HYDROGEOLOGIC DATA FROM A 2,000-FOOT DEEP CORE HOLE AT POLK CITY, GREEN SWAMP AREA, CENTRAL FLORIDA

By A. S. Navoy

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ABSTRACT

Continuous core samples, discrete water-quality samples, and discrete head measurements were obtained from 1,996 feet of core hole at Polk City in the Green Swamp area of central Florida in order to investigate the hydrogeology of the Tertiary limestone (Floridan) aquifer system. Selected core samples were analyzed to determine the hydraulic properties of the rock. Planned geophysical logging and packer tests and aquifer tests could not be attempted because of drilling problems.

Limestone and dolomite of Eocene age are overlain by a veneer of predominantly clastic sediments of Miocene and post-Miocene age. The Miocene sediments constitute the upper confining unit of the Floridan aquifer. The top of the Floridan aquifer occurs at a depth of 120 feet, or 17 feet above sea level. The aquifer has two major permeable zones. The upper zone occurs at depths of 120 to 473 feet and the lower zone is from 780 to 960 feet. The upper and lower permeable zones are separated by a zone of low permeability composed of dense dolomite. Below the base of the lower permeable zone, evaporites composed of anhydritic and gypsiferous dolomite first appear at a depth of 1,023 feet and continue to 1,785 feet, marking a second confining unit. Within this confining unit, isolated zones of higher permeability exist. This evaporitic dolomite is believed to extend laterally westward into the Tampa area. A third permeable zone consisting of pelletal limestone, is less permeable than the two shallower zones above and lies below 1,785 feet.

The dissolved solids concentration of the formation waters ranged from approximately 150 milligrams per liter in the major permeable zones to approximately 2,000 milligrams per liter in the bottom of the deeper core hole. Water level in the core hole declined approximately 16 feet as drilling progressed. Most of the head loss occurred at depths below 1,800 feet. The porosities of selected core samples ranged from 1.6 percent to 45.3 percent. The hydraulic conductivities of selected cores ranged from less than 0.000024 to 19.0 feet per day in the horizontal direction and from 0.000024 to 3.0 feet per day in the vertical direction. The ratio of vertical to horizontal permeability ranged from 0.03 to 1.98.

Regionally, the geology of the formations comprising the Floridan rocks at Polk City exhibit characteristics of both the Orlando area and the Tampa area. The formations at Polk City appear to be lithologically transitional between the two areas.

INTRODUCTION

This report is presented as part of a Regional Aquifer Systems Analysis (RASA) of the Tertiary limestone (Floridan) aquifer system and is designed to provide hydrogeologic information concerning the aquifer in central Florida. The RASA study encompasses all of Florida and extends into Georgia, Alabama, and South Carolina. A complete discussion of the regional study and a map showing the several subproject areas comprising the study are given in Johnston (1978). Hydrogeologic data for this report were collected from two core holes due to drilling problems, completed to depths of 908 feet and 1,996 feet at Polk City, Polk County, Fla. The two core holes are located about 50 feet apart, therefore the data can be considered as originating from a single source.

Purpose and Scope

The purpose of collecting data at this location was to define the geologic and hydrologic controls on the Floridan aquifer in an area of sparse data between the well-studied Orlando and Tampa areas. This report presents the data collected from the core hole and provides an overview of the hydrogeology of the deeper parts of the Floridan aquifer at Polk City.

Data collected include: (1) detailed geologic description and analysis of cores, (2) water-quality samples at discrete depths, (3) discrete water-level data, and (4) hydraulic analysis of selected cores.

Limitations of the Data

Geophysical logging and packer tests were to be undertaken once the coring was completed. However, due to drilling problems, a drill stem became lodged in both core holes, thus eliminating the possibility of collecting hydrogeologic data other than from the core itself or during the drilling.

HYDROGEOLOGIC SETTING

Polk City is located within the Green Swamp area of central Florida, about 40 miles southwest of Orlando and about 40 miles northeast of Tampa (fig. 1). The Green Swamp includes extensive flatlands and swamps, and extends along the crest of peninsular Florida. Five major drainage systems originate in or near the Green Swamp, flowing in several directions to the Atlantic and Gulf of Mexico (Pride and others, 1966). Coincident with the Green Swamp is a high in the potentiometric surface of the Floridan aquifer, approximately centered at Polk City (fig. 2). The high has a maximum altitude of approximately 130 feet above sea level.

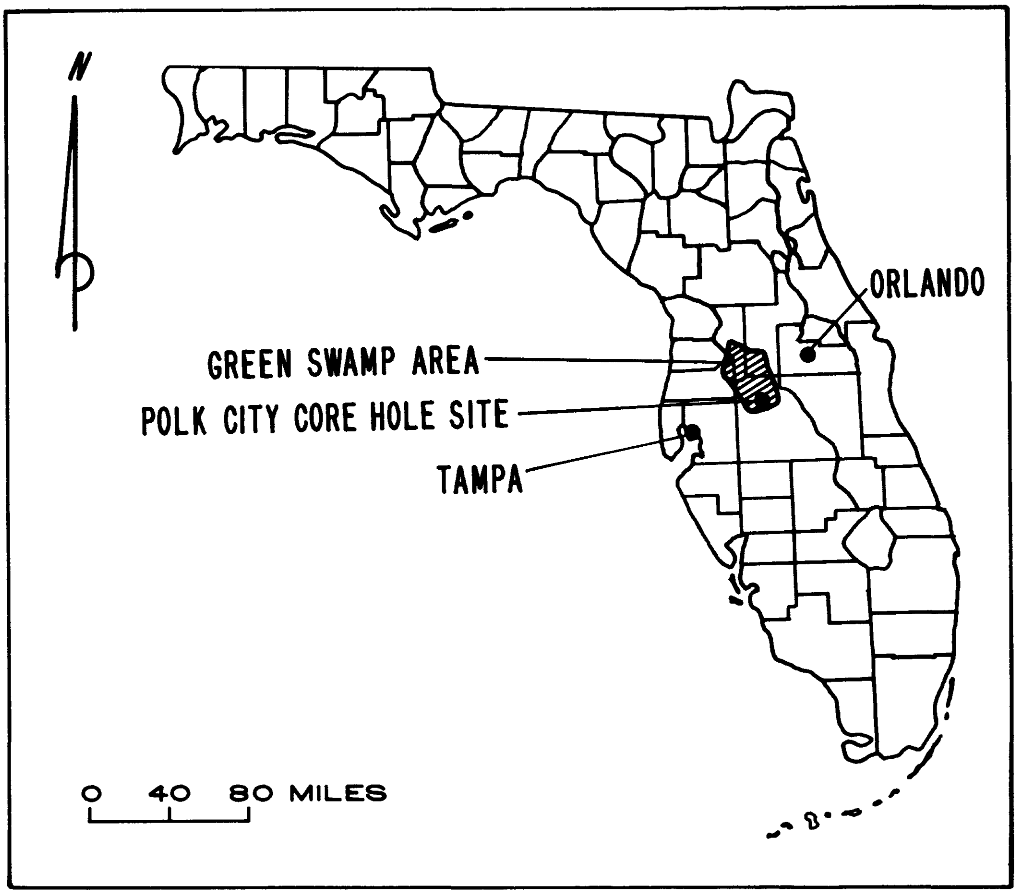
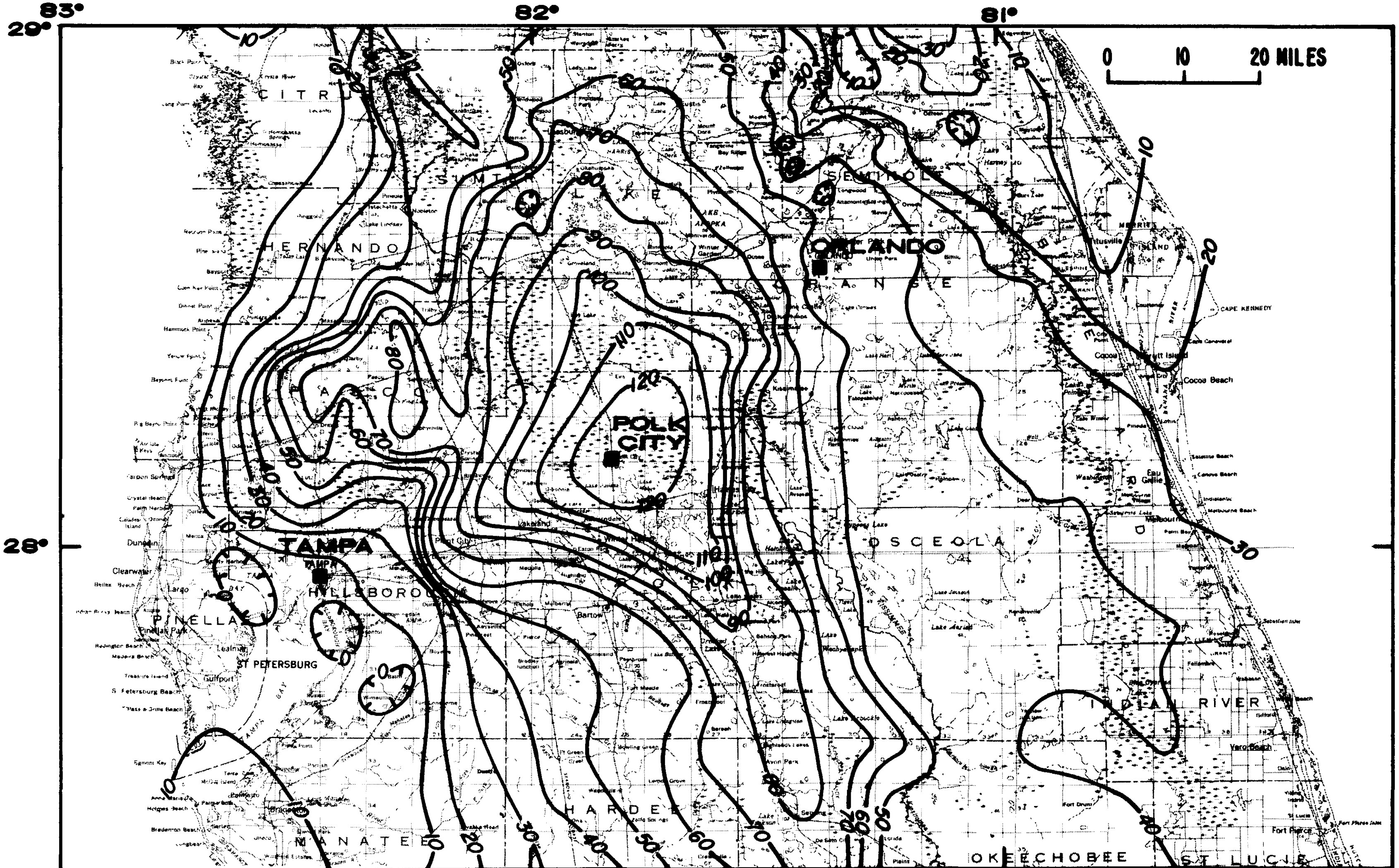


Figure 1.--Location of Polk City core hole site and Green Swamp area.

The Polk City area is underlain by Eocene and pre-Eocene shallow marine carbonate rocks that are covered by a veneer of Miocene and post-Miocene clastic sediments. The top of the Floridan aquifer is generally defined as the first persistent occurrence of carbonate rock. The Floridan is generally overlain and confined by sands, silts, and clays. Surficial and intermediate aquifers in the overlying sediments are the source of recharge to the Floridan aquifer at Polk City. The base of the Floridan aquifer is considered to occur at the top of early Eocene evaporitic and chalky carbonates (Tibbals, 1981). Within the Floridan aquifer, zones of high and low permeability constitute subaquifers that are hydraulically connected in variable degrees.



EXPLANATION

——10—— CONTOUR-SHOWS ALTITUDE OF THE POTENTIOMETRIC SURFACE FOR THE UPPER PART OF THE FLORIDAN AQUIFER SYSTEM, DURING MAY 1980. CONTOUR INTERVAL 10 FEET. HACHURES INDICATE DEPRESSIONS, DATUM IS SEA LEVEL

Figure 2.--Potentiometric surface of the Floridan aquifer in central Florida (modified from Johnston and others, 1981).

WELL CONSTRUCTION AND DATA COLLECTION

Well Construction

Two core holes were drilled at Polk City, whereas only one was planned. Due to drilling problems, the drill became lodged in the first core hole at 908.4 feet. A second hole was drilled 50 feet from the first in an effort to complete the objective of coring to 2,500 feet. At a depth of 1,996 feet, a drill stem became lodged in the second hole. The decision was then made to stop coring at that point rather than to continue with a third hole to the intended completion depth of 2,500 feet.

Coring was accomplished using wire-line coring apparatus, consisting of a standard rotary drilling rig fitted with a cable winch capable of recovering a removable inner core barrel from the hollow drill stem. The inner core barrel locked into place near the bottom of the drill stem and drilling proceeded until the core barrel filled. The core barrel used at Polk City had a length of 20 feet and cut an approximately 1.5-inch diameter core. When the core barrel was full, drilling stopped and the wire line (cable), with a retrieval assembly attached, was lowered into the drill rods to unlock and recover the core barrel holding the core. After the core was brought to the surface and removed from the core barrel, the core barrel was again lowered into the drill stem, locked into place, and drilling resumed. Because drilling in this manner allows the core to be brought to the surface without the need to completely remove or "trip out" the drill rods, coring time is greatly reduced.

The upper 350 feet of the first core hole was drilled by the standard rotary method. A 4-inch casing was set to a depth of 350 feet, thus the upper 230 feet of the Floridan aquifer and the 120 feet of overlying materials were cased off. A wire-line coring rig was then brought in to complete the coring. Core was successfully recovered to a depth of 908.4 feet where the drill rods became lodged. All attempts to free the drill stem were unsuccessful, so a second hole was started. The second core hole, about 50 feet from the first, was drilled by the cable-tool method and cased to a depth of 900 feet at which point wire-line coring resumed. Core was successfully recovered in the second hole to a depth of 1,996 feet, where the drill stem again became lodged. Figure 3 shows a schematic diagram of the core hole construction. During the drilling of the second hole it was necessary to ream with 3.5 inch O.D. (outside diameter) drill bit in order to free the 2.375 inch O.D. drill rod from a temporary hang-up at about 1,000 feet. The 3.5 inch O.D. stem was left in place after reaming and eventually wore through at 725 feet due to subsequent drilling. Part of these rods remain in the hole between 1,000 feet and 725 feet. Coring continued to 1,996 feet. After the 2.375 inch O.D. drill stem lodged at 1,996 feet, it broke at 1,404 feet during the attempted recovery operation. Consequently, the smaller rods remain in the hole from 1,404 to 1,996 feet.

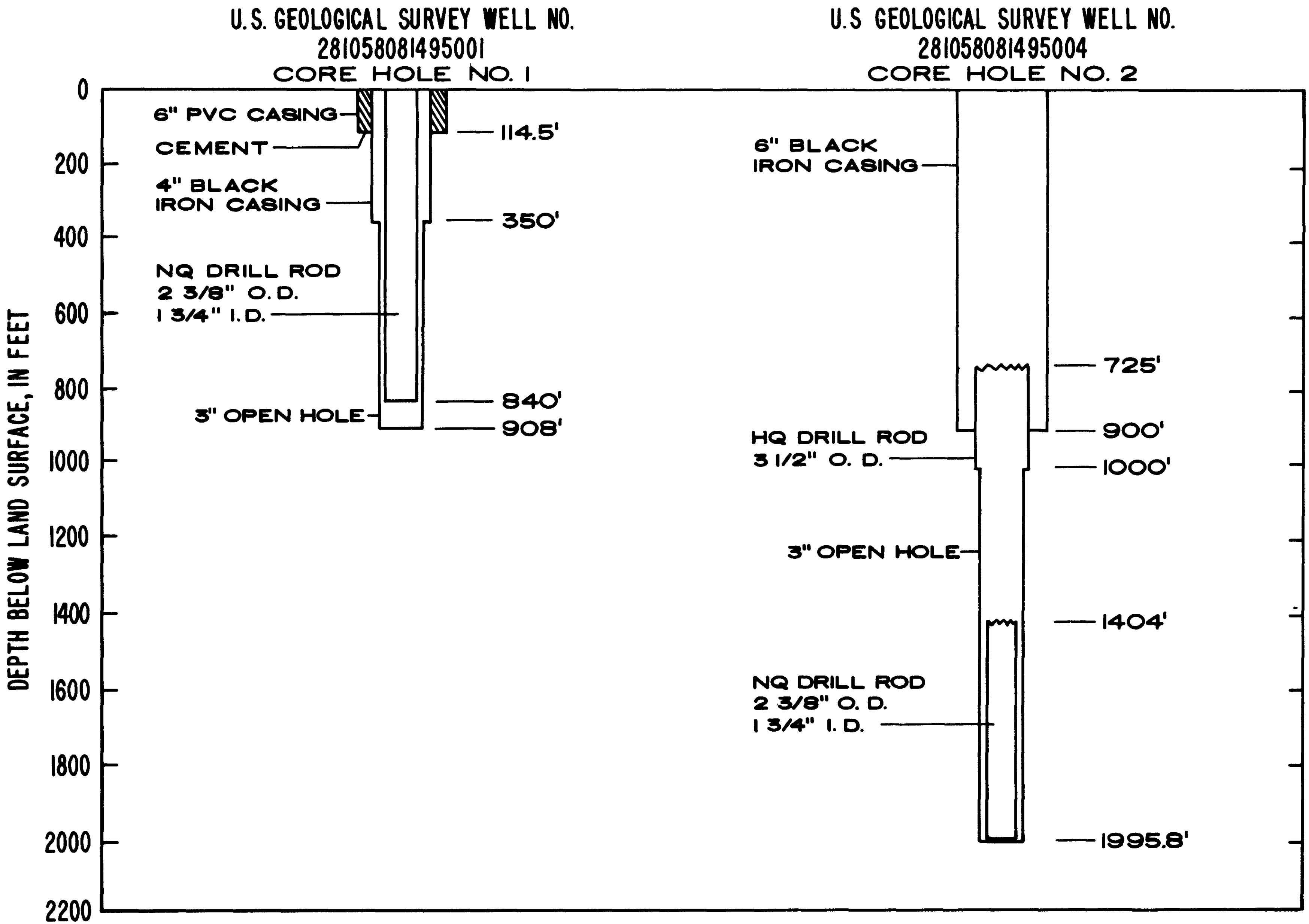


Figure 3.--Schematic diagram of core hole construction.

Core Handling Procedure

As the core was recovered from the core barrel, it was immediately measured, described in detail, and photographed. Subsequently, the core was boxed and stored. Upon completion of the coring, the boxed core was reexamined in order to produce a consistent description.

Water-Level Measurement Procedure

Water-level data were collected using wetted tape or electric tape methods. Two types of measurements were obtained in the core holes--a water level within the drill stem and a water level in the annular space between the drill stem and the wall of the hole. Apparently, debris or cuttings filled in around the drill stem after each core run and effectively isolated the bottom of the hole. The difference between the annular measurements and the drill-stem measurements indicated that a discrete head measurement was obtained for the aquifer interval at the bottom of the hole. That this water level collection method is valid can be explained as follows: As coring proceeded, open hole would exist outside of the drill stem and thus the water level in the open-hole section (representing a composite head for the entire open-hole part of the well) could be measured in the annular space. Because Polk City is in a recharge area, the head in the aquifer declines with depth. Thus, if the head measured in the drill stem, open to only the bottom few feet of the hole, was lower than the head measured in the annulus, then the head measured in the drill stem would be somewhat, if not totally, reliable. Generally, the head differences indicated that the drill-stem water-level measurement was discrete.

Water-level measurements were obtained from both the drill stem and annular space at the beginning of each day and after every 20-foot core run. The measurements made at the beginning of each day are considered more reliable because there was time for the formation to recover from any stresses associated with the circulation of water in the hole during the coring process.

A 315-foot deep observation well, Polk City ROMP (Southwest Florida Water Management District's Regional Observation and Monitor-Well Program) well near Polk City, Fla., approximately 25 feet from the core holes, provided background water levels in the upper Floridan aquifer so that the long-term trend of the regional potentiometric surface during coring could be determined.

Water-Quality Sampling Procedure

Fifteen water samples were collected for analysis at approximately 100-foot depth intervals, starting at a depth of 474 feet and ending at the bottom of the hole. The water quality of the Floridan aquifer at depths shallower than 474 feet is well documented in the area. Samples were collected either for standard ion analysis or for standard ion plus trace metal analysis. Samples for standard ion analysis were collected at 100-foot intervals; at the selected depths of 856, 1,172, and 1,815 feet, samples for the additional trace metal were collected.

The sampling procedure was to pump from the drill stem, by centrifugal pump, a volume of water equivalent to the volume contained in the stem, in order to clear out the hole, and then to continue pumping until the specific conductance of the water stabilized. Only water, and not a mud-water mixture, was used as the drilling fluid during the coring process. This eliminated the possibility of contaminating the water samples with drilling mud. The source of the water for drilling fluid was the nearby Polk City ROMP well. The water samples thus obtained are believed to represent the formation water and to be reasonably discrete samples. During pumping, water levels did not decline in the annular space, indicating the hydraulic isolation of the bottom of the hole. Due to declining water levels with depth, it became necessary to use an airlift pump to obtain water samples after the hole reached a depth of 1,800 feet. The airlift was used to pump out the water in the drill stem and thereby draw in formation water. To prevent disturbing the sample by aeration, the final water for the sample was obtained by bailing several times with the empty core barrel.

LITHOLOGY

Core Lithology

The core holes penetrated Eocene limestone and dolomite overlain by a veneer of clastic sediments of Miocene and post-Miocene age. The Eocene carbonate rocks compose the Floridan aquifer. Post-Miocene sediments, composed of quartz sand and silt, extend from the land surface to a depth of about 30 feet. Miocene sediments occur from a depth of 30 feet to 120 feet and are composed of interbedded sand, clay, and sandy limestone. Rocks of Eocene age occur from a depth of 120 feet to at least the bottom of the core hole at 1,996 feet. The Eocene rocks generally consist of limestone, dolomitic limestone, and dolomite, and commonly contain varying amounts of anhydrite and gypsum below 1,023 feet.

Based upon index microfossils and lithology, the Eocene Series is subdivided into formations whose ages roughly coincide with Gulf Coast Stage units (Murray, 1961). The Ocala Limestone (Jacksonian Stage) is found in the interval from 120 to 240 feet. The Avon Park and Lake City Limestones (Claibornian Stage) occur in the interval from 240 to 1,780 feet. Data were not sufficient to accurately differentiate the two formations. The Oldsmar Limestone (Sabinian Stage) occurs in the interval from 1,780 feet to at least the bottom of the hole, at 1,996 feet.

The classification of limestones used in this report follows that proposed by Folk (1959). The classification is based on the nature and origin of the constituent particles of limestone. Fossiliferous, pelletal, and micritic limestones were encountered in the core samples at Polk City. Fossiliferous limestone is composed predominantly of the carbonate remains of organisms, such as foraminifera. Pelletal limestone is composed predominantly of microstructures or oolites, spherical or subspherical in shape, consisting of microcrystalline calcite. Micritic limestone is predominantly composed of a microcrystalline calcite ooze, precipitated chemically or biochemically.

A lithologic log of the core hole that includes stratigraphic divisions is given in table 1. A graphic lithologic log of the core hole is shown in figure 4, and a detailed lithologic description of the core samples is given in table 2 (located at the end of the report).

Table 1.--Generalized lithostratigraphy of core hole at Polk City

Depth, in feet	Lithology
	Post-Miocene Undifferentiated:
0-30	Sand: white quartz, some dark brown silt.
	Miocene Hawthorn Formation:
30-120	Clay, limestone, and sand: interbedded. Clay, blue and green in color, sandy limestone, conspicuous phosphate and fossil fragments (gastropods).
	Eocene Ocala Limestone:
120-240	Limestone, fossiliferous: off-white to cream; large microfossils: *Lepidocyclina*, *Operculinoides*, and *Camerina*; minor micritic matrix, very-pale orange, chalky, soft; good porosity.
	Avon Park and Lake City Limestones, undifferentiated:
240-356	Limestone, pelletal: cream to light gray; fine to medium-sized pellets, composed of micritic material; microfossils: *Discorinopsis*, *Spiralina*, *Lituonella*; *Spirolina*, *Lituonella*; minor micritic matrix; poor porosity.
356-396	Dolomite: tan to medium brown; very fine to medium crystalline; some highly vuggy zones. Minor pelletal Limestone: very-pale orange to light gray; fine to medium-sized pellets, micritic matrix; microfossils: *Dictyoconus*.
396-491	Limestone, pelletal: very-pale orange to light gray; gray; fine to medium-sized pellets; minor micritic matrix; fossil casts and molds; fair porosity. Minor Dolomite: tan; fine crystalline; vuggy and fractured; fossil casts and molds; high porosity.

Table 1.--Generalized lithostratigraphy of core hole at Polk City--Continued

Depth, in feet	Lithology
491-1023	Dolomite: cream, tan to medium brown; fine to medium crystalline; mostly vuggy, some zones with no vugs; some massive bedding; fossil casts and molds; fair porosity. Minor pelletal limestone: very-pale orange; fine-sized pellets; minor micritic matrix; low porosity. Minor algal chalk: white to tan; massively bedded; low porosity.
1023-1780	Dolomite: cream, tan to medium brown; very fine to fine crystalline; massively bedded; hard; microfossils: Dictyoconus, Asterigerina texana. With small (5mm) to large (0.25m) inclusions of anhydrite: white to medium gray; some anhydrite appears massively bedded; more anhydrite in upper part of section. Vugs, pores, and fractures in dolomite generally filled with selenitic gypsum: clear. Section generally has very low porosity, but minor zones of fair porosity exist.
	Oldsmar Limestone:
1780-1995	Limestone, pelletal, with some micritic; cream to light gray; fine-sized pellets; massively bedded; somewhat vuggy; microfossils: Pseudophragmina (Proporocyclina) cedarkeyensis, Dictyoconus, Quinqueloculina; fossil casts and molds; low porosity. Minor dolomitic limestone: tan; micritic; low porosity.

Lithologic Features

Several lithologic features in the rock influence the hydrogeology of the area. These are: (1) the nature and characteristics of voids, such as pores, fractures, vugs, and other secondary porosity; and (2) the occurrence of the evaporitic minerals, anhydrite and gypsum. Voids within the rock often facilitate the storage and transmission of fluids. The occurrence of anhydrite and gypsum at Polk City has the opposite effect. Because these evaporitic minerals can fill much of the pore space in the rock, storage and transmission of fluids can be significantly impeded.

Voids

Voids in sedimentary rocks, including limestones and dolomites, have origins that are concurrent with (primary porosity) or subsequent to (secondary porosity) the depositional process. The pelletal limestones recovered in the

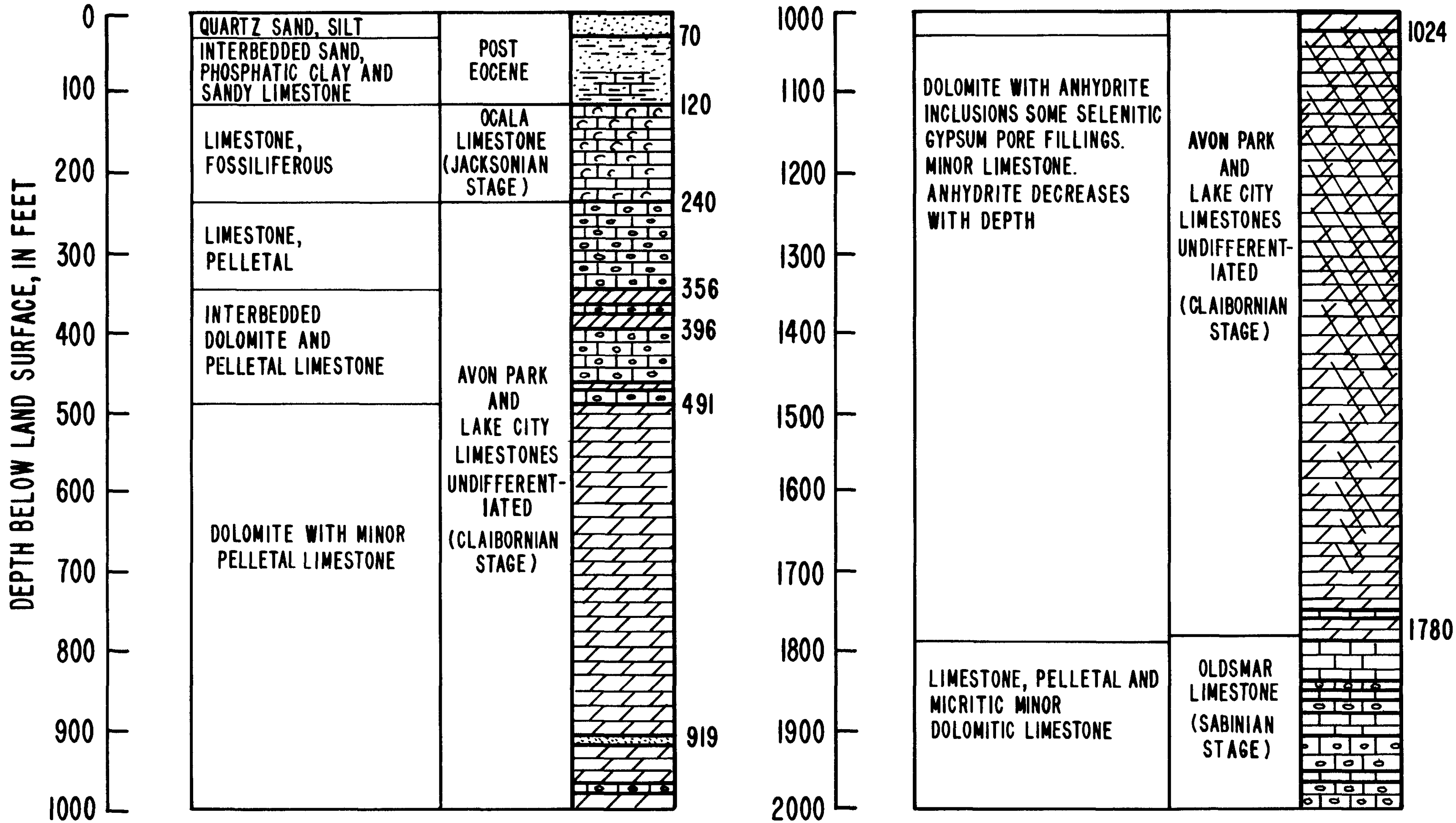


Figure 4.--Generalized lithologic log of core hole.

core samples have voids between the pellets or oolites that form primary porosity. The micritic limestones, however, have more intergranular spaces filled with clay-sized carbonate material. Secondary porosity can be created by dissolution of carbonate material by ground water. Secondary porosity can also be produced by dolomitization. A shrinkage in volume of up to 11 percent can take place during dolomitization of limestone, thus creating porosity (Gary and others, 1972, p. 207).

The cores shown in figure 5 exhibit the range of porosity common at Polk City. In figure 5a, a large dissolution void 1.25 inches in diameter is shown. Figure 5b shows smaller vug-type porosity probably related to differential solution along a preferred orientation and perhaps partially due to dolomitization. Figure 5c shows primary intergranular porosity in a pelletal limestone. Figure 5d shows the very low porosity of a very finely crystalline, dense dolomite.

In any rotary coring operation, recovery of the entire core is seldom achieved. Due to fracturing, incomplete consolidation, friability, or porosity, the rock may crumble during the coring process, be powdered by the bit, and flushed out in the circulating drilling fluid. This loss of material, for the most part unavoidable, may indicate the relative amount of void space or porosity of the rock (assuming that porosity is proportional to the resistance of a rock to the mechanical stress of drilling). Near-complete recovery is common in hard, dense, low porosity material, whereas incomplete recovery is common in relatively soft, porous material. Figure 6 is a plot of the percent of core recovered from each 20-foot cored interval versus depth. Observed differences in porosity or void space correlate well with the data in figure 6. Recovery was higher in the 500 to 600-foot and the 1,023 to 2,000-foot intervals, generally indicating relatively hard, dense rocks. In the 350 to 500-foot and 600 to 1,023-foot intervals, recovery was less complete, generally indicating softer, more porous rocks. This qualitative indication is consistent with observations of the core.

Evaporites

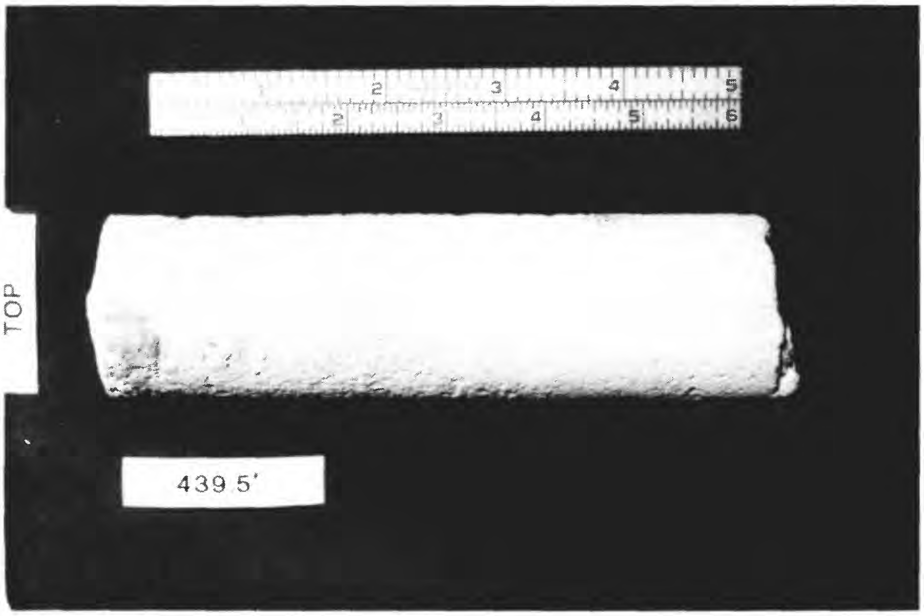
Evaporites occur at Polk City as anhydrite ($CaSO_4$) and gypsum ($CaSO_4+2H_2O$) at depths below 1,023 feet. Stewart (1966) reported a similar depth of the top of evaporite bearing rocks in nearby core holes. The presence of these minerals greatly reduces the porosity of the rocks because they fill much of the pore space. The graph in figure 7 shows the percent of megascopic evaporite present in the total volume of core recovered versus depth.

Anhydrite is present as inclusions within a dolomite or dolomitic limestone matrix. In a few isolated occurrences the anhydrite in the recovered cores is somewhat massive (up to about 1 foot in thickness) and layered. These occurrences are probably only large inclusions whose limits cannot be resolved because of the small core diameter. The bulk of the anhydrite occurs filling voids and solution cavities, and is not thought to represent extensive beds.

5a.--Large dissolution void.

5b.--Vugs with preferred orientation.

Figure 5.--Examples of range of porosity in core samples.



5c.--Intergranular porosity.

5d.--Very low porosity.

Figure 5.--Examples of range of porosity in core samples--(Continued).

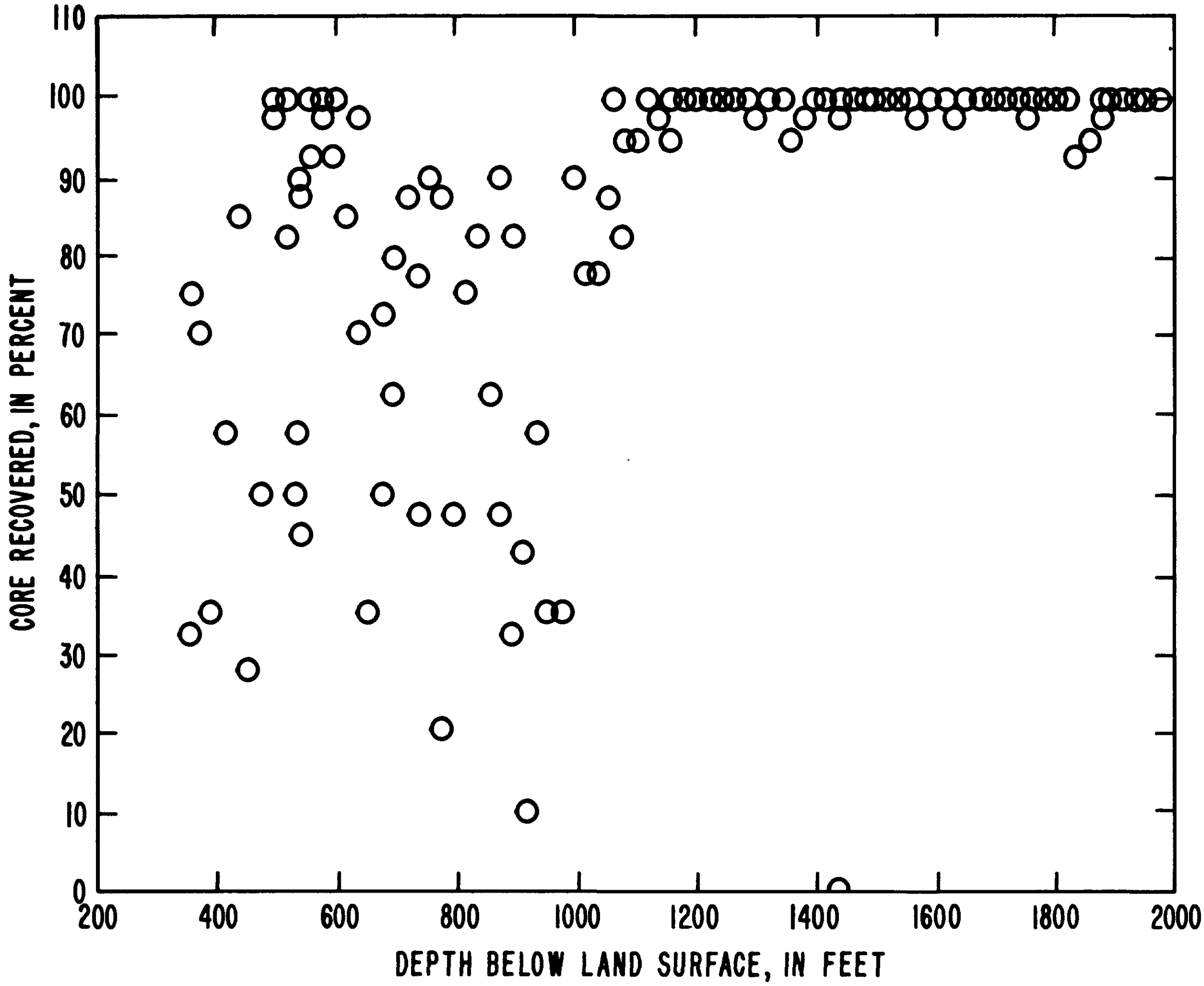


Figure 6.--Percent of core recovery versus depth.

The anhydrite occurs in several textures or characters, probably related to depositional mode and post-depositional brecciation. This character includes a variation in the size and frequency of occurrence of inclusions. The inclusions ranged in size from small (0.125 inch) to large (1 foot). The small-sized inclusions occur generally in clusters and the large-sized inclusions may either be isolated or in clusters. The photographs in figure 8 show these variations in character. Figure 8a shows the small anhydrite inclusions, photographed as the slightly darker material, in a lighter-colored dolomite matrix. Figure 8b shows medium-sized anhydrite inclusions (again, the slightly darker material) and extension fractures filled with anhydrite. Figure 8c shows a large-sized anhydrite inclusion; the anhydrite in this photograph is the white material. In figure 8c, a rind of clear gypsum can be seen as the darker material on the perimeter of the white anhydrite. Figure 8d is an example of massive anhydrite; all material in the figure is anhydrite or gypsum.

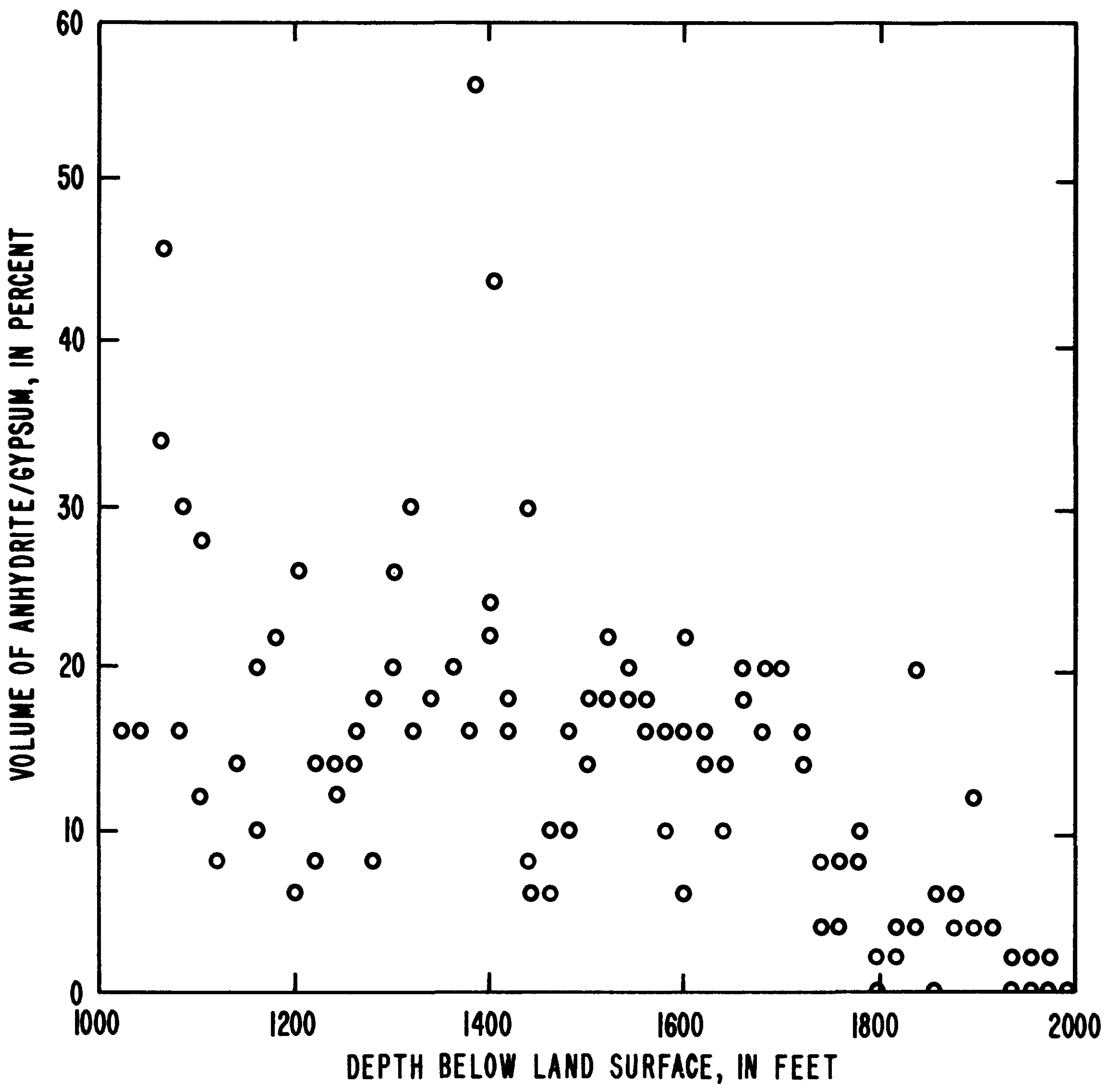


Figure 7.--Percent of megascopic anhydrite and gypsum in total volume of core recovered.

Figure 8a.--Small anhydrite inclusions.

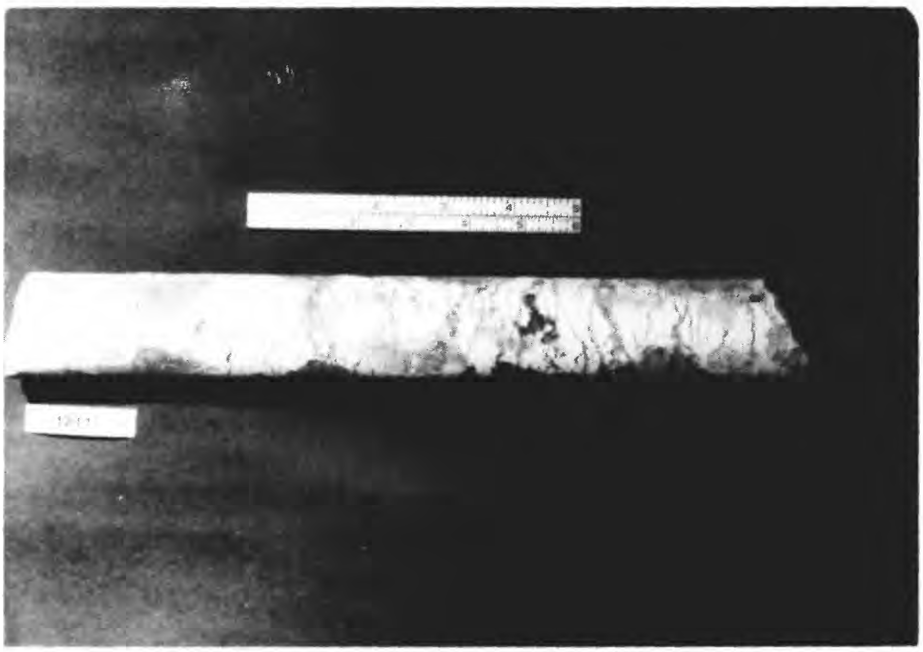


Figure 8b.--Medium sized anhydrite inclusions.

Figure 8.--Examples of anhydrite character and texture encountered in core samples.

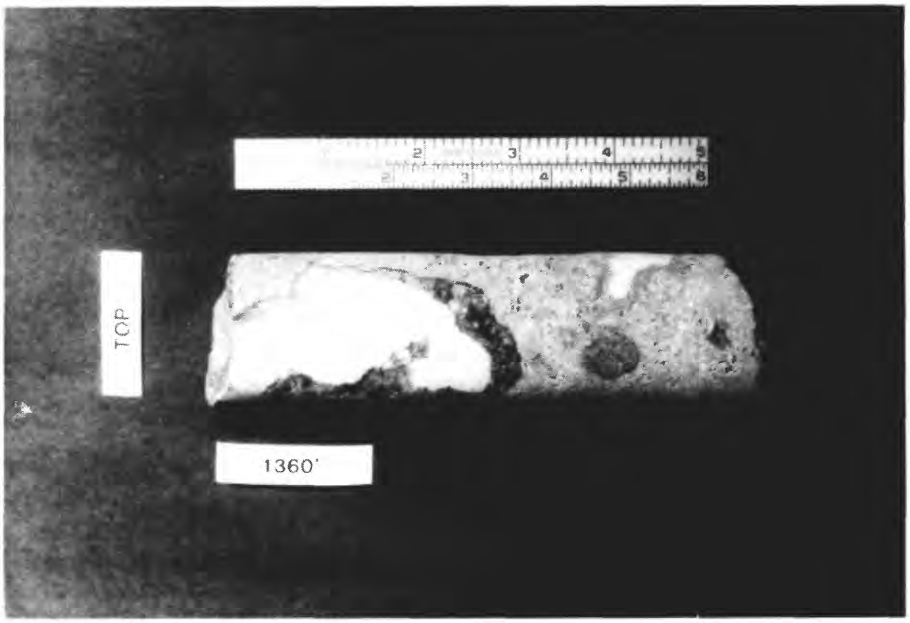


Figure 8c.--Larger anhydrite inclusion with gypsum rind.

Figure 8d.--Massive anhydrite.

Figure 8.--Examples of anhydrite character and texture encountered in core samples--Continued.

Gypsum is present as pore-filling material and is generally in selenitic form. Some gypsum also occurs as a rind on the perimeter of anhydrite inclusions. In the form of a rind, the gypsum indicates either a change in environment during precipitation of the evaporite or, more likely, a transformation of the perimeter of the anhydrite under subsequent diagenetic conditions. An example of a gypsum rind is seen in figure 8c. The pore-filling gypsum definitely results from post-depositional processes because it fills vugs and solution voids, and occurs as fossil casts. Figure 9a shows gypsum-filled pore spaces. The bright glare from the broken face of the core in figure 9a is light reflecting off the cleavage surface of selenitic gypsum filling the entire pore space of the rock. Figure 9b shows a fossil mold filled with gypsum that appears dark in the photograph.

A possible modern analog to the environment that deposited the evaporites is found in the Sabkha regions of the Arabian Gulf Coast (Butler, 1969). The Sabkhas are low, supratidal mudflats where an evaporitive mechanism concentrates interstitial seawater resulting in gypsum or anhydrite precipitation. Salinity, temperature, and the presence of organic matter appear to control whether gypsum or anhydrite is precipitated (Cody and Hull, 1980). Dolomitization of limestone is also associated with this mechanism.

HYDROGEOLOGY

During the drilling process, water levels were frequently measured in the core holes. When drilling was completed, selected core samples were tested for porosity and permeability.

Water Levels

The water level declined in the core holes as the depth of drilling increased. The decline was expected as Polk City is astride a recharge area. Water levels measured in the drill stem after the core barrel was recovered may be subject to some instability error, and accordingly water levels measured at the start of the day, having had the night to stabilize, are considered more reliable.

Figure 10 shows measured water levels plotted against depth, unadjusted for changes in water level with time. Prevailing dry conditions during the coring caused a regionwide lowering of the potentiometric surface. In order to determine the true head-depth relation in the core holes, an adjustment was neccessary to filter out the effects of the regional potentiometric surface decline.

Figure 11 shows the start-of-day measurements adjusted for change in water level with time. The adjustment was performed using water-level measurements at the nearby Polk City ROMP well near Polk City, Fla. taken during the coring. There is some scatter in the data, perhaps due to the coring procedure. However, a general trend is identifiable. In figure 11, showing the adjusted

9a.--Pore-filling selenitic gypsum.

9b.--Fossil mold (gastropod) filled with gypsum.

Figure 9.--Examples of gypsum character and texture encountered in core sample

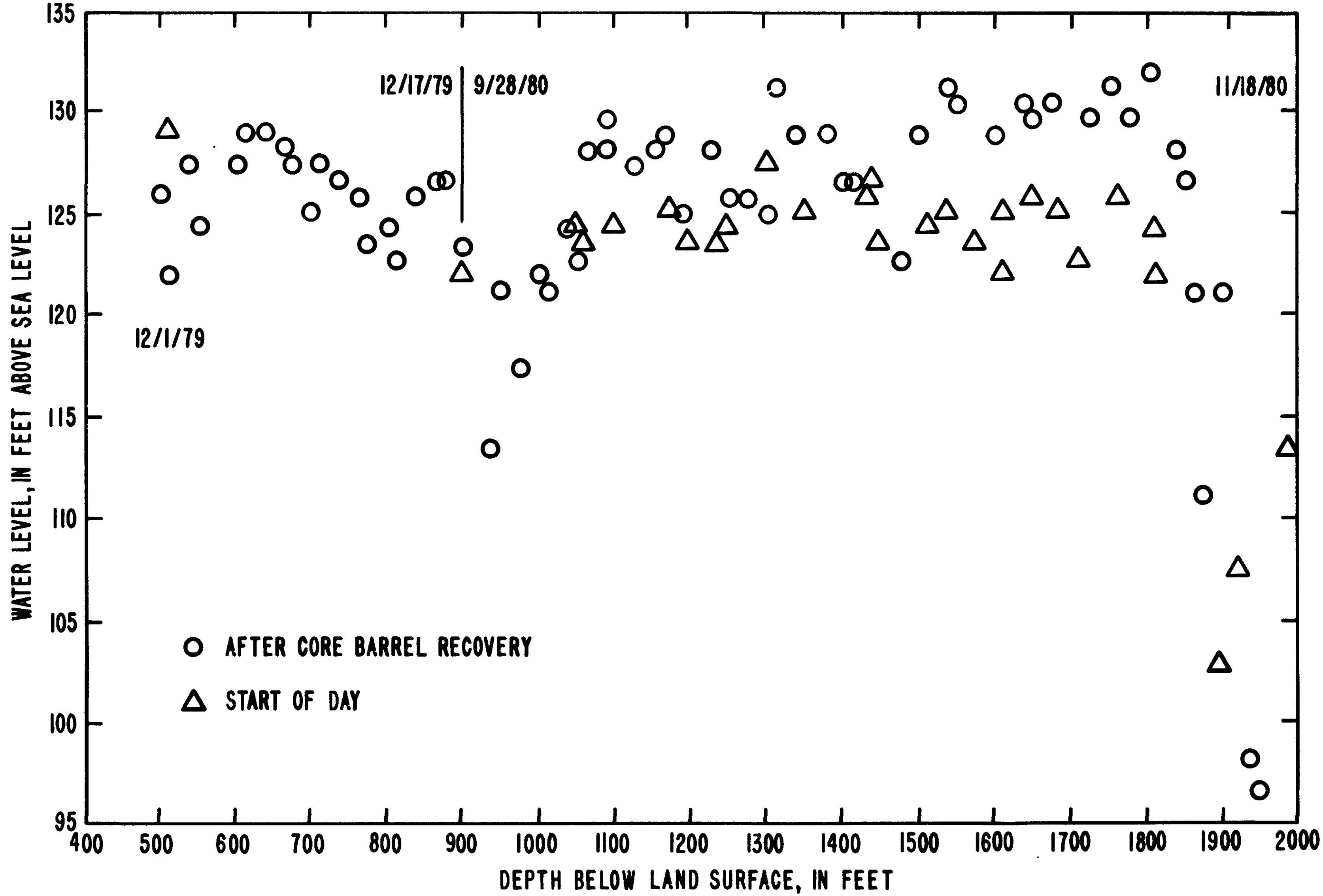


Figure 10.--Water levels in core holes during drilling.

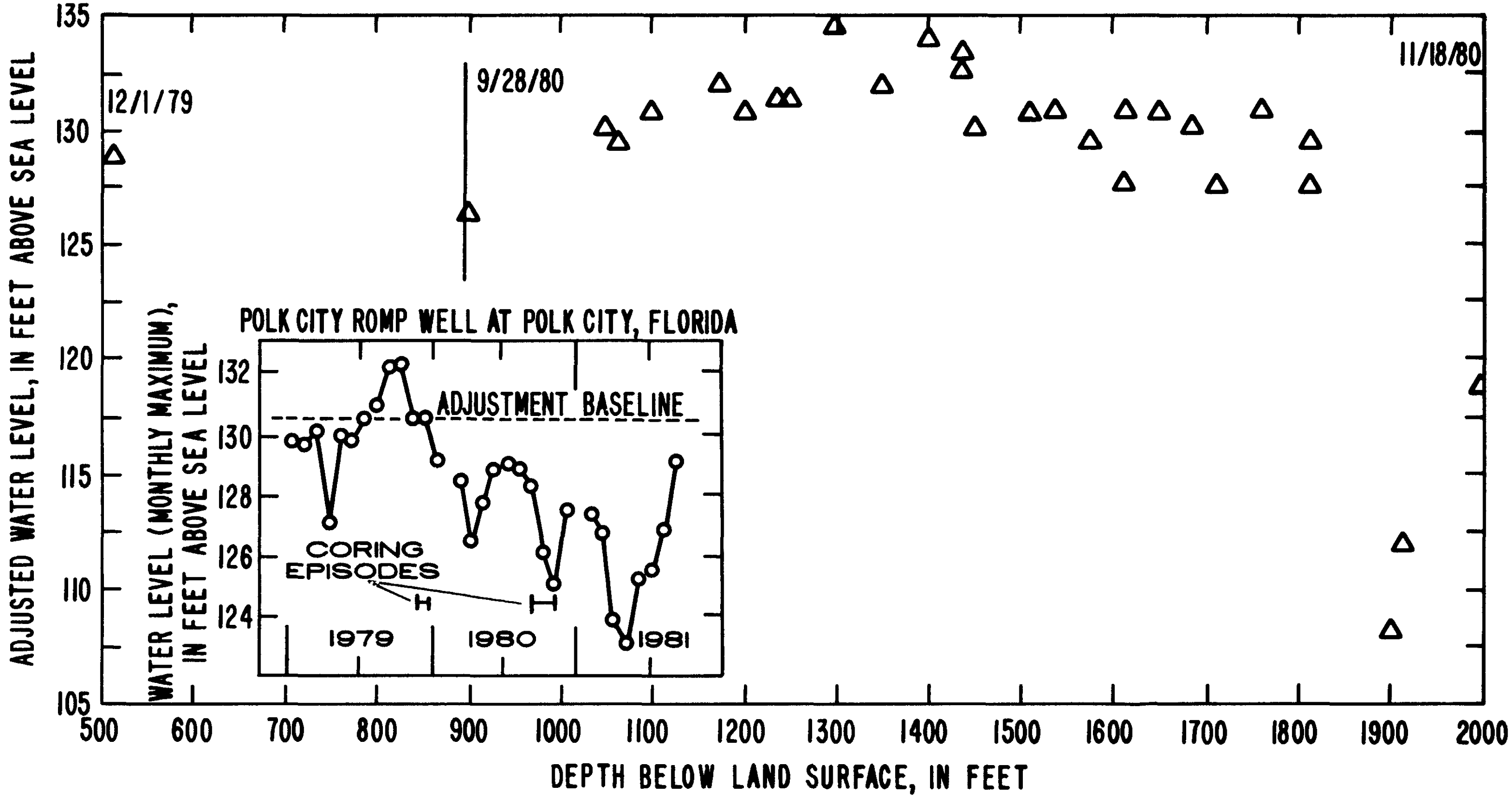


Figure 11.--Graph showing water levels at start of day in core holes during drilling, adjusted to reflect water-level changes with time in Polk City ROMP Well at Polk City, Florida.

data, a slight rise in water level appears to occur to a depth of approximately 1,300 feet. This rise is probably due to an inaccurate adjustment, attributable to an attenuation in the effect of the declining head on the deeper parts of the aquifer than to an actual increase in water level with depth. The attenuation would cause an overcompensation when shallower observation well data are used to adjust deeper well data. Unfortunately, no deep aquifer observation wells existed in the area at that time that would provide a more accurate adjustment. The most reasonable interpretation of the data is that water levels remained at a rather constant level as depth increased, until a marked decline of approximately 16 feet occurred at the 1,800 to 1,900-foot level. This decline is coincident with the top of the Oldsmar Limestone. Stewart (1966) reported a similarly large decline in water level in his core hole 801-200-3, which is near Polk City, during drilling in the Oldsmar.

Water-level data for the core holes are given in table 3. Hydrographs of the Polk City ROMP well near Polk City, Fla., and of the Lake Alfred deep well near Lake Alfred, Fla. (total depth 425 feet), located 6 miles east of the core hole site, are given in figure 12. The Lake Alfred well hydrograph verifies the credibility of the Polk City ROMP well as a representative observation well.

Hydrogeologic Units

The sediments encountered in the core holes can be divided into hydrogeologic units based upon the lithology and observed porosity and permeability. A section showing the hydrogeologic units is shown in figure 13. Highly permeable zones were found at depths of 120 to 473 feet and at 780 to 960 feet. The upper permeable zone is composed of fossiliferous and pelletal limestone that contains minor amounts of dolomite. This unit includes the Ocala Limestone and the upper part of the Claiborne sequence. The lower permeable zone is composed of a vuggy dolomite in the Claiborne sequence. Between the two permeable zones is a less permeable zone composed of harder, less porous dolomite. The upper permeable zone is overlain by the upper confining unit composed of Miocene and post-Miocene sediments. Underlying the lower permeable zone is a second confining unit composed of dense, low permeability anhydritic and gypsiferous dolomite. The Floridan aquifer, in a practical sense, occurs in the 840-foot interval between the upper confining and lower confining units, with an intervening less permeable zone, dividing the aquifer into upper and lower members. However, some thin, isolated, permeable zones exist within the lower confining unit. This determination is based upon the lithologic log, drilling characteristics, and the data from hydraulic analysis of selected core samples. Low to moderately permeable limestones underlie the lower confining unit from 1,785 feet to the bottom of the hole at 1,996 feet. These permeable limestones are considered part of the Floridan aquifer, as it is defined in a regional sense.

Table 3.--Water-level measurements during drilling

Start of day measurements and adjusted measurements

Depth (feet)	Date	Polk City core hole water level (feet above sea level)	Polk City ROMP well water level (feet above sea level)	Adjusted[1/] core hole water level (feet above sea level)
512.0	12-03-79	128.44	130.50	127.85
904.4	09-28-80	121.39	125.85	125.71
1049.8	10-12-80	123.58	124.16	130.16
1065.8	10-13-80	122.78	123.83	129.77
1105.8	10-14-80	123.71	123.50	131.09
1172.8	10-15-80	124.27	123.16	132.06
1205.8	10-16-80	123.26	123.02	131.19
1235.8	10-18-80	123.01	122.88	131.41
1255.8	10-19-80	123.41	122.74	131.71
1295.8	10-21-80	126.44	122.66	134.47
1355.8	10-22-80	124.14	122.72	132.24
1401.8	10-23-80	125.82	122.78	133.86
1435.8	10-24-80	124.89	122.84	132.87
1440.8	10-25-80	124.98	122.88	132.92
1440.8	10-27-80	125.83	123.14	133.51
1455.8	10-28-80	122.96	123.40	130.38
1515.8	10-29-80	123.55	123.67	130.70
1534.8	10-30-80	124.39	124.09	131.12
1574.8	10-31-80	123.10	124.31	129.61
1615.8	11-01-80	124.71	124.37	131.16
1615.8	11-02-80	121.54	124.76	127.60
1651.8	11-03-80	125.17	125.10	130.89
1692.8	11-04-80	124.46	125.02	130.26
1710.8	11-05-80	122.29	125.04	128.07
1760.8	11-06-80	125.04	125.06	130.72
1815.8	11-07-80	123.74	125.07	129.36
1815.8	11-09-80	121.73	125.08	127.34
1898.5	11-14-80	102.41	125.04	108.19
1915.0	11-15-80	106.13	125.03	111.92
1995.8	11-18-80	112.89	125.01	118.70

[1/]Adjustment determined by using a Polk City ROMP well base water level of 130.56 feet and shifting the core hole water level accordingly. Correction made to a density of 1.000 gr/cm^3.

Table 3.-- Water-level measurements during drilling--Continued

Measurement made after core barrel recovery

Depth (feet)	Core hole water level (feet above sea level)	Date	Depth (feet)	Core hole water level (feet above sea level)	Date
505.9	125.12	12-02-79	1275.8	125.16	10-19-80
514.7	121.60	12-02-79	1295.8	124.62	10-19-80
534.1	127.01	12-02-79	1315.8	130.47	10-21-80
556.1	123.69	12-03-79	1335.8	128.21	10-21-80
616.4	126.49	12-13-79	1375.8	127.91	10-22-80
636.4	127.93	12-14-79	1395.8	126.36	10-22-80
656.4	127.86	12-14-79	1415.8	126.06	10-23-80
676.4	126.49	12-14-79	1475.8	122.32	10-28-80
696.4	124.25	12-14-79	1495.8	128.30	10-28-80
716.4	126.47	12-14-79	1534.8	130.51	10-29-80
736.4	125.86	12-15-79	1554.8	129.49	10-30-80
756.4	125.30	12-15-79	1595.8	127.97	10-31-80
776.4	122.89	12-15-79	1635.8	129.78	11-02-80
796.4	123.86	12-15-79	1655.8	128.90	11-03-80
816.4	122.30	12-15-79	1675.8	129.95	11-03-80
836.4	125.51	12-16-79	1725.8	129.13	11-05-80
856.4	126.36	12-16-79	1745.8	130.53	11-05-80
876.4	126.11	12-17-79	1775.8	128.93	11-06-80
896.4	123.15	12-17-79	1795.8	130.96	11-06-80
935.8	113.49	10-03-80	1835.8	127.52	11-09-80
955.8	120.84	10-04-80	1851.8	126.32	11-09-80
975.8	117.16	10-04-80	1864.8	120.75	11-09-80
993.8	121.34	10-04-80	1876.8	110.86	11-10-80
1015.8	120.41	10-11-80	1895.8	120.56	11-10-80
1033.8	123.92	10-11-80	1935.8	98.15	11-15-80
1055.8	121.98	10-12-80	1955.8	97.01	11-15-80
1065.8	127.30	10-12-80	1975.8	104.83	11-17-80
1085.8	127.15	10-13-80	1995.8	100.25	11-17-80
1092.8	128.79	10-13-80			
1125.8	127.01	10-14-80			
1145.8	127.23	10-14-80			
1165.8	127.92	10-14-80			
1185.8	124.15	10-15-80			
1225.8	127.47	10-16-80			
1255.8	125.58	10-18-80			

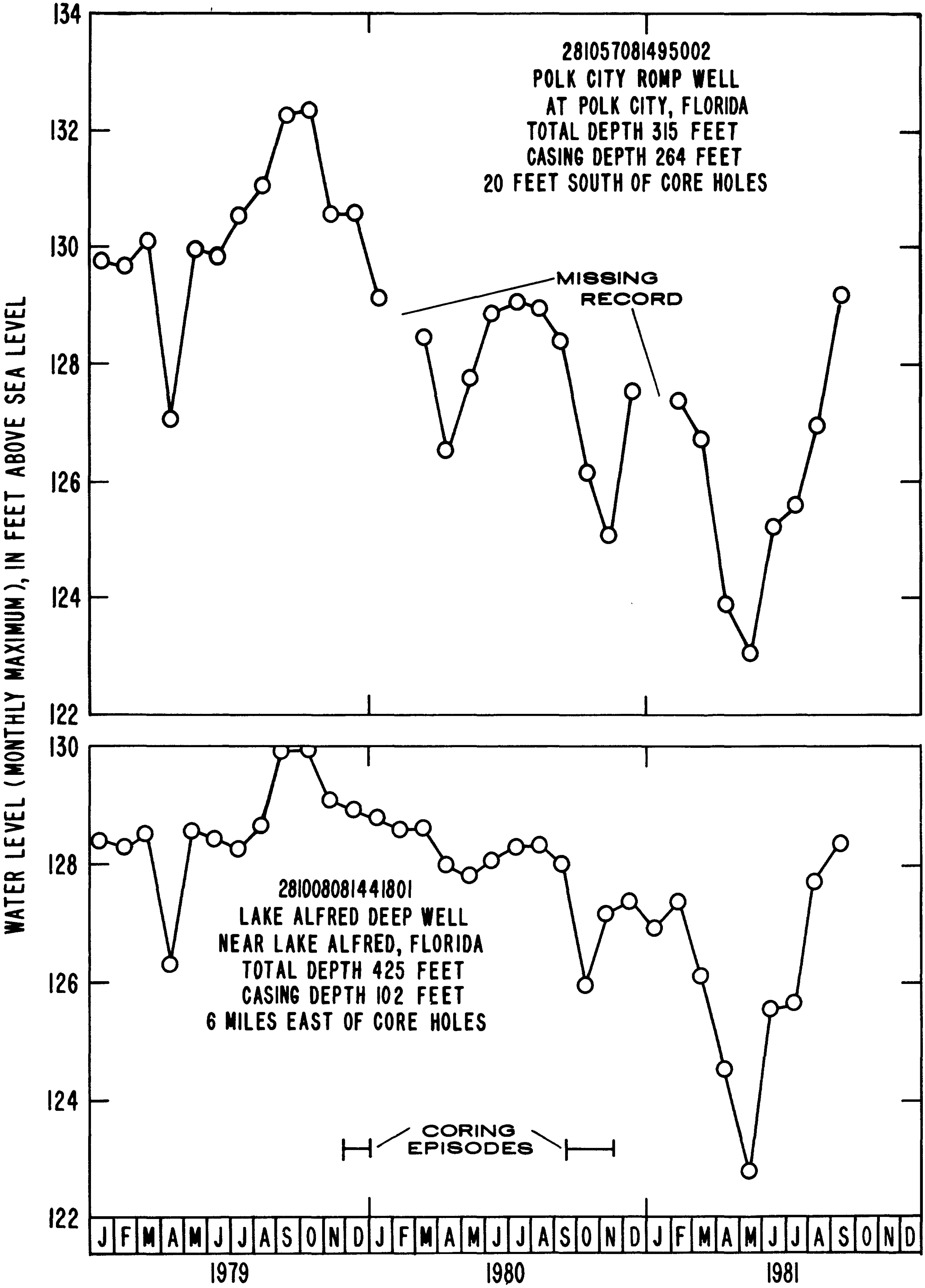


Figure 12.--Hydrographs of Polk City ROMP well near Polk City, Florida and of Lake Alfred deep well near Lake Alfred, Florida.

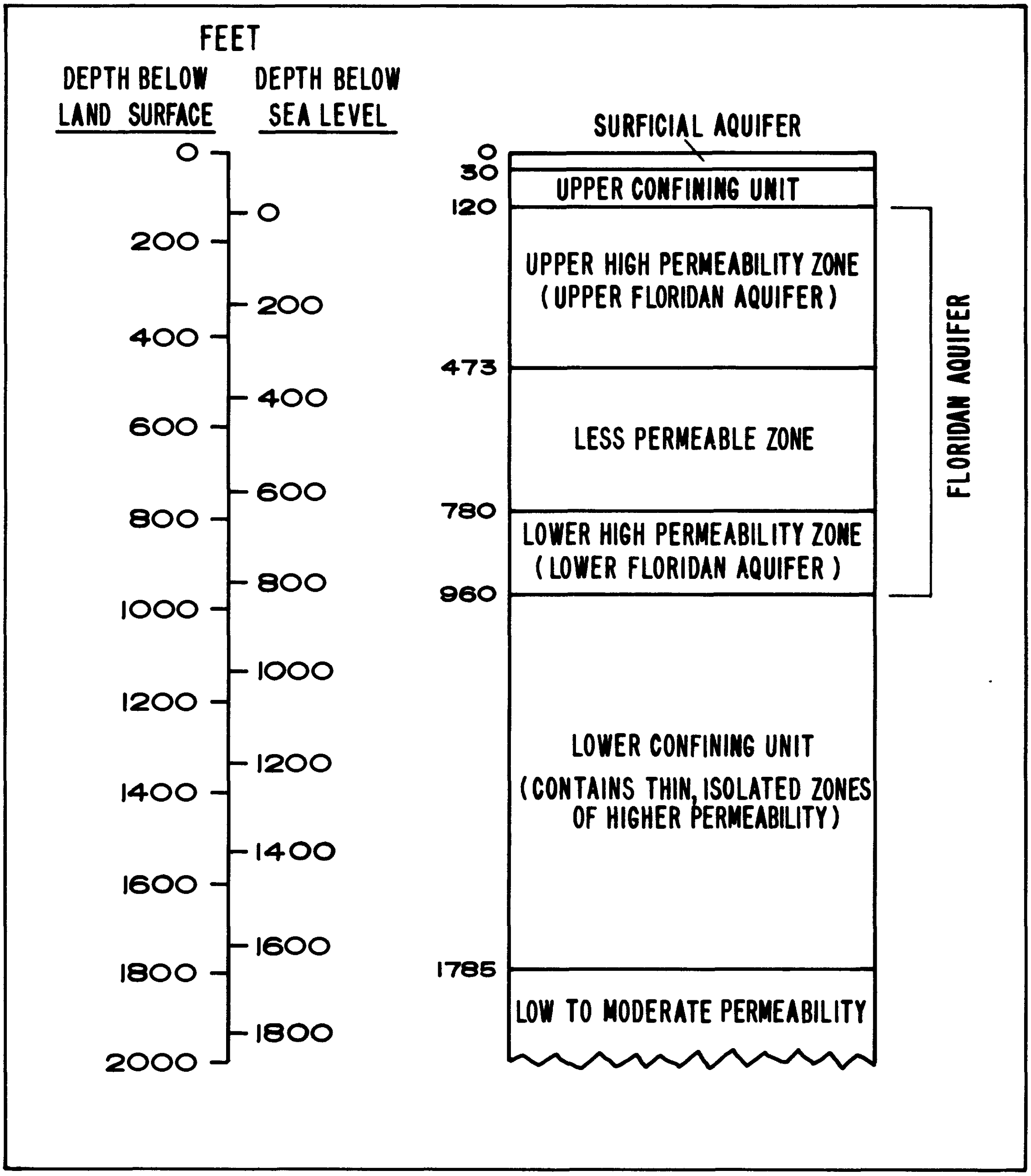


Figure 13.--Hydrogeologic units present at Polk City.

Hydraulic Properties

The hydraulic properties of 19 representative half- to one-foot long sections of core were analyzed by Core Laboratories, Inc. of Dallas, Tex. (use of name is for informational purposes only and does not constitute an endorsement by the U.S. Geological Survey). The hydraulic properties analyzed were horizontal and vertical hydraulic conductivity, porosity, and grain density. Table 4 contains the results of the analyses. Horizontal hydraulic conductivities range from less than 0.000024 feet per day to 19.0 feet per day, vertical hydraulic conductivities range from 0.000024 feet per day to 3.0 feet per day, and porosities range from 1.6 percent to 45.3 percent. The ratio of vertical to horizontal hydraulic conductivity ranges from 0.03 to 1.98. These laboratory hydraulic conductivities appear much lower than field values that might be expected of the Floridan aquifer based upon standard aquifer tests. Fractures and cavities play a major role in conducting water to a pumped well in the Floridan aquifer, whereas only the properties of the rock itself were measured in the laboratory. Therefore, the laboratory data should be used only in a relative sense and should not be considered to represent absolute aquifer characteristics.

Because half-foot to one-foot sections of core were analyzed, extrapolation of these data to represent entire rock sequences or lithologic units requires careful examination of the lithologic data. The coring commenced at a depth of 353 feet. Hydraulic analysis was not performed on the limestones in the 120 to 353-foot interval because these rocks were known to be very permeable and highly porous. Sample H-1 (see table 4) from the stratigraphically highest Eocene dolomite in the core hole has low porosity and hydraulic conductivity compared to the other samples taken at this site. The dolomite is approximately 35 feet thick and is underlain by 80 feet of limestone that has higher hydraulic conductivity and very high porosity, as determined by sample H-2. Samples H-1 and H-2 were taken from the upper permeable zone or upper Floridan aquifer. In summary, the upper Floridan aquifer is very porous and permeable from 120 to 355 feet, rather impermeable and nonporous from 355 to 390 feet, and moderately permeable and highly porous from 390 to 473 feet.

Samples H-3 and H-4 were taken from the less permeable zone. Sample H-3 has low hydraulic conductivity and extremely low porosity, as might be expected. Sample H-4, however, has reasonably high hydraulic conductivity and very high porosity, and was taken from a more porous zone in the low hydraulic conductivity sequence. The significant point is that a disparity exists between the vertical and horizontal hydraulic conductivities in the two samples. The vertical hydraulic conductivity is only a fraction of the horizontal in each case. This condition would effectively restrict the vertical fluid flow across the less permeable zone that intervenes between the upper and lower parts of the Floridan aquifer.

Sample H-5, from the lower Floridan aquifer, has extremely high porosity and hydraulic conductivity. Lithologic data show that there are some thin zones within the lower Floridan that appear to have low porosity. Therefore, sample H-5 is representative only of the more porous part of the lower Floridan.

Table 4.--Hydraulic properties of selected cores

Sample No.	Depth (feet)	Hydraulic conductivity (feet/day) Horizontal (H)	Vertical (V)	V/H (percent)	Porosity (percent)	Grain density (mass/volume)
H-1	368.0-369.0	0.012	0.024	1.98	15.2	2.85
H-2	440.5-441.0	.28	.37	1.32	39.6	2.74
H-3	538.0-539.0	.0025	.0004	.18	1.6	2.82
H-4	670.0-671.0	.46	.012	.03	36.8	2.86
H-5	817.0-818.0	4.2	3.0	.72	45.3	2.84
H-6	1001.0-1002.0	.034	.061	1.79	29.6	2.82
H-7	1075.0-1076.0	.0027	.002	.75	22.8	2.84
H-8	1211.0-1212.0	.0046	.001	.22	17.9	2.87
H-9	1372.0-1373.0	.0011	.0002	.20	10.1	2.84
H-10	1431.0-1432.0	.90	.47	.52	18.4	2.83
H-11	1458.0-1459.0	19.0	.81	.04	27.0	2.82
H-12	1549.5-1550.0	.0033	.0019	.57	10.0	2.85
H-13	1566.0-1567.0	6.6	.28	.04	23.7	2.73
H-14	1598.0-1599.0	.071	.021	.29	20.4	2.76
H-15	1653.5-1654.0	<.000024	.000024	1.00	7.4	2.84
H-16	1712.0-1713.0	.0004	.0006	1.44	9.5	2.86
H-17	1751.0-1752.0	.0006	.000049	.08	24.1	2.70
H-18	1835.8-1836.8	.023	.019	.85	15.3	2.73
H-19	1931.5-1932.0	1.1	.91	.86	35.8	2.76

Analyses by Core Laboratories, Inc., Dallas, Texas, 8/27/81.

Samples H-6 to H-19 were from the lower confining unit where the porosities and hydraulic conductivities ranged from very low to very high. These samples indicate that the hydraulic conductivity is substantially reduced in the evaporitic-bearing sequences. However, isolated zones of high hydraulic conductivity exist within this confining unit.

An important aspect is that anhydrite does not always cause reductions in porosity. Sample H-7 is predominatly anhydrite and has a porosity of 22.8 percent, which is relatively high although its hydraulic conductivity is quite low. The occurrence of pore-filling gypsum, on the other hand, can cause a reduction in porosity and hydraulic conductivity. Sample H-14, for example,is a dolomite that has pores filled with gypsum, so that porosity and hydraulic conductivity are extremely low.

Grain density is the specific gravity of the material composing the rock. The grain densities of the analyzed samples are listed in table 3. This measure aids in the identification of the predominant mineral. Calcite, the major constituent of limestone, has a specific gravity of 2.71, dolomite 2.85, anhydrite 2.89 to 2.98, and gypsum 2.32 (Hurlbut, 1971).

WATER QUALITY

Fifteen water-quality samples were collected from discrete depths in the core holes during drilling. The quality of the water in the upper 900 feet of aquifer meets all requirements for potable water. The dissolved solids concentration is approximately 150 mg/L (milligrams per liter). This was expected because the site is coincident with a recharge area. Figure 14 shows the relation between dissolved solids concentration of the formation water with depth of the core hole. Below the depth where anhydrite was first encountered (1,023 feet), the dissolved solids concentration rose to a range of 1,000 to 2,000 mg/L.

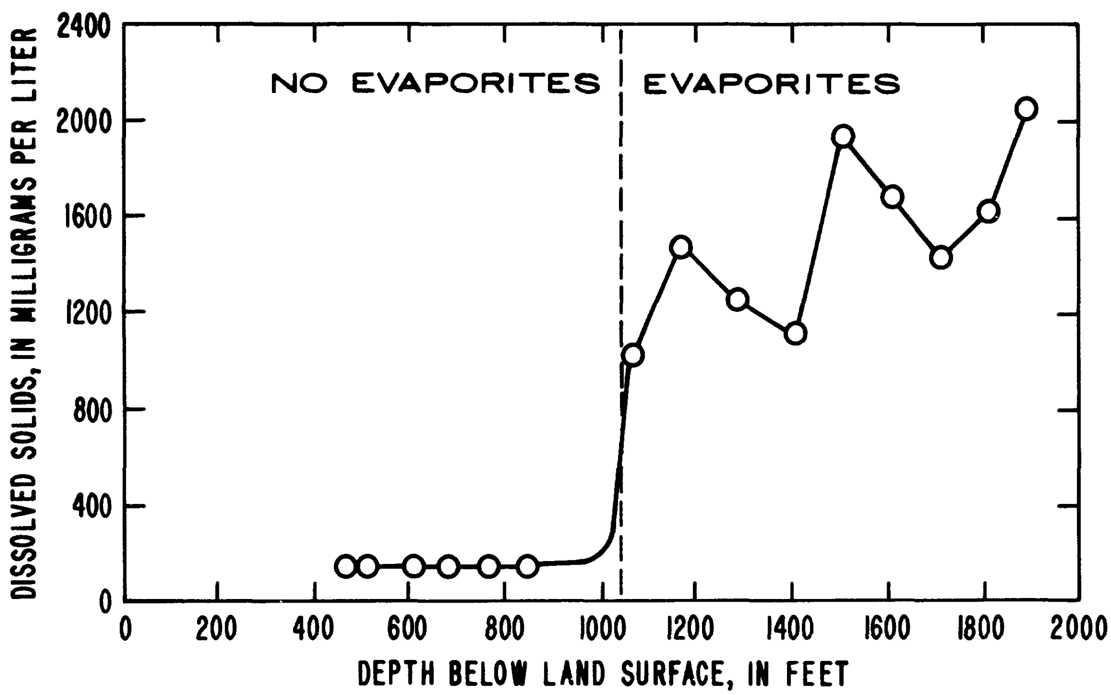


Figure 14.--Dissolved solids concentration, residue on evaporation at 180°C of water samples from core holes.

Generally, there is a contrast between the proportions of constituents in water from the permeable parts of the Floridan aquifer and water within the lower confining unit. The permeable strata contain calcium bicarbonate type water and the lower confining unit contains calcium sulfate type water, due to the presence of evaporitic minerals. This difference in types of water can be readily seen in the central field of the Piper diagram (Piper, 1944) in figure 15, because the analyses plot in two distinct groups. The two other fields of the diagram show the relative proportions of the major anions and cations present. The disparity between the groups of analyses on the central field of the Piper diagram indicates no significant mixing between the water of the permeable zones and the lower confining unit.

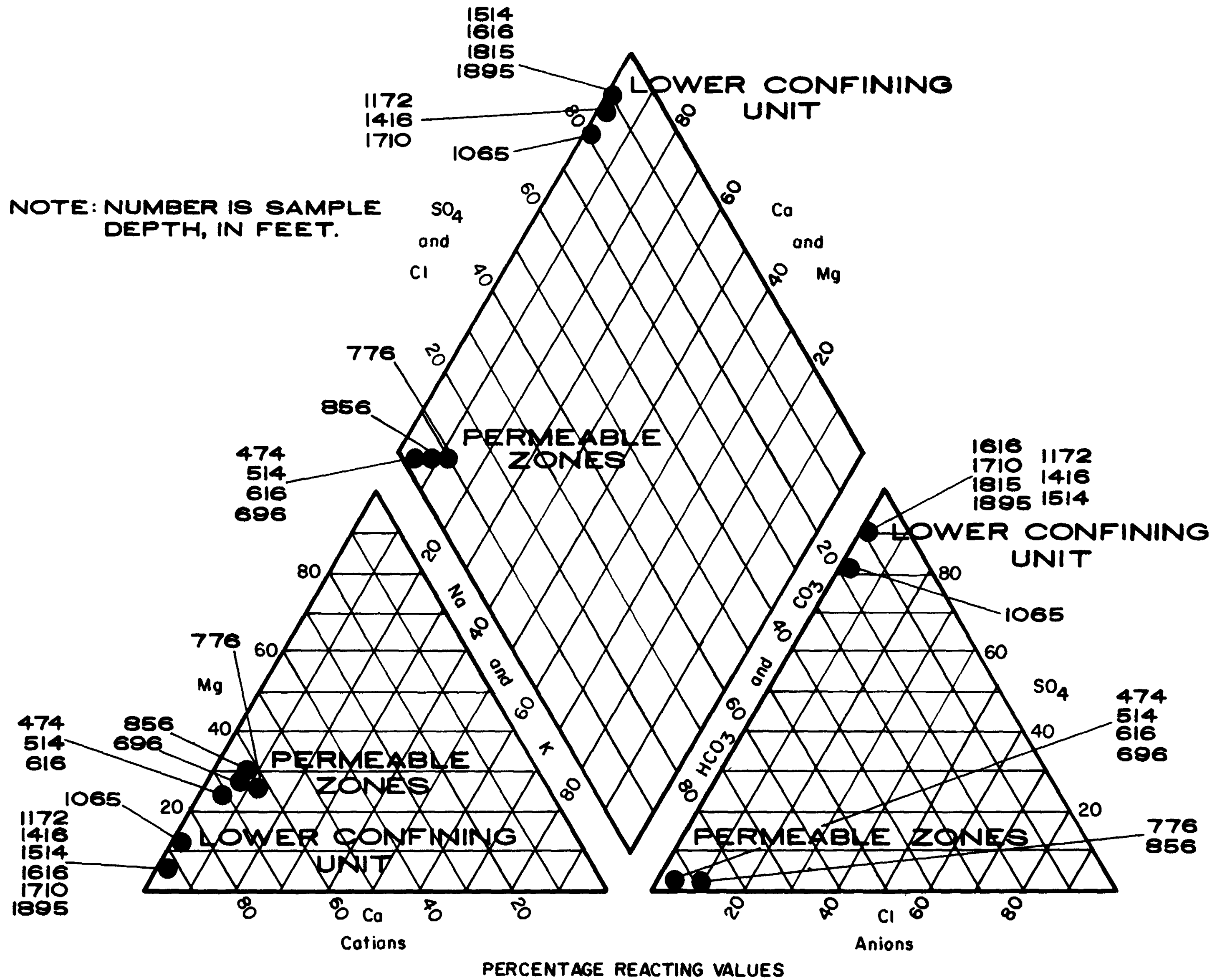


Figure 15.--Piper diagram showing relative proportions of major ions at each sampling depth of water samples from core holes.

The differences between the types of water in the permeable zones and the lower confining unit are also obvious in the relation of hardness, major cations, and sulfide-sulfate concentrations with depth. Apparently evaporitic minerals at depths greater than 1,000 feet in the lower confining unit, by contributing calcium sulfate, cause a significant increase in noncarbonate hardness (fig. 16) and sulfate (fig. 17), and account for the predominance of calcium as the major cation (fig. 18).

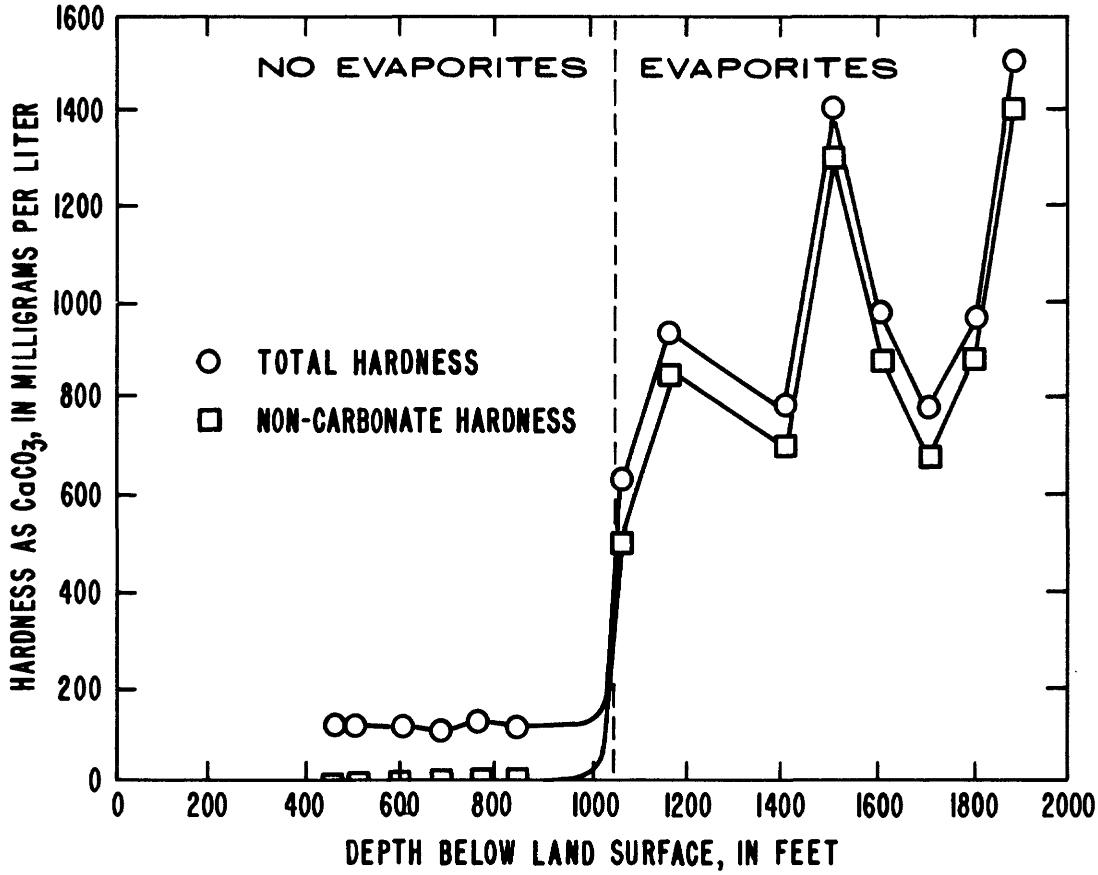


Figure 16.--Total and noncarbonate hardness of water samples from core holes.

Chloride concentrations are not a significant factor in the water chemistry of the core holes. Concentrations of chloride range from 3.9 to 11.0 mg/L (fig. 19). These low concentrations are in contrast to the chemistry of ground water in coastal regions of Florida where chloride concentrations increase with depth.

The data from the samples collected from the core holes are presented in tables 5 and 6.

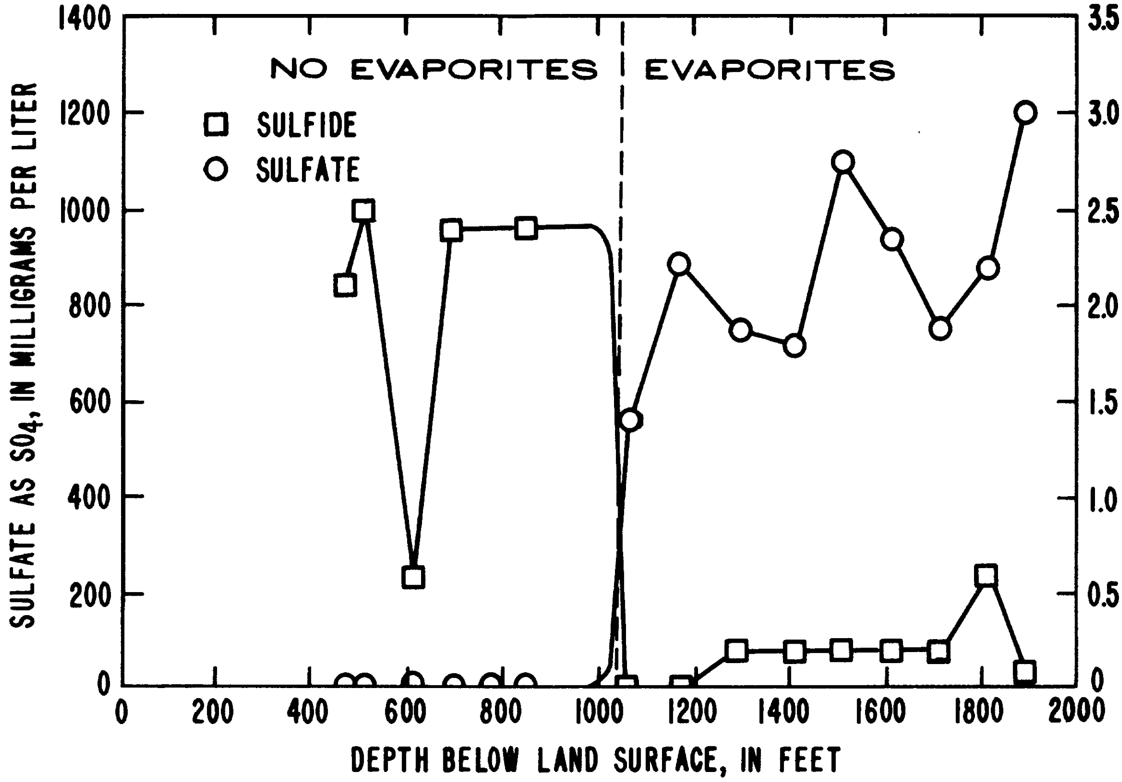


Figure 17.--Sulfide and sulfate concentrations of water samples from core holes.

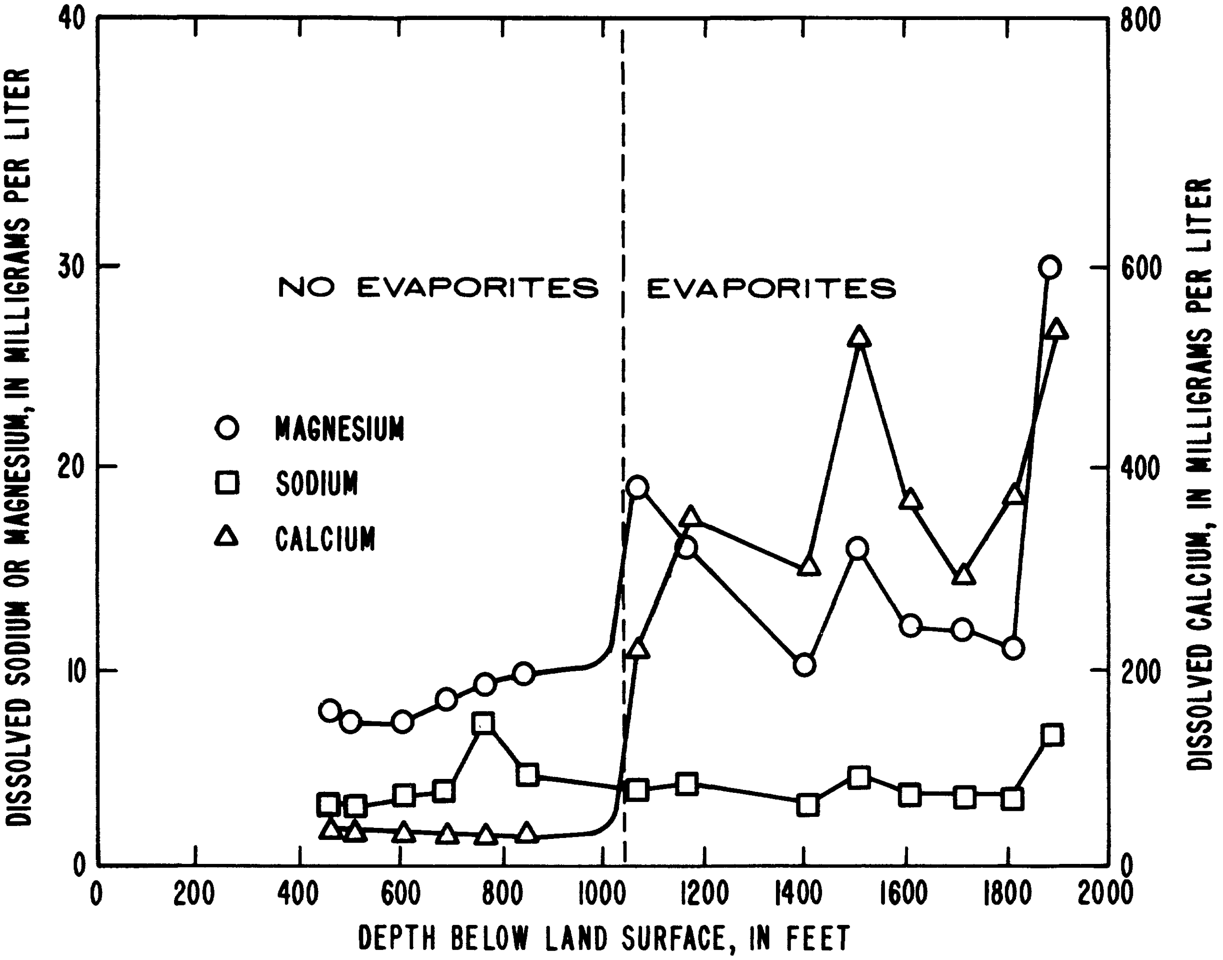


Figure 18.--Major cation concentration of water samples from core holes.

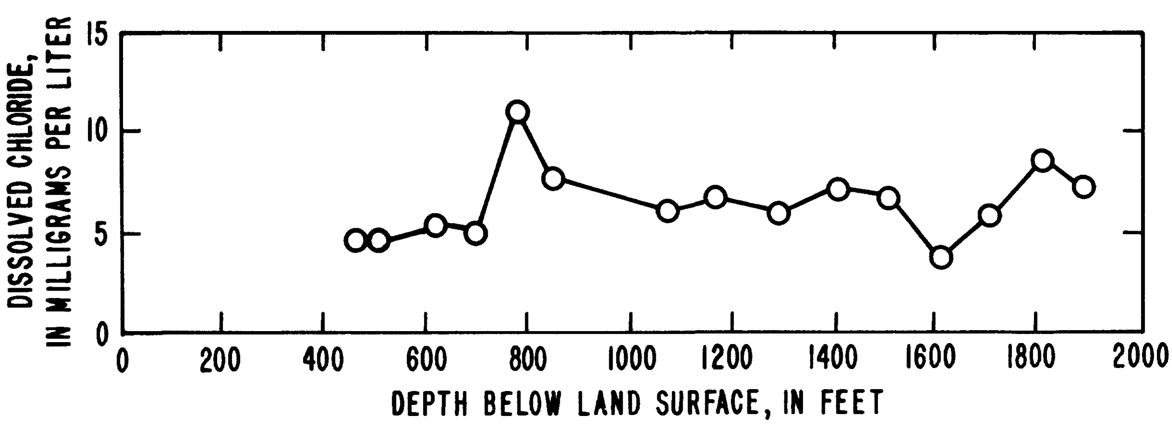


Figure 19.--Chloride concentration of water samples from core holes.

Table 5.--Analyses of water-quality samples from selected depths of 474 to 1,172 feet

[Parameter phases: D, dissolved; T, total; S, suspended; SR, suspended recoverable]

	1979						1980	
Date of samples	Nov 29	Dec 2	Dec 13	Dec 14	Dec 15	Dec 16	Oct 12	Oct 15
Depth of samples (feet)	474	514	616	696	776	856	1,065	1,172
Temperature, (°C)	25.0	25.0	25.0	25.0	24.0	25.0	29.0	26.0
Specific conductance (umhos/cm at 25 °C)	215	215	239	240	283	245	1,150	1,620
Solids, residue, D (mg/L)	153	141	135	135	156	155	1,020	1,480
Solids, sum of constituents, D (mg/L)	141	130	132	132	158	145	901	1,350
Density (g/mL at 20°C)	1.000	1.000	1.000	1.000	1.000	1.000	1.002	1.003
pH (units)	7.4	7.9	7.9	8.2	7.8	8.0	7.2	7.4
Alkalinity, as $CaCO_3$ (mg/L)	120	110	110	100	130	120	123	113
Aluminium, T (ug/L)	--	--	--	--	--	--	--	20
Aluminium, D (ug/L)	--	--	--	--	--	--	--	10
Aluminium, SR (ug/L)	--	--	--	--	--	--	--	10
Ammonia, D (mg/L)	--	--	--	--	--	--	--	.1
Arsenic, D (ug/L)	--	--	--	--	--	16	--	3
Arsenic, S (ug/L)	--	--	--	--	--	1	--	2
Arsenic, T (ug/L)	--	--	--	--	--	17	--	5
Barium, D (ug/L)	--	--	--	--	--	30	--	--
Barium, S (ug/L)	--	--	--	--	--	70	--	--
Barium, T (ug/L)	--	--	--	--	--	100	--	--
Beryllium, D (ug/L)	--	--	--	--	--	0	--	0
Beryllium, SR (ug/L)	--	--	--	--	--	10	--	0
Beryllium, T (ug/L)	--	--	--	--	--	10	--	0
Bicarbonate ion, as HCO_3 (mg/L)	140	130	130	--	440	150	150	140
Bromide, D (mg/L)	.0	.1	.0	.0	.0	--	--	.2
Cadmium, D (ug/L)	--	--	--	--	--	2	--	2
Cadmium, SR (ug/L)	--	--	--	--	--	--	--	0
Cadmium, T (ug/L)	--	--	--	--	--	--	--	0
Calcium, D (mg/L)	37	34	34	32	36	34	220	350
Carbon dioxide, D (mg/L)	9.2	2.6	2.6	--	11	2.4	15	8.8
Carbonate ion, as CO_3 (mg/L)	.0	--	.0	--	.0	.0	.0	.0
Carbon, organic, T (mg/L)	--	--	--	--	--	12	--	6.8
Chloride, D (mg/L)	4.6	4.6	5.4	5.1	11	7.8	6.4	6.7

Table 5.--Analyses of water-quality samples from selected depths of 474 to 1,172 feet--Continued

[Parameter phases: D, dissolved; T, total; S, suspended; SR, suspended recoverable]

	1979						1980	
Date of samples	Nov 29	Dec 2	Dec 13	Dec 14	Dec 15	Dec 16	Oct 12	Oct 15
Depth of samples (feet)	474	514	616	696	776	856	1,065	1,172
Chromium, D (ug/L)	--	--	--	--	--	10	--	30
Chromium, SR (ug/L)	--	--	--	--	--	10	--	--
Chromium, T (ug/L)	--	--	--	--	--	20	--	30
Cobalt, D (ug/L)	--	--	--	--	--	1	--	--
Cobalt, SR (ug/L)	--	--	--	--	--	--	--	--
Cobalt, T (ug/L)	--	--	--	--	--	--	--	--
Copper, D (ug/L)	--	--	--	--	--	--	--	1
Copper, SR (ug/L)	--	--	--	--	--	41	--	2
Copper, T (ug/L)	--	--	--	--	--	41	--	3
Deuterium/protium, isotope ratio	--	--	--	--	--	--	--	-2.35
Fluoride, D (mg/L)	.2	.2	.2	.2	.2	.2	.5	.5
Hardness, as $CaCO_3$ T (mg/L)	120	120	120	110	130	120	630	940
Hardness, noncarb. as $CaCO_3$ (mg/L)	4	10	5	5	.0	.0	500	850
Iodide, D (mg/L)	.01	.00	.00	.00	.00	.00	--	.05
Iron, SR (ug/L)	--	--	--	--	--	1,400	--	1,700
Iron, T (ug/L)	--	--	--	--	--	1,400	--	6,000
Iron, D (ug/L)	--	--	--	--	--	30	--	4,300
Lead, D (ug/L)	--	--	--	--	--	1	--	3
Lead, SR (ug/L)	--	--	--	--	--	19	--	9
Lead, T (ug/L)	--	--	--	--	--	20	--	12
Lithium, D (ug/L)	--	--	--	--	--	--	--	5
Lithium, SR (ug/L)	--	--	--	--	--	--	--	5
Lithium, T (ug/L)	--	--	--	--	--	--	--	10
Magnesium, D (mg/L)	7.7	7.4	7.3	8.4	9.4	9.6	19	16
Manganese, SR (ug/L)	--	--	--	--	--	10	--	--
Manganese, T (ug/L)	--	--	--	--	--	20	--	150
Manganese, D (ug/L)	--	--	--	--	--	6	--	160
Mercury, D (ug/L)	--	--	--	--	--	.1	--	.1
Mercury, SR (ug/L)	--	--	--	--	--	--	--	--
Mercury, T (ug/L)	--	--	--	--	--	.1	--	.1

Table 5.--Analyses of water-quality samples from selected depths of 474 to 1,172 feet--Continued

[Parameter phases: D, dissolved; T, total; S, suspended; SR, suspended recoverable]

	1979						1980	
Date of samples	Nov 29	Dec 2	Dec 13	Dec 14	Dec 15	Dec 16	Oct 12	Oct 15
Depth of samples (feet)	474	514	616	696	776	856	1,065	1,172
Molybdenum, D (ug/L)	--	--	--	--	--	--	--	600
Molybdenum, SR (ug/L)	--	--	--	--	--	--	--	100
Molybdenum, T (ug/L)	--	--	--	--	--	--	--	700
Nickel, D (ug/L)	--	--	--	--	--	1	--	12
Nickel, SR (ug/L)	--	--	--	--	--	--	--	0
Nickel, T (ug/L)	--	--	--	--	--	1.0	--	12
Nitrate, D (mg/L)	--	--	--	--	--	--	--	.5
Nitrite, D (mg/L)	--	--	--	--	--	--	--	.36
Nitrogen, organic, D (mg/L)	--	--	--	--	.02	--	--	--
Nitrogen, ammonia, D (mg/L)	--	--	--	--	.08	--	--	--
Nitrogen, nitrite, T (mg/L)	--	--	--	--	.11	--	--	--
Nitrogen, nitrate, D (mg/L)	--	--	--	--	.11	--	--	--
Oxygen-18/-16, isotope ratio	--	--	--	--	--	--	--	-0.36
Phosphorus, D (mg/L)	--	--	.03	.02	.01	.01	.01	.0
Potassium, D (mg/L)	.7	.7	.7	.9	1.1	.9	1.1	1.1
Potassium-40, D (pCi/L)	--	--	--	--	--	--	.8	--
Selenium, D (ug/L)	--	--	--	--	--	0	--	3
Selenium, SR (ug/L)	--	--	--	--	--	0	--	--
Selenium, T (ug/L)	--	--	--	--	--	0	--	--
Silica, D (mg/L)	15	13	13	14	14	14	13	11
Silver, D (ug/L)	--	--	--	--	--	0	--	--
Silver, SR (ug/L)	--	--	--	--	--	0	--	--
Silver, T (ug/L)	--	--	--	--	--	0	--	--
Sodium, D (mg/L)	3.2	3.0	3.6	3.8	7.3	4.8	4.0	4.2
Strontium, D (ug/L)	70	80	80	90	80	330	2,700	4,100
Sulfate, D (mg/L)	.0	.9	1.6	1.3	.7	1.4	560	890
Sulfide, T (mg/L)	2.1	2.5	.6	--	2.4	2.4	.0	.0
Vanadium, D (ug/L)	--	--	--	--	--	--	--	3
Zinc, D (ug/L)	--	--	--	--	--	40	--	30
Zinc, SR (ug/L)	--	--	--	--	--	70	--	10
Zinc, T (ug/L)	--	--	--	--	--	110	--	40

Table 6.--Analyses of water-quality samples from selected depths of 1,295 to 1,895 feet

[Parameters: D, dissolved; T, total, S, suspended; SR, suspended recoverable]

	1980						
Date of samples	Oct 19	Oct 23	Oct 29	Nov 1	Nov 4	Nov 7	Nov 14
Depth of samples (feet)	1,295	1,415	1,513	1,615	1,710	1,815	1,895
Temperature, (°C)	26.0	26.5	26.0	26.0	26.0	27.0	25.0
Specific conductance (umhos/cm at 25 °C)	1,450	1,490	2,125	1,840	1,550	1,640	2,150
Solids, residue, D (mg/L)	1,250	233	1,940	1,680	1,340	1,630	2,070
Solids, sum of constituents, D (mg/L)	--	1,110	1,730	1,400	1,130	1,350	1,870
Density (gm/mL at 20°C)	1.001	1.002	1.002	1.002	1.002	1.001	1.002
pH (units)	7.2	7.0	6.5	7.2	7.0	7.0	7.4
Alkalinity, as $CaCO_3$ (mg/L)	105	95	90	100	98	85	100
Aluminium, T (ug/L)	--	--	--	--	--	30	--
Aluminium, D (ug/L)	--	--	--	--	--	10	--
Aluminium, SR (ug/L)	--	--	--	--	--	20	--
Ammonia, D (mg/L)	--	--	--	--	--	.08	--
Arsenic, D (ug/L)	--	--	--	--	--	1	--
Arsenic, S (ug/L)	--	--	--	--	--	--	--
Arsenic, T (ug/L)	--	--	--	--	--	1	--
Barium, D (ug/L)	--	--	--	--	--	--	--
Barium, S (ug/L)	--	--	--	--	--	--	--
Barium, T (ug/L)	--	--	--	--	--	--	--
Beryllium, D (ug/L)	--	--	--	--	--	1	--
Beryllium, SR (ug/L)	--	--	--	--	--	9	--
Beryllium, T (ug/L)	--	--	--	--	--	10	--
Bicarbonate ion, as HCO_3 (mg/L)	130	120	98	120	120	100	120
Bromide, D (mg/L)	.2	.5	.5	.1	.3	.2	.2
Cadmium, D (ug/L)	--	--	--	--	--	3	--
Cadmium, SR (ug/L)	--	--	--	--	--	0	--
Cadmium, T (ug/L)	--	--	--	--	--	1	--
Calcium, D (mg/L)	--	300	530	370	290	370	540
Carbon dioxide, D (mg/L)	12	19	48	11	17	15	7.8
Carbonate ion, as CO_3 (mg/L)	.0	.0	.0	.0	.0	.0	.0
Carbon, organic, T (mg/L)	--	--	--	--	--	14.0	--
Chloride, D (mg/L)	6.0	7.4	6.9	3.9	5.9	8.6	7.3

Table 6.--Analyses of water-quality samples from selected depths of 1,295 to 1,895 feet--Continued

[Parameters: D, dissolved; T, total, S, suspended; SR, suspended recoverable]

	1980						
Date of samples	Oct 19	Oct 23	Oct 29	Nov 1	Nov 4	Nov 7	Nov 14
Depth of samples (feet)	1,295	1,415	1,513	1,615	1,710	1,815	1,895
Chromium, D (ug/L)	--	--	--	--	--	20	--
Chromium, SR (ug/L)	--	--	--	--	--	10	--
Chromium, T (ug/L)	--	--	--	--	--	30	--
Cobalt, D (ug/L)	--	--	--	--	--	--	--
Cobalt, SR (ug/L)	--	--	--	--	--	--	--
Cobalt, T (ug/L)	--	--	--	--	--	--	--
Copper, D (ug/L)	--	--	--	--	--	2	--
Copper, SR (ug/L)	--	--	--	--	--	7	--
Copper, T (ug/L)	--	--	--	--	--	9	--
Deuterium/protium, isotope ratio	--	--	--	--	--	-2.0	--
Fluoride, D (mg/L)	0.3	0.2	0.3	0.3	0.2	0.4	0.8
Hardness, as $CaCO_3$ T (mg/L)	--	790	1,400	980	780	970	1,500
Hardness, noncarb. as $CaCO_3$ (mg/L)	--	700	1,300	880	680	890	1,400
Iodide, D (mg/L)	.0	.04	.05	.0	.0	.0	.03
Iron, SR (ug/L)	--	--	--	--	--	8,900	--
Iron, T (ug/L)	--	--	--	--	--	4,000	--
Iron, D (ug/L)	--	--	--	--	--	5,100	--
Lead, D (ug/L)	--	--	--	--	--	0	--
Lead, SR (ug/L)	--	--	--	--	--	10	--
Lead, T (ug/L)	--	--	--	--	--	10	--
Lithium, D (ug/L)	--	--	--	--	--	8	--
Lithium, SR (ug/L)	--	--	--	--	--	2	--
Lithium, T (ug/L)	--	--	--	--	--	10	--
Magnesium, D (mg/L)	--	10	16	12	12	11	30
Manganese, SR (ug/L)	--	--	--	--	--	50	--
Manganese, T (ug/L)	--	--	--	--	--	260	--
Manganese, D (ug/L)	--	--	--	--	--	210	--
Mercury, D (ug/L)	--	--	--	--	--	.1	--
Mercury, SR (ug/L)	--	--	--	--	--	--	--
Mercury, T (ug/L)	--	--	--	--	--	.1	--

Table 6.--Analyses of water-quality samples from selected depths of 1,295 to 1,895 feet--Continued

[Parameters: D, dissolved; T, total, S, suspended; SR, suspended recoverable]

	1980						
Date of samples	Oct 19	Oct 23	Oct 29	Nov 1	Nov 4	Nov 7	Nov 14
Depth of samples (feet)	1,295	1,415	1,513	1,615	1,710	1,815	1,895
Molybdenum, D (ug/L)	--	--	--	--	--	10	--
Molybdenum, SR (ug/L)	--	--	--	--	--	--	--
Molybdenum, T (ug/L)	--	--	--	--	--	10	--
Nickel, D (ug/L)	--	--	--	--	--	9	--
Nickel, SR (ug/L)	--	--	--	--	--	5	--
Nickel, T (ug/L)	--	--	--	--	--	14	--
Nitrate, D (mg/L)	--	--	--	--	--	.0	--
Nitrite, D (mg/L)	--	--	--	--	--	.0	--
Nitrogen, organic, D (mg/L)	--	--	--	--	--	.06	--
Nitrogen, ammonia, D (mg/L)	--	--	--	--	--	.06	--
Nitrogen, nitrite, T (mg/L)	--	--	--	--	--	.00	--
Nitrogen, nitrate, D (mg/L)	--	--	--	--	--	.00	--
Oxygen-18/-16, isotope ratio	--	--	--	--	--	-0.30	--
Phosphorus, D (mg/L)	0.00	0.01	0.00	0.04	0.01	.00	0.00
Potassium, D (mg/L)	--	.7	1.0	.9	.9	1.0	2.2
Potassium-40, D (pCi/L)	--	--	--	.7	--	--	--
Selenium, D (ug/L)	--	--	--	--	--	--	--
Selenium, SR (ug/L)	--	--	--	--	--	1	--
Selenium, T (ug/L)	--	--	--	--	--	1	--
Silica, D (mg/L)	--	10	11	12	11	12	14
Silver, D (ug/L)	--	--	--	--	--	--	--
Silver, SR (ug/L)	--	--	--	--	--	--	--
Silver, T (ug/L)	--	--	--	--	--	--	--
Sodium, D (mg/L)	--	3.2	4.7	3.8	3.8	3.8	6.9
Strontium, D (ug/L)	--	1,300	2,800	2,200	1,100	2,400	5,800
Sulfate, D (mg/L)	750	720	1,100	940	750	880	1,200
Sulfide, T (mg/L)	.2	.2	.2	.2	.2	.6	.1
Vanadium, D (ug/L)	--	--	--	--	--	3	--
Zinc, D (ug/L)	--	--	--	--	--	50	--
Zinc, SR (ug/L)	--	--	--	--	--	350	--
Zinc, T (ug/L)	--	--	--	--	--	400	--

RELEVANCE TO REGIONAL AQUIFER SYSTEM

The Floridan aquifer at Polk City contains two highly permeable zones, separated by a less-permeable zone and confined by upper and lower confining units that bound the highly permeable zones at depths of 120 and 960 feet. The main zone of vigorous ground-water circulation at Polk City thus extends vertically for about 840 feet. However, the less-permeable zone, from about 475 to 780 feet in depth, accounts for about 300 feet of this thickness. Zones of moderate permeability exist below the base of the lower confining unit (at a depth of 1,785 feet).

The hydrogeologic section of the Floridan aquifer across central Florida (figs. 20 and 21) shows that the configuration of the Floridan aquifer underlying the Tampa and the Orlando areas is different, and that the hydrogeology at Polk City exhibits characteristics of both areas. In the Orlando area, the Floridan consists of upper and lower permeable zones, separated by a less permeable zone within a 2,300-foot sequence, whereas, in the Tampa area, the freshwater part of the aquifer is considered to be a single unit extending for approximately 1,300 feet to a thick confining unit. Permeable zones in the Tampa area that lie between the lower confining unit and the base of the Floridan aquifer are effectively isolated from overlying strata and have limited utility due to poor water quality.

The extent and characteristics of the less permeable zone and of the lower confining unit result in the differences between the Tampa and Orlando areas (fig. 21). The less permeable zone found at Polk City that extends east to the Orlando area consists of a dense, rather nonporous dolomite. The lower confining unit consists of an anhydritic and gypsiferous dolomite that extends east from the Tampa area to Polk City. The differing origins of the less-permeable zone and of the lower confining unit suggest that the two units are not connected. Evaporites occur at the base of the Floridan aquifer in the Orlando area, but at a much deeper level and at a different stratigraphic position from evaporites in the lower confining unit in the Polk City and Tampa areas. Apparently, the depositional environment of the younger evaporites, that make up the lower confining unit, did not extend east of the Polk City area. The occurrence of evaporites within the aquifer appears to have a substantial effect upon the water quality. In the Orlando area, where evaporites do not occur above the base of the aquifer, the water quality is acceptable, even at considerable depths. The dissolved solids concentration of the water is approximately 150 mg/L (Geraghty and Miller, Inc., 1977, Appendix D) throughout 2,000 feet of the aquifer. At Polk City and in the Tampa area, good quality water occurs above the lower confining unit. However, within and below the lower confining unit the water quality is poor and dissolved solids concentration is greater than 1,000 mg/L. The less permeable zone in the Orlando area has lower porosity and has a substantially lower occurrence of secondary solution features (Lichtler and others, 1968, p. 96) than the rocks above and below it. The dense dolomite at Polk City and the Orlando area that constitutes this less permeable zone becomes more permeable in the Tampa area, resulting in a single permeable unit there. The hydrogeology at Polk City appears to be transitional between the Orlando and Tampa regimes.

Figure 22 diagrams the stratigraphy along the same traverse as the hydrogeologic section shown in figure 19. The lack of complexity in the stratigraphy, compared to the hydrogeologic section, shows that rock types or facies rather than stratigraphic relation govern the hydraulic conductivity within each formational unit, and exercise the greatest influence upon the groundwater system of the Floridan aquifer in central Florida.

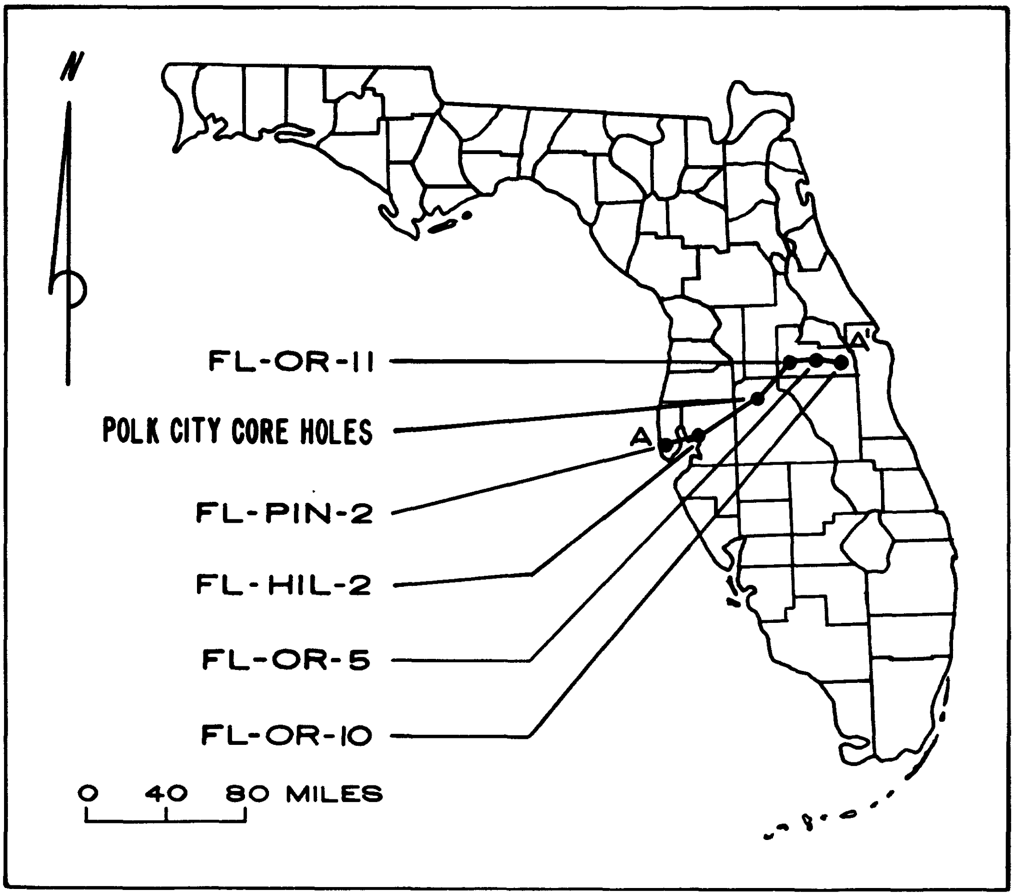


Figure 20.--Location of hydrogeologic and stratigraphic sections A-A'.

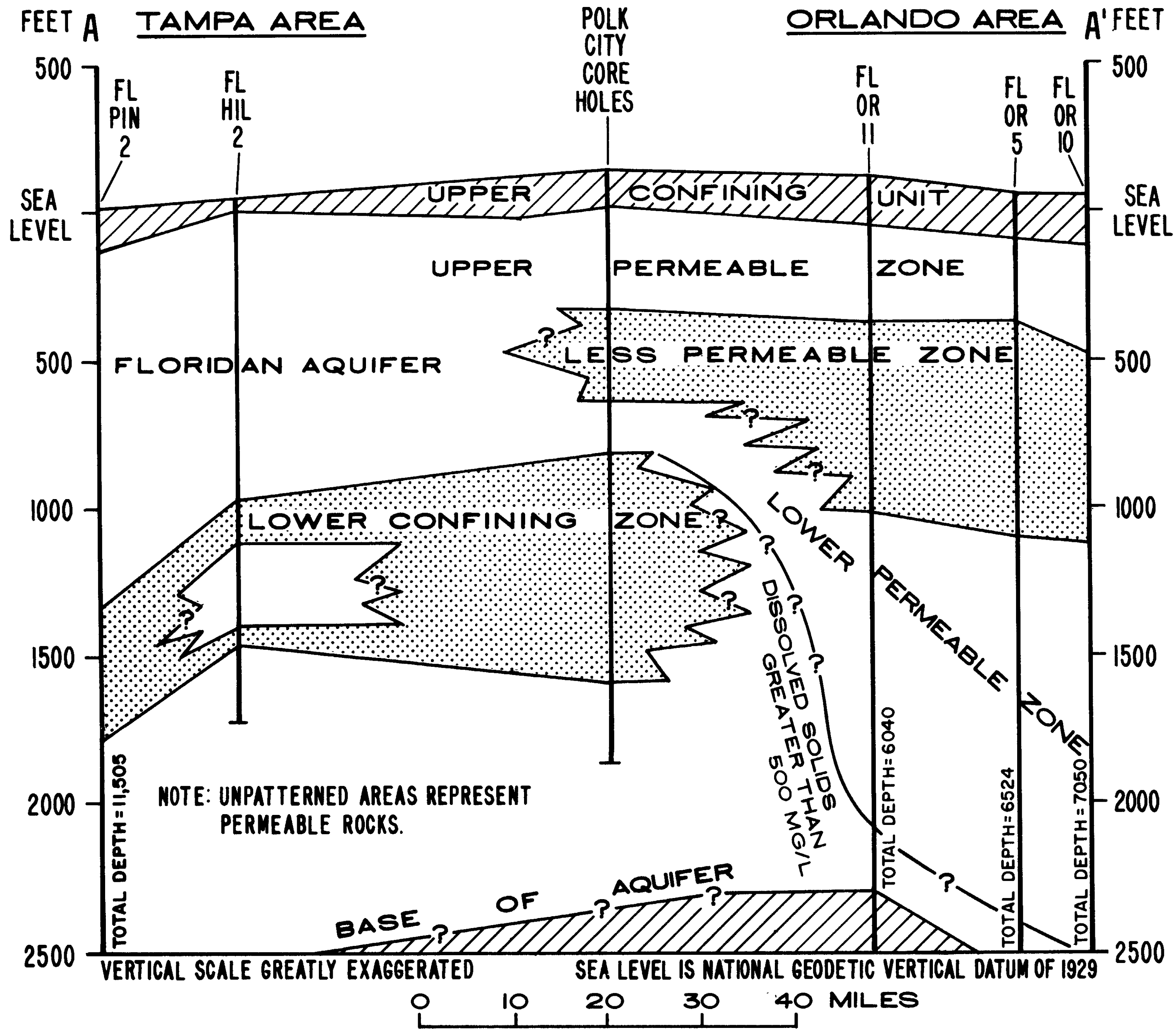


Figure 21.--Hydrogeologic section of Floridan aquifer in central Florida (modified from James A. Miller, written commun., 1982).

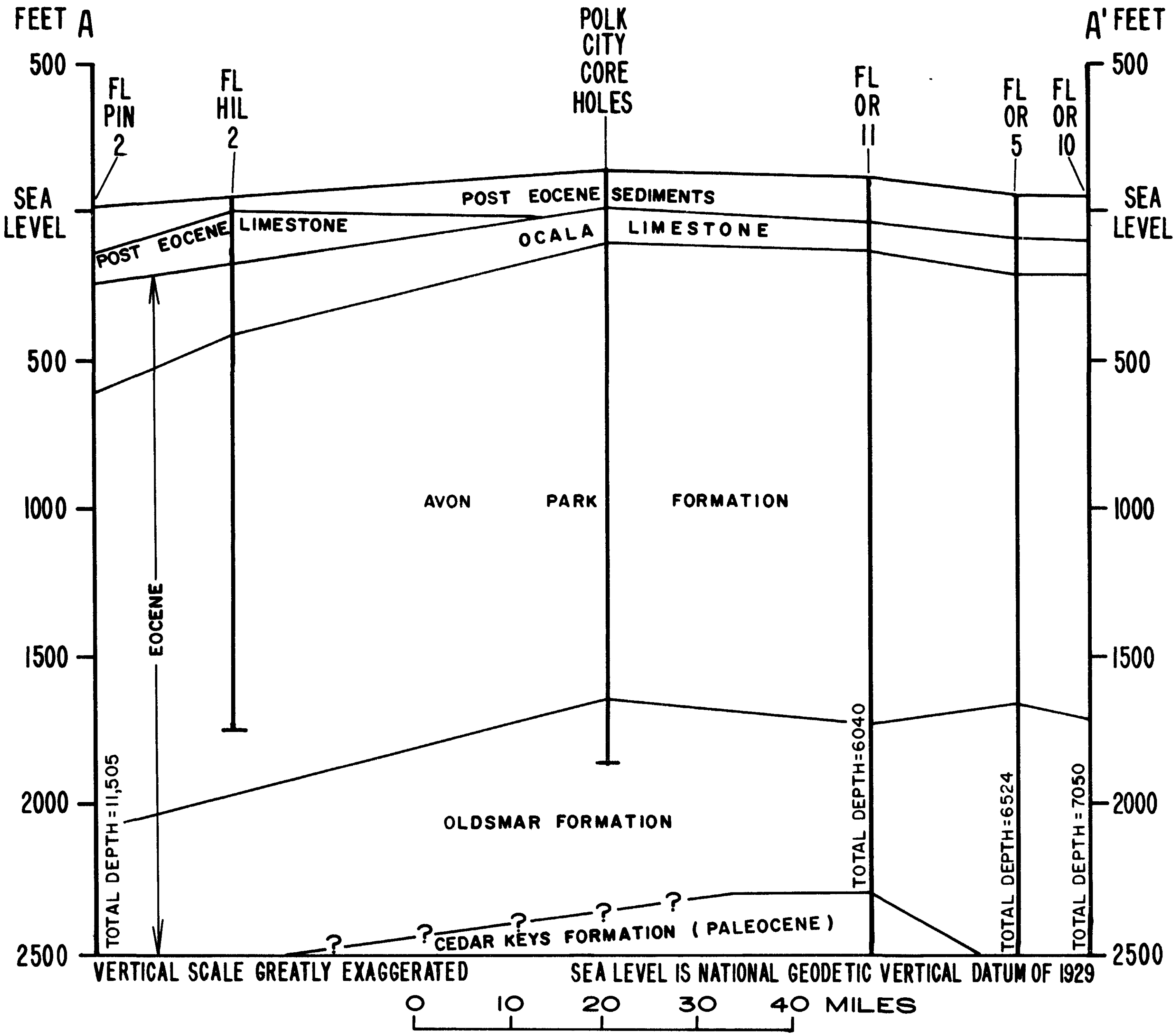


Figure 22.--Stratigraphic cross-section of central Florida (James A. Miller, written commun., 1982).

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Table 2.--Detailed core description
(Modified from James A. Miller, written commun., 1981)

Depth, in feet	Lithology
	Drill cutting samples
0-30	Surficial sand and organic silt.
30-57	Limestone, sandy, light gray, with interbedded blue and green clay, phosphatic. Conspicuous megafossils (gastropods, molds and casts filled with phosphatic sand).
57-68	Limestone, very sandy, hard, phosphatic pellets and sand as above, fossiliferous.
68-69	Clay, phosphatic, dark blue-gray.
69-120	No sample.
120-135	Limestone, very-pale orange, soft, chalky, micritic, low porosity. Lepidocyclina sp., Operculinoides ocalanus, Operculinoides floridensis common. Ocala.
135-140	No sample.
140-145	Fossiliferous limestone, very-pale orange: 70 percent large microfossils: Lepidocyclina (mostly), Operculinoides and Camerina. Thirty percent chalky, soft, off-white, micritic limestone matrix. Good porosity.
145-150	No sample.
150-155	Fossiliferous limestone as above.
155-160	No sample.
160-165	Fossiliferous limestone as above with 10 percent increase in matrix, corresponding decrease in microfossils. Fair porosity.
165-170	No sample.
170-175	Fossiliferous limestone as above.
175-180	No sample.
180-185	Fossiliferous limestone as above.

Table 2.--Detailed core description--Continued
(Modified from James A. Miller, written commun., 1981)

Depth, in feet	Lithology
	Drill cutting samples
185-190	No sample.
190-195	Limestone as 140-145 foot interval with decrease in matrix to 15 percent, corresponding decrease in large microfossils. Essentially a coquina of large foraminifera. Good porosity.
195-200	No sample.
200-205	Fossiliferous limestone as above.
205-210	No sample.
210-215	Fossiliferous limestone as 140-145 foot interval. Fair porosity.
215-220	No Sample.
220	Spot sample. Fossiliferous limestone as above.
220-230	No sample.
230-251	Pelletal limestone, dark-gray to cream. Dark-gray limestone is weathered, with black phosphate "case-hardening" common. Cream is unweathered phase. Both types consist of 65 percent fine to medium-sized micritic limestone pellets and small to medium-sized foraminifera in a 35 percent matrix of micritic to fine crystalline limestone. Low porosity. Trace of *Discorinopsis gunteri*, *Dictyoconus* sp. Avon Park.
251-255	Pelletal limestone, cream: Seventy-five percent fine- (mostly) to medium-sized pellets of cream-colored micritic limestone and small foraminifera. Twenty-five percent micritic limestone matrix. Broken pelecypod fragments common. Fair intergranular porosity.
255-260	Dolomitic limestone, light brown. Forty percent light-brown hard, dense microcrystalline dolomitic limestone matrix. Thirty percent small microfossils (mostly) and pellets of micritic limestone. Thirty percent clear to white quartz, filling pore space between pellets. Low porosity.

Table 2.--Detailed core description--Continued
(Modified from James A. Miller, written commun., 1981)

Depth, in feet	Lithology
	Drill cutting samples
260-265	Pelletal limestone, cream. Ninety percent fine- to medium pellets of cream micritic limestone and small foraminifera. Ten percent fine-crystalline limestone binder. Algal fragments prominent. Microgastropods common. Good intergranular porosity. Microfauna includes rod-shaped algae, Spirolina coryensis, Discorinopsis gunteri, Lituonella floridana, and Textularia coryensis.
265-270	Pelletal limestone as above with increase in matrix (fine crystalline to microcrystalline) to 20 percent, corresponding decrease in pellets. Good porosity.
270-275	Pelletal limestone as above but all fine crystalline (both pellets and matrix), light gray. Microfauna not so well observed as above.
275-280	Pelletal limestone, light-gray with cream cast, 60 percent fine pellets of microcrystalline cream limestone and small- to medium-sized foraminifera. Forty percent microcrystalline hard limestone matrix, partly altered to tan medium crystalline dolomite. Low porosity.
280-285	Pelletal limestone as above but soft, with matrix chalky micritic limestone. Trace of crab remains, mostly claws. Low porosity.
285-290	Pelletal limestone as 275-280 foot interval with 20 percent increase in pellets, corresponding decrease in matrix. Fair amount of intergranular porosity.
290-295	Pelletal limestone as above with Dictyoconus sp. prominent. Trace of Pseudorbitolina cubensis.
295-300	Pelletal limestone as 275-280 foot interval. Low porosity.
300-305	Pelletal limestone as above. Most pellets fine- to very-fine. Dictyoconus sp. common. Both pellets and matrix fine crystalline.
305-310	Pelletal limestone as above but with fair intergranular porosity.

Table 2.--Detailed core description--Continued
(Modified from James A. Miller, written commun., 1981)

Depth, in feet	Lithology
	Drill cutting samples
310-315	Pelletal limestone as above with *Dictyoconus* sp. very prominent.
315-330	Pelletal limestone as 305-310 foot interval.
330-345	Pelletal limestone, cream. Eighty percent fine pellets of cream microcrystalline limestone and small foraminifera. Twenty percent very fine crystalline limestone matrix. Coarse crystalline medium-brown calcite, *Dictyoconus* sp. prominent. Fair porosity.
345-350	Pelletal limestone, very-pale orange. Fifty percent very fine- to fine pellets of off-white chalky limestone. Fifty percent soft chalky micritic limestone matrix. Low porosity.
	Core samples
353.0-354.1	Recovered 1.1 feet in 353.0-356.4 foot interval. Loss at bottom. Limestone, cream, microcrystalline, interbedded with thin laminae of dark-brown earthy dolomite. Low porosity.
354.1-356.4	No recovery.
356.4-359.1	Recovered 14.9 feet in 356.4-376.4 foot interval. Loss at bottom. Dolomite, medium-brown, fine crystalline, hard, massive, with isolated vugs prominent. In a few thin zones, the vugs are connected and/or partially filled with fine crystalline drusy dolomite. These vuggy zones commonly contain much dark-colored organic material. Low porosity. Gradational into -
359.1-365.6	Dolomite as above with only a trace of isolated vugs. Thin bedded. Low porosity. Gradational into -
365.6-367.0	Dolomite, medium-brown, medium crystalline, hard, highly vuggy and porous. Overall porosity about 25 to 30 percent. Trace of incompletely dolomitized medium-sized limestone pellets. Thin bedded. Gradational into -

Table 2.--Detailed core description--Continued
(Modified from James A. Miller, written commun., 1981)

Depth, in feet	Lithology
	Core samples
367.0-371.0	Dolomite, light-brown, hard, massive, very fine crystalline, with trace of isolated small vugs. Thick bedded. Low porosity. One 0.5 foot long vertical fracture at 367.5 feet. Gradational into -
371.0-371.3	Limestone, light-gray, pelletal: Seventy percent medium-sized pellets of microcrystalline limestone and medium-sized foraminifera. Thirty percent soft micritic limestone matrix. High intergranular porosity. Dictyoconus sp. common.
371.3-376.4	No recovery.
376.4-378.8	Recovered 13.3 feet in 376.4-396.4 foot interval. Put loss at bottom. Limestone, very-pale orange, massive, chalky, soft, micritic, low porosity. Fine pellets of micritic limestone prominent. Trace of small echinoids, filled with coarse crystalline calcite. Gradational into -
378.8-385.0	Dolomite, tan, fine crystalline, massive, low porosity. Highly vuggy from 382-383 feet. Much dark and light banding (dark is due to concentration of argillaceous material) from 384-385 feet. In sharp contact with -
385.0-389.7	Dolomite, tan, fine crystalline, highly vuggy and porous. Thick bedded. The vugs in this interval are large and represent molds of pelecypods and other macrofauna.
389.7-396.4	No recovery.
396.4-403.7	Recovered 7.3 feet in 396.4-416.4 foot interval. Put loss at bottom. Limestone, very-pale orange, pelletal, soft, chalky, 80 percent fine to medium-sized pellets of micritic limestone and small foraminifera. Twenty percent soft chalky micritic limestone matrix. Medium bedded. Low porosity. Trace of medium-sized whole echinoids, with coarse crystalline calcite shells. Abundant microfauna.
403.7-421.4	No recovery.

Table 2.--Detailed core description--Continued
(Modified from James A. Miller, written commun., 1981)

Depth, in feet	Lithology
	Core samples
421.4-424.0	Recovered 8.6 feet in 421.4-436.4 foot interval. Put loss at bottom. Limestone, light-gray, pelletal, soft. Sixty-five percent fine (mostly) to medium-sized pellets of very-pale orange micritic limestone. Thirty-five percent fine crystalline limestone matrix. Massive bedding. Fair porosity. Gradational into -
424.0-430.0	Pelletal limestone as above with most pellets medium-sized.
430.0-436.4	No recovery.
436.4-443.0	Recovered 16.8 feet in 436.4-456.4 foot interval. Put loss at bottom. Pelletal limestone, cream. Fifty percent fine pellets of fine crystalline cream limestone along with small foraminifera and algal fragments. Fifty percent micritic soft- to semi-indurated limestone matrix. Trace of pelecypod casts and molds. Massive bedding. Fair porosity. Gradational into -
443.0-444.3	Pelletal limestone, cream: Sixty percent medium- (mostly) to fine pellets of fine crystalline cream limestone, along with medium-sized foraminifera. Forty percent fine crystalline limestone matrix, semi-indurated. Massive bedding. Fair porosity. Gradational into -
444.3-449.3	Pelletal limestone as 436.4-443.0 interval but low porosity, no fossil casts and molds.
449.3-453.2	Pelletal limestone as above.
453.2-471.1	No recovery (456.4-476.4 - recovered 5.3 feet. Loss at top, according to driller).
471.1-473.1	Pelletal limestone as above. In sharp contact with -
473.1-476.4	Dolomite, tan, fine crystalline, silty appearance, massive. Small- to large unconnected vugs, vertical- to high-angle fractures common. Some vugs lined with medium crystalline dolomite. Medium- to massive bedding. Casts and molds of pelecypods and echinoids common. Trace of dark-brown woody material. Low intergranular porosity, high secondary (fracture) porosity.

Table 2.--Detailed core description--Continued
(Modified from James A. Miller, written commun., 1981)

Depth, in feet	Lithology
	Core samples
476.4-483.7	No recovery (476.4-491 - recovered 7.3 feet. Loss at top, according to driller).
483.7-491.0	Pelletal limestone, very-pale orange, friable. Eighty percent medium- to coarse-pellets of fine crystalline limestone and medium-sized foraminifera. Loosely bound by 20 percent soft chalky very fine crystalline limestone matrix. Massive bedding. Fair porosity. In sharp contact with -
491.0-493.0	Recovered 14.6 feet in 491.0-505.9 foot interval. Put loss at bottom. Dolomite, tan, very fine crystalline, earthy appearance, massive. A few thin zones of fine- to medium crystalline vuggy dolomite, with vugs mostly unconnected. In lower 1 foot, a few layers of dark-brown organic-rich medium crystalline dolomite. Thick bedded. Low porosity. Gradational into -
493.0-496.1	Dolomite, tan, massive, hard, very fine crystalline, low porosity. Contains scattered laminae of dark-brown organic-rich dolomite, has a few zones of medium crystalline dolomite with fair unconnected vuggy porosity and with pelecypod and gastropod casts and molds prominent. Thick bedded. Laminae are slightly inclined to long axis of core. Gradational into -
496.1-505.6	Dolomite as above. Cut rubbly in lower 3 feet.
505.6-505.9	No recovery.
505.9-508.3	Recovered 7.3 feet in 505.9-514.7 foot interval. Put loss at bottom. Dolomite, medium-brown, fine- to medium crystalline, highly vuggy and porous. Most of vugs are probably altered fossil casts and molds. Thick bedded. Gradational into -
508.3-513.2	Dolomite as 496.4-505.9 foot interval but with high angle fractures common, lined with dark-brown discolored organic-rich material. Cut rubbly.
513.2-514.7	No recovery.

Table 2.--Detailed core description--Continued
(Modified from James A. Miller, written commun., 1981)

Depth, in feet	Lithology
	Core samples
514.7-517.6	Recovered 2.9 feet in 514.7-518.2 foot interval. Put loss at bottom. Dolomite, medium-brown, fine crystalline, hard, massive, with black organic material prominent in vugs and high to low-angle fractures. Cut rubbly. Fair secondary porosity (low primary).
517.6-518.2	No recovery.
518.2-520.2	Recovered 2.0 feet. Dolomite, medium-brown, medium crystalline, with fair intergranular and small-vug porosity. Cut rubbly. Gradational into -
520.2-527.3	Recovered 7.1 feet in 520.2-528.7 foot interval. Put loss at bottom. Dolomite, tan, fine- to medium crystalline, hard, massive, low porosity, with a few scattered small to large vugs. Massive bedded. Trace of dark-brown coating of organic material on bedding planes and high-angle fractures.
527.3-528.7	No recovery.
528.7-531.4	Recovered 2.7 feet in 528.7-534.1 foot interval. Put loss at bottom. Dolomite as above.
531.4-534.1	No recovery.
534.1-536.1	Recovered 2.0 feet in 534.1-536.4 foot interval. Put loss at bottom. Dolomite as above. Thick bedded.
536.1-536.4	No recovery.
536.4-540.1	Recovered 3.7 feet in 536.4-540.7 foot interval. Put loss at bottom. Dolomite as above but fine to very fine crystalline. Cut rubbly in upper 1.5 feet, remainder is thick-bedded.
540.1-540.7	No recovery.
540.7-542.4	Recovered 1.7 feet in 540.7-543.7 foot interval. Put loss at bottom. Dolomite, medium-brown, hard, massive, very fine crystalline, massive bedded in upper 1 foot, rest cut rubbly. Trace of small vugs, dark-brown organic material aligned along bedding planes. Low porosity.

Table 2.--Detailed core description--Continued
(Modified from James A. Miller, written commun., 1981)

Depth, in feet	Lithology
	Core samples
542.4-543.7	No recovery.
543.7-549.2	Recovered 5.5 feet in 543.7-557.1 foot interval. Put loss at bottom. Dolomite as above but with partings of black organic material. Alternately rubbly and massive bedded. Partings appear slightly wavy.
549.2-556.1	No recovery.
556.1-559.8	Recovered 3.7 feet in 556.1-560.1 foot interval. Put loss at bottom. Dolomite, dark- to light-brown banded, medium crystalline, with minor highly vuggy zones. Overall porosity low. Medium- to thick bedded. Laminae, due to organic material admixed with dolomite, are flat.
559.8-560.1	No recovery.
560.1-566.0	Recovered 11.5 feet in 560.1-571.6 foot interval. Dolomite, light- to medium-brown banded, fine- to medium crystalline. Banding is due to different crystal sizes. Low porosity. Mostly massively bedded. Gradational into -
566.0-571.6	Dolomite, medium-brown, fine crystalline, saccharoidal, massive, low porosity. Massively bedded with traces of isolated medium- to large vugs. Gradational into -
571.6-576.4	Recovered 4.8 feet in 571.6-576.4 foot interval. Dolomite, light-brown, very fine- to fine- crystalline, massively bedded with about half of interval very highly vuggy, slightly friable, light-weight, highly porous, with tufa-like appearance. Overall porosity fair. Gradational into -
576.4-578.7	Recovered 12.8 feet in 576.4-589.4 foot interval. Put loss at bottom. Dolomite, cream, very fine crystalline, argillaceous, slightly calcareous (because of crystal size), massive, low porosity. Massively bedded. Trace of isolated vugs. Gradational into -
578.7-589.2	Dolomite, tan, medium crystalline, highly vuggy and porous, light-weight, tufa-like appearance. Trace of fossil casts and molds. Massive bedding.

Table 2.--Detailed core description--Continued
(Modified from James A. Miller, written commun., 1981)

Depth, in feet	Lithology
	Core samples
589.2-589.4	No recovery.
589.4-591.5	Recovered 6.5 feet in 589.4-596.4 foot interval. Put loss at bottom. Dolomite, tan- to light brown banded (crenulated wavy bands), fine crystalline, silty appearance, fair amount of intergranular and vuggy porosity. Massive bedding. Gradational into -
591.5-594.9	Dolomite, tan, very fine crystalline, massive, hard, low porosity. A few thin scattered zones of vuggy porosity, parallel to bedding planes. Massive bedding. In sharp contact with -
594.9-595.9	Dolomite, light to dark-brown mottled, medium- (mostly) to fine crystalline, highly vuggy and porous, thickly bedded.
595.9-596.4	No recovery.
596.4-598.4	Recovered 20.0 feet in 596.4-616.4 foot interval. Dolomite as above. In sharp contact with -
598.4-601.0	Dolomite, cream, fine crystalline, highly vuggy and porous, massively bedded. Interval contains a few thin beds of argillaceous dolomite as above. Gradational into -
601.0-604.4	Dolomite, cream, fine crystalline, highly vuggy and porous, massively bedded. Interval contains a few thin beds of argillaceous dolomite as above. Gradational into -
604.4-610.4	Dolomite, light-brown, medium crystalline, massive, with much intergranular and small-vug porosity. Massive bedding. Gradational into -
610.4-612.9	Dolomite, brecciated. As above with angular to subangular coarse-pebble size blocks of dark and light-gray banded chert prominent. Massive bedding. Fair overall porosity. Gradational into -
612.9-614.0	Dolomitic limestone, very-pale orange, micritic, chalky, semi-indurated, massive, low porosity. Massive bedding. In sharp contact with -

Table 2.--Detailed core description--Continued
(Modified from James A. Miller, written commun., 1981)

Depth, in feet	Lithology
	Core samples
614.0-616.4	Dolomite, cream to tan mottled, brecciated, rubbly. Seventy percent matrix of tan fine crystalline dolomite enclosing 30 percent angular to subangular pebble-sized particles of cream-colored micritic dolomitic limestone. Massive bedding. Trace of large vugs filled with black organic-rich clay. Low intergranular porosity, fair amount of vuggy porosity.
616.4-619.2	Recovered 11.7 feet in 616.4-629.9 foot interval. Put loss at bottom. Dolomite as above. Gradational into -
619.2-622.0	Dolomite, cream medium crystalline, highly vuggy and porous, rubbly. Massive bedding. Pebble-sized particles of dark-brown medium crystalline organic-rich dolomite, cream argillaceous dolomite prominent. In sharp contact with -
622.0-628.1	Pelletal dolomite, light-brown, highly vuggy and porous. Seventy-five percent medium-sized pellets of fine crystalline medium-brown dolomite. Twenty-five percent argillaceous dolomite binder. High intergranular and vuggy porosity. Trace of pelecypod, gastropod casts and molds. Massive bedding. More argillaceous and micritic in lower 1 foot.
628.1-629.9	No recovery.
629.9-632.5	Recovered 6.4 feet in 629.9-636.4 foot interval. Put loss at bottom. Dolomite, tan, fine crystalline, massive bedding, slightly vuggy, with fine relict pellets prominent. More dense (less vugs) toward bottom of interval. Low porosity. Gradational into -
632.5-636.3	Dolomite, cream, very fine crystalline, argillaceous (clay-sized particles), massive, low porosity. Has a few zones of vuggy porosity, mostly unconnected, and parallel to bedding planes. Massive bedding.
636.3-636.4	No recovery.
636.4-638.4	Recovered 13.9 feet in 636.4-656.4 foot interval. Put loss at bottom. Dolomite as above. Gradational into -

Table 2.--<u>Detailed core description</u>--Continued
(Modified from James A. Miller, written commun., 1981)

Depth, in feet	Lithology
	<u>Core samples</u>
638.4-645.6	Dolomite, cream, medium crystalline, with medium-sized relict pellets prominent, fair amount of vuggy porosity. Thick-bedded, with some beds low-porosity because of greater amounts of argillaceous dolomite matrix. Gradational into -
645.6-650.3	Dolomite, very-pale orange, semi-indurated, extremely fine crystalline, argillaceous (clay-sized particles), massive, low porosity. Massive bedding.
650.3-656.4	No recovery.
656.4-657.4	Recovered 3.5 feet in 656.4-666.4 foot interval. Put loss at bottom. Dolomite as above. Loss is probably from softer argillaceous dolomite washing out. Gradational into -
657.4-659.9	Dolomite as above but fine crystalline, with isolated small vugs prominent. Massive bedding.
659.9-676.4	No recovery.
676.4-680.0	Recovered 11.5 feet in 676.4-692.4 foot interval. Put loss at bottom. Dolomite as 656.6-650.3 foot interval with trace of fine dark-brown organic-rich intercalations. Gradational into -
680.0-687.9	Dolomite, tan, fine crystalline, highly vuggy and porous. Vugs are casts and molds of medium-sized microfossils. Some vugs lined with dark-brown to black organic-rich clayey material.
687.9-692.4	No recovery.
692.4-694.9	Recovered 2.5 feet in 692.4-696.4 foot interval. Put loss at bottom. Dolomite as above.
694.9-696.4	No recovery.
696.4-700.0	Recovered 15.9 feet in 696.4-716.4 foot interval. Put loss at bottom. Dolomite as above.

Table 2.--Detailed core description--Continued
(Modified from James A. Miller, written commun., 1981)

Depth, in feet	Lithology
	Core samples
700.0-706.5	Dolomite as above, thickly interbedded with cream very fine crystalline argillaceous (clay-sized particles) dolomite that has very dark-brown to black organic-rich laminae prominent. Overall porosity of interval low. Some vugs in porous beds are casts of large flat Dictyoconus sp. In sharp contact with -
706.5-712.3	Dolomite, light brown, medium crystalline, massive, low porosity. Massively bedded, with a few thin zones of vuggy porosity in upper 3 feet.
712.3-716.4	No recovery.
716.4-721.0	Recovered 11.1 feet in 716.4-729.4 foot interval. Put loss at bottom. Low porosity dolomite as above. Dark-brown organic-rich laminae prominent in lower 1 foot. Gradational into -
721.0-726.6	Dolomite, tan, fine crystalline, massive, with a fair amount of vuggy porosity. Massively bedded. Trace of scattered thin irregular laminae of dark-brown organic-rich material. Gradational into -
726.6-727.5	Dolomite, cream, very fine crystalline, argillaceous (clay-sized particles), massive, low porosity, with irregular laminae and mottles of dark-brown organic-rich material prominent.
727.5-729.4	No recovery.
729.4-732.8	Recovered 3.4 feet in 729.4-736.4 foot interval. Put loss at bottom. Dolomite, cream, fine crystalline, massive, with fair amount of vuggy porosity. Scattered thin partings and beds of argillaceous dolomite as above prominent. Massively bedded.
732.8-736.4	No recovery.
736.4-741.5	Recovered 15.3 feet in 736.4-756.4 foot interval. Put loss at bottom. Dolomite, tan, very fine crystalline, silty appearance, low porosity, massively bedded, with isolated small- to medium-sized vugs prominent. Gradational into -

Table 2.--Detailed core description--Continued
(Modified from James A. Miller, written commun., 1981)

Depth, in feet	Lithology
	Core samples
741.5-751.7	Dolomite, cream, medium crystalline, highly vuggy and porous, tufa-like appearance, with a few thin beds of argillaceous low-porosity dolomite. Massively bedded.
751.7-756.4	No recovery.
756.4-760.8	Recovered 8.9 feet in 756.4-766.4 foot interval. Put loss at bottom. Dolomite as above. Gradational into -
760.8-764.4	Dolomite as above with a few vugs lined with dark-brown organic-rich clayey material. In sharp contact with -
764.4-764.7	Clay, dark-gray, with thin laminae of tan fine crystalline dolomite. Black fine specks of organic (algal?) material prominent. Much gypsum "bloom" on surface of dry core. In sharp contact with -
764.7-765.3	Dolomite, cream, very fine crystalline, massive, with small vugs prominent but unconnected. Tufa-like appearance. Massively bedded.
765.3-766.4	No recovery.
766.4-774.2	Recovered 9.0 feet in 766.4-776.4 foot interval. Put loss at bottom. Dolomite as above. Gradational into -
774.2-775.4	Dolomite, cream, very fine crystalline, argillaceous (clay-sized particles), soft, massive, low porosity. Trace of banding of dark-brown organic-rich layers.
775.4-776.4	No recovery.
776.4-778.4	Recovered 3.9 feet in 776.4-796.4 foot interval. Put loss at bottom. Dolomite, cream, fine crystalline, low porosity, massive, hard. In sharp contact with -
778.4-780.3	Dolomite, cream-tan banded, very fine crystalline, argillaceous (clay-sized particles), low porosity, soft, with crenulated wavy bands due to alternating cream and organic-rich tan laminae. Dark-green clay at 778.6-778.8 feet.

Table 2.--Detailed core description--Continued
(Modified from James A. Miller, written commun., 1981)

Depth, in feet	Lithology
	Core samples
780.3-805.7	No recovery.
805.7-816.4	Recovered 15.0 feet in 816.4-836.4 foot interval. Put loss at bottom. Dolomite as above but thin bedded, with vuggy and argillaceous dolomite alternating. Gradational into -
816.4-820.8	Recovered 15.0 feet in 816.4-836.4 foot interval. Put loss at bottom. Dolomite as above but thin bedded, with vuggy and argillaceous dolomite alternating. Gradational into -
820.8-821.6	Dolomite, cream, very fine crystalline, massive, low porosity, argillaceous (clay-sized particles). In sharp contact with -
821.6-827.8	Dolomite, cream, fine crystalline, soft, friable, crumbly, with fair intergranular porosity. Massively bedded.
827.8-831.4	Dolomite as above, soft, rubbly.
831.4-836.4	No recovery.
836.4-844.2	Recovered 16.3 feet in 836.4-856.4 foot interval. Put loss at bottom. Dolomite as 805.7-816.4 foot interval thickly interbedded with argillaceous dolomite as 820.8-821.6 foot interval. Overall porosity of interval fair.
844.2-852.7	Dolomite as above. Cut rubbly in upper half, massive in lower half. Upper half has more argillaceous dolomite, lower more vuggy dolomite.
852.7-856.4	No recovery.
856.4-865.4	Recovered 9.5 feet in 856.4-871.8 foot interval. Put loss at bottom. Dolomite, very-pale orange, fine- to very fine crystalline, slightly vuggy (vugs mostly unconnected), cut rubbly in upper 3 feet, massive in rest. Thickly interbedded with soft chalky massive argillaceous (clay-sized particles) dolomite. Low porosity.
865.4-871.8	No recovery.

Table 2.--Detailed core description--Continued
(Modified from James A. Miller, written commun., 1981)

Depth, in feet	Lithology
	Core samples
871.8-875.9	Recovered 4.1 feet in 871.8-876.4 foot interval. Put loss at bottom. Upper half is dolomite, cream, very fine to fine crystalline, trace of intergranular porosity. Massive bedding. Lower half is dolomite, cream, fine crystalline, fair amount of vuggy porosity.
875.9-876.4	No recovery.
876.4-879.7	Recovered 6.3 feet in 876.4-889.7 foot interval. Put loss at bottom. Dolomite, cream, coarse crystalline, thick bedded, with much intergranular porosity. Gradational into -
879.7-882.7	Dolomite, cream, fine- to medium crystalline, massive, hard, low porosity, argillaceous (clay-sized particles) in part.
882.7-889.7	No recovery.
889.7-895.2	Recovered 5.5 feet in 889.7-896.4 foot interval. Put loss at bottom. Dolomite, cream, fine crystalline, massive, with much intergranular and vuggy porosity. Hard, with tufa-like appearance. Very massive bedding.
895.2-896.4	No recovery.
896.4-900.3	Recovered 3.9 feet in 896.4-908.4 foot interval. Put loss at bottom. Dolomite as above with thick interbeds of hard very-fine crystalline massive low-porosity dolomite prominent.
900.3-908.4	No recovery.
908.4-909.5	Recovered 1.1 feet in 908.4-915.8 foot interval. Put loss at bottom. Porous dolomite as above.
909.5-915.8	No recovery.
915.8-917.0	Recovered 8.0 feet in 915.8-935.8 foot interval. Put loss at bottom. Dolomite, very-pale orange, fine crystalline, silty appearance, highly vuggy and porous, soft, friable. Thick bedded. This rock was originally a medium pelletal limestone. In sharp contact with -

Table 2.--Detailed core description--Continued
(Modified from James A. Miller, written commun., 1981)

Depth, in feet	Lithology
	Core samples
917.0-919.0	Dolomite, cream, very fine crystalline, massive, low porosity, with small high-angle to vertical fractures common. Massive bedding. Gradational into -
919.0-922.3	Algal chalk, white-tan banded. Tan laminae are probably due to concentrations of algal mats in rough beds. Chalk comprised in large part of calcareous ball-shaped algal masses. Chalk partially dolomitized. Trace of coarse crystalline tan dolomite as blebs and stringers. Low porosity. Massively bedded. Gradational into -
922.3-923.8	Limestone, very-pale orange, micritic, chalky, low porosity, massive bedding.
923.8-935.8	No recovery.
935.8-939.8	Recovered 11.3 feet in 935.8-955.8 foot interval. Put loss at bottom. Dolomite, very-pale orange, very fine crystalline, fair- to high porosity, depending on amount of small vugs present in ill-defined beds. Rock was originally a fine pelletal limestone with varying amounts of micritic matrix. Claiborne-age rod-shaped algae, *Quinqueloculina* sp. still recognizable. Gradational into -
939.8-945.1	Dolomite, cream, medium crystalline, highly vuggy and porous, with scattered thin low-porosity beds that have much clay-sized dolomite. Massive bedding.
945.1-947.1	Dolomitic limestone, very-pale orange, chalky, micritic, soft, massive, low porosity. Medium- to coarse crystalline dolomite prominent, as isolated crystals and crystal aggregates (mostly), rarely as vug linings.
947.1-955.8	No recovery.
955.8-957.8	Recovered 7.1 feet in 955.8-975.8 foot interval. Put loss at bottom. Dolomite, cream, fine crystalline, somewhat friable, with fair amount of vuggy porosity. Thin bedded appearance due to scattered thin beds and laminae of clay-sized dolomite. Rock was originally a fine pelletal limestone. Gradational into -

Table 2.--Detailed core description--Continued
(Modified from James A. Miller, written commun., 1981)

Depth, in feet	Lithology
	Core samples
957.8-961.4	Dolomite as above with laminae and beds of clay-sized dolomite increasing to 40 percent of interval. Low porosity. Gradational into -
961.4-962.9	Dolomite, cream, soft, cuts up rubbly, highly vuggy and porous, consists mostly of casts and molds of macrofossils and medium-sized microfossils.
962.9-975.8	No recovery.
975.8-977.1	Recovered 6.5 feet in 975.8-993.8 foot interval. Put loss at bottom. Dolomite, cream, fine crystalline, slightly pelletal (fine pellets), with vuggy porosity common. Thick bedding. Overall porosity low. Gradational into -
977.1-978.2	Limestone, very-pale orange, fine pelletal, consists of 65 percent fine crystalline to micritic small limestone pellets in 35 percent chalky micritic limestone matrix. Massive bedding. Trace of chalky micritic limestone matrix. Massive bedding. Trace of medium crystalline dolomite, as isolated crystals "floating" in limestone. Low porosity. Gradational into -
978.2-980.7	Limestone, very-pale orange with light-gray banding, chalky, micritic, low porosity, massive bedding. Bands are due to concentrations of algal material. Gradational into -
980.7-982.3	Dolomitic limestone, very-pale orange, soft, chalky, micritic, massive bedding, low porosity, rubbly.
982.3-993.8	No recovery.
993.8-995.8	Recovered 20.0 feet in 993.8-1015.8 foot interval. Put loss at bottom. Dolomite, very-pale orange, hard, micritic texture, massive, low porosity. Gradational into -
995.8-997.8	Dolomite, cream, fine crystalline, massive bedding, with a fair amount of small-vug porosity. Rock was originally a finely pelletal limestone. Gradational into -
997.8-1001.8	Dolomite as 993.8-995.8 foot interval.

Table 2.--Detailed core description--Continued
(Modified from James A. Miller, written commun., 1981)

Depth, in feet	Lithology
	Core samples
1001.8-1005.8	Dolomite, cream, very fine crystalline to microcrystalline, hard, massively bedded, with fair amount of medium- to large-vug porosity. Gradational into -
1005.8-1008.0	Dolomite, very-pale orange to tan banded, highly laminated (darker laminae due to concentrations of algal material), soft, micritic texture, low porosity, massive bedding. Gradational into -
1008.0-1013.0	Dolomite as 995.8-997.8 foot interval except medium crystalline. Add minor amount of intergranular porosity. Gradational into -
1013.0-1013.8	Dolomite as above but very fine crystalline, almost no vugs. Low porosity.
1013.8-1015.8	No recovery.
1015.8-1018.0	Recovered 13.8 feet in 1015.8-1033.8 foot interval. Put loss at bottom. Dolomite as above. Gradational into -
1018.0-1023.8	Dolomitic limestone, very-pale orange, finely pelletal, 60 percent fine pellets of dolomitic limestone in 40 percent micritic matrix. Massive bedding, low porosity. In irregular (but sharp) contact with -
1023.8-1024.3	Anhydrite, white to light-gray mottled, massive, with thin fractures filled with dolomitic limestone as above. Top and bottom contacts irregular. Probably a large inclusion rather than a bed.
1024.3-1026.3	Dolomitic limestone, very-pale orange, soft, chalky, micritic texture. Irregular laminae and blebs of medium-brown argillaceous organic-rich material prominent. Trace of isolated large euhedral selenite crystals "floating" in dolomitic limestone matrix. Massive bedding. Low porosity. In sharp contact with -
1026.3-1027.5	Clay, medium-gray with minor light-gray banding, semi-indurated, ashy (?), with dark specks of organic (algal?) material very prominent. Dry core has gypsum "bloom" on surface. In sharp contact with -

Table 2.--Detailed core description--Continued
(Modified from James A. Miller, written commun., 1981)

Depth, in feet	Lithology
	Core samples
1027.5-1027.8	Dolomitic limestone as 1024.3-1026.3 foot interval. In sharp contact with -
1027.8-1028.3	Anhydrite as 1023.8-1024.3 foot interval except the evaporite here appears to be a bed. Bottom contact irregular but sharp with -
1028.3-1029.6	Dolomitic limestone as 1024.3-1026.3.
1029.6-1033.8	No recovery.
1033.8-1041.0	Recovered 12.5 feet in 1033.8-1049.8 foot interval. Put loss at bottom. Dolomitic limestone as above, chalky and micritic. Twenty-five percent of interval is scattered medium to large blebs and intercalations of clear to white anhydrite, "growing in," and in sharp contact with, limestone. In sharp contact with -
1041.0-1044.0	Dolomite, cream, fine crystalline, fair small-vug porosity. Casts and molds of microfossils and macrofossils prominent. Massively bedded. Gradational into -
1044.0-1046.3	Dolomitic limestone, white, microcrystalline, hard, low porosity, massively bedded. Trace of fine vertical fractures and fossil molds, both filled with clear selenite.
1046.3-1049.8	No recovery.
1049.8-1055.0	Recovered 5.2 feet in 1049.8-1055.8 interval. Put loss at bottom. Dolomitic limestone, cream, pelletal, consists of 70 percent fine pellet-size particles of dolomitic limestone in 30 percent semi-indurated micritic dolomite matrix. Massively bedded, low porosity.
1055.0-1055.8	No recovery.
1055.8-1057.0	Recovered 10.0 feet in 1055.8-1065.8 foot interval. Dolomitic limestone as above. Gradational into -

Table 2.--Detailed core description--Continued
(Modified from James A. Miller, written commun., 1981)

Depth, in feet	Lithology
	Core samples
1057.0-1062.0	Anhydrite, white to light-gray, massive, with 10 percent lenses, stringers, patches, and vein-like fracture fillings of very-pale orange soft chalky micritic dolomitic limestone.
1062.0-1064.0	Dolomitic limestone, cream, argillaceous (clay-sized particles), massive bedding, low porosity. Small- to large inclusions, blebs, and lenses of clear- to white anhydrite prominent.
1064.0-1065.8	Anhydrite as 1057.0-1062.0 foot interval.
1065.8-1067.0	Recovered 16.6 feet in 1065.8-1085.8 foot interval. Put loss at bottom. Anhydrite as above.
1067.0-1072.0	Dolomite, very-pale orange, soft to semi-indurated, chalky, micritic texture, low porosity, massively bedded. Coarse blebs of clear- to white anhydrite prominent. Gradational into -
1072.0-1076.0	Anhydrite, clear- to white, with 30 percent blebs, stringers, and fracture fillings of very-pale orange dolomite as above. Massive beddings. Gradational into -
1076.0-1082.4	Dolomite, cream, silty-textured, micritic, massively bedded. Low porosity.
1082.4-1085.8	No recovery.
1085.8-1087.8	Recovered 6.6 feet in 1085.8-1092.8 foot interval. Put loss at bottom. Dolomite as above. Gradational into -
1087.8-1092.4	Dolomite as above but argillaceous (clay-sized particles) with coarse blebs of clear- to white anhydrite prominent. Thick seams (or coarse blebs) of anhydrite at 1089 feet and 1091 feet. Very large crystal of clear selenite at 1091 feet, almost as large as diameter of core.
1092.4-1092.8	No recovery.
1092.8-1095.0	Recovered 12.1 feet in 1092.8-1105.8 foot interval. Put loss at bottom. Dolomite as above with no selenite, decrease in size and number of anhydrite blebs.

Table 2.--Detailed core description--Continued
(Modified from James A. Miller, written commun., 1981)

Depth, in feet	Lithology
	Core samples
1095.0-1100.0	Dolomite, very fine crystalline, soft- to semi-indurated, massively bedded, argillaceous to silty texture, low porosity. Contains scattered beds (?) and thick pods of anhydrite that are 3 to 6 inches across. Medium-sized vugs common, filled with clear anhydrite. In sharp contact with -
1100.0-1100.5	Dolomite, cream to tan laminated, argillaceous texture, laminae due to concentration of light-brown organic (algal?) material. Low porosity. Gradational into -
1100.5-1104.9	Argillaceous dolomite, cream, massively bedded, with coarse blebs and isolated euhedral crystals of clear to white anhydrite prominent. Low porosity.
1104.9-1105.8	No recovery.
1105.8-1109.0	Recovered 20.0 feet in 1105.8-1125.8 foot interval. Argillaceous dolomite as above but with fine pellets of dolomite prominent (up to 30 percent of sample). Gradational into -
1109.0-1113.0	Argillaceous dolomite as 1100.5-1104.9 foot interval. Trace of scattered dark-brown organic-rich algal (?) laminae. Low porosity, massively bedded. Gradational into -
1113.0-1120.0	Dolomite, cream, fine crystalline, silty appearance, with small vugs prominent, most of which are filled with clear euhedral very coarse crystalline anhydrite. Massively bedded, low porosity. Rock was originally a fine pelletal limestone. Gradational into -
1120.0-1125.8	Dolomite as above with vugs unfilled. Trace of pelecypod casts and molds. Fair amount of porosity. Gradational into -
1125.8-1132.4	Recovered 19.7 feet in 1125.8-1145.8 foot interval. Put loss at bottom. Dolomite, cream, argillaceous texture, massively bedded, low porosity. In irregular contact with -
1132.4-1132.9	Anhydrite, white to light-gray, massive, fractured, with fractures filled with argillaceous dolomite as above. In irregular contact with -

Table 2.--Detailed core description--Continued
(Modified from James A. Miller, written commun., 1981)

Depth, in feet	Lithology
	Core samples
1132.9-1137.0	Dolomite, tan, very fine crystalline, argillaceous, massively bedded. Trace of scattered dark-brown organic particles in upper part, increasing to "prominent" in lower 2 feet. Low porosity. In sharp contact with -
1137.0-1139.0	Anhydrite, light-gray to white, massive, fractured. Thirty percent of interval is thin to medium beds, stringers, and fracture fillings of cream argillaceous-textured dolomite. Low porosity. Gradational into -
1139.0-1145.5	Dolomite, cream, argillaceous texture, massively bedded, low porosity. Very dark-brown organic-rich partings at 1143.0 and 1145.0 feet that probably represent grass beds. Coarse blebs and inclusions of white- to light-gray anhydrite at 1144.5 feet.
1145.5-1145.8	No recovery.
1145.8-1149.0	Recovered 19.7 feet in 1145.8-1165.8 foot interval. Put loss at bottom. Dolomite as above with coarse anhydrite blebs accounting for 20 percent of interval. In sharp contact with -
1149.0-1149.2	Clay, medium-brown with gray cast, thinly laminated with many dark-brown organic layers, ashy, with very small white specks (dolomitic material) prominent. Low porosity. In sharp contact with -
1149.2-1156.0	Dolomite, cream, argillaceous texture, semi-indurated, low porosity, massively bedded. Trace of large blebs of white- to clear-anhydrite, mostly in upper 3 feet. Gradational into -
1156.0-1158.0	Dolomite as above with increase in large anhydrite blebs to 30 percent of interval. Gradational into -
1158.0-1160.0	Dolomite as above with no anhydrite. Gradational into -
1160.0-1165.5	Dolomite as 1156.0-1158.0 foot interval. A thick bed of brecciated-appearing anhydrite occurs at 1163.1-1164.1 feet.
1165.5-1165.8	No recovery.

Table 2.--Detailed core description--Continued
(Modified from James A. Miller, written commun., 1981)

Depth, in feet	Lithology
	Core samples
1165.8-1168.0	Recovered 6.7 feet in 1165.8-1172.8 foot interval. Put loss at bottom. Dolomite as 1158.0-1160.0 foot interval with anhydrite prominent, occurring both as isolated small crystals and large blebs. Gradational into -
1168.0-1172.5	Dolomite as 1156.0-1158.0 feet. Anhydrite locally fills gastropod casts.
1172.5-1172.8	No recovery.
1172.8-1175.0	Recovered 13.0 feet in 1172.8-1185.8 foot interval. Dolomite, cream, argillaceous texture, massive bedding, low porosity, with dark-brown bands of algal(?) material prominent. Gradational into -
1175.0-1177.0	Anhydrite, light-gray to white, massive, brecciated, thickly interbedded with (and fractures filled with) cream argillaceous-textured dolomite. On one irregular solution plane in anhydrite, dark-gray clay has been deposited. Gradational into -
1177.0-1185.8	Dolomite, cream, argillaceous texture, massively bedded, low porosity, with medium to large inclusions and blebs of clear to white anhydrite very prominent.
1185.8-1192.5	Recovered 20.0 feet in 1185.8-1205.8 foot interval. Dolomite as above. Roughly 20 percent of interval is anhydrite. Gradational into -
1192.5-1194.5	Dolomite, cream, very fine crystalline, with isolated small to medium vugs, some pellets and small foraminifera still recognizable. Low porosity. Massively bedded. Gradational into -
1194.5-1197.5	Dolomite as above but tan, with fair amount of vuggy porosity.
1197.5-1202.1	Dolomite as above with very small vugs. Dark organic-rich bed at 1198.5 feet. Gradational into -
1202.1-1205.8	Dolomite, cream, very fine crystalline, once had fair amount of small to medium-vug porosity. Vugs now filled with clear crystalline anhydrite, producing a very low porosity rock. Gradational into -

Table 2.--Detailed core description--Continued
(Modified from James A. Miller, written commun., 1981)

Depth, in feet	Lithology
	Core samples
1205.8-1208.0	Recovered 20 feet in 1205.8-1225.8 foot interval. Dolomite, cream, fine crystalline, silty texture, with isolated vugs prominent, low porosity, massively bedded. Gradational into -
1208.0-1219.0	Dolomite as above (in upper 4 feet), grading downward into cream argillaceous-textured massive low-porosity dolomite. Thirty-five percent of interval is coarsely brecciated white to light-gray anhydrite, with dolomite filling cracks. Blebs of anhydrite prominent. Gradational into -
1219.0-1225.8	Dolomite, cream, argillaceous-textured, massively bedded, low porosity. Lower half of interval has many dark-brown organic-rich laminae. Gradational into -
1225.8-1229.8	Recovered 10.0 feet in 1225.8-1235.8 foot interval. Dolomite, cream, fine crystalline, with fair amount of small-vug porosity. Rock was a finely pelletal limestone before alteration. Massively bedded. Dark-brown organic-rich argillaceous-textured dolomite at 1227.3 feet. Gradational into -
1229.8-1234.0	Dolomite, cream, argillaceous-textured, massively bedded, low porosity. Gradational into -
1234.0-1235.8	Dolomite, cream, fine crystalline, massively bedded, with small-vug porosity prominent but mostly unconnected.
1235.8-1239.8	Recovered 20.0 feet in 1235.8-1255.8 foot interval. Dolomite as above with coarse blebs of anhydrite. Gradational into -
1239.8-1246.5	Dolomite, cream, highly pelletal, 55 percent fine argillaceous dolomite pellets in 45 percent massively-bedded argillaceous-textured dolomite matrix. Dark-brown organic-rich band at 1241.5 feet. Low porosity. In sharp contact with -
1246.5-1247.0	Anhydrite, medium-gray, massive, appears to be a bed. In sharp contact with -

Table 2.--Detailed core description--Continued
(Modified from James A. Miller, written commun., 1981)

Depth, in feet	Lithology
	Core samples
1247.0-1248.3	Dolomite as 1239.8-1246.5 foot interval but with much dark-brown mottling due to irregular, contorted organic (algal) laminae. Blebs and coarse crystals of clear- to light-gray anhydrite prominent. One 0.4 foot bed(?) of brecciated anhydrite at 1247.0 feet. Gradational into -
1248.3-1251.2	Dolomite as 1239.8-1246.5 foot interval. Gradational into -
1251.2-1255.8	Dolomite, cream, argillaceous textured, low porosity, massively bedded, with medium to coarse blebs of anhydrite accounting for about 15 percent of interval. Gradational into -
1255.8-1258.0	Recovered 19.0 feet in 1255.8-1275.8 foot interval. Put loss at bottom. Dolomite, very-pale orange, argillaceous-textured, massively bedded, low porosity. Trace of vuggy porosity in 1255.8-1256.0 foot interval.
1258.0-1266.0	Dolomite as above. Brecciated anhydrite in 1261.5-1262.0 foot interval.
1266.0-1274.0	Dolomite as above. Black organic-rich laminae in bottom 0.1 feet of interval. Gradational into -
1274.0-1274.8	Dolomite, cream, microcrystalline, hard, dense, massively bedded, low porosity. Massive chalk-white frosted-appearing anhydrite bed from 1275.0-1275.7 feet.
1274.8-1275.8	No recovery.
1275.8-1276.4	Recovered 19.9 feet in 1275.8-1295.8 foot interval. Put loss at bottom. Anhydrite as bottom of above interval. In irregular contact with -
1276.4-1292.8	Dolomite, tan, very fine crystalline, silty appearance, massively bedded, low porosity, grading into cream argillaceous-textured low-porosity dolomite in lower half of interval. A few scattered medium-brown organic-rich laminae. Gradational into -

Table 2.--Detailed core description--Continued
(Modified from James A. Miller, written commun., 1981)

Depth, in feet	Lithology
	Core samples
1292.8-1295.7	Dolomite, tan, very fine crystalline to microcrystalline, hard, low porosity. Thick beds and medium to coarse blebs of white to light-gray anhydrite make up about 25 percent of interval. Low porosity.
1295.7-1295.8	No recovery.
1295.8-1299.6	Recovered 19.6 feet in 1295.8-1315.8 foot interval. Put loss at bottom. Dolomite, cream, argillaceous-textured, massively bedded, low porosity. Large blebs of white to light-gray anhydrite prominent. Lower 0.5 feet mostly anhydrite (top and bottom contacts irregular but sharp).
1299.6-1309.4	Dolomite as above, slightly silty in bottom 3 feet. Bed(?) of anhydrite, with brecciated appearance and cracks filled with dolomite at 1299.6-1301.3 feet. Minor dark-brown relict grass in this anhydritic interval also. Much anhydrite as large blebs at 1306-1307 feet. Whole interval is massively bedded, with low porosity.
1309.4-1315.4	Dolomite, cream, argillaceous-textured, low porosity, massively bedded. Brecciated-appearing anhydrite beds(?), with dolomite filling cracks at 1309.6-1310.0, 1310.5-1310.7, and 1312.6-1313.0 feet. Trace of dark-brown grass-textured organic material as isolated blades and aggregates.
1315.4-1315.8	No recovery.
1315.8-1318.5	Recovered 20.0 feet in 1315.8-1335.8 foot interval. Mostly cream argillaceous-textured dolomite as above, with scattered dark-brown to black lignitic material prominent. Anhydrite, with brecciated appearance, at 1316.0-1316.4 and 1317.0-1317.6 foot intervals. Entire interval is low porosity. Gradational into -

Table 2.--Detailed core description--Continued
(Modified from James A. Miller, written commun., 1981)

Depth, in feet	Lithology
	Core samples
1318.5-1335.8	Dolomite, light-brown, microcrystalline, hard, dense, very massively bedded, with considerable medium-sized vuggy porosity, most of which is filled with clear coarse crystalline selenite. Scattered dark to medium brown irregular spots of organic-rich material mark grass concentrations. Large anhydrite blebs prominent in lower 0.3 feet. Low porosity interval. Gradational into -
1335.8-1337.8	Recovered 20.0 feet in 1335.8-1355.8 foot interval. Dolomite as above but medium brown, medium crystalline, with dark-brown to black organic material prominent.
1337.8-1341.8	Dolomite as above with coarse anhydrite inclusions at 1338.5-1338.7 and 1339.8-1340.2 feet. Lower inclusion has much black organic material associated with anhydrite. Rock is otherwise massively bedded. Low porosity. Gradational into -
1341.8-1349.0	Dolomite, medium-brown with a few scattered thick dark-brown beds, coarse crystalline, with considerable intergranular and medium-vug porosity. Rock is a loosely- to well-cemented mosaic of dolomite rhombs. About 40 percent of pore space is filled with clear to light-gray selenite. Interval has fair porosity in spite of this. Rock was originally a pelletal limestone - remnants of large Dictyoconus sp. still recognizable. Gradational into -
1349.0-1355.8	Dolomite, light-brown, medium crystalline, crystals closely bound and interlocked in a matrix of microcrystalline dolomite. Rock once had considerable vuggy porosity that is now filled with clear to white selenite. Massively bedded, low porosity. Trace of large white to light-gray anhydrite inclusions in lower 2 feet.
1355.8-1363.2	Recovered 19.0 feet in 1355.8-1375.8 foot interval. Put loss at bottom. Dolomite, selenitic, as above but tan. Coarse to medium isolated vugs prominent. Low-porosity interval. Much white to light gray anhydrite, as coarse blebs, in lower 3 feet. Can't determine nature of lower contact because of a solution feature there.

Table 2.--Detailed core description--Continued
(Modified from James A. Miller, written commun., 1981)

Depth, in feet	Lithology
	Core samples
1363.2-1368.5	Dolomite as above with decrease in selenite vug fillings to prominent. No coarse anhydrite blebs. Rock has low porosity because vugs (that represent molds of gastropods and large flat *Dictyoconus*) are isolated. Highly organic (black lignitic material mixed with dolomite) at 1367.0-1367.6 and 1368.4-1368.5 feet. Gradational into -
1368.5-1370.4	Dolomite, dull medium-brown, earthy appearance, consists of friable mosaic of loosely bound coarse dolomite crystals. Fair intergranular porosity. Gradational into -
1370.4-1373.0	Dolomite, medium to dark-brown mottled, medium to coarse crystalline, hard, massively bedded. Medium-sized vugs common but isolated. Low porosity. Gradational into -
1373.0-1374.8	Dolomite, medium-brown, fine crystalline, hard, massively bedded, low porosity. Coarse blebs of white- to light-gray anhydrite comprise 25 percent of interval. Anhydrite fills all the vuggy pore space in the rock also.
1374.8-1375.8	No recovery.
1375.8-1377.8	Recovered 19.8 feet in 1375.8-1395.8 foot interval. Put loss at bottom. Dolomite as above but tan. Fossil molds (large vugs) in wall of core are emphasized because part of the anhydrite that filled them was dissolved during the drilling operation.
1377.8-1388.4	Dolomite as above but mostly very fine crystalline, argillaceous texture. Thickly interbedded with massive (0.5 to 1.3 foot) lenses and pods of white anhydrite that appears brecciated, with dolomite filling cracks in the anhydrite. Anhydrite accounts for about 45 percent of interval. Dark-brown organic-rich streaks at 1379, 1381, and 1384 feet. Bottom 0.3 feet is dark-colored and in angular unconformity with -
1388.4-1390.4	Dolomite, medium- to dark-brown banded, fine crystalline, earthy appearance, with fair amount of intergranular porosity. Banding (due to concentrations of organic material) more prominent in lower 1 foot. Gradational into -

Table 2.--Detailed core description--Continued
(Modified from James A. Miller, written commun., 1981)

Depth, in feet	Lithology
	Core samples
1390.4-1395.6	Dolomite, medium-brown, medium crystalline, hard, consists of a well-cemented mosaic of medium-sized dolomite crystals. Fair amount of intergranular and small-vug porosity. Trace of dark-brown mottling, due to concentration of organic materials. Lower 0.4 feet is a large white anhydrite lens (or bed?) with irregular but sharp contact above.
1395.6-1395.8	No recovery.
1395.8-1402.5	Recovered 20.0 feet in 1395.8-1415.8 foot interval. Dolomite, as above but fine crystalline, light-brown. Very thickly (18-inch beds) interbedded with massive white anhydrite, some of which is fractured and has fractures lined with dark-gray clay. Low-porosity interval because most vugs are filled with clear selenite. Gradational into -
1402.5-1404.1	Dolomite, light-brown, very fine crystalline to microcrystalline, hard, massively bedded. Low porosity. Rock once had considerable vuggy porosity, vugs are now filled with clear selenite that is also concentrated (1) on bedding planes(?) normal to long axis of core and (2) on poorly defined low-angle fractures at about a 35 degree angle to the long axis. In irregular but sharp contact with -
1404.1-1405.1	Anhydrite, light-gray, massive, broken by intersecting high-angle black clay-coated fractures 0.3 feet above bottom. In irregular but sharp contact with -
1405.1-1410.1	Dolomite, light-gray with tan cast, very fine crystalline, hard, massively bedded, low porosity. Once had considerable small-vug and intergranular porosity that is now filled with gray selenite. Dark-brown to black organic (some woody) material prominent. Gradational into -
1410.1-1412.2	Dolomite, dark-brown, coarse crystalline, saccharoidal, consists of a hard well-cemented highly porous mosaic of coarse dolomite crystals. Minor clear selenite, mostly as scattered vug fillings. Gradational into -
1412.2-1415.8	Dolomite as 1405.1-1410.1 except not very vuggy, with very little selenite. Low porosity. Gradational into -

Table 2.--Detailed core description--Continued
(Modified from James A. Miller, written commun., 1981)

Depth, in feet	Lithology
	Core samples
1415.8-1420.8	Recovered 20.0 feet in 1415.8-1435.8 foot interval. Dolomite, cream, fine crystalline, massively bedded, with fair amount of intergranular porosity. Dark-brown disseminated organic material prominent. Trace of clear selenite, filling some of the intergranular pore space and some scattered vugs. One large anhydrite intercalation at 1419.6-1419.8 feet. Gradational into -
1420.8-1424.8	Dolomite as 1412.2-1415.8. Add trace of medium-sized blebs of white anhydrite. Gradational into -
1424.8-1433.0	Dolomite, tan, fine crystalline, hard, consists of a mosaic of interlocking crystals with low to fair porosity. Massively bedded. Fractured at 1427-1428.5 feet. Clear selenite common, as vertical veinlets and filling some pore spaces. Trace of dark-brown to black organic material. In sharp but irregular contact with -
1433.0-1434.5	Anhydrite, white, massive, with a low-angle fracture filled with black clay. In sharp but irregular contact with -
1434.5-1435.8	Dolomite, cream, fine crystalline, massively bedded, with low intergranular porosity. Trace of scattered blebs of anhydrite.
1435.8-1439.8	Recovered 4.0 feet in 1435.8-1439.8 foot interval. Dolomite as above with very thick (0.5 to 1 foot) beds of white brecciated anhydrite (dolomite fills cracks in breccia) at 1436.8 and 1437.8 feet.
1439.8-1440.8	No recovery.
1440.8-1445.0	Recovered 15.0 feet in 1440.8-1455.8 foot interval. Dolomite as 1405.1-1410.1 foot interval. Gradational into -
1445.0-1455.8	Dolomite, light-brown, highly porous. Sixty percent cream-colored boxwork of fine crystalline dolomite, mostly replacing foraminifera and bryozoan remains. Forty percent coarse crystalline light-brown dolomite that has replaced a micritic limestone matrix. High porosity, massively bedded.

Table 2.--Detailed core description--Continued
(Modified from James A. Miller, written commun., 1981)

Depth, in feet	Lithology
	Core samples
1455.8-1460.8	Recovered 20.0 feet in 1455.8-1475.8 foot interval. Dolomite as above. Gradational into -
1460.8-1462.4	Dolomite, light-brown with light-gray cast, coarse to very coarse crystalline, low porosity, massively bedded. Gradational into -
1462.4-1466.8	Dolomite, cream. Sixty-five percent cream fine crystalline silty-appearing dolomite. Thirty-five percent very-pale orange very fine crystalline to microcrystalline "boxwork" dolomite. Low porosity, massively bedded. Gradational into -
1466.8-1475.8	Dolomite as above but with boxwork still slightly calcareous (incompletely replaced limestone), enclosed in medium crystalline dolomite. Fair intergranular porosity. Gradational into -
1475.8-1482.0	Recovered 20.0 feet in 1475.8-1495.8 foot interval. Dolomite as above but low porosity. Intergranular pores filled with clear selenite. Very massively bedded. Gradational into -
1482.0-1484.0	Dolomite, tan with gray cast, low porosity, anhydritic. Seventy percent very fine crystalline hard massively bedded dolomite. Thirty percent clear- to white anhydrite, filling intergranular porosity.
1484.0-1488.0	Dolomite as above. Gradational into -
1488.0-1490.0	Dolomite, tan, fine- to medium crystalline, silty to argillaceous-appearing, massively bedded, with fair amount of intergranular porosity. Gradational into -
1490.0-1495.8	Dolomite, light-gray, selentic (?) or anhydritic. As 1482.0-1484.0 foot interval.
1495.8-1501.8	Recovered 18.0 feet in 1495.8-1513.8 foot interval. Dolomite as above.
1501.8-1510.8	Dolomite as above with a few thin beds of argillaceous-textured hard anhydritic dolomite. Trace of anhydrite blebs at 1502.5 and 1509.4 feet.

Table 2.--Detailed core description--Continued
(Modified from James A. Miller, written commun., 1981)

Depth, in feet	Lithology
	Core samples
1510.8-1513.8	Dolomite as above with medium to coarse blebs of white anhydrite prominent. Gradational into -
1513.8-1528.0	Recovered 21.0 feet in 1513.8-1534.8 foot interval. Dolomite, light-gray with tan cast, fine- to medium crystalline, hard, dense, low porosity. Clear- to white anhydrite as blebs, stringers, and veinlets, accounts for 20 percent of interval. Very massively bedded. Gradational into -
1528.0-1534.8	Dolomite, light-brown, medium- to coarse crystalline, hard, with low intergranular and vuggy porosity. Fossil casts and molds common. Massively bedded. Gradational into -
1534.8-1554.8	Recovered 20.0 feet in 1534.8-1554.8 foot interval. Dolomite, cream, very fine crystalline, silty to argillaceous-textured, very massively bedded, low porosity. Coarse- to very coarse blebs of anhydrite scattered throughout interval about every 1.5 to 2.0 feet, more common in lower part.
1554.8-1559.8	Recovered 20.0 feet in 1554.8-1574.8 foot interval. Dolomite as above with decrease in anhydrite to trace. In sharp contact with -
1559.9-1570.0	Dolomite, dark-brown with much gray mottling, medium crystalline, hard and massive mostly, locally saccharoidal, once had fair amount of vuggy porosity that is now filled with clear to gray anhydrite. Large blebs of anhydrite at 1563, 1567.6 and 1569.6 feet. Total anhydrite in interval is about 30 percent. Low porosity. Thin to thick beds of light-gray fine crystalline hard low-porosity dolomite prominent, increasing in lower 4 feet. Gradational into -
1570.0-1574.8	Dolomite, light-gray with tan cast, anhydritic; as dolomite in 1482.0-1484.0 foot interval.
1574.8-1578.8	Recovered 20.7 feet in 1574.8-1595.8 foot interval. Put loss at bottom. Dolomite as above with dark-brown organic-rich partings prominent. Gradational into -

Table 2.--Detailed core description--Continued
(Modified from James A. Miller, written commun., 1981)

Depth, in feet	Lithology
	Core samples
1578.8-1581.8	Dolomite as 1570.0-1574.8 foot interval. In sharp contact with -
1581.8-1585.8	Dolomite, medium-brown, medium crystalline, with fair amount of intergranular and vuggy porosity, massively bedded. Trace of dark-gray organic-rich clay partings. Gradational into -
1585.8-1592.8	Dolomite as 1570.0-1574.8 foot interval. Gradational into -
1592.8-1595.5	Dolomitic limestone, white with cream cast. Fifty-five percent white chalky micritic limestone matrix. Forty-five percent medium crystalline light-brown dolomite, "floating" in chalky limestone matrix as isolated crystals and as aggregates. Low porosity. Massive bedding.
1595.5-1595.8	No recovery.
1595.8-1603.8	Recovered 20.0 feet in 1595.8-1615.8 foot interval. Limestone, pelletal, very-pale orange with cream cast. Sixty-five percent fine pellets of micritic limestone and small foraminifera. Thirty-five percent white chalky micritic limestone matrix. Low porosity. Trace of tan dolomite (as vug fillings and isolated coarse euhedral crystals), clear selenite as vug fillings. Low porosity, massively bedded. Gradational into -
1603.8-1605.8	Dolomite, medium-brown with gray cast, fine- to medium crystalline, massive, hard, low porosity. Clear- to white anhydrite, filling former intergranular and vuggy porosity, accounts for 25 percent of sample. Massive bleb (or bed?) of white anhydrite 1604.2-1604.6 feet. Gradational into -
1605.8-1609.8	Dolomite, light-brown, fine to medium crystalline, hard, low porosity, massively bedded, with white chalky remains of unreplaced foraminifera and bryozoa "floating" in dolomite matrix. Gradational into -
1609.8-1611.8	Dolomite, medium-brown, medium crystalline, hard, dense, low porosity, massively bedded. Large- to small blebs of white to clear anhydrite prominent. Gradational into -

Table 2.--Detailed core description--Continued
(Modified from James A. Miller, written commun., 1981)

Depth, in feet	Lithology
	Core samples
1611.8-1614.3	Dolomite as 1605.8-1609.8 with large blebs of anhydrite in upper 0.6 foot. Gradational into -
1614.3-1615.0	Anhydrite, white, massive, probably the side of a large intercalation or bleb. Gradational into -
1615.0-1615.8	Dolomite as 1609.8-1611.8 foot interval.
1615.8-1625.4	Recovered 19.9 in 1615.8-1635.8 foot interval. Put loss at bottom. Dolomite as above.
1625.4-1635.7	Dolomite as above.
1635.7-1635.8	No recovery.
1635.8-1645.0	Recovered 19.7 feet in 1635.8-1655.8 foot interval. Put loss at bottom. Dolomite, dark-brown, medium- to coarse crystalline, hard, very massively bedded, with fair amount of small-vug porosity. A few vugs are filled with clear anhydrite. Gradational into -
1645.0-1655.5	Dolomite, dark-brown with gray cast, medium- to coarse crystalline, hard, very massively bedded. Once had considerable small- to medium-sized vuggy porosity which is now filled with white to clear anhydrite. Low porosity.
1655.5-1655.8	No recovery.
1655.8-1663.7	Recovered 20.0 feet in 1655.8-1675.8 foot interval. Dolomite, dark-brown, medium crystalline, mostly hard, dense, but with a few scattered zones up to 0.5 foot thick that have fair intergranular porosity. White- to clear selenite very prominent (20 percent of total interval), as large blebs, vug fillings, and veinlets. Gradational into -
1663.7-1675.8	Dolomite, tan, fine- to very fine crystalline, silty appearance, massively bedded, low porosity. Scattered- coarse to very coarse blebs of white- to light-gray anhydrite make up about 15 percent of interval.

Table 2.--Detailed core description--Continued
(Modified from James A. Miller, written commun., 1981)

Depth, in feet	Lithology
	Core samples
1675.8-1692.9	Recovered 17.1 feet in 1675.8-1692.9 foot interval. Dolomite as above with decrease in anhydrite to "prominent." Anhydrite is concentrated at 1675.8-1676.6, 1682.3-1683.3, 1689.2-1689.8, and 1691.6-1692.5 feet.
1692.9-1710.8	Recovered 17.9 feet in 1692.9-1710.8 foot interval. Dolomite as 1663.7-1675.8 foot interval. Add trace of dark-brown organic-rich partings. At 1709.8 feet, one high-angle fracture is coated with dark organic (?) material.
1710.8-1725.8	Recovered 15.0 feet in 1710.8-1725.8 foot interval. Dolomite as above.
1725.8-1733.0	Recovered 20.0 feet in 1725.8-1748.5 foot interval. Dolomite as above. Add trace of scattered dark-brown grassy-appearing organic material.
1733.0-1736.5	Dolomite as above but with anhydrite blebs very rare. Gradational into -
1736.5-1744.0	Dolomitic limestone, cream. Sixty percent very-pale orange micritic limestone matrix. Forty percent very-fine crystalline light-brown dolomite, replacing limestone. Trace of broken shell material. Massively bedded, low porosity. Gradational into -
1744.0-1748.5	Recovered 14.5 feet in 1748.5-1760.8 foot interval. Put loss at bottom. Dolomite as 1733.0-1736.5 foot interval. Gradational into -
1748.5-1760.8	Limestone, very-pale orange with tan cast, micritic, massively bedded, low porosity, with light-brown grassy-appearing organic material and bryozoan fragments prominent. Trace of pelecypod remains (unaltered coarse shell material).
1760.8-1766.4	Recovered 15.0 feet in 1760.8-1775.8 foot interval. Limestone as above with Asterigerina texana common (a middle Eocene form). Fine crystalline light-brown dolomite prominent, "floating" in limestone. Gradational into -

Table 2.--Detailed core description--Continued
(Modified from James A. Miller, written commun., 1981)

Depth, in feet	Lithology
	Core samples
1766.4-1766.6	Dolomite, light- to dark-brown mottled and laminated, appears bioturbidated, with concentrations of dark-brown organic material in darker mottles, medium crystalline, with traces of white chalky unreplaced limestone. Low porosity. Gradational into -
1766.6-1772.4	Dolomitic limestone, tan: Fifty-five percent light-brown fine crystalline dolomite; replacing 45 percent cream micritic limestone. Massively bedded, low porosity. Very dark brown organic material concentrated in lower 0.2 foot. Gradational into -
1772.4-1774.6	Dolomite, medium-brown, fine- to medium crystalline, with blebs, stringers, and veinlets of clear to white anhydrite prominent. In lower 1 foot, dolomite is very fine crystalline to microcrystalline, hard, dense, and very strongly anhydritic.
1774.6-1775.8	Dolomite as upper part of preceding interval but highly banded, appears bioturbidated.
1775.8-1777.0	Recovered 20.0 feet in 1775.8-1795.8 foot interval. Dolomite as above. Gradational into -
1777.0-1781.0	Dolomite, light-brown, fine crystalline, massively bedded, hard, low porosity, with dark-brown organic-rich spots and laminae commom. Gradational into -
1781.0-1785.5	Dolomite as above but with silty appearance. Blebs of white anhydrite prominent at 1779.0, 1780.0, 1781.9, and 1783.4 feet. Trace of disseminated greenish-black altered glauconite. Lowermost anhydrite extends to 1784.1 feet, is in sharp contact with -
1785.5-1795.8	Limestone, cream with white mottling, micritic, chalky, very massively bedded, low porosity. About 25 percent of middle part of interval (and about 15 percent of upper part) is light-brown coarse crystalline dolomite, replacing limestone matrix. Large *Pseudophragmina (Proporocyclina) cedarkeysensis*, an early Eocene form, prominent.

Table 2.--Detailed core description--Continued
(Modified from James A. Miller, written commun., 1981)

Depth, in feet	Lithology
	Core samples
1795.8-1815.8	Recovered 20.0 feet in 1795.8-1815.8 foot interval. Limestone, very-pale orange, micritic, very massively bedded, with large *Pseudophragmina cedarkeysensis* prominent. Fine-grained glauconite common, mostly as disseminated grains, but also as irregular bands in upper 2 feet. Fine to medium crystalline light-brown dolomite common in middle and lower part of interval. Low porosity. Gradational into -
1815.8-1824.0	Recovered 19.9 feet in 1815.8-1835.8 foot interval. Put loss at bottom. Limestone, very-pale orange with cream cast, micritic, massively bedded, low porosity, with light-brown dolomite present in amounts from "trace" to 25 percent. Trace of coarse-grained very dark green glauconite. Gradational into -
1824.0-1826.0	Dolomitic limestone, light-gray, hard, very fine crystalline, massively bedded. Seventy percent fine pellets of very-pale orange limestone and small foraminifera in 30 percent matrix of tan microcrystalline dolomite. Trace of coarse-grained dark greenish-black glauconite. Low porosity.
1826.0-1827.0	Limestone as above with large unconnected vugs, that are brown-stained pelecypod molds, prominent. Gradational into -
1827.0-1833.0	Limestone as 1824.0-1826.0 foot interval with pellets enclosed in a microcrystalline very-pale orange limestone matrix (rather than dolomite). Gradational into -
1833.0-1835.7	Limestone, light-gray, very-fine crystalline to microcrystalline, hard, massively bedded, highly fossiliferous. Large unconnected vugs (pelecypod and gastropod casts and molds) prominent.
1835.7-1835.8	No recovery.
1835.8-1837.5	Recovered 14.7 feet of core in 1835.8-1851.8 foot interval. Put loss at bottom. Limestone, very-pale orange, pelletal: Sixty-five percent fine pellets of white- to cream micritic limestone. Thirty-five percent white micritic limestone matrix. Low intergranular porosity. Pelecypod fragments common. Massively bedded.

Table 2.--Detailed core description--Continued
(Modified from James A. Miller, written commun., 1981)

Depth, in feet	Lithology
	Core samples
1837.5-1843.0	Limestone as above. Gradational into -
1843.0-1847.5	Pelletal limestone as 1835.8-1837.5 foot interval with 10 percent increase in matrix, corresponding decrease in pellets. Low porosity.
1847.5-1850.5	Pelletal limestone as above but highly vuggy. Soft throughout, rubbly, with a dark-colored clay bed in top 0.5 foot. Low porosity.
1850.5-1851.8	No recovery.
1851.8-1853.8	Recovered 12.3 feet in 1851.8-1864.8 foot interval. Put loss in bottom. Limestone, very-pale orange, micritic, chalky, low porosity, massively bedded. Trace of coarse broken pelecypod fragments. Gradational into -
1853.8-1855.4	Pelletal limestone as 1843.0-1847.5 foot interval. Gradational into -
1855.4-1856.8	Pelletal limestone, light-gray, highly porous. Eighty percent loosely bound medium-sized foraminifera (Dictyoconus, large Quinqueloculina are the most common species) and medium-sized micritic limestone pellets. Fifteen percent microcrystalline limestone matrix. Gradational into -
1856.8-1858.3	Limestone, light-gray, micritic, hard, massively bedded, low porosity. Trace of scattered medium-sized Dictyoconus sp. In hairline contact with -
1858.3-1861.7	Micritic limestone as above but with rubbly appearance due to blebs and stringers of medium-brown argillaceous limestone admixed with gray micritic limestone. Low porosity. Gradational into -
1861.7-1864.1	Rubbly limestone, gray-white mottled. Sixty percent pebble-sized dark-gray hard microcrystalline limestone particles in a 40 percent white chalky limestone matrix. Clear to light-gray coarse crystalline selenite, mostly as vug fillings, prominent. Low porosity.

Table 2.--Detailed core description--Continued
(Modified from James A. Miller, written commun., 1981)

Depth, in feet	Lithology
	Core samples
1864.1-1864.8	No recovery.
1864.8-1867.0	Recovered 12.0 feet in 1864.8-1876.8 foot interval. Limestone, very-pale orange, chalky, soft, micritic, massively bedded, low porosity. Trace of dark-brown organic-rich laminae, in lower part. Gradational into -
1867.0-1872.0	Limestone, light-gray, fine pelletal, fair intergranular porosity. Seyenty percent fine pellets of micritic limestone and small foraminifera. Thirty percent micritic matrix. Massively bedded. Gradational into -
1872.0-1873.6	Limestone as above, thickly interbedded with chalky limestone as 1864.1-1867.0 foot interval. Gradational into -
1873.6-1874.6	Porous pelletal limestone as 1867.0-1872.0 foot interval with reworked particles of dark-gray microcrystalline limestone prominent. Gradational into -
1874.6-1876.8	Pelletal limestone, very-pale orange: Sixty percent fine pellets of micritic limestone and small foraminifera. Forty percent semi-indurated off-white micritic limestone matrix. Low porosity, rubbly. Gradational into -
1876.8-1877.8	Recovered 18.3 feet in 1874.6-1895.8 foot interval. Put loss in bottom. Pelletal limestone as above but harder, massively bedded. Gradational into -
1877.8-1878.8	Pelletal limestone as above with thin interbeds of light-gray micritic hard microcrystlline limestone prominent. Coarse crystalline clear selenite common, as vug fillings. Gradational into -
1878.8-1886.8	Limestone, very-pale orange, micritic, chalky to well indurated, massively bedded, low pososity, slightly pelletal in upper 2 feet (fine pellets). Trace of scattered Dictyoconus sp. Lower 1.5 feet contains thin beds of medium pelletal limestone with medium-sized foraminifera, that have been reworked, prominent. No recognizable species. Gradational into -

Table 2.--Detailed core description--Continued
(Modified from James A. Miller, written commun., 1981)

Depth, in feet	Lithology
	Core samples
1886.8-1888.8	Limestone, light-gray, micritic, well indurated, massively bedded, low porosity. Gastropod and pelecypod casts and molds prominent. Gradational into -
1888.8-1894.5	Rubbly limestone, gray-white mottled: Forty-five percent very-pale orange micritic well-indurated limestone matrix, rarely pelletal, with minor replacement by tan fine crystalline dolomite. Forty percent irregular angular to subrounded pebble-sized particles of medium-gray hard microcrystalline limestone. Fifteen percent clear- to white anhydrite blebs, mostly filling vugs. Low porosity. Gradational into -
1894.5-1895.1	Dolomitic limestone, light-gray, consists of fine to medium pellets of tan dolomitic limestone and dolomitized medium-sized foraminifera loosely bound by a hard microcrystalline dolomitic limestone matrix. High amount of vuggy and intergranular porosity. Massively bedded.
1895.1-1895.8	No recovery.
1895.8-1897.9	Recovered 2.7 feet in 1895.8-1898.5 foot interval. Dolomitic limestone as above. Gradational into -
1897.9-1898.5	Dolomitic limestone as above but low porosity, non-vuggy, and with most of intergranular pore space filled with hard microcrystalline dolomitic limestone. Gradational into -
1898.5-1899.0	Recovered 16.5 feet in 1898.5-1915.0 foot interval. Porous pelletal limestone as 1894.5-1895.4 foot interval. Gradational into -
1899.0-1903.0	Rubbly limestone as 1888.8-1894.5 foot interval with thin interbeds of dark-brown microcrystalline massive dolomitic limestone in lower 1.5 feet.
1903.0-1904.0	Rubbly limestone as above. Thin beds of medium pelletal dolomite limestone. Gradational into -

Table 2.--Detailed core description--Continued
(Modified from James A. Miller, written commun., 1981)

Depth, in feet	Lithology
	Core samples
1904.0-1907.0	Limestone, light-gray with cream cast, pelletal (medium-sized pellets of micritic limestone and medium-sized foraminifera), fairly porous in upper half, less so in lower part because of increase in micritic matrix that binds pellets, and addition of clear selenite crystals. Massively bedded. Gradational into -
1907.0-1911.0	Dolomitic limestone, tan. Mostly microcrystalline hard dense low-porosity dolomitic limestone. Thin beds and strings of fine pelletal tan limestone prominent. Massively bedded. Gradational into -
1911.0-1915.0	Limestone, light-gray, very finely pelletal, consists of 75 percent fine micritic limestone pellets in a 25 percent matrix of soft to semi-indurated micritic limestone. Thin- to medium-bedded appearance because of washout of soft beds. Low porosity. Trace of coarse anhydrite blebs in lower 0.3 foot of interval. Rare partings of dark-brown organic-rich material.
1915.0-1925.8	Recovered 20.8 feet in 1915.0-1935.8 foot interval. Finely pelletal limestone as above with no anhydrite. Massively bedded.
1925.8-1935.8	Pelletal limestone as above with medium-sized foraminifera very prominent. Fair porosity (intergranular) over much of interval, due to decrease in micritic matrix.
1935.8-1944.8	Recovered 20.0 feet in 1935.8-1955.8 foot interval. Finely pelletal limestone as 1915.0-1925.8 foot interval. Low porosity. Massively bedded. Slightly more micritic near bottom.
1944.8-1947.8	Pelletal limestone as above. Slightly dolomitized and highly porous from 1945.0-1946.0 feet. Gradational into -
1947.8-1948.8	Pelletal limestone as above but cuts up in "poker-chip" fashion due to washout of thin soft beds alternating with harder beds. Gradational into -
1948.8-1955.8	Pelletal limestone as 1935.8-1944.8 foot interval with increase in micritic matrix to 40 percent. Low porosity.

Table 2.--Detailed core description--Continued
(Modified from James A. Miller, written commun., 1981)

Depth, in feet	Lithology
	Core samples
1955.8-1961.8	Recovered 20.0 feet in 1955.8-1975.8 foot interval. Finely pelletal limestone as above. Massively bedded. Slightly rubbly, with coarse pebble-sized particles of light-gray microcrystalline limestone, in lower 0.5 foot.
1961.8-1963.5	"Poker chip" pelletal limestone as 1947.8-1948.8 foot interval. Many of the pellets in this interval are small Quinqueloculina sp.
1963.5-1969.0	"Poker chip" pelletal limestone as above with some beds up to 0.6 foot thick. Most beds, however are thinner.
1969.0-1975.8	Highly micritic massively bedded pelletal limestone as 1948.8-1955.8 foot interval. Gradational into -
1975.8-1976.8	Recovered 19.8 feet in 1975.8-1995.8 foot interval. Put loss at bottom. Pelletal limestone, cream, consists of 80 percent medium-sized pellets of cream micritic limestone and medium-sized foraminifera loosely bound in a 20 percent matrix of micritic limestone. Fair intergranular porosity. Gradational into -
1976.8-1979.8	Pelletal limestone - most of interval is micritic finely pelletal limestone as 1948.8-1955.8 foot interval. There are a few thin beds of medium pelletal limestone with fair intergranular and small-vug porosity. Overall porosity of interval is low. Gradational into -
1979.8-1982.8	Pelletal limestone, cream, medium to finely pelletal, fair to low porosity depending on amount of micritic matrix preserved. Thin-bedded to "poker-chip" layers, indicating washout of softer beds.
1982.8-1983.8	Pelletal limestone, cream, finely pelletal, fairly porous, with trace of micritic matrix binding pellets. Upper 0.3 foot is micritic argillaceous dark to light-gray banded highly organic limestone. Gradational into -

Table 2.--Detailed core description--Continued
(Modified from James A. Miller, written commun., 1981)

Depth, in feet	Lithology
	Core samples
1983.8-1989.6	Pelletal limestone, very-pale orange: Fifty percent very fine pellets of off-white micritic limestone and small foraminifera. Fifty percent off-white chalky micritic limestone matrix. Low porosity, massively bedded.
1989.6-1995.6	Pelletal limestone as above. Trace of dark-brown organic-rich partings in lower 1 foot.
1995.6-1995.8 (T.D.)	No recovery.

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