Core Logs from Five Test Holes Near Kramer California

By WILLIAM K. BENDA, R. C. ERD, *and* WARD C. SMITH

GEOLOGIC INVESTIGATIONS IN THE MOJAVE DESERT AND ADJACENT REGION, CALIFORNIA

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Detailed logs of drill cores of Quaternary alluvium and Tertiary colemanite-bearing sediments

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By WILLIAM K. BENDA, R. C. ERD, and WARD C. SMITH

ABSTRACT

In 1957, five test holes were drilled near Kramer, Calif., in the western Mojave Desert, for the U.S. Geological Survey. 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 1 was drilled in sec. 20, T. 10 N., R. 6 W., to a depth of 3,500 feet. Four Corners test hole 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 Kramer Junction, the intersection of U.S. Highways 395 and 466 and locally known as Four Corners, penetrated colemanite-bearing sediments. The location and total depth of these holes are as follows: Four Corners test hole 3, sec. 18, T. 11 N., R. 6 W., depth 2,568 feet; Four Corners test hole 4, near the north edge of sec. 30, T. 11 N., R. 6 W., depth 3,500 feet; Four Corners test hole 5, near the south edge of sec. 30, depth 1,604 feet. The sections of rocks penetrated in these 3 holes are similar. In each, the colemanite is in fine-grained sediments; these 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 5, particularly in the 76 feet of core recovered between depths of 1,051 and 1,131 feet. Chemical analysis indicates 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 mineral content of the colemanite-bearing sediments north of Kramer Junction (Four Corners), together with the general lithology of the lake beds and the occurrence of the sediments 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 that were drilled for the U.S. Geological Survey near the Kramer sodium borate district, in the Mojave Desert, Calif.,

during the period January to May 1957. Among the holes, 3 that are grouped in an alluvial-covered area about 6 miles east of Kramer penetrated 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 valuable minerals 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 minerals 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 economic 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 that the potential reward for discovery of a new borate field will be very great.
2. The sought-for ore body is expected to be half a 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. The largest community in the vicinity now is Boron, popu-

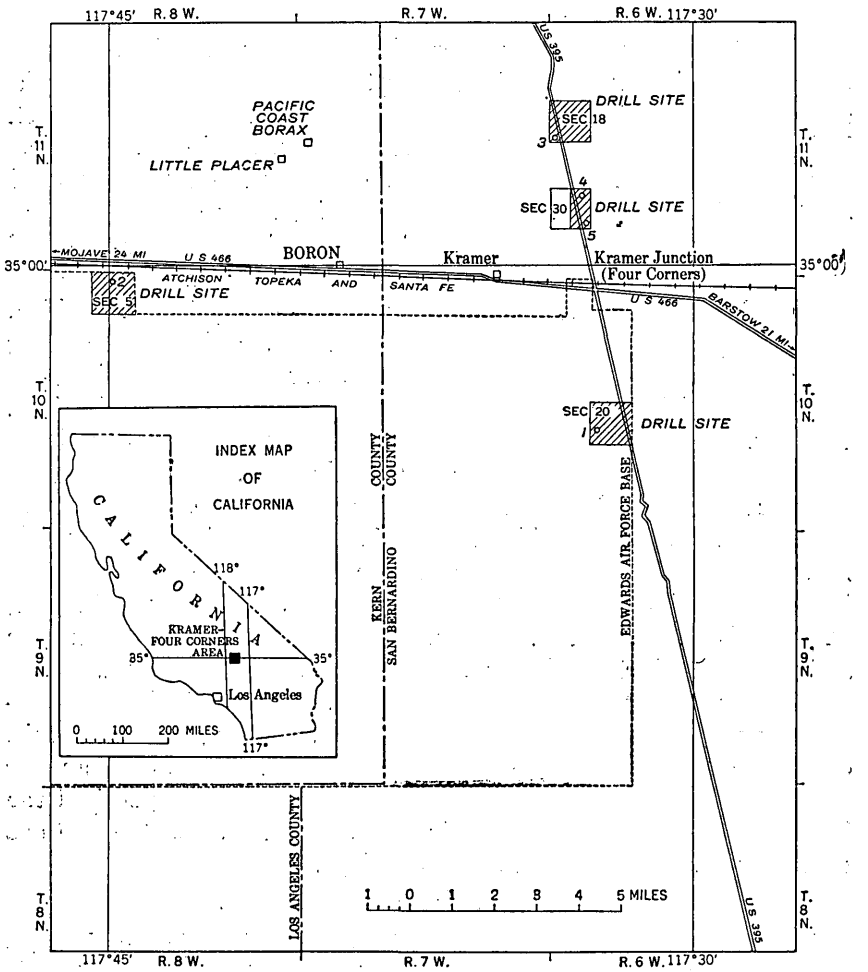

FIGURE 8.—Index map showing location of five test holes near Kramer, in the Mojave Desert, Calif.

lation about 500; it lies about halfway between the town of Mojave and Barstow. (See index map, fig. 8.) The junction of U.S. Highways 466 and 395, 6 miles east of Boron, is known locally as Four Corners but is shown as Kramer Junction on the topographic map of the area. Directions for reaching the U.S. Geological Survey drill sites are most conveniently referred to this junction, and the test holes drilled in the area for the Survey are identified as Four Corners 1 to 5. The accompanying map of the Kramer-Four Corners area (pl. 11) shows details of local roads on a planimetric base taken from several recently issued 15-minute quadrangles (scale 1:62,500): Fremont Peak, Boron, Castle Butte, Rogers Lake, Kramer, and Hawes.

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, U.S. Department of the Navy. The drilling was done for the U.S. Geological Survey by Miller and York, Bakersfield, Calif., under contract. Many members of the 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 ground water 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 acknowledges the generous help given during the early stages of this fieldwork by A. M. Bassett, T. W. Dibblee, Jr., D. V. Haines, and G. I. Smith. J. C. Thomas assisted Benda during fieldwork. R. C. Erd joined Benda in the more detailed core logging done in the laboratory, and is particularly responsible for mineral identifications. Hy Almond and Angelina C. Vlisidis, of the U.S. Geological Survey, made chemical analyses of core samples from test holes 3 to 5 (tables 2, 3). 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). 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 that he had gathered on the regional geology during his years in the Mojave Desert. He also pointed 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 test hole 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 (1957). Those already published in the

regular series of the Survey and in scientific journals are listed under "Selected References" together with certain preliminary open-file reports. Among the published reports is that of Dickey (1957), which describes the cores from two shallow holes drilled for the Survey in 1954–55 at the same sites as test holes 1 and 2 of this report.

Dibblee's geologic maps of the region have been mentioned already. In 1957, the Geological Survey placed in open file two compilations of his data at certain Survey offices. One compilation is a map showing a simplified geologic map of the western Mojave Desert, at the scale of 1 : 250,000. The other consists of similar simplified geology, at the scale of 1 : 62,500, for parts of the Mojave, including the Kramer-Four Corners area, on quadrangles used as base maps in the report on boron in ground water by Stone (1957).

GEOLOGY

GEOLOGIC UNITS

The distribution and structure of the rocks in the Kramer-Four Corners vicinity are shown on plate 11, and the explanation 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 Mesozoic(?), including mostly quartz monzonite, 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, whose outcrops 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 (Gale, 1946; Bowen, 1954; Dibblee, 1958). Because the Tertiary rocks have been divided and named in different ways, the sequences of rocks described in published reports are shown in table 1 for convenient reference.

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

TABLE 1.—*Sequences of rock units near Kramer, Calif.*

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

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 (pl. 11) 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 Mesozoic(?) 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 geologic importance, 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 local markers; but neither has been found in drill cores north of Four Corners, where test hole 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 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 penetrated 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 below. This mineral content, 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 borates

of the Calico Mountains, 50 miles east of Kramer, are well dated as middle Miocene in age, whereas 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 and Quaternary stratigraphic sections.

SUMMARY OF GRAVITY STUDY OF BEDROCK CONFIGURATION

By D. R. MABEY

As the map of Kramer-Four Corners 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, though 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 g per cm^3 (grams per cubic centimeter), whereas most of the pre-Tertiary crystalline rocks are in the density range between 2.65 and 2.70 g per $cm.^3$ Because the maximum probable density contrast is known, estimates of the minimum thickness of fill that could produce a gravity anomaly are reliable. However, the minimum density contrast can approach zero and therefore reliable estimates of the maximum thickness of fill associated with an anomaly can not be computed. 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 (a) alluvial covered; (b) underlain by thick "fill"; (c) marked by marginal outcrops of Tertiary rocks—that is, not surrounded by hills composed of quartz monzonite alone; (d) 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 penetrate 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 test hole 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 here summarized. Of the three areas drilled, that north of Four Corners is shown to contain borates and is discussed at greatest length. The two areas tested by Four Corners 1 and 2 seem to require only a brief comment, for 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 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 hole 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 on plate 11 show the correlations between sections penetrated in the test holes and sections exposed in outcrops.

FOUR CORNERS TEST HOLE 1

Four Corners test hole 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 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 found. The following summary of the lithology combines the data obtained from both holes.

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

FOUR CORNERS TEST HOLE 2

Four Corners test hole 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 lies 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, which was cored and drilled to a depth of 1,714.5 feet; and which was described by Dickey (1957). The new hole was offset about 30 yards northeast of the old one. 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 penetrated neither borate minerals nor lake sediments. In general, the core consists of arkosic greenish-gray fine to medium sand, and a few interbedded layers of silt, clay, and conglomerate. The following summary of lithology combines the data from both holes.

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

FOUR CORNERS TEST HOLES 3 TO 5

The three test 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.

TEST HOLE 3

Location.—1,450 east and 150 feet north of SW cor. sec. 18, T. 11 N., R. 6 W., San Bernardino base line and meridian, San Bernardino County, Calif., 3.7 miles northwest of Four Corners. Elevation 2,565.1 feet.

Interval (feet)	*Lithology*
0–648	Sand and gravel. Core recovery poor.
648–1,730	Clay, gray, thin-bedded, and some interbedded arkosic sands; colemanite in thin layers (max 1 in.) between 1,465 and 1,520 ft; 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 that is gray, massive to bedded, hard, medium- to coarse-grained, and arkosic. Core recovery poor.
2,555–2,568	Clay, gray, bedded, hard; some interbedded sandstone; dip 30°.

TEST HOLE 4

Location.—960 feet west and 120 feet south of NE cor. sec. 30, T. 11 N., R. 6 W., San Bernardino base line and meridian, San Bernardino County, Calif., 2.5 miles north of Four Corners. Elevation, 2,498.4 feet.

Interval (feet)	*Lithology*
0–808	Sand and gravel. Drilled without coring.
808–1,846	Clay, gray, thin-bedded, and some interbedded fine to medium sands; quartzose sandstone between 925 and 1,210 ft; thin layers of colemanite in clay between 1,354 and 1,358 ft. 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 ft.

TEST HOLE 5

Location.—410 feet west and 50 feet north of SE cor., sec. 30, T. 11 N., R. 6 W., San Bernardino base line and meridian, San Bernardino County, Calif., 1.5 miles north of Four Corners. Elevation, 2,462.4 feet.

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

MINERALOGY

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

Borates.—Colemanite, $2CaO \cdot 3B_2O_3 \cdot 5H_2O$, 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, $SrO \cdot 3B_2O_3 \cdot 2H_2O$, was found at several horizons in test hole 5. In 2 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. Veatchite occurs as fine scaly crystals disseminated in montmorillonitic clay and with colemanite. This is the second known occurrence of this mineral in the United States, 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 percent of cold-water-soluble B_2O_3 for core 5 is given in table 3.

Clay minerals.—These are chiefly montmorillonite and hydrous mica. Attapulgite as fracture fillings and on slickensided surfaces is present in the core recovered from depth 902 to 908 feet in test hole 3.

Zeolites.—Analcime and heulandite are relatively abundant; analcime is especially abundant in cores from test hole 3 and heulandite in cores from holes 4 and 5. Small amounts of other unidentified zeolites are less common. The zeolites seem 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. 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 3.

Sulfides.—Realgar and orpiment, the sulfides of arsenic, are common in cores from holes 3 to 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 test holes 3 to 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 test holes 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 below.

The core from test hole 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 com-

TABLE 2.—*Percentage of* B_2O_3 *in borate-bearing core from Four Corners test holes 3 and 4*

[Analyst, Hy Almond]

Four Corners 3			
Interval (feet)	Content of acid-soluble B_2O_3 (weight percent)	Interval (feet)	Content of acid-soluble B_2O_3 (weight percent)
1,473–1,482	9. 66	1,506–1,514	2. 88
1,482–1,487	7. 71	2,394–2,404 [1]	3. 12
1,490–1,495	12. 31	2,404–2,414 [1]	1. 06
1,498–1,503	5. 54		
Four Corners 4			
1,338–1,340	8. 19	1,354.1–1,356.2	10. 94
1,350–1,350.5	4. 37	1,357.5–1,360	9. 52

[1] Determined on cuttings.

puted for a selected section of core without much concern over the effect of lost core. For the 80-foot unit between depths of 1,051 and 1,131 feet, for example, 76 feet of core was recovered; 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; in this section, therefore, more than a fourth of the core is colemanite.

TABLE 3.—*Percentage of* B_2O_3 *in borate-bearing core from Four Corners test hole 5*

[Analyst, Angelina C. Vlisidis]

Interval (feet)	Content of—	
	Acid-soluble B_2O_3 (weight percent)	Cold-water-soluble B_2O_3 (weight percent)
1,051 –1,054	17.17	0.86
1,054 –1,056.5	10.79	.40
1,056.5–1,059	14.16	.42
1,059 –1,062	26.15	.75
1,062 –1,064.5	11.94	.74
1,064.5–1,067	14.18	.75
1,067 –1,070	20.57	1.02
1,070 –1,072	13.18	.64
1,072 –1,075	7.84	.54
1,075 –1,078	9.29	.61
1,078 –1,080.5	7.85	.54
1,080.5–1,083	2.62	.29
1,083 –1,085.5	16.30	.56
1,086 –1,088.5	12.57	.62
1,088.5–1,091	19.09	.74
1,091 –1,093.5	1.82	.27
1,094 –1,096	16.15	.67
1,096 –1,099	11.51	.43
1,099 –1,102	9.80	.46
1,102 –1,104.5	9.27	.50
1,104.5–1,107	8.28	.45
1,107 –1,110	22.90	.74
1,110 –1,112.5	17.52	.86
1,112.5–1,115	18.39	.77
1,115 –1,118	10.75	.66
1,118 –1,120.5	16.57	.67
1,120.5–1,123	27.06	.88
1,123 –1,126	13.30	.67
1,126 –1,128.5	15.06	.70
1,128.5–1,131	14.10	.64
1,131 –1,134	16.34	.74
1,134 –1,136.5	11.06	.61
1,136.5–1,139	16.18	.90
1,139 –1,142	14.74	1.02
1,142 –1,145	5.63	.45
1,194 –1,197	11.88	.80
1,241 –1,244	8.99	.78
1,244 –1,246.5	14.33	1.18
1,246.5–1,249	14.39	.98
1,249 –1,252	17.72	1.34

CORRELATION OF UNITS

As the summaries of the lithologies show, all three test holes penetrated a similar sequence of sediments. The uppermost sands and gravels are Recent alluvium, and perhaps the entire thicknesses of such sediments—648, 808, 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 was 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. Their occurrence as a tilted section below sands and gravels, the lithology of the lake beds, and particularly the mineral content, 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 in the cores from test hole 5 and not in cores from holes 3 or 4, or at Kramer. Some of the ulexite at Kramer, however, is known to be strontium bearing. Although the cores do not contain sodium or magnesium borate, nor the antimony sulfide found at Kramer, their other mineralogic features suggest that they represent borate-bearing beds that 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 test hole 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 are 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 2¼ inches in diameter. The bits used were the calyx type, which are 8¾ inches in diameter.

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 [1] of only 5 feet.

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 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 (pl. 12) shows a continuous log 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 5 holes, for the parts that were 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 test holes 3 to 5. (See graphic logs, pl. 12). 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 Geological Society of America.

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.

[1] The term "run" refers to the length of hole drilled between removals of the core barrel from the hole.

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CORE LOGS OF FOUR CORNERS TEST HOLES 1 TO 5

Test hole 1

Depth (feet)	*Unit thickness (feet)*	*Description*
1, 511. 3	11. 3	Sand, fine to coarse, pale-olive (10*Y* 6/2), slightly calcareous, massive, moderately indurated. Unit contains a 1½-in. layer of clay at 1,506.6 ft.
1, 517. 0	5. 7	No core. Cuttings suggest same as above.
1, 538. 1	21. 1	Sand, similar to sand at 1,511.3 ft. Unit contains a 2½-in. layer of sandstone at 1,531.1 ft.
1, 547. 0	8. 9	No core. Cuttings suggest same as above.
1, 569. 1	22. 1	Sand, similar to sand at 1,511.3 ft. Unit contains a quartz monzonitic cobble at 1,566.0 ft.
1, 577. 0	7. 9	No core. Cuttings suggest same as above.
1, 580. 5	3. 5	Conglomerate. Subangular quartz monzonitic and quartz pebbles and cobbles in a groundmass of medium to coarse pale-olive (10*Y* 6/2) slightly calcareous moderately indurated sand.
1, 584. 8	4. 3	Sand, similar to sand at 1,511.3 ft. Unit contains local quartz monzonitic cobbles.
1, 605. 0	20. 2	No core. Cuttings suggest same as above.
1, 607. 3	2. 3	Sand, silt, and clay (interbedded). Sand is medium to coarse, pale olive (10*Y* 6/2), calcareous, moderately indurated. Silt is olive gray (5*Y* 3/2), slightlv calcareous, moderately well indurated. Clay is moderate brown (5*YR* 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, 608. 6	1. 3	Sandstone, fine-grained, pale greenish-yellow (10*Y* 3/2) and yellowish-gray (5*Y* 7/2), calcareous, thinly bedded, well-indurated. Bedding is nearly vertical.
1, 610. 5	1. 9	Sandstone, fine- to medium-grained, olive-gray (5*Y* 3/2), slightly calcareous, medium-bedded, well-indurated. Unit contains local quartz monzonitic pebbles and cobbles.
1, 620. 0	9. 5	No core. Cuttings suggest same as above.
1, 630. 0	10. 0	Not cored. Cuttings suggest same as above.
1, 631. 0	1. 0	Sand, medium to coarse, light olive-brown (5*Y* 5/6), calcareous, limonitic, massive, poorly indurated. Unit contains local quartz monzonitic cobbles.
1, 635. 5	4. 5	Sand, silt, and clay (interbedded). Sand is fine to coarse, pale olive (10*Y* 6/2), calcareous, moderately well indurated. Silt is grayish olive (10*Y* 4/2), slightly calcareous, moderately well indurated. Clay is olive gray (5*Y* 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.

Test hole 1—Continued

Depth (feet)	Unit thickness (feet)	Description
1,662.0	26.5	No core. Cuttings suggest same as at 1,673.9 ft.
1,673.9	11.9	Sand, fine to coarse, pale-olive (10*Y* 6/2) to light-olive (10*Y* 5/4), calcareous, medium-bedded, moderately indurated. Unit contains a 6-in. layer of sand at 1,666.9 ft.
1,674.7	.8	Clay, dusky yellowish-green (10*GY* 3/2), noncalcareous, silty, slightly sandy, moderately indurated.
1,675.9	1.2	Sand, fine to coarse, pale-olive (10*Y* 6/2) to dusky yellow-green (5*GY* 5/2) and grayish-green (10*G* 4/2), slightly calcareous, moderately indurated. Unit contains a 2½-in. layer of clay at 1,675.4 ft.
1,677.0	1.1	No core. Cuttings suggest same as above.
1,678.2	1.2	Sandstone, fine- to coarse-grained, greenish-gray (5*GY* 6/1), calcareous, bedded, well-indurated. Bedding is horizontal.
1,693.3	15.1	Sand, fine to coarse, pebbly, dusky yellow-green (5*GY* 5/2) and grayish-green (5*G* 5/2), calcareous, medium-bedded, moderately indurated to poorly indurated. Unit contains local layers (up to ¼ in. thick) of clay. Bedding is nearly horizontal.
1,697.0	6.7	No core. Cuttings suggest same as above.
1,723.9	26.9	Sand, fine to coarse, pebbly, dusky yellow-green (5*GY* 5/2) to grayish-green (10*GY* 5/2) to grayish olive-green (5*GY* 3/2), calcareous, massive to medium-bedded, moderately indurated. Bedding is horizontal.
1,727.0	3.1	No core. Cuttings suggest same as above.
1,751.3	24.3	Sand, fine to coarse, slightly pebbly, pale-olive (10*Y* 6/2) dusky yellow-green (5*GY* 5/2), grayish-olive (10*Y* 4/2), and olive-gray (5*Y* 3/2) alternating, calcareous, medium-bedded, moderately indurated. Unit contains a 6-in. layer of sandstone at 1,749.6 ft.
1,759.0	7.7	No core. Cuttings suggest same as above.
1,778.7	19.7	Sand, fine to medium, pale-olive (10*Y* 6/2) to grayish-olive (10*Y* 4/2), calcareous, massive to faintly bedded, moderately indurated. Unit contains local layers (up to 3 in. thick) of sandstone and clay and local weathered quartz monzonitic cobbles.
1,786.0	7.7	Sandstone, fine- to medium-grained, pale-olive (10*Y* 6/2), grayish-olive (10*Y* 4/2), and pale greenish-yellow (10*Y* 8/2) alternating, calcareous, medium-bedded to thinly bedded, moderately well indurated. Unit contains local lenses (up to ⅛ in. thick) of garnetiferous and magnetitiferous sand.
1,790.0	3.6	No core. Cuttings suggest same as above.
1,798.4	8.4	Sandstone, fine- to coarse-grained, pebbly, pale-olive (10*Y* 6/2) and grayish-olive (10*Y* 4/2), calcareous, poorly sorted, medium-bedded to thinly bedded, moderately well indurated. Unit contains layers (up to ⅜ in. thick) of clay throughout.

Test hole 1—Continued

Depth (feet)	Unit thickness (feet)	Description
1,810.5	12.1	Sandstone, siltstone, claystone (interbedded). Sandstone is fine to coarse grained, grayish olive (10Y 4/2), pale olive (10Y 6/2), and moderate olive brown (5Y 4/4), calcareous, moderately well indurated. Siltstone is olive gray (5Y 3/2), grayish olive (10Y 4/2), and pale greenish yellow (10Y 8/2), calcareous, moderately well indurated. Claystone is 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.
1,820.0	9.5	No core. Cuttings suggest that the lithology is a sand.
1,833.8	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 and layers (up to 7 in. thick) of sand. Bedding is horizontal.
1,838.2	4.4	Sand, fine to medium, light olive-gray (5Y 5/2), calcareous, faintly bedded, moderately indurated. Bedding is horizontal.
1,847.2	9.0	Sandstone, fine- to coarse-grained, 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 1,839.0 ft.
1,852.0	4.8	No core. Cuttings suggest same as above.
1,876.9	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 1,825.0 ft.
1,883.0	6.1	No core. Cuttings suggest same as above.
1,885.1	2.1	Sand, similar to sand at 1,751.3 ft.
1,891.3	6.2	Sandstone, similar to sandstone at 1,798.4 ft. Unit contains a 6-in. layer of sand at 1,889.5 ft. Bedding is horizontal.
1,892.8	1.5	Sand, similar to sand at 1,751.3 ft.
1,893.9	1.1	Sandstone, fine- to medium-grained, grayish-olive (10Y 4/2), calcareous, massive to faintly bedded, moderately well indurated.
1,897.7	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 1,894.5 ft.
1,904.2	6.5	Sandstone, similar to sandstone at 1,798.4 ft. Unit contains many layers (up to 9½ in. thick) of sand throughout. Bedding is horizontal.
1,908.1	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 1,905.2 ft. Bedding is horizontal.

Test hole 1—Continued

Depth (feet)	Unit thickness (feet)	Description
1,915.0	6.9	No core. Cuttings suggest same as above.
1,917.2	2.2	Sandstone, fine- to coarse-grained, pebbly, grayish-olive (10Y 4/2), calcareous, poorly sorted, massive, moderately well indurated.
1,921.6	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 1,917.5 ft.
1,922.3	.7	Sandstone, similar to sandstone at 1,917.2 ft.
1,924.3	2.0	Sand, fine to medium, pale-olive (10Y 6/2) and grayish-olive (10Y 4/2), calcareous, faintly bedded, moderately indurated.
1,927.3	3.0	Sandstone, similar to sandstone at 1,917.2 ft. Unit contains a 2½-in. layer of sand at 1,927.0 ft and a quartz monzonitic pebble at 1,927.2 ft.
1,934.5	7.2	Sand, pebbly, similar to sandstone at 1,924.3 ft. Unit contains 2 layers (7½ and 5 in. thick) of sandstone at 1,930 and 1,932.5 ft, respectively, and a 1-in. layer of siltstone at 1,932.9 ft.
1,940.9	6.4	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.
1,944.2	3.3	Sandstone, slightly pebbly; similar to sandstone at 1,798.4 ft. Unit contains a 7-in. layer of sand at 1,943.6 ft.
1,945.0	.8	No core. Cuttings suggest same as above.
1,946.1	1.1	Sandstone, similar to sandstone at 1,917.2 ft. Unit contains a 2½-in. layer of sand at 1,945.2 ft and plant remains scattered throughout.
1,946.8	.7	Sand, silt, and clay (interbedded). Sand is 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 is olive gray (5Y 3/2), moderately indurated. Clay is greenish black (6Y 2/1), slightly silty, moderately indurated. Unit is medium bedded to laminated. Bedding is horizontal.
1,951.4	4.6	Sandstone, similar to sandstone at 1,917.2 ft. Unit contains a 1-in. layer of clay at 1,949.3 ft.
1,952.4	1.0	Sand, fine to medium, in places pebbly; grayish olive (10Y 4/2), calcareous, slightly limonitic, massive, moderately indurated. Unit contains a quartz monzonitic cobble at 1,951.4 ft.
1,960.1	7.7	Sandstone, similar to sandstone at 1,917.2 ft. Unit contains a 7-in. layer of sand at 1,955.1 ft.
1,970.1	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 2 layers (10½ and 5 in. thick) of sandstone at 1,964.7 and 1,967.6 ft, respectively.
1,977.0	6.9	No core. Cuttings suggest same as above.

Test hole 1—Continued

Depth (feet)	Unit thickness (feet)	Description
1, 982. 3	5. 3	Sand, fine to medium, slightly pebbly; light olive-gray (5*Y* 5/2) to pale-olive (10*Y* 6/2), calcareous, faintly bedded, poorly indurated. Unit contains a 1-in. layer of silt at 1,980.2 ft.
1, 993. 7	11. 4	Sand, similar to sand at 1,970.1 ft. Unit contains a 3½-in. layer of sandstone at 1,991.7 ft.
2, 008. 0	14. 3	No core. Cuttings suggest same as above.
2, 009. 0	1. 0	Sandstone, fine- to medium-grained, yellowish-gray (5*Y* 7/2), calcareous, massive, moderately well indurated.
2, 013. 0	4. 0	Sand and sandstone (alternating). Sand is similar to sand at 1,970.1 ft. Sandstone is similar to sandstone at 1,798.4 ft. Unit is thinly bedded.
2, 017. 0	4. 0	Sand, fine to coarse, pebbly, pale-olive (10*Y* 6/2), calcareous, poorly sorted, massive, moderately indurated.
2, 018. 0	1. 0	Sandstone, fine- to medium-grained, pale-olive (10*Y* 6/2), calcareous, massive, moderately well indurated.
2, 022. 4	4. 4	Sand, similar to sand at 2,017.0 ft. Unit contains a 2½-in. layer of sandstone at 2,022.2 ft.
2, 024. 9	2. 5	Sand, fine to coarse, pebbly, yellowish-gray (5*Y* 7/2), calcareous, poorly sorted, massive, moderately indurated. Unit contains a 1-in. layer of sand at 2,024.6 ft and a 2½-in. layer of sandstone at 2,024.7 ft.
2, 039. 0	14. 4	No core. Cuttings suggest same as above.
2, 051. 3	11. 3	Sand, similar to sand at 1,970.1 ft. Unit contains an 11-in. layer of sand at 2,041.6 ft.
2, 069. 0	17. 7	No core. Cuttings suggest same as above.
2, 074. 7	5. 7	Sand, fine to medium, slightly pebbly, grayish-olive (10*Y* 4/2), calcareous, massive to faintly bedded, moderately to poorly indurated.
2, 075. 9	1. 2	Clay and silt (alternating). Clay is olive gray (5*Y* 3/2), calcareous, silty, moderately indurated. Silt is grayish olive (10*Y* 4/2), calcareous, poorly indurated. Unit is thinly bedded.
2, 086. 1	10. 2	Sand, similar to sand at 1,970.1 ft. Unit contains a 2½-in. layer of clay at 2,077.7 ft.
2, 098. 0	11. 9	No core. Cuttings suggest same as above.
2, 099. 0	1. 0	Sand, fine to medium, olive-gray (5*Y* 3/2) and pale-olive (10*Y* 6/2), calcareous, medium-bedded, moderately to poorly indurated. Unit contains a 3½-in. layer of sandstone at 2,098.7 ft.
2, 111. 4	12. 4	Sand, similar to sand at 2,074.7 ft. Unit contains a 1-in. layer of clay at 2,108.7 ft, a 2½-in. layer of silt at 2,108.2 ft, plant remains. Bedding is horizontal.
2, 119. 8	8. 4	Sand, fine to coarse, slightly pebbly, pale-olive (10*Y* 6/2) and grayish-olive (10*Y* 4/2), calcareous, poorly sorted, massive to medium-bedded, moderately to poorly indurated. Unit contains 2 layers (3½ and 2½ in. thick) of sandstone at 2,113.7 and 2,115.0 ft, respectively; two 2½-in. layers of silt at 2,114.2 and 2,116.7 ft, respectively; and plant remains.

Test hole 1—Continued

Depth (feet)	Unit thickness (feet)	Description
2,129.0	9.2	No core. Cuttings suggest same as above.
2,151.3	22.3	Sand, similar to sand at 2,119.8 ft. Unit contains a 1-in. layer of silt at 2,133.2 ft and a ½-in. layer of clay at 2,136.6 ft.
2,159.0	7.7	No core. Cuttings suggest same as above.
2,181.5	22.5	Sand, similar to sand at 2,119.8 ft. Unit contains a 3½-in. layer of sandstone and a 1-in. layer of clay. Bedding is horizontal.
2,191.0	9.5	No core. Cuttings suggest same as above.
2,198.0	7.0	Sand, fine to medium, pale-olive (10*Y* 6/2) and yellowish-gray (5*Y* 7/2), calcareous, massive, medium-bedded to thinly bedded, moderately to poorly indurated. Unit contains a 2-in. layer of clay at 2,192.9 ft with desiccation cracks or animal tracks(?) on bedding planes and scattered partings of clay throughout. Bedding is horizontal.
2,211.0	13.0	No core. Cuttings suggest same as above.
2,219.0	8.0	Sand, very fine, very light gray (*N* 8), medium-bedded to thinly bedded, moderately indurated. Unit contains many thin layers of silt throughout.
2,230.3	11.3	Sand, fine, pale-olive (10*Y* 6/2), calcareous, medium-bedded to laminated, moderately indurated. Unit contains local thin layers of clay and silt throughout.
2,232.3	2.0	Sand, very fine, yellowish-gray (5*Y* 7/2), calcareous, medium-bedded to thinly bedded, moderately indurated. Unit contains many thin layers of silt throughout. Bedding is horizontal.
2,250.0	18.0	No core. Cuttings suggest same as above.
2,252.6	2.6	Sand, similar to sand at 2,230.3 ft. Unit contains many thin layers of silt throughout. Bedding is horizontal.
2,255.6	3.0	Sand, similar to sand at 2,074.7 ft. Unit contains a 3½-in. layer of sandstone at 2,255.3 ft. Bedding is horizontal.
2,259.2	3.2	Sand, similar to sand at 2,230.3 ft. Unit contains many thin layers of silt throughout. Bedding is horizontal.
2,263.1	3.9	Sand, very fine, moderate olive-brown (5*Y* 4/4), calcareous, massive, poorly indurated to unconsolidated.
2,264.3	1.2	Sand, very fine, light-gray (*N* 7), calcareous, medium-bedded to thinly bedded, moderately indurated. Unit contains a 3½-in. layer of sand at 2,263.1 ft.
2,283.0	18.7	No core. Cuttings suggest same as above.
2,285.2	2.2	Sands, similar to sand at 2,119.8 ft. Unit contains local lenses of sand throughout.
2,287.6	2.4	Sand and clay (alternating). Sand is fine to coarse, pebbly, pale olive (10*Y* 6/2) and olive gray (5*Y* 3/2), calcareous, poorly sorted, moderately indurated. Clay is dark yellowish brown (10*YR* 4/2), olive gray (5*Y* 3/2), and moderate brown (5*YR* 3/4), slightly calcareous, slightly silty, moderately indurated. Unit contains a 6-in. layer of sandstone at 2,267.8 ft. Unit is thinly bedded to laminated. Bedding is horizontal.

Test hole 1—Continued

Depth (feet)	Unit thickness (feet)	Description
2, 297. 4	9. 8	Sand, fine to coarse, pebbly, pale-olive (10*Y* 6/2), calcareous, slightly limonitic, poorly sorted, massive, moderately indurated.
2, 313. 0	15. 6	No core. Cuttings suggest same as above.
2, 323. 2	10. 2	Sand, fine to coarse, pebbly, light olive-gray (5*Y* 5/2), calcareous, slightly limonitic, poorly sorted, massive, moderately indurated.
2, 329. 3	6. 1	Sand, similar to sand at 2,297.4 ft.
2, 345. 0	15. 7	No core. Cuttings suggest same as above.
2, 352. 0	7. 0	Sand, similar to sand at 2,119.8 ft. Unit contains a 1-in. layer of clay at 2,351.9 ft.
2, 359. 0	7. 0	Sand, fine to coarse, pebbly, pale-olive (10*Y* 6/2), olive-gray (5*Y* 3/2), and light olive-gray (5*Y* 5/2) alternating, calcareous, poorly sorted, massive to medium-bedded, moderately indurated. Unit contains a 2½-in. layer of sandstone at 2,355.1 ft. Bedding is horizontal.
2, 376. 0	17. 0	No core. Cuttings suggest same as above.
2, 382. 0	6. 0	Sand, similar to sand at 2,297.4 ft. Unit contains 2 layers (2½ and 1 in. thick) of silt at 2,378.2 and 2,381.9 ft, respectively.
2, 387. 5	5. 5	Sand, fine to coarse, slightly pebbly, light olive-gray (5*Y* 5/2), and pale-olive (10*Y* 6/2) alternating, calcareous, medium-bedded, moderately to poorly indurated. Unit contains a 6-in. layer of clay at 2,382.0 ft.
2, 407. 0	19. 5	No core. Cuttings suggest same as above.
2, 410. 4	3. 4	Sand, similar to sand at 2,387.5 ft. Unit contains a 1-in. layer of sandstone at 2,409.2 ft.
2, 412. 6	2. 2	Sandstone, fine- to coarse-grained, pebbly, very light gray (*N* 8) to olive-gray (5*Y* 3/2), calcareous, poorly sorted, massive, well-indurated.
2, 414. 1	1. 5	Sand, fine to medium, pale-olive (10*Y* 6/2), calcareous, faintly bedded, moderately indurated. Unit contains thin layers of sandstone and siltstone throughout.
2, 438. 0	23. 9	No core. Cuttings suggest same as above.
2, 447. 5	9. 5	Sand, fine to coarse, slightly pebbly, pale-olive (10*Y* 6/2), light olive-gray (5*Y* 5/2), and light-gray (*N* 7) alternating, calcareous, medium-bedded, moderately indurated. Unit contains local thin layers of sandstone and clay throughout.
2, 452. 0	4. 5	No core. Cuttings suggest same as above.
2, 459. 2	7. 2	Sand, fine to coarse, slightly pebbly, light olive-gray (5*Y* 5/2), calcareous, poorly sorted, faintly bedded, moderately indurated. Unit contains a 2-in. layer of siltstone at 2,454.9 ft.
2, 459. 9	. 7	Sandstone, fine-grained, pale-olive (10*Y* 6/2) to olive-gray (5*Y* 3/2), very calcareous, well-indurated.
2, 460. 4	. 5	Clay, grayish-olive (10*Y* 4/2), calcareous, silty, laminated, moderately indurated. Unit contains a ¾-in. layer of siltstone at 2,460.3 ft.
2, 466. 0	5. 6	No core. Cuttings suggest that the material is sand.

Test hole 1—Continued

Depth (feet)	Unit thickness (feet)	Description
2,468.0	2.0	Sand, fine to coarse, pebbly, light olive-gray (5*Y* 5/2), calcareous, poorly sorted, massive, moderately indurated.
2,469.6	1.6	Sandstone, siltstone, and claystone (interbedded). Sandstone is fine grained, pale olive (10*Y* 6/2) and olive gray (5*Y* 3/2) alternating, calcareous, fine grained, well indurated. Siltstone is olive gray (5*Y* 3/2), calcareous, well indurated. Claystone is olive gray (5*Y* 3/2), calcareous, very silty, laminated, fractured, slickensided, moderately indurated. Unit is thinly bedded and crossbedded.
2,470.9	1.3	Sand, similar to sand at 2,468.0 ft.
2,472.9	2.0	Siltstone, grayish-olive (10*Y* 4/2) and pale olive (10*Y* 6/2) alternating, calcareous, thinly bedded, crossbedded, well-indurated. Unit contains a 2½-in. layer of sandstone at 2,470.9 ft.
2,477.4	4.5	Sandstone, siltstone, and claystone (interbedded). Sandstone is fine to medium grained, light gray (*N* 7), very calcareous, well indurated. Siltstone is grayish olive (10*Y* 4/2) and olive gray (5*Y* 3/2), calcareous, well indurated. Claystone is grayish olive (10*Y* 4/2) and olive gray (5*Y* 3/2), calcareous, very silty, laminated, moderately well indurated. Unit is thinly bedded and crossbedded.
2,479.9	2.5	Claystone, olive-gray (5*Y* 3/2), calcareous, silty, laminated, fractured, moderately well indurated. Unit contains a 5-in. layer of siltstone at 2,478.5 ft and unoriented veinlets of white (*N* 9) calcite throughout.
2,482.1	2.2	Sandstone, siltstone, and claystone (interbedded). Sandstone is similar to sandstone at 2,477.4 ft. Siltstone is pale olive (10*Y* 6/2), very calcareous, well indurated. Claystone is grayish olive (10*Y* 4/2), calcareous, silty, moderately well indurated. Unit is thinly bedded.
2,483.7	1.6	Claystone, grayish olive-green (5*GY* 3/2), calcareous, silty, thinly bedded, moderately well indurated.
2,488.0	4.3	Siltstone, light-gray (*N* 7), olive-gray (5*Y* 3/2), and pale-olive (10*Y* 6/2) alternating, calcareous, thinly bedded, crossbedded, moderately well indurated. Unit contains a 2½-in. layer of claystone at 2,485.5 ft and a 2½-in. layer of sand at 2,486.4 ft.
2,490.9	2.9	Sandstone, fine-grained, pale-olive (10*Y* 6/2) to light olive-gray (5*Y* 5/2) and light-gray (*N* 7) alternating, calcareous, thinly bedded, crossbedded, well-indurated. Unit contains local partings of siltstone throughout.
2,492.2	1.3	Siltstone, olive-gray (5*Y* 3/2), noncalcareous, medium-bedded, well-indurated. Unit contains a 4-in. layer of sandstone at 2,491.9 ft.
2,494.4	2.2	Sand, similar to sand at 2,414.1 ft. Unit contains a ¾-in. layer of clay at 2,493.9 ft.
2,496.0	1.6	No core. Cuttings suggest same as above.
2,497.1	1.1	Sandstone, similar to sandstone at 2,477.4 ft.

Test hole 1—Continued

Depth (feet)	Unit thickness (feet)	Description
2,500.0	2.9	Sand, fine to medium, light-gray (*N* 7), slightly calcareous, massive to medium-bedded, crossbedded, moderately indurated. Unit contains a 2½-in. layer of siltstone at 2,499.5 ft and a 4-in. layer of sandstone at 2,499.7 ft.
2,506.7	6.7	Sand, similar to sand at 2,459.2 ft. Unit contains a 1-in. layer of siltstone at 2,500.0 ft and local partings of clay throughout.
2,508.2	1.5	Sandstone, fine-grained, light-gray (*N* 7) and light olive-gray (5*Y* 5/2), calcareous, faintly bedded, moderately well indurated. Bedding dips less than 5°.
2,510.2	2.0	Sand, fine to medium, light-gray (*N* 7) and light olive-gray (5*Y* 5/2), slightly calcareous, medium-bedded, moderately indurated. Unit contains local partings of clay throughout.
2,513.6	3.4	Sandstone, siltstone, and clay (interbedded). Sandstone is fine grained, pale olive (10*Y* 6/2) and light gray (*N* 7), calcareous, moderately well indurated. Siltstone is pale olive (10*Y* 6/2) and olive gray (5*Y* 3/2) alternating, noncalcareous, moderately well indurated. Clay is olive gray (5*Y* 3/2) and grayish olive (10*Y* 4/2), noncalcareous, slightly silty, moderately indurated. Unit is thinly bedded to laminated.
2,514.7	1.1	Sandstone, similar to sandstone at 2,477.4 ft. Unit contains local thin layers of siltstone throughout.
2,517.3	2.6	Siltstone, pale-olive (10*Y* 6/2) and olive-gray (5*Y* 3/2) alternating, calcareous, thinly bedded to laminated, moderately well indurated. Unit contains local layers (up to ¼ in. thick) of clay throughout.
2,521.6	4.3	Sandstone and siltstone (alternating). Sandstone is fine grained, pale olive (10*Y* 6/2) to olive gray (5*Y* 3/2), calcareous, thinly bedded, crossbedded, and well indurated. Siltstone is pale olive (10*Y* 6/2) and olive gray (5*Y* 3/2) alternating, calcareous and moderately well indurated. Unit contains a 2½-in. layer of sand at 2,521.4 ft and local partings of clay throughout. Bedding is horizontal to very low dipping. Unit is thinly bedded and crossbedded.
2,527.6	5.6	Sandstone, fine-grained, pale-olive (10*Y* 6/2) and olive-gray (5*Y* 3/2) alternating, calcareous, medium-bedded to thinly bedded, crossbedded, moderately well indurated. Unit contains local thin layers of siltstone and clay throughout. Bedding is horizontal to very low dipping.
2,531.5	3.9	Sand, fine to medium, light olive-gray (5*Y* 6/1) and pale-olive (10*Y* 6/2) to grayish-olive (10*Y* 4/2), calcareous, faintly bedded, moderately indurated. Unit contains thin layers of siltstone and sandstone throughout. Bedding is nearly horizontal.

Test hole 1—Continued

Depth (feet)	Unit thickness (feet)	Description
2, 538. 6	7. 1	Sandstone, fine- to medium-grained, very light gray (*N* 8), calcareous, medium-bedded to thinly bedded, moderately well indurated. Unit contains a 7-in. layer of sand at 2,535.7 ft and thin layers of siltstone and claystone throughout. Bedding is nearly horizontal.
2, 540. 8	2. 2	Sand, fine to coarse, pebbly, grayish-olive (10*Y* 4/2), calcareous, poorly sorted, massive, moderately indurated. Unit contains a 6-in. layer of sandstone at 2,540.2 ft and very thin layers of claystone throughout. Bedding is nearly horizontal.
2, 559. 0	18. 2	No core. Cuttings suggest same as above.
2, 560. 7	1. 7	Siltstone, pale-olive (10*Y* 6/2) and olive-gray (5*Y* 3/2) alternating, slightly arkosic, calcareous, thinly bedded, moderately well indurated.
2, 561. 7	1. 0	Sandstone, similar to sandstone at 2,514.7 ft.
2, 565. 7	4. 0	Siltstone, similar to siltstone at 2,560.7 ft. Unit contains local partings of clay throughout. Bedding is nearly horizontal.
2, 566. 7	1. 0	Sandstone, similar to sandstone at 2,514.7 ft.
2, 574. 7	8. 0	Sand, fine to coarse, slightly pebbly, pale-olive (10*Y* 6/2), calcareous, massive to faintly bedded, moderately indurated. Unit contains a 10-in. layer of siltstone at 2,573.6 ft, and local thin layers of clay with desiccation cracks or animal tracks(?) on bedding planes.
2, 576. 8	2. 1	Sandstone, similar to sandstone at 2,514.7 ft. Unit contains local layers (up to 3/4 in. thick) of clay throughout.
2, 577. 6	. 8	Siltstone, similar to siltstone at 2,560.7 ft. Unit contains a 3/4-in. layer of clay at 2,577.0 ft.
2, 579. 0	1. 4	Sand, similar to sand at 2,500.0 ft.
2, 580. 8	1. 8	Siltstone, similar to siltstone at 2,560.7 ft. Unit contains a 2½-in. layer of sandstone at 2,579.0 ft and a 3/4-in. layer of clay at 2,579.3 ft.
2, 583. 4	2. 6	Sandstone, similar to sandstone at 2,527.6 ft. Unit contains a 5-in. layer of sand at 2,580.8 ft.
2, 585. 9	2. 5	Sand, similar to sand at 2,574.7 ft.
2, 591. 0	5. 1	No core. Cuttings suggest same as above.
2, 614. 9	23. 9	Sand, fine to medium, pebbly, light olive-gray (5*Y* 5/2), pale-olive (10*Y* 6/2), grayish-olive (10*Y* 4/2), and light-gray (*N* 7) alternating, calcareous, massive to medium-bedded, moderately indurated. Unit contains a 3½-in. layer of siltstone at 2,608.5 ft and layers (2½ and 3½ in. thick) of clay at 2,610.7 and 2614.6 ft, respectively.
2, 624. 0	9. 1	No core. Cuttings suggest same as above.
2, 626. 8	2. 8	Sand, fine, pale-olive (10*Y* 6/2), very calcareous, medium-bedded to thinly bedded, crossbedded, poorly indurated. Bedding is horizontal.
2, 629. 8	3. 0	Sand, fine to coarse, pebbly, light olive-gray (5*Y* 5/2), calcareous, poorly sorted, massive, moderately indurated.

Test hole 1—Continued

Depth (feet)	Unit thickness (feet)	Description
2,632.2	2.4	Sand, fine, grayish-olive (10*Y* 4/2) to pale-olive (10*Y* 6/2), calcareous, medium-bedded to thinly bedded, moderately indurated. Unit contains a 2½-in. layer of clay at 2,631.6 ft. Bedding dips less than 5°.
2,636.4	4.2	Sand, fine to medium, pale-olive (10*Y* 6/2), calcareous, slightly limonitic, medium-bedded to thinly bedded, moderately indurated. Unit contains local thin layers of silt throughout. Bedding is nearly horizontal.
2,637.7	1.3	Sand, fine to coarse, slightly pebbly, grayish-olive (10*Y* 4/2) and yellowish-gray (5*Y* 7/2), calcareous, slightly limonitic, medium-bedded to thinly bedded, moderately indurated. Unit contains a 1-in. layer of silt at 2,637.6 ft.
2,643.4	5.7	Sand, similar to sand at 2,636.4 ft. Unit contains local thin layers of silt throughout. Bedding is horizontal.
2,645.6	2.2	Sand, fine to coarse, pebbly, light-gray (*N* 7) to pale-olive (10*Y* 6/2), calcareous, poorly sorted, massive, moderately indurated. Unit contains a 1½-in. layer of clay at 2,645.5 ft.
2,648.5	2.9	Sand, similar to sand at 2,636.4 ft. Unit contains many thin layers of silt throughout.
2,655.0	6.5	No core. Cuttings suggest same as above.
2,659.1	4.1	Sand, similar to sand at 2,645.6 ft. Unit contains many thin layers of silt throughout and local thin layers of sand at 2,657.9 ft.
2,662.0	2.9	Sand, fine to coarse, pebbly, grayish-olive (10*Y* 4/2) and light olive-gray (5*Y* 5/2), calcareous, poorly sorted, massive to faintly bedded, moderately indurated.
2,666.6	4.6	Sand, similar to sand at 2,632.2 ft. Unit contains 2 layers (6 and 4 in. thick) of sandstone at 2,665.5 and 2,666.4 ft, respectively, and local thin layers of silt throughout. Bedding is nearly horizontal.
2,668.3	1.7	Sand, fine to coarse, slightly pebbly, pale-olive (10*Y* 6/2) and light olive-gray (5*Y* 5/2), calcareous, medium-bedded, moderately indurated. Unit contains a 5-in. layer of claystone at 2,667.4 ft.
2,670.2	1.9	Siltstone, olive-gray (5*Y* 3/2), calcareous, massive to faintly bedded, moderately well indurated.
2,674.2	4.0	Sand, similar to sand at 2,662.0 ft.
2,675.5	1.3	Siltstone, grayish-olive (10*Y* 4/2), slightly arkosic, noncalcareous, massive, moderately well indurated.
2,677.5	2.0	Sand, fine to coarse, pebbly, pale-olive (10*Y* 6/2) and grayish-olive (10*Y* 4/2), calcareous, massive to medium-bedded in places, moderately indurated. Unit contains local thin layers of silt throughout.
2,679.5	2.0	Siltstone, grayish-olive (10*Y* 4/2), calcareous, medium-bedded, moderately well indurated. Bedding is horizontal.
2,681.2	1.7	Sand, similar to sand at 2,632.2 ft. Unit contains many thin layers of silt throughout.
2,686.0	4.8	No core. Cuttings suggest same as above.

Test hole 1—Continued

Depth (feet)	Unit thickness (feet)	Description
2,689.2	3.2	Sand, similar to sand at 2,632.2 ft. Unit contains local thin layers of silt and clay throughout and a quartz monzonitic cobble at 2,686.0 ft. Bedding is horizontal.
2,691.9	2.7	Sand, similar to sand at 2,662.0 ft. Unit contains a 3½-in. layer of siltstone at 2,691.6 ft. Bedding is horizontal.
2,696.1	4.2	Sand, similar to sand at 2,632.2 ft. Unit contains a 4-in. layer of claystone at 2,695.8 ft and local thin layers of clay throughout.
2,710.4	14.3	Sand, fine, pale-olive (10*Y* 6/2), calcareous, medium-bedded to thinly bedded, moderately indurated. Unit contains 3 layers (6, 1, and 9 in. thick) of clay at 2,697.0, 2,698.5, and 2,699.3 ft, respectively, and local thin layers of silt throughout.
2,713.4	3.0	Sand, similar to sand at 2,632.2 ft. Unit contains a 3½-in. layer of sandstone at 2,710.4 ft and a 3-in. layer of clay at 2,713.1 ft. Bedding is horizontal.
2,718.0	4.6	No core. Cuttings suggest same as above.
2,719.7	1.7	Sand, similar to sand at 2,662.0 ft. Unit contains a 7-in. layer of sand at 2,719.1 ft and thin layers of silt throughout.
2,735.2	15.5	Sand, similar to sand at 2,710.4 ft. Unit contains a 1½-in. layer of sandstone at 2,719.7 ft and a 5-in. layer of clay at 2,725.8 ft.
2,737.1	1.9	Sand, fine, slightly pebbly, pale-olive (10*Y* 6/2) and grayish-olive (10*Y* 4/2), calcareous, medium-bedded, moderately indurated. Unit contains a 1-in. layer of sandstone at 2,735.2 ft and a 2-in. layer of claystone at 2,737.8 ft.
2,741.6	4.5	Sand, similar to sand at 2,710.4 ft. Unit contains a 3½-in. layer of siltstone at 2,737.5 ft and local thin layers of silt throughout.
2,742.9	1.3	Sandstone and siltstone (alternating). Sandstone is fine to medium grained, pale olive (10*Y* 6/2), very calcareous, well indurated. Siltstone is pale olive (10*Y* 6/2) to grayish olive (10*Y* 4/2), calcareous, moderately indurated. Unit is thinly bedded.
2,745.9	3.0	Sand, fine, light-gray (*N* 7), very calcareous, medium-bedded to thinly bedded, moderately indurated. Unit also contains a 1½-in. layer of claystone at 2,745.8 ft and many thin layers of silt throughout.
2,747.4	1.5	Sand, fine, pale-olive (10*Y* 6/2), very calcareous, medium-bedded to thinly bedded, moderately indurated. Unit contains a 3½-in. layer of siltstone at 2,747.1 ft.
2,750.0	2.6	No core. Cuttings suggest same as above.
2,752.7	2.7	Sand, similar to sand at 2,662.0 ft. Unit contains many thin layers of silt throughout.
2,753.7	1.0	Sand, fine, light-gray (*N* 7), very calcareous, faintly bedded, moderately indurated.
2,756.3	2.6	Siltstone, grayish-olive (10*Y* 4/2) and olive-gray (5*Y* 3/2), calcareous, thinly bedded, well indurated. Unit contains a 3-in. layer of claystone at 2,754.7 ft.

Test hole 1—Continued

Depth (feet)	Unit thickness (feet)	Description
2, 761. 3	5. 0	Sand, similar to sand at 2,737.1 ft. Unit contains a 2½-in. layer of claystone at 2,759.4 ft and a 4-in. layer of sandstone at 2,760.9 ft.
2, 762. 2	. 9	Siltstone, pale-olive (10*Y* 6/2) and grayish-olive (10*Y* 4/2) alternating, calcareous, medium-bedded to thinly bedded, moderately well indurated. Unit contains a 3/4-in. layer of clay at 2,762.1 ft and local thin layers of siltstone throughout.
2, 765. 4	3. 2	Sand, similar to sand at 2,737.1 ft. Unit contains local thin layers of silt throughout.
2, 767. 2	1. 8	Claystone, olive-gray (5*Y* 3/2), calcareous, silty, massive, well-indurated. Unit contains a 1-in. layer of sandstone at 2,766.2 ft, and thin lenses of sand.
2, 772. 0	4. 8	Sandstone and siltstone (alternating). Similar to unit at 2,742.9 ft. Unit contains a 5-in. layer of clay at 2,771.6 ft. Unit is thinly bedded.
2, 776. 6	4. 6	Siltstone, similar to siltstone at 2,762.2 ft. Unit contains a 2½-in. layer of clay at 2,774.7 ft. Bedding is horizontal.
2, 777. 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 2,777.1 ft. Bedding is horizontal.
2, 778. 6	. 7	Siltstone, similar to siltstone at 2,762.2 ft. Unit contains thin partings of clay.
2, 783. 0	4. 4	No core. Cuttings suggest same as above.
2, 784. 0	1. 0	Sandstone and siltstone (alternating). Sandstone is fine grained, light gray (*N* 7), calcareous, moderately well indurated. Siltstone is pale olive (10*Y* 6/2) to grayish olive (10*Y* 4/2) calcareous, crossbedded, moderately well indurated. Unit contains a 1-in. layer of claystone at 2,783.6 ft. Unit is thinly bedded.
2, 785. 5	1. 5	Sand, similar to sand at 2,747.4 ft. Unit contains a 3½-in. layer of siltstone at 2,785.2 ft, and plant remains.
2, 787. 4	1. 9	Sandstone and siltstone (alternating). Sandstone is fine to medium grained, pale olive (10*Y* 6/2) and light gray (*N* 7), calcareous, moderately well indurated. Siltstone is pale olive (10*Y* 6/2) and grayish olive (10*Y* 4/2) alternating, moderately arkosic, calcareous, moderately indurated. Unit contains thin partings of slightly silty clay. Unit is thinly bedded.
2, 792. 4	5. 0	Sand, similar to sand at 2,747.4 ft. Unit contains a 2½-in. layer of sandstone at 2,790.7 ft, a 3-in. layer of clay at 2,791.4 ft, and local thin layers of silt.
2, 794. 0	1. 6	Sandstone and siltstone (alternating). Sandstone is fine to medium grained, very light gray (*N* 8), very calcareous, moderately well indurated. Siltstone is pale olive (10*Y* 6/2) and grayish olive (10*Y* 4/2) alternating, moderately arkosic, calcareous, moderately indurated. Unit contains a 1½-in. layer of clay at 2,792.9 ft. Unit is medium bedded to thinly bedded.

Test hole 1—Continued

Depth (feet)	Unit thickness (feet)	Description
2,795.6	1.6	Sand, fine to coarse, pale-olive (10Y 6/2), calcareous, poorly sorted, massive, moderately indurated.
2,796.6	1.0	Siltstone, pale-olive (10Y 6/2), grayish-olive (10Y 4/2), and olive-gray (5Y 3/2) alternating, moderately arkosic, calcareous, medium-bedded to thinly bedded, moderately indurated. Unit contains a 1½-in. layer of clay at 2,796.4 ft.
2,801.1	4.5	Sand, similar to sand at 2,795.6 ft. Unit contains a 2½-in. layer of clay at 2,799.9 ft.
2,803.7	2.6	Siltstone, similar to siltstone at 2,756.3 ft. Unit contains a 5-in. layer of sandstone at 2,803.3 ft and thin layers of silty clay.
2,815.0	11.3	No core. Cuttings suggest that the material is an arkosic sand.
2,821.2	6.2	Sand, similar to sand at 2,795.6 ft. Unit contains a 1-in. layer of clay at 2,817.6 ft.
2,821.9	.7	Siltstone, pale-olive (10Y 6/2), grayish-olive (10Y 4/2), and olive-gray (5Y 3/2) alternating, moderately arkosic, calcareous, medium-bedded to thinly bedded, moderately indurated. Unit contains partings of slightly silty clay.
2,824.2	2.3	Sand, similar to sand at 2,795.6 ft.
2,825.4	1.2	Sand, fine, light-gray (N 7), calcareous, massive, moderately well indurated.
2,827.5	2.1	Sand, fine to coarse, 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 2,826.8 ft.
2,846.0	18.5	No core. Cuttings suggest same as above.
2,847.1	1.1	Sandstone, fine- to medium-grained, pale-olive (10Y 6/2), calcareous, massive, moderately well indurated.
2,863.7	16.6	Sand, similar to sand at 2,827.5 ft. Unit contains 2 layers (5 and 2½ in. thick) of siltstone at 2,847.1 and 2,847.9 ft, respectively, and partings (up to 1 in. thick) of clay.
2,879.0	15.3	No core. Cuttings suggest same as above.
2,883.4	4.4	Sandstone, fine-grained, pale-olive (10Y 6/2) to grayish-olive (10Y 4/2), calcareous, medium-bedded to thinly bedded, moderately well indurated. Unit contains a 3½-in. layer of sand at 2,879.0 ft and local thin layers of claystone.
2,885.4	2.0	Siltstone, similar to siltstone at 2,821.9 ft. Unit contains a 3½-in. layer of claystone at 2,883.4 ft and thin layers (up to ½ in. thick) of clay. Bedding dips from 5° to 10°.
2,887.1	1.7	Sand, fine to medium, pale-olive (10Y 6/2), calcarceous, faintly bedded, moderately indurated. Unit contains a 2½-in. layer of siltstone at 2,885.8 ft. Bedding dips from 5° to 10°.
2,891.1	4.0	Siltstone, similar to siltstone at 2,821.9 ft. Unit contains a 5½-in. layer of sand at 2,890.1 ft, and thin layers of slightly silty clay. Bedding dips from 1° to 5°.

Test hole 1—Continued

Depth (feet)	Unit thickness (feet)	Description
2,895.5	4.4	Sand, similar to sand at 2,887.1 ft. Unit contains a 8½-in. layer of siltstone at 2,893.7 ft, and local layers (up to ½ in. thick) of clay. Bedding dips from 1° to 5°.
2,904.0	8.5	No core. Cuttings suggest same as above.
2,905.3	1.3	Sand, fine to coarse, pale yellowish-brown (10*YR* 6/2) and grayish-olive (10*Y* 4/2), calcareous, medium-bedded, moderately indurated. Unit contains 2 layers (6 and 1 in. thick) of sandstone at 2,904.0 and 2,904.6 ft, respectively.
2,908.0	2.7	Sand, fine to coarse, pale yellowish-brown (10*YR* 6/2), calcareous, massive, moderately indurated. Unit contains a 5-in. layer of sandstone at 2,906.1 ft.
2,911.0	3.0	Sandstone, fine- to medium-grained, pale yellowish-brown (10*YR* 6/2), calcareous, medium-bedded to thinly bedded, crossbedded, moderately well indurated.
2,912.6	1.6	Sand, similar to sand at 2,905.3 ft.
2,915.2	2.6	Siltstone, pale yellowish-brown (10*YR* 6/2) to pale-olive (10*Y* 6/2) and grayish-olive (10*Y* 4/2) to olive gray (5*Y* 3/2) alternating, moderately arkosic, calcareous, medium-bedded to thinly bedded, crossbedded, moderately well indurated. Unit contains a 3½-in layer of sand at 2,914.9 ft, and local layers (up to ½ in. thick) of clay.
2,941.0	25.8	No core. Cuttings suggest same as above.
2,942.4	1.4	Sand, similar to sand at 2,908.0 ft. Unit contains a 6-in. layer of sandstone at 2,941.0 ft.
2,946.8	4.4	Sandstone, similar to sandstone at 2,911.0 ft. Unit contains a 3½-in. layer of sand at 2,944.7 ft, and partings of clay. Bedding is nearly horizontal.
2,953.0	6.2	Sand, similar to sand at 2,908.0 ft. Unit contains thin layers of siltstone in the upper 5 in.
2,975.0	22.0	No core. Cuttings suggest same as above.
2,979.3	4.3	Sandstone, similar to sandstone at 2,911.0 ft. Unit contains partings (up to ⅛ in. thick) of clay, and a quartz monzonitic cobble at 2,975.0 ft.
2,980.7	1.4	Sand, similar to sand at 2,908.0 ft. Unit contains thin layers of siltstone in the upper 5 in.
3,007.0	26.3	No core. Cuttings suggest same as above.
3,016.1	9.1	Sandstone, similar to sandstone at 2,911.0 ft. Unit contains a 3½-in. layer of sand at 3,010.0 ft.
3,038.0	21.9	No core. Cuttings suggest same as above.
3,039.5	1.5	Sand, similar to sand at 2,887.1 ft. Unit contains a quartz monzonitic cobble at 3,038.0 ft and a 1½-in. layer of siltstone at 3,038.4 ft.
3,046.2	6.7	Sandstone, fine- to medium-grained, pale-olive (10*Y* 6/2), calcareous, faintly bedded, moderately well indurated. Unit contains some thin layers of slightly calcareous siltstone.

Test hole 1—Continued

Depth (feet)	Unit thickness (feet)	Description
3,051.0	4.8	Sand, fine to coarse, slightly pebbly, brownish-gray (5*YR* 4/1), calcareous, massive, moderately indurated. Unit contains a 7-in. layer of sandstone at 3,048.5 ft, dipping from 1° to 5°.
3,054.5	3.5	Sand, fine to medium, grayish yellow-green (5*GY* 7/2), calcareous, faintly bedded, moderately indurated. Unit contains 3 layers (3, 1½, and 1 in. thick) of clay at 3,051.0, 3,053.1, and 3,053.9, ft, respectively.
3,056.4	1.9	Sandstone, similar to sandstone at 3,046.2 ft. Unit contains some thin layers of siltstone.
3,060.1	3.7	Sandstone, fine- to medium-grained, grayish yellow-green (5*GY* 7/2) to dusky yellow-green (5*GY* 5/2) to pale-olive (10*Y* 6/2), calcareous, massive to faintly bedded, moderately indurated. Unit contains a 1½-in. layer of claystone at 3,060.0 ft.
3,064.1	4.0	Sandstone, fine- to medium-grained, pale-olive (10*Y* 6/2) and dark greenish-gray (5*GY* 6/1), calcareous, massive to faintly bedded, well-indurated.
3,071.0	6.9	No core. Cuttings suggest same as above.
3,073.8	2.8	Sand, fine, greenish-gray (5*GY* 6/1), calcareous, massive, poorly indurated.
3,076.2	2.4	Sandstone, fine-grained, greenish-gray (5*GY* 6/1), calcareous, massive, moderately well indurated.
3,082.4	6.2	Sand, fine to medium, greenish-gray (5*GY* 6/1), calcareous, medium-bedded, moderately to poorly indurated. Unit contains some thin layers of silt and clay.
3,104.0	21.6	No core. Cuttings suggest same as above.
3,105.0	1.0	Sand, similar to sand at 3,082.4 ft.
3,135.0	30.0	No core. Cuttings suggest same as above.
3,152.5	17.5	Sand, similar to sand at 3,082.4 ft. Unit contains some thin layers (up to 3 in. thick) of clay and thin layers of silt.
3,167.0	14.5	No core. Cuttings suggest same as above.
3,168.3	1.3	Sand, similar to sand at 3,051.0 ft.
3,190.0	22.7	No core. Cuttings suggest same as above.
3,228.0	37.0	Not cored. Cuttings suggest that the material is an arkosic sand.
3,230.4	2.4	Sandstone, fine- to medium-grained, brownish-gray (5*YR* 4/1), calcareous, medium-bedded to thinly bedded, moderately well indurated.
3,236.8	6.4	Sand, fine to coarse, pale-olive (10*Y* 6/2), brownish-gray (5*YR* 4/1), greenish-gray (5*GY* 6/1), and olive-gray (5*Y* 4/1) alternating, calcareous, poorly sorted, medium-bedded, moderately indurated. Unit contains 3 layers (2½, 6, and 2½ in. thick) of sandstone at 3,233.5, 3,234.5, and 3,235.9 ft, respectively.
3,238.1	1.3	Sandstone, similar to sandstone at 3,230.4 ft. Unit contains some partings (up to ¼ in. thick) of clay.

Test hole 1—Continued

Depth (feet)	Unit thickness (feet)	Description
3,240.6	2.5	Sand, fine to coarse, pebbly, greenish-gray (5*GY* 6/1), calcareous, poorly sorted, massive, moderately indurated. Unit contains a 8½-in. layer of sandstone at 3,239.9 ft.
3,260.0	19.4	No core. Cuttings suggest same as above.
3,260.9	.9	Sand and sandstone (alternating). Sand is fine to coarse, brownish-gray (5*YR* 4/1) and light brownish-gray (6*YR* 2/1), calcareous, poorly sorted, moderately indurated. Sandstone is fine grained, light olive gray (5*Y* 6/1) and pale olive (10*Y* 6/2), calcareous, moderately well indurated. Unit is faintly to medium bedded.
3,263.0	2.1	Sandstone, fine- to coarse-grained, brownish-gray (5*YR* 4/1), calcareous, massive, well-indurated. Unit contains a 5-in. layer of siltstone at 3,260.9 ft, and many partings of clay. Bedding is horizontal.
3,267.2	4.2	Sandstone, fine- to medium-grained, greenish-gray (5*GY* 6/1), brownish-gray (5*YR* 4/1), and olive-gray (5*Y* 4/1), alternating, calcareous, faintly bedded, moderately indurated.
3,292.0	24.8	No core. Cuttings suggest same as above.
3,294.0	2.0	Sandstone, fine- to coarse-grained, pale-olive (10*Y* 6/2), very calcareous, poorly sorted, medium-bedded, well-indurated.
3,296.3	2.3	Sandstone and siltstone (alternating). Sandstone is fine grained, pale olive (10*Y* 6/2), calcareous, well indurated. Siltstone is grayish olive (10*Y* 4/2) to olive gray (5*Y* 3/2), calcareous, well indurated. Unit is thinly bedded.
3,297.3	1.0	Sandstone, fine- to medium-grained, pale-olive (10*Y* 6/2) to grayish-olive (10*Y* 4/2), calcareous, medium-bedded to thinly bedded, moderately well indurated. Unit contains plant remains.
3,298.2	.9	Sandstone and siltstone (alternating). Similar to unit at 3,296.3 ft. Unit is thinly bedded.
3,325.0	26.8	No core. Cuttings suggest same as above.
3,326.5	1.5	Sandstone and siltstone (alternating). Similar to unit at 3,296.3 ft. Unit is thinly bedded.
3,329.0	2.5	Sand, similar to sand at 3,240.6 ft. Unit contains 2 layers (8 and 2 in. thick) of sandstone at 3,327.1 and 3,328.3 ft, respectively. Bedding is horizontal.
3,355.0	26.0	No core. Cuttings suggest same as above.
3,357.2	2.2	Sandstone and siltstone (alternating). Similar to unit at 3,296.3 ft. Unit contains a quartz monzonitic cobble at 3,355.0 ft. Unit is thinly bedded.
3,358.2	1.0	Sand, fine to coarse, pebbly, pale-olive (10*Y* 6/2) to grayish-olive (10*Y* 4/2), calcareous, poorly sorted, massive, moderately indurated.
3,359.1	.9	Sandstone and siltstone (alternating). Similar to unit at 3,296.3 ft. Unit contains a 2½ in. layer of sandstone at 3,358.8 ft. Unit is thinly bedded.
3,387.0	27.9	No core. Cuttings suggest that the material is an arkosic sand.
3,388.0	1.0	Sand, similar to sand at 3,358.2 ft.

Test hole 1—Continued

Depth (feet)	Unit thickness (feet)	Description
3,420.0	32.0	No core. Cuttings suggest same as above.
3,421.3	1.3	Sand, fine to coarse, pebbly, brownish-gray (5*YR* 4/1), calcareous, poorly sorted, massive, moderately indurated.
3,427.0	5.7	No core. Cuttings suggest same as above.
3,428.4	1.4	Sandstone, very fine grained, light brownish-gray (5*YR* 6/1) to light olive-gray (5*Y* 6/1) and olive gray (5*Y* 4/1) alternating, calcareous, thinly bedded to laminated, cross-bedded, moderately well indurated.
3,432.2	3.8	Conglomerate. Scattered quartz monzonitic cobbles and numerous pebbles of quartz and feldspar in a fine to coarse, brownish-gray (5*YR*4/1), arkosic, micaceous (biotite) calcareous, argillaceous, poorly sorted, massive moderately well indurated, sand groundmass. Unit contains a 1-in. layer of sandstone at 3,431.0 ft.
3,460.0	27.8	No core. Cuttings suggest same as above.
3,490.0	30.0	Not cored. Cuttings suggest that the material is an arkosic sand.
3,491.8	1.8	Sandstone, similar to sandstone at 3,267.2 ft. Unit contains a 2½-in. layer of conglomerate at 3,491.4 ft.
3,500.0	8.2	No core. Cuttings suggest same as above.

Test hole 2

1,651.0	1.0	Sand, fine to coarse, slightly pebbly, light olive-gray (5*Y* 6/1), slightly calcareous, massive, moderately indurated.
1,664.0	13.0	No core. Cuttings suggest same as above.
1,665.0	1.0	Sand, similar to sand at 1,651.0 ft.
1,679.0	14.0	No core. Cuttings suggest same as above.
1,680.7	1.7	Silt and clay (alternating). Silt is pale olive (10*Y* 6/2) and greenish gray (5*GY* 6/1), arkosic, slightly calcareous, moderately indurated. Clay is grayish orange (10*YR* 7/4), light olive gray (5*Y* 6/1), and greenish gray (5*GY* 6/1), noncalcareous, slightly silty, moderately indurated. Unit contains some unoriented veinlets of heulandite. Unit is thinly bedded.
1,682.4	1.7	Sand, very fine, greenish gray (5*GY* 6/1) to yellowish-gray (5*Y* 7/2), noncalcareous, silty, massive, moderately indurated.
1,682.6	.2	Limestone, white (*N* 9) to very light gray (*N* 8), argillaceous, arenaceous, moderately well indurated.
1,683.4	.8	Siltstone, light greenish-gray (5*GY* 8/1), arkosic, very calcareous, arenaceous, moderately well indurated.
1,685.1	1.7	Sand, similar to sand at 1,651.0 ft. Unit contains a 1-in. layer of sand at 1,684.1 ft.
1,685.7	.6	Silt, light olive-gray (5*Y* 6/1) and yellowish-gray (5*Y* 7/2), arkosic, calcareous, massive, moderately indurated. Unit contains some thin lenses and layers of very calcareous clay.
1,695.0	9.3	No core. Cuttings suggest that the material is an arkosic sand, interbedded with clay and silt.

Test hole 2—Continued

Depth (feet)	*Unit thickness (feet)*	*Description*
1, 697. 8	2. 8	Silt, light olive-gray (5*Y* 6/1), arkosic, very calcareous, massive, moderately indurated.
1, 703. 8	6. 0	Sand, fine, pale-olive (10*Y* 6/2), calcareous, massive, poorly indurated. Unit contains a 3-in. layer of clay at 1,703.5 ft.
1, 708. 6	4. 8	Sand, very fine, yellowish-gray (5*Y* 7/2), calcareous, massive, moderately indurated. Unit contains a 9 in. layer of sand at 1,706.6 ft and some thin layers of silt in the upper 6 in.
1, 711. 8	3. 2	Sand, fine, yellowish-gray (5*Y* 7/2), calcareous, medium-bedded, moderately indurated. Unit contains a 1-in. layer of silt at 1,710.5 ft.
1, 713. 1	1. 3	Sand, silt, and clay (interbedded). Sand is fine to coarse, yellowish gray (5*Y* 7/2), calcareous, poorly indurated. Silt is yellowish gray (5*Y* 7/2), calcareous, moderately indurated. Clay is yellowish gray (5*Y* 7/2), calcareous, slightly silty, moderately indurated. Unit is thinly bedded.
1, 719. 4	6. 3	Sand, very fine, yellowish-gray (5*Y* 7/2) and pale-olive (10*Y* 6/2), calcareous, silty, massive, moderately indurated.
1, 722. 2	2. 8	Silt and clay (alternating). Silt is pale olive (10*Y* 6/2), calcareous, moderately indurated. Clay is moderate olive brown (5*Y* 4/4), calcareous, slightly silty, fractured, slickensided, moderately indurated.
1, 727. 0	4. 8	No core. Cuttings suggest same as above.
1, 731. 8	4. 8	Silt, yellowish-gray (5*Y* 7/2), very calcareous, massive to faintly bedded, moderately indurated. Unit contains a 4-in. layer of siltstone at 1,730.0 ft.
1, 733. 5	1. 7	Sand, fine to medium, pale-olive (10*Y* 6/2), greenish-gray (5*GY* 6/1), and light greenish-gray (5*G* 8/1) alternating, calcareous, medium-bedded, moderately indurated.
1, 734. 6	1. 1	Silt, similar to silt at 1,731.8 ft. Unit contains some partings of slightly silty clay.
1, 735. 4	. 8	Sand, similar to sand at 1,711.8 ft.
1, 739. 5	4. 1	Silt, pale-olive (10*Y* 6/2) and yellowish-gray (5*Y* 7/2), calcareous, medium-bedded, moderately indurated. Unit contains a 3½-in. layer of sand at 1,737.3 ft, and some partings of silty clay.
1, 744. 9	5. 4	Sand, very fine, yellowish-gray (5*Y* 7/2) and pale-olive (10*Y* 6/2), very calcareous, medium-bedded, moderately indurated. Unit contains a 5-in. layer of silt at 1,743.8 ft, and some partings of slightly silty clay. Bedding dips 20°.
1, 746. 7	1. 8	Silt, similar to silt at 1,739.5 ft. Unit contains some partings of slightly silty clay.
1, 747. 8	1. 1	Clay, moderate olive-brown (5*Y* 4/4), calcareous, slightly silty, massive, fractured, slickensided, moderately indurated.
1, 749. 0	1. 2	Silt, similar to silt at 1,739.5 ft.

Test hole 2—Continued

Depth (feet)	Unit thickness (feet)	Description
1,750.2	1.2	Clay, light olive-gray (5*Y* 5/2), very calcareous, slightly silty, fractured, slickensided, moderately indurated. Unit contains a 2-in. layer of siltstone at 1,749.8 ft.
1,752.9	2.7	Sand, similar to sand at 1,744.9 ft. Unit contains a 3-in. layer of calcareous clay at 1,750.2 ft and a 7-in. layer of very calcareous siltstone at 1,750.6 ft. Bedding dips 15°.
1,760.1	7.2	Siltstone, yellowish-gray (5*Y* 7/2), very calcareous, faintly bedded, moderately well indurated. Unit contains some partings of slightly slity clay. Bedding is slightly contorted.
1,761.5	1.4	Clay, similar to clay at 1,750.2 ft. Unit contains a 1-in. layer of siltstone at 1,761.0 ft.
1,762.5	1.0	Siltstone, yellowish-gray (5*Y* 7/2), very calcareous, massive to faintly bedded, moderately well indurated. Unit contains some partings of slightly silty clay.
1,765.8	3.3	Sand, silt, and clay (interbedded). Sand is similar to sand at 1,703.8 ft. Silt is similar to silt at 1,734.6 ft. Clay is grayish olive (10*Y* 4/2) and light olive gray (5*Y* 5/2), calcareous, slightly silty, moderately indurated. Unit contains a 6½-in. layer of siltstone at 1,765.2 ft. Unit is thinly bedded.
1,769.4	3.6	Clay, moderate olive-brown (5*Y* 4/4), calcareous, massive, moderately indurated, fractured, slickensided. Unit contains a 5-in. layer of very calcareous claystone at 1,765.8 ft and a 1½-in. layer of clayey silt at 1,767.1 ft.
1,771.8	2.4	Silt, very light gray (*N* 8), very calcareous, faintly bedded, moderately indurated. Unit contains a 6-in. layer of clay at 1,770.3 ft.
1,774.1	2.3	Clay, similar to clay at 1,769.4 ft. Unit contains a 3½-in. layer of claystone at 1,773.2 ft, and some thin lenses and blebs of white (*N* 9) calcite.
1,789.0	14.9	No core. Cuttings suggest same as above.
1,796.9	7.9	Clay, olive-gray (5*Y* 4/1), very calcareous, massive, fractured, slickensided, moderately indurated. Unit contains a 2½-in. layer of siltstone at 1,790.7 ft, a 1½-in. layer of claystone at 1,791.0 ft, and a 5-in. layer of silt at 1,793.4 ft. Local thin lenses and blebs of white (*N* 9) calcite are scattered throughout.
1,797.9	1.0	Silt, light greenish-gray (5*G* 8/1), calcareous, medium-bedded, moderately indurated. Unit contains partings of slightly silty clay.
1,805.9	8.0	Clay, light olive-gray (5*Y* 6/1) to brownish-gray (5*YR* 4/1) to olive-gray (5*Y* 4/1), calcareous, slightly silty, massive, fractured, slickensided, moderately indurated.
1,811.3	5.4	Siltstone, similar to siltstone at 1,760.1 ft. Unit contains a 2½-in. layer of sand at 1,811.1 ft, and partings of clay.

Test hole 2—Continued

Depth (feet)	Unit thickness (feet)	Description
1, 812. 7	1. 4	Silt and clay (alternating). Silt is similar to silt at 1,739.5 ft. Clay is grayish olive (10*Y* 4/2) to brownish black (5*YR* 2/1) and olive gray (5*Y* 4/1), calcareous. Unit is thinly bedded. Upper 9 in. of unit dips 5°; lower 8 in. dips 20°.
1, 813. 4	. 7	Clay, greenish-gray (5*GY* 6/1), calcareous, slightly silty, massive, fractured, slickensided, moderately indurated.
1, 820. 0	6. 4	No core. Cuttings suggest same as above.
1, 824. 0	4. 0	Claystone, light olive-gray (5*Y* 6/1), yellowish-gray (5*Y* 7/2), greenish-gray (5*GY* 6/1), and light bluish-gray (5*B* 7/1) alternating, calcareous, slightly silty, moderately well indurated. Unit contains a 3-in. layer of clay at 1,820.0 ft.
1, 827. 3	3. 3	Tuff, very light gray (*N* 8), noncalcareous, siliceous, bedded, moderately well indurated. Unit contains a 2-in. layer of clay at 1,825.7 ft.
1, 830. 0	2. 7	Clay, pale-olive (10*Y* 6/2) and light olive-gray (5*Y* 5/2), very calcareous, massive, moderately indurated. Unit contains a 7-in. layer of slightly silty clay at 1,827.3 ft.
1, 838. 0	8. 0	Clay, similar to clay at 1,750.2 ft. Unit contains a 2-in. layer of very calcareous clay at 1,832.1 ft.
1, 840. 9	2. 9	Sand, medium, slightly pebbly, yellowish-gray (5*Y* 7/2), very calcareous, medium-bedded, poorly indurated to unconsolidated. Unit contains a 2½-in. layer of clay at 1,838.0 ft.
1, 842. 5	2. 0	Sand, medium, light olive-gray (5*Y* 5/2) and pale-olive (10*Y* 6/2), slightly calcareous, massive, poorly indurated. Unit contains a 2½-in. layer of clay at 1,840.9 ft.
1, 851. 0	8. 1	No core. Cuttings suggest same as above.
1, 855. 0	4. 0	Clay, light olive-gray (5*Y* 5/2) to moderate olive-brown (5*Y* 4/4), slightly calcareous, slightly silty, slightly sandy, massive, moderately indurated. Unit contains some layers (up to ¼ in. thick) of very calcareous clay.
1, 858. 0	3. 0	Clay, white (*N* 9) to pale-olive (10*Y* 6/2) and light-brown (5*YR* 6/4), very calcareous, slightly silty, massive, moderately indurated. Clay minerals are montmorillonite and hydrous mica.
1, 860. 3	2. 3	Silt, similar to silt at 1,797.9 ft.
1, 862. 5	2. 2	Clay, moderate-brown (5*YR* 3/4), calcareous, massive, fractured, slickensided, poorly indurated. Unit contains a 5½-in. layer of silty clay at 1,862.0 ft.
1, 868. 5	6. 0	Silt, pale-olive (10*Y* 6/2) and light olive-gray (5*Y* 6/1), calcareous, massive, moderately indurated. Unit contains some partings of slightly silty clay.
1, 869. 5	1. 0	Clay, olive-gray (5*Y* 4/1) and dark greenish-gray (5*G* 4/1), calcareous, massive, moderately indurated.
1, 869. 9	. 4	Limestone, light greenish-gray (5*G* 8/1), very clayey, bedded, well-indurated.
1, 872. 5	2. 6	Clay, similar to clay at 1,869.5 ft.
1, 882. 0	9. 5	No core. Cuttings suggest same as above.

Test hole 2—Continued

Depth (feet)	Unit thickness (feet)	Description
1, 885. 4	3. 4	Silt, similar to silt at 1,868.5 ft. Unit contains a 1-in. layer of slightly silty clay at 1,882.0 ft and a 7-in. layer of sand at 1,882.1 ft.
1, 887. 9	2. 5	Sand, very fine, light olive-gray (5*Y* 6/1) and greenish-gray (5 *GY* 6/1), slightly calcareous, massive to faintly bedded, moderately indurated.
1, 888. 4	. 5	Sand, fine to coarse, pale-olive (10*Y* 6/2) to yellowish-gray (5*Y* 7/2), slightly calcareous, poorly sorted, massive, moderately indurated.
1, 889. 2	. 8	Sand, fine to medium, grayish-orange (10*YR* 7/4), noncalcareous, massive, moderately indurated.
1, 890. 4	1. 2	Clay, dark yellowish-brown (10*YR* 4/2), calcareous, silty, slightly sandy, massive, moderately indurated.
1, 891. 1	. 7	Sand, fine, grayish-orange (10*YR* 7/4) and light greenish-gray (5*G* 8/1), calcareous, massive, moderately indurated.
1, 892. 6	1. 5	Sand, similar to sand at 1,888.4 ft. Unit contains a 5-in. layer of calcareous sand at 1,892.2 ft.
1, 898. 5	5. 9	Sand, silt, and clay (interbedded). Sand is fine, greenish gray (5*GY* 6/1), slightly calcareous, moderately indurated. Silt is light olive gray (5*Y* 6/1), slightly calcareous, moderately indurated. Clay is moderate brown (5*YR* 4/4), slightly calcareous, slightly silty, moderately indurated. Unit is medium to thinly bedded.
1, 905. 0	6. 5	Sand, similar to sand at 1,840.9 ft. Unit contains a 9-in. layer of slightly calcareous silt at 1,904.2 ft.
1, 906. 1	1. 1	Sand, fine to medium, moderate-brown (5*YR* 4/4), calcareous, massive, moderately indurated.
1, 913. 0	6. 9	No core. Cuttings suggest same as above.
1, 939. 7	26. 7	Sand, silt, and clay (interbedded). Sand is fine to medium, light brown (5*YR* 6/4), moderate yellowish brown (10*YR* 5/4), pale yellowish brown (10*YR* 6/2), and yellowish gray (5*Y* 7/2), calcareous, moderately indurated. Clay is dark reddish brown (10*R* 3/4), slightly calcareous, slightly silty, moderately indurated. Silt is moderate brown (5*YR* 4/4), dark yellowish brown (10*YR* 4/2), and moderate yellowish brown (10*YR* 5/4), slightly calcareous, moderately indurated. Unit is medium bedded. Bedding dips 30°.
1, 944. 0	4. 3	No core. Cuttings suggest same as above.
1, 958. 4	14. 4	Sand, silt, and clay (interbedded). Similar to unit at 1,939.7 ft. Unit is medium bedded. Bedding dips 30°.
1, 960. 0	1. 6	Silt, light-brown (5*YR* 5/6), slightly calcareous, moderately indurated.
1, 960. 9	. 9	Sand, fine, yellowish-gray (5*Y* 7/2), calcareous, massive, moderately indurated.
1, 971. 8	10. 9	Sand, silt, and clay (interbedded). Similar to unit at 1,939.7 ft. Unit contains some thin lenses and blebs of white (*N* 9) calcite. Unit is medium bedded. Bedding dips 30°.
1, 975. 0	3. 2	No core. Cuttings suggest that the material is a claystone.

Test hole 2—Continued

Depth (feet)	Unit thickness (feet)	Description
1,994.1	19.1	Claystone, slightly silty, sandy, slightly pebbly, light-brown (5*YR* 5/6) to grayish-orange (10*YR* 7/4), micaceous (biotite), calcareous, massive, moderately well indurated.
2,006.0	11.9	No core. Cuttings suggest same as above.
2,015.9	9.9	Claystone, similar to unit at 1,994.1 ft.
2,018.8	2.9	Sandstone, sand, and clay (interbedded). Sandstone is fine to medium grained, yellowish gray (5*Y* 7/2) and white (*N* 9), arkosic, very calcareous, well indurated. Sand is fine to medium, yellowish gray (5*Y* 7/2), calcareous, moderately indurated. Clay is moderate brown (5*YR* 4/4), calcareous, slightly silty, moderately indurated. Unit is medium bedded.
2,023.6	4.8	Silt, moderate yellowish-brown (10*YR* 5/4) to grayish-orange (10*YR* 7/4) to pale yellowish-brown (10*YR* 6/2), calcareous, slightly sandy, massive, moderately indurated. Unit contains some blebs of white (*N* 9) calcite.
2,024.9	1.3	Sand, fine to coarse, slightly pebbly, grayish-orange (10*YR* 7/4), very calcareous, poorly sorted, massive, moderately indurated. Unit grades into next lower unit imperceptibly.
2,025.7	.8	Claystone, sandy, slightly pebbly, grayish-orange (10*YR* 7/4) to moderate brown (5*YR* 4/4), micaceous (biotite), calcareous, massive, moderately indurated.
2,027.6	1.9	Silt, light olive-gray (5*Y* 6/1), calcareous, slightly sandy, massive, moderately indurated.
2,031.2	3.6	Clay, pale yellowish-brown (10*YR* 6/2), moderate-brown (5*YR* 3/4), and yellowish-gray (5*Y* 7/2), slightly calcareous, silty, bedded, moderately indurated. Unit contains a 3½-in. layer of very calcareous sand at 2,030.1 ft and a 7-in. layer of silt at 2,030.5 ft. Blebs of yellowish-gray (5*Y* 7/2) silt give unit mottled appearance.
2,032.7	1.5	Sand, fine to coarse, grayish-orange (10*YR* 7/4) and yellowish-gray (5*Y* 7/2), calcareous, massive, moderately indurated. Unit contains a 5-in. layer of clay at 2,031.2 ft.
2,037.0	4.3	No core. Cuttings suggest same as above.
2,038.2	1.2	Silt, yellowish-gray (5*Y* 7/2) and grayish-orange (10*YR* 7/4), calcareous, moderately indurated. Unit contains a 1-in. layer of clay at 2,038.1 ft.
2,039.2	1.0	Sandstone, very fine grained, yellowish-gray (5*Y* 7/2), slightly calcareous, massive, well-indurated.
2,040.1	.9	Silt, similar to silt at 2,023.6 ft.
2,041.6	1.6	Claystone, similar to claystone at 2,025.7 ft.
2,044.0	2.3	Silt, grayish-orange (10*YR* 7/4) and light-brown (5*YR* 5/6), calcareous, slightly sandy, massive, moderately indurated.
2,045.2	1.2	Sand, fine to medium, pale yellowish-brown (10*YR* 6/2) and yellowish-gray (5*Y* 7/2), massive, moderately indurated.

Test hole 2—Continued

Depth (feet)	Unit thickness (feet)	Description
2,046.3	1.1	Silt, grayish-orange (10*YR* 7/4) and moderate-brown (5*YR* 4/4), calcareous, slightly sandy, massive, moderately indurated.
2,048.7	2.4	Claystone, similar to claystone at 2,025.7 ft.
2,052.1	3.4	Silt, similar to unit at 2,044.0 ft.
2,063.6	11.5	Claystone, silty, sandy, slightly pebbly, dark yellowish-brown (10*YR* 4/2), moderate yellowish-brown (10*YR* 5/4), and moderate-brown (5*YR* 3/4), micaceous (biotite), calcareous, massive, moderately well indurated.
2,069.0	5.4	No core. Cuttings suggest same as above.
2,083.9	14.9	Sand, fine to coarse, slightly pebbly, grayish-orange (10*YR* 7/4) to light-brown (5*YR* 5/6), calcareous, poorly sorted, massive to faintly bedded, moderately indurated. Unit contains a 5-in. layer of silt at 2,071.5 ft.
2,086.2	2.3	Silt, clay, and sand (interbedded). Silt is moderate brown (5*YR* 4/4), micaceous (biotite), calcareous, massive, moderately indurated. Clay is moderate brown (5*YR* 3/4), calcareous, slightly silty, slightly sandy, moderately indurated. Sand is fine to coarse, pale yellowish brown (10*YR* 6/2) and light greenish gray (5*GY* 8/1), calcareous, moderately indurated.
2,087.8	1.6	Silt, similar to sand at 2,038.2 ft. Unit contains a 4-in. layer of calcareous clayey sand at 2,087.5 ft.
2,089.3	1.5	Sand, similar to sand at 2,024.9 ft. Unit contains a 5-in. layer of silt at 2,087.8 ft.
2,090.5	1.2	Sand, similar to sand at 2,032.7 ft. Unit contains a 2-in. layer of silt at 2,089.3 ft.
2,091.4	.9	Siltstone, very pale orange (10*YR* 8/2), grayish-orange (10*YR* 7/4), and dark yellowish-orange (10*YR* 6/6), very calcareous, massive, moderately well indurated.
2,092.2	.8	Silt, similar to silt at 2,038.2 ft.
2,099.0	6.8	No core. Cuttings suggest same as above.
2,104.4	5.4	Sand, similar to sand at 2,083.9 ft. Unit contains a 2½-in. layer of clay at 2,099.0 ft and a 2-in. layer of sandstone at 2,099.2 ft.
2,106.8	2.4	Sand, fine to coarse, light olive-gray (5*Y* 6/1), calcareous, massive, moderately indurated.
2,108.8	2.0	Silt, yellowish-gray (5*Y* 7/2), calcareous, massive, moderately indurated. Unit contains a 6-in. layer of clay at 2,108.3 ft.
2,110.3	1.3	Sand, fine to coarse, light-brown (5*YR* 6/4), calcareous, poorly sorted, massive, moderately indurated. Unit contains a 2½-in. layer of sand at 2,108.8 ft.
2,111.3	1.0	Claystone, sandy, moderate-brown (5*YR* 4/4), micaceous (biotite), slightly calcareous, massive, moderately indurated.
2,113.1	1.8	Sand, fine to coarse, moderate-brown (5*YR* 4/4), slightly calcareous, poorly sorted, massive, moderately indurated.
2,114.2	1.1	Claystone, similar to claystone at 2,111.3 ft.
2,129.0	14.8	No core. Cuttings suggest same as above.

Test hole 2—Continued

Depth (feet)	Unit thickness (feet)	Description
2,130.0	1.0	Sand, fine, yellowish-gray (5*Y* 7/2), calcareous, massive, moderately indurated.
2,159.0	29.0	No core. Cuttings suggest same as above.
2,160.0	1.0	Claystone, light olive-gray (5*Y* 5/2), calcareous, massive, well-indurated.
2,161.0	1.0	Sand and clay (alternating). Sand is fine to coarse, yellowish gray (5*Y* 7/2), calcareous, poorly sorted, massive, moderately indurated. Clay is dark yellowish brown. (10*YR* 4/2), noncalcareous, massive, moderately indurated.
2,174.0	13.0	No core. Cuttings suggest same as above.
2,179.2	5.2	Sand, fine to coarse, pale-olive (10*Y* 6/2), moderate yellowish-brown (10*YR* 5/4), and moderate brown (5*YR* 4/4) alternating, calcareous, medium-bedded, moderately indurated. Unit contains some layers (up to 3 in. thick) of slightly silty clay. Bedding dips 15°.
2,180.2	1.0	Silt, similar to silt at 2,046.3 ft.
2,183.8	3.6	Sand, fine to coarse, dark yellowish-brown (10*YR* 4/2) to pale yellowish-brown (10*YR* 6/2), calcareous, poorly sorted, massive, moderately indurated. Unit contains a 9-in. layer of clayey sand at 2,180.2 ft.
2,186.2	2.4	Silt, light-brown (5*YR* 5/6), calcareous, slightly sandy, massive, moderately indurated. Unit contains a 1½-in. layer of sand at 2,183.8 ft.
2,188.5	2.3	Sand, similar to sand at 2,179.2 ft.
2,190.0	1.5	No core. Cuttings suggest same as above.
2,191.0	1.0	Silt, similar to unit at 2,108.8 ft.
2,253.0	62.0	No core. Cuttings suggest that the material is an arkosic sand, interbedded with some layers of silt and clay.
2,283.0	30.0	Not cored. Cuttings suggest same as above.
2,298.0	15.0	No core. Cuttings suggest same as above.
2,328.0	30.0	Not cored. Cuttings suggest same as above.

Test hole 3

106.0	106.0	No core. Cuttings suggest that the material is an arkosic sand, interbedded 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, slightly pebbly, grayish-orange (10*YR* 7/4) and dark yellowish-orange (10*YR* 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 sand at 172.5 ft.
228.0	29.9	No core. Cuttings suggest same as above.
229.0	1.0	Sand, similar to sand at 172.5 ft.
258.0	29.0	No core. Cuttings suggest same as above.
259.0	1.0	Claystone, sandy, slightly pebbly, dark yellowish-orange (10*YR* 6/6), micaceous (biotite), massive, moderately well indurated.
288.0	29.0	No core. Cuttings suggest that the material is an arkosic sand, interbedded with some thin layers of silt and clay.

Test hole 3—Continued

Depth (feet)	Unit thickness (feet)	Description
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	. 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.
383. 0	33. 0	No core. Cuttings suggest same as above.
384. 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, pebbly, grayish-orange (10*YR* 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. Bedding dips 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.
633. 2	8. 2	Claystone, slightly sandy, pebbly, yellowish-gray (5*Y* 7/2), micaceous (biotite), 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, silty, pale yellowish-orange (10*YR* 8/6) and yellowish-gray (5*Y* 7/2) alternating, 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, silty, pale yellowish-orange (10*YR* 8/6) and white (*N* 9) alternating, calcareous, tuffaceous, bentonitic, thinly bedded to laminated, moderately indurated. Bedding dips from 20° to 40°.
659. 0	4. 0	Sand, very fine, moderate-yellow (5*Y* 7/6) and light olive-gray (5*Y* 6/1), very calcareous, faintly bedded, moderately indurated. Unit contains some thin 1-in. layers of clay.
660. 3	1. 3	Clay, silty, pale yellowish-orange (10*YR* 8/6) and white (*N* 9) alternating, calcareous, thinly bedded, moderately indurated. Bedding dips 25°.
665. 6	5. 3	Sand, fine, grayish-yellow (5*Y* 8/4) and white (*N* 9), calcareous, faintly bedded, moderately indurated.

Test hole 3—Continued

Depth (feet)	*Unit thickness (feet)*	*Description*
685.0	19.7	No core. Cuttings suggest same as above.
688.8	3.8	Sand, fine to coarse, moderate-yellow (5*Y* 7/6), yellowish-gray (5*Y* 7/2), and white (*N* 9), calcareous, massive, poorly indurated.
697.9	9.1	Clay, moderate-yellow (5*Y* 7/6), yellowish-gray (5*Y* 7/2), and moderate reddish-brown (10*YR* 4/6), calcareous, slightly silty, medium-bedded to thinly bedded, moderately indurated. Bedding dips 15°.
699.2	1.3	Sand, very fine, yellowish-gray (5*Y* 7/2), calcareous, slightly silty, bedded, poorly indurated.
700.9	1.7	Clay, dusky-yellow (5*Y* 6/1) and pale-olive (10*Y* 6/2), calcareous, slightly silty, bedded, poorly indurated.
710.0	9.1	Sand, fine to medium, dark yellowish-orange (10*YR* 6/6), pale-olive (10*Y* 6/2), and white (*N* 9) alternating, medium-bedded to thinly bedded, moderately indurated. Bedding dips 25°.
711.3	1.3	Silt, dark yellowish-orange (10*YR* 6/6), pale-olive (10*Y* 6/2), and white (*N* 9) alternating, calcareous, medium-bedded, moderately indurated.
713.6	2.3	Sand, silt, and clay (interbedded). Sand is fine, dark yellowish orange (10*YR* 6/6) and yellowish gray (5*Y* 7/2), calcareous, bedded, moderately indurated. Silt is dark yellowish orange (10*YR* 6/6) and yellowish gray (5*Y* 7/2), calcareous, bedded, moderately indurated. Clay is pale olive (10*Y* 6/2), slightly calcareous, slightly silty, moderately indurated. Bedding dips 15°.
715.0	1.4	Clay, dark yellowish-orange (10*YR* 6/6) and olive-gray (10*Y* 6/2), slightly calcareous, silty, bedded, moderately indurated.
716.2	1.2	Silt, pale yellowish-orange (10*YR* 8/6) and yellowish-gray (5*Y* 7/2) alternating, calcareous, medium-bedded to thinly bedded, moderately to poorly indurated. Bedding dips 25°.
717.0	.8	No core. Cuttings suggest same as above.
719.4	2.4	Clay, pale yellowish-orange (10*YR* 8/6), dark yellowish-orange (10*YR* 6/6), and pale-olive (10*Y* 6/2) alternating, calcareous, slightly silty, medium-bedded to thinly bedded, moderately indurated. Unit contains 3 layers (3, 3½, and 2½ in. thick) of calcareous clayey silt at 717.9, 718.7, and 719.0 ft, respectively. Bedding dips 20°.
748.3	28.9	Sand, very fine, pale yellowish-orange (10*YR* 8/6), dusky-yellow (5*Y* 6/4), and pale-olive (10*Y* 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	.7	No core. Cuttings suggest same as above.

Test hole 3—Continued

Depth (feet)	Unit thickness (feet)	Description
765. 1	16. 1	Sand, fine to medium, dark yellowish-orange (10*YR* 6/6), dark yellowish-brown (10*YR* 4/2), and yellowish-gray (5*Y* 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 (5*GY* 4/1), dark reddish-brown (10*R* 3/4), and pale-olive (10*Y* 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 (10*YR* 6/6), dark reddish-brown (10*R* 3/4), yellowish-gray (5*Y* 7/2), and greenish-gray (5*GY* 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 (5*GY* 6/1), slightly calcareous, massive, moderately indurated.
801. 9	12. 6	Clay, greenish-gray (5*GY* 6/1), dark yellowish-orange (10*YR* 6/6), and pale-olive (10*Y* 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 and some layers (up to 3 in. thick) of calcareous silt.
809. 0	7. 1	No core. Cuttings suggest same as above.
816. 2	7. 2	Clay, greenish-gray (5*GY* 6/1), calcareous, massive to faintly bedded, moderately indurated. Bedding dips from 25° to 32°.
818. 0	1. 8	Sand, medium, greenish-gray (5*GY* 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 (5*GY* 6/1), calcareous, massive, moderately indurated.
842. 8	8. 4	Clay, grayish olive-green (5*GY* 3/2) to greenish-gray (5*GY* 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 (5*GY* 3/2) to greenish-black (5*G* 2/1) to dark greenish-gray (5*GY* 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 (10*YR* 6/6) to pale yellowish-orange (10*YR* 8/6), light-brown (5*YR* 6/4), greenish-gray (5*GY* 6/1), and white (*N* 9), slightly calcareous, limonitic, silty, massive to faintly bedded, fractured, moderately indurated. Bedding dips 25°.
894. 4	10. 1	Sandstone, fine-grained, moderate yellowish-brown (10*YR* 5/4) to dark yellowish-orange (10*YR* 6/6), calcareous, silty, massive, moderately well indurated. Unit contains some thin layers of white (*N* 9) calcite.

Test hole 3—Continued

Depth (feet)	Unit thickness (feet)	Description
904.0	9.6	Clay, light brownish-gray (5*YR* 6/1), olive-gray (5*Y* 4/1), and greenish-gray (5*GY* 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	.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 (5*GY* 3/2), grayish-olive (10*Y* 4/2), yellowish-gray (5*Y* 7/2), and greenish-gray (5*GY* 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, and some lenses (up to ½ in. thick) of white (*N* 9) calcite.
951.3	1.6	Sandstone, fine-grained, greenish-gray (5*GY* 6/1), calcareous, massive, moderately well indurated.
959.6	8.3	Clay, dark greenish-gray (5*GY* 4/1) and greenish-gray (5*GY* 6/1), calcareous, faintly bedded, moderately indurated. Unit contains a 3½-in. layer of sandstone at 955.5 ft, and many flecks and layers (up to ⅛ 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 (5*GY* 4/1), grayish olive-green (5*GY* 3/2), medium bluish-gray (5*B* 5/1), and greenish-gray (5*GY* 6/1) alternating, calcareous, slightly silty, massive to faintly bedded, moderately indurated. Unit contains scattered flecks of white (*N* 9) calcite. Montmorillonite and 2 zeolite minerals (analcime, heulandite) occur at 976.0 ft. Bedding dips from 20° to 35°.
993.0	3.1	No core. Cuttings suggest same as above.
1,017.3	24.3	Clay, similar to clay at 989.9 ft. Unit contains 2 layers (9 and 6 in. thick) of sand at 1,012.5 and 1,015.3 ft, respectively.
1,023.0	5.7	No core. Cuttings suggest same as above.
1,024.5	1.5	Sand, silt, and clay (interbedded). Sand is fine to coarse, greenish gray (5*GY* 6/1), slightly calcareous, moderately indurated. Silt is greenish gray (5*GY* 6/1), calcareous, moderately indurated. Clay is greenish gray (5*GY* 6/1), calcareous, moderately indurated. Unit is thinly bedded.
1,025.6	1.1	Clay, similar to clay at 816.2 ft. Unit dips 7°.
1,027.1	1.6	Clay, olive-black (5*Y* 2/1), olive-gray (5*Y* 4/1), and grayish olive-green (5*GY* 3/2) alternating, calcareous, thinly bedded to laminated, moderately indurated.

Test hole 3—Continued

Depth (feet)	Unit thickness (feet)	Description
1,039.9	12.8	Clay, grayish olive-green (5*GY* 3/2), light olive-gray (5*Y* 5/2), yellowish-gray (5*Y* 7/2), and greenish-gray (5*GY* 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.
1,053.0	13.1	No core. Cuttings suggest same as above.
1,054.3	1.3	Clay, grayish olive-green (5*GY* 3/2), yellowish-gray (5*Y* 7/2), and white (*N* 9) alternating, calcareous, silty, medium-bedded to thinly bedded, moderately indurated. Bedding dips 20°.
1,084.0	29.7	No core. Cuttings suggest same as above.
1,084.8	.8	Clay, greenish-gray (5*GY* 6/1), calcareous, faintly bedded, moderately indurated.
1,086.2	1.4	Siltstone, greenish-gray (5*GY* 6/1) to light-gray (*N* 7), calcareous, faintly bedded, well-indurated.
1,087.5	1.3	Silt, very light gray (*N* 8), calcareous, moderately indurated. Unit contains some thin lenses of calcareous clay.
1,093.1	5.6	Clay, dark greenish-gray (5*GY* 4/1), grayish olive-green (5*GY* 3/2), yellowish-gray (5*Y* 7/2), and greenish-gray (5*GY* 6/1) alternating, calcareous, silty, medium-bedded to thinly bedded, moderately indurated. Bedding dips from 12° to 20°.
1,094.2	1.1	Sand, fine to medium, yellowish-gray (5*Y* 7/2), dark yellowish-orange (10*YR* 6/6), and pale-olive (10*Y* 6/2), calcareous, moderately indurated.
1,114.0	19.8	No core. Cuttings suggest same as above.
1,122.5	8.5	Sand, fine to medium, dark yellowish-orange (10*YR* 6/6), pale yellowish-orange (10*YR* 8/6), moderate-red (5*R* 4/6), dark yellowish-brown (10*YR* 4/2), and greenish-gray (5*GY* 6/1) alternating, calcareous, moderately indurated. Bedding dips 20°.
1,126.5	4.0	Sand, silt, and clay (interbedded). Sand is fine, yellowish gray (5*Y* 7/2), calcareous, moderately indurated. Silt is pale yellowish brown (10*YR* 6/2), calcareous, moderately indurated. Clay is dark yellowish brown (10*YR* 4/2) and moderate red (5*R* 4/6), slightly calcareous, slightly silty, moderately indurated. Unit is thinly bedded. Bedding dips 30°.
1,135.0	8.5	No core. Cuttings suggest same as above.
1,139.1	4.1	Sand and clay (alternating). Sand is fine, yellowish gray (5*Y* 7/2), calcareous, moderately indurated. Clay is dark yellowish brown (10*YR* 4/2) and moderate red (5*R* 4/6), slightly calcareous, slightly silty, moderately indurated. Unit is thinly bedded.
1,144.1	5.0	Sand, fine, grayish orange-pink (5*YR* 7/2), yellowish-gray (5*Y* 7/2), and dusky-yellow (5*Y* 6/4), calcareous, medium-bedded to thinly bedded, moderately to poorly indurated.
1,153.0	8.9	No core. Cuttings suggest same as above.
1,176.0	23.0	Sand, similar to sand at 1,144.1 ft. Unit contains an 8½-in layer of clay at 1,156.8 ft.

Test hole 3—Continued

Depth (feet)	Unit thickness (feet)	Description
1,183.0	7.0	No core. Cuttings suggest same as above.
1,200.0	17.0	Sand, fine, moderate-red (5*R* 4/6), pale yellowish-brown (10*YR* 6/2), grayish olive-green (5*GY* 3/2), and very light gray (*N* 8) alternating, calcareous, medium-bedded to thinly bedded, crossbedded, moderately indurated. Bedding is slightly contorted.
1,206.2	6.2	Silt, moderate-red (5*R* 4/6), pale yellowish-brown (10*YR* 6/2), grayish olive-green (5*GY* 3/2), and very light gray (*N* 8) alternating, calcareous, medium-bedded to thinly bedded, crossbedded, moderately indurated.
1,212.2	6.0	Clay, moderate-red (5*R* 4/6), pale yellowish-brown (10*YR* 6/2), grayish olive-green (5*GY* 3/2), and very light gray (*N* 8) alternating, calcareous, sandy, very silty, thinly bedded to laminated, moderately indurated.
1,215.0	2.8	No core. Cuttings suggest same as above.
1,226.9	11.9	Claystone, greenish-gray (5*GY* 6/1), greenish-black (5*GY* 2/1), light olive-gray (5*Y* 6/1), and moderate-brown (5*YR* 3/4) alternating, slightly calcareous, slightly silty, medium-bedded to thinly bedded, fractured, slickensided, well-indurated. Unit contains some layers (up to 1 in. thick) of sandstone.
1,247.0	20.1	No core. Cuttings suggest same as above.
1,256.3	9.3	Sand, fine, pale yellowish-orange (10*YR* 8/6), moderate-red (5*R* 5/4), and yellowish-gray (5*Y* 7/2), calcareous, medium-bedded to thinly bedded, moderately indurated. Unit contains a 2½-in. layer of clay at 1,248.5 ft. Bedding dips 30°.
1,258.1	1.8	Tuff, white (*N* 9), micaceous (biotite), slightly calcareous, bedded, moderately indurated.
1,279.0	20.9	No core. Cuttings suggest that the material is a sand interbedded with some thin layers of silt and clay.
1,282.0	3.0	Clay, grayish olive-green (5*GY* 3/2) and greenish-gray (5*GY* 6/1) alternating, calcareous, very silty, thinly bedded, crossbedded, moderately indurated. Bedding dips 30°.
1,282.9	.9	Sandstone and siltstone (alternating). Sandstone is fine to medium grained, yellowish gray (5*Y* 7/2), very calcareous, well indurated. Siltstone is greenish gray (5*GY* 6/1), calcareous, moderately well indurated. Unit is thinly bedded.
1,289.9	7.0	Sand, very fine, dark yellowish-orange (10*YR* 6/6), light olive-gray (5*Y* 6/1), and pale-olive (10*Y* 6/2) alternating, calcareous, thinly bedded to laminated, moderately indurated. Unit contains a 9½-in. layer of clay at 1,282.9 ft.
1,295.0	5.1	No core. Cuttings suggest same as above.
1,317.6	22.6	Sand, fine, yellowish-gray (5*Y* 7/2) and pale-olive (10*Y* 6/2), calcareous, medium-bedded to thinly bedded, moderately to poorly indurated. Unit contains some thin layers (up to ¼ in. thick) of clay, and a 3½-in. layer of clay at 1,301.4 ft.

Test hole 3—Continued

Depth (feet)	Unit thickness (feet)	Description
1,324.0	6.4	No core. Cuttings suggest same as above.
1,325.1	1.1	Claystone, pale-olive (10*Y* 6/2) to grayish-olive (10*Y* 4/2), slightly calcareous, silty, massive, well-indurated.
1,331.6	6.5	Sandstone, fine- to medium-grained, yellowish-gray (5*Y* 7/2) and greenish-gray (5*GY* 6/1), calcareous, massive to medium-bedded, moderately well indurated.
1,332.5	.9	Claystone, similar to claystone at 1,325.1 ft.
1,332.7	.2	Analcime, white (*N* 9), bedded.
1,335.4	2.7	Siltstone, grayish-olive (10*Y* 4/2) and greenish-gray (5*GY* 6/1) alternating, slightly calcareous, medium-bedded to thinly bedded, moderately well indurated.
1,336.2	.8	Claystone, similar to claystone at 1,332.5 ft.
1,354.0	17.8	No core. Cuttings suggest same as above
1,354.9	.9	Claystone, similar to claystone at 1,332.5 ft.
1,356.1	1.2	Siltstone, greenish-gray (5*GY* 6/1), calcareous, massive, moderately well indurated.
1,374.0	17.9	No core. Cuttings suggest same as above.
1,393.7	19.7	Clay, grayish-olive (10*Y* 4/2), pale-olive (10*Y* 6/2), and medium-gray (*N* 5) alternating, calcareous, slightly silty, thinly bedded to laminated, moderately indurated. Bedding is slightly contorted, the dip irregular.
1,394.0	.3	No core. Cuttings suggest same as above
1,405.0	11.0	Clay, brownish-gray (5*YR* 4/1), grayish-olive (10*Y* 4/2), and yellowish-gray (5*Y* 7/2) alternating, calcareous, very silty, slightly sandy, thinly bedded to laminated, moderately indurated.
1,419.0	14.0	No core. Cuttings suggest same as above.
1,448.0	29.0	Clay, similar to clay at 1,405.0 ft. Unit contains numerous thin layers of silt, two 2-in. layers of very calcareous sandstone at 1,427.5 and 1,440.0 ft, respectively, and montmorillonite, analcime, hydrous mica, and chlorite at 1,430.0 ft.
1,450.0	2.0	No core. Cuttings suggest same as above.
1,478.9	28.9	Clay, grayish-olive (10*Y* 4/2) to brownish-gray (5*YR* 4/1) and dark greenish-gray (5*GY* 4/1), slightly calcareous, slightly silty, faintly bedded, moderately indurated. Unit contains some flecks and layers (up to ¾ in. thick) of white (*N* 9) crystalline colemanite; it also contains analcime and chlorite. Borax and halite present in water-soluble fraction.
1,481.0	2.1	No core. Cuttings suggest same as above.
1,521.4	40.4	Clay, similar to clay at 1,478.9 ft. Unit contains numerous thin layers of silt; also numerous flecks and thin lenses of white (*N* 9) crystalline colemanite; and analcime, hydrous mica, and chlorite at 1,515.0 ft. Bedding dips 5°.
1,529.7	8.3	Silt, pale-olive (10*Y* 6/2) and grayish-olive (10*Y* 4/2) alternating, calcareous, slightly sandy, thinly bedded to laminated, moderately indurated. Bedding dips from 50° to 60°.
1,540.0	10.3	No core. Cuttings suggest same as above.

Test hole 3—Continued

Depth (feet)	Unit thickness (feet)	Description
1, 556. 0	16. 0	Silt and clay (alternating). Silt is yellowish gray (5*Y* 7/2), calcareous, moderately indurated. Clay is light olive gray (5*Y* 5/2), grayish olive (10*Y* 4/2), and dark greenish gray (5*GY* 4/1), slightly calcareous, slightly silty, moderately indurated. Unit is medium to thinly bedded. Bedding dips 40°.
1, 570. 0	14. 0	No core. Cuttings suggest same as above.
1, 573. 1	3. 1	Silt, light-brown (5*YR* 6/1) and yellowish-gray (5*Y* 7/2), very calcareous, thinly bedded to laminated, moderately indurated. Dip is irregular, from 15° to 20°.
1, 601. 0	27. 9	No core. Cuttings suggest same as above.
1, 624. 2	23. 2	Clay, grayish-olive (10*Y* 4/2) and medium bluish-gray (5*B* 5/1), calcareous, silty, massive to thinly bedded, locally laminated, crossbedded, moderately indurated. Unit contains numerous thin layers of silt: it also contains analcime, hydrous mica, and chlorite at 1,621.0 ft.
1, 664. 0	31. 0	Silt and clay (alternating). Silt is pale olive (10*Y* 6/2) and yellowish gray (5*Y* 7/2), calcareous, bedded, moderately indurated. Clay is grayish olive (10*Y* 4/2), calcareous, silty, moderately indurated. Unit is thinly bedded to laminated. Dip is irregular, from 5° to 15°.
1, 692. 7	28. 7	Clay, similar to clay at 1,624.2 ft. Unit contains a 6-in. layer of sandstone at 1,685.5 ft, some thin layers of silt, and analcime, hydrous mica, and chlorite at 1,676.0 ft.
1, 696. 0	3. 3	No core. Cuttings suggest same as above.
1, 712. 2	16. 2	Clay, dark-gray (*N* 3), grayish-olive (10*Y* 4/2), and moderate-yellow (5*Y* 7/6), calcareous, thinly bedded, fractured, slickensided, moderately indurated, with coatings of realgar and orpiment along bedding planes. Unit contains an 8½-in. layer of siltstone at 1,701.5 ft; some flecks and lenses (up to 1 in. thick) of white (*N* 9) calcite; and analcime, hydrous mica, and iron sulphide at 1,700.0 ft.
1, 728. 0	11. 8	No core. Cuttings suggest same as above.
1, 734. 0	6. 0	Clay, similar to clay at 1,712.2 ft. Unit contains a 5-in. layer of sandstone at 1,731.5 ft, and some thin layers of silt.
1, 760. 0	26. 0	No core. Cuttings suggest that the material is an arkosic fine sand and silt, interbedded with some thin layers of clay.
1, 761. 5	1. 5	Siltstone, light olive-gray (5*Y* 6/1) and moderate-brown (5*YR* 3/4), calcareous, slightly sandy, medium-bedded to thinly bedded, moderately well indurated.
1, 791. 0	29. 5	No core. Cuttings suggest same as above.
1, 793. 9	2. 9	Silt and clay (alternating). Silt is light brown (5*YR* 6/4), pale yellowish brown (10*YR* 6/2), and pale olive (10*Y* 6/2) alternating, calcareous, moderately indurated. Clay is light brownish gray (5*YR* 6/1), light brown (5*YR* 6/4), pale yellowish brown (10*YR* 6/2), and pale-olive (10*Y* 6/2) alternating, calcareous, slightly silty, moderately indurated. Unit is thinly bedded.

Test hole 3—Continued

Depth (feet)	Unit thickness (feet)	Description
1,795.1	1.2	Sandstone, fine- to medium-grained, greenish-gray (5*GY* 6/1), noncalcareous, medium-bedded, moderately well indurated. Unit contains a 2-in. layer of sandstone at 1,794.9 ft.
1,824.0	28.9	No core. Cuttings suggest same as above.
1,825.0	1.0	Silt and clay (alternating). Silt is greenish gray (5*GY* 6/1), calcareous, moderately indurated. Clay is grayish olive (10*Y* 4/2), calcareous, slightly silty, moderately indurated. Bedding is slightly contorted.
1,825.8	.8	Sandstone, fine- to medium-grained, grayish-green (10*GY* 5/2), very calcareous, massive, moderately well indurated.
1,829.1	3.3	Silt and clay (alternating). Silt is pale olive (10*Y* 6/2) and greenish gray (5*GY* 6/1), calcareous, moderately indurated. Clay is dark greenish gray (5*GY* 4/1) and grayish olive (10*Y* 4/2), calcareous, slightly silty, moderately indurated. Bedding is slightly contorted.
1,856.0	26.9	No core. Cuttings suggest same as above.
1,857.3	1.3	Sand, fine to coarse, greenish-gray (5*GY* 6/1), calcareous, massive, poorly indurated to unconsolidated.
1,858.3	1.0	Conglomerate. Numerous subrounded cobbles (quartz monzonitic) in a ground mass of greenish-gray (5*GY* 6/1) slightly calcareous fine to coarse massive moderately indurated sand.
1,888.0	29.7	No core. Cuttings suggest same as above.
1,889.0	1.0	Conglomerate, similar to conglomerate at 1,858.3 ft.
1,904.0	15.0	No core. Cuttings suggest same as above.
1,905.0	1.0	Conglomerate, similar to conglomerate at 1,858.3 ft.
1,920.0	15.0	No core. Cuttings suggest same as above.
1,940.0	20.0	Not cored. Cuttings suggest same as above.
1,941.0	1.0	Conglomerate, similar to conglomerate at 1,858.3 ft.
1,945.0	4.0	No core. Cuttings suggest same as above.
2,033.0	88.0	Not cored. Cuttings suggest same as above.
2,034.0	1.0	Conglomerate, similar to conglomerate at 1,858.3 ft.
2,043.0	9.0	No core. Cuttings suggest same as above.
2,100.0	57.0	Not cored. Cuttings suggest same as above.
2,101.0	1.0	Conglomerate, similar to conglomerate at 1,858.3 ft.
2,106.0	5.0	No core. Cuttings suggest same as above.
2,139.0	33.0	Not cored. Cuttings suggest same as above.
2,140.2	1.2	Conglomerate, similar to conglomerate at 1,858.3 ft.
2,147.0	6.8	No core. Cuttings suggest same as above.
2,209.0	62.0	Not cored. Cuttings suggest same as above.
2,226.9	17.9	Sand, fine to medium, greenish-gray (5*GY* 5/2) and very light gray (*N* 8), calcareous, massive to medium-bedded, moderately indurated. Unit contains some thin layers of clay.
2,239.0	12.1	No core. Cuttings suggest same as above.
2,240.0	1.0	Claystone, grayish-olive (10*Y* 4/2) to yellowish-gray (5*Y* 7/2), very calcareous, slightly sandy, massive, moderately well indurated.

Test hole 3—Continued

Depth (feet)	Unit thickness (feet)	Description
2, 241. 0	1. 0	Sandstone, fine-grained, greenish-gray (5*GY* 6/1) to light-gray (*N* 7), very calcareous, bedded, well-indurated. Bedding dips 25°.
2, 245. 5	4. 5	Sandstone, fine- to coarse-grained, light bluish-gray (5*B* 7/1) to greenish-gray (5*GY* 6/1), calcareous, poorly sorted, massive, well-indurated. Unit contains a 8½-in. layer of sandstone at 2,244.8 ft.
2, 247. 3	1. 8	Sand, fine to coarse, slightly pebbly, grayish-green (5*G* 5/2) to moderate blue-green (5*BG* 4/6), very calcareous, poorly sorted, massive, moderately well indurated.
2, 269. 0	21. 7	No core. Cuttings suggest same as above.
2, 270. 0	1. 0	Sand, similar to sand at 2,247.3 ft.
2, 304. 0	34. 0	No core. Cuttings suggest same as above.
2, 305. 0	1. 0	Sand, similar to sand at 2,247.3 ft. Unit contains a thin layer of sandstone at 2,304.5 ft.
2, 336. 0	31. 0	No core. Cuttings suggest same as above.
2, 401. 0	65. 0	Not cored. Cuttings and drilling characteristics suggest that the predominant material probably is a pebble and cobble (quartz monzonitic) conglomerate, interbedded with some layers of sand.
2, 402. 0	1. 0	Sandstone, fine- to medium-grained, light brownish-gray (5*YR* 6/1) and greenish-gray (5*GY* 6/1) alternating, calcareous, medium-bedded to thinly bedded, moderately well indurated.
2, 403. 0	1. 0	Conglomerate, similar to conglomerate at 1,858.3 ft.
2, 421. 0	18. 0	No core. Cuttings suggest same as above.
2, 522. 0	101. 0	Not cored. Cuttings and drilling characteristics suggest that the predominant material probably is a pebble and cobble (quartz monzonitic) conglomerate, interbedded with some layers of sand.
2, 524. 0	2. 1	Sand, very fine, dark greenish-gray (5*GY* 4/1) and greenish-gray (5*GY* 6/1) alternating, calcareous, silty, medium-bedded to thinly bedded, moderately indurated. Unit contains a 3-in. layer of sandstone at 2,522.0 ft. Bedding is contorted.
2, 525. 0	1. 0	Sandstone, similar to sandstone at 2,245.5 ft. Unit contains a 2-in. layer of sand at 2,524.8 ft.
2, 553. 0	28. 0	No core. Cuttings suggest same as above.
2, 556. 1	3. 1	Claystone, dark-gray (*N* 3), medium bluish-gray (5*B* 5/1), grayish olive-green (5*GY* 3/2), and light olive-gray (5*Y* 6/1) alternating, calcareous, slightly silty, thinly bedded to laminated, moderately well indurated.
2, 557. 7	1. 6	Silt and clay (interbedded). Silt is greenish gray (5*GY* 6/1), calcareous, moderately indurated. Clay is dark greenish gray (5*G* 4/1), slightly calcareous, slightly silty, moderately indurated. Unit is medium to thinly bedded.
2, 565. 0	7. 3	Claystone, similar to claystone at 2,556.1 ft. Unit contains hydrous mica.
2, 568. 0	3. 0	No core. Cuttings suggest same as above.

Test hole 4

Depth (feet)	Unit thickness (feet)	Description
806.0	806.0	Not cored. Cuttings suggest that the material is an arkosic, slightly pebbly, slightly cobbly fine to coarse sand, interbedded with some layers of silt and clay.
814.8	8.8	Sand, fine to medium, yellowish-gray (5*Y* 7/2) to grayish-orange (10*YR* 7/4), calcareous, massive, moderately indurated.
818.0	3.2	Sand, fine to medium, light-brown (5*YR* 6/4) to moderate yellowish-brown (10*YR* 5/4), very calcareous, massive, moderately indurated. Unit contains unoriented stringers of white (*N* 9) calcite.
819.6	1.6	Clay, moderate-brown (5*YR* 3/4), noncalcareous, slightly silty, moderately indurated.
820.9	1.3	Siltstone, grayish-orange (10*Y* 7/4) to yellowish-gray (5*Y* 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 (5*Y* 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.
826.3	2.2	Siltstone, light olive-gray (5*Y* 5/2) to grayish-orange (10*YR* 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 (10*R* 3/4) to moderate-brown (5*YR* 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 and 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, slightly sandy, moderate-brown (5*YR* 4/4) to light-brown (5*YR* 6/4), calcareous, medium-bedded, moderately well indurated. Unit contains some thin layers of slightly calcareous clay.
865.6	2.3	Sand, fine to medium, yellowish-gray (5*Y* 7/2) to pale-olive (10*Y* 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.

Test hole 4—Continued

Depth (feet)	Unit thickness (feet)	Description
886.3	14.3	Sand, fine to medium, moderate reddish-brown (10*R* 4/6) to pale reddish-brown (10*R* 5/4) to moderate yellowish-brown (10*YR* 5/4), very calcareous, massive, moderately indurated. Unit contains an 8-in. layer of claystone at 872.0 ft, and unoriented thin stringers and blebs of white (*N* 9) calcite.
888.6	2.3	Sand, very fine, white (*N* 9) and greenish-gray (5*GY* 6/1) alternating, very calcareous, medium-bedded 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 (10*YR* 8/6), light-brown (5*YR* 6/4), and grayish yellowish-green (5*GY* 7/2) alternating, very calcareous, slightly sandy, medium-bedded to thinly bedded, moderately indurated. Unit contains a 6-in. layer of sand.
907.4	3.3	Clay, grayish yellow-green (5*GY* 7/2) to dusky yellow-green (5*GY* 5/2), slightly calcareous, faintly bedded, fractured, slickensided, moderately indurated.
913.5	6.1	Sand, very fine, light-gray (5*GY* 8/1) to very light gray (*N* 8), calcareous, medium-bedded to thinly bedded, cross-bedded, moderately indurated. Unit contains some thin layers of clay.
919.1	5.6	Sand, fine to coarse, pale-olive (10*Y* 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 is light greenish gray (5*GY* 8/1), slightly calcareous, moderately indurated. Clay is dusky yellow green (5*GY* 5/2) and grayish olive green (5*GY* 3/2), moderately indurated; contains 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	.7	Claystone, pebbly, grayish yellow-green (5*GY* 7/2), dusky yellow-green (5*GY* 5/2), grayish-green (10*GY* 5/2), and white (*N* 9), calcareous, massive, fractured, slickensided, moderately indurated.
927.2	3.8	Clay, slightly sandy, slightly pebbly, dusky yellow-green (5*GY* 5/2) to grayish yellow-green (5*GY* 7/2), calcareous, massive, moderately indurated. Unit contains a 5-in. layer of sand at 923.4 ft and an unoriented cobble of siltstone at 924.5 ft.
931.0	3.8	No core. Cuttings suggest that the material is an arkosic fine to coarse sand.
932.0	1.0	Sandstone, white (*N* 9) and dark yellowish-orange (10*YR* 6/6), quartzose, bedded, very well indurated.
950.0	18.0	No core. Cuttings suggest same as above.
1,207.0	257.0	Not cored. Cuttings and the drilling characteristics suggest that the material is the same as above.

Test hole 4—Continued

Depth (feet)	Unit thickness (feet)	Description
1, 211. 9	4. 9	Sand, fine to coarse, dusky yellow-green (5*GY* 5/2) to grayish olive-green (5*GY* 3/2), calcareous, poorly sorted, massive, moderately indurated.
1, 212. 9	1. 0	Silt, dusky yellow-green (5*GY* 5/2) to grayish olive-green (5*GY* 3/2), slightly calcareous, massive, moderately indurated.
1, 214. 7	1. 8	Clay, similar to clay at 927.2 ft. Unit contains an unoriented cobble of siltstone at 1,214.6 ft.
1, 226. 9	12. 2	Sand, fine to medium, slightly pebbly, dusky yellow-green (5*GY* 5/2), calcareous, massive, moderately indurated. Unit contains a 5-in. layer of clay at 1,223.1 ft.
1, 232. 3	5. 4	Silt, similar to silt at 1,212.9 ft. Unit contains some thin layers of clay.
1, 237. 0	4. 7	No core. Cuttings suggest same as above.
1, 237. 8	. 8	Sandstone, medium- to coarse-grained, dusky yellow-green (5*GY* 5/2) to grayish yellow green (5*GY* 7/2), very calcareous, well-indurated.
1, 241. 7	3. 9	Clay, similar to clay at 927.2 ft.
1, 247. 0	5. 3	No core. Cuttings suggest same as above.
1, 262. 2	15. 2	Clay, slightly pebbly, slightly cobbly (quartz monzonitic), dusky yellow-green (5*GY* 5/2) to grayish olive-green (5*GY* 3/2) to grayish-black (*N* 2), calcareous, massive, fractured, slickensided, moderately indurated.
1, 266. 2	4. 0	Sand, very fine, light greenish-gray (5*GY* 8/1) to grayish yellow-green (5*GY* 7/2) to dusky yellow-green (5*GY* 5/2), very calcareous, medium-bedded to thinly bedded, moderately indurated. Unit contains some unoriented stringers and partings of clay. Bedding is contorted.
1, 267. 0	. 8	No core. Cuttings suggest same as above.
1, 268. 6	1. 6	Clay, similar to clay at 1,262.2 ft. Unit contains a 5-in. layer of sand at 1,267.0 ft.
1, 271. 6	3. 0	Clay and silt (alternating). Silt is grayish yellow-green (5*GY* 7/2) to dusky yellow-green (5*GY* 5/2), very calcareous, moderately indurated. Clay is dusky yellow green (5*GY* 5/2) to grayish olive green (5*GY* 3/2), calcareous, moderately indurated. Unit is medium bedded.
1, 277. 8	6. 2	Clay, similar to clay at 1,262.2 ft. Unit contains some thin lenses of silt and some lenses and pods of calcite.
1, 280. 3	2. 5	Claystone, grayish olive-green (5*GY* 3/2) to dusky yellow-green (5*GY* 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 1,277.8 ft. Bedding dips less than 3°.
1, 282. 4	2. 1	Siltstone, greenish-gray (5*GY* 6/1) to medium-gray (*N* 5), calcareous, massive, well-indurated. Unit contains plant remains.
1, 284. 2	1. 8	Clay, similar to clay at 1,262.2 ft. Unit contains two 2½-in. layers of calcareous siltstone at 1,282.8 and 1,283.3 ft, respectively, and plant remains. Bedding dips 15°.

Test hole 4—Continued

Depth (feet)	Unit thickness (feet)	Description
1, 285. 9	1. 7	Siltstone, similar to siltstone at 1,282.4 ft. Unit contains plant remains.
1, 287. 9	2. 0	Clay, similar to clay at 1,262.2 ft. Unit contains some thin layers of silt.
1, 289. 4	1. 5	Siltstone, greenish-gray (5*GY* 6/1) and white (*N* 9), calcareous, medium-bedded to thinly bedded, moderately well indurated. Unit contains plant remains.
1, 289. 45	. 05	Lignite.
1, 294. 7	5. 25	Siltstone, similar to siltstone at 1,289.4 ft. Unit contains a 3½-in. layer of claystone at 1,291.9 ft, and plant remains.
1, 298. 0	3. 3	Clay, light-gray (*N* 7), medium-gray (*N* 5), grayish-black (*N* 2), and grayish olive-green (5*GY* 3/2) alternating, calcareous, slightly silty, medium-bedded to thinly bedded, fractured, slickensided, moderately indurated, with coatings of disseminated realgar along fracture faces. Unit contains a 7-in. layer of sand at 1,297.2 ft. Bedding dips 30°.
1, 299. 6	1. 6	Siltstone, similar to siltstone at 1,282.4 ft. Unit contains a 2½-in. layer of clay at 1,299.4 ft, and plant remains.
1, 301. 1	1. 5	Sandstone, white (*N* 9) to medium light-gray (*N* 6) to greenish-gray (5*GY* 6/1), slightly calcareous, moderately well indurated. Unit contains a 7-in. layer of silt at 1,299.6 ft.
1, 306. 1	5. 0	Clay, similar to clay at 1,298.0 ft, with scattered coatings of disseminated realgar and orpiment along bedding planes. Bedding dips 25°.
1, 308. 5	2. 4	Siltstone, similar to siltstone at 1,289.4 ft. Unit contains a 6-in. layer of calcareous laminated clay at 1,308.0 ft, with some coatings of disseminated realgar and orpiment along bedding planes.
1, 312. 7	4. 2	Sandstone, fine-grained, greenish-gray (5*GY* 6/1) to medium bluish-gray (5*B* 5/1) to dark-gray (*N* 3), slightly calcareous, massive, moderately well indurated. Unit contains a 2½-in. layer of calcareous laminated clay at 1,312.5 ft, with some coatings of disseminated realgar and orpiment along bedding planes.
1, 312. 8	. 1	Marl, yellowish-gray (5*Y* 8/1), bedded, moderately indurated. Unit dips 10°.
1, 314. 0	1. 2	Claystone, greenish-gray (5*GY* 6/1) to dusky yellow-green (5*GY* 5/2) to dark-gray (*N* 3), noncalcareous, slightly silty, massive, moderately well indurated.
1, 315. 5	1. 5	Sandstone and siltstone (alternating). Sandstone is fine to medium grained, white (*N* 9) to greenish gray (5*GY* 6/1), micaceous (biotite), calcareous, moderately well indurated. Siltstone is greenish gray (5*GY* 6/1), slightly calcareous, moderately well indurated. Unit is medium to thinly bedded.

Test hole 4—Continued

Depth (feet)	Unit thickness (feet)	Description
1,318.8	3.3	Siltstone and clay (alternating). Siltstone is greenish gray (5*GY* 6/1) to medium light gray (*N* 6), calcareous, moderately indurated. Clay is medium bluish gray (5*B* 5/1) and dusky yellow green (5*GY* 5/2) to light olive gray (5*Y* 6/1) alternating, calcareous, moderately indurated. Unit is thinly bedded.
1,320.1	1.3	Claystone, similar to claystone at 1,314.0 ft.
1,323.8	3.7	Clay, yellowish-gray (5*Y* 8/1), dusky yellow-green (5*GY* 5/2), grayish olive-green (5*GY* 3/2), and brownish-black (5*YR* 2/1) alternating, calcareous, slightly silty, thinly bedded to laminated, moderately indurated. Unit contains some blebs of white (*N* 9) calcite. Bedding dips 40°.
1,325.0	1.2	Silt, light-gray (*N* 7) to medium bluish-gray (5*B* 5/1), slightly calcareous, slightly limonitic, medium-bedded to thinly bedded, moderately indurated.
1,325.8	.8	Clay, grayish olive-green (5*GY* 3/2) to greenish-black (5*G* 2/1), slightly calcareous, thinly bedded to laminated, fractured, slickensided, moderately indurated. Unit contains a 1-in. layer of silt at 1,325.5 ft. Unit gives a medium positive test for B_2O_3.
1,326.2	.4	Claystone, similar to claystone at 1,320.1 ft.
1,329.0	2.8	No core. Cuttings suggest that the material is an arkosic sand interbedded with some layers of silt and clay.
1,332.2	3.2	Sand, silt, and clay (interbedded). Sand is fine to medium, greenish gray (5*GY* 6/1), calcareous, moderately indurated. Silt is greenish gray (5*GY* 6/1) to dusky yellow green (5*GY* 5/2), calcareous, moderately indurated. Clay is grayish olive green (5*GY* 3/2), medium bluish gray (5*B* 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 1,331.5 ft. Unit gives a medium positive test for B_2O_3.
1,334.7	2.5	Silt, greenish-gray (5*GY* 6/1), pale-olive (10*Y* 6/2) and pale greenish-yellow (10*Y* 8/2), alternating, calcareous, medium-bedded to thinly bedded, moderately indurated. Unit contains a 3½-in. layer of very calcareous siltstone at 1,334.4 ft, with plant remains and a molluscan fauna.
1,337.4	2.7	Silt, greenish-gray (5*GY* 6/1) to medium bluish-gray (5*B* 5/1), calcareous, medium-bedded to thinly bedded, moderately indurated. Unit contains 2 layers (3½ and 5 in. thick) of very calcareous siltstone at 1,335.7 and 1,336.5 ft, respectively, and some thin layers of slightly silty clay. Bedding dips 1°.

Test hole 4—Continued

Depth (feet)	Unit thickness (feet)	Description
1,359.2	21.8	Clay, olive-gray (5*Y* 4/1), greenish-black (5*G* 2/1), medium bluish-gray (5*B* 5/1), brownish-black (5*YR* 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 1,339.5 ft, some thin layers of white (*N* 9) and yellowish-gray (5*Y* 8/1) crystalline colemanite in the lower 5 ft, and montmorillonite and hydrous mica. Bedding dips 3° to 10°.
1,360.0	.8	No core. Cuttings suggest same as above.
1,361.3	1.3	Clay, greenish-gray (5*GY* 6/1), light olive-gray (5*Y* 6/1), brownish-black (5*YR* 2/1), dusky yellow-green (5*GY* 5/2), and yellowish-gray (5*Y* 8/1) alternating, calcareous, slightly silty, thinly bedded to laminated, moderately indurated. Unit contains a 3½-in. layer of siltstone at 1,360.0 ft.
1,362.1	.8	Siltstone, greenish-gray (5*GY* 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.
1,362.9	.8	Silt and clay (alternating). Silt is greenish gray (5*GY* 6/1), calcareous, moderately indurated. Clay is greenish gray (5*GY* 6/1), olive gray (5*Y* 4/1), medium bluish gray (5*B* 5/1), and yellowish gray (5*Y* 8/1) alternating, calcareous, slightly silty, moderately indurated. Unit is thinly bedded to laminated. Unit gives a medium positive test for B_2O_3.
1,365.6	2.7	Siltstone, similar to siltstone at 1,362.1 ft. Unit contains 2 layers (5 and 3½ in. thick) of clay at 1,364.2 and 1,364.8 ft, respectively. Unit gives a medium positive test for B_2O_3.
1,369.1	3.5	Siltstone and clay (alternating). Similar to unit at 1,362.9 ft. Unit contains some thin layers of silt. Unit is thinly bedded to laminated.
1,371.7	2.6	Clay, yellowish-gray (5*Y* 8/1), greenish-gray (5*GY* 6/1), olive-gray (5*Y* 4/1), brownish-black (5*YR* 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 1,369.1 ft. Bedding is slightly contorted.
1,375.6	3.9	Silt and clay (alternating). Similar to unit at 1,362.9 ft. Unit contains a 2½-in. layer of siltstone at 1,371.7 ft. Unit is thinly bedded. Bedding dips 10°.
1,385.1	9.5	Clay, greenish-gray (5*GY* 6/1), olive-gray (5*Y* 4/1), dusky yellow-green (5*GY* 5/2), grayish olive-green (5*GY* 3/2), brownish-black (5*YR* 2/1), and grayish-black (*N* 2) alternating, calcareous, slightly silty, thinly bedded to laminated, moderately indurated.

Test hole 4—Continued

Depth (feet)	Unit thickness (feet)	Description
1, 387. 6	2. 5	Sandstone, fine- to coarse-grained, pale-olive (10*Y* 6/2) to greenish-gray (5*GY* 6/1) to dusky yellowish-green (10*GY* 3/2), very calcareous, bedded, well indurated. Unit contains a 3½-in. layer of siltstone at 1,385.1 ft, and plant remains. Bedding dips 15°.
1, 388. 2	1. 2	Siltstone, dusky yellowish-green (10*GY* 3/2) to grayish olive-green (5*GY* 3/2), very calcareous, slightly sandy, massive, well-indurated. Unit contains some partings of slightly calcareous clay.
1, 390. 0	1. 2	No core. Cuttings suggest that the rock is a sandstone.
1, 390. 5	. 5	Sandstone, fine- to coarse-grained, dusky yellowish-green (10*GY* 3/2) to grayish olive-green (5*GY* 3/2), slightly calcareous, poorly sorted, massive, well-indurated.
1, 392. 6	2. 1	Sand, fine to coarse, pale-olive (10*Y* 6/2) to greenish-gray (5*GY* 6/1), slightly calcareous, poorly sorted, massive, moderately indurated.
1, 410. 2	17. 6	Sandstone, similar to sandstone at 1,387.6 ft. Unit contains some partings of clay.
1, 411. 3	1. 1	Heulandite and claystone (alternating). Heulandite is medium gray (*N* 5). Claystone is grayish olive green (5*GY* 3/2) to dusky yellow green (5*GY* 5/2), noncalcareous, bedded, well indurated.
1, 413. 4	2. 1	Claystone, white (*N* 9) to pale olive (10*Y* 6/2), noncalcareous, massive, well-indurated. Unit contains an 8-in. layer of sandstone at 1,411.3 ft. Unit is given a mottled appearance by heulandite blebs.
1, 416. 8	3. 4	Sandstone, fine- to coarse-grained, greenish-gray (5*GY* 6/1) to moderate greenish-yellow (10*Y* 7/4) to pale-olive (10*Y* 6/2), slightly calcareous, poorly sorted, massive, well-indurated. Unit contains a 1½-in. layer of siltstone at 1,413.4 ft.
1, 421. 0	4. 2	No core. Cuttings suggest same as above.
1, 423. 8	2. 8	Sandstone, fine- to coarse-grained, greenish-gray (5*GY* 6/1), dusky yellow-green (5*GY* 5/2), and pale-olive (10*Y* 6/2) alternating, noncalcareous, poorly sorted, massive to medium-bedded, moderately well indurated. Unit contains a 7-in. layer of noncalcareous clay groundmass at 1,421.9 ft.
1, 426. 0	2. 2	Claystone, slightly sandy, slightly pebbly, grayish olive-green (5*GY* 3/2), noncalcareous, massive, moderately well indurated.
1, 431. 0	5. 0	Sandstone, similar to sandstone at 1,416.8 ft.
1, 432. 0	1. 0	Siltstone, grayish-green (10*GY* 5/2), noncalcareous, slightly sandy, massive, well-indurated.
1, 448. 4	16. 4	Sandstone, fine-grained, grayish-green (10*GY* 5/2), noncalcareous, massive, well-indurated. Unit contains 3 layers (5, 3½, and 2½ in. thick) of siltstone at 1,433.3, 1,436.4, and 1,444.4 ft, respectively, and some partings of noncalcareous clay.
1, 451. 0	2. 6	No core. Cuttings suggest same as above.

Test hole 4—Continued

Depth (feet)	Unit thickness (feet)	Description
1, 452. 6	1. 6	Claystone, dusky yellow-green (5*GY* 5/2) to light greenish-gray (5*GY* 8/1), micaceous (biotite), noncalcareous, slightly sandy, massive, moderately well indurated. Unit contains a 3½-in. layer of fine- to coarse-grained sandstone, and a 2½-in. layer of sandstone at 1,451.4 ft.
1, 457. 9	5. 3	Sandstone, fine- to medium-grained, very light gray (*N* 8) to light-gray (*N* 7) to light olive-brown (5*Y* 5/6) and light greenish-gray (5*GY* 8/1), noncalcareous, faintly bedded, well-indurated. Unit contains a 7½-in. layer of siltstone at 1,454.3 ft. Bedding dips 20°.
1, 465. 4	7. 5	Sandstone, similar to sandstone at 1,416.8 ft.
1, 466. 5	1. 1	Claystone, grayish olive-green (5*GY* 3/2) to dusky yellow-green (5*GY* 5/2), noncalcareous, slightly sandy, slightly silty, massive, moderately well indurated.
1, 470. 6	4. 1	Claystone, sandy, slightly pebbly, grayish-olive (10*Y* 4/2) to grayish olive-green (5*GY* 3/2), noncalcareous, massive, moderately well indurated. Unit contains a 2½-in. layer of sandstone at 1,466.5 ft, and some angular fragments of clay.
1, 471. 8	1. 2	Sandstone, similar to sandstone at 1,416.8 ft.
1, 481. 0	9. 2	No core. Cuttings suggest same as above.
1, 482. 0	1. 0	Sand, similar to sand at 1,392.6 ft.
1, 483. 9	1. 9	Sandstone, fine- to medium-grained, dusky yellow-green (5*GY* 5/2), noncalcareous, massive, well-indurated. Unit contains a 6-in. layer of claystone at 1,482.3 ft.
1, 486. 3	2. 4	Sand, similar to sand at 1,392.6 ft. Unit contains a 6-in. layer of sandstone at 1,484.2 ft and a 6-in. layer of silt at 1,485.8 ft.
1, 491. 3	5. 0	Sandstone, similar to sandstone at 1,416.8 ft. Unit contains some partings of noncalcareous clay.
1, 492. 3	1. 0	Claystone, similar to claystone at 1,426.0 ft. Unit contains some angular fragments of clay.
1, 494. 1	1. 8	Sandstone, fine- to medium-grained, grayish yellow-green (10*GY* 7/2) to dusky yellow-green (5*GY* 5/2), slightly calcareous, massive, moderately well indurated. Unit contains some angular fragments of clay.
1, 512. 0	17. 9	No core. Cuttings suggest same as above.
1, 524. 2	12. 2	Sandstone, similar to sandstone at 1,494.1 ft. Unit contains a 6-in. layer of siltstone at 1,512.3 ft, and some blebs of noncalcareous clay.
1, 525. 2	1. 0	Claystone, grayish olive-green (5*GY* 3/2) and grayish-green (10*G* 4/2), noncalcareous, silty, massive, well-indurated.
1, 536. 4	11. 2	Sandstone, similar to sandstone at 1,494.1 ft. Unit contains some partings of noncalcareous clay.
1, 543. 0	6. 6	No core. Cuttings suggest same as above.
1, 561. 3	18. 3	Sandstone, similar to sandstone at 1,494.1 ft. Unit contains some partings of noncalcareous clay.

Test hole 4—Continued

Depth (feet)	Unit thickness (feet)	Description
1, 574. 0	12. 7	No core. Cuttings suggest same as above.
1, 583. 0	9. 0	Sandstone, similar to sandstone at 1,494.1 ft. Unit contains a 6-in. layer of siltstone at 1,582.4 ft and a 1½-in. layer of claystone at 1,582.9 ft.
1, 584. 8	1. 8	Sandstone, fine- to medium-grained, greenish-gray (5*GY* 6/1) and dusky yellow-green (5*GY* 5/2), slightly calcareous, faintly bedded, moderately well indurated. Unit contains a 4-in. layer of siltstone at 1,583.0 ft, and some blebs of noncalcareous clay. Bedding dips 10°.
1, 605. 0	20. 2	No core. Cuttings suggest same as above.
1, 619. 3	14. 3	Sand, fine to coarse, slightly pebbly, greenish-gray (5*GY* 6/1) to grayish yellow-green (5*GY* 7/2) to dusky yellow-green (5*GY* 5/2), slightly calcareous, poorly sorted, massive, moderately well indurated.
1, 620. 6	1. 3	Sandstone, similar to sandstone at 1,584.8 ft.
1, 623. 8	3. 2	Sandstone, fine- to medium-grained, grayish-green (10*GY* 5/2) to light greenish-gray (5*G* 8/1), noncalcareous, well indurated. Unit contains a 3½-in. layer of slightly calcareous sandstone at 1,622.6 ft.
1, 635. 0	11. 2	No core. Cuttings suggest same as aobve.
1, 641. 8	6. 8	Sandstone, fine- to coarse-grained, light greenish-gray (5*G* 8/1) and greenish-gray (5*GY* 6/1) to light bluish-gray (5*B* 7/1), noncalcareous, poorly sorted, massive, well-indurated. Unit contains a 3½-in. layer of very fine grained sandstone at 1,640.8 ft, and some angular fragments of noncalcareous clay.
1, 650. 7	8. 9	Sandstone, similar to sandstone at 1,619.3 ft. Unit contains a 6-in. layer of slightly calcareous siltstone at 1,641.8 ft and a 1-in. layer of noncalcareous sandstone at 1,650.6 ft.
1, 652. 0	1. 3	Sandstone, very fine grained, grayish olive-green (5*GY* 3/2) to dark greenish-gray (5*GY* 4/1) and light greenish-gray (5*G* 8/1), noncalcareous, faintly bedded, well-indurated. Unit contains a 2-in. layer of claystone at 1,650.7 ft. Bedding dips 25°.
1, 654. 0	2. 0	Sandstone, fine- to medium-grained, very light gray (*N* 8) to light greenish-gray (5*G* 8/1) and grayish yellow-green (5*GY* 7/2) to dusky yellow-green (5*GY* 5/2), noncalcareous, silty, medium-bedded, moderately well indurated. Unit contains a 3½-in. layer of claystone at 1,652.5 ft. Bedding dips 15°.
1, 660. 6	6. 6	Sandstone, similar to sandstone at 1,619.3 ft. Bedding dips 30°.
1, 666. 0	5. 4	No core. Cuttings suggest same as above.
1, 666. 9	.9	Siltstone, dusky yellow-green (5*GY* 5/2), noncalcareous, slightly sandy, massive, moderately well indurated. Unit contains some angular particles of noncalcareous clay.
1, 673. 1	6. 2	Sand, similar to sand at 1,619.3 ft. Unit contains a 9-in. layer of fine- to medium-grained sandstone at 1,666.9 ft.

Test hole 4—Continued

Depth (feet)	Unit thickness (feet)	Description
1,691.7	18.6	Sandstone and siltstone (alternating). Sandstone is fine to coarse grained, grayish yellow green (5*GY* 7/2), slightly calcareous, well indurated. Siltstone is grayish yellow green (5*GY* 7/2) to dusky yellow green (5*GY* 5/2), slightly calcareous, well indurated. Unit contains some thin layers of noncalcareous clay. Unit is medium bedded. Bedding dips 20°.
1,696.0	4.3	No core. Cuttings suggest same as above.
1,712.6	16.6	Sand, fine to medium, greenish-gray (5*GY* 6/1) to dusky yellow-green (5*GY* 5/2), slightly calcareous, massive, moderately well indurated. Unit contains a 5-in. layer of noncalcareous claystone at 1,712.2 ft.
1,722.4	9.8	Sandstone, fine- to coarse-grained, slightly pebbly, grayish yellow-green (5*GY* 7/2) to pale greenish-yellow (10*Y* 8/2) to pale-olive (10*Y* 6/2), slightly calcareous, poorly sorted, massive, moderately well indurated. Unit contains a 9½-in. layer of claystone at 1,718.8 ft and a 2½-in. layer of siltstone at 1,719.6 ft.
1,725.0	2.6	Siltstone, yellowish-gray (5*Y* 7/2) and pale-olive (10*Y* 6/2), slightly calcareous, massive, moderately well indurated.
1,726.0	1.0	No core. Cuttings suggest same as above.
1,734.5	8.5	Sandstone, fine- to medium-grained, dusky yellow-green (5*GY* 5/2), massive, well-indurated. Unit contains some partings of noncalcareous clay.
1,738.3	3.8	Claystone, slightly silty, slightly sandy, dusky blue-green (5*BG* 3/2) to dusky yellow-green (5*GY* 5/2), noncalcareous, massive, moderately well indurated.
1,742.4	4.1	Sandstone, medium-grained, grayish-olive (10*Y* 4/2) to light greenish-gray (5*GY* 8/1), noncalcareous, massive, moderately well indurated. Unit contains some partings of noncalcareous slickensided clay.
1,745.9	3.5	Sandstone, fine- to coarse-grained, grayish-olive (10*Y* 4/2) and dusky yellow-green (5*GY* 5/2), slightly calcareous, poorly sorted, massive, moderately well indurated. Unit contains a 2½-in. layer of noncalcareous claystone at 1,742.7 ft, and some partings of noncalcareous clay.
1,749.9	4.0	Siltstone, grayish olive-green (5*GY* 3/2) to dusky yellowish-green (10*GY* 3/2), slightly calcareous, massive, moderately well indurated. Unit contains a 7-in. layer of fine- to medium-grained sandstone and some partings of noncalcareous slickensided clay.
1,751.0	1.1	Claystone, grayish olive-green (5*GY* 3/2) to dusky yellow-green (5*GY* 5/2), slightly calcareous, slightly silty, massive, fractured, slickensided, well-indurated. Unit contains a 3-in. layer of sandstone at 1,750.6 ft.
1,757.0	6.0	No core. Cuttings suggest same as above.
1,762.9	5.9	Siltstone, similar to siltstone at 1,749.9 ft. Unit contains a 3½-in. layer of claystone at 1,758.9 ft, and some partings of clay. Bedding dips 40°.

Test hole 4—Continued

Depth (feet)	Unit thickness (feet)	Description
1,770.1	7.2	Sandstone, fine- to coarse-grained, light greenish-gray (5*GY* 8/1) to dusky yellow-green (5*GY* 5/2), noncalcareous, poorly sorted, massive, well-indurated. Unit contains a 7½-in. layer of slightly calcareous fine-grained sandstone at 1,762.9 ft.
1,772.2	2.1	Claystone, grayish olive-green (5*GY* 3/2) to dusky blue-green (5*BG* 3/2), slightly calcareous, silty, slightly sandy, massive, moderately well indurated.
1,774.9	2.7	Siltstone, dusky yellow-green (5*GY* 5/2) to greenish-gray (5*GY* 6/1) to dusky blue-green (5*BG* 3/2), slightly calcareous, bedded, well-indurated. Bedding dips 40°.
1,778.0	3.1	Sandstone, similar to sandstone at 1,770.1 ft.
1,780.8	2.8	Siltstone, similar to siltstone at 1,762.9 ft. Unit contains some partings of noncalcareous clay. Bedding dips 20°.
1,782.1	1.3	Sandstone, fine- to coarse-grained, grayish olive-green (5*GY* 3/2) and dusky blue-green (5*BG* 3/2), slightly calcareous, poorly sorted, massive, moderately well indurated.
1,786.0	3.9	No core. Cuttings suggest same as above.
1,787.4	1.4	Sandstone, similar to sandstone at 1,782.1 ft.
1,792.2	4.8	Claystone, similar to claystone at 1,772.2 ft. Unit contains an 8-in. layer of sand at 1,788.8 ft and a 6-in. layer of calcareous sandstone at 1,789.5 ft.
1,797.2	5.0	Sand, fine to coarse, slightly pebbly; grayish olive-green (5*GY* 3/2) to dusky yellow-green (5*GY* 5/2), slightly calcareous, poorly sorted, massive, moderately indurated. Unit contains a 2½-in. layer of noncalcareous sandstone at 1,796.6 ft and a 5-in. layer of siltstone at 1,796.8 ft.
1,808.1	10.9	Sandstone, fine- to medium-grained, greenish-gray (5*GY* 6/1), slightly calcareous, massive, well-indurated. Unit contains a 9-in. layer of noncalcareous siltstone, at 1,806.5 ft, dipping 25°, and some partings of clay.
1,809.5	1.4	Sand, fine to medium, grayish olive-green (5*GY* 3/2), noncalcareous, massive, moderately indurated.
1,810.4	.9	Silt, grayish olive-green (5*GY* 3/2) to dusky blue-green (5*BG* 3/2), noncalcareous, massive, moderately indurated. Unit contains some partings of clay.
1,811.8	1.4	Clay, sandy, grayish olive-green (5*GY* 3/2), noncalcareous, massive, moderately indurated. Unit contains a 6-in. layer of slightly calcareous sandstone at 1,810.4 ft.
1,816.0	4.2	No core. Cuttings suggest same as above.
1,817.2	1.2	Sand, fine to medium, grayish olive-green (5*GY* 3/2) to dusky yellow-green (5*GY* 5/2), calcareous, massive, moderately indurated.
1,820.1	2.9	Sandstone, fine- to coarse-grained, greenish-gray (5*GY* 6/1), slightly calcareous, poorly sorted, massive, well-indurated.
1,825.1	5.0	Sand, fine to medium, greenish-gray (5*GY* 6/1) to dark greenish-gray (5*G* 4/1), slightly calcareous, massive, moderately indurated.

Test hole 4—Continued

Depth (feet)	Unit thickness (feet)	Description
1, 829. 7	4. 6	Sandstone, similar to sandstone at 1,820.1 ft. Unit contains some angular particles of slightly calcareous clay.
1, 832. 2	2. 5	Sand, fine to medium, greenish-gray (5*GY* 6/1), slightly calcareous, faintly bedded, moderately to poorly indurated. Bedding dips 10°.
1, 833. 7	1. 5	Siltstone, grayish olive-green (5*GY* 3/2) to dusky yellow-green (5*GY* 5/2), slightly calcareous, massive, well-indurated. Unit contains a 4-in. layer of very calcareous sandstone at 1,833.3 ft, and some stringers of noncalcareous clay.
1, 834. 8	1. 1	Sandstone, similar to sandstone at 1,820.1 ft.
1, 835. 9	1. 1	Siltstone, dusky yellow-green (5*GY* 5/2), noncalcareous, massive, well-indurated. Unit contains some partings of noncalcareous slickensided clay.
1, 837. 4	1. 5	Sandstone, similar to sandstone at 1,820.1 ft.
1, 846. 0	8. 6	No core. Cuttings suggest same as above.
1, 847. 6	1. 6	Siltstone, similar to siltstone at 1,833.7 ft. Unit contains a 5-in. layer of sand at 1,846.0 ft and a 1½-in. layer of sandstone at 1,846.6 ft. Bedding dips 25°.
1, 850. 3	2. 7	Sand, similar to sand at 1,832.2 ft.
1, 866. 0	15. 7	No core. Cuttings suggest same as above.
2, 126. 0	260. 0	Not cored. Cuttings and drilling characteristics suggest that the predominant rock probably is a pebble and cobble (quartz monzonitic) conglomerate, interbedded with some layers of sand, silt, and clay.
2, 127. 0	1. 0	Sandstone and siltstone (alternating). Sandstone is fine grained, greenish gray (5*GY* 6/1) very calcareous, well indurated. Siltstone is greenish gray (5*GY* 6/1), calcareous, well indurated. Bedding dips 60°. Unit is medium bedded.
2, 137. 0	1. 0	No core. Cuttings suggest same as above.
2, 307. 0	170. 0	Not cored. Cuttings and drilling characteristics suggest that the predominant rock probably is a pebble and cobble (quartz monzonitic) conglomerate, interbedded with some layers of sand, silt, and clay.
2, 310. 0	3. 0	Conglomerate. Numerous quartz monzonitic pebbles and cobbles in a groundmass of greenish-gray (5*GY* 6/1), very calcareous massive moderately well indurated sand.
2, 312. 0	2. 0	Breccia. Numberous angular quartz monzonitic pebbles in a ground mass of greenish-gray (5*GY* 6/1) calcareous sandy massive well-indurated claystone.
2, 332. 0	20. 0	No core. Cuttings suggest same as above.
2, 515. 0	183. 0	Not cored. Cuttings and drilling characteristics suggest that the rocks probably are a pebble and cobble (quartz monzonitic) conglomerate and a breccia.
2, 516. 7	1. 0	Sandstone, fine- to medium-grained, pale yellowish-brown (10*YR* 6/2) to greenish-gray (5*GY* 6/1), calcareous, massive, moderately well indurated.
2, 521. 0	5. 0	No core. Cuttings suggest same as above.

Test hole 4—Continued

Depth (feet)	Unit thickness (feet)	Description
2,539.0	18.0	Sandstone, fine- to medium-grained, pale yellowish-brown (10*YR* 6/2) to greenish-gray (5*GY* 6/1), grayish olive-green (5GY 3/2) to dusky yellow-green (5*GY* 5/2) and pale-olive (10*Y* 6/2), calcareous, massive, moderately well indurated. Unit contains 2 6-in. layers of siltstone at 2,528.3 and 2,538.2 ft, respectively, and a 6-in. layer of claystone at 2,536.1 ft.
2,539.9	.9	Claystone, grayish olive-green (5*GY* 3/2), slightly calcareous, very sandy, slightly pebbly, massive, moderately well indurated.
2,547.6	7.7	Sandstone, fine- to medium-grained, light olive-gray (5*Y* 6/1), pale-olive (10*Y* 6/2), pale yellowish-brown (10*YR* 6/2), and grayish-green (10*GY* 5/2), calcareous, faintly bedded, moderately well indurated. Unit contains a 5-in. layer of siltstone at 2,542.4 ft and 2 layers (4 and 5 in. thick) of claystone at 2,544.6 and 2,545.2 ft, respectively.
2,548.0	.4	No core. Cuttings suggest same as above.
2,555.1	7.1	Sandstone, similar to sandstone at 2,547.6 ft. Unit contains a 5-in. layer of claystone at 2,554.7 ft, and some angular particles of noncalcareous clay. Bedding dips 30°.
2,566.5	11.4	Sandstone, fine- to coarse-grained, slightly pebbly, dusky yellow-green (5*GY* 5/2) to pale-olive (10*Y* 6/2), slightly calcareous, poorly sorted, massive, well-indurated. Unit contains some angular particles of noncalcareous clay.
2,568.7	2.2	Claystone, dusky yellow-green (5*GY* 5/2) to brownish-gray (5*YR* 4/1), calcareous, slightly silty, massive, fractured, slickensided, well-indurated. Unit contains some unoriented stringers of white (*N* 9) calcite.
2,578.0	9.3	No core. Cuttings suggest same as above.
2,580.5	2.5	Sandstone, fine-grained, light olive-gray (5*Y* 6/1) to greenish-gray (5*GY* 6/1), calcareous, massive, well-indurated. Unit contains a 2-in. layer of sandstone at 2,578.0 ft and a 9½-in. layer of siltstone at 2,578.2 ft.
2,582.0	1.5	Sand, fine to medium, greenish-gray (5*GY* 6/1), calcareous, massive, moderately indurated.
2,584.7	2.7	Sandstone, fine- to coarse-grained, light olive-gray (5*Y* 6/1) to greenish-gray (5*GY* 6/1), slightly calcareous, poorly sorted, massive, well-indurated.
2,586.0	1.3	Siltstone, greenish-gray (5*GY* 6/1), calcareous, massive, well-indurated. Unit contains some angular particles of clay.
2,588.3	2.3	Sandstone, similar to sandstone at 2,584.7 ft.
2,589.7	1.4	Sandstone, very fine grained, greenish-gray (5*GY* 6/1) and dark greenish-gray (5*G* 4/1) alternating, calcareous, medium-bedded to thinly bedded, crossbedded, well-indurated. Unit contains some unoriented stringers of calcareous clay. Bedding dips 30°.

Test hole 4—Continued

Depth (feet)	Unit thickness (feet)	Description
2, 592. 3	2. 6	Siltstone, pale-olive (10*Y* 6/2), slightly calcareous, massive, well-indurated. Unit contains some unoriented stringers of calcareous clay.
2, 608. 0	15. 7	No core. Cuttings suggest same as above.
2, 610. 8	2. 8	Sandstone, very fine grained, light greenish-gray (5*GY* 8/1), very slightly calcareous, medium-bedded, well-indurated. Bedding dips 25°.
2, 617. 2	6. 4	Sandstone, fine- to coarse-grained, slightly pebbly, pale-olive (10*Y* 6/2), arkosic, calcareous, poorly sorted, massive, well-indurated. Unit contains some unoriented stringers of brownish-black (5*YR* 2/1) and very light gray (*N* 8) calcite and a 3½-in. layer of siltstone at 2,616.9 ft, with plant remains.
2, 621. 1	3. 9	Sandstone, fine- to coarse-grained, slightly pebbly, greenish-gray (5*GY* 6/1), calcareous, poorly sorted, massive, well-indurated. Unit contains an 8½-in. layer of claystone at 2,620.2 ft, with some angular particles of clay.
2, 639. 0	17. 9	No core. Cuttings suggest same as above.
2, 640. 9	1. 9	Sandstone, similar to sandstone at 2,621.1 ft. Unit contains a 5-in layer of siltstone at 2,639.0 ft, and a 3½-in. layer of sandstone at 2,640.6 ft, dipping 35°.
2, 643. 4	2. 5	Sandstone, very fine grained, pale-olive (10*Y* 6/2) and dark greenish-gray (5*G* 4/1), calcareous, medium-bedded to thinly bedded, crossbedded, well-indurated. Bedding dips 35°.
2, 644. 8	1. 4	Sandstone, fine- to coarse-grained, greenish-gray (5*GY* 6/1) to light olive-gray (5*Y* 6/1), calcareous, poorly sorted, massive, well-indurated.
2, 646. 1	1. 3	Sand and clay (alternating). Sand is fine, pale olive (10*Y* 6/2), calcareous, moderately indurated. Clay is grayish olive (10*Y* 4/2) to dusky yellow green (5*GY* 5/2), slightly calcareous, slightly silty, massive, fractured, moderately indurated. Unit is thinly bedded.
2, 647. 1	1. 0	Sand, fine, greenish-gray (5*GY* 6/1) to pale-olive (10*Y* 6/2), calcareous, medium-bedded to thinly bedded, moderately indurated.
2, 648. 3	1. 2	Sandstone, similar to sandstone at 2,621.1 ft. Unit contains some unoriented stringers of white (*N* 9) calcite.
2, 649. 5	1. 2	Sandstone, very fine grained, dark greenish-gray (5*GY* 4/1) to greenish-gray (5*GY* 6/1) and yellowish-gray (5*Y* 7/2), calcareous, medium-bedded to thinly bedded, crossbedded, well-indurated. Bedding dips 30°.
2, 649. 9	. 4	Limestone, light greenish-gray (5*GY* 8/1) to medium light-gray (*N* 6), clayey, slightly sandy, bedded, well-indurated.
2, 650. 7	. 8	Sandstone, fine- to medium-grained, pale-olive (10*Y* 6/2), calcareous, bedded, well-indurated.

Test hole 4—Continued

Depth (feet)	Unit thickness (feet)	Description
2, 652. 4	1. 7	Sand and clay (alternating). Sand is fine to medium, greenish gray (5*GY* 6/1), calcareous, moderately indurated. Clay is dark greenish gray (5*G* 4/1), slightly calcareous, fractured, moderately indurated. Unit is thinly bedded.
2, 654. 5	2. 1	Sandstone, very fine grained, greenish-gray (5*GY* 6/1) to dark greenish-gray (5*GY* 4/1) to light olive-gray (5*Y* 6/1), calcareous, medium-bedded, well-indurated. Unit contains a 5-in. layer of sandstone at 2,652.4 ft.
2, 657. 2	2. 7	Sandstone, fine-grained, greenish-gray (5*GY* 6/1), light olive-gray (5*Y* 6/1) and yellowish-gray (5*Y* 7/2), calcareous, massive to medium-bedded, well-indurated. Unit contains some thin layers of clay. Bedding dips 30°.
2, 670. 0	9. 8	No core. Cuttings suggest same as above.
2, 673. 1	3. 1	Sand and sandstone (alternating). Sand is fine to coarse, greenish gray (5*GY* 6/1) and light olive gray (5*Y* 6/1), calcareous, in places poorly sorted, moderately indurated. Sandstone is fine grained, greenish gray (5*GY* 6/1), dark greenish gray (5*G* 4/1) and yellowish gray (5*GY* 7/2), calcareous, moderately well indurated. Unit contains a 3-in. layer of quartz monzonitic pebbles at 2,670.0 ft and a 3½-in layer of claystone at 2,672.8 ft. Unit is medium bedded.
2, 675. 7	2. 6	Sandstone, similar to sandstone at 2,648.3 ft. Unit contains 2 layers (6 and 3½ in. thick) of siltstone at 2,673.1 and 2,675.2 ft, respectively. Bedding dips 35°.
2, 677. 1	1. 4	Breccia. Numerous quartz and feldspar pebbles in a groundmass of greenish-gray (5*GY* 6/1) to light olive-gray (5*Y* 6/1) calcareous moderately well indurated sand.
2, 680. 6	3. 5	Sandstone, similar to sandstone at 2,648.3 ft. Unit contains a 3½-in. layer of very fine grained sandstone at 2,677.3 ft, dipping 45°, and a 3½-in. layer of claystone at 2,677.9 ft.
2, 696. 0	15. 4	No core. Cuttings suggest same as above.
2, 698. 5	2. 5	Sand, fine to coarse, pebbly, pale reddish-brown (10*R* 5/4), very calcareous, poorly sorted, massive, poorly indurated. Unit contains a 7-in. layer of sandstone at 2,697.9 ft, dipping 35°.
2, 725. 0	26. 5	No core. Cutting suggest same as below.
2, 758. 0	33. 0	Not cored. Cuttings and drilling characteristics suggest that the predominant rock probably is a pebble and cobble (quartz monzonitic) breccia, interbedded with some layers of sand and silt.
2, 763. 0	5. 0	Breccia. Numerous pebbles and cobbles in a groundmass of pale reddish-brown (10*R* 5/4) calcareous sandy massive well-indurated claystone. Unit contains some quartz monzonitic boulders.
2, 788. 0	25. 0	No core. Cuttings suggest same as above.
2, 851. 0	63. 0	Not cored. Similar to unit at 2,763.0 ft (based on cuttings and drilling characteristics).

Test hole 4—Continued

Depth (feet)	Unit thickness (feet)	Description
2, 855. 5	4. 5	Breccia, similar to breccia at 2,763.0 ft. Unit contains a 5-in. layer of sandstone at 2,853.9 ft, dipping 40° and some quartz monzonitic boulders.
2, 875. 0	19. 5	No core. Cuttings suggest same as above.
2, 975. 0	100. 0	Not cored. Similar to unit at 2,763.0 ft (based on cuttings and drilling characteristics).
2, 976. 6	1. 6	Breccia, similar to breccia at 2,763.0 ft. Unit contains a 3½-in. layer of sandstone at 2,975.0 ft.
2, 994. 0	17. 4	No core. Cuttings suggest same as above.
3, 065. 0	71. 0	Not cored. Similar to unit at 2,763.0 ft (based on cuttings and drilling characteristics).
3, 069. 0	4. 0	Breccia, similar to breccia at 2,763.0 ft.
3, 075. 0	6. 0	No core. Cuttings suggest same as above.
3, 290. 0	215. 0	Not cored. Similar to unit at 2,763.0 ft.
3, 293. 9	3. 9	Breccia, similar to breccia at 2,763.0 ft. Unit contains a 6-in. layer of sandstone at 3,293.4 ft, dipping 50°.
3, 316. 0	22. 1	No core. Cuttings suggest same as above.
3, 490. 0	174. 0	Not cored. Similar to uit at 2,763.0 ft.
3, 494. 6	4. 6	Breccia, similar to breccia at 2,763.0 ft.
3, 500. 0	5. 4	No core. Cuttings suggest same as above.

Test hole 5

700. 0	700. 0	Not cored. Cuttings suggest that the rock is an arkosic sand, interbedded with layers of silt and clay.
962. 0	262. 0	Not cored. Cuttings suggest that the rock is predominantly a calcerous bedded clay with some beds of silt and sand.
971. 5	9. 5	Clay, grayish-green (5*G* 5/2), dusky yellow-green (5*GY* 5/2), and dark greenish-gray (5*GY* 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 also contains a 6½-in. layer of siltstone at 971.2 ft and 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	. 03	Lignite, dusky-brown (5*YR* 2/2), bedded.
975. 4	3. 87	Sandstone, fine- to coarse-grained, greenish-gray (5*GY* 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; it also contains plant remains. Unit gives a very strong positive test for B_2O_3.
1, 007. 0	31. 6	Clay, similar to clay at 971.5 ft. Unit contains some layers up to ½-in. thick of crystalline colemanite and some thin layers of white (*N* 9) calcite. Bedding dips 0° to 3°.
1, 008. 4	1. 4	Siltstone, greenish-gray (5*GY* 6/1), slightly calcareous, moderately well indurated.

Test hole 5—Continued

Depth (feet)	Unit thickness (feet)	Description
1,015.3	6.9	Clay, dusky yellow-green (5 *GY* 5/2), greenish-black (5*GY* 2/1), and greenish-gray (5*GY* 6/1) alternating, calcareous, slightly silty, thinly bedded to laminated, moderately indurated. Unit contains some thin layers of white (*N* 9) crystalline colemanite and a 2-in. layer of very light gray (*N* 8) calcareous tuff at 1,015.2 ft.
1,020.0	4.7	No core. Cutting suggest same as above.
1,028.3	8.3	Clay, grayish-green (5*G* 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 and many thin layers of very light gray (*N* 8) very calcareous clay. Bedding dips 0° to 3°.
1,029.8	1.5	Sandstone, fine- to medium-grained, greenish-gray (5*GY* 6/1), calcareous, moderately well indurated, with minor amounts of realgar and orpiment. Unit contains a 3½-in. layer of siltstone at 1,028.3 ft.
1,045.6	15.8	Clay, dusky yellow-green (5*GY* 5/2), grayish-green (10*GY* 5/2), medium bluish-gray (5*B* 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 (5*Y* 8/1) crystalline colemanite, 2 layers (6 and 5 in. thick) of sandstone at 1,044.2 ft and 1,044.9 ft, respectively, and a 2½-in. layer of claystone at 1,045.4 ft.
1,047.8	2.2	Sandstone, similar to sandstone at 1,029.8 ft. Unit contains a 3½-in. layer of siltstone at 1,045.6 ft. Unit gives a strong positive test for B_2O_3.
1,050.8	3.0	Clay, similar to clay at 1,045.6 ft, with thin seams and coatings of orpiment on bedding planes. Bedding is horizontal. Unit gives a strong positive test for B_2O_3.
1,052.0	1.2	No core. Cuttings suggest same as above.
1,111.0	59.0	Clay, similar to clay at 1,045.2 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 (5*Y* 8/1) crystalline colemanite; it also contains veatchite, montmorillonite, hydrous mica, chlorite, heulandite, analcime, and iron sulfide.
1,113.0	2.0	No core. Cuttings suggest same as above.

Test hole 5—Continued

Depth (feet)	Unit thickness (feet)	Description
1,143.5	33.8	Clay, similar to clay at 1,045.2 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 (5*Y* 8/1) crystalline colemanite; it also contains a 1½-in. layer of sandstone at 1,145.4 ft, with orpiment and some realgar. Bedding is horizontal. Minerals present are the same as in clay at 1,111.0 ft.
1,145.2	1.7	Siltstone, greenish-gray (5*GY* 6/1) to medium bluish-gray (5*B* 5/1), calcareous, massive, moderately well indurated.
1,147.1	1.9	Clay, greenish-gray (5*GY* 6/1), medium bluish-gray (5*B* 5/1) and light olive-gray (5*Y* 6/1) alternating, calcareous, slightly silty, medium-bedded to thinly bedded, fractured, slickensided, moderately indurated, with some coatings of orpiment along bedding planes. Bedding is horizontal. Unit gives a strong positive test for B_2O_3.
1,148.8	1.7	Siltstone, greenish-gray (5*GY* 6/1), micaceous (biotite), calcareous, massive, well-indurated. Unit contains some partings of clay. Unit gives a strong positive test for B_2O_3.
1,150.5	1.7	Clay, olive-gray (5*Y* 4/1), light olive-gray (5*Y* 6/1), and brownish-black (5*YR* 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 1,153.5 ft, and some crusts and vugs of white (*N* 9) crystalline heulandite. Bedding is horizontal.
1,152.6	2.1	Clay greenish-gray (5*GY* 6/1), olive-gray (5*Y* 4/1), and light olive-gray (5*Y* 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 1,155.2 ft.
1,155.0	2.4	Sandstone, siltstone, and claystone (interbedded). Sandstone is fine grained, very light gray (*N* 8) to white (*N* 9), calcareous, well indurated. Siltstone is very light gray (*N* 8), dark greenish gray (5*GY* 4/1), medium dark gray (*N* 4) and very light gray (*N* 8), alternating, calcareous, moderately indurated. Claystone is light olive gray (5*Y* 5/2), greenish gray (5*GY* 6/1) and dark greenish gray (5*GY* 4/1), calcareous, slightly silty, fractured, slickensided, moderately well indurated. Unit contains a 2½-in. layer of clay at 1,156.0 ft, and thin seams and coatings of realgar and orpiment along bedding planes. Unit is thinly bedded. Bedding is horizontal.
1,156.6	1.6	Claystone, greenish-gray (5*GY* 6/1), calcareous, slightly silty, massive, fractured, slickensided, moderately well indurated. Unit contains a 5-in. layer of clay at 1,158.3 ft, and numerous coatings of orpiment and realgar along bedding planes.

Test hole 5—Continued

Depth (feet)	Unit thickness (feet)	Description
1,158.5	1.9	Siltstone and clay (alternating). Siltstone is very light gray (*N* 8) to white (*N* 9), micaceous (biotite), very calcareous, well indurated. Clay is light gray (*N* 7), medium gray (*N* 5), greenish gray (5*GY* 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.
1,160.0	1.5	Clay, similar to clay at 1,152.6 ft.
1,161.3	1.3	Siltstone, very light gray (*N* 8) to white (*N* 9), very calcareous, faintly bedded, well-indurated.
1,167.5	6.2	Clay, very light gray (*N* 8), greenish-gray (5*GY* 6/1), olive-gray (5*Y* 4/1), and medium dark-gray (*N* 4) alternating, calcareous, slightly silty, medium-bedded to thinly bedded, moderately indurated.
1,175.0	7.5	Sandstone, fine- to medium-grained, greenish-gray (5*GY* 6/1), calcareous, massive, moderately well indurated.
1,190.8	15.8	Clay, similar to clay at 1,167.5 ft, with coatings of realgar and orpiment along bedding planes and fractures. Unit contains some layers (up to ¼ in. thick) of very light gray (*N* 8) and white (*N* 9) crystalline colemanite. Bedding dips 0° to 5°.
1,193.5	2.7	Clay, grayish-green (10*GY* 5/2) to dusky yellow-green (5*GY* 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; it also contains veatchite, montmorillonite, hydrous mica, chlorite, iron sulfide, and analcime.
1,198.5	5.0	Clay, similar to clay at 1,190.8 ft. Unit contains some layers (up to ½ in. thick) of very light gray (*N* 8) crystalline colemanite. Bedding is horizontal. Minerals present same as above.
1,207.0	8.5	No core. Cuttings suggest same as above.
1,208.9	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.
1,210.4	1.5	Clay, dark greenish-gray (5*GY* 4/1) to greenish-gray (5*GY* 3/1) to dark-gray (*N* 3), calcareous, faintly bedded, moderately indurated.
1,211.4	1.0	Clay and silt (alternating). Silt is light greenish gray (5*GY* 8/1), calcareous. Clay is dark greenish gray (5*GY* 4/1) to dusky yellow green (5*GY* 5/2), calcareous, slightly silty, moderately indurated. Bedding is slightly contorted. Unit is thinly bedded.
1,212.6	1.2	Siltstone, greenish-gray (5*GY* 6/1), calcareous, faintly bedded, moderately well indurated.
1,213.6	1.0	Sandstone, similar to sandstone at 1,175.0 ft.

Test hole 5—Continued

Depth (feet)	Unit thickness (feet)	Description
1, 214. 9	1. 3	Silt and clay (alternating). Silt is greenish gray (5*GY* 6/1) to medium light gray (*N* 6), calcareous, moderately indurated. Clay is dusky yellow green (5*GY* 5/2) to grayish green (5*GY* 6/1) to dark gray (*N* 3), calcareous, moderately indurated.
1, 216. 1	1. 2	Sandstone, similar to sandstone at 1,175.0 ft.
1, 225. 1	9. 0	Clay, greenish-gray (5*GY* 6/1) to dark greenish-gray (5*G* 4/1) to grayish olive-green (5*G* 3/2), calcareous, slightly silty, thinly bedded to laminated, slickensided, moderately indurated. Unit contains a 6-in. layer of sandstone at 1,222.0 ft, and some thin layers of light-gray (*N* 7) to yellowish-gray (5*Y* 8/1) very calcareous clay. Bedding is slightly contorted.
1, 226. 5	1. 4	Sandstone, similar to sandstone at 1,175.0 ft. Unit contains a 3-in. layer of clay at 1,226.2 ft.
1, 239. 0	12. 5	No core. Cuttings suggest same as above.
1, 249. 4	10. 4	Clay, greenish-gray (5*GY* 6/1), light olive-gray (5*Y* 6/1) dusky yellow-green (5*GY* 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; it also contains veatchite, montmorillonite, hydrous mica, analcime, and chlorite. Bedding is horizontal.
1, 258. 3	8. 9	Clay, moderate-red (5*R* 5/4) to dusky-red (5*R* 3/4), brownish-gray (5*YR* 4/1), olive-gray (5*Y* 4/1), and light olive-gray (5*Y* 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.
1, 266. 9	8. 6	Clay, dusky yellow-green (5*GY* 5/2) to grayish olive-green (5*GY* 3/2) to greenish-black (5*G* 2/1), slightly calcareous, slightly silty, medium-bedded, fractured, slickensided, moderately indurated. Unit contains 3 layers (5, 3½, and 3 in. thick) of sandstone at 1,261.0, 1,263.9, and 1,265.7 ft, respectively, and a 6-in. layer of silt at 1,258.5 ft
1, 270. 0	3. 1	No core. Cuttings suggest same as above.
1, 294. 6	24. 6	Clay, greenish-gray (5*GY* 6/1), pale-olive (10*Y* 6/2), grayish olive-green (5*GY* 3/2), and grayish-black (*N* 2) alternating, calcareous, slightly silty, thinly bedded to laminated, moderately indurated, with some layers (up to ⅜ in. thick) of white (*N* 9) crystalline colemanite. Unit also contains 2 layers (9 and 5½ in. thick) of sandstone at 1,282.6 and 1,291.5 ft, respectively. Bedding is horizontal
1, 300. 0	5. 4	No core. Cuttings suggest same as above.
1, 303. 7	3. 7	Siltstone, dark greenish-gray (5*GY* 4/1) to medium light-gray (*N* 6), calcareous, medium-bedded to thinly bedded, moderately well indurated. Unit contains 2 layers (5 and 6 in. thick) of sandstone at 1,300.0 and 1,303.2 ft, respectively.

Test hole 5—Continued

Depth (feet)	Unit thickness (feet)	Description
1,305.7	2.0	Siltstone, light-gray (*N* 7) and white (*N* 9) to very light gray (*N* 8), calcareous, bedded, moderately well indurated. Unit contains 2 layers (2½ and 5 in. thick) of clay at 1,304.5 and 1,305.2 ft, respectively.
1,306.7	1.0	Sandstone, fine- to coarse-grained, greenish-gray (5*GY* 6/1), calcareous, poorly sorted, well-indurated.
1,307.7	1.0	Siltstone, similar to siltstone at 1,212.6 ft.
1,309.3	1.6	Sandstone, similar to sandstone at 1,306.7 ft. Unit contains a 6-in. layer of siltstone at 1,308.8 ft.
1,311.6	2.3	Clay, greenish-gray (5*GY* 6/2) to dusky yellow-green (5*GY* 5/2) to grayish olive-green (5*GY* 3/2) to grayish-black (*N* 2), calcareous, bedded, fractured, moderately indurated. Unit contains some thin layers of yellow-gray (5*Y* 8/1) calcite. Bedding is contorted.
1,313.1	1.5	Sandstone and siltstone (alternating). Similar to sandstone at 1,306.7 ft; similar to siltstone at 1,212.6 ft. Unit is thinly bedded.
1,314.4	1.3	Silt and clay (alternating). Silt is white (*N* 9) to very light gray (*N* 8) calcareous, thinly bedded, moderately indurated. Clay is dusky yellow green (5*GY* 5/2) to grayish olive green (5*GY* 3/2), calcareous, thinly bedded, fractured, slickensided, moderately indurated. Bedding is slightly contorted.
1,315.5	1.1	Sandstone, similar to sandstone at 1,306.7 ft.
1,318.7	3.2	Clay, similar to clay at 1,266.9 ft. Unit contains a 6-in. layer of siltstone at 1,317.5 ft and a 7½-in. layer of sandstone at 1,318.0 ft.
1,330.0	11.3	No core. Cuttings suggest same as above.
1,332.7	2.7	Sandstone, similar to sandstone at 1,306.7 ft. Unit contains a 6-in. layer of clay at 1,330.5 ft.
1,334.5	1.8	Siltstone, dark greenish-gray (5*GY* 4/1) to olive-gray (5*Y* 4/1), calcareous, bedded, well-indurated. Unit contains a 4-in. layer of clay at 1,332.7 ft.
1,337.5	3.5	Clay and silt (alternating). Silt is light olive gray (5*Y* 6/1), calcareous, moderately indurated. Clay is olive gray (5*Y* 4/1) and grayish black (*N* 2), calcareous, moderately indurated. Unit is medium to thinly bedded.
1,338.9	1.4	Clay, olive-gray (5*Y* 4/1) to olive-black (5*Y* 2/1), calcareous, silty, bedded, fractured, slickensided, moderately indurated. Unit contains mollusks.
1,341.5	2.6	Clay and silt (alternating). Similar to unit at 1,337.5 ft. Unit is thinly bedded.
1,344.4	2.9	Clay, dark greenish-gray (5*GY* 4/1) to olive-black (5*Y* 2/1) and brownish-black (5*YR* 2/1), slightly silty, bedded, fractured, slickensided, moderately indurated.

Test hole 5 Continued

Depth (feet)	Unit thickness (feet)	Description
1,353.7	9.3	Clay, grayish olive-green (5*GY* 3/2) and grayish-black (*N* 2), calcareous, slightly silty, faintly bedded, fractured, slickensided, moderately indurated. Unit contains a thin lens of yellowish-gray (5*Y* 8/1) very calcareous clay at 1,344.4 ft.
1,354.8	1.1	Silt and clay (alternating). Silt is greenish gray (5*GY* 6/1), calcareous, moderately indurated. Clay is dark gray (*N* 3), calcareous, moderately indurated. Bedding is contorted. Unit is thinly bedded.
1,358.6	3.8	Silt, greenish-gray (5*GY* 6/1), calcareous, bedded, moderately indurated. Unit contains some thin layers of clay.
1,360.0	1.4	No core. Cuttings suggest same as above.
1,362.5	2.5	Sandstone, fine- to medium-grained, greenish-gray (5*GY* 6/1), calcareous, massive, well-indurated. Unit contains an 8½-in. layer of siltstone at 1,360.4 ft.
1,363.9	1.4	Siltstone, dusky yellow-green (5*GY* 5/2), greenish-gray (5*GY* 6/1), and grayish yellow-green (5*GY* 7/2), calcareous, bedded, moderately well indurated. Unit contains numerous thin layers of calcareous clay. Iron sulfide ends here.
1,365.4	1.5	Sandstone, similar to sandstone at 1,362.5 ft.
1,367.9	2.5	Siltstone, greenish-gray (5*GY* 6/1), calcareous, medium-bedded to thinly bedded, moderately well indurated. Unit contains a 2½-in. layer of clay at 1,365.7 ft and a 1-in. layer of sandstone at 1,366.0 ft.
1,369.4	1.5	Claystone, grayish-green (10*GY* 5/2), calcareous, silty, faintly bedded, moderately well indurated.
1,370.8	1.4	Clay, siltstone, and sandstone (interbedded). Clay is grayish olive green (5*GY* 3/2), dusky yellow green (5*GY* 5/2), and grayish black (*N* 2) alternating, calcareous, faintly bedded, fractured, slickensided, moderately indurated. Siltstone is greenish gray (5*GY* 6/1), very calcareous, bedded, moderately well indurated. Sandstone is medium grained, greenish gray (5*GY* 6/1), calcareous, well indurated.
1,390.0	19.2	No core. Cuttings suggest same as above.
1,392.7	2.7	Silt and clay (alternating). Silt is very light gray (*N* 8) and grayish green (5*G* 5/2), calcareous, moderately indurated. Clay is dark greenish gray (5*G* 4/1) and dusky yellowish green (10*GY* 3/2), calcareous, slightly silty, moderately indurated. Unit contains a 6-in. layer of breccia at 1,390.0 ft and a 4-in. layer of very light gray (*N* 8) to white (*N* 9) bedded well-indurated tuff at 1,390.5 ft. Unit is thinly bedded.
1,419.0	26.3	No core. Cuttings suggest same as above.
1,420.3	1.3	Sandstone, fine- to medium-grained, slightly pebbly, grayish-green (10*GY* 5/2), very calcareous, massive, moderately well indurated.

Test hole 5 Continued

Depth (feet)	*Unit thickness (feet)*	*Description*
1,449.0	28.7	No core. Cuttings and drilling characteristics suggest that the predominant rock probably is a pebble and cobble (quartz dioritic) breccia, interbedded with some layers of sandstone, siltstone, and clay.
1,574.0	125.0	Not cored. Cuttings suggest same as above.
1,575.5	1.5	Sandstone and siltstone (alternating). Sandstone is similar to sandstone at 1,420.3 ft. Siltstone is grayish green (10*GY* 5/2), calcareous, moderately well indurated. Unit contains a 1-in. layer of noncalcareous slickensided clay at 1,574.1 ft and a thin layer of angular pebbles and cobbles at 1,575.5 ft.
1,604.0	28.5	No core. Similar to unit at 1,449.0 ft.