

Mabey, D. R., 1956, Geophysical studies in the intermontane basins in southern California: Geophysics, v. 21, no. 3, p. 839-853, illus.

Stone, R. S., 1957, Ground-water reconnaissance in the western part of the Mojave Desert, California, with particular respect to the boron content of well water. U. S. Geol. Survey open file report (available for inspection at the following places: Geological Survey, 2929 Fulton Ave, Sacramento, Calif.; Geological Survey, 116 North Alexander Avenue, Claremont, Calif.; Room 1242-G General Services Building, Washington 25, D. C.) Report released for public inspection May 17, 1957, 102 p., 13 pls.

Switzer, George, 1938, Veatchite, a new calcium borate from Lang, California: Am. Mineralogist, v. 23, p. 409-411.

Ver Planck, W. E., 1956, History of Borax Production in the United States: Calif. Jour. Mines and Geology, v. 52, no. 3, p. 287-291.

Wentworth, C. L., 1922, A scale of grade and class terms for clastic sediments: Jour. Geology, v. 30, p. 377-392.

Geology

Geologic units

The distribution and structure of the rocks in the Kramer-Four Corners vicinity is shown on figure 2, and the explanation that appears on the map describes each local rock unit. As is typical of much of the western Mojave Desert, the rock units are in three main divisions; in order of areal extent, these are as follows: (1) the Quaternary, including Recent alluvium and older alluvium, which together cover about three-fourths of the ground; (2) the pre-Tertiary, including mostly quartz monzonite, with minor amounts of other granitic rocks, some pegmatite dikes, and masses of metamorphic rocks (outcrops of these crystalline rocks cover about two-tenths of the area on the map, but they form the basement "complex" of the region, and from their exposures on the eroded ranges they extend under the basins, buried below younger rocks to various depths); (3) the Tertiary, consisting of continental sediments and volcanic rocks, with outcrops that amount to only a tenth of the area.

Since the borates of the Kramer-Four Corners area are in lake sediments that are in the upper part of the Tertiary series, the Tertiary rocks are of chief interest. Descriptions of them in considerable detail appear in published reports, to which the interested reader is referred (see Gale, 1946; Bowen, 1954; Dibblee, ~~in press~~ 1958). Since the Tertiary rocks have been divided and named in different ways, the sequences of rocks described in published reports are shown on the accompanying table 1 for convenient reference.

Table 1. Sequence of rock units near Kramer, California.

Table 1.--Sequences of rock units near Kramer, California

Kramer Borate District Gale, 1946			Kramer Hills Bowen, 1954			Western Mojave Dibblee, 1958		
QUATERNARY		Recent alluvium	QUATERNARY	RECENT	Alluvium	QUATERNARY	RECENT	Alluvium
		Older alluvium			(Unconformity)			(Unconformity)
		(Unconformity)		PLEISTOCENE	Old Alluvium		PLEISTOCENE	Fanglomerate
					(Unconformity)			(Unconformity)
TERTIARY	UPPER MIOCENE	Ricardo formation Upper conglomerate or fanglomerate Kramer lake beds (including borates) Saddleback basalt	TERTIARY	UPPER MIOCENE?	Continental deposits Arkose Upper lake beds Black quartz andesite	TERTIARY	PLIOCENE?	Tropico group Upper part Saddleback basalt | Red Buttes quartz basalt
		(Unconformity)			(Unconformity)			(Unconformity)
	MIDDLE MIOCENE(?)	Rosamond formation (Arkosic sands, conglomerates, siliceous volcanics)			Continental deposits Lower lake beds		MIOCENE?	Lower part
		(Unconformity)			(Unconformity)			(Unconformity)
PRE-TERTIARY		Quartz monzonite and Amargo formation	MESOZOIC		Quartz monzonite and Sidewinder meta-volcanics	PRE-TERTIARY		Quartz monzonite and Quartz latite porphyry

As the table shows, age assignments are tentative. Fossils of any kind are rare in the Tertiary rocks of the Mojave Desert, and none of specific value in correlation have been found in the Kramer-Four Corners area. Consequently, the isolated stratigraphic sections are correlated mostly on lithology, with evidence of structural relationships used where it can be established.

Some complexities of the Tertiary rocks with which the prospector must deal are evident from the geologic map and its explanation, and can be indicated briefly by noting here the Tertiary history. The Tertiary rocks accumulated as continental basin sediments and volcanic rocks, deposited unconformably upon the greatly eroded pre-Tertiary basement under conditions of climate and topography that, in general, were much like local conditions of recent times. During and after deposition the Tertiary deposits were locally faulted, folded, and partly eroded. Individual layers of sediments are characteristically local lenses that grade laterally to different lithologic types, just as the rocky alluvial fans of today grade to playa silts or saline deposits. Marker beds may have local value, but none has been found widely usable for correlating the stratigraphic sections that now are isolated by faulting and erosion. For example, the Saddleback basalt of the Kramer borate district and the Red Buttes quartz basalt of the Kramer Hills are valuable local markers, but neither has been found in drill cores north of Four Corners, where test hole No. 4 penetrated to a depth of 3,500 feet.

In the lower part of the accumulated Tertiary series, rhyolitic or closely related tuffs and breccias are particularly abundant, and limestone, dolomite, and magnesite are closely associated with them. Arkosic sands and gravels, common throughout the Tertiary series, are dominant in the upper part. As Gale (1946) pointed out, the granitic detritus of the uppermost part of the Tertiary is so much like similar detritus of the Quaternary Recent alluvium and older alluvium that the units are distinguished less by lithology than by topographic or structural relationships. They cannot be distinguished in drill cores or cuttings.

The borate-bearing lake beds encountered in the test holes drilled north of Four Corners contain an unusual combination of minerals also found in the colemanite-bearing lake beds that are marginal to the sodium borate ore body at Kramer, as is discussed in the summary of the drill cores in a later section of this report. This mineralogy, as well as the general lithology and structural position, gives strong support to correlation of the two borate-bearing sediments. Much less certain is the correlation of beds exposed on the south side of the Kramer Hills, in the NE¼, sec. 15, T. 9 N., R. 6 W., which also contain borates, though only in small amount--at the locality there are scattered "cotton balls" of ulexite in fine-grained lake beds that dip 50° S. (J. F. McAllister, written communication, 1953). The need for caution in correlating on the basis of borate minerals alone is apparent when consideration is given to the wider region, in which the nearest major deposits of borates have a wide spread in age: The Calico Mountain borates, 50 miles east of Kramer, are well-dated as mid-Miocene in age, while the borate-bearing salt bodies of Searles Lake, 50 miles north, are Pleistocene. The Kramer deposit is assumed to be Pliocene. It seems advisable, therefore, to keep in mind the possibility that in this region borates might occur anywhere in the Tertiary-Quaternary stratigraphic sections.

Summary of gravity study of bedrock configuration

by D. R. Mabey

As the Kramer-Four Corners map shows, the gravimetric survey demonstrated that there are gravity highs over the granitic outcrops and conspicuous gravity lows over some of the alluvium-covered basins. The contrast in density between the pre-Tertiary crystalline rocks and the "fill" (including Tertiary and Quaternary sedimentary and volcanic deposits) is assumed to be the chief factor producing the gravity anomalies, although density variations within the pre-Tertiary rocks and within the fill exert a minor influence (Mabey, 1956). It follows that the lines of equal Bouguer anomaly in a very general way reflect the configuration of the bedrock below the fill. The actual depth to the pre-Tertiary bedrock cannot be calculated accurately from the gravity data because a representative value for the density of the fill, and thus the contrast in density producing the anomaly, is not known.

Large variations in the density are known to exist within and between local basins in the Kramer-Four Corners area. Determinations made on drill core samples showed that they range in density from 2.0 to 2.65 gms per cm^3. Using the gravity survey with the limited density data available, estimates of the minimum thickness of fill that could produce a gravity anomaly are reliable, but estimates of the maximum thickness are not. The general configuration of the pre-Tertiary rock surface can be inferred from the gravity data; several of the steep gravity gradients indicate faults along which movement has produced apparent vertical displacement of the pre-Tertiary rock surface. However, considerably more direct control in the form of known depths to the pre-Tertiary rock and relatively detailed density sampling is required before an accurate representation of the configuration of the pre-Tertiary rock surface can be computed from the gravity data.

Selection of drill sites

In the vicinity of Kramer-Four Corners, three areas were selected for drill tests. Besides being near Kramer, each area is (1) alluvial covered; (2) underlain by thick "fill"; (3) marked by marginal outcrops of Tertiary rocks--that is, not surrounded by hills composed of quartz monzonite alone; (4) not adequately tested by earlier drilling. Within each area, the site selected for a first test was within the part where, according to the gravimetric data, the fill was thickest. It seemed likely that where the fill is thickest the drill would encounter the most complete section.

Drilling showed that the most abundant borates north of Four Corners lie off the center of the gravimetric low. Probably the position of the low is established partly by a large stratigraphic thickness of older sediments which are below the borate-bearing sediments, and partly by an effect of thickening where the beds are tilted, near Hole No. 3. The borate ore body at Kramer also is off the center of the gravity low, and this second example probably has a similar explanation.

Summary of results of drilling

The lithology of the cores recovered from the test holes is described in detail in the graphic and written logs that form the final, main part of this report, and only the chief results of drilling are summarized in this section. Of the three areas drilled, that north of Four Corners is shown to contain borates and is discussed at greatest length, while the two areas tested by Four Corners No. 1 and No. 2 seem to require only a short comment, since both are shown to be unpromising, if not actually barren of borates. Of these two, perhaps there is still some possibility of borates within the thick body of sediments marked out by the long gravimetric low extending northwest of Four Corners No. 2--one hole is hardly an adequate test of such a large area--but the absence of even traces of boron in the cores from No. 2 is discouraging. As the map shows, the test hole was placed in the southeastern part of the low. This location seems geologically as good as elsewhere in the low, and there is the added consideration that this site lies within the Edwards Air Force Base, in ground not open to test-drilling except by a government agency.

The geologic cross sections that appear on figure 2 show the correlations between sections encountered in the test holes and sections in the outcrops.

Four Corners No. 1

Four Corners No. 1 is in the NW¼SW¼, sec. 20, T. 10 N., R. 6 W., San Bernardino County, at an elevation of 2,700 feet. The site is 3.5 miles south of Four Corners and 0.6 mile west of U. S. Highway 395, and it lies within the Edwards Air Force Base military reservation. The previous test hole of the same designation, drilled to a depth of 1,561 feet, is described by Dickey (1957). The new hole was located 20 yards southwest of the old one. It was drilled to 1,500 feet without coring, then cored to 3,500 feet. No borate minerals were encountered. The following summary of the lithology combines the data obtained from both holes.

Depth (feet)	Lithology
0- 128	Sand and gravel.
128-1,151	Conglomerate, gray, with cobbles and pebbles of granitic rocks in matrix of gray arkosic sandstone.
1,151-2,575	Sand, fine to coarse; gray, arkosic, locally pebbly, with some partings of clay; dips 0° to 5°.
2,575-2,885	Sand, as above, with some interbedded clay and siltstone, greenish gray. Bedding horizontal.
2,885-3,416	Sand and sandstone, fine to medium; gray, arkosic, with rare partings of clay; dips 0° to 10°.
3,416-3,500	Sandstone, gray friable, medium to coarse-grained, with some conglomerate of granitic pebbles and cobbles.

Four Corners No. 2

Four Corners No. 2 is in the N½, sec. 5, T. 10 N., R. 8 W., in Kern County, at an elevation of 2,330 feet. The site is 11.5 miles west of Four Corners and 0.8 mile south of U. S. Highway 466, and within the Edwards Air Force Base military reservation. This hole is also a continuation of a test of the same number made in 1954-55 and described by Dickey (1957), which was cored and drilled to a depth of 1,714.5 feet. The new hole was offset about 30 yards northeast of the old one, and it was drilled without coring to a depth of 1,650 feet, then core drilled to 2,328 feet. The test was abandoned at that depth because the drill had encountered neither borate minerals nor lake sediments. In general, the core consists of fine to medium sand, arkosic, greenish gray, with occasional interbeds of silt, clay and conglomerate. The following summary of lithology combines the data from both holes.

Depth (feet)	Lithology
0- 100	Sand.
100- 536	Clay and silt, both tan, poorly bedded.
536-1,202	Sand, fine to coarse, arkosic; silt and clay, light brown; some thin layers of pebble gravel.
1,202-1,679	Gravel, of granitic and volcanic pebbles and cobbles; and sand, tan, medium to coarse, some silt, tan.
1,679-1,913	Sand, fine to medium; greenish gray, arkosic, friable to moderately hard; minor gray silt and clay; dips 15° to 20°.
1,913-2,328	Sand, like that of last interval but with some granitic cobbles; some thin layers of gray clay; dips 15° to 30°.

Four Corners No. 3, 4, and 5

Lithology

The three holes north of Four Corners were drilled about a mile apart and roughly along a northwest-trending line where, according to the gravity data, the surface alluvium is underlain by the maximum thickness of fill. The location of each hole is given below, with the summary of its log.

Four Corners No. 3

Location.--1,450 east and 150 feet north of SW corner of sec. 18, T. 11 N., R. 6 W., S.B.B.&M., San Bernardino County, California, 3.7 miles northwest of Four Corners. Elevation 2,565 feet.

Depth (feet)	Lithology
0- 648	Sand and gravel. Core recovery poor.
648-1,730	Clay, gray, thin bedded, with some interbedded arkosic sands; colemanite in thin layers (maximum 1 inch) between 1,465 and 1,520 feet; dips 20° to 30°.
1,730-2,555	Conglomerate and breccia, gray, poorly bedded with granitic cobbles and pebbles in matrix of hard arkosic sandstone; some interbedded sandstone, gray, massive to bedded, hard, medium- to coarse-grained, arkosic; core recovery poor.
2,555-2,568	Clay, gray, bedded, hard; some interbedded sandstone; dip 30°.

Four Corners No. 4

Location.--960 feet west and 120 feet south of northeast corner of Sec. 30, T. 11 N., R. 6 W., S.B.B.&M., San Bernardino County, California, 2.5 miles north of Four Corners. Elevation, 2,498.4 feet.

Depth (feet)	Lithology
0- 808	Sand and gravel. Drilled without coring.
808-1,846	Clay, gray, thin bedded, with some interbedded fine to medium sands; quartzose sandstone between 925 and 1,210 feet; thin layers of colemanite in clay between 1,354 and 1,358 feet. Dips generally about 5° to 10° throughout.
1,846-3,500	Conglomerate and breccia, granitic cobbles, pebbles and fragments in matrix of hard arkosic sandstone; some interbedded coarse arkosic sandstone; poor core recovery; arkosic sandstone and some interbedded shale between 2,525 and 2,560 feet.

Four Corners No. 5

Location.--410 feet west and 50 feet north of southeast corner of sec. 30, T. 11 N., R. 6 W., S.B.B.&M., San Bernardino County, California, 1.5 miles north of Four Corners. Elevation, 2,462.4 feet.

Depth (feet)	Lithology
0- 700	Sand and gravel. Drilled without coring.
700-1,360	Clay, gray, thin bedded, with some interbedded arkosic sands; colemanite, in layers as thick as 3 inches; colemanite is most abundant between 1,051 and 1,145 feet, and between 1,241 and 1,252 feet.
1,360-1,604	Conglomerate: granitic fragments in matrix of hard sandstone; interbedded sandstone, gray, hard medium- to coarse-grained; poor core recovery.

Mineralogy

Many identifications of minerals appear in the core logs, but detailed mineralogical examinations have been made only of borate-bearing portions of the cores from holes 3, 4, and 5. The short summaries of the various groups of minerals given below are preliminary to a more complete study.

Borates.--Colemanite, $2CaO.3B_2O_3.5H_2O$, is the predominant borate mineral. It is found bedded, as veins, and as podlike concretions. The thickest beds are about 4 inches thick. In some beds it is massive and coarsely granular, but in most it occurs as the coarse fibrous form, perpendicular to bedding or fracture surfaces.

Veatchite, $SrO.3B_2O_3.2H_2O$, was encountered at several horizons in drill hole No. 5. In two intervals, 1,059 to 1,062 feet and 1,118 to 1,120.5 feet, it constitutes about 10 percent of the total core. It has not been found in the other holes. It occurs as fine scaly crystals disseminated in montmorillonitic clay and with colemanite. This is the second known occurrence of this mineral in California, the other being at Lang (Switzer, 1938).

There is a small amount of water-soluble borate present, but no borax or other water-soluble borate mineral has been identified. The weight percentage of cold-water-soluble B_2O_3 for No. 5 core is given in table 3.

Table 3. Percentage of B_2O_3 in borate-bearing core from Four Corners No. 5.

Clay minerals.--These are essentially montmorillonite and hydrous mica. Attapulgite as fractured fillings and on slickensided surface is present in the core recovered from depth 902 to 908 feet in hole No. 3.

Zeolites.--Analcime, heulandite, and mordenite are relatively abundant; analcime especially in cores from hole No. 3 and heulandite and mordenite in cores from holes No. 4 and 5. Small amounts of heulandite and other unidentified zeolites are less common. The zeolites appear to have originated by alteration of tuffaceous layers and feldspars.

Carbonates.--Fine-grained and often fetid calcite is common in these cores. Some fine-grained dolomite is also present, though much less abundant, but neither aragonite nor water-soluble carbonates have been found.

Saline minerals.--A small amount of halite was obtained on evaporating the cold-water leach of core from a depth of 1,474 feet in hole No. 3.

Sulfides.--Realgar and orpiment, the sulfides of arsenic, are common in cores from holes No. 3, 4, and 5, as veinlets and as inclusions in colemanite. Sulfides of antimony have not been detected.

An unusual ferromagnetic iron sulfide of undetermined composition and unique X-ray powder pattern is abundant in drill holes No. 3, 4, and 5. This mineral is extremely fine-grained, soft, and grayish black. It is almost invariably associated with the clay minerals and occurs in a sequence of alternating sulfide-bearing and sulfide-free clay beds. Evidence from preliminary study suggests that this mineral is a layer-lattice compound similar to smythite.

Detrital minerals.--Biotite as fresh subhedral to euhedral crystals is probably the most conspicuous detrital mineral. Chlorite, quartz, plagioclase, microcline, and traces of zircon constitute the other common clastic material in the cores examined.

Boron content of the cores

Of the core from holes No. 3 and 4, only a few lengths in which colemanite was relatively abundant were sampled and analyzed for the content of acid-soluble B_2O_3. The results of analysis are given in table 2, which follows:

Table 2. Percentage of B_2O_3 in borate-bearing core from Four Corners No. 3 and No. 4. (Analyst, Hy Almond, U. S. Geological Survey).

Four Corners No. 3

Depth (feet)	Content of acid-soluble B_2O_3 (wt. %)
1473 - 1482	9.66
1482 - 1487	7.71
1490 - 1495	12.31
1498 - 1503	5.54
1506 - 1514	2.88
2394 - 2404[1/]	3.12
2404 - 2414[1/]	1.06

Four Corners No. 4

Depth (feet)	
1338 - 1340	8.19
1350 - 1350.5	4.37
1354.1 - 1356.2	10.94
1357.5 - 1360	9.52

1/ Determined on cuttings.

The core from Hole No. 5 includes sections that contain abundant colemanite, and through these sections samples for chemical analysis were taken from consecutive lengths of core, each about 2.5 feet long. The results of analysis are given in table 3. As the detailed logs show, very little core was lost in drilling the colemanite-bearing sections thus; the average content of acid-soluble B_2O_3 may be computed for a selected section of core without much concern over the effect of lost core. For the 80-foot interval between depths of 1,051 feet and 1,131 feet, for example, 76 feet of core ~~were~~ was recovered and for this core the average content of acid soluble B_2O_3 is more than 14 percent. Pure colemanite contains 50.8 percent B_2O_3, so in this section more than a fourth of the core is colemanite.

Table 3. Percentage of B_2O_3 in borate-bearing core from Four Corners No. 5. (Analyst, Angelina C. Vlisidis, U. S. Geological Survey).

Four Corners No. 5

Depth (feet)	Content of acid-soluble B_2O_3 (wt. %)	Content of cold-water-soluble B_2O_3 (wt. %)
1051 - 1054	17.17	0.86
1054 - 1056.5	10.79	0.40
1056.5 - 1059	14.16	0.42
1059 - 1062	26.15	0.75
1062 - 1064.5	11.94	0.74
1064.5 - 1067	14.18	0.75
1067 - 1070	20.57	1.02
1070 - 1072	13.18	0.64
1072 - 1075	7.84	0.54
1075 - 1078	9.29	0.61
1078 - 1080.5	7.85	0.54
1080.5 - 1083	2.62	0.29
1083 - 1085.5	16.30	0.56
1086 - 1088.5	12.57	0.62
1088.5 - 1091	19.09	0.74
1091 - 1093.5	1.82	0.27
1094 - 1096	16.15	0.67
1096 - 1099	11.51	0.43
1099 - 1102	9.80	0.46
1102 - 1104.5	9.27	0.50
1104.5 - 1107	8.28	0.45

Table 3 (cont'd)

Depth (feet)	Content of acid-soluble B_2O_3 (wt. %)	Content of cold-water-soluble B_2O_3 (wt. %)
1107 - 1110	22.90	0.74
1110 - 1112.5	17.52	0.86
1112.5 - 1115	18.39	0.77
1115 - 1118	10.75	0.66
1118 - 1120.5	16.57	0.67
1120.5 - 1123	27.06	0.88
1123 - 1126	13.30	0.67
1126 - 1128.5	15.06	0.70
1128.5 - 1131	14.10	0.64
1131 - 1134	16.34	0.74
1134 - 1136.5	11.06	0.61
1136.5 - 1139	16.18	0.90
1139 - 1142	14.74	1.02
1142 - 1145	5.63	0.45
1194 - 1197	11.88	0.80
1241 - 1244	8.99	0.78
1244 - 1246.5	14.33	1.18
1246.5 - 1249	14.39	0.98
1249 - 1252	17.72	1.34

Correlations of units

As the summaries of lithologies show, all three holes penetrated a similar sequence of sediments. The uppermost sands and gravels are Recent alluvium, and perhaps the entire thicknesses of such sediments--648 feet, 808 feet, and 700 feet in the successive holes--is Recent or slightly older. It is more probable, though, that the lower part of the sand and gravel section belongs with the underlying borate-bearing sediments, and that somewhere within the unit there is an unconformity that went unrecognized during the drilling because no significant change in lithology within the sands and gravels were noted.

Several features of the colemanite-bearing beds suggest correlation with the upper or marginal parts of the Kramer borate-bearing section, though there is no evidence that any beds are exactly equivalent in age. The occurrence as a tilted section below sands and gravels, the lake bed lithology, and particularly the mineralogy, support the correlation. The sulfides of arsenic, the unique iron sulfide, and the zeolites of the cores are present in specimens from Kramer. The strontium borate veatchite may be sporadic, for it has been found only the cores from No. 5 and not in No. 3 or 4, or at Kramer. Some of the ulexite at Kramer, however, is known to be strontium bearing. The cores do not contain sodium or magnesium borate, nor the antimony sulfide found at Kramer, but the other mineralogic features suggest that they represent borate-bearing beds which accumulated in a lake chemically like that in which some of the Kramer colemanite-bearing sediments formed, if not actually the same lake.

The granitic conglomerate below the lake beds seems to be the continuation of conglomerate that crops out 0.7 mile north of Hole No. 3. Projection from the outcrops at the observed dips of 20° to 30° indicates the connection is reasonable. The age of the lower conglomerate and its correlation with the sections known in the Kramer Hills and north of the Kramer borate district, is uncertain.

Detailed logs of the core

Drilling method.--The contractor used a rotary drill of the type commonly used in oil-field drilling. The main items of equipment included the following: a drill with a 96-foot tower and a Giant Clipper Franks unit; Emsco pump of heavy-duty type, fitted with a shaker screen that continuously separated coarse cuttings from the "mud", or drilling fluid; and core barrels 30 feet long, taking cores approximately 2½ inches in diameter. The bits used were the calyx type, of 8-3/4 inch size.

The drilling method, involving continuous drilling and the use of a thick drilling mud, is believed to have kept the walls of the holes in such condition that no significant caving took place. During core drilling, most runs were the full length of the core barrel, 30 feet, but some were shorter; for example, in attempts to core some of the coarse sediments, there were a few runs of only 5 feet. (The term "run" refers to the length of hole drilled between removals of the core barrel from the hole).

Logging.--When the core recovered from any given run was less than 100 percent, there was generally no reliable indication of the position of the recovered core within the run. For all of the logs here discussed, the recovered core has been assigned arbitrarily to the upper part of the run and the lost core to the lower part. The composition of missing core was interpreted from drilling characteristics and cuttings.

The right side of each graphic log (fig. 3) shows a continuous log

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Figure 3. Graphic logs of the cores from Four Corners test holes 1 to 5 near Kramer, California.

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obtained by combining the interpretation of missing core with the logs of recovered core. The left side shows the recovered core only. The graphic logs make no distinction between the parts drilled without coring and those where the core was lost. The record of coring and noncoring is given, however, in the detailed logs.

Core recovery.--The average recovery for the five holes, for the parts core drilled, was 56 percent. The recovery was better than average through sections of sands and silts, and it was excellent through the colemanite-bearing sections in Holes No. 3, 4, and 5. (See graphic logs, fig. 3). Early in the drilling, it was found that core recovery was very poor through gravel, conglomerate, and bouldery materials. So far as practical thereafter, whenever the presence of these coarser materials was indicated by the behavior of the drill and the appearance of cuttings, they were drilled with only intermittent attempts to core them.

Sediment and rock names.--In logging, reliance was placed mainly on careful inspection with a hand lens in the field and with a binocular microscope in the laboratory, but various wet and dry chemical tests were used also. Sediment names are in accordance with those suggested by Wentworth (1922) and colors are named and numbered like those of the Rock-Color Chart (Goddard and others, 1948) distributed by the National Research Council.

Unless otherwise noted, the sand and sandstone units are arkosic, micaceous (biotite), and argillaceous; the silt and siltstone units are micaceous and argillaceous; and the clay and claystone units are micaceous.

Depth 1/ (feet)	Thickness (feet)	Description
1511.3	11.3	Sand, fine to coarse; pale olive (10Y 6/2), slightly calcareous, massive, moderately indurated. Unit contains a 1½-in. layer of clay at 1506.6 ft.
1517.0	5.7	No core. Cuttings suggest same as above.
1538.1	21.1	Sand, similar to sand at 1511.3 ft. Unit contains a 2½-in. layer of sandstone at 1531.1 ft.
1547.0	8.9	No core. Cuttings suggest same as above.
1569.1	22.1	Sand, similar to sand at 1511.3 ft. Unit contains a quartz monzonitic cobble at 1566.0 ft.
1577.0	7.9	No core. Cuttings suggest same as above.
1580.5	3.5	Conglomerate. Subangular quartz monzonitic and quartz pebbles and cobbles in a groundmass of pale olive (10Y 6/2), slightly calcareous, medium to coarse, moderately indurated sand.
1584.8	4.3	Sand, similar to sand at 1511.3 ft. Unit contains local quartz monzonitic cobbles.
1605.0	20.2	No core. Cuttings suggest same as above.
1607.3	2.3	Sand, silt and clay (interbedded). Sand, medium to coarse, pale olive (10Y 6/2), calcareous, moderately indurated; silt, olive gray (5Y 3/2), slightly calcareous, moderately well indurated; clay, moderate brown (5YR 3/4), laminated, moderately well indurated with bedding plane fractures and slickensiding on fracture faces. Unit is thinly bedded to laminated. Bedding is horizontal.

1/ to bottom of unit described.

Depth[1] (feet)	Thickness (feet)	Description
1608.6	1.3	Sandstone, fine-grained; pale greenish yellow (10Y 3/2) and yellowish gray (5Y 7/2), calcareous, thinly bedded, well indurated. Bedding is nearly vertical.
1610.5	1.9	Sandstone, fine- to medium-grained; olive gray (5Y 3/2), slightly calcareous, medium bedded, well indurated. Unit contains local quartz monzonitic pebbles and cobbles.
1620.0	9.5	No core. Cuttings suggest same as above.
1630.0	10.0	Not cored. Cuttings suggest same as above.
1631.0	1.0	Sand, medium to coarse; light olive brown (5Y 5/6), calcareous, limonitic, massive, poorly indurated. Unit contains local quartz monzonitic cobbles.
1635.5	4.5	Sand, silt and clay (interbedded). Sand, fine to coarse, pale olive (10Y 6/2), calcareous, moderately well indurated; silt, grayish olive (10Y 4/2), slightly calcareous, moderately well indurated; clay, olive gray (5Y 3/2), noncalcareous, slightly silty, laminated, moderately indurated, with bedding plane fractures and slickensiding on fracture faces. Unit is thinly bedded to laminated. Bedding is horizontal.
1662.0	26.5	No core. Cuttings suggest same as at 1673.9 ft.

Depth[1/] (feet)	Thickness (feet)	Description
1673.9	11.9	Sand, fine to coarse; pale olive (10Y 6/2) to light olive (10Y 5/4), calcareous, medium bedded, moderately indurated. Unit contains a 6-in. layer of sand at 1666.9 ft.
1674.7	0.8	Clay, dusky yellowish green (10GY 3/2), noncalcareous, silty, slightly sandy, moderately indurated.
1675.9	1.2	Sand, fine to coarse; pale olive (10Y 6/2) to dusky yellow green (5GY 5/2) and grayish green (10G 4/2), slightly calcareous, moderately indurated. Unit contains a 2½-in. layer of clay at 1675.4 ft.
1677.0	1.1	No core. Cuttings suggest same as above.
1678.2	1.2	Sandstone, fine- to coarse-grained; greenish gray (5GY 6/1), calcareous, bedded, well indurated. Bedding is horizontal.
1693.3	15.1	Sand, fine to coarse, pebbly; dusky yellow green (5GY 5/2) and grayish green (5G 5/2), calcareous, medium bedded, moderately indurated to poorly indurated. Unit contains local layers (up to ½-in. thick) of clay; Bedding is nearly horizontal.
1697.0	6.7	No core. Cuttings suggest same as above.
1723.9	26.9	Sand, fine to coarse, pebbly; dusky yellow green (5GY 5/2) to grayish green (10GY 5/2) to grayish olive green (5GY 3/2), calcareous, massive to medium bedded, moderately indurated. Bedding is horizontal.

Depth[1/] (feet)	Thickness (feet)	Description
1727.0	3.1	No core. Cuttings suggest same as above.
1751.3	24.3	Sand, fine to coarse, slightly pebbly; pale olive (10Y 6/2), dusky yellow green (5GY 5/2), grayish olive (10Y 4/2) and olive gray (5Y 3/2) alternating, calcareous, medium bedded, moderately indurated. Unit contains a 6-in. layer of sandstone at 1749.6 ft.
1759.0	7.7	No core. Cuttings suggest same as above.
1778.7	19.7	Sand, fine to medium; pale olive (10Y 6/2) to grayish olive (10Y 4/2), calcareous, massive to faintly bedded, moderately indurated. Unit contains local layers (up to 3-in. thick) of sandstone and clay; unit also contains local weathered quartz monzonitic cobbles.
1786.0	7.7	Sandstone, fine- to medium-grained; pale olive (10Y 6/2), grayish olive (10Y 4/2) and pale greenish yellow (10Y 8/2) alternating, calcareous, medium to thinly bedded, moderately well indurated. Unit contains local lenses (up to 1/8-in. thick) of garnetiferous and magnetitiferous sand.
1790.0	3.6	No core. Cuttings suggest same as above.
1798.4	8.4	Sandstone, fine- to coarse-grained, pebbly; pale olive (10Y 6/2) and grayish olive (10Y 4/2), calcareous, poorly sorted, medium to thinly bedded, moderately well indurated. Unit contains layers (up to 3/8-in. thick) of clay throughout.

Depth[1/] (feet)	Thickness (feet)	Description
1810.5	12.1	Sandstone, siltstone, claystone (interbedded). Sandstone, fine- to coarse-grained, granulitic, grayish olive (10Y 4/2), pale olive (10Y 6/2), and moderate olive brown (5Y 4/4), calcareous, moderately well indurated; siltstone, olive gray (5Y 3/2), grayish olive (10Y 4/2) and pale greenish yellow (10Y 8/2), calcareous, moderately well indurated; claystone, olive gray (5Y 3/2) and grayish olive (10Y 4/2), calcareous, silty, moderately well indurated. Unit contains layers (up to 4-in. thick) of sand and clay throughout. Unit is medium to thinly bedded. Bedding is horizontal.
1820.0	9.5	No core. Cuttings suggest that the lithology is a sand.
1833.8	13.8	Sandstone, fine- to coarse-grained, pebbly; grayish olive (10Y 4/2), olive gray (5Y 3/2) and yellowish gray (5Y 7/2), calcareous, massive to medium bedded, moderately well indurated. Unit contains layers (up to 3½-in. thick) of claystone; unit also contains layers (up to 7-in. thick) of sand. Bedding is horizontal.
1838.2	4.4	Sand, fine to medium; light olive gray (5Y 5/2), calcareous, faintly bedded, moderately indurated. Bedding is horizontal.

Depth[1/] (feet)	Thickness (feet)	Description
1847.2	9.0	Sandstone, fine- to coarse-grained, granulitic, slightly pebbly; pale olive (10Y 6/2), poorly sorted, massive to medium bedded, moderately well indurated. Unit contains a 3½-in. layer of sand at 1839.0 ft.
1852.0	4.8	No core. Cuttings suggest same as above.
1876.9	24.9	Sandstone, fine- to medium-grained; pale olive (10Y 6/2), calcareous, massive to faintly bedded, moderately well indurated. Unit contains a 9½-in. layer of sandstone at 1825.0 ft.
1883.0	6.1	No core. Cuttings suggest same as above.
1885.1	2.1	Sand, similar to sand at 1751.3 ft.
1891.3	6.2	Sandstone, similar to sandstone at 1798.4 ft. Unit contains a 6-in. layer of sand at 1889.5 ft. Bedding is horizontal.
1892.8	1.5	Sand, similar to sand at 1751.3 ft.
1893.9	1.1	Sandstone, fine- to medium-grained; grayish olive (10Y 4/2), calcareous, massive to faintly bedded, moderately well indurated.
1897.7	3.8	Sand, fine to coarse, pebbly; pale olive (10Y 6/2) to grayish olive (10Y 4/2), calcareous, poorly sorted, faintly bedded, moderately indurated. Unit contains a 8½-in. layer of sandstone at 1894.5 ft.

epth[1/] (feet)	Thickness (feet)	Description
1904.2	6.5	Sandstone, similar to sandstone at 1798.4 ft. Unit contains numerous layers (up to 9½-in. thick) of sand throughout. Bedding is horizontal.
1908.1	3.9	Sand, fine; grayish olive (10Y 4/2), pale olive (10Y 6/2), and moderate olive brown (5Y 4/4), calcareous, faintly bedded, moderately to poorly indurated. Unit contains a 10½-in. layer of sandstone at 1905.2 ft. Bedding is horizontal.
1915.0	6.9	No core. Cuttings suggest same as above.
1917.2	2.2	Sandstone, fine- to coarse-grained, pebbly; grayish olive (10Y 4/2), calcareous, poorly sorted, massive, moderately well indurated.
1921.6	4.4	Sand, fine to medium; pale olive (10Y 6/2), calcareous, medium bedded, moderately indurated. Unit contains a 2½-in. layer of sandstone at 1917.5 ft.
1922.3	0.7	Sandstone, similar to sandstone at 1917.2 ft.
1924.3	2.0	Sand, fine to medium; pale olive (10Y 6/2) and grayish olive (10Y 4/2), calcareous, faintly bedded, moderately indurated.
1927.3	3.0	Sandstone, similar to sandstone at 1917.2 ft. Unit contains a 2½-in. layer of sand at 1927.0 ft; this unit also contains a quartz monzonitic pebble at 1927.2 ft.

Depth[1/] (feet)	Thickness (feet)	Description
1934.5	7.2	Sand, pebbly, similar to sandstone at 1934.3 ft. Unit contains two layers (7½-in. and 5-in. thick) of sandstone at 1930 ft and 1932.5 ft respectively; unit also contains a 1-in. layer of siltstone at 1932.9 ft.
1940.9	3.4	Sand, fine to coarse, slightly pebbly; pale olive (10Y 6/2) and grayish olive (10Y 4/2), calcareous, poorly sorted, massive to faintly bedded, poorly indurated.
1944.2	3.3	Sandstone, slightly pebbly, similar to sandstone at 1798.4 ft. Unit contains a 7-in. layer of sand at 1943.6 ft.
1945.0	0.8	No core. Cuttings suggest same as above.
1946.1	1.1	Sandstone, similar to sandstone at 1917.2 ft. Unit contains a 2½-in. layer of sand at 1945.2 ft. Unit contains plant remains scattered throughout.
1946.8	0.7	Sand, silt, and clay (interbedded). Sand, fine to medium, light olive gray (5Y 5/2), pale olive (10Y 6/2) and grayish olive (10Y 4/2) alternating, calcareous, moderately to poorly indurated; silt, olive gray (5Y 3/2), moderately indurated; clay, greenish black (5Y 2/1), slightly silty, moderately indurated. Unit is medium bedded to laminated. Bedding is horizontal.

Depth 1/ (feet)	Thickness (feet)	Description
1951.4	4.6	Sandstone, similar to sandstone at 1917.2 ft. Unit contains a 1-in. layer of clay at 1949.3 ft.
1952.4	1.0	Sand, fine to medium, occasionally pebbly; grayish olive (10Y 4/2), calcareous, slightly limonitic, massive, moderately indurated. Unit contains a quartz monzonitic cobble at 1951.4 ft.
1960.1	7.7	Sandstone, similar to sandstone at 1917.2 ft. Unit contains a 7-in. layer of sand at 1955.1 ft.
1970.1	10.0	Sand, fine to coarse, pebbly; pale olive (10Y 6/2) and grayish olive (10Y 4/2) alternating, calcareous, poorly sorted, massive to faintly bedded, moderately indurated. Unit contains two layers (10½-in. and 5-in. thick) of sandstone at 1964.7 ft and 1967.6 ft respectively.
1977.0	6.9	No core. Cuttings suggest same as above.
1982.3	5.3	Sand, fine to medium, slightly pebbly; light olive gray (5Y 5/2) to pale olive (10Y 6/2), calcareous, faintly bedded, poorly indurated. Unit contains a 1-in. layer of silt at 1980.2 ft.
1993.7	11.4	Sand, similar to sand at 1970.1 ft. Unit contains a 3½-in. layer of sandstone at 1991.7 ft.
2008.0	14.3	No core. Cuttings suggest same as above.
2009.0	1.0	Sandstone, fine- to medium-grained; yellowish gray (5Y 7/2), calcareous, massive, moderately well indurated.

Depth[1] (feet)	Thickness (feet)	Description
2013.0	4.0	Sand and sandstone (alternating). Sand, similar to sand at 1970.1 ft; sandstone, similar to sandstone at 1798.4 ft. Unit is thinly bedded.
2017.0	4.0	Sand, fine to coarse, pebbly; pale olive (10Y 6/2), calcareous, poorly sorted, massive, moderately indurated.
2018.0	1.0	Sandstone, fine- to medium-grained; pale olive (10Y 6/2), calcareous, massive, moderately well indurated.
2022.4	4.4	Sand, similar to sand at 2017.0 ft. Unit contains a 2½-in. layer of sandstone at 2022.2 ft.
2024.9	2.5	Sand, fine to coarse, pebbly; yellowish gray (5Y 7/2), calcareous, poorly sorted, massive, moderately indurated. Unit contains a 1-in. layer of sand at 2024.6 ft; unit also contains a 2½-in. layer of sandstone at 2024.7 ft.
2039.0	14.4	No core. Cuttings suggest same as above.
2051.3	11.3	Sand, similar to sand at 1970.1 ft. Unit contains an 11-in. layer of sand at 2041.6 ft.
2069.0	17.7	No core. Cuttings suggest same as above.
2074.7	5.7	Sand, fine to medium, slightly pebbly; grayish olive (10Y 4/2), calcareous, massive to faintly bedded, moderately to poorly indurated.

Depth[1/] (feet)	Thickness (feet)	Description
2099.0	1.0	Sand, fine to medium; olive gray (5Y 3/2) and pale olive (10Y 6/2), calcareous, medium bedded, moderately to poorly indurated. Unit contains a 3½-in. layer of sandstone at 2098.7 ft.
2111.4	12.4	Sand, similar to sand at 2074.7 ft. Unit contains a 1-in. layer of clay at 2108.7 ft; unit also contains a 2½-in. layer of silt at 2108.2 ft. Unit contains plant remains. Bedding is horizontal.
2075.9	1.2	Clay and silt (alternating). Clay, olive gray (5Y 3/2), calcareous, silty, moderately indurated; silt, grayish olive (10Y 4/2), calcareous, poorly indurated. Unit thinly bedded.
2086.1	10.2	Sand, similar to sand at 1970.1 ft. Unit contains a 2½-in. layer of clay at 2077.7 ft.
2098.0	11.9	No core. Cuttings suggest same as above.
2119.8	8.4	Sand, fine to coarse, slightly pebbly; pale olive (10Y 6/2) and grayish olive (10Y 4/2), calcareous, poorly sorted, massive to medium bedded, moderately to poorly indurated. Unit contains two layers (3½-in. and 2½-in. thick) of sandstone at 2113.7 ft and 2115.0 ft respectively; unit also contains two 2½-in. layers of silt at 2114.2 ft and 2116.7 ft respectively. Unit contains plant remains.
2129.0	9.2	No core. Cuttings suggest same as above.

Depth (feet)	Thickness (feet)	Description
2151.3	22.3	Sand, similar to sand at 2119.8 ft. Unit contains a 1-in. layer of silt at 2133.2 ft; unit also contains a ½-in. layer of clay at 2136.6 ft.
2159.0	7.7	No core. Cuttings suggest same as above.
2181.5	22.5	Sand, similar to sand at 2119.8 ft. Unit contains a 3½-in. layer of sandstone; unit also contains a 1-in. layer of clay. Bedding is horizontal.
2191.0	9.5	No core. Cuttings suggest same as above.
2198.0	7.0	Sand, fine to medium; pale olive (10Y 6/2) and yellowish gray (5Y 7/2), calcareous, massive, medium to thinly bedded, moderately to poorly indurated. Unit contains a 2-in. layer of clay at 2192.9 ft with desiccation cracks or animal tracks(?) on bedding planes; unit also contains occasional partings of clay throughout. Bedding is horizontal.
2211.0	13.0	No core. Cuttings suggest same as above.
2219.0	8.0	Sand, very fine; very light gray (N 8), medium to thinly bedded, moderately indurated. Unit contains numerous thin layers of silt throughout.
2230.3	11.3	Sand, pale olive (10Y 6/2), calcareous, fine; medium bedded to laminated, moderately indurated. Unit contains local thin layers of clay and silt throughout.

Depth[1/] (feet)	Thickness (feet)	Description
2232.3	2.0	Sand, very fine; yellowish gray (5Y 7/2), calcareous, medium to thinly bedded, moderately indurated. Unit contains numerous thin layers of silt throughout. Bedding is horizontal.
2250.0	18.0	No core. Cuttings suggest same as above.
2252.6	2.6	Sand, similar to sand at 2230.3 ft. Unit contains numerous thin layers of silt throughout. Bedding is horizontal.
2255.6	3.0	Sand, similar to sand at 2074.7 ft. Unit contains a 3½-in. layer of sandstone at 2255.3 ft. Bedding is horizontal.
2259.2	3.2	Sand, similar to sand at 2230.3 ft. Unit contains numerous thin layers of silt throughout. Bedding is horizontal.
2263.1	3.9	Sand, very fine; moderate olive brown (5Y 4/4), calcareous, massive, poorly indurated to unconsolidated.
2264.3	1.2	Sand, very fine; light gray (N 7), calcareous, medium to thinly bedded, moderately indurated. Unit contains a 3½-in. layer of sand at 2263.1 ft.
2283.0	18.7	No core. Cuttings suggest same as above.
2285.2	2.2	Sand, similar to sand at 2119.8 ft. Unit contains local lenses of sand throughout.

Depth (feet)	Thickness (feet)	Description
2287.6	2.4	Sand and clay (alternating). Sand, fine to coarse, pebbly, pale olive (10Y 6/2) and olive gray (5Y 3/2), calcareous, poorly sorted, moderately indurated; clay, dark yellowish brown (10YR 4/2), olive gray (5Y 3/2) and moderate brown (5YR 3/4), slightly calcareous, slightly silty, moderately indurated. Unit contains a 6-in. layer of sandstone at 2267.8 ft. Unit is thinly bedded to laminated. Bedding is horizontal.
2297.4	9.8	Sand, fine to coarse, pebbly; pale olive (10Y 6/2), calcareous, slightly limonitic, poorly sorted, massive, moderately indurated.
2313.0	15.6	No core. Cuttings suggest same as above.
2323.2	10.2	Sand, fine to coarse, pebbly; light olive gray (5Y 5/2), calcareous, slightly limonitic, poorly sorted, massive, moderately indurated.
2329.3	6.1	Sand, similar to sand at 2297.4 ft.
2345.0	15.7	No core. Cuttings suggest same as above.
2352.0	7.0	Sand, similar to sand at 2119.8 ft. Unit contains a 1-in. layer of clay at 2351.9 ft.
2359.0	7.0	Sand, fine to coarse, pebbly; pale olive (10Y 6/2), olive gray (5Y 3/2) and light olive gray (5Y 5/2) alternating, calcareous, poorly sorted, massive to medium bedded, moderately indurated. Unit contains a 2½-in. layer of sandstone at 2355.1 ft. Bedding is horizontal.

Depth[1] (feet)	Thickness (feet)	Description
2376.0	17.0	No core. Cuttings suggest same as above.
2382.0	6.0	Sand, similar to sand at 2297.4 ft. Unit contains two layers (2½-in. and 1-in. thick) of silt at 2378.2 ft and 2381.9 ft respectively.
2387.5	5.5	Sand, fine to coarse, slightly pebbly; light olive gray (5Y 5/2) and pale olive (10Y 6/2) alternating, calcareous, medium bedded, moderately to poorly indurated. Unit contains a 6-in. layer of clay at 2382.0 ft.
2407.0	19.5	No core. Cuttings suggest same as above.
2410.4	3.4	Sand, similar to sand at 2387.5 ft. Unit contains a 1-in. layer of sandstone at 2409.2 ft.
2412.6	2.2	Sandstone, fine- to coarse-grained, pebbly; very light gray (N 8) to olive gray (5Y 3/2), calcareous, poorly sorted, massive, well indurated.
2414.1	1.5	Sand, fine to medium; pale olive (10Y 6/2), calcareous, faintly bedded, moderately indurated. Unit contains thin layers of sandstone and siltstone throughout.
2438.0	23.9	No core. Cuttings suggest same as above.
2447.5	9.5	Sand, fine to coarse, slightly pebbly; pale olive (10Y 6/2), light olive gray (5Y 5/2) and light gray (N 7) alternating, calcareous, medium bedded, moderately indurated. Unit contains local thin layers of sandstone and clay throughout.

Depth[1/] (feet)	Thickness (feet)	Description
2452.0	4.5	No core. Cuttings suggest same as above.
2459.2	7.2	Sand, fine to coarse, slightly pebbly; light olive gray (5Y 5/2), calcareous, poorly sorted, faintly bedded, moderately indurated. Unit contains a 2-in. layer of siltstone at 2454.9 ft.
2459.9	0.7	Sandstone, fine-grained; pale olive (10Y 6/2) to olive gray (5Y 3/2), very calcareous, well indurated.
2460.4	0.5	Clay, grayish olive (10Y 4/2), calcareous, silty, laminated, moderately indurated. Unit contains a 3/4-in. layer of siltstone at 2460.3 ft.
2466.0	5.6	No core. Cuttings suggest that the lithology is sand.
2468.0	2.0	Sand, fine to coarse, pebbly; light olive gray (5Y 5/2), calcareous, poorly sorted, massive, moderately indurated.
2469.6	1.6	Sandstone, siltstone and claystone (interbedded). Sandstone, fine-grained, pale olive (10Y 6/2) and olive gray (5Y 3/2) alternating, calcareous, fine-grained, well indurated; siltstone, olive gray (5Y 3/2), calcareous, well indurated; claystone, olive gray (5Y 3/2), calcareous, very silty, laminated, fractured, slickensided, moderately indurated. Unit is thinly bedded and cross-bedded.
2470.9	1.3	Sand, similar to sand at 2468.0 ft.

Depth (feet)	Thickness (feet)	Description
2472.9	2.0	Siltstone, grayish olive (10Y 4/2) and pale olive (10Y 6/2) alternating, calcareous, thinly bedded, cross-bedded, well indurated. Unit contains a 2½-in. layer of sandstone at 2470.9 ft.
2477.4	4.5	Sandstone, siltstone and claystone (interbedded). Sandstone, fine- to medium-grained, light gray (N 7), very calcareous, well indurated; siltstone, grayish olive (10Y 4/2) and olive gray (5Y 3/2), calcareous, well indurated; claystone, grayish olive (10Y 4/2) and olive gray (5Y 3/2), calcareous, very silty, laminated, moderately well indurated. Unit is thinly bedded and cross-bedded.
2479.9	2.5	Claystone, olive gray (5Y 3/2), calcareous, silty, laminated, fractured, moderately well indurated. Unit contains a 5-in. layer of siltstone at 2478.5 ft; unit also contains unoriented veinlets of white (N 9) calcite throughout.
2482.1	2.2	Sandstone, siltstone, and claystone (interbedded). Sandstone, similar to sandstone at 2477.4 ft; siltstone, pale olive (10Y 6/2), very calcareous, well indurated; claystone, grayish olive (10Y 4/2), calcareous, silty, moderately well indurated. Unit is thinly bedded.
2483.7	1.6	Claystone, grayish olive green (5GY 3/2), calcareous, silty, thinly bedded, moderately well indurated.

Depth (feet)	Thickness (feet)	Description
2488.0	4.3	Siltstone, light gray (N 7), olive gray (5Y 3/2) and pale olive (10Y 6/2) alternating, calcareous, thinly bedded, cross-bedded, moderately well indurated. Unit contains a 2½-in. layer of claystone at 2485.5 ft; unit also contains a 2½-in. layer of sand at 2486.4 ft.
2490.9	2.9	Sandstone, fine-grained; pale olive (10Y 6/2) to light olive gray (5Y 5/2) and light gray (N 7) alternating, calcareous, thinly bedded, cross-bedded, well indurated. Unit contains local partings of siltstone throughout.
2492.2	1.3	Siltstone, olive gray (5Y 3/2), noncalcareous, medium bedded, well indurated. Unit contains a 4-in. layer of sandstone at 2491.9 ft.
2494.4	2.2	Sand, similar to sand at 2414.1 ft. Unit contains a 3/4-in. layer of clay at 2493.9 ft.
2496.0	1.6	No core. Cuttings suggest same as above.
2497.1	1.1	Sandstone, similar to sandstone at 2477.4 ft.
2500.0	2.9	Sand, fine to medium; light gray (N 7), slightly calcareous, massive to medium bedded, cross-bedded, moderately indurated. Unit contains a 2½-in. layer of siltstone at 2499.5 ft; unit also contains a 4-in. layer of sandstone at 2499.7 ft.

Depth (feet)	Thickness (feet)	Description
2505.7	6.7	Sand, similar to sand at 2459.2 ft. Unit contains a 1-in. layer of siltstone at 2500.0 ft; unit also contains local partings of clay throughout.
2508.2	1.5	Sandstone, fine-grained; light gray (N 7) and light olive gray (5Y 5/2), calcareous, faintly bedded, moderately well indurated. Bedding dips less than 5°.
2510.2	2.0	Sand, fine to medium; light gray (N 7) and light olive gray (5Y 5/2), slightly calcareous, medium bedded, moderately indurated. Unit contains local partings of clay throughout.
2513.6	3.4	Sandstone, siltstone and clay (interbedded). Sandstone, fine-grained, pale olive (10Y 6/2) and light gray (N 7), calcareous, moderately well indurated; siltstone, pale olive (10Y 6/2) and olive gray (5Y 3/2) alternating, noncalcareous, moderately well indurated; clay, olive gray (5Y 3/2) and grayish olive (10Y 4/2), noncalcareous, slightly silty, moderately indurated. Unit is thinly bedded to laminated.
2514.7	1.1	Sandstone, similar to sandstone at 2477.4 ft. Unit contains local thin layers of siltstone throughout.
2517.3	2.6	Siltstone, pale olive (10Y 6/2) and olive gray (5Y 3/2) alternating, calcareous, thinly bedded to laminated, moderately well indurated. Unit contains local layers (up to ½-in. thick) of clay throughout.

Depth[1/] (feet)	Thickness (feet)	Description
2521.3	4.3	Sandstone and siltstone (alternating). Sandstone, fine-grained, pale olive (10Y 6/2) to olive gray (5Y 3/2), calcareous, thinly bedded, cross-bedded, well indurated; siltstone, pale olive (10Y 6/2) and olive gray (5Y 3/2) alternating, calcareous, moderately well indurated. Unit contains a 2½-in. layer of sand at 2521.4 ft; unit also contains local partings of clay throughout. Bedding is horizontal to very low dipping. Unit is thinly bedded and cross-bedded.
2527.6	5.6	Sandstone, fine-grained; pale olive (10Y 6/2) and olive gray (5Y 3/2) alternating, calcareous, medium to thinly bedded, cross-bedded, moderately well indurated. Unit contains local thin layers of siltstone and clay throughout. Bedding is horizontal to very low dipping.
2531.5	3.9	Sand, fine to medium, slightly granulitic; light olive gray (5Y 6/1) and pale olive (10Y 6/2) to grayish olive (10Y 4/2), calcareous, faintly bedded, moderately indurated. Unit contains thin layers of siltstone and sandstone throughout. Bedding is nearly horizontal.

Depth[1/] (feet)	Thickness (feet)	Description
2538.6	7.1	Sandstone, fine- to medium-grained; very light gray (N 8), calcareous, medium to thinly bedded, moderately well indurated. Unit contains a 7-in. layer of sand at 2535.7 ft; unit also contains thin layers of siltstone and claystone throughout. Bedding is nearly horizontal.
2540.8	2.2	Sand, fine to coarse, granulitic, pebbly; grayish olive (10Y 4/2), calcareous, poorly sorted, massive, moderately indurated. Unit contains a 6-in. layer of sandstone at 2540.2 ft; unit also contains very thin layers of claystone throughout. Bedding is nearly horizontal.
2559.0	18.2	No core. Cuttings suggest same as above.
2560.7	1.7	Siltstone, pale olive (10Y 6/2) and olive gray (5Y 3/2) alternating, slightly arkosic, calcareous, thinly bedded, moderately well indurated.
2561.7	1.0	Sandstone, similar to sandstone at 2514.7 ft.
2565.7	4.0	Siltstone, similar to siltstone at 2560.7 ft. Unit contains local partings of clay throughout. Bedding is nearly horizontal.
2566.7	1.0	Sandstone, similar to sandstone at 2514.7 ft.

Depth[1/] (feet)	Thickness (feet)	Description
2574.7	8.0	Sand, fine to coarse, slightly pebbly; pale olive (10Y 6/2), calcareous, massive to faintly bedded, moderately indurated. Unit contains a 10-in. layer of siltstone at 2573.6 ft; unit also contains local thin layers of clay, with desiccation cracks or animal tracks(?) on bedding planes.
2576.8	2.1	Sandstone, similar to sandstone at 2514.7 ft. Unit contains local layers (up to 3/4-in. thick) of clay throughout.
2577.6	0.8	Siltstone, similar to siltstone at 2560.7 ft. Unit contains a 3/4-in. layer of clay at 2577.0 ft.
2579.0	1.4	Sand, similar to sand at 2500.0 ft.
2580.3	1.8	Siltstone, similar to siltstone at 2560.7 ft. Unit contains a 2½-in. layer of sandstone at 2579.0 ft; unit also contains a 3/4-in. layer of clay at 2579.3 ft.
2583.4	2.6	Sandstone, similar to sandstone at 2527.6 ft. Unit contains a 5-in. layer of sand at 2580.8 ft.
2585.9	2.5	Sand, similar to sand at 2574.7 ft.
2591.0	5.1	No core. Cuttings suggest same as above.

Depth[1/] (feet)	Thickness (feet)	Description
2614.9	23.9	Sand, fine to medium, slightly granulitic, pebbly; light olive gray (5Y 5/2), pale olive (10Y 6/2), grayish olive (10Y 4/2) and light gray (N 7) alternating, calcareous, massive to medium bedded, moderately indurated. Unit contains a 3½-in. layer of siltstone at 2608.5 ft; unit also contains layers (2½-in. and 3½-in. thick) of clay at 2610.7 ft and 2614.6 ft respectively.
2624.0	9.1	No core. Cuttings suggest same as above.
2626.8	2.8	Sand, fine; pale olive (10Y 6/2), very calcareous, medium to thinly bedded, cross-bedded, poorly indurated. Bedding is horizontal.
2629.8	3.0	Sand, fine to coarse, pebbly; light olive gray (5Y 5/2), calcareous, poorly sorted, massive, moderately indurated.
2632.2	2.4	Sand, fine; grayish olive (10Y 4/2) to pale olive (10Y 6/2), calcareous, medium to thinly bedded, moderately indurated. Unit contains a 2½-in. layer of clay at 2631.6 ft. Bedding dips less than 5°.
2636.4	4.2	Sand, fine to medium; pale olive (10Y 6/2), calcareous, slightly limonitic, medium to thinly bedded, moderately indurated. Unit contains local thin layers of silt throughout. Bedding is nearly horizontal.

Depth[1/] (feet)	Thickness (feet)	Description
2637.7	1.3	Sand, fine to coarse, slightly pebbly; grayish olive (10Y 4/2) and yellowish gray (5Y 7/2), calcareous, slightly limonitic, medium to thinly bedded, moderately indurated. Unit contains a 1-in. layer of silt at 2637.6 ft.
2643.4	5.7	Sand, similar to sand at 2636.4 ft. Unit contains local thin layers of silt throughout. Bedding is horizontal.
2645.6	2.2	Sand, fine to coarse, pebbly; light gray (N 7) to pale olive (10Y 6/2), calcareous, poorly sorted, massive, moderately indurated. Unit contains a 1½-in. layer of clay at 2645.5 ft.
2648.5	2.9	Sand, similar to sand at 2636.4 ft. Unit contains numerous thin layers of silt throughout.
2655.0	6.5	No core. Cuttings suggest same as above.
2659.1	4.1	Sand, similar to sand at 2645.6 ft. Unit contains numerous thin layers of silt throughout; unit also contains local thin layers of sand at 2657.9 ft.
2662.0	2.9	Sand, fine to coarse, pebbly; grayish olive (10Y 4/2) and light olive gray (5Y 5/2), calcareous, poorly sorted, massive to faintly bedded, moderately indurated.

Depth[1] (feet)	Thickness (feet)	Description
2666.6	4.6	Sand, similar to sand at 2632.2 ft. Unit contains two layers (6-in. and 4-in. thick) of sandstone at 2665.5 ft and 2666.4 ft respectively; unit also contains local thin layers of silt throughout. Bedding is nearly horizontal.
2668.3	1.7	Sand, fine to coarse, slightly pebbly; pale olive (10Y 6/2) and light olive gray (5Y 5/2), calcareous, medium bedded, moderately indurated. Unit contains a 5-in. layer of claystone at 2667.4 ft.
2670.2	1.9	Siltstone, olive gray (5Y 3/2), calcareous, massive to faintly bedded, moderately well indurated.
2674.2	4.0	Sand, similar to sand at 2662.0 ft.
2675.5	1.3	Siltstone, grayish olive (10Y 4/2), slightly arkosic, noncalcareous, massive, moderately well indurated.
2677.5	2.0	Sand, fine to coarse, pebbly; pale olive (10Y 6/2) and grayish olive (10Y 4/2), calcareous, massive to medium bedded in places, moderately indurated. Unit contains local thin layers of silt throughout.
2679.5	2.0	Siltstone, grayish olive (10Y 4/2), calcareous, medium bedded, moderately well indurated. Bedding is horizontal.
2681.2	1.7	Sand, similar to sand at 2632.2 ft. Unit contains numerous thin layers of silt throughout.
2686.0	4.8	No core. Cuttings suggest same as above.

Depth[1/] (feet)	Thickness (feet)	Description
2689.2	3.2	Sand, similar to sand at 2632.2 ft. Unit contains local thin layers of silt and clay throughout; unit also contains a quartz monzonitic cobble at 2686.0 ft. Bedding is horizontal.
2691.9	2.7	Sand, similar to sand at 2662.0 ft. Unit contains a 3½-in. layer of siltstone at 2691.6 ft. Bedding is horizontal.
2696.1	4.2	Sand, similar to sand at 2632.2 ft. Unit contains a 4-in. layer of claystone at 2695.8 ft; unit also contains local thin layers of clay throughout.
2710.4	14.3	Sand, fine; pale olive (10Y 6/2), calcareous, medium to thinly bedded, moderately indurated. Unit contains three layers (6-in., 1-in. and 9-in. thick) of clay at 2697.0 ft, 2698.5 ft and 2699.3 ft respectively; unit also contains local thin layers of silt throughout.
2713.4	3.0	Sand, similar to sand at 2632.2 ft. Unit contains a 3½-in. layer of sandstone at 2710.4 ft; unit also contains a 3-in. layer of clay at 2713.1 ft. Bedding is horizontal.
2718.0	4.6	No core. Cuttings suggest same as above.

Depth[1/] (feet)	Thickness (feet)	Description
2719.7	1.7	Sand, similar to sand at 2662.0 ft. Unit contains a 7-in. layer of sand at 2719.1 ft; unit also contains thin layers of silt throughout.
2735.2	15.5	Sand, similar to sand at 2710.4 ft. Unit contains a 1½-in. layer of sandstone at 2719.7 ft; unit also contains a 5-in. layer of clay at 2725.8 ft.
2737.1	1.9	Sand, fine, slightly pebbly; pale olive (10Y 6/2) and grayish olive (10Y 4/2), calcareous, medium bedded, moderately indurated. Unit contains a 1-in. layer of sandstone at 2735.2 ft; unit also contains a 2-in. layer of claystone at 2737.8 ft.
2741.6	4.5	Sand, similar to sand at 2710.4 ft. Unit contains a 3½-in. layer of siltstone at 2737.5 ft; unit also contains local thin layers of silt throughout.
2742.9	1.3	Sandstone and siltstone (alternating). Sandstone, fine- to medium-grained, pale olive (10Y 6/2), very calcareous, well indurated; siltstone, pale olive (10Y 6/2) to grayish olive (10Y 4/2), calcareous, moderately indurated. Unit is thinly bedded.
2745.9	3.0	Sand, fine; light gray (N 7), very calcareous, medium to thinly bedded, moderately indurated. Unit also contains a 1½-in. layer of claystone at 2745.8 ft; unit also contains numerous thin layers of silt throughout.

Depth (feet)	Thickness (feet)	Description
2747.4	1.5	Sand, fine; pale olive (10Y 6/2), very calcareous, medium to thinly bedded, moderately indurated. Unit contains a 3½-in. layer of siltstone at 2747.1 ft.
2750.0	2.6	No core. Cuttings suggest same as above.
2752.7	2.7	Sand, similar to sand at 2662.0 ft. Unit contains numerous thin layers of silt throughout.
2753.7	1.0	Sand, fine; light gray (N 7), very calcareous, faintly bedded, moderately indurated.
2756.3	2.6	Siltstone, grayish olive (10Y 4/2) and olive gray (5Y 3/2), calcareous, thinly bedded, well indurated. Unit contains a 3-in. layer of claystone at 2754.7 ft.
2761.3	5.0	Sand, similar to sand at 2737.1 ft. Unit contains a 2½-in. layer of claystone at 2759.4 ft; unit also contains a 4-in. layer of sandstone at 2760.9 ft.
2762.2	0.9	Siltstone, pale olive (10Y 6/2) and grayish olive (10Y 4/2) alternating, calcareous, medium to thinly bedded, moderately well indurated. Unit contains a 3/4-in. layer of clay at 2762.1 ft; unit also contains local thin layers of siltstone throughout.
2765.4	3.2	Sand, similar to sand at 2737.1 ft. Unit contains local thin layers of silt throughout.

Depth[1/] (feet)	Thickness (feet)	Description
2767.2	1.8	Claystone, olive gray (5Y 3/2), calcareous, silty, massive, well indurated. Unit contains a 1-in. layer of sandstone at 2766.2 ft; unit also contains thin lenses of sand.
2772.0	4.8	Sandstone and siltstone (alternating). Similar to unit at 2742.9 ft. Unit contains a 5-in. layer of clay at 2771.6 ft. Unit is thinly bedded.
2776.6	4.6	Siltstone, similar to siltstone at 2762.2 ft. Unit contains a 2½-in. layer of clay at 2774.7 ft. Bedding is horizontal.
2777.9	1.3	Sandstone, fine-grained; very light gray (N 8), very calcareous, medium bedded, moderately well indurated. Unit contains a 1-in. layer of clay at 2777.1 ft. Bedding is horizontal.
2778.6	0.7	Siltstone, similar to siltstone at 2762.2 ft. Unit contains thin partings of clay.
2783.0	4.4	No core. Cuttings suggest same as above.
2784.0	1.0	Sandstone and siltstone (alternating). Sandstone, fine-grained, light gray (N 7), calcareous, moderately well indurated; siltstone, pale olive (10Y 6/2) to grayish olive (10Y 4/2), calcareous, cross-bedded, moderately well indurated. Unit contains a 1-in. layer of claystone at 2783.6 ft. Unit is thinly bedded.

Depth[1/] (feet)	Thickness (feet)	Description
2785.5	1.5	Sand, similar to sand at 2747.4 ft. Unit contains a 3½-in. layer of siltstone at 2785.2 ft. Unit contains plant remains.
2787.4	1.9	Sandstone and siltstone (alternating). Sandstone, fine- to medium-grained, pale olive (10Y 6/2) and light gray (N 7), calcareous, moderately well indurated; siltstone, pale olive (10Y 6/2) and grayish olive (10Y 4/2) alternating, moderately arkosic, calcareous, moderately indurated. Unit contains thin partings of slightly silty clay. Unit is thinly bedded.
2792.4	5.0	Sand, similar to sand at 2747.4 ft. Unit contains a 2½-in. layer of sandstone at 2790.7 ft; unit also contains a 3-in. layer of clay at 2791.4 ft. In addition, unit contains local thin layers of silt.
2794.0	1.6	Sandstone and siltstone (alternating). Sandstone, fine- to medium-grained, very light gray (N 8), very calcareous, moderately well indurated; siltstone, pale olive (10Y 6/2) and grayish olive (10Y 4/2) alternating, moderately arkosic, calcareous, moderately indurated. Unit contains a 1½-in. layer of clay at 2792.9 ft. Unit is medium to thinly bedded.
2795.6	1.6	Sand, fine to coarse, granulitic; pale olive (10Y 6/2), calcareous, poorly sorted, massive, moderately indurated.

Depth[1/] (feet)	Thickness (feet)	Description
2795.6	1.0	Siltstone, pale olive (10Y 6/2), grayish olive (10Y 4/2), and olive gray (5Y 3/2) alternating, moderately arkosic, calcareous, medium to thinly bedded, moderately indurated. Unit contains a 1½-in. layer of clay at 2796.4 ft.
2801.1	4.5	Sand, similar to sand at 2795.6 ft. Unit contains a 2½-in. layer of clay at 2799.9 ft.
2803.7	2.6	Siltstone, similar to siltstone at 2756.3 ft. Unit contains a 5-in. layer of sandstone at 2803.3 ft; unit also contains thin layers of silty clay.
2815.0	11.3	No core. Cuttings suggest that the lithology is an arkosic sand.
2821.2	6.2	Sand, similar to sand at 2795.6 ft. Unit contains a 1-in. layer of clay at 2817.6 ft.
2821.9	0.7	Siltstone, pale olive (10Y 6/2), grayish olive (10Y 4/2) and olive gray (5Y 3/2) alternating, moderately arkosic, calcareous, medium to thinly bedded, moderately indurated. Unit contains partings of slightly silty clay.
2824.2	2.3	Sand, similar to sand at 2795.6 ft.
2825.4	1.2	Sand, fine; light gray (N 7), calcareous, massive, moderately well indurated.

Depth[1/] (feet)	Thickness (feet)	Description
2827.5	2.1	Sand, fine to coarse, slightly granulitic; pale olive (10Y 6/2) and light gray (N 7) alternating, calcareous, faintly bedded, moderately indurated. Unit contains a 2½-in. layer of claystone at 2826.8 ft.
2846.0	18.5	No core. Cuttings suggest same as above.
2847.1	1.1	Sandstone, fine- to medium-grained; pale olive (10Y 6/2), calcareous, massive, moderately well indurated.
2863.7	16.6	Sand, similar to sand at 2827.5 ft. Unit contains two layers (5-in. and 2½-in. thick) of siltstone at 2847.1 ft and 2847.9 ft respectively; unit also contains partings (up to 1-in. thick) of clay.
2879.0	15.3	No core. Cuttings suggest same as above.
2883.4	4.4	Sandstone, fine-grained; pale olive (10Y 6/2) to grayish olive (10Y 4/2), calcareous, medium to thinly bedded, moderately well indurated. Unit contains a 3½-in. layer of sand at 2879.0 ft; unit also contains local thin layers of claystone.
2885.4	2.0	Siltstone, similar to siltstone at 2821.9 ft. Unit contains a 3½-in. layer of claystone at 2883.4 ft; unit also contains thin layers (up to ½-in. thick) of clay. Bedding dips from 5° to 10°.

Depth[1] (feet)	Thickness (feet)	Description
2887.1	1.7	Sand, fine to medium; pale olive (10Y 6/2), calcareous, faintly bedded, moderately indurated. Unit contains a 2½-in. layer of siltstone at 2885.8 ft. Bedding dips from 5° to 10°.
2391.1	4.0	Siltstone, similar to siltstone at 2821.9 ft. Unit contains a 5½-in. layer of sand at 2890.1 ft; unit also contains thin layers of slightly silty clay. Bedding dips from 1° to 5°.
2895.5	4.4	Sand, similar to sand at 2887.1 ft. Unit contains a 0½-in. layer of siltstone at 2893.7 ft; unit also contains local layers (up to ½-in. thick) of clay. Bedding dips from 1° to 5°.
2904.0	8.5	No core. Cuttings suggest same as above.
2905.3	1.3	Sand, fine to coarse, slightly granulitic; pale yellowish brown (10YR 6/2) and grayish olive (10Y 4/2), calcareous, medium bedded, moderately indurated. Unit contains two layers (6-in. and 1-in. thick) of sandstone at 2904.0 ft and 2904.6 ft respectively.
2908.0	2.7	Sand, fine to coarse, granulitic; pale yellowish brown (10YR 6/2), calcareous, massive, moderately indurated. Unit contains a 5-in. layer of sandstone at 2906.1 ft.
2911.0	3.0	Sandstone, fine- to medium-grained; pale yellowish brown (10YR 6/2), calcareous, medium to thinly bedded, cross-bedded, moderately well indurated.

Depth[1/] (feet)	Thickness (feet)	Description
2912.6	1.6	Sand, similar to sand at 2905.3 ft.
2915.2	2.6	Siltstone, pale yellowish brown (10YR 6/2) to pale olive (10Y 6/2) and grayish olive (10Y 4/2) to olive gray (5Y 3/2) alternating, moderately arkosic, calcareous, medium to thinly bedded, cross-bedded, moderately well indurated. Unit contains a 3½-in. layer of sand at 2914.9 ft; unit also contains local layers (up to ½-in. thick) of clay.
2941.0	25.8	No core. Cuttings suggest same as above.
2942.4	1.4	Sand, similar to sand at 2908.0 ft. Unit contains a 6-in. layer of sandstone at 2941.0 ft.
2944.8	4.4	Sandstone, similar to sandstone at 2911.0 ft. Unit contains a 3½-in. layer of sand at 2944.7 ft; unit also contains partings of clay. Bedding is nearly horizontal.
2953.0	6.2	Sand, similar to sand at 2908.0 ft. Unit contains thin layers of siltstone in the upper 5-in.
2975.0	22.0	No core. Cuttings suggest same as above.
2979.3	4.3	Sandstone, similar to sandstone at 2911.0 ft. Unit contains partings (up to 1/8-in. thick) of clay; unit also contains a quartz monzonitic cobble at 2975.0 ft.
2980.7	1.4	Sand, similar to sand at 2908.0 ft. Unit contains thin layers of siltstone in the upper 5-in.
3007.0	26.3	No core. Cuttings suggest same as above.

Depth[1] (feet)	Thickness (feet)	Description
3016.1	9.1	Sandstone, similar to sandstone at 2911.0 ft. Unit contains a 3½-in. layer of sand at 3010.0 ft.
3038.0	21.9	No core. Cuttings suggest same as above.
3039.5	1.5	Sand, similar to sand at 2887.1 ft. Unit contains a quartz monzonitic cobble at 3038.0 ft; unit also contains a 1½-in. layer of siltstone at 3038.4 ft.
3041.2	6.7	Sandstone, fine- to medium-grained, slightly granulitic; pale olive (10Y 6/2), calcareous, faintly bedded, moderately well indurated. Unit contains some thin layers of slightly calcareous siltstone.
3051.0	4.8	Sand, fine to coarse, granulitic, slightly pebbly; brownish gray (5YR 4/1), calcareous, massive, moderately indurated. Unit contains a 7-in. layer of sandstone, dipping from 1° to 5°, at 3048.5 ft.
3054.5	3.5	Sand, fine to medium; grayish yellow green (5GY 7/2), calcareous, faintly bedded, moderately indurated. Unit contains three layers (3-in., 1½-in. and 1-in. thick) of clay at 3051.0 ft, 3053.1 ft and 3053.9 ft respectively.
3056.4	1.9	Sandstone, similar to sandstone at 3046.2 ft. Unit contains some thin layers of siltstone.

Depth[1/] (feet)	Thickness (feet)	Description
3060.1	3.7	Sandstone, fine- to medium-grained; grayish yellow green (5GY 7/2) to dusky yellow green (5GY 5/2) to pale olive (10Y 6/2), calcareous, massive to faintly bedded, moderately indurated. Unit contains a 1½-in. layer of claystone at 3060.0 ft.
3064.1	4.0	Sandstone, fine- to medium-grained; pale olive (10Y 6/2) and dark greenish gray (5GY 6/1), calcareous, massive to faintly bedded, well indurated.
3071.0	6.9	No core. Cuttings suggest same as above.
3073.8	2.8	Sand, fine, slightly granulitic; greenish gray (5GY 6/1), calcareous, massive, poorly indurated.
3076.2	2.4	Sandstone, fine-grained, slightly granulitic; greenish gray (5GY 6/1), calcareous, massive, moderately well indurated.
3082.4	6.2	Sand, fine to medium, slightly granulitic; greenish gray (5GY 6/1), calcareous, medium bedded, moderately to poorly indurated. Unit contains some thin layers of silt and clay.
3104.0	21.6	No core. Cuttings suggest same as above.
3105.0	1.0	Sand, similar to sand at 3082.4 ft.
3135.0	30.0	No core. Cuttings suggest same as above.
3152.5	17.5	Sand, similar to sand at 3082.4 ft. Unit contains some thin layers (up to 3-in. thick) of clay; unit also contains thin layers of silt.

Depth[1/] (feet)	Thickness (feet)	Description
3167.0	14.5	No core. Cuttings suggest same as above.
3168.3	1.3	Sand, similar to sand at 3051.0 ft.
3190.0	22.7	No core. Cuttings suggest same as above.
3228.0	37.0	Not cored. Cuttings suggest that the lithology is an arkosic sand.
3230.4	2.4	Sandstone, fine- to medium-grained; brownish gray (5YR 4/1), calcareous, medium to thinly bedded, moderately well indurated.
3236.8	6.4	Sand, fine to coarse, granulitic; pale olive (10Y 6/2), brownish gray (5YR 4/1), greenish gray (5GY 6/1) and olive gray (5Y 4/1) alternating, calcareous, poorly sorted, medium bedded, moderately indurated. Unit contains three layers (2½-in., 6-in. and 2½-in. thick) of sandstone at 3233.5 ft, 3234.5 ft and 3235.9 ft respectively.
3238.1	1.3	Sandstone, similar to sandstone at 3230.4 ft. Unit contains some partings (up to ½-in. thick) of clay.
3240.5	2.5	Sand, fine to coarse, granulitic, pebbly; greenish gray (5GY 6/1), calcareous, poorly sorted, massive, moderately indurated. Unit contains a 8½-in. layer of sandstone at 3239.9 ft.
3260.0	19.4	No core. Cuttings suggest same as above.

Depth[1/] (feet)	Thickness (feet)	Description
3260.9	0.9	Sand and sandstone (alternating). Sand, fine to coarse, slightly granulitic, brownish gray (5YR 4/1) and light brownish gray (6YR 2/1), calcareous, poorly sorted, moderately indurated; sandstone, fine-grained, light olive gray (5Y 6/1) and pale olive (10Y 6/2), calcareous, moderately well indurated. Unit is faintly to medium bedded.
3263.0	2.1	Sandstone, fine- to coarse-grained, slightly granulitic; brownish gray (5YR 4/1), calcareous, massive, well indurated. Unit contains a 5-in. layer of siltstone at 3260.9 ft; unit also contains numerous partings of clay. Bedding is horizontal.
3267.2	4.2	Sandstone, fine- to medium-grained, slightly granulitic; greenish gray (5GY 6/1), brownish gray (5YR 4/1) and olive gray (5Y 4/1), alternating, calcareous, faintly bedded, moderately indurated.
3292.0	24.8	No core. Cuttings suggest same as above.
3294.0	2.0	Sandstone, fine- to coarse-grained, granulitic; pale olive (10Y 6/2), very calcareous, poorly sorted, medium bedded, well indurated.
3296.3	2.3	Sandstone and siltstone (alternating). Sandstone, fine-grained, pale olive (10Y 6/2), calcareous, well indurated; siltstone, grayish olive (10Y 4/2) to olive gray (5Y 3/2), calcareous, well indurated. Unit is thinly bedded.

Depth[1/] (feet)	Thickness (feet)	Description
3297.3	1.0	Sandstone, fine- to medium-grained; pale olive (10Y 6/2) to grayish olive (10Y 4/2), calcareous, medium to thinly bedded, moderately well indurated. Unit contains plant remains.
3298.2	0.9	Sandstone and siltstone (alternating). Similar to unit at 3296.3 ft. Unit is thinly bedded.
3325.0	26.8	No core. Cuttings suggest same as above.
3326.5	1.5	Sandstone and siltstone (alternating). Similar to unit at 3296.3 ft. Unit is thinly bedded.
3329.0	2.5	Sand, similar to sand at 3240.6 ft. Unit contains two layers (8-in. and 2-in. thick) of sandstone at 3327.1 ft and 3328.3 ft respectively. Bedding is horizontal.
3355.0	26.0	No core. Cuttings suggest same as above.
3357.2	2.2	Sandstone and siltstone (alternating). Similar to unit at 3296.3 ft. Unit contains a quartz monzonitic cobble at 3355.0 ft. Unit is thinly bedded.
3358.2	1.0	Sand, fine to coarse, granulitic, pebbly; pale olive (10Y 6/2) to grayish olive (10Y 4/2), calcareous, poorly sorted, massive, moderately indurated.
3359.1	0.9	Sandstone and siltstone (alternating). Similar to unit at 3296.3 ft. Unit contains a 2½-in. layer of sandstone at 3358.8 ft. Unit is thinly bedded.
3387.0	27.9	No core. Cuttings suggest that the lithology is an arkosic sand.

Depth[1/] (feet)	Thickness (feet)	Description
3388.0	1.0	Sand, similar to sand at 3358.2 ft.
3420.0	32.0	No core. Cuttings suggest same as above.
3421.3	1.3	Sand, fine to coarse, granulitic, pebbly; brownish gray (5YR 4/1), calcareous, poorly sorted, massive, moderately indurated.
3427.0	5.7	No core. Cuttings suggest same as above.
3428.4	1.4	Sandstone, very fine-grained; light brownish gray (5YR 6/1) to light olive gray (5Y 6/1) and olive gray (5Y 4/1) alternating, calcareous, thinly bedded to laminated, cross-bedded, moderately well indurated.
3432.2	3.8	Conglomerate. Occasional quartz monzonitic cobbles and numerous pebbles of quartz and feldspar in a brownish gray (5YR 4/1), arkosic, micaceous (biotite), calcareous, argillaceous, fine to coarse, granulitic, poorly sorted, massive, moderately well indurated sand groundmass. Unit contains a 1-in. layer of sandstone at 3431.0 ft.
3460.0	27.8	No core. Cuttings suggest same as above.
3490.0	30.0	Not cored. Cuttings suggest that the lithology is an arkosic sand.
3491.8	1.8	Sandstone, similar to sandstone at 3267.2 ft. Unit contains a 2½-in. layer of conglomerate at 3491.4 ft.
3500.0 (TD)	8.2	No core. Cuttings suggest same as above.

Depth[1/] (feet)	Thickness (feet)	Description
1651.0	1.0	Sand, fine to coarse, granulitic, slightly pebbly; light olive gray (5Y 6/1), slightly calcareous, massive, moderately indurated.
1664.0	13.0	No core. Cuttings suggest same as above.
1665.0	1.0	Sand, similar to sand at 1651.0 ft.
1679.0	14.0	No core. Cuttings suggest same as above.
1680.7	1.7	Silt and clay (alternating). Silt, pale olive (10Y 6/2) and greenish gray (5GY 6/1), arkosic, slightly calcareous, moderately indurated; clay, grayish orange (10YR 7/4), light olive gray (5Y 6/1) and greenish gray (5GY 6/1), noncalcareous, slightly silty, moderately indurated. Unit contains some unoriented stringers of mordenite. Unit is thinly bedded.
1682.4	1.7	Sand, very fine; greenish gray (5GY 6/1) to yellowish gray (5Y 7/2), noncalcareous, silty, massive, moderately indurated.
1682.6	0.2	Limestone, white (N 9) to very light gray (N 8), argillaceous, arenaceous, slightly granulitic, moderately well indurated.
1683.4	0.8	Siltstone, light greenish gray (5GY 8/1), arkosic, very calcareous, arenaceous, moderately well indurated.
1685.1	1.7	Sand, similar to sand at 1651.0 ft. Unit contains a 1-in. layer of sand at 1684.1 ft.

1/ to the bottom of unit described.

Depth[1/] (feet)	Thickness (feet)	Description
1685.7	0.6	Silt, light olive gray (5Y 6/1) and yellowish gray (5Y 7/2), arkosic, calcareous, massive, moderately indurated. Unit contains some thin lenses and interbeds of very calcareous clay.
1695.0	9.3	No core. Cuttings suggest that the lithology is an arkosic sand, with interbeds of clay and silt.
1697.8	2.8	Silt, light olive gray (5Y 6/1), arkosic, very calcareous, massive, moderately indurated.
1703.8	6.0	Sand, fine; pale olive (10Y 6/2), calcareous, massive, poorly indurated. Unit contains a 3-in. layer of clay at 1703.5 ft.
1708.6	4.8	Sand, very fine; yellowish gray (5Y 7/2), calcareous, massive, moderately indurated. Unit contains a 9-in. layer of sand at 1706.6 ft; unit also contains some thin layers of silt in the upper 6-in.
1711.8	3.2	Sand, fine, slightly granulitic; yellowish gray (5Y 7/2), calcareous, medium bedded, moderately indurated. Unit contains a 1-in. layer of silt at 1710.5 ft.
1713.1	1.3	Sand, silt and clay (interbedded). Sand, fine to coarse, yellowish gray (5Y 7/2), calcareous, poorly indurated; silt, yellowish gray (5Y 7/2), calcareous, moderately indurated; clay, yellowish gray (5Y 7/2), calcareous, slightly silty, moderately indurated. Unit is thinly bedded.

Depth[1/] (feet)	Thickness (feet)	Description
1719.4	6.3	Sand, very fine; yellowish gray (5Y 7/2) and pale olive (10Y 6/2), calcareous, silty, massive, moderately indurated.
1722.2	2.8	Silt and clay (alternating). Silt, pale olive (10Y 6/2), calcareous, moderately indurated; clay, moderate olive brown (5Y 4/4), calcareous, slightly silty, fractured, slickensided, moderately indurated.
1727.0	4.8	No core. Cuttings suggest same as above.
1731.8	4.8	Silt, yellowish gray (5Y 7/2), very calcareous, massive to faintly bedded, moderately indurated. Unit contains a 4-in. layer of siltstone at 1730.0 ft.
1733.5	1.7	Sand, fine to medium; pale olive (10Y 6/2), greenish gray (5GY 6/1) and light greenish gray (5G 8/1) alternating, calcareous, medium bedded, moderately indurated.
1734.6	1.1	Silt, similar to silt at 1731.8 ft. Unit contains some partings of slightly silty clay.
1735.4	0.8	Sand, similar to sand at 1711.8 ft.
1739.5	4.1	Silt, pale olive (10Y 6/2) and yellowish gray (5Y 7/2), calcareous, medium bedded, moderately indurated. Unit contains a 3½-in. layer of sand at 1737.3 ft; unit also contains some partings of silty clay.

Depth[1/] (feet)	Thickness (feet)	Description
1744.9	5.4	Sand, very fine; yellowish gray (5Y 7/2) and pale olive (10Y 6/2), very calcareous, medium bedded, moderately indurated. Unit contains a 5-in. layer of silt at 1743.8 ft; unit also contains some partings of slightly silty clay. Bedding dips 20°.
1746.7	1.8	Silt, similar to silt at 1739.5 ft. Unit contains some partings of slightly silty clay.
1747.8	1.1	Clay, moderate olive brown (5Y 4/4), calcareous, slightly silty, massive, fractured, slickensided, moderately indurated.
1749.0	1.2	Silt, similar to silt at 1739.5 ft.
1750.2	1.2	Clay, light olive gray (5Y 5/2), very calcareous, slightly silty, fractured, slickensided, moderately indurated. Unit contains a 2-in. layer of siltstone at 1749.8 ft.
1752.9	2.7	Sand, similar to sand at 1744.9 ft. Unit contains a 3-in. layer of calcareous clay at 1750.2 ft; unit also contains a 7-in. layer of very calcareous siltstone at 1750.6 ft. Bedding dips 15°.
1760.1	7.2	Siltstone, yellowish gray (5Y 7/2), very calcareous, faintly bedded, moderately well indurated. Unit contains some partings of slightly silty clay. Bedding is slightly contorted.

Depth[1/] (feet)	Thickness (feet)	Description
1761.5	1.4	Clay, similar to clay at 1750.2 ft. Unit contains a 1-in. layer of siltstone at 1761.0 ft.
1762.5	1.0	Siltstone, yellowish gray (5Y 7/2), very calcareous, massive to faintly bedded, moderately well indurated. Unit contains some partings of slightly silty clay.
1765.8	3.3	Sand, silt and clay (interbedded). Sand similar to sand at 1703.8 ft; silt, similar to silt at 1734.6 ft; clay, grayish olive (10Y 4/2) and light olive gray (5Y 5/2), calcareous, slightly silty, moderately indurated. Unit contains a 6½-in. layer of siltstone at 1765.2 ft. Unit is thinly bedded.
1769.4	3.6	Clay, moderate olive brown (5Y 4/4), calcareous, massive, moderately indurated, fractured, slickensided, Unit contains a 5-in. layer of very calcareous claystone at 1765.8 ft; unit also contains a 1½-in. layer of clayey silt at 1767.1 ft.
1771.8	2.4	Silt, very light gray (N 8), very calcareous, faintly bedded, moderately indurated. Unit contains a 6-in. layer of clay at 1770.3 ft.
1774.1	2.3	Clay, similar to clay at 1769.4 ft. Unit contains a 3½-in. layer of claystone at 1773.2 ft; unit also contains some thin lenses and blebs of white (N 9) calcite.

Depth[1/] (feet)	Thickness (feet)	Description
1789.0	14.9	No core. Cuttings suggest same as above.
1796.9	7.9	Clay, olive gray (5Y 4/1), very calcareous, massive, fractured, slickensided, moderately indurated. Unit contains a 2½-in. layer of siltstone at 1790.7 ft; unit also contains a 1½-in. layer of claystone at 1791.0 ft; unit in addition contains a 5-in. layer of silt at 1793.4 ft. Local thin lenses and blebs of white (N 9) calcite are scattered throughout.
1797.9	1.0	Silt, light greenish gray (5G 8/1), calcareous, medium bedded, moderately indurated. Unit contains partings of slightly silty clay.
1805.9	8.0	Clay, light olive gray (5Y 6/1) to brownish gray (5YR 4/1) to olive gray (5Y 4/1), calcareous, slightly silty, massive, fractured, slickensided, moderately indurated.
1811.3	5.4	Siltstone, similar to siltstone at 1760.1 ft. Unit contains a 2½-in. layer of sand at 1811.1 ft; unit also contains partings of clay.
1812.7	1.4	Silt and clay (alternating). Silt, similar to silt at 1739.5 ft; clay, grayish olive (10Y 4/2) to brownish black (5YR 2/1) and olive gray (5Y 4/1), calcareous clay. Unit is thinly bedded. Upper 9-in. of unit dips 5°, lower 8-in. dips 20°.

Depth[1/] (feet)	Thickness (feet)	Description
1813.4	0.7	Clay, greenish gray (5GY 6/1), calcareous, slightly silty, massive, fractured, slickensided, moderately indurated.
1820.0	6.4	No core. Cuttings suggest same as above.
1824.0	4.0	Claystone, light olive gray (5Y 6/1), yellowish gray (5Y 7/2), greenish gray (5GY 6/1) and light bluish gray (5B 7/1) alternating, calcareous, slightly silty, moderately well indurated. Unit contains a 3-in. layer of clay at 8120.0 ft.
1827.3	3.3	Tuff, very light gray (N 8), noncalcareous, siliceous, bedded, moderately well indurated. Unit contains a 2-in. layer of clay at 1825.7 ft.
1830.0	2.7	Clay, pale olive (10Y 6/2) and light olive gray (5Y 5/2), very calcareous, massive, moderately indurated. Unit contains a 7-in. layer of slightly silty clay at 1827.3 ft.
1838.0	8.0	Clay, similar to clay at 1750.2 ft. Unit contains a 2-in. layer of very calcareous clay at 1832.1 ft.
1840.9	2.9	Sand, medium, slightly pebbly; yellowish gray (5Y 7/2), very calcareous, medium bedded, poorly indurated to unconsolidated. Unit contains a 2½-in. layer of clay at 1838.0 ft.
1842.5	2.0	Sand, medium; light olive gray (5Y 5/2) and pale olive (10Y 6/2), slightly calcareous, massive, poorly indurated. Unit contains a 2½-in. layer of clay at 1840.9 ft.

Depth[1/] (feet)	Thickness (feet)	Description
1851.0	3.1	No core. Cuttings suggest same as above.
1855.0	4.0	Clay, light olive gray (5Y 5/2) to moderate olive brown (5Y 4/4), slightly calcareous, slightly silty, slightly sandy, massive, moderately indurated. Unit contains some layers (up to ½-in. thick) of very calcareous clay.
1858.0	3.0	Clay, white (N 9) to pale olive (10Y 6/2) and light brown (5YR 6/4), very calcareous, slightly silty, massive, moderately indurated. Unit contains montmorillonite and hydrous mica.
1860.3	2.3	Silt, similar to silt at 1797.9 ft.
1862.5	2.2	Clay, moderate brown (5YR 3/4), calcareous, massive, fractured, slickensided, poorly indurated. Unit contains a 5½-in. layer of silty clay at 1862.0 ft.
1868.5	6.0	Silt, pale olive (10Y 6/2) and light olive gray (5Y 6/1), calcareous, massive, moderately indurated. Unit contains some partings of slightly silty clay.
1869.5	1.0	Clay, olive gray (5Y 4/1) and dark greenish gray (5G 4/1), calcareous, massive, moderately indurated.
1869.9	0.4	Limestone, light greenish gray (5G 8/1), very clayey, bedded, well indurated.
1872.5	2.6	Clay, similar to clay at 1869.5 ft.
1882.0	9.5	No core. Cuttings suggest same as above.

Depth[1/] (feet)	Thickness (feet)	Description
1885.4	3.4	Silt, similar to silt at 1868.5 ft. Unit contains a 1-in. layer of slightly silty clay at 1882.0 ft; unit also contains a 7-in. layer of sand at 1882.1 ft.
1887.9	2.5	Sand, very fine; light olive gray (5Y 6/1) and greenish gray (5GY 6/1), slightly calcareous, massive to faintly bedded, moderately indurated.
1888.4	0.5	Sand, fine to coarse, slightly granulitic; pale olive (10Y 6/2) to yellowish gray (5Y 7/2), slightly calcareous, poorly sorted, massive, moderately indurated.
1889.2	0.8	Sand, fine to medium; grayish orange (10YR 7/4), noncalcareous, massive, moderately indurated.
1890.4	1.2	Clay, dark yellowish brown (10YR 4/2), calcareous, silty, slightly sandy, massive, moderately indurated.
1891.1	0.7	Sand, fine; grayish orange (10YR 7/4) and light greenish gray (5G 8/1), calcareous, massive, moderately indurated.
1892.6	1.5	Sand, similar to sand at 1888.4 ft. Unit contains a 5-in. layer of calcareous sand at 1892.2 ft.

Depth[1/] (feet)	Thickness (feet)	Description
1898.5	5.9	Sand, silt and clay (interbedded). Sand, fine, greenish gray (5GY 6/1), slightly calcareous, moderately indurated; silt, light olive gray (5Y 6/1), slightly calcareous, moderately indurated; clay, moderate brown (5YR 4/4), slightly calcareous, slightly silty, moderately indurated. Unit is medium to thinly bedded.
1905.0	6.5	Sand, similar to sand at 1840.9 ft. Unit contains a 9-in. layer of slightly calcareous silt at 1904.2 ft.
1906.1	1.1	Sand, fine to medium, slightly granulitic; moderate brown (5YR 4/4), calcareous, massive, moderately indurated.
1913.0	6.9	No core. Cuttings suggest same as above.
1939.7	26.7	Sand, silt and clay (interbedded). Sand, fine to medium, light brown (5YR 6/4), moderate yellowish brown (10YR 5/4), pale yellowish brown (10YR 6/2) and yellowish gray (5Y 7/2), calcareous, moderately indurated; clay, dark reddish brown (10R 3/4), slightly calcareous, slightly silty, moderately indurated; silt, moderate brown (5YR 4/4), dark yellowish brown (10YR 4/2) and moderate yellowish brown (10YR 5/4), slightly calcareous, moderately indurated. Unit is medium bedded. Bedding dips 30°.

Depth[1/] (feet)	Thickness (feet)	Description
1944.0	4.3	No core. Cuttings suggest same as above.
1953.4	14.4	Sand, silt and clay (interbedded). Similar to unit at 1939.7 ft. Unit is medium bedded. Bedding dips 30°.
1960.0	1.0	Silt, light brown (5YR 5/6), slightly calcareous, moderately indurated.
1960.9	0.9	Sand, fine; yellowish gray (5Y 7/2), calcareous, massive, moderately indurated.
1971.8	10.9	Sand, silt and clay (interbedded). Similar to unit at 1939.7 ft. Unit contains some thin lenses and blebs of white (N 9) calcite. Unit is medium bedded. Bedding dips 30°.
1975.0	3.2	No core. Cuttings suggest that the lithology is a claystone.
1994.1	19.1	Claystone, light brown (5YR 5/6) to grayish orange (10YR 7/4), micaceous (biotite), calcareous, slightly silty, sandy, granulitic, slightly pebbly, massive, moderately well indurated.
2006.0	11.9	No core. Cuttings suggest same as above.
2015.9	9.9	Claystone, similar to unit at 1994.1 ft.

Depth[1/] (feet)	Thickness (feet)	Description
2018.8	2.9	Sandstone, sand and clay (interbedded). Sandstone, fine- to medium-grained, yellowish gray (5Y 7/2) and white (N 9), arkosic, very calcareous, well indurated; sand, fine to medium, yellowish gray (5Y 7/2), calcareous, moderately indurated; clay, moderate brown (5YR 4/4), calcareous, slightly silty, moderately indurated. Unit is medium bedded.
2023.6	4.8	Silt, moderate yellowish brown (10YR 5/4) to grayish orange (10YR 7/4) to pale yellowish brown (10YR 6/2), calcareous, slightly sandy, massive, moderately indurated. Unit contains some blebs of white (N 9) calcite.
2024.9	1.3	Sand, fine to coarse, granulitic, slightly pebbly; grayish orange (10YR 7/4), very calcareous, poorly sorted, massive, moderately indurated. Unit grades into next lower unit imperceptibly.
2025.7	0.8	Claystone, grayish orange (10YR 7/4) to moderate brown (5YR 4/4), micaceous (biotite), calcareous, sandy, slightly granulitic, slightly pebbly, massive, moderately indurated.
2027.6	1.9	Silt, light olive gray (5Y 6/1), calcareous, slightly sandy, massive, moderately indurated.

Depth[1/] (feet)	Thickness (feet)	Description
2031.2	3.6	Clay, pale yellowish brown (10YR 6/2), moderate brown (5YR 3/4) and yellowish gray (5Y 7/2), slightly calcareous, silty, bedded, moderately indurated. Unit contains a 3½-in. layer of very calcareous sand at 2030.1 ft; unit also contains a 7-in. layer of silt at 2030.5 ft. Blebs of yellowish gray (5Y 7/2) silt give unit mottled appearance.
2032.7	1.5	Sand, fine to coarse; grayish orange (10YR 7/4) and yellowish gray (5Y 7/2), calcareous, massive, moderately indurated. Unit contains a 5-in. layer of clay at 2031.2 ft.
2037.0	4.3	No core. Cuttings suggest same as above.
2038.2	1.2	Silt, yellowish gray (5Y 7/2) and grayish orange (10YR 7/4), calcareous, moderately indurated. Unit contains a 1-in. layer of clay at 2038.1 ft.
2039.2	1.0	Sandstone, very fine-grained; yellowish gray (5Y 7/2), slightly calcareous, massive, well indurated.
2040.1	0.9	Silt, similar to silt at 2023.6 ft.
2041.6	1.6	Claystone, similar to claystone at 2025.7 ft.
2044.0	2.3	Silt, grayish orange (10YR 7/4) and light brown (5YR 5/6), calcareous, slightly sandy, massive, moderately indurated.
2045.2	1.2	Sand, fine to medium; pale yellowish brown (10YR 6/2) and yellowish gray (5Y 7/2), massive, moderately indurated.

Depth[1/] (feet)	Thickness (feet)	Description
2046.3	1.1	Silt, grayish orange (10YR 7/4) and moderate brown (5YR 4/4), calcareous, slightly sandy, massive, moderately indurated.
2048.7	2.4	Claystone, similar to claystone at 2025.7 ft.
2052.1	3.4	Silt, similar to unit at 2044.0 ft.
2063.6	11.5	Claystone, dark yellowish brown (10YR 4/2), moderate yellowish brown (10YR 5/4) and moderate brown (5YR 3/4), micaceous (biotite), calcareous, silty, sandy, granulitic, slightly pebbly, massive, moderately well indurated.
2069.0	5.4	No core. Cuttings suggest same as above.
2083.9	14.9	Sand, fine to coarse, granulitic, slightly pebbly; grayish orange (10YR 7/4) to light brown (5YR 5/6), calcareous, poorly sorted, massive to faintly bedded, moderately indurated. Unit contains a 5-in. layer of silt at 2071.5 ft.
2086.2	2.3	Silt, clay and sand (interbedded). Silt, moderate brown (5YR 4/4), micaceous (biotite), calcareous, massive, moderately indurated; clay, moderate brown (5YR 3/4), calcareous, slightly silty, slightly sandy, moderately indurated; sand, fine to coarse, pale yellowish brown (10YR 6/2) and light greenish gray (5GY 8/1), calcareous, moderately indurated.
2087.8	1.6	Silt, similar to sand at 2038.2 ft. Unit contains a 4-in. layer of calcareous, clayey sand at 2087.5 ft.

Depth[1/] (feet)	Thickness (feet)	Description
2089.3	1.5	Sand, similar to sand at 2024.9 ft. Unit contains a 5-in. layer of silt at 2087.8 ft.
2090.5	1.2	Sand, similar to sand at 2032.7 ft. Unit contains a 2-in. layer of silt at 2089.3 ft.
2091.4	0.9	Siltstone, very pale orange (10YR 8/2), grayish orange (10YR 7/4) and dark yellowish orange (10YR 6/6), very calcareous, massive, moderately well indurated.
2092.2	0.8	Silt, similar to silt at 2038.2 ft.
2099.0	6.8	No core. Cuttings suggest same as above.
2104.4	5.4	Sand, similar to sand at 2083.9 ft. Unit contains a 2½-in. layer of clay at 2099.0 ft; unit also contains a 2-in. layer of sandstone at 2099.2 ft.
2106.8	2.4	Sand, fine to coarse, slightly granulitic; light olive gray (5Y 6/1), calcareous, massive, moderately indurated.
2108.8	2.0	Silt, yellowish gray (5Y 7/2), calcareous, massive, moderately indurated. Unit contains a 6-in. layer of clay at 2108.3 ft.
2110.3	1.3	Sand, fine to coarse; light brown (5YR 6/4), calcareous, poorly sorted, massive, moderately indurated. Unit contains a 2½-in. layer of sand at 2108.8 ft.
2111.3	1.0	Claystone, moderate brown (5YR 4/4), micaceous (biotite), slightly calcareous, sandy, slightly granulitic, massive, moderately indurated.

Depth[1/] (feet)	Thickness (feet)	Description
2113.1	1.8	Sand, fine to coarse, slightly granulitic; moderate brown (5YR 4/4), slightly calcareous, poorly sorted, massive, moderately indurated.
2114.2	1.1	Claystone, similar to claystone at 2111.3 ft.
2129.0	14.8	No core. Cuttings suggest same as above.
2130.0	1.0	Sand, fine; yellowish gray (5Y 7/2), calcareous, massive, moderately indurated.
2159.0	29.0	No core. Cuttings suggest same as above.
2160.0	1.0	Claystone, light olive gray (5Y 5/2), calcareous, massive, well indurated.
2161.0	1.0	Sand and clay (alternating). Sand, fine to coarse, granulitic, yellowish gray (5Y 7/2), calcareous, poorly sorted, massive, moderately indurated; clay, dark yellowish brown (10YR 4/2), noncalcareous, massive, moderately indurated.
2174.0	13.0	No core. Cuttings suggest same as above.
2179.2	5.2	Sand, fine to coarse; pale olive (10Y 6/2), moderate yellowish brown (10YR 5/4) and moderate brown (5YR 4/4) alternating, calcareous, medium bedded, moderately indurated. Unit contains some layers (up to 3-in. thick) of slightly silty clay. Bedding dips 15°.

Depth[1/] (feet)	Thickness (feet)	Description
2180.2	1.0	Silt, similar to silt at 2046.3 ft.
2183.8	3.6	Sand, fine to coarse, granulitic; dark yellowish brown (10YR 4/2) to pale yellowish brown (10YR 6/2), calcareous, poorly sorted, massive, moderately indurated. Unit contains a 9-in. layer of clayey sand at 2180.2 ft.
2186.2	2.4	Silt, light brown (5YR 5/6), calcareous, slightly sandy, massive, moderately indurated. Unit contains a 1½-in. layer of sand at 2183.8 ft.
2188.5	2.3	Sand, similar to sand at 2179.2 ft.
2190.0	1.5	No core. Cuttings suggest same as above.
2191.0	1.0	Silt, similar to unit at 2108.8 ft.
2253.0	62.0	No core. Cuttings suggest that the lithology is an arkosic, sand, with some interbeds of silt and clay.
2283.0	30.0	Not cored. Cuttings suggest same as above.
2298.0	15.0	No core. Cuttings suggest same as above.
2328.0 (TD)	30.0	Not cored. Cuttings suggest same as above.

Depth[1/] (feet)	Thickness (feet)	Description
106.0	106.0	No core. Cuttings suggest that the lithology is an arkosic sand, with some layers of silt and clay.
166.0	60.0	No core. Cuttings suggest same as above.
172.5	6.5	Sand, medium to coarse, granulitic, slightly pebbly; grayish orange (10YR 7/4) and dark yellowish orange (10YR 6/6), poorly sorted, massive, moderately indurated.
196.0	23.5	No core. Cuttings suggest same as above.
198.1	2.1	Sand, similar to 172.5 ft.
228.0	29.9	No core. Cuttings suggest same as above.
229.0	1.0	Sand, similar to 172.5 ft.
258.0	29.0	No core. Cuttings suggest same as above.
259.0	1.0	Claystone, dark yellowish orange (10YR 6/6), micaceous (biotite), sandy, slightly granulitic, slightly pebbly, massive, moderately well indurated.
288.0	29.0	No core. Cuttings suggest that the lithology is an arkosic sand, with some thin layers of silt and clay.
288.5	0.5	Sand, similar to sand at 172.5 ft.
318.0	29.5	No core. Cuttings suggest same as above.
318.5	0.5	Sand, similar to sand at 172.5 ft.
348.0	29.5	No core. Cuttings suggest same as above.
350.0	2.0	Sand, similar to sand at 172.5 ft.

1/ to bottom of unit described.

Depth[1/] (feet)	Thickness (feet)	Description
303.0	33.0	No core. Cuttings suggest same as above.
334.0	1.0	Sand, similar to sand at 172.5 ft.
413.0	29.0	No core. Cuttings suggest same as above.
416.0	3.0	Sand, similar to sand at 172.5 ft.
443.0	27.0	No core. Cuttings suggest same as above.
444.0	1.0	Sand, similar to sand at 172.5 ft.
474.0	30.0	No core. Cuttings suggest same as above.
475.0	1.0	Sand, similar to sand at 172.5 ft.
504.0	29.0	No core. Cuttings suggest same as above.
509.0	5.0	Sand, fine to coarse, granulitic, pebbly; grayish orange (10YR 7/4), poorly sorted, poorly indurated to unconsolidated.
534.0	25.0	No core. Cuttings suggest same as above.
536.5	2.5	Sand, similar to sand at 509.0 ft. Unit contains a 3½-in. layer of slightly sandy siltstone at 536.2 ft, with bedding in this unit dipping 5°.
564.0	27.5	No core. Cuttings suggest same as above.
567.0	3.0	Sand, similar to sand at 509.0 ft.
594.0	27.0	No core. Cuttings suggest same as above.
599.5	5.0	Sand, similar to sand at 509.0 ft.
609.0	9.5	No core. Cuttings suggest same as above.
611.5	2.5	Sand, similar to sand at 509.0 ft.
625.0	13.5	No core. Cuttings suggest same as above.

Depth[1/] (feet)	Thickness (feet)	Description
633.2	8.2	Claystone, yellowish gray (5Y 7/2), micaceous (biotite), slightly sandy, granulitic, pebbly, massive, fractured, slickensided, moderately well indurated.
640.0	6.8	No core. Cuttings suggest same as above.
642.5	2.5	Claystone, similar to claystone at 633.2 ft.
643.5	1.0	Clay, pale yellowish orange (10YR 8/6) and yellowish gray (5Y 7/2) alternating, silty, thinly bedded to laminated, moderately indurated. Bedding dips 25°.
647.0	3.5	Claystone, similar to claystone at 633.2 ft.
655.0	8.0	Clay, pale yellowish orange (10YR 8/6) and white (N 9) alternating, calcareous, tuffaceous, bentonitic, silty, thinly bedded to laminated, moderately indurated. Bedding dips from 20° to 40°.
659.0	4.0	Sand, very fine; moderate yellow (5Y 7/6) and light olive gray (5Y 6/1), very calcareous, faintly bedded, moderately indurated. Unit contains some thin 1-in. layers of clay.
660.3	1.3	Clay, pale yellowish orange (10YR 8/6) and white (N 9) alternating, calcareous, silty, thinly bedded, moderately indurated. Bedding dips 25°.
665.6	5.3	Sand, fine; grayish yellow (5Y 8/4) and white (N 9), calcareous, faintly bedded, moderately indurated.
685.0	19.7	No core. Cuttings suggest same as above.

Depth[1/] (feet)	Thickness (feet)	Description
688.8	3.8	Sand, fine to coarse; moderate yellow (5Y 7/6), yellowish gray (5Y 7/2) and white (N 9), calcareous, massive, poorly indurated.
697.9	9.1	Clay, moderate yellow (5Y 7/6), yellowish gray (5Y 7/2) and moderate reddish brown (10YR 4/6), calcareous, slightly silty, medium to thinly bedded, moderately indurated. Bedding dips 15°.
699.2	1.3	Sand, very fine; yellowish gray (5Y 7/2), calcareous, slightly silty, bedded, poorly indurated.
700.9	1.7	Clay, dusky yellow (5Y 6/1) and pale olive (10Y 6/2), calcareous, slightly silty, bedded, poorly indurated.
710.0	9.1	Sand, fine to medium; dark yellowish orange (10YR 6/6), pale olive (10Y 6/2) and white (N 9) alternating, medium to thinly bedded, moderately indurated. Bedding dips 25°.
711.3	1.3	Silt, dark yellowish orange (10YR 6/6), pale olive (10Y 6/2) and white (N 9) alternating, calcareous, medium bedded, moderately indurated.
713.6	2.3	Sand, silt and clay (interbedded). Sand, fine, dark yellowish orange (10YR 6/6) and yellowish gray (5Y 7/2), calcareous, bedded, moderately indurated; silt, dark yellowish orange (10YR 6/6) and yellowish gray (5Y 7/2), calcareous, bedded, moderately indurated; clay, pale olive (10Y 6/2); slightly calcareous, slightly silty, moderately indurated. Bedding dips 15°.

Depth[1] (feet)	Thickness (feet)	Description
715.0	1.4	Clay, dark yellowish orange (10YR 6/6) and olive gray (10Y 6/2), slightly calcareous, silty, bedded, moderately indurated.
716.2	1.2	Silt, pale yellowish orange (10YR 8/6) and yellowish gray (5Y 7/2) alternating, calcareous, medium to thinly bedded, moderately to poorly indurated. Bedding dips 25°.
717.0	0.8	No core. Cuttings suggest same as above.
719.4	2.4	Clay, pale yellowish orange (10YR 8/6), dark yellowish orange (10YR 6/6) and pale olive (10Y 6/2) alternating, calcareous, slightly silty, medium to thinly bedded, moderately indurated. Unit contains three layers (3-in., 3½-in. and 2½-in. thick) of calcareous, clayey silt at 717.9 ft, 718.7 ft and 719.0 ft respectively. Bedding dips 20°.
748.3	28.9	Sand, very fine; pale yellowish orange (10YR 8/6), dusky yellow (5Y 6/4) and pale olive (10Y 6/2), calcareous, slightly silty, medium bedded, moderately indurated. Unit contains some layers (up to 2-in. thick) of slightly calcareous, slightly silty clay.
749.0	0.7	No core. Cuttings suggest same as above.

Depth[1/] (feet)	Thickness (feet)	Description
765.1	16.1	Sand, fine to medium; dark yellowish orange (10YR 6/6), dark yellowish brown (10YR 4/2) and yellowish gray (5Y 7/2), calcareous, massive to medium bedded, moderately indurated. Unit contains a 8½-in. layer of slightly calcareous, slightly silty clay at 762.8 ft.
775.7	10.6	Clay, dark greenish gray (5GY 4/1), dark reddish brown (10R 3/4) and pale olive (10Y 6/2), calcareous, slightly silty, massive, faintly bedded, moderately indurated.
779.0	3.0	No core. Cuttings suggest same as above.
788.2	9.2	Clay, dark yellowish orange (10YR 6/6), dark reddish brown (10R 3/4), yellowish gray (5Y 7/2) and greenish gray (5GY 6/1), slightly calcareous, slightly sandy, massive to faintly bedded, moderately indurated. Unit contains a 2½-in. layer of very calcareous sand at 779.0 ft.
789.3	1.1	Sand, medium to coarse; greenish gray (5GY 6/1), slightly calcareous, massive, moderately indurated.
801.9	12.6	Clay, greenish gray (5GY 6/1), dark yellowish orange (10YR 6/6) and pale olive (10Y 6/2), slightly calcareous, silty, slightly sandy, massive to faintly bedded, moderately indurated. Unit contains some layers (up to 3-in. thick) of calcareous sand; unit also contains some layers (up to 3-in. thick) of calcareous silt.

Depth[1/] (feet)	Thickness (feet)	Description
809.0	7.1	No core. Cuttings suggest same as above.
816.2	7.2	Clay, greenish gray (5GY 6/1), calcareous, massive to faintly bedded, moderately indurated. Bedding dips from 25° to 32°.
818.0	1.8	Sand, medium; greenish gray (5GY 6/1), calcareous, massive, moderately indurated.
831.8	13.8	Clay, similar to clay at 816.2 ft.
835.1	3.1	Sand, fine to coarse; very light gray (N 8) to greenish gray (5GY 6/1), calcareous, massive, moderately indurated.
842.8	8.4	Clay, grayish olive green (5GY 3/2) to greenish gray (5GY 6/1), calcareous, silty, massive to faintly bedded, moderately indurated. Unit contains a 7-in. layer of sandstone at 836.6 ft. Bedding dips 25°.
873.5	30.0	Clay, grayish olive green (5GY 3/2) to greenish black (5G 2/1) to dark greenish gray (5GY 4/1), calcareous, pyritiferous, massive, fractured, slickensided, moderately indurated. Unit contains some flecks and blebs of white (N 9) calcite.
884.3	10.8	Clay, dark yellowish orange (10YR 6/6) to pale yellowish orange (10YR 8/6), light brown (5YR 6/4), greenish gray (5GY 6/1) and white (N 9), slightly calcareous, limonitic, silty, massive to faintly bedded, fractured, moderately indurated. Bedding dips 25°.

Depth 1/ (feet)	Thickness (feet)	Description
894.4	10.1	Sandstone, fine-grained; moderate yellowish brown (10YR 5/4) to dark yellowish orange (10YR 6/6), calcareous, silty, massive, moderately well indurated. Unit contains some thin layers of white (N 9) calcite.
904.0	9.6	Clay, light brownish gray (5YR 6/1), olive gray (5Y 4/1) and greenish gray (5GY 6/1), calcareous, silty, massive to faintly bedded, slickensided, moderately indurated. Unit contains a 4-in. layer of very fine-grained sandstone at 899.9 ft. Slickensided surfaces contain attapulgite.
912.9	8.9	Sand, similar to sand at 765.1 ft. Bedding dips 30.
926.1	13.2	Clay, similar to clay at 904.0 ft. Unit contains some flecks and blebs of white (N 9) calcite. Bedding dips 30°.
927.0	0.9	Sandstone, medium-grained; light gray (N 7), very calcareous, massive, well indurated.
931.0	4.0	No core. Cutting suggest same as above.
949.7	18.7	Clay, grayish olive green (5GY 3/2), grayish olive (10Y 4/2), yellowish gray (5Y 7/2) and greenish gray (5GY 6/1) alternating, calcareous, slightly silty, massive to laminated, fractured, slickensided, moderately indurated. Unit contains a 7-in. layer of calcareous sandstone at 933.0 ft; unit also contains some lenses (up to ½-in. thick) of white (N 9) calcite.

Depth[1/] (feet)	Thickness (feet)	Description
951.3	1.6	Sandstone, fine-grained; greenish gray (5GY 6/1), calcareous, massive, moderately well indurated.
959.6	8.3	Clay, dark greenish gray (5GY 4/1) and greenish gray (5GY 6/1), calcareous, faintly bedded, moderately indurated. Unit contains a 3½-in. layer of sandstone at 955.5 ft; unit also contains numerous flecks and layers (up to 1/8-in. thick) of white (N 9) calcite.
962.0	2.4	No core. Cuttings suggest same as above.
989.9	27.9	Clay, dark greenish gray (5GY 4/1), grayish olive green (5GY 3/2), medium bluish gray (5B 5/1) and greenish gray (5GY 6/1) alternating, calcareous, slightly silty, massive to faintly bedded, moderately indurated. Unit contains occasional flecks of white (N 9) calcite. Bedding dips from 20° to 35°. Unit contains montmorillonite and two zeolite minerals (analcime, mordenite) at 976.0 ft.
993.0	3.1	No core. Cuttings suggest same as above.
1017.3	24.3	Clay, similar to clay at 989.9 ft. Unit contains two layers (9-in. and 5-in. thick) of sand at 1012.5 ft and 1015.3 ft respectively.
1023.0	5.7	No core. Cuttings suggest same as above.

Depth[1/] (feet)	Thickness (feet)	Description
1024.5	1.5	Sand, silt and clay (interbedded). Sand, fine to coarse, greenish gray (5GY 6/1), slightly calcareous, moderately indurated; silt, greenish gray (5GY 6/1), calcareous, moderately indurated; clay, greenish gray (5GY 6/1), calcareous, moderately indurated. Unit is thinly bedded.
1025.6	1.1	Clay, similar to clay at 816.2 ft. Unit dips 7°.
1027.1	1.6	Clay, olive black (5Y 2/1), olive gray (5Y 4/1) and grayish olive green (5GY 3/2) alternating, calcareous, thinly bedded to laminated, moderately indurated.
1039.9	12.8	Clay, grayish olive green (5GY 3/2), light olive gray (5Y 5/2), yellowish gray (5Y 7/2) and greenish gray (5GY 6/1) alternating, calcareous, silty, massive to thinly bedded, moderately indurated. Dip is variable and irregular, from 40° at top of unit to 20° at bottom.
1053.0	13.1	No core. Cuttings suggest same as above.
1054.3	1.3	Clay, grayish olive green (5GY 3/2), yellowish gray (5Y 7/2) and white (N 9) alternating, calcareous, silty, medium to thinly bedded, moderately indurated. Bedding dips 20°.
1084.0	29.7	No core. Cuttings suggest same as above.
1084.8	0.3	Clay, greenish gray (5GY 6/1), calcareous, faintly bedded, moderately indurated.

Depth[1/] (feet)	Thickness (feet)	Description
1086.2	1.4	Siltstone, greenish gray (5GY 6/1) to light gray (N 7), calcareous, faintly bedded, well indurated.
1087.5	1.3	Silt, very light gray (N 8), calcareous, moderately indurated. Unit contains some thin lenses of calcareous clay.
1093.1	5.6	Clay, dark greenish gray (5GY 4/1), grayish olive green (5GY 3/2), yellowish gray (5Y 7/2) and greenish gray (5GY 6/1) alternating, calcareous, silty, medium to thinly bedded, moderately indurated. Bedding dips from 12° to 20°.
1094.2	1.1	Sand, fine to medium; yellowish gray (5Y 7/2), dark yellowish orange (10YR 6/6) and pale olive (10Y 6/2), calcareous, moderately indurated.
1114.0	19.8	No core. Cuttings suggest same as above.
1122.5	8.5	Sand, fine to medium; dark yellowish orange (10YR 6/6), pale yellowish orange (10YR 8/6), moderate red (5R 4/6), dark yellowish brown (10YR 4/2) and greenish gray (5GY 6/1) alternating, calcareous, moderately indurated. Bedding dips 20°.
1126.5	4.0	Sand, silt and clay (interbedded). Sand, fine, yellowish gray (5Y 7/2), calcareous, moderately indurated; silt, pale yellowish brown (10YR 6/2), calcareous, moderately indurated; clay, dark yellowish brown (10YR 4/2) and moderate red (5R 4/6), slightly calcareous, slightly silty, moderately indurated. Bedding dips 30°. Unit is thinly bedded.

Depth[1/] (feet)	Thickness (feet)	Description
1135.0	8.5	No core. Cuttings suggest same as above.
1139.1	4.1	Sand and clay (alternating). Sand, fine, yellowish gray (5Y 7/2), calcareous, moderately indurated; clay, dark yellowish brown (10YR 4/2) and moderate red (5R 4/6), slightly calcareous, slightly silty, moderately indurated. Unit is thinly bedded.
1144.1	5.0	Sand, fine; grayish orange pink (5YR 7/2), yellowish gray (5Y 7/2) and dusky yellow (5Y 6/4), calcareous, medium to thinly bedded, moderately to poorly indurated.
1153.0	8.9	No core. Cuttings suggest same as above.
1176.0	23.0	Sand, similar to sand at 1144.1 ft. Unit contains a 8½-in. layer of clay at 1156.8 ft.
1183.0	7.0	No core. Cuttings suggest same as above.
1200.0	17.0	Sand, fine; moderate red (5R 4/6), pale yellowish brown (10YR 6/2), grayish olive green (5GY 3/2) and very light gray (N 8) alternating, calcareous, medium to thinly bedded, cross-bedded, moderately indurated. Bedding is slightly contorted.
1206.2	6.2	Silt, moderate red (5R 4/6), pale yellowish brown (10YR 6/2), grayish olive green (5GY 3/2) and very light gray (N 8) alternating, calcareous, medium to thinly bedded, cross-bedded, moderately indurated.

Depth[1/] (feet)	Thickness (feet)	Description
1212.2	6.0	Clay, moderate red (5R 4/6), pale yellowish brown (10YR 6/2), grayish olive green (5GY 3/2) and very light gray (N 8) alternating, calcareous, sandy, very silty, thinly bedded to laminated, moderately indurated.
1215.0	2.8	No core. Cuttings suggest same as above.
1226.9	11.9	Claystone, greenish gray (5GY 6/1), greenish black (5GY 2/1), light olive gray (5Y 6/1) and moderate brown (5YR 3/4) alternating, slightly calcareous, slightly silty, medium to thinly bedded, fractured, slickensided, well indurated. Unit contains some layers (up to 1-in. thick) of sandstone.
1247.0	20.1	No core. Cuttings suggest same as above.
1256.3	9.3	Sand, fine; pale yellowish orange (10YR 8/6), moderate red (5R 5/4) and yellowish gray (5Y 7/2), calcareous, medium to thinly bedded, moderately indurated. Unit contains a 2½-in. layer of clay at 1248.5 ft. Bedding dips 30°.
1258.1	1.8	Tuff, white (N 9), micaceous (biotite), slightly calcareous, bedded, moderately indurated.
1279.0	20.9	No core. Cuttings suggest that the lithology is a sand with some thin layers of silt and clay.

Depth[1/] (feet)	Thickness (feet)	Description
1282.0	3.0	Clay, grayish olive green (5GY 3/2) and greenish gray (5GY 6/1) alternating, calcareous, very silty, thinly bedded, cross-bedded, moderately indurated. Bedding dips 30°.
1282.9	0.9	Sandstone and siltstone (alternating). Sandstone, fine- to medium-grained, yellowish gray (5Y 7/2), very calcareous, well indurated; siltstone, greenish gray (5GY 6/1), calcareous, moderately well indurated. Unit is thinly bedded.
1289.9	7.0	Sand, very fine; dark yellowish orange (10YR 6/6), light olive gray (5Y 6/1) and pale olive (10Y 6/2) alternating, calcareous, thinly bedded to laminated, moderately indurated. Unit contains a 9½-in. layer of clay at 1282.9 ft.
1295.0	5.1	No core. Cuttings suggest same as above.
1317.6	22.6	Sand, fine; yellowish gray (5Y 7/2) and pale olive (10Y 6/2), calcareous, medium to thinly bedded, moderately to poorly indurated. Unit contains some thin layers (up to ½-in. thick) of clay; unit also contains a 3½-in. layer of clay at 1301.4 ft.
1324.0	6.4	No core. Cuttings suggest same as above.
1325.1	1.1	Claystone, pale olive (10Y 6/2) to grayish olive (10Y 4/2), slightly calcareous, silty, massive, well indurated.

Depth[1/] (feet)	Thickness (feet)	Description
1331.6	6.5	Sandstone, fine- to medium-grained, yellowish gray (5Y 7/2) and greenish gray (5GY 6/1), calcareous, massive to medium bedded, moderately well indurated.
1332.5	0.9	Claystone, similar to claystone at 1325.1 ft.
1332.7	0.2	Analcime, white (N 9), bedded.
1335.4	2.7	Siltstone, grayish olive (10Y 4/2) and greenish gray (5GY 6/1) alternating, slightly calcareous, medium to thinly bedded, moderately well indurated.
1336.2	0.8	Claystone, similar to claystone at 1332.5 ft.
1354.0	17.8	No core. Cuttings suggest same as above.
1354.9	0.9	Claystone, similar to claystone at 1332.5 ft.
1356.1	1.2	Siltstone, greenish gray (5GY 6/1), calcareous, massive, moderately well indurated.
1374.0	17.9	No core. Cuttings suggest same as above.
1393.7	19.7	Clay, grayish olive (10Y 4/2), pale olive (10Y 6/2) and medium gray (N 5) alternating, calcareous, slightly silty, thinly bedded to laminated, moderately indurated. Bedding is slightly contorted, the dip irregular.
1394.0	0.3	No core. Cuttings suggest same as above.
1405.0	11.0	Clay, brownish gray (5YR 4/1), grayish olive (10Y 4/2) and yellowish gray (5Y 7/2) alternating, calcareous, very silty, slightly sandy, thinly bedded to laminated, moderately indurated.

Depth[1/] (feet)	Thickness (feet)	Description
1419.0	14.0	No core. Cuttings suggest same as above.
1448.0	29.0	Clay, similar to clay at 1405.0 ft. Unit contains numerous thin layers of silt; unit also contains two 2-in. layers of very calcareous sandstone at 1427.5 ft and 1440.0 ft respectively. Unit contains montmorillonite, analcime, hydrous mica and chlorite at 1430.0 ft.
1450.0	2.0	No core. Cuttings suggest same as above.
1478.9	28.9	Clay, grayish olive (10Y 4/2) to brownish gray (5YR 4/1) and dark greenish gray (5GY 4/1), slightly calcareous, slightly silty, faintly bedded, moderately indurated. Unit contains some flecks and layers (up to 3/4-in. thick) of white (N 9), crystalline colemanite; unit also contains analcime and chlorite. Borax and halite present in water-soluble fraction.
1481.0	2.1	No core. Cuttings suggest same as above.
1521.4	40.4	Clay, similar to clay at 1478.9 ft. Unit contains numerous flecks and thin lenses of white (N 9), crystalline colemanite; unit also contains numerous thin layers of silt. Unit contains analcime, hydrous mica, and chlorite at 1515.0 ft. Bedding dips 5°.
1529.7	8.3	Silt, pale olive (10Y 6/2) and grayish olive (10Y 4/2) alternating, calcareous, slightly sandy, thinly bedded to laminated, moderately indurated. Bedding dips from 50° to 60°.

Depth[1/] (feet)	Thickness (feet)	Description
1540.0	10.3	No core. Cuttings suggest same as above.
1555.0	16.0	Silt and clay (alternating). Silt, yellowish gray (5Y 7/2), calcareous, moderately indurated; clay, light olive gray (5Y 5/2), grayish olive (10Y 4/2) and dark greenish gray (5GY 4/1), slightly calcareous, slightly silty, moderately indurated. Unit is medium to thinly bedded. Bedding dips 40°.
1570.0	14.0	No core. Cuttings suggest same as above.
1573.1	3.1	Silt, light brown (5YR 6/1) and yellowish gray (5Y 7/2), very calcareous, thinly bedded to laminated, moderately indurated. Dip is irregular, from 15° to 20°.
1601.0	27.9	No core. Cuttings suggest same as above.
1624.2	23.2	Clay, grayish olive (10Y 4/2) and medium bluish gray (5B 5/1), calcareous, silty, massive to thinly bedded, locally laminated, cross-bedded, moderately indurated. Unit contains numerous thin layers of silt. Unit contains analcime, hydrous mica, and chlorite at 1621.0 ft.
1664.0	31.0	Silt and clay (alternating). Silt, pale olive (10Y 6/2) and yellowish gray (5Y 7/2), calcareous, bedded, moderately indurated; clay, grayish olive (10Y 4/2), calcareous, silty, moderately indurated. Unit is thinly bedded to laminated. Dip is irregular, from 5° to 15°.

Depth[1/] (feet)	Thickness (feet)	Description
1692.7	28.7	Clay, similar to clay at 1624.2 ft. Unit contains a 6-in. layer of sandstone at 1685.5 ft; unit also contains some thin layers of silt. Unit contains analcime, hydrous mica, and chlorite at 1676.0 ft.
1696.0	3.3	No core. Cuttings suggest same as above.
1712.2	16.2	Clay, dark gray (N 3), grayish olive (10Y 4/2) and moderate yellow (5Y 7/6), calcareous, thinly bedded, fractured, slickensided, moderately indurated, with coatings of realgar and orpiment along bedding planes. Unit contains a 8½-in. layer of siltstone at 1701.5 ft; unit also contains some flecks and lenses (up to 1-in. thick) of white (N 9) calcite. Unit contains analcime, hydrous mica, and iron sulphides at 1700.0 ft.
1728.0	11.8	No core. Cuttings suggest same as above.
1734.0	6.0	Clay, similar to clay at 1712.2 ft. Unit contains a 5-in. layer of sandstone at 1731.5 ft; unit also contains some thin layers of silt.
1760.0	26.0	No core. Cuttings suggest that the lithology is an arkosic, fine sand and silt, with some thin layers of clay.
1761.5	1.5	Siltstone, light olive gray (5Y 6/1) and moderate brown (5YR 3/4), calcareous, slightly sandy, medium to thinly bedded, moderately well indurated.

Depth[1/] (feet)	Thickness (feet)	Description
1791.0	29.5	No core. Cuttings suggest same as above.
1793.9	2.9	Silt and clay (alternating). Silt, light brown (5YR 6/4), pale yellowish brown (10YR 6/2) and pale olive (10Y 6/2) alternating, calcareous, moderately indurated; clay, light brownish gray (5YR 6/1), light brown (5YR 6/4), pale yellowish brown (10YR 6/2) and pale olive (10Y 6/2) alternating, calcareous, slightly silty, moderately indurated. Unit is thinly bedded.
1795.1	1.2	Sandstone, fine- to medium-grained; greenish gray (5GY 6/1), noncalcareous, medium bedded, moderately well indurated. Unit contains a 2-in. layer of sandstone at 1794.9 ft.
1824.0	28.9	No core. Cuttings suggest same as above.
1825.0	1.0	Silt and clay (alternating). Silt, greenish gray (5GY 6/1), calcareous, moderately indurated; clay, grayish olive (10Y 4/2), calcareous, slightly silty, moderately indurated. Bedding is slightly contorted.
1825.8	0.8	Sandstone, fine- to medium-grained; grayish green (10GY 5/2), very calcareous, massive, moderately well indurated.
1829.1	3.3	Silt and clay (alternating). Silt, pale olive (10Y 6/2) and greenish gray (5GY 6/1), calcareous, moderately indurated; clay, dark greenish gray (5GY 4/1) and grayish olive (10Y 4/2), calcareous, slightly silty, moderately indurated. Bedding is slightly contorted.

Depth[1/] (feet)	Thickness (feet)	Description
1856.0	26.9	No core. Cuttings suggest same as above.
1857.3	1.3	Sand, fine to coarse; greenish gray (5GY 6/1), calcareous, massive, poorly indurated to unconsolidated.
1858.3	1.0	Conglomerate. Numerous subrounded cobbles (quartz monzonitic) in a groundmass of greenish gray (5GY 6/1), slightly calcareous, fine to coarse, massive, moderately indurated sand.
1888.0	29.7	No core. Cuttings suggest same as above.
1889.0	1.0	Conglomerate, similar to conglomerate at 1858.3 ft.
1904.0	15.0	No core. Cuttings suggest same as above.
1905.0	1.0	Conglomerate, similar to conglomerate at 1858.3 ft.
1920.0	15.0	No core. Cuttings suggest same as above.
1940.0	20.0	Not cored. Cuttings suggest same as above.
1941.0	1.0	Conglomerate, similar to conglomerate at 1858.3 ft.
1945.0	4.0	No core. Cuttings suggest same as above.
2033.0	88.0	Not cored. Cuttings suggest same as above.
2034.0	1.0	Conglomerate, similar to conglomerate at 1858.3 ft.
2043.0	9.0	No core. Cuttings suggest same as above.
2100.0	57.0	Not cored. Cuttings suggest same as above.
2101.0	1.0	Conglomerate, similar to conglomerate at 1858.3 ft.
2106.0	5.0	No core. Cuttings suggest same as above.
2139.0	33.0	Not cored. Cuttings suggest same as above.
2140.2	1.2	Conglomerate, similar to conglomerate at 1858.3 ft.

Depth[1/] (feet)	Thickness (feet)	Description
2147.0	6.8	No core. Cuttings suggest same as above.
2209.0	62.0	Not cored. Cuttings suggest same as above.
2226.9	17.9	Sand, fine to medium; greenish gray (5GY 5/2) and very light gray (N 8), calcareous, massive to medium bedded, moderately indurated. Unit contains some thin layers of clay.
2239.0	12.1	No core. Cuttings suggest same as above.
2240.0	1.0	Claystone, grayish olive (10Y 4/2) to yellowish gray (5Y 7/2), very calcareous, slightly sandy, massive, moderately well indurated.
2241.0	1.0	Sandstone, fine-grained; greenish gray (5GY 6/1) to light gray (N 7), very calcareous, bedded, well indurated. Bedding dips 25°.
2245.5	4.5	Sandstone, fine- to coarse-grained, granulitic; light bluish gray (5B 7/1) to greenish gray (5GY 6/1), calcareous, poorly sorted, massive, well indurated. Unit contains a 8½-in. layer of sandstone at 2244.8 ft.
2247.3	1.8	Sand, fine to coarse, granulitic, slightly pebbly; grayish green (5G 5/2) to moderate blue green (5BG 4/6), very calcareous, poorly sorted, massive, moderately well indurated.
2269.0	21.7	No core. Cuttings suggest same as above.
2270.0	1.0	Sand, similar to sand at 2247.3 ft.

Depth[1/] (feet)	Thickness (feet)	Description
2304.0	34.0	No core. Cuttings suggest same as above.
2305.0	1.0	Sand, similar to sand at 2247.3 ft. Unit contains a thin layer of sandstone at 2304.5 ft.
2336.0	31.0	No core. Cuttings suggest same as above.
2401.0	65.0	Not cored. The predominant lithology is probably a pebble and cobble (quartz monzonitic) conglomerate with some layers of sand. Lithologies are based on cuttings and drilling characteristics.
2402.0	1.0	Sandstone, fine- to medium-grained; light brownish gray (5YR 6/1) and greenish gray (5GY 6/1) alternating, calcareous, medium to thinly bedded, moderately well indurated.
2403.0	1.0	Conglomerate, similar to conglomerate at 1858.3 ft.
2421.0	18.0	No core. Cuttings suggest same as above.
2522.0	101.0	Not cored. The predominant lithology is probably a pebble and cobble (quartz monzonitic) conglomerate, with some layers of sand. Lithologies are based on cuttings and drilling characteristics.
2524.0	2.1	Sand, very fine; dark greenish gray (5GY 4/1) and greenish gray (5GY 6/1) alternating, calcareous, silty, medium to thinly bedded, moderately indurated. Unit contains a 3-in. layer of sandstone at 2522.0 ft. Bedding is contorted.

Depth[1/] (feet)	Thickness (feet)	Description
2525.0	1.0	Sandstone, similar to sandstone at 2245.5 ft. Unit contains a 2-in. layer of sand at 2524.8 ft.
2553.0	28.0	No core. Cuttings suggest same as above.
2556.1	3.1	Claystone, dark gray (N 3), medium bluish gray (5B 5/1), grayish olive green (5GY 3/2) and light olive gray (5Y 6/1) alternating, calcareous, slightly silty, thinly bedded to laminated, moderately well indurated.
2557.7	1.6	Silt and clay (interbedded). Silt, greenish gray (5GY 6/1), calcareous, moderately indurated; clay, dark greenish gray (5G 4/1), slightly calcareous, slightly silty, moderately indurated. Unit is medium to thinly bedded.
2565.0	7.3	Claystone, similar to claystone at 2556.1 ft. Unit contains hydrous mica.
2568.0 (TD)	3.0	No core. Cuttings suggest same as above.

Four Corners No. 4

Depth 1/ (feet)	Thickness (feet)	Description
806.0	306.0	Not cored. Cuttings suggest that the lithology is an arkosic, slightly pebbly, slightly cobbly, fine to coarse sand, with some beds of silt and clay.
814.8	8.8	Sand, fine to medium, slightly granulitic; yellowish gray (5Y 7/2) to grayish orange (10YR 7/4), calcareous, massive, moderately indurated.
818.0	3.2	Sand, fine to medium; light brown (5YR 6/4) to moderate yellowish brown (10YR 5/4), very calcareous, massive, moderately indurated. Unit contains unoriented stringers of white (N 9) calcite.
819.6	1.6	Clay, moderate brown (5YR 3/4), noncalcareous, slightly silty, moderately indurated.
820.9	1.3	Siltstone, grayish orange (10Y 7/4) to yellowish gray (5Y 7/2), noncalcareous, slightly sandy, massive, moderately well indurated.
822.0	1.1	Clay, similar to clay at 819.6 ft.
823.1	1.1	Sand, very fine; light olive gray (5Y 5/2), slightly calcareous, faintly bedded, moderately indurated. Unit contains some thin layers of noncalcareous clay.
824.1	1.0	Clay, similar to clay at 819.6 ft.

1/ to bottom of unit described.

Depth[1/] (feet)	Thickness (feet)	Description
826.3	2.2	Siltstone, light olive gray (5Y 5/2) to grayish orange (10YR 7/4), calcareous, faintly bedded, moderately indurated. Unit contains some thin layers of clay.
830.3	4.0	Sand, similar to sand at 814.8 ft. Unit contains thin layers of clay.
841.0	10.7	No core. Cuttings suggest same as above.
844.0	3.0	Sand, similar to sand at 814.8 ft.
845.4	1.4	Clay, dark reddish brown (10R 3/4) to moderate brown (5YR 3/4), calcareous, slightly silty, slightly sandy, massive, moderately indurated. Unit contains numerous unoriented stringers of white (N 9) calcite.
855.3	9.9	Sand, similar to sand at 814.8 ft. Unit contains a 2½-in. layer of siltstone at 853.9 ft; unit also contains a quartz monzonitic cobble at 853.7 ft.
858.4	3.1	Siltstone, similar to siltstone at 820.9 ft. Unit contains a 9½-in. layer of claystone at 856.9 ft with numerous blebs of white (N 9) calcite.
859.9	1.5	Clay, similar to clay at 845.4 ft. Unit contains numerous blebs of white (N 9) calcite.
863.3	3.4	Siltstone, moderate brown (5YR 4/4) to light brown (5YR 6/4), calcareous, slightly sandy, slightly granulitic, medium bedded, moderately well indurated. Unit contains some thin layers of slightly calcareous clay.

Depth[1/] (feet)	Thickness (feet)	Description
865.6	2.3	Sand, fine to medium, slightly granulitic; yellowish gray (5Y 7/2) to pale olive (10Y 6/2), calcareous, poorly sorted, massive, moderately indurated. Unit contains a 7-in. layer of very calcareous, very fine-grained sandstone at 865.0 ft.
872.0	6.4	No core. Cuttings suggest same as above.
886.3	14.3	Sand, fine to medium, slightly granulitic; moderate reddish brown (10R 4/6) to pale reddish brown (10R 5/4) to moderate yellowish brown (10YR 5/4), very calcareous, massive, moderately indurated. Unit contains a 8-in. layer of claystone at 872.0 ft; unit also contains unoriented thin stringers and blebs of white (N 9) calcite.
888.6	2.3	Sand, very fine; white (N 9) and greenish gray (5GY 6/1) alternating, very calcareous, medium to thinly bedded, moderately indurated. Unit contains a 2½-in. layer of clay at 888.2 ft.
902.0	13.4	No core. Cuttings suggest same as above.
904.1	2.1	Clay, white (N 9), pale yellowish orange (10YR 8/6), light brown (5YR 6/4) and grayish yellowish green (5GY 7/2) alternating, very calcareous, slightly sandy, medium to thinly bedded, moderately indurated. Unit contains a 6-in. layer of sand.
907.4	3.3	Clay, grayish yellow green (5GY 7/2) to dusky yellow green (5GY 5/2), slightly calcareous, faintly bedded, fractured, slickensided, moderately indurated.

Depth[1] (feet)	Thickness (feet)	Description
913.5	6.1	Sand, very fine; light gray (5GY 8/1) to very light gray (N 8), calcareous, medium to thinly bedded, cross-bedded, moderately indurated. Unit contains some thin layers of clay.
919.1	5.6	Sand, fine to coarse, slightly granulitic; pale olive (10Y 6/2) to very light gray (N 8), calcareous, poorly sorted, massive, moderately indurated. Unit contains a 1-in. layer of sandstone at 919.0 ft.
922.7	3.6	Silt and clay (alternating). Silt, light greenish gray (5GY 8/1), slightly calcareous, moderately indurated; clay, dusky yellow green (5GY 5/2) and grayish olive green (5GY 3/2), moderately indurated, with some unoriented stringers of white (N 9) calcite. Unit contains a 2-in. layer of white (N 9) tuff at 919.6 ft. Unit is medium to thinly bedded.
923.4	0.7	Claystone, grayish yellow green (5GY 7/2), dusky yellow green (5GY 5/2), grayish green (10GY 5/2), and white (N 9), calcareous, pebbly, massive, fractured, slickensided, moderately indurated.

Depth[1] (feet)	Thickness (feet)	Description
927.2	3.8	Clay, dusky yellow green (5GY 5/2) to grayish yellow green (5GY 7/2), calcareous, slightly sandy, slightly granulitic, slightly pebbly, massive, moderately indurated. Unit contains a 5-in. layer of sand at 923.4 ft; unit also contains an unoriented cobble of siltstone at 924.5 ft.
931.0	3.8	No core. Cuttings suggest that the lithology is an arkosic, fine to coarse sand.
932.0	1.0	Sandstone, white (N 9) and dark yellowish orange (10YR 6/6), quartzose, bedded, very well indurated.
950.0	18.0	No core. Cuttings suggest same as above.
1207.0	257.0	Not cored. Cuttings and the drilling characteristics suggest that the lithology is the same as above.
1211.9	4.9	Sand, fine to coarse, slightly granulitic; dusky yellow green (5GY 5/2) to grayish olive green (5GY 3/2), calcareous, poorly sorted, massive, moderately indurated.
1212.9	1.0	Silt, dusky yellow green (5GY 5/2) to grayish olive green (5GY 3/2), slightly calcareous, massive, moderately indurated.
1214.7	1.3	Clay, similar to clay at 927.2 ft. Unit contains an unoriented cobble of siltstone at 1214.6 ft.

Depth 1/ (feet)	Thickness (feet)	Description
1226.9	12.2	Sand, fine to medium, slightly granulitic, slightly pebbly; dusky yellow green (5GY 5/2), calcareous, massive, moderately indurated. Unit contains a 5-in. layer of clay at 1223.1 ft.
1232.3	5.4	Silt, similar to silt at 1212.9 ft. Unit contains some thin layers of clay.
1237.0	4.7	No core. Cuttings suggest same as above.
1237.8	0.8	Sandstone, medium- to coarse-grained; dusky yellow green (5GY 5/2) to grayish yellow green (5GY 7/2), very calcareous, well indurated.
1241.7	3.9	Clay, similar to clay at 927.2 ft.
1247.0	5.3	No core. Cuttings suggest same as above.
1262.2	15.2	Clay, dusky yellow green (5GY 5/2) to grayish olive green (5GY 3/2) to grayish black (N 2), calcareous, slightly granulitic, slightly pebbly, slightly cobbly (quartz monzonitic), massive, fractured, slickensided, moderately indurated.
1276.2	4.0	Sand, very fine; light greenish gray (5GY 8/1) to grayish yellow green (5GY 7/2) to dusky yellow green (5GY 5/2), very calcareous, medium to thinly bedded, moderately indurated. Unit contains some unoriented stringers and partings of clay. Bedding is contorted.
1287.0	0.8	No core. Cuttings suggest same as above.

Depth[1/] (feet)	Thickness (feet)	Description
1268.6	1.6	Clay, similar to clay at 1262.2 ft. Unit contains a 5-in. layer of sand at 1267.0 ft.
1271.6	3.0	Clay and silt (alternating). Silt, grayish yellow green (5GY 7/2) to dusky yellow green (5GY 5/2), very calcareous, moderately indurated; clay, dusky yellow green (5GY 5/2) to grayish olive green (5GY 3/2), calcareous, moderately indurated. Unit is medium bedded.
1277.8	6.2	Clay, similar to clay at 1262.2 ft. Unit contains some thin lenses of silt; unit also contains some lenses and pods of calcite.
1280.3	2.5	Claystone, grayish olive green (5GY 3/2) to dusky yellow green (5GY 5/2) to grayish black (N 2), calcareous, very silty, medium bedded to laminated, well indurated. Unit contains a 8-in. layer of sand at 1277.8 ft. Bedding dips less than 3°.
1282.4	2.1	Siltstone, greenish gray (5GY 6/1) to medium gray (N 5), calcareous, massive, well indurated. Unit contains plant remains.
1284.2	1.8	Clay, similar to clay at 1262.2 ft. Unit contains two 2½-in. layers of calcareous siltstone at 1282.8 ft. and 1283.3 ft respectively. Unit contains plant remains. Bedding dips 15°.

Depth[1/] (feet)	Thickness (feet)	Description
1285.9	1.7	Siltstone, similar to siltstone at 1282.4 ft. Unit contains plant remains.
1287.9	2.0	Clay, similar to clay at 1262.2 ft. Unit contains some thin layers of silt.
1289.4	1.5	Siltstone, greenish gray (5GY 6/1) and white (N 9), calcareous, medium to thinly bedded, moderately well indurated. Unit contains plant remains.
1289.45	0.05	Lignite.
1294.7	5.25	Siltstone, similar to siltstone at 1289.4 ft. Unit contains a 3½-in. layer of claystone at 1291.9 ft. Unit contains plant remains.
1298.0	3.3	Clay, light gray (N 7), medium gray (N 5), grayish black (N 2) and grayish olive green (5GY 3/2) alternating, calcareous, slightly silty, medium to thinly bedded, fractured, slickensided, moderately indurated, with coatings of disseminated realgar along fracture faces. Unit contains a 7-in. layer of sand at 1297.2 ft. Bedding dips 30°.
1299.6	1.6	Siltstone, similar to siltstone at 1282.4 ft. Unit contains a 2½-in. layer of clay at 1299.4 ft. Unit contains plant remains.
1301.1	1.5	Sandstone, white (N 9) to medium light gray (N 6) to greenish gray (5GY 6/1), slightly calcareous, moderately well indurated. Unit contains a 7-in. layer of silt at 1299.6 ft.

Depth[1/] (feet)	Thickness (feet)	Description
1306.1	5.0	Clay, similar to clay at 1298.0 ft, with occasional coatings of disseminated realgar and orpiment along bedding planes. Bedding dips 25°.
1308.5	2.4	Siltstone, similar to siltstone at 1289.4 ft. Unit contains a 6-in. layer of calcareous, laminated, clay at 1308.0 ft, with some coatings of disseminated realgar and orpiment along bedding planes.
1312.7	4.2	Sandstone, fine-grained; greenish gray (5GY 6/1) to medium bluish gray (5B 5/1) to dark gray (N 3), slightly calcareous, massive, moderately well indurated. Unit contains a 2½-in. layer of calcareous, laminated clay at 1312.5 ft, with some coatings of disseminated realgar and orpiment along bedding planes.
1312.8	0.1	Marl, yellowish gray (5Y 8/1), bedded, moderately indurated. Unit dips 10°.
1314.0	1.2	Claystone, greenish gray (5GY 6/1) to dusky yellow green (5GY 5/2) to dark gray (N 3), noncalcareous, slightly silty, massive, moderately well indurated.
1315.5	1.5	Sandstone and siltstone (alternating). Sandstone, fine- to medium-grained, white (N 9) to greenish gray (5GY 6/1), micaceous (biotite), calcareous, moderately well indurated; siltstone, greenish gray (5GY 6/1), slightly calcareous, moderately well indurated. Unit is medium to thinly bedded.

Depth[1/] (feet)	Thickness (feet)	Description
1313.6	3.3	Siltstone and clay (alternating). Siltstone, greenish gray (5GY 6/1) to medium light gray (N 6), calcareous, moderately indurated; clay, medium bluish gray (5B 5/1) and dusky yellow green (5GY 5/2) to light olive gray (5Y 6/1) alternating, calcareous, moderately indurated. Unit is thinly bedded.
1320.1	1.3	Claystone, similar to claystone at 1314.0 ft.
1323.8	3.7	Clay, yellowish gray (5Y 8/1), dusky yellow green (5GY 5/2), grayish olive green (5GY 3/2) and brownish black (5YR 2/1) alternating, calcareous, slightly silty, thinly bedded to laminated, moderately indurated. Unit contains some blebs of white (N 9) calcite. Bedding dips 40°.
1325.0	1.2	Silt, light gray (N 7) to medium bluish gray (5B 5/1), slightly calcareous, slightly limonitic, medium to thinly bedded, moderately indurated.
1325.3	0.8	Clay, grayish olive green (5GY 3/2) to greenish black (5G 2/1), slightly calcareous, thinly bedded to laminated, fractured, slickensided, moderately indurated. Unit contains a 1-in. layer of silt at 1325.5 ft. Interval gives a medium positive test for B_2O_3.
1326.2	0.4	Claystone, similar to claystone at 1320.1 ft.

Depth[1/] (feet)	Thickness (feet)	Description
1329.0	2.8	No core. Cuttings suggest that the lithology is an arkosic sand with some interbeds of silt and clay.
1332.2	3.2	Sand, silt and clay (interbedded). Sand, fine to medium, greenish gray (5GY 6/1), calcareous, moderately indurated; silt, greenish gray (5GY 6/1) to dusky yellow green, (5GY 5/2), calcareous, moderately indurated; clay, grayish olive green (5GY 3/2), medium bluish gray (5B 5/1) and dark gray (N 3) alternating, slightly calcareous, slightly silty, moderately indurated. Unit contains a 8-in. layer of very fine-grained sandstone at 1331.5 ft. Unit gives a medium positive test for B_2O_3.
1334.7	2.5	Silt, greenish gray (5GY 6/1), pale olive (10Y 6/2) and pale greenish yellow (10Y 8/2) alternating, calcareous, medium to thinly bedded, moderately indurated. Unit contains a 3½-in. layer of very calcareous siltstone at 1334.4 ft, with plant remains and a molluscan fauna.
1337.4	2.7	Silt, greenish gray (5GY 6/1) to medium bluish gray (5B 5/1), calcareous, medium to thinly bedded, moderately indurated. Unit contains two layers (3½-in. and 5-in. thick) of very calcareous siltstone at 1335.7 ft and 1336.5 ft respectively; unit also contains some thin layers of slightly silty clay. Bedding dips 1°.

Depth[1/] (feet)	Thickness (feet)	Description
1359.2	21.8	Clay, olive gray (5Y 4/1), greenish black (5G 2/1), medium bluish gray (5B 5/1), brownish black (5YR 2/1) and dark gray (N 3) alternating, calcareous, slightly silty, thinly bedded to laminated, moderately indurated. Unit contains a 3½-in. layer of claystone at 1339.5 ft; unit also contains some thin layers of white (N 9) and yellowish gray (5Y 8/1) crystalline colemanite in the lower 5 ft. Bedding dips 3° to 10°. In addition unit contains montmorillonite and hydrous mica.
1360.0	0.8	No core. Cuttings suggest same as above.
1361.3	1.3	Clay, greenish gray (5GY 6/1), light olive gray (5Y 6/1), brownish black (5YR 2/1), dusky yellow green (5GY 5/2) and yellowish gray (5Y 8/1) alternating, calcareous, slightly silty, thinly bedded to laminated, moderately indurated. Unit contains a 3½-in. layer of siltstone at 1360.0 ft.
1362.1	0.8	Siltstone, greenish gray (5GY 6/1), very calcareous, bedded, moderately well indurated. Unit contains some thin layers of slightly silty clay. Unit gives a medium positive test for B_2O_3.

Depth[1/] (feet)	Thickness (feet)	Description
1362.9	0.8	Silt and clay (alternating). Silt, greenish gray (5GY 6/1), calcareous, moderately indurated; clay, greenish gray (5GY 6/1), olive gray (5Y 4/1), medium bluish gray (5B 5/1), and yellowish gray (5Y 8/1) alternating, calcareous, slightly silty, moderately indurated. Unit gives a medium positive test for B_2O_3. Unit is thinly bedded to laminated.
1365.6	2.7	Siltstone, similar to siltstone at 1362.1 ft. Unit contains two layers (5-in. and 3½-in. thick) of clay at 1364.2 ft and 1364.8 ft respectively. Unit gives a medium positive test for B_2O_3.
1369.1	3.5	Siltstone and clay (alternating). Similar to unit at 1362.9 ft. Unit contains some thin layers of silt. Unit is thinly bedded to laminated.
1371.7	2.6	Clay, yellowish gray (5Y 8/1), greenish gray (5GY 6/1), olive gray (5Y 4/1), brownish black (5YR 2/1) and dark gray (N 3) alternating, slightly calcareous, slightly silty, thinly bedded to laminated, moderately indurated. Unit contains a 2-in. layer of calcareous siltstone at 1369.1 ft. Bedding is slightly contorted.

Depth[1/] (feet)	Thickness (feet)	Description
1375.6	3.9	Silt and clay (alternating). Similar to unit at 1362.9 ft. Unit contains a 2½-in. layer of siltstone at 1371.7 ft. Bedding dips 10°. Unit is thinly bedded.
1385.1	9.5	Clay, greenish gray (5GY 6/1), olive gray (5Y 4/1), dusky yellow green (5GY 5/2), grayish olive green (5GY 3/2), brownish black (5YR 2/1) and grayish black (N 2) alternating, calcareous, slightly silty, thinly bedded to laminated, moderately indurated.
1387.6	2.5	Sandstone, fine- to coarse-grained; pale olive (10Y 6/2) to greenish gray (5GY 6/1) to dusky yellowish green (10GY 3/2), very calcareous, bedded, well indurated. Unit contains a 3½-in. layer of siltstone at 1385.1 ft. Unit contains plant remains. Bedding dips 15°.
1388.2	1.2	Siltstone, dusky yellowish green (10GY 3/2) to grayish olive green (5GY 3/2), very calcareous, slightly sandy, massive, well indurated. Unit contains some partings of slightly calcareous clay.
1390.0	1.2	No core. Cuttings suggest that the lithology is a sandstone.
1390.5	0.5	Sandstone, fine- to coarse-grained, granulitic; dusky yellowish green (10GY 3/2) to grayish olive green (5GY 3/2), slightly calcareous, poorly sorted, massive, well indurated.

Depth[1/] (feet)	Thickness (feet)	Description
1392.6	2.1	Sand, fine to coarse, granulitic; pale olive (10Y 6/2) to greenish gray (5GY 6/1), slightly calcareous, poorly sorted, massive, moderately indurated.
1410.2	17.6	Sandstone, similar to sandstone at 1387.6 ft. Unit contains some partings of clay.
1411.3	1.1	Mordenite and claystone (alternating). Mordenite, medium gray (N 5); claystone, grayish olive green (5GY 3/2) to dusky yellow green (5GY 5/2), non-calcareous, bedded, well indurated.
1413.4	2.1	Claystone, white (N 9) to pale olive (10Y 6/2), non-calcareous, massive, well indurated. Unit contains an 8-in. layer of sandstone at 1411.3 ft. Unit is given a mottled appearance by mordenite blebs.
1416.8	3.4	Sandstone, fine- to coarse-grained, slightly granulitic; greenish gray (5GY 6/1) to moderate greenish yellow (10Y 7/4) to pale olive (10Y 6/2), slightly calcareous, poorly sorted, massive, well indurated. Unit contains a 1½-in. layer of siltstone at 1413.4 ft.
1421.0	4.2	No core. Cuttings suggest same as above.
1423.8	2.8	Sandstone, fine- to coarse-grained, granulitic; greenish gray (5GY 6/1), dusky yellow green (5GY 5/2) and pale olive (10Y 6/2) alternating, noncalcareous, poorly sorted, massive to medium bedded, moderately well indurated. Unit contains a 7-in. layer of noncalcareous clay groundmass at 1421.9 ft.

Depth[1] (feet)	Thickness (feet)	Description
1426.0	2.2	Claystone, grayish olive green (5GY 3/2), noncalcareous, slightly sandy, slightly granulitic, slightly pebbly, massive, moderately well indurated.
1431.0	5.0	Sandstone, similar to sandstone at 1416.8 ft.
1432.0	1.0	Siltstone, grayish green (10GY 5/2), noncalcareous, slightly sandy, massive, well indurated.
1448.4	16.4	Sandstone, fine-grained; grayish green (10GY 5/2), noncalcareous, massive, well indurated. Unit contains three layers (5-in., 3½-in. and 2½-in. thick) of siltstone at 1433.3 ft, 1436.4 ft and 1444.4 ft respectively; unit also contains some partings of noncalcareous clay.
1451.0	2.6	No core. Cuttings suggest same as above.
1452.6	1.6	Claystone, dusky yellow green (5GY 5/2) to light greenish gray (5GY 8/1), micaceous (biotite), noncalcareous, slightly sandy, massive, moderately well indurated. Unit contains a 3½-in. layer of fine- to coarse-grained sandstone; unit also contains a 2½-in. layer of sandstone at 1451.4 ft.
1457.9	5.3	Sandstone, fine- to medium-grained; very light gray (N 8) to light gray (N 7) to light olive brown (5Y 5/6) and light greenish gray (5GY 8/1), noncalcareous, faintly bedded, well indurated. Unit contains a 7½-in. layer of siltstone at 1454.3 ft. Bedding dips 20°.

Depth[1] (feet)	Thickness (feet)	Description
1465.4	7.5	Sandstone, similar to sandstone at 1416.8 ft
1466.5	1.1	Claystone, grayish olive green (5GY 3/2) to dusky yellow green (5GY 5/2), noncalcareous, slightly sandy, slightly silty, massive, moderately well indurated.
1470.6	4.1	Claystone, grayish olive (10Y 4/2) to grayish olive green (5GY 3/2), noncalcareous, sandy, slightly granulitic, slightly pebbly, massive, moderately well indurated. Unit contains a 2½-in. layer of sandstone at 1466.5 ft; unit also contains some angular fragments of clay.
1471.8	1.2	Sandstone, similar to sandstone at 1416.8 ft.
1481.0	9.2	No core. Cuttings suggest same as above.
1482.0	1.0	Sand, similar to sand at 1392.6 ft.
1483.9	1.9	Sandstone, fine- to medium-grained, slightly granulitic; dusky yellow green (5GY 5/2), noncalcareous, massive, well indurated. Unit contains a 6-in. layer of claystone at 1482.3 ft.
1486.3	2.4	Sand, similar to sand at 1392.6 ft. Unit contains a 6-in. layer of sandstone at 1484.2 ft; unit also contains a 5-in. layer of silt at 1485.8 ft.
1491.3	5.0	Sandstone, similar to sandstone at 1416.8 ft. Unit contains some partings of noncalcareous clay.
1492.3	1.0	Claystone, similar to claystone at 1426.0 ft. Unit contains some angular fragments of clay.

Depth[1/] (Feet)	Thickness (feet)	Description
1494.1	1.8	Sandstone, fine- to medium-grained, slightly granulitic; grayish yellow green (10GY 7/2) to dusky yellow green (5GY 5/2), slightly calcareous, massive, moderately well indurated. Unit contains some angular fragments of clay.
1512.0	17.9	No core. Cuttings suggest same as above.
1524.2	12.2	Sandstone, similar to sandstone at 1494.1 ft. Unit contains a 6-in. layer of siltstone at 1512.3 ft; unit also contains some blebs of noncalcareous clay.
1525.2	1.0	Claystone, grayish olive green (5GY 3/2) and grayish green (10G 4/2), noncalcareous, silty, massive, well indurated.
1536.4	11.2	Sandstone, similar to sandstone at 1494.1 ft. Unit contains some partings of noncalcareous clay.
1543.0	6.6	No core. Cuttings suggest same as above.
1561.3	18.3	Sandstone, similar to sandstone at 1494.1 ft. Unit contains some partings of noncalcareous clay.
1574.0	12.7	No core. Cuttings suggest same as above.
1583.0	9.0	Sandstone, similar to sandstone at 1494.1 ft. Unit contains a 6-in. layer of siltstone at 1582.4 ft; unit also contains a 1½-in. layer of claystone at 1582.9 ft.

Depth[1/] (feet)	Thickness (feet)	Description
1584.8	1.8	Sandstone, fine- to medium-grained, slightly granulitic; greenish gray (5GY 6/1) and dusky yellow green (5GY 5/2), slightly calcareous, faintly bedded, moderately well indurated. Unit contains a 4-in. layer of siltstone at 1583.0 ft; unit also contains some blebs of noncalcareous clay. Bedding dips 10°.
1605.0	20.2	No core. Cuttings suggest same as above.
1619.3	14.3	Sand, fine to coarse, granulitic, slightly pebbly; greenish gray (5GY 6/1) to grayish yellow green (5GY 7/2) to dusky yellow green (5GY 5/2), slightly calcareous, poorly sorted, massive, moderately well indurated.
1620.6	1.3	Sandstone, similar to sandstone at 1584.8 ft.
1623.8	3.2	Sandstone, fine- to medium-grained; grayish green (10GY 5/2) to light greenish gray (5G 8/1), noncalcareous, well indurated. Unit contains a 3½-in. layer of slightly calcareous sandstone at 1622.6 ft.
1635.0	11.2	No core. Cuttings suggest same as above.

Depth[1] (feet)	Thickness (feet)	Description
1641.8	6.8	Sandstone, fine- to coarse-grained, slightly granulitic; light greenish gray (5G 8/1) and greenish gray (5GY 6/1) to light bluish gray (5B 7/1), noncalcareous, poorly sorted, massive, well indurated. Unit contains a 3½-in. layer of very fine-grained sandstone at 1640.8 ft; unit also contains some angular fragments of noncalcareous clay.
1650.7	8.9	Sandstone, similar to sandstone at 1619.3 ft. Unit contains a 6-in. layer of slightly calcareous siltstone at 1641.8 ft; unit also contains a 1-in. layer of noncalcareous sandstone at 1650.6 ft.
1652.0	1.3	Sandstone, very fine-grained; grayish olive green (5GY 3/2) to dark greenish gray (5GY 4/1) and light greenish gray (5G 8/1), noncalcareous, faintly bedded, well indurated. Unit contains a 2-in. layer of claystone at 1650.7 ft. Bedding dips 25°.
1654.0	2.0	Sandstone, fine- to medium-grained; very light gray (N 8) to light greenish gray (5G 8/1) and grayish yellow green (5GY 7/2) to dusky yellow green (5GY 5/2), noncalcareous, silty, medium bedded, moderately well indurated. Unit contains a 3½-in. layer of claystone at 1652.5 ft. Bedding dips 15°.
1660.6	6.6	Sandstone, similar to sandstone at 1619.3 ft. Bedding dips 30°.

Depth[1/] (feet)	Thickness (feet)	Description
1666.0	5.4	No core. Cuttings suggest same as above.
1666.9	0.9	Siltstone, dusky yellow green (5GY 5/2), noncalcareous, slightly sandy, massive, moderately well indurated. Unit contains some angular particles of noncalcareous clay.
1673.1	6.2	Sand, similar to sand at 1619.3 ft. Unit contains a 9-in. layer of fine- to medium-grained sandstone at 1666.9 ft.
1691.7	18.6	Sandstone and siltstone (alternating). Sandstone, fine- to coarse-grained, slightly granulitic, grayish yellow green (5GY 7/2), slightly calcareous, well indurated; siltstone, grayish yellow green (5GY 7/2) to dusky yellow green (5GY 5/2), slightly calcareous, well indurated. Unit contains some thin layers of noncalcareous clay. Bedding dips 20°. Unit is medium bedded.
1696.0	4.3	No core. Cuttings suggest same as above.
1712.6	16.6	Sand, fine to medium, slightly granulitic; greenish gray (5GY 6/1) to dusky yellow green (5GY 5/2), slightly calcareous, massive, moderately well indurated. Unit contains a 5-in. layer of noncalcareous claystone at 1712.2 ft.

Depth[1/] (feet)	Thickness (feet)	Description
1722.4	9.8	Sandstone, fine- to coarse-grained, slightly granulitic, slightly pebbly; grayish yellow green (5GY 7/2) to pale greenish yellow (10Y 8/2) to pale olive (10Y 6/2), slightly calcareous, poorly sorted, massive, moderately well indurated. Unit contains a 9½-in. layer of claystone at 1718.8 ft; unit also contains a 2½-in. layer of siltstone at 1719.6 ft.
1725.0	2.6	Siltstone, yellowish gray (5Y 7/2) and pale olive (10Y 6/2), slightly calcareous, massive, moderately well indurated.
1726.0	1.0	No core. Cuttings suggest same as above.
1734.5	8.5	Sandstone, fine- to medium-grained, slightly granulitic; dusky yellow green (5GY 5/2), massive, well indurated. Unit contains some partings of noncalcareous clay.
1738.3	3.8	Claystone, dusky blue green (5BG 3/2) to dusky yellow green (5GY 5/2), noncalcareous, slightly silty, slightly sandy, slightly granulitic, massive, moderately well indurated.
1742.4	4.1	Sandstone, medium-grained; grayish olive (10Y 4/2) to light greenish gray (5GY 8/1), noncalcareous, massive, moderately well indurated. Unit contains some partings of noncalcareous, slickensided clay.

Depth[1/] (feet)	Thickness (feet)	Description
1745.9	3.5	Sandstone, fine- to coarse-grained, slightly granulitic; grayish olive (10Y 4/2) and dusky yellow green (5GY 5/2), slightly calcareous, poorly sorted, massive, moderately well indurated. Unit contains a 2½-in. layer of noncalcareous claystone at 1742.7 ft; unit also contains some partings of noncalcareous clay.
1749.9	4.0	Siltstone, grayish olive green (5GY 3/2) to dusky yellowish green (10GY 3/2), slightly calcareous, massive, moderately well indurated. Unit contains a 7-in. layer of fine- to medium-grained sandstone; unit also contains some partings of noncalcareous, slickensided clay.
1751.0	1.1	Claystone, grayish olive green (5GY 3/2) to dusky yellow green (5GY 5/2), slightly calcareous, slightly silty, massive, fractured, slickensided, well indurated. Unit contains a 3-in. layer of sandstone at 1750.6 ft.
1757.0	6.0	No core. Cuttings suggest same as above.
1762.9	5.9	Siltstone, similar to siltstone at 1749.9 ft. Unit contains a 3½-in. layer of claystone at 1758.9 ft; unit also contains some partings of clay. Bedding dips 40°.

Depth[1/] (feet)	Thickness (feet)	Description
1770.1	7.2	Sandstone, fine- to coarse-grained, slightly granulitic; light greenish gray (5GY 8/1) to dusky yellow green (5GY 5/2), noncalcareous, poorly sorted, massive, well indurated. Unit contains a 7½-in. layer of slightly calcareous, fine-grained sandstone at 1762.9 ft.
1772.2	2.1	Claystone, grayish olive green (5GY 3/2) to dusky blue green (5BG 3/2), slightly calcareous, silty, slightly sandy, massive, moderately well indurated.
1774.9	2.7	Siltstone, dusky yellow green (5GY 5/2) to greenish gray (5GY 6/1) to dusky blue green (5BG 3/2), slightly calcareous, bedded, well indurated. Bedding dips 40°.
1778.0	3.1	Sandstone, similar to sandstone at 1770.1 ft.
1780.8	2.8	Siltstone, similar to siltstone at 1762.9 ft. Unit contains some partings of noncalcareous clay. Bedding dips 20°.
1782.1	1.3	Sandstone, fine- to coarse-grained, slightly granulitic; grayish olive green (5GY 3/2) and dusky blue green (5BG 3/2), slightly calcareous, poorly sorted, massive, moderately well indurated.
1786.0	3.9	No core. Cuttings suggest same as above.
1787.4	1.4	Sandstone, similar to sandstone at 1782.1 ft.

Depth[1/] (feet)	Thickness (feet)	Description
1792.2	4.8	Claystone, similar to claystone at 1772.2 ft. Unit contains an 8-in. layer of sand at 1788.8 ft; unit also contains a 6-in. layer of calcareous sandstone at 1789.5 ft.
1797.2	5.0	Sand, fine to coarse, granulitic, slightly pebbly; grayish olive green (5GY 3/2) to dusky yellow green (5GY 5/2), slightly calcareous, poorly sorted, massive, moderately indurated. Unit contains a 2½-in. layer of noncalcareous sandstone at 1796.6 ft; unit also contains a 5-in. layer of siltstone at 1796.8 ft.
1808.1	10.9	Sandstone, fine- to medium-grained; greenish gray (5GY 6/1), slightly calcareous, massive, well indurated. Unit contains a 9-in. layer of noncalcareous siltstone, dipping 25°, at 1806.5 ft; unit also contains some partings of clay.
1809.5	1.4	Sand, fine to medium; grayish olive green (5GY 3/2), noncalcareous, massive, moderately indurated.
1810.4	0.9	Silt, grayish olive green (5GY 3/2) to dusky blue green (5BG 3/2), noncalcareous, massive, moderately indurated. Unit contains some partings of clay.
1811.8	1.4	Clay, grayish olive green (5GY 3/2), noncalcareous, sandy, slightly granulitic, massive, moderately indurated. Unit contains a 6-in. layer of slightly calcareous sandstone at 1810.4 ft.

Depth[1/] (feet)	Thickness (feet)	Description
1816.0	4.2	No core. Cuttings suggest same as above.
1817.2	1.2	Sand, fine to medium; grayish olive green (5GY 3/2) to dusky yellow green (5GY 5/2), calcareous, massive, moderately indurated.
1820.1	2.9	Sandstone, fine- to coarse-grained, slightly granulitic; greenish gray (5GY 6/1), slightly calcareous, poorly sorted, massive, well indurated.
1825.1	5.0	Sand, fine to medium, slightly granulitic; greenish gray (5GY 6/1) to dark greenish gray (5G 4/1), slightly calcareous, massive, moderately indurated.
1829.7	4.6	Sandstone, similar to sandstone at 1820.1 ft. Unit contains some angular particles of slightly calcareous clay.
1832.2	2.5	Sand, fine to medium, slightly granulitic; greenish gray (5GY 6/1), slightly calcareous, faintly bedded, moderately to poorly indurated. Bedding dips 10°.
1833.7	1.5	Siltstone, grayish olive green (5GY 3/2) to dusky yellow green (5GY 5/2), slightly calcareous, massive, well indurated. Unit contains a 4-in. layer of very calcareous sandstone at 1833.3 ft; unit also contains some stringers of noncalcareous clay.
1834.8	1.1	Sandstone, similar to sandstone at 1820.1 ft.

Depth 1/ (feet)	Thickness (feet)	Description
1835.9	1.1	Siltstone, dusky yellow green (5GY 5/2), noncalcareous, massive, well indurated. Unit contains some partings of noncalcareous, slickensided clay.
1837.4	1.5	Sandstone, similar to sandstone at 1820.1 ft.
1846.0	8.6	No core. Cuttings suggest same as above.
1847.6	1.6	Siltstone, similar to siltstone at 1833.7 ft. Unit contains a 5-in. layer of sand at 1846.0 ft; unit also contains a 1½-in. layer of sandstone at 1846.6 ft. Bedding dips 25°.
1850.3	2.7	Sand, similar to sand at 1832.2 ft.
1866.0	15.7	No core. Cuttings suggest same as above.
2126.0	260.0	Not cored. Predominant lithology is probably a pebble and cobble (quartz monzonitic) conglomerate, with some interbeds of sand, silt and clay. Lithologies based on cuttings and drilling characteristics.
2127.0	1.0	Sandstone and siltstone (alternating). Sandstone, fine-grained, greenish gray (5GY 6/1), very calcareous, well indurated; siltstone, greenish gray (5GY 6/1), calcareous, well indurated. Bedding dips 60°. Unit is medium bedded.
2137.0	1.0	No core. Cuttings suggest same as above.
2307.0	170.0	Not cored. Predominant lithology is probably a pebble and cobble (quartz monzonitic) conglomerate, with some interbeds of sand, silt and clay. Lithologies are based on cuttings and drilling characteristics.

Depth[1/] (feet)	Thickness (feet)	Description
2310.0	3.0	Conglomerate. Numerous quartz monzonitic pebbles and cobbles in a groundmass of greenish gray (5GY 6/1), very calcareous, massive, moderately well indurated sand.
2312.0	2.0	Breccia. Numerous angular quartz monzonitic pebbles in a groundmass of greenish gray (5GY 6/1), calcareous, sandy, massive, well indurated claystone.
2332.0	20.0	No core. Cuttings suggest same as above.
2515.0	183.0	Not cored. Lithologies are probably a pebble and cobble (quartz monzonitic) conglomerate and a breccia. Lithologies are based on cuttings and drilling characteristics.
2516.7	1.0	Sandstone, fine- to medium-grained, slightly granulitic; pale yellowish brown (10YR 6/2) to greenish gray (5GY 6/1), calcareous, massive, moderately well indurated.
2521.0	5.0	No core. Cuttings suggest same as above.
2539.0	18.0	Sandstone, fine- to medium-grained, slightly granulitic; pale yellowish brown (10YR 6/2) to greenish gray (5GY 6/1), grayish olive green (5GY 3/2) to dusky yellow green (5GY 5/2) and pale olive (10Y 6/2), calcareous, massive, moderately well indurated. Unit contains two 6-in. layers of siltstone at 2528.3 ft and 2538.2 ft respectively; unit also contains a 6-in. layer of claystone at 2536.1 ft.

Depth[1/] (feet)	Thickness (feet)	Description
2539.9	0.9	Claystone, grayish olive green (5GY 3/2), slightly calcareous, very sandy, slightly pebbly, massive, moderately well indurated.
2547.6	7.7	Sandstone, fine- to medium-grained; light olive gray (5Y 6/1), pale olive (10Y 6/2), pale yellowish brown (10YR 6/2) and grayish green (10GY 5/2), calcareous, faintly bedded, moderately well indurated. Unit contains a 5-in. layer of siltstone at 2542.4 ft; unit also contains two layers (4-in. and 5-in. thick) of claystone at 2544.6 ft. and 2545.2 ft respectively.
2548.0	0.4	No core. Cuttings suggest same as above.
2555.1	7.1	Sandstone, similar to sandstone at 2547.6 ft. Unit contains a 5-in. layer of claystone at 2554.7 ft; unit also contains some angular particles of noncalcareous clay. Bedding dips 30°.
2566.5	11.4	Sandstone, fine- to coarse-grained, slightly pebbly; dusky yellow green (5GY 5/2) to pale olive (10Y 6/2), slightly calcareous, poorly sorted, massive, well indurated. Unit contains some angular particles of noncalcareous clay.
2568.7	2.2	Claystone, dusky yellow green (5GY 5/2) to brownish gray (5YR 4/1), calcareous, slightly silty, massive, fractured, slickensided, well indurated. Unit contains some unoriented stringers of white (N 9) calcite.

Depth[1/] (feet)	Thickness (feet)	Description
2578.0	9.3	No core. Cuttings suggest same as above.
2580.5	2.5	Sandstone, fine-grained; light olive gray (5Y 6/1) to greenish gray (5GY 6/1), calcareous, massive, well indurated. Unit contains a 2-in. layer of sandstone at 2578.0 ft; unit also contains a 9½-in. layer of siltstone at 2578.2 ft.
2582.0	1.5	Sand, fine to medium; greenish gray (5GY 6/1), calcareous, massive, moderately indurated.
2584.7	2.7	Sandstone, fine- to coarse-grained, granulitic; light olive gray (5Y 6/1) to greenish gray (5GY 6/1), slightly calcareous, poorly sorted, massive, well indurated.
2586.0	1.3	Siltstone, greenish gray (5GY 6/1), calcareous, massive, well indurated. Unit contains some angular particles of clay.
2588.3	2.3	Sandstone, similar to sandstone at 2584.7 ft.
2589.7	1.4	Sandstone, very fine-grained; greenish gray (5GY 6/1) and dark greenish gray (5G 4/1) alternating, calcareous, medium to thinly bedded, cross-bedded, well indurated. Unit contains some unoriented stringers of calcareous clay. Bedding dips 30°.
2592.3	2.6	Siltstone, pale olive (10Y 6/2), slightly calcareous, massive, well indurated. Unit contains some unoriented stringers of calcareous clay.

Depth[1/] (feet)	Thickness (feet)	Description
2608.0	15.7	No core. Cuttings suggest same as above.
2610.8	2.8	Sandstone, very fine-grained; light greenish gray (5GY 8/1), very slightly calcareous, medium bedded, well indurated. Bedding dips 25°.
2617.2	6.4	Sandstone, fine- to coarse-grained, slightly granulitic, slightly pebbly; pale olive (10Y 6/2), arkosic, calcareous, poorly sorted, massive, well indurated. Unit contains some unoriented stringers of brownish black (5YR 2/1) and very light gray (N 8) calcite; unit also contains a 3½-in. layer of siltstone at 2616.9 ft, with plant remains.
2621.1	3.9	Sandstone, fine- to coarse-grained, slightly granulitic, slightly pebbly; greenish gray (5GY 6/1), calcareous, poorly sorted, massive, well indurated. Unit contains an 8½-in. layer of claystone at 2620.2 ft, with some angular particles of clay.
2639.0	17.9	No core. Cuttings suggest same as above.
2640.9	1.9	Sandstone, similar to sandstone at 2621.1 ft. Unit contains a 5-in. layer of siltstone at 2639.0 ft; unit also contains a 3½-in. layer of sandstone at 2640.6 ft, dipping 35°.
2643.4	2.5	Sandstone, very fine-grained; pale olive (10Y 6/2) and dark greenish gray (5G 4/1), calcareous, medium to thinly bedded, cross-bedded, well indurated. Bedding dips 35°.

Depth[1/] (feet)	Thickness (feet)	Description
2644.8	1.4	Sandstone, fine- to coarse-grained, slightly granulitic; greenish gray (5GY 6/1) to light olive gray (5Y 6/1), calcareous, poorly sorted, massive, well indurated.
2646.1	1.3	Sand and clay (alternating). Sand, fine, pale olive (10Y 6/2), calcareous, moderately indurated; clay, grayish olive (10Y 4/2) to dusky yellow green (5GY 5/2), slightly calcareous, slightly silty, massive, fractured, moderately indurated. Unit is thinly bedded.
2647.1	1.0	Sand, fine; greenish gray (5GY 6/1) to pale olive (10Y 6/2), calcareous, medium to thinly bedded, moderately indurated.
2648.3	1.2	Sandstone, similar to sandstone at 2621.1 ft. Unit contains some unoriented stringers of white (N 9) calcite.
2649.5	1.2	Sandstone, very fine-grained; dark greenish gray (5GY 4/1) to greenish gray (5GY 6/1) and yellowish gray (5Y 7/2), calcareous, medium to thinly bedded, cross-bedded, well indurated. Bedding dips 30°.
2649.9	0.4	Limestone, light greenish gray (5GY 8/1) to medium light gray (N 6), clayey, slightly sandy, bedded, well indurated.

Depth[1/] (feet)	Thickness (feet)	Description
2650.7	0.8	Sandstone, fine- to medium-grained; pale olive (10Y 6/2), calcareous, bedded, well indurated.
2652.4	1.7	Sand and clay (alternating). Sand, fine to medium, greenish gray (5GY 6/1), calcareous, moderately indurated; clay, dark greenish gray (5G 4/1), slightly calcareous, fractured, moderately indurated. Unit is thinly bedded.
2654.5	2.1	Sandstone, very fine-grained; greenish gray (5GY 6/1) to dark greenish gray (5GY 4/1) to light olive gray (5Y 6/1), calcareous, medium bedded, well indurated. Unit contains a 5-in. layer of sandstone at 2652.4 ft.
2657.2	2.7	Sandstone, fine-grained, slightly granulitic; greenish gray (5GY 6/1), light olive gray (5Y 6/1) and yellowish gray (5Y 7/2), calcareous, massive to medium bedded, well indurated. Unit contains some thin layers of clay. Bedding dips 30°.
2670.0	9.8	No core. Cuttings suggest same as above.

Depth[1/] (feet)	Thickness (feet)	Description
2673.1	3.1	Sand and sandstone (alternating). Sand, fine to coarse, slightly granulitic, greenish gray (5GY 6/1) and light olive gray (5Y 6/1), calcareous, occasionally poorly sorted, moderately indurated; sandstone, fine-grained, greenish gray (5GY 6/1), dark greenish gray (5G 4/1) and yellowish gray (5GY 7/2), calcareous, moderately well indurated. Unit contains a 3-in. layer of quartz monzonitic pebbles at 2670.0 ft; unit also contains a 3½-in. layer of claystone at 2672.8 ft. Unit is medium bedded.
2675.7	2.6	Sandstone, similar to sandstone at 2648.3 ft. Unit contains two layers (6-in. and 3½-in. thick) of siltstone at 2673.1 ft and 2675.2 ft respectively. Bedding dips 35°.
2677.1	1.4	Breccia. Numerous quartz and feldspar pebbles in a groundmass of greenish gray (5GY 6/1) to light olive gray (5Y 6/1), calcareous, moderately well indurated sand.
2680.6	3.5	Sandstone, similar to sandstone at 2648.3 ft. Unit contains a 3½-in. layer of very fine-grained sandstone at 2677.3 ft, dipping 45°; unit also contains a 3½-in. layer of claystone at 2677.9 ft.
2696.0	15.4	No core. Cuttings suggest same as above.

Depth[1/] (feet)	Thickness (feet)	Description
2698.5	2.5	Sand, fine to coarse, granulitic, pebbly; pale reddish brown (10R 5/4), very calcareous, poorly sorted, massive, poorly indurated. Unit contains a 7-in. layer of sandstone at 2697.9 ft, dipping 35°.
2725.0	26.5	No core. Cutting suggest same as below.
2758.0	33.0	Not cored. Predominant lithology is probably a pebble and cobble (quartz monzonitic) breccia, with some interbeds of sand and silt. Lithologies are based on cuttings and drilling characteristics.
2763.0	5.0	Breccia. Numerous pebbles and cobbles in a groundmass of pale reddish brown (10R 5/4), calcareous, sandy, granulitic, massive, well indurated claystone. Unit contains some quartz monzonitic boulders.
2788.0	25.0	No core. Cuttings suggest same as above.
2851.0	63.0	Not cored. Similar to unit at 2763.0 ft. Lithology is based on cuttings and drilling characteristics.
2855.5	4.5	Breccia, similar to breccia at 2763.0 ft. Unit contains a 5-in. layer of sandstone at 2853.9 ft, dipping 40°; unit also contains some quartz monzonitic boulders.
2875.0	19.5	No core. Cuttings suggest same as above.
2975.0	100.0	Not cored. Similar to unit at 2763.0 ft. Lithology is based on cuttings and drilling characteristics.

Depth[1/] (feet)	Thickness (feet)	Description
2976.6	1.6	Breccia, similar to breccia at 2763.0 ft. Unit contains a 3½-in. layer of sandstone at 2975.0 ft.
2994.0	17.4	No core. Cuttings suggest same as above.
3065.0	71.0	Not cored. Similar to unit at 2763.0 ft. Lithology is based on cuttings and drilling characteristics.
3069.0	4.0	Breccia, similar to breccia at 2763.0 ft.
3075.0	6.0	No core. Cuttings suggest same as above.
3290.0	215.0	Not cored. Similar to unit at 2763.0 ft.
3293.9	3.9	Breccia, similar to breccia at 2763.0 ft. Unit contains a 6-in. layer of sandstone at 3293.4 ft, dipping 50°.
3316.0	22.1	No core. Cuttings suggest same as above.
3490.0	174.0	Not cored. Similar to unit at 2763.0 ft.
3494.6	4.6	Breccia, similar to breccia at 2763.0 ft.
3500.0 (TD)	5.4	No core. Cuttings suggest same as above.

Depth[1/] (feet)	Thickness (feet)	Description
700.0	700.0	Not cored. Cuttings suggest that the lithology is an arkosic sand, with some interbeds of silt and clay.
962.0	262.0	Not cored. Cuttings suggest that the lithology is predominantly a calcareous, bedded clay with some beds of silt and sand.
971.5	9.5	Clay, grayish green (5G 5/2), dusky yellow green (5GY 5/2) and dark greenish gray (5GY 4/1) alternating, calcareous, slightly silty to fine sandy, thinly bedded to laminated, fractured, slickensided, moderately indurated. Unit contains thin seams and coatings of realgar and orpiment along bedding planes. Unit contains a 6½-in. layer of siltstone at 971.2 ft; unit also contains a ½-in. layer of light gray (N 7), thinly bedded, very fine sand at 962.9 ft, with realgar and orpiment. Bedding dips 0° to 5°.
971.53	0.03	Lignite, dusky brown (5YR 2/2), bedded.
975.4	3.87	Sandstone, fine- to coarse-grained; greenish gray (5GY 6/1), slightly calcareous, massive, moderately well indurated. Unit contains a 1-in. layer of very light gray (N 8), well indurated tuff at 975.3 ft, with realgar and orpiment. Unit contains plant remains. In addition unit gives a very strong positive test for B_2O_3.

1/ to bottom of unit described.

Depth[1/] (feet)	Thickness (feet)	Description
1007.0	31.6	Clay, similar to clay at 971.5 ft. Unit contains some layers up to ½-in. thick of crystalline colemanite; unit also contains some thin layers of white (N 9) calcite. Bedding dips 0° to 3°.
1008.4	1.4	Siltstone, greenish gray (5GY 6/1), slightly calcareous, moderately well indurated.
1015.3	6.9	Clay, dusky yellow green (5GY 5/2), greenish black (5GY 2/1) and greenish gray (5GY 6/1) alternating, calcareous, slightly silty, thinly bedded to laminated, moderately indurated. Unit contains some thin layers of white (N 9) crystalline colemanite; unit also contains a 2-in. layer of very light gray (N 8), calcareous tuff at 1015.2 ft.
1020.0	4.7	No core. Cutting suggest same as above.
1028.3	8.3	Clay, grayish green (5G 5/2) and grayish black (N 2) alternating, calcareous, slightly silty, thinly bedded to laminated, moderately indurated, with thin seams and coatings of realgar and orpiment along bedding planes. Unit contains some layers up to 1-in. thick, of white (N 9), crystalline colemanite; unit also contains numerous thin layers of very light gray (N 8), very calcareous clay. Bedding dips 0° to 3°.

Depth[1] (feet)	Thickness (feet)	Description
1029.8	1.5	Sandstone, fine- to medium-grained; greenish gray (5GY 6/1), calcareous, moderately well indurated, with minor amounts of realgar and orpiment. Unit contains a 3½-in. layer of siltstone at 1028.3 ft.
1045.6	15.8	Clay, dusky yellow green (5GY 5/2), grayish green (10GY 5/2), medium bluish gray (5B 5/1) and grayish black (N 2) alternating, calcareous, slightly silty, thinly bedded to laminated, moderately indurated, with thin seams and coatings of realgar and orpiment along bedding planes. Unit contains some layers, up to ½-in. thick, of very light gray (N 8) and yellowish gray (5Y 8/1), crystalline colemanite; unit also contains two layers (6-in. and 5-in. thick) of sandstone at 1044.2 ft and 1044.9 ft respectively; in addition unit contains a 2½-in. layer of claystone at 1045.4 ft.
1047.8	2.2	Sandstone, similar to sandstone at 1029.8 ft. Unit contains a 3½-in. layer of siltstone at 1045.6 ft. Unit gives a strong positive test for B_2O_3.
1050.8	3.0	Clay, similar to clay at 1045.6 ft, with thin seams and coatings of orpiment on bedding planes. Bedding is horizontal. Unit gives a strong positive test for B_2O_3.
1052.0	1.2	No core. Cuttings suggest same as above.

Depth[1/] (feet)	Thickness (feet)	Description
1111.0	59.0	Clay, similar to clay at 1045.2 ft, with thin seams and coatings of realgar and orpiment along bedding planes. Unit contains numerous layers (up to 3½-in. thick) of white (N 9) and yellowish gray (5Y 8/1), crystalline colemanite. In addition unit contains veatchite, montmorillonite, hydrous mica, chlorite, mordenite, analcime, and iron sulfide.
1113.0	2.0	No core. Cuttings suggest same as above.
1143.5	33.8	Clay, similar to clay at 1045.2 ft, with thin seams and coatings of realgar and orpiment along bedding planes. Unit contains numerous layers (up to 3-in. thick) of white (N 9) and yellowish gray (5Y 8/1), crystalline colemanite; unit also contains a 1½-in. layer of sandstone at 1145.4 ft, with orpiment and some realgar. Bedding is horizontal. Mineralogy is same as clay at 1111.0 ft.
1145.2	1.7	Siltstone, greenish gray (5GY 6/1) to medium bluish gray (5B 5/1), calcareous, massive, moderately well indurated.
1147.1	1.9	Clay, greenish gray (5GY 6/1), medium bluish gray (5B 5/1) and light olive gray (5Y 6/1) alternating, calcareous, slightly silty, medium to thinly bedded, fractured, slickensided, moderately indurated, with some coatings of orpiment along bedding planes. Bedding is horizontal. In addition unit gives a strong positive test for B_2O_3.

Depth[1] (feet)	Thickness (feet)	Description
1143.8	1.7	Siltstone, greenish gray (5GY 6/1), micaceous (biotite), calcareous, massive, well indurated. Unit contains some partings of clay. Unit gives a strong positive test for B_2O_3.
1150.5	1.7	Clay, olive gray (5Y 4/1), light olive gray (5Y 6/1) and brownish black (5YR 2/1) alternating, slightly calcareous, thinly bedded to laminated, moderately indurated, with thin seams and coatings of orpiment and realgar along bedding planes. Unit contains a 3-in. layer of siltstone at 1153.5 ft; unit also contains some crusts and vugs of white (N 9), crystalline mordenite. Bedding is horizontal.
1152.6	2.1	Clay, greenish gray (5GY 6/1), olive gray (5Y 4/1) and light olive gray (5Y 6/1) alternating, calcareous, slightly silty, thinly bedded to laminated, moderately indurated, with coatings of orpiment and realgar along bedding planes. Unit contains a 6-in. layer of claystone at 1155.2 ft.

Depth[1/] (feet)	Thickness (feet)	Description
1155.0	2.4	Sandstone, siltstone and claystone (interbedded). Sandstone, fine-grained, very light gray (N 8) to white (N 9), calcareous, well indurated; siltstone, very light gray (N 8), dark greenish gray (5GY 4/1), medium dark gray (N 4) and very light gray (N 8) alternating, calcareous, moderately indurated; claystone, light olive gray (5Y 5/2), greenish gray (5GY 6/1) and dark greenish gray (5GY 4/1), calcareous, slightly silty, fractured, slickensided, moderately well indurated. Unit contains a 2½-in. layer of clay at 1156.0 ft; unit also contains thin seams and coatings of realgar and orpiment along bedding planes. Unit is thinly bedded. Bedding is horizontal.
1156.6	1.5	Claystone, greenish gray (5GY 6/1), calcareous, slightly silty, massive, fractured, slickensided, moderately well indurated. Unit contains a 5-in. layer of clay at 1158.3 ft; unit also contains numerous coatings of orpiment and realgar along bedding planes.

Depth[1/] (feet)	Thickness (feet)	Description
1158.5	1.9	Siltstone and clay (alternating). Siltstone, very light gray (N 8) to white (N 9), micaceous (biotite), very calcareous, well indurated; clay, light gray (N 7), medium gray (N 5), greenish gray (5GY 6/1) and grayish black (N 2) alternating, calcareous, slightly silty, moderately indurated, with some coatings of orpiment and realgar along bedding planes. Unit is thinly bedded. Bedding is horizontal.
1160.0	1.5	Clay, similar to clay at 1152.6 ft.
1161.3	1.3	Siltstone, very light gray (N 8) to white (N 9), very calcareous, faintly bedded, well indurated.
1167.5	6.2	Clay, very light gray (N 8), greenish gray (5GY 6/1), olive gray (5Y 4/1) and medium dark gray (N 4) alternating, calcareous, slightly silty, medium to thinly bedded, moderately indurated.
1175.0	7.5	Sandstone, fine- to medium-grained; greenish gray (5GY 6/1), calcareous, massive, moderately well indurated.
1190.8	15.8	Clay, similar to clay at 1167.5 ft, with coatings of realgar and orpiment along bedding planes and fractures. Unit contains some layers (up to ½-in. thick) of very light gray (N 8) and white (N 9) crystalline colemanite. Bedding dips 0° to 5°.

Depth[1/] (feet)	Thickness (feet)	Description
1193.5	2.7	Clay, grayish green (10GY 5/2) to dusky yellow green (5GY 5/2), calcareous, slightly silty, faintly bedded, moderately indurated, with some coatings of orpiment and realgar. Unit contains some thin layers of very light gray (N 8) and white (N 9) crystalline colemanite. In addition unit contains veatchite, montmorillonite, hydrous mica, chlorite, iron sulfide and analcime.
1198.5	5.0	Clay, similar to clay at 1190.8 ft. Unit contains some layers (up to ½-in. thick) of very light gray (N 8), crystalline colemanite. Bedding is horizontal. Mineralogy same as above.
1207.0	8.5	No core. Cuttings suggest same as above.
1208.9	1.9	Sandstone, fine- to medium-grained; light gray (N 7) to medium light gray (N 6), calcareous, silty, faintly bedded, moderately well indurated. Unit gives a strong positive test for B_2O_3.
1210.4	1.5	Clay, dark greenish gray (5GY 4/1) to greenish gray (5GY 3/1) to dark gray (N 3), calcareous, faintly bedded, moderately indurated.
1211.4	1.0	Clay and silt (alternating). Silt, light greenish gray (5GY 8/1), calcareous; clay, dark greenish gray (5GY 4/1) to dusky yellow green (5GY 5/2), calcareous, slightly silty, moderately indurated. Bedding is slightly contorted. Unit is thinly bedded.

Depth[1/] (feet)	Thickness (feet)	Description
1212.6	1.2	Siltstone, greenish gray (5GY 6/1), calcareous, faintly bedded, moderately well indurated.
1213.6	1.0	Sandstone, similar to sandstone at 1175.0 ft.
1214.9	1.3	Silt and clay (alternating). Silt, greenish gray (5GY 6/1) to medium light gray (N 6), calcareous, moderately indurated; clay, dusky yellow green (5GY 5/2) to grayish green (5GY 6/1) to dark gray (N 3), calcareous, moderately indurated.
1216.1	1.2	Sandstone, similar to sandstone at 1175.0 ft.
1225.1	9.0	Clay, greenish gray (5GY 6/1) to dark greenish gray (5G 4/1) to grayish olive green (5G 3/2), calcareous, slightly silty, thinly bedded to laminated, slickensided, moderately indurated. Unit contains a 6-in. layer of sandstona at 1222.0 ft; unit also contains some thin layers of light gray (N 7) to yellowish gray (5Y 8/1), very calcareous clay. Bedding is slightly contorted.
1226.5	1.4	Sandstone, similar to sandstone at 1175.0 ft. Unit contains a 3-in. layer of clay at 1226.2 ft.
1239.0	12.5	No core. Cuttings suggest same as above.

Depth[1/] (feet)	Thickness (feet)	Description
1249.4	10.4	Clay, greenish gray (5GY 6/1), light olive gray (5Y 6/1), dusky yellow green (5GY 5/2) and grayish black (N 2) alternating, calcareous, slightly silty, thinly bedded to laminated, moderately indurated. Unit contains some layers (up to 3/4-in. thick) of very light gray (N 8), crystalline colemanite; unit also contains veatchite, montmorillonite, hydrous mica, analcime and chlorite. Bedding is horizontal.
1258.3	8.9	Clay, moderate red (5R 5/4) to dusky red (5R 3/4), brownish gray (5YR 4/1), olive gray (5Y 4/1), and light olive gray (5Y 5/2) alternating, calcareous, slightly silty, thinly bedded to laminated, moderately indurated. Unit contains some layers (up to ½-in. thick) of very light gray (N 8), crystalline colemanite.
1266.9	8.6	Clay, dusky yellow green (5GY 5/2) to grayish olive green (5GY 3/2) to greenish black (5G 2/1), slightly calcareous, slightly silty, medium bedded, fractured, slickensided, moderately indurated. Unit contains three layers (5-in., 3½-in. and 3-in. thick) of sandstone at 1261.0 ft, 1263.9 ft and 1265.7 ft respectively; unit also contains a 6-in. layer of silt at 1258.5 ft.

Depth[1/] (feet)	Thickness (feet)	Description
1270.0	3.1	No core. Cuttings suggest same as above.
1294.6	24.6	Clay, greenish gray (5GY 6/1), pale olive (10Y 6/2), grayish olive green (5GY 3/2) and grayish black (N 2) alternating, calcareous, slightly silty, thinly bedded to laminated, moderately indurated, with some layers (up to 3/8-in. thick) of white (N 9) crystalline colemanite. Unit also contains two layers (9-in. and 5½-in. thick) of sandstone at 1282.6 ft and 1291.5 ft respectively. Bedding is horizontal.
1300.0	5.4	No core. Cuttings suggest same as above.
1303.7	3.7	Siltstone, dark greenish gray (5GY 4/1) to medium light gray (N 6), calcareous, medium to thinly bedded, moderately well indurated. Unit contains two layers (5-in. and 6-in. thick) of sandstone at 1300.0 ft and 1303.2 ft respectively.
1305.7	2.0	Siltstone, light gray (N 7) and white (N 9) to very light gray (N 8), calcareous, bedded, moderately well indurated. Unit contains two layers (2½-in. and 5-in. thick) of clay at 1304.5 ft and 1305.2 ft respectively.
1306.7	1.0	Sandstone, fine- to coarse-grained, granulitic; greenish gray (5GY 6/1), calcareous, poorly sorted, well indurated.

Depth[1] (feet)	Thickness (feet)	Description
1307.7	1.0	Siltstone, similar to siltstone at 1212.6 ft.
1309.3	1.6	Sandstone, similar to sandstone at 1306.7 ft. Unit contains a 6-in. layer of siltstone at 1308.8 ft.
1311.6	2.3	Clay, greenish gray (5GY 6/2) to dusky yellow green (5GY 5/2) to grayish olive green (5GY 3/2) to grayish black (N 2), calcareous, bedded, fractured, moderately indurated. Unit contains some thin layers of yellow gray (5Y 8/1) calcite. Bedding is contorted.
1313.1	1.5	Sandstone and siltstone (alternating). Similar to sandstone at 1306.7 ft; similar to siltstone at 1212.6 ft. Unit is thinly bedded.
1314.4	1.3	Silt and clay (alternating). Silt, white (N 9) to very light gray (N 8), calcareous, thinly bedded, moderately indurated; clay, dusky yellow green (5GY 5/2) to grayish olive green (5GY 3/2), calcareous, thinly bedded, fractured, slickensided, moderately indurated. Bedding is slightly contorted.
1315.5	1.1	Sandstone, similar to sandstone at 1306.7 ft.
1318.7	3.2	Clay, similar to clay at 1266.9 ft. Unit contains a 6-in. layer of siltstone at 1317.5 ft; unit also contains a 7½-in. layer of sandstone at 1318.0 ft.
1330.0	11.3	No core. Cuttings suggest same as above.

Depth[1/] (feet)	Thickness (feet)	Description
1332.7	2.7	Sandstone, similar to sandstone at 1306.7 ft. Unit contains a 6-in. layer of clay at 1330.5 ft.
1334.5	1.8	Siltstone, dark greenish gray (5GY 4/1) to olive gray (5Y 4/1), calcareous, bedded, well indurated. Unit contains a 4-in. layer of clay at 1332.7 ft.
1337.5	3.5	Clay and silt (alternating). Silt, light olive gray (5Y 6/1), calcareous, moderately indurated; clay, olive gray (5Y 4/1) and grayish black (N 2), calcareous, moderately indurated. Unit is medium to thinly bedded.
1338.9	1.4	Clay, olive gray (5Y 4/1) to olive black (5Y 2/1), calcareous, silty, bedded, fractured, slickensided, moderately indurated. Unit contains mollusks.
1341.5	2.9	Clay and silt (alternating). Similar to unit at 1337.5 ft. Unit is thinly bedded.
1344.4	2.9	Clay, dark greenish gray (5GY 4/1) to olive black (5Y 2/1) and brownish black (5YR 2/1), slightly silty, bedded, fractured, slickensided, moderately indurated.
1353.7	9.3	Clay, grayish olive green (5GY 3/2) and grayish black (N 2), calcareous, slightly silty, faintly bedded, fractured, slickensided, moderately indurated. Unit contains a thin lens of yellowish gray (5Y 8/1), very calcareous clay at 1344.4 ft.

Depth[1/] (feet)	Thickness (feet)	Description
1354.8	1.1	Silt and clay (alternating). Silt, greenish gray (5GY 6/1), calcareous, moderately indurated; clay, dark gray (N 3), calcareous, moderately indurated. Bedding is contorted. Unit is thinly bedded.
1358.6	3.8	Silt, greenish gray (5GY 6/1), calcareous, bedded, moderately indurated. Unit contains some thin layers of clay.
1360.0	1.4	No core. Cuttings suggest same as above.
1362.5	2.5	Sandstone, fine- to medium-grained, slightly granulitic; greenish gray (5GY 6/1), calcareous, massive, well indurated. Unit contains an 8½-in. layer of siltstone at 1360.4 ft.
1363.9	1.4	Siltstone, dusky yellow green (5GY 5/2), greenish gray (5GY 6/1) and grayish yellow green (5GY 7/2), calcareous, bedded, moderately well indurated. Unit contains numerous thin layers of calcareous clay. Iron sulfide ends here.
1365.4	1.5	Sandstone, similar to sandstone at 1362.5 ft.
1367.9	2.5	Siltstone, greenish gray (5GY 6/1), calcareous, medium to thinly bedded, moderately well indurated. Unit contains a 2½-in. layer of clay at 1365.7 ft; unit also contains a 1-in. layer of sandstone at 1366.0 ft.
1369.4	1.5	Claystone, grayish green (10GY 5/2), calcareous, silty, faintly bedded, moderately well indurated.

Depth 1/ (feet)	Thickness (feet)	Description
1370.8	1.4	Clay, siltstone and sandstone (interbedded). Clay, grayish olive green (5GY 3/2), dusky yellow green (5GY 5/2) and grayish black (N 2) alternating, calcareous, faintly bedded, fractured, slickensided, moderately indurated; siltstone, greenish gray (5GY 6/1), very calcareous, bedded, moderately well indurated; sandstone, medium-grained, slightly granulitic, greenish gray (5GY 6/1), calcareous, well indurated.
1390.0	19.2	No core. Cuttings suggest same as above.
1392.7	2.7	Silt and clay (alternating). Silt, very light gray (N 8) and grayish green (5G 5/2), calcareous, moderately indurated; clay, dark greenish gray (5G 4/1) and dusky yellowish green (10GY 3/2), calcareous, slightly silty, moderately indurated. Unit contains a 6-in. layer of breccia at 1390.0 ft; unit also contains a 4-in. layer of very light gray (N 8) to white (N 9), bedded, well indurated tuff at 1390.5 ft. Unit is thinly bedded.
1419.0	26.3	No core. Cuttings suggest same as above.
1420.3	1.3	Sandstone, fine- to medium-grained, slightly pebbly; grayish green (10GY 5/2), very calcareous, massive, moderately well indurated.

Depth[1/] (feet)	Thickness (feet)	Description
1449.0	28.7	No core. Predominant lithology is probably a pebble and cobble (quartz dioritic) breccia, with some layers of sandstone, siltstone and clay. Lithologies based on cuttings and drilling characteristics.
1574.0	125.0	Not cored. Cuttings suggest same as above.
1575.5	1.5	Sandstone and siltstone (alternating). Similar to sandstone at 1420.3 ft; siltstone, grayish green (10GY 5/2), calcareous, moderately well indurated. Unit contains a 1-in. layer of noncalcareous, slickensided clay at 1574.1 ft; unit also contains a thin layer of angular pebbles and cobbles at 1575.5 ft.
1604.0 (TD)	28.5	No core. Similar to unit at 1449.0 ft.