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GEOLOGICAL ANALYSIS
OF CONVENTIONAL CORE
FROM THE
ANADARKO PETROLEUM CORPORATION
YOUNGREN H-2H WELL
STEVENS COUNTY, KANSAS

Prepared for

Anadarko Petroleum Corporation

Houston, Texas

RSH 3835

CONFIDENTIAL
March, 1998

RESERVOIRS INC.

SUMMARY

A total of 158.4 feet (2458.0-2518.4 feet and 2598.0-2696.0 feet) of conventional core from the Anadarko Petroleum Corporation Youngren H-2H Well were analyzed to determine depositional environments and reservoir quality. The following general conclusions have been derived.

1. The principal depositional facies delineated in the core are summarized below:

Depositional Facies	Percent of Cored Interval	Lithologic Characteristics	Porosity Range (Average) (%)	Permeability Range (Average) (md)	Estimated Reservoir Potential
Paleosol/ Coastal Plain	9%	Red-brown to gray-green, argillaceous siltstones to fine-grained sandstones. Often root mottled, slightly dolomitic. Thin anhydrite bed. "Clean" streaks with intergranular pores.	10.63-13.87 (12.97)	0.053-11.5 (3.20)	Variable, Poor to Fair
Tidal Flat	21%	Gray-green, occasionally tan, ripple and undulatory, laminated, very fine-grained sandstones and siltstones. Contains dolomitic and calcic cements. Slightly argillaceous, occasionally bioturbated. Rare fossils. Locally well preserved intergranular pores.	5.56-26.24 (13.95)	0.005-84.1 (11.9)	Poor to Good
Lagoon	5%	Dark gray-brown to gray-green, argillaceous siltstone/ very fine-grained sandstone to silty dolowackestone. Flat to undulatory laminae, with occasional ripples. Authigenic pyrite common. Burrows common. Poor intergranular porosity.	3.91-12.64 (8.55)	0.002-1.65 (0.152)	Poor

Depositional Facies	Percent of Cored Interval	Lithologic Characteristics	Porosity Range (Average) (%)	Permeability Range (Average) (md)	Estimated Reservoir Potential
Shoal	59%	Gray-brown to gray-tan, slightly sandy limestone to dolostone. Grainstone, packstone, and occasionally wackestone textures. Coarsening-upward sequences common. Mostly massive with occasional cross-bedding. Allochems include peloids, bivalves, fusulinids, oncoids, ooids, ostracodes, intraclasts, and a trace of glauconite. Moldic, intercrystalline, and interparticle pores are present. Partially cemented with calcite, anhydrite, and dolomite.	9.05-28.65 (16.08)	0.042-331.0 (39.6)	Very Good to Fair
Shallow Shelf	6%	Olive-gray to dark gray-green, argillaceous siltstones to wackestones. Bioturbated. Diverse faunal assemblage. Occasional anhydrite nodules. Little visible pore space.	8.35-13.45 (10.91)	0.004-0.153 (0.036)	Poor

2. The grainstones and packstones of the carbonate shoal facies have the best reservoir potential. Three separate shoal zones were delineated; these are summarized in the table below. Zone 1 is a completely dolomitized interval, while Zones 2 and 3 are limestone.

Zone	Lithology	Core Depth (ft)	Porosity Range (Average) (%)	Permeability Range (Average) (md)	Estimated Reservoir Potential
-1-	Dolostone	2481.0-2514.3	10.96-28.65 (20.64)	1.68-331.0 (100.2)	Very Good
-2-	Limestone	2605.7-2632.5	9.05-18.55 (13.49)	0.042-51.3 (4.51)	Good
-3-	Limestone	2656.9-2686.3	9.91-17.31 (13.11)	0.059-5.05 (0.813)	Fair

Zone 1 has the best reservoir potential. Grain dissolution followed by pervasive dolomitization enhanced the original pores. Porosity enhancement has altered the initially low porosity packstones, at the base of Zone 1, into the best part of the reservoir, with porosities of up to 28.65% and permeabilities up to 331 md. Zone 2 is a limestone that "cleans upward" from skeletal wackestones at the base to skeletal grainstones at the top. The middle of Zone 2 has well developed intergranular and moldic pores. Zone 3 is predominantly a lime packstone; it has the least reservoir potential of the three shoal units. The low permeability in Zone 3 is due to: 1) a higher clay content, 2) lack of cleaner grainstones, and 3) moldic leaching common in the upper two zones is poorly developed here.

3. The tidal flat facies consists of gray-green to tan, well-sorted, laminated to ripple cross-stratified siltstones and very fine sandstones. The tidal flat facies is the second best reservoir facies within the cored interval, with a pore system composed of intergranular, and less common moldic, pores. Clay laminae may restrict vertical permeability. Overall, the tidal flat facies has a poor to good reservoir potential.

4. The paleosol/coastal plain deposits are characterized by red-brown to gray-green, argillaceous siltstones to fine-grained sandstones. The oxidized red-brown color, root mottling, and interbedded anhydrite indicate terrestrial deposition. Average porosity in the paleosol/coastal plain facies is 12.97%; permeability is more variable, but averages around 3.2 md. Overall, this facies is judged to have poor reservoir potential. It should be noted that the sample set is small (5), and induced fractures could skew the permeability to an unrepresentatively high average value.

5. The lagoon and shallow shelf deposits consist of gray-green to dark gray-brown, argillaceous siltstones, silty dolowackestones, and shales. These

deposits have low porosity and permeability due to their matrix-rich textures. These rocks may form permeability baffles between the shoal units.

GEOLOGICAL ANALYSIS

OF CONVENTIONAL CORE

FROM THE

ANADARKO PETROLEUM CORPORATION

YOUNGREN H-2H WELL

STEVENS COUNTY, KANSAS

INTRODUCTION

This report, prepared for Anadarko Petroleum Corporation, presents the results and conclusions obtained from geological analysis of 158.4 feet of conventional core (from between 2458.0 and 2518.4 feet, and between 2598.0 and 2696.0 feet) from the Anadarko Petroleum Corporation Youngren H-2H Well, Stevens County, Kansas.

The objectives of this study were to: 1) describe the conventional core and delineate lithologies, textures, depositional environments, sedimentary structures, and contact relationships and 2) evaluate reservoir potential. In order to meet these objectives, the following analytical program was utilized:

- The conventional core was slabbed into one-third and two-third sections. Color photographs of the core are provided in Plates 2 through 12.

- Representative core pieces were photographed. These close core photographs are displayed in Plate 1.

- The core was described in detail. Rock types, depositional textures, sedimentary structures, contact relationships, and depositional environments were delineated. This description is presented in the Core Description Panel at the end of this report.

Reservoirs' Job Number RSH 3835 was assigned to this study. Any communications regarding this report should refer to this Job Number. Three copies of this report have been forwarded to Mr. P. K. Pande, Anadarko Petroleum Corporation, Houston, Texas. Additional copies of this report may be obtained for reproduction costs. All data, interpretations, and other matters related to this study are considered highly confidential and the sole property of Anadarko Petroleum Corporation, Houston, Texas.

Lawrence Bruno
Manager, General Projects - Geology
RESERVOIRS, INC.

Paul W. Grover, Ph.D.
Geologist
RESERVOIRS, INC.

GEOLOGICAL ANALYSIS

This section of the report presents the results of geological analysis of 158.4 feet of conventional core (from between 2458.0 and 2518.4 feet, and between 2598.0 and 2696.0 feet) from the Anadarko Petroleum Corporation Youngren H-2H Well, Stevens County, Kansas.

Depositional Environments

Five principal depositional facies were identified in the core. These depositional facies are: paleosol/coastal plain, tidal flat, lagoon, shoal, and shallow shelf. These depositional facies are summarized in Table 1; Figure 4 shows an idealized depositional model.

TABLE 1

Depositional Facies	Percent of Cored Interval	Lithologic Characteristics	Porosity Range (Average) (%)	Permeability Range (Average) (md)	Estimated Reservoir Potential
Paleosol/ Coastal Plain	9%	Red-brown to gray-green, argillaceous siltstones to fine-grained sandstones. Often root mottled, slightly dolomitic. Thin anhydrite bed. "Clean" streaks with intergranular pores.	10.63-13.87 (12.97)	0.053-11.5 (3.20)	Variable, Poor to Fair
Tidal Flat	21%	Gray-green, occasionally tan, ripple and undulatory, laminated, very fine-grained sandstones and siltstones. Contains dolomitic and calcic cements. Slightly argillaceous, occasionally bioturbated. Rare fossils. Locally well preserved intergranular pores.	5.56-26.24 (13.95)	0.005-84.1 (11.9)	Poor to Good
Lagoon	5%	Dark gray-brown to gray-green, argillaceous siltstone/ very fine-grained sandstone to silty dolowackestone. Flat to undulatory laminae, with occasional ripples. Authigenic pyrite common. Burrows common. Poor intergranular porosity.	3.91-12.64 (8.55)	0.002-1.65 (0.152)	Poor

Depositional Facies	Percent of Cored Interval	Lithologic Characteristics	Porosity Range (Average) (%)	Permeability Range (Average) (md)	Estimated Reservoir Potential
Shoal	59%	Gray-brown to gray-tan, slightly sandy limestone to dolostone. Grainstone, packstone, and occasionally wackestone textures. Coarsening-upward sequences common. Mostly massive with occasional cross-bedding. Allochems include peloids, bivalves, fusulinids, oncoids, ooids, ostracodes, intraclasts, and a trace of glauconite. Moldic, intercrystalline, and interparticle pores are present. Partially cemented with calcite, anhydrite, and dolomite.	9.05-28.65 (16.08)	0.042-331.0 (39.6)	Very Good to Fair
Shallow Shelf	6%	Olive-gray to dark gray-green, argillaceous siltstones to wackestones. Bioturbated. Diverse faunal assemblage. Occasional anhydrite nodules. Little visible pore space.	8.35-13.45 (10.91)	0.004-0.153 (0.036)	Poor

Paleosol/Coastal Plain Facies

The paleosol/coastal plain facies accounts for roughly 9% of the cored interval. Three individual units were delineated, ranging in thickness from 4.1 to 4.3 feet (see the Core Description Panel). The deposits are characterized by red-brown to gray-green, dolomitic/calcareous, argillaceous siltstones and fine-grained sandstones. A 1.2-foot thick anhydrite bed is also associated with the paleosol/coastal plain unit. Two prominent features of the paleosol/coastal plain facies are the red-brown color and the abundance of root mottling (Plate 1,A). Primary sedimentary structures are relatively uncommon in this facies, although faint laminae and ripples are present. The paleosol/coastal plain deposits generally have gradational contacts with the tidal flat deposits and sharp contacts with the shoal or lagoonal strata.

The red-brown (oxidized) color, abundant root mottling, and bedded anhydrite in the paleosol/coastal plain facies indicate subaerial exposure and deposition in a terrestrial (non-marine) environment. The paleosol/coastal plain deposits should thin and pinchout toward the center of the basin where they grade into intertidal and marine-dominated deposits. The gradational contact between the paleosol/coastal plain facies and the tidal flat facies (such as at 2650.7 feet) reflects the interfingering of two, laterally adjacent depositional environments. The sharp, or undulatory, contacts between the paleosol/coastal plain facies and the overlying shoal facies indicate an erosional or non-depositional contact (for example at 2514.3 feet); rapid marine transgression over the paleosols reworked the tops of these terrestrial deposits and left a black carbonaceous shale at the contact (e.g., at 2514.3 and 2646.0 feet).

Routine core analysis data (excluding artificially fractured core pieces) show porosity values in the paleosol/coastal plain facies ranging from 10.6 to 13.9% (average of 12.9%) and permeability ranging from 0.053 to 11.5 md (average of 3.20 md). The higher permeability values occur in association with lenses of "clean" siltstone to very fine-grained sandstone. The average values are skewed by the small data set. Most of this facies will have matrix permeability below 1.0 md. Pore space is filled by detrital clay and various amounts of calcite, dolomite, iron oxide, and patchy anhydrite cements. The paleosol/coastal plain deposits generally have rather poor reservoir potential.

Tidal Flat Facies

The tidal flat facies accounts for roughly 21% of the cored strata and is composed of gray-green to tan, dolomitic/calcic, well-sorted, fine-grained sandstones and siltstones with occasional very sandy dolostone (Plate 1,B). Scattered fossil fragments were noted. Four individual units were delineated, ranging in thickness from 3 to 15 feet. The tidal flat deposits are thin-bedded and ripple- to wavy-laminated. Commonly, the siltstones/sandstones display flaser bedding; that is, there are alternating lenses or laminae of "clean" siltstone/sandstone and green-gray shale. Bioturbation is more

common in the more argillaceous sediments. Apparent bi-directional, ripple cross-stratification were occasionally noted.

Features that indicate deposition in a tidal flat environment are: 1) occasional bi-directional, ripple cross-stratification, 2) stratigraphic positioning adjacent to paleosol deposits, and 3) the flaser bedding indicative of fluctuating energy conditions. The cored interval between 2463 and 2488 feet provides a good example of a progradational sequence from shoal to lagoon to tidal flat.

Tidal flat deposits often form in coastal embayments that have fairly low relief and a meso- to macrotidal range. These deposits often form widespread, sheet-like lithosomes that parallel the coastline.

Routine core analysis measurements from the tidal flat facies (excluding the mixed carbonate/clastic tidal flat facies) show porosity values ranging from 6.25 to 26.24% (average of 15.05%) and permeability values ranging from 0.006 to 84.1 md. (average of 14.78 md.). Of the five depositional facies delineated in the core, the tidal flat facies is the second best reservoir target, with the shoal facies being the best. However, the fine laminae and occasional shale partings may limit vertical permeability. The tidal flat deposits from 2466 to 2472 feet (core depth) display density-neutron crossover. This 6-foot unit has an average core porosity of 22.8% and an average permeability of 50 md. Primary intergranular pores account for most of the pore volume, with occasional moldic and intercrystalline pores also present. Clay, calcite, dolomite, and patchy anhydrite are the main pore-filling constituents. Overall, the tidal flat facies has poor to good reservoir potential.

Lagoon Facies

The lagoon facies accounts for roughly 5% of the cored strata, with three individual units, ranging in thickness from 3 to 8 feet. The deposits consist of gray-green to dark gray-brown to tan, argillaceous siltstones to silty dolowackestones (Plate 1,C). The

lagoonal deposits are commonly argillaceous, dolomitic/calcitic, and pyritic, with occasional anhydrite nodules. Bioturbation is fairly common, with scattered ripple laminae also present. The lagoonal facies are consistently positioned atop shoal deposits with a fairly sharp contact. The lagoon facies typically coarsens up into the overlying tidal flat deposits.

Lagoons develop between barrier bars or shoals, and the coastal plain. Lagoons trap most of the mud brought in from the coastal plain and have limited current or wave energy.

Routine core analysis data (excluding artificially fractured samples) show porosity values in the lagoonal facies ranging from 3.91 to 12.64% (average of 8.55%) and permeability values ranging from 0.002 to 1.65 md (average of 0.152 md). The high percentage of clay matrix, combined with the carbonate and dolomite cement, yield low permeability values. Overall, these deposits are judged to have poor reservoir potential.

Shoal Facies

The carbonate shoal/shoal flank facies accounts for 59% of the cored strata. The deposits are composed of tan to gray-brown grainstones, packstones, and rare wackestones. There are three shoal units, ranging in thickness from 27 to 33 feet. The uppermost (or shallowest) shoal unit, between 2481.0 and 2514.3 feet (core depth), consists of dolostone; the other two units are limestones. The shoal units tend to "clean" upwards with wackestones and packstones near the base and packstones to grainstones in the middle and top. Most of the shoal deposits are massive, with occasional faint, low-angle cross-bedding. The three shoal units appear to be composed of smaller-scale "parasequences." The middle shoal (2605.7-2632.5 feet, core depth) provides a good example of this high-frequency stacking pattern.

The grainstones and packstones have a wide variety of carbonate allochems, including: echinoderms, forams, algal-coated grains, peloids, bryozoans, and pelecypods. Very fine-grained sand and silt are scattered throughout these limestones and dolostones. Anhydrite crystals and nodules are dispersed throughout this facies.

Features that indicate deposition in a high-energy shoal to shoal flank environment are: 1) the well-sorted, grain-rich texture, 2) the low percentage of lime mud matrix, and 3) the wide range of abraded skeletal debris (Plate 1,D).

Carbonate shoal deposits accumulate in shallow, typically normal marine, subtidal zones where wave, tide, or wind-driven currents break or dissipate against a shallow shelf edge, bank margin, or low gradient coast. High sedimentation rates can prograde the shoal in a seaward direction. Shoal deposits generally tend to parallel the shoreline. The interfingering of shoal, lagoon, and paleosol deposits suggest that the shoals were positioned fairly close to the strandline.

Routine core analysis for the shoal/shoal flank deposits (excluding fractured samples) reveal porosity values ranging from 9.05 to 28.65% (average of 16.08%) and permeability values ranging from 0.042 to 331.0 md (average of 39.6 md). The shoal facies generally show crossover of the neutron and density porosity logs. The shoal deposits have **the best reservoir potential in the cored interval**. Porosity and permeability are usually best developed in the middle of the individual shoal units.

A summary of porosity and permeability data for the three shoal units are provided in the following table.

Zone and Core Depth (ft)	Porosity Range (Average) (%)	Permeability Range (Average) (md)	Average Core Water Saturation (%)	Average Core Gas Saturation (%)	Grain Density (g/cc)	Number of Analyses
-1- 2481.0 to 2514.3	10.96-28.65 (20.64)	1.68-331.0 (100.2)	47.1	52.9	2.84	33

Zone and Core Depth (ft)	Porosity Range (Average) (%)	Permeability Range (Average) (md)	Average Core Water Saturation (%)	Average Core Gas Saturation (%)	Grain Density (g/cc)	Number of Analyses
-2- 2605.7 to 2632.5	9.05-18.55 (13.49)	0.042-51.3 (4.51)	52.4	47.6	2.72	26
-3- 2656.9 to 2686.3	9.91-17.31 (13.11)	0.059-5.05 (0.813)	57.3	42.7	2.72	28

Zone 1 is the best of the three shoal zones, having the highest average permeability, 100.2 md, and the highest average porosity, 20.64%. This 33-foot interval shows density log porosity values of 15 to 29% and neutron log porosity of 8 to 14%; correlative core porosities are between 10.96 and 28.65% (average of 20.64%). Based on analysis of core plugs, Zone 1 also has the highest average gas saturation, 52.9%, and the lowest average water saturation, 47.1%. Zone 1 has been extensively dolomitized, leaving moldic and intercrystalline porosity. The best porosity and permeability are developed in the basal "shoal flank" facies. Diagenetic porosity enhancement substantially improved the reservoir potential of these initially low porosity packstones.

Zone 2 is the second best reservoir zone, with an average porosity of 13.49% and an average permeability of 4.51 md. This 26.8-foot interval shows density log porosities of 10 to 22% and neutron log porosity values of 7 to 10%; correlative core porosity values are between 9.05 and 18.55% (average of 13.49%). Zone 2 has an average gas saturation of 47.6% and water saturation of 52.4%. Zone 2 "cleans upward" from skeletal wackestones and packstones at the base to skeletal grainstones at the top. Only the top 20 feet of Zone 2 are considered to have significant reservoir potential.

The porosity values in Zone 3 are similar to Zone 2; however, Zone 3 has a much lower average permeability value. The average porosity is 13.11%, but average permeability is only 0.813 md. This 29.4-foot interval shows density log porosity values

of 12 to 18% and neutron porosity values of 9 to 13%. These values are somewhat similar to core porosity values over the same interval, which range from 9.91 to 17.31% (average of 13.11%). As with the other shoal units, the best developed porosity and permeability occur within the middle part of the shoal. Shoal 3 has an average gas saturation of 42.7% and an average water saturation of 57.3%. Moldic pores that are fairly common in the upper two shoal zones are not well developed in Zone 3. In addition, primary pores are less common because "clean" grainstones are not as well represented in Zone 3 as in Zones 1 and 2. The lack of secondary porosity enhancement and the poorly interconnected, intergranular and intercrystalline pores are probably the reason that Zone 3 has the lowest permeability of the three shoal zones. Zone 3 also has the highest gamma-ray count of the three shoal zones, indicating a higher clay content.

Shallow Shelf Facies

The shallow shelf facies accounts for roughly 6% of the cored strata, with one 9.7-foot thick unit. The deposit consists of olive-gray to dark gray-green wackestone to argillaceous siltstone (Plate 1,E). The shallow shelf deposits are commonly bioturbated, fossiliferous, slightly silty, and slightly dolomitic. The deposits are very thin-bedded with occasional ripple to undulatory laminae. The shallow shelf facies can look very similar to the lagoonal facies, except that the shallow shelf deposits: 1) have lower clay content, 2) are more fossiliferous, and 3) have less pyrite. The shallow shelf facies has a gradational contact with the shoal facies.

Routine core analysis data show porosity values ranging from 8.35 to 13.45% (average of 10.91%) and permeability values ranging from 0.004 to 0.153 md. (average of 0.036 md.). The shallow shelf facies has the lowest average permeability of the five delineated depositional facies; **the shallow shelf facies has poor reservoir potential**.

DEPOSITIONAL MODEL

Figure 4 provides an idealized depositional model for the cored strata.

The paleosol/coastal plain facies record terrestrial deposition, above normal high tide. The tidal flat facies is the product of sedimentation in the intertidal to shallow subtidal environment. Tidal flat deposits parallel the strandline, thinning down depositional dip into subtidal marine sediments. The lagoon facies records low-energy, shallow subtidal sedimentation in a backshoal environment. The high clay content and low diversity faunal assemblage indicate somewhat restricted, quiet water conditions for the lagoon deposits. The carbonate shoal and shoal flank deposits formed in fairly clean, shallow waters that are agitated by persistent currents. These deposits probably formed as strike-elongate carbonate sand bars. The shallow shelf sediments were deposited seaward of the shoal, under low-energy, open marine conditions.

The repeated stacking of these five lithofacies reflects cyclic sea level fluctuations. The numerous progradational and retrogradational cycles also resulted in the "stacking" of potential reservoir facies. The shoal/shoal flank deposits that form the main reservoir targets are separated by low porosity, low permeability lagoon, shelf, and paleosol/ coastal plain deposits.

FIGURE 1

CORE TO LOG CORRELATION
ANADARKO PETROLEUM CORPORATION
YOUNGREN H-2H WELL
STEVENS COUNTY, KANSAS

CORE 1: LOG DEPTH = CORE DEPTH – 12 FEET
CORES 2 & 3: LOG DEPTH = CORE DEPTH – 15 FEET

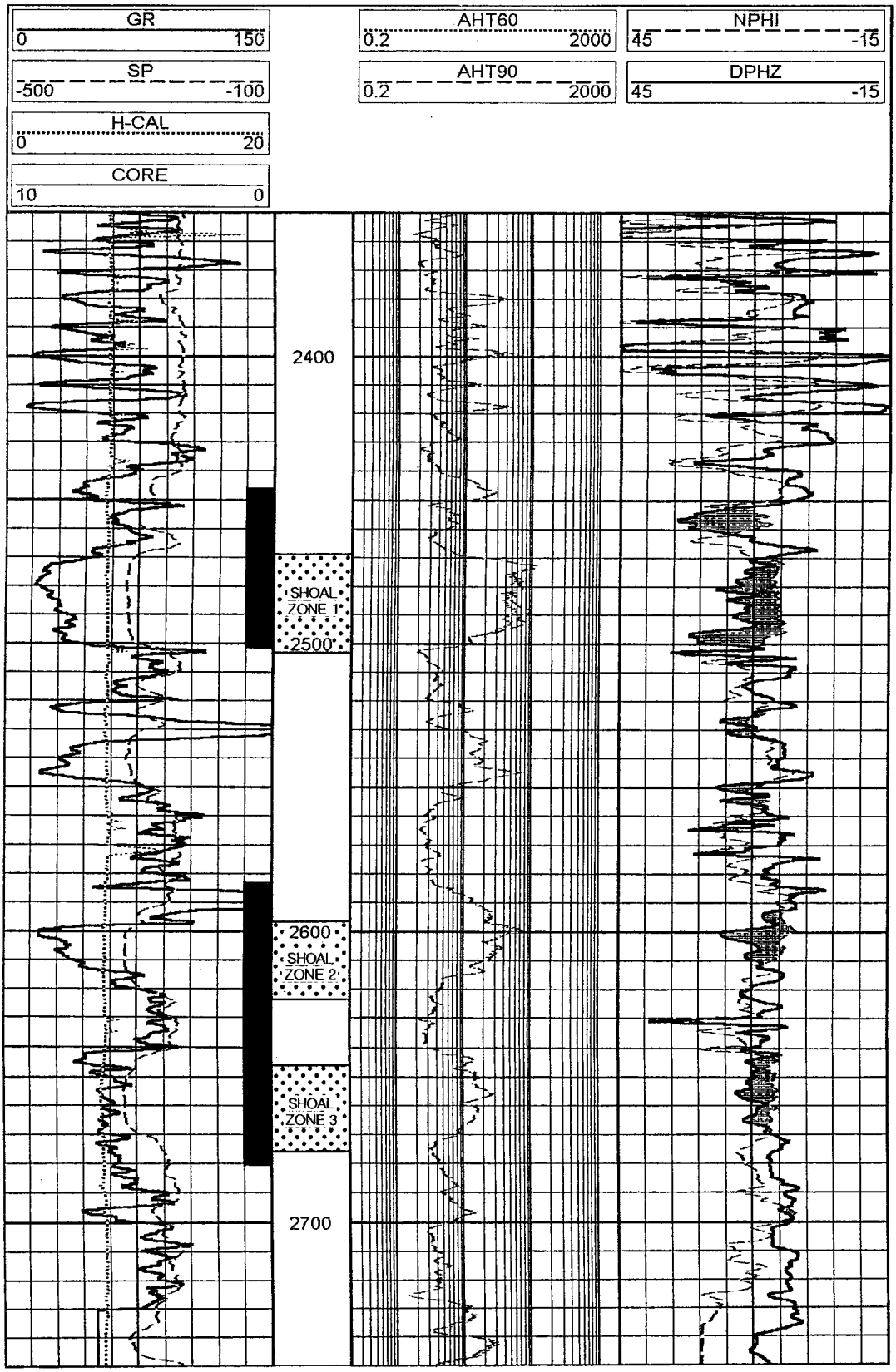


TABLE 1

CONVENTIONAL CORE ANALYSIS STATISTICS BY FACIES*

Anadarko Petroleum Corporation
Youngren H-2H Well
Stevens County, Kansas

		Porosity (% BV)	Permeability to gas (md)	Saturation (% PV) Water	Oil	Gas	Grain Density (g/cc)	No. of Samples
Facies 1	**Min:**	10.63	0.053	57.7	0.0	24.4	2.71	5
	Max:	13.87	11.5	75.6	0.0	42.3	2.76	
	Avg:	**12.97**	**3.20**	**65.2**	**0.0**	**34.8**	**2.73**	
	Std Dev:	1.34	4.94	7.2	0.0	7.2	0.02	
Facies 2	**Min:**	5.56	0.005	39.6	0.0	15.8	2.68	27
	Max:	26.24	84.1	84.2	0.0	60.4	2.85	
	Avg:	**13.95**	**11.9**	**62.9**	**0.0**	**37.1**	**2.73**	
	Std Dev:	5.32	25.4	9.7	0.0	9.7	0.05	
Facies 3	**Min:**	3.91	0.002	39.0	0.0	17.1	2.67	15
	Max:	12.64	1.65	82.9	0.0	61.0	2.84	
	Avg:	**8.55**	**0.152**	**60.6**	**0.0**	**39.4**	**2.75**	
	Std Dev:	3.26	0.421	13.0	0.0	13.0	0.06	
Facies 4	**Min:**	9.05	0.042	27.6	0.0	31.5	2.70	87
	Max:	28.65	331.	68.5	0.0	72.4	2.86	
	Avg:	**16.08**	**39.6**	**52.0**	**0.0**	**48.0**	**2.77**	
	Std Dev:	4.66	76.1	8.0	0.0	8.0	0.06	
Facies 5	**Min:**	8.35	0.004	53.5	0.0	18.9	2.68	9
	Max:	13.45	0.153	81.1	0.0	46.5	2.78	
	Avg:	**10.91**	**0.036**	**64.3**	**0.0**	**35.7**	**2.73**	
	Std Dev:	1.42	0.048	8.7	0.0	8.7	0.03	

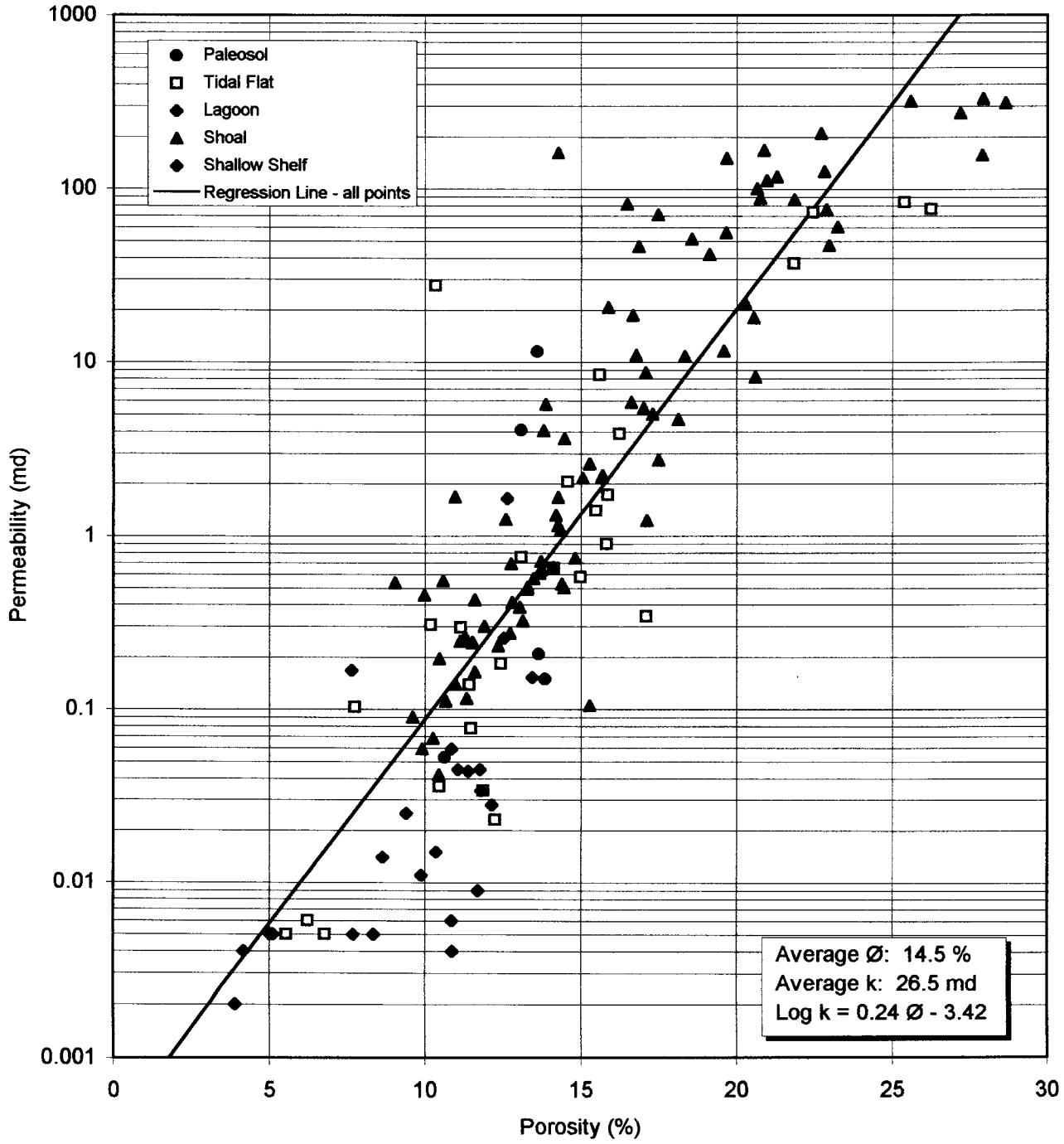
* Statistics exclude fractured or broken samples.

Facies Codes

1 - Paleosol
2 - Tidal Flat
3 - Lagoon
4 - Shoal (includes all subgroups)
5 - Shallow Shelf

FIGURE 2

POROSITY - PERMEABILITY CROSSPLOT
Anadarko Petroleum Corporation
Youngren H-2H Well
Stevens County, Kansas



Plot excludes fractured or broken samples.

TABLE 2

CONVENTIONAL CORE ANALYSIS STATISTICS OF SHOAL FACIES BY ZONE*

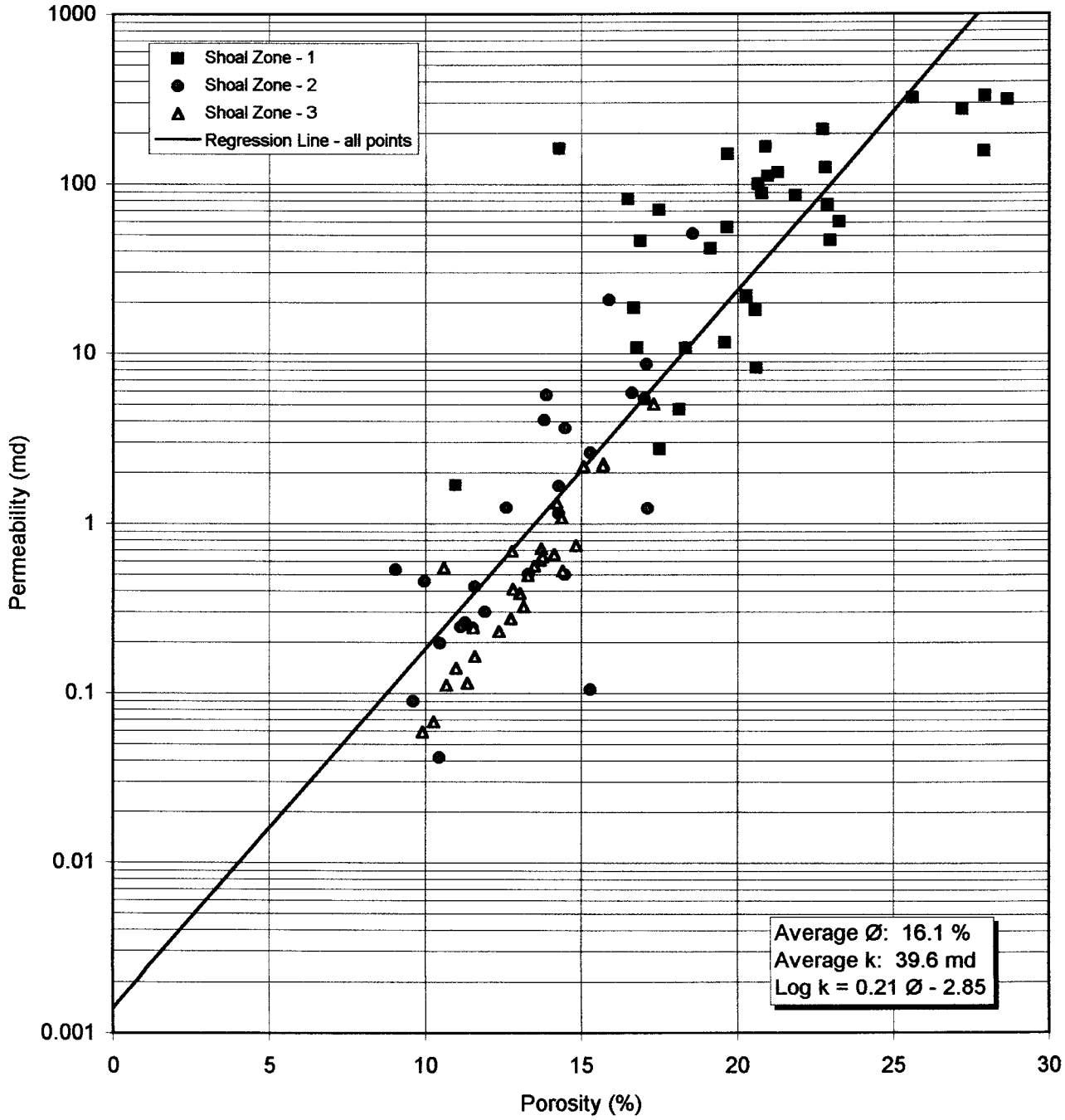
Anadarko Petroleum Corporation
Youngren H-2H Well
Stevens County, Kansas

Shoal		Porosity (% BV)	Permeability to gas (md)	Saturation (% PV) Water	Oil	Gas	Grain Density (g/cc)	No. of Samples
Zone 1	Min:	10.96	1.68	27.6	0.0	31.5	2.76	33
	Max:	28.65	331.0	68.5	0.0	72.4	2.86	
	Avg:	**20.64**	**100.2**	**47.1**	**0.0**	**52.9**	**2.84**	
	Std Dev:	3.95	96.8	8.6	0.0	8.6	0.02	
Zone 2	Min:	9.05	0.042	38.4	0.0	37.3	2.70	26
	Max:	18.55	51.3	62.7	0.0	61.6	2.79	
	Avg:	**13.49**	**4.51**	**52.4**	**0.0**	**47.6**	**2.72**	
	Std Dev:	2.66	10.5	6.9	0.0	6.9	0.03	
Zone 3	Min:	9.91	0.059	50.0	0.0	36.5	2.70	28
	Max:	17.31	5.05	63.5	0.0	50.0	2.77	
	Avg:	**13.11**	**0.813**	**57.3**	**0.0**	**42.7**	**2.72**	
	Std Dev:	1.81	1.04	3.5	0.0	3.5	0.02	

* Statistics exclude fractured or broken samples.

FIGURE 3

POROSITY - PERMEABILITY CROSSPLOT
SHOAL FACIES
Anadarko Petroleum Corporation
Youngren H-2H Well
Stevens County, Kansas



Plot excludes fractured or broken samples.

FIGURE 4

IDEALIZED DEPOSITIONAL MODEL

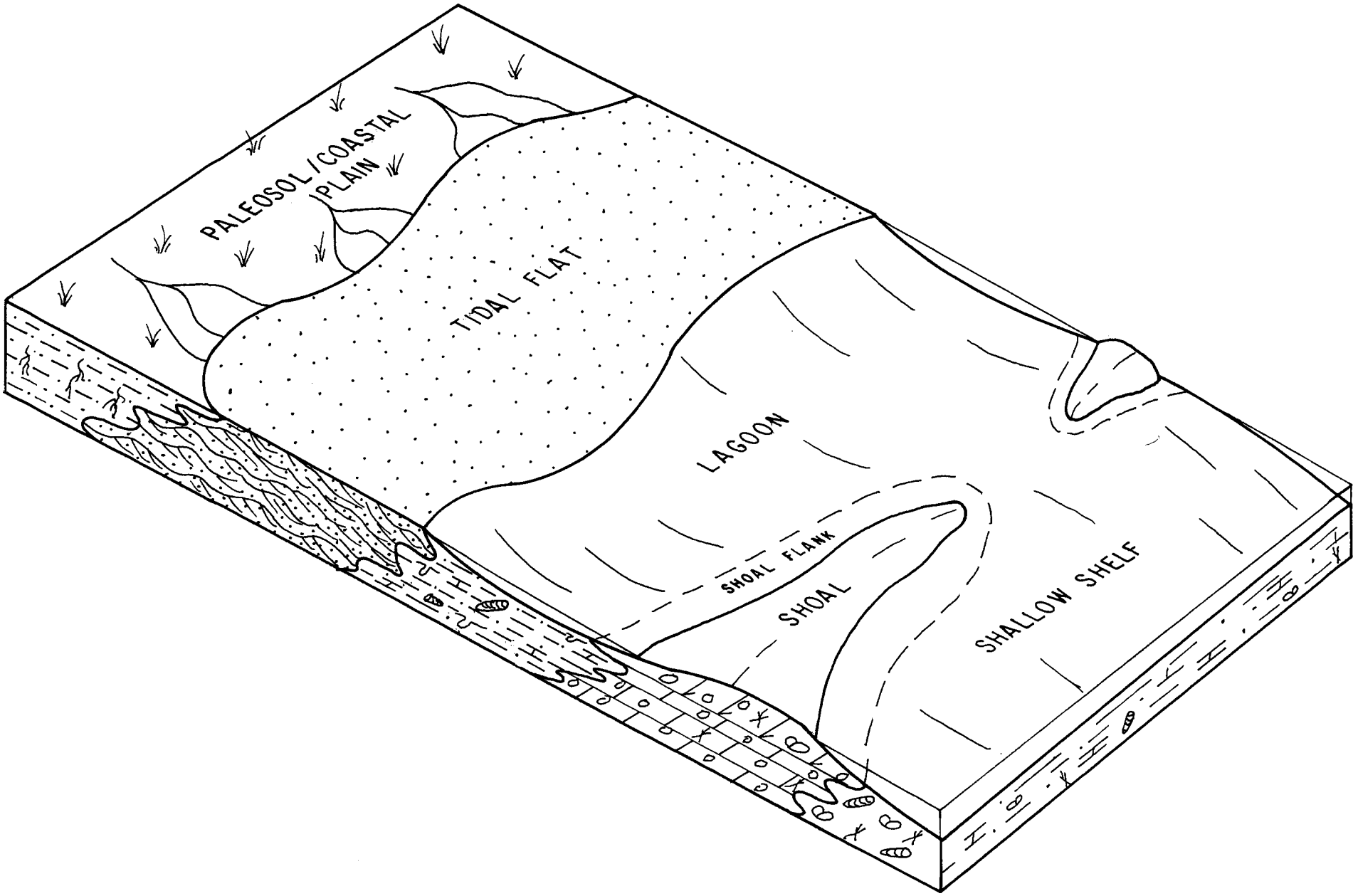


TABLE 3

CONVENTIONAL CORE ANALYSIS

Anadarko Petroleum Corporation
Youngren H-2H Well
Stevens County, Kansas

Depth (ft)	Porosity (% BV)	Permeability to gas (md)		Saturation (% PV) Water	Oil	Gas	Grain Density (g/cc)	Core	Facies	Shoal Zone
2458.6	5.56	0.005		39.6	0.0	60.4	2.85	1	2	
2459.3	7.76	0.103		46.2	0.0	53.8	2.85	1	2	
2460.4	6.80	0.005		70.5	0.0	29.5	2.80	1	2	
2461.6	15.61	8.41		55.7	0.0	44.3	2.81	1	2	
2462.8	13.09	0.757		61.3	0.0	38.7	2.80	1	2	
2463.7	15.49	1.40		67.6	0.0	32.4	2.70	1	2	
2464.3	11.15	0.297		70.0	0.0	30.0	2.73	1	2	
2465.4	10.19	0.306		66.9	0.0	33.1	2.74	1	2	
2467.9	25.39	84.1		70.1	0.0	29.9	2.68	1	2	
2468.7	26.24	76.5		63.0	0.0	37.0	2.68	1	2	
2469.4	22.45	73.7		69.5	0.0	30.5	2.70	1	2	
2470.6	21.84	37.3		64.7	0.0	35.3	2.68	1	2	
2471.4	16.24	3.89		71.3	0.0	28.7	2.74	1	2	
2472.8	24.90	23.4	[1]	72.3	0.0	27.7	2.67	1	2	
2473.5	12.24	0.023		84.2	0.0	15.8	2.74	1	2	
2474.2	11.80	0.034		81.1	0.0	18.9	2.76	1	3	
2475.3	11.71	0.009		82.9	0.0	17.1	2.82	1	3	
2477.9	9.40	0.025		71.7	0.0	28.3	2.81	1	3	
2478.3	7.66	0.168		76.0	0.0	24.0	2.81	1	3	
2479.4	11.07	0.045		64.9	0.0	35.1	2.82	1	3	
2480.7	12.55	0.257		44.8	0.0	55.2	2.84	1	3	
2481.3	17.49	2.76		44.2	0.0	55.8	2.85	1	4	1
2482.3	20.27	21.9		39.8	0.0	60.2	2.86	1	4	1
2483.4	10.96	1.68		44.9	0.0	55.1	2.84	1	4	1
2484.7	16.87	46.4		55.3	0.0	44.7	2.85	1	4	1
2485.4	17.47	70.9		57.3	0.0	42.7	2.85	1	4	1
2486.4	16.48	81.8		56.8	0.0	43.2	2.84	1	4	1
2487.5	20.76	88.6		56.1	0.0	43.9	2.84	1	4	1
2488.5	19.59	11.6		40.0	0.0	60.0	2.84	1	4	1
2489.4	23.88	275.	[1]	55.1	0.0	44.9	2.84	1	4	1
2490.5	19.67	151.		51.7	0.0	48.3	2.84	1	4	1
2491.4	20.88	167.		54.7	0.0	45.3	2.84	1	4	1
2492.3	22.88	76.3		51.3	0.0	48.7	2.84	1	4	1
2493.6	18.34	10.8		46.0	0.0	54.0	2.84	1	4	1
2494.6	16.77	10.9		40.4	0.0	59.6	2.83	1	4	1

TABLE 3 (CONTINUED)

CONVENTIONAL CORE ANALYSIS

Anadarko Petroleum Corporation
Youngren H-2H Well
Stevens County, Kansas

Depth (ft)	Porosity (% BV)	Permeability to gas (md)		Saturation (% PV) Water	Oil	Gas	Grain Density (g/cc)	Core	Facies	Shoal Zone
2495.5	18.12	4.70		30.4	0.0	69.6	2.84	1	4	1
2496.5	21.84	86.8		47.7	0.0	52.3	2.85	1	4	1
2497.3	20.65	101.		54.3	0.0	45.7	2.84	1	4	1
2498.3	19.65	55.8		41.8	0.0	58.2	2.84	1	4	1
2499.5	23.24	60.3		42.5	0.0	57.5	2.84	1	4	1
2500.4	22.81	126.		48.5	0.0	51.5	2.84	1	4	1
2501.4	22.71	210.		56.3	0.0	43.7	2.86	1	4	1
2502.6	21.29	118.		52.4	0.0	47.6	2.85	1	4	1
2503.4	19.12	41.8		49.0	0.0	51.0	2.84	1	4	1
2504.4	20.96	112.		51.5	0.0	48.5	2.84	1	4	1
2505.6	16.67	18.6		38.3	0.0	61.7	2.85	1	4	1
2506.4	22.96	47.1		27.6	0.0	72.4	2.84	1	4	1
2507.3	25.59	320.		49.4	0.0	50.6	2.85	1	4	1
2508.3	27.19	275.		45.7	0.0	54.3	2.86	1	4	1
2509.2	27.92	331.		49.8	0.0	50.2	2.85	1	4	1
2510.4	28.65	313.		68.5	0.0	31.5	2.85	1	4	1
2511.3	27.90	157.		48.7	0.0	51.3	2.84	1	4	1
2512.5	20.55	18.0		34.6	0.0	65.4	2.84	1	4	1
2513.6	20.60	8.22		34.2	0.0	65.8	2.82	1	4	1
2514.3	14.27	162.		46.0	0.0	54.0	2.76	1	4	1
2598.6	10.63	0.053		57.7	0.0	42.3	2.73	2	1	
2599.2	13.11	0.439	[1]	69.2	0.0	30.8	2.71	2	1	
2600.7	15.84	0.024	[1]	50.4	0.0	49.6	2.81	2	1	
2601.4	5.03	0.005		54.6	0.0	45.4	2.69	2	3	
2602.6	5.08	0.005		62.5	0.0	37.5	2.68	2	3	
2603.2	5.14	0.005		57.8	0.0	42.2	2.69	2	3	
2604.7	3.91	0.002		52.5	0.0	47.5	2.71	2	3	
2605.4	7.71	0.005		46.3	0.0	53.7	2.67	2	3	
2606.4	4.18	0.004		39.0	0.0	61.0	2.72	2	3	
2607.3	9.61	0.090		38.4	0.0	61.6	2.70	2	4	2
2608.2	11.59	0.426		49.0	0.0	51.0	2.70	2	4	2
2609.5	11.91	0.301		42.8	0.0	57.2	2.70	2	4	2
2610.4	11.52	0.242		41.9	0.0	58.1	2.70	2	4	2
2611.4	10.46	0.196		47.5	0.0	52.5	2.70	2	4	2
2612.6	9.05	0.536		51.9	0.0	48.1	2.70	2	4	2

TABLE 3 (CONTINUED)

CONVENTIONAL CORE ANALYSIS

Anadarko Petroleum Corporation
Youngren H-2H Well
Stevens County, Kansas

Depth (ft)	Porosity (% BV)	Permeability to gas (md)		Saturation (% PV) Water	Oil	Gas	Grain Density (g/cc)	Core	Facies	Shoal Zone
2613.3	9.98	0.456		55.3	0.0	44.7	2.70	2	4	2
2614.3	15.89	20.7		58.1	0.0	41.9	2.70	2	4	2
2615.5	18.55	51.3		52.6	0.0	47.4	2.71	2	4	2
2616.5	17.09	8.69		58.9	0.0	41.1	2.71	2	4	2
2617.6	17.01	5.44		61.5	0.0	38.5	2.70	2	4	2
2618.5	14.28	1.67		58.3	0.0	41.7	2.70	2	4	2
2619.6	14.27	1.15		55.3	0.0	44.7	2.70	2	4	2
2620.4	13.88	5.72		58.5	0.0	41.5	2.74	2	4	2
2621.5	13.81	4.06		62.7	0.0	37.3	2.72	2	4	2
2622.5	14.48	3.64		58.0	0.0	42.0	2.74	2	4	2
2623.4	16.63	5.88		61.3	0.0	38.7	2.73	2	4	2
2624.4	15.28	2.63		59.2	0.0	40.8	2.73	2	4	2
2625.4	12.60	1.24		58.4	0.0	41.6	2.71	2	4	2
2626.4	17.12	1.23		45.7	0.0	54.3	2.77	2	4	2
2627.6	11.28	0.261		47.2	0.0	52.8	2.73	2	4	2
2628.6	11.13	0.246		52.3	0.0	47.7	2.73	2	4	2
2629.3	14.46	0.502		44.1	0.0	55.9	2.76	2	4	2
2630.6	13.29	0.505		46.9	0.0	53.1	2.79	2	4	2
2631.6	15.28	0.105		47.2	0.0	52.8	2.78	2	4	2
2632.3	10.44	0.042		48.9	0.0	51.1	2.75	2	4	2
2633.3	15.83	0.897		51.8	0.0	48.2	2.73	2	2	
2635.4	14.99	0.578		59.8	0.0	40.2	2.72	2	2	
2635.4	15.86	1.73		58.5	0.0	41.5	2.70	2	2	
2636.3	14.13	0.651		65.2	0.0	34.8	2.72	2	2	
2637.8	14.57	2.07		69.3	0.0	30.7	2.69	2	2	
2639.3	11.86	0.034		65.7	0.0	34.3	2.70	2	2	
2639.3	10.46	0.036		63.8	0.0	36.2	2.70	2	2	
2640.6	9.47	6.06	[1]	59.1	0.0	40.9	2.72	2	2	
2641.4	6.25	0.006		56.6	0.0	43.4	2.72	2	2	
2642.6	11.43	0.139		55.6	0.0	44.4	2.71	2	2	
2643.6	12.44	0.184		51.1	0.0	48.9	2.70	2	2	
2644.6	11.47	0.078		67.0	0.0	33.0	2.70	2	2	
2645.5	17.09	0.343		55.1	0.0	44.9	2.68	2	2	
2646.7	10.34	27.6		79.5	0.0	20.5	2.73	3	2	
2647.3	13.28	42.8	[1]	69.5	0.0	30.5	2.72	3	5	

TABLE 3 (CONTINUED)

CONVENTIONAL CORE ANALYSIS

Anadarko Petroleum Corporation
Youngren H-2H Well
Stevens County, Kansas

Depth (ft)	Porosity (% BV)	Permeability to gas (md)		Saturation (% PV) Water	Oil	Gas	Grain Density (g/cc)	Core	Facies	Shoal Zone
2648.7	13.34	0.860	[1]	60.9	0.0	39.1	2.72	3	5	
2649.8	13.08	4.07		66.0	0.0	34.0	2.72	3	1	
2650.6	13.60	11.5		75.6	0.0	24.4	2.76	3	1	
2651.7	13.87	0.150		59.3	0.0	40.7	2.72	3	1	
2652.2	13.65	0.209		67.4	0.0	32.6	2.71	3	1	
2653.9	14.45		[2]	76.2	0.0	23.8	2.69	3	2	
2655.7	8.65	0.014		57.4	0.0	42.6	2.72	3	3	
2656.3	11.76	0.045		60.3	0.0	39.7	2.76	3	3	
2657.6	12.64	1.65		57.6	0.0	42.4	2.73	3	3	
2658.4	12.77	0.689		59.0	0.0	41.0	2.72	3	4	3
2659.7	14.20	1.32		59.0	0.0	41.0	2.70	3	4	3
2660.5	11.54	0.243		58.2	0.0	41.8	2.74	3	4	3
2661.6	11.34	0.115		58.9	0.0	41.1	2.72	3	4	3
2662.5	14.36	1.08		54.2	0.0	45.8	2.70	3	4	3
2663.7	10.59	0.550		59.7	0.0	40.3	2.72	3	4	3
2664.6	13.71	0.714		54.3	0.0	45.7	2.70	3	4	3
2665.6	14.81	0.745		53.5	0.0	46.5	2.71	3	4	3
2666.7	14.39	0.526		55.3	0.0	44.7	2.71	3	4	3
2667.6	13.68	0.609		56.1	0.0	43.9	2.77	3	4	3
2668.5	15.69	2.25		61.8	0.0	38.2	2.72	3	4	3
2669.5	17.31	5.05		60.0	0.0	40.0	2.73	3	4	3
2670.5	15.68	2.19		63.5	0.0	36.5	2.72	3	4	3
2671.5	15.06	2.17		59.5	0.0	40.5	2.72	3	4	3
2672.3	13.27	0.493		56.2	0.0	43.8	2.72	3	4	3
2673.4	12.73	0.274		50.0	0.0	50.0	2.71	3	4	3
2674.5	12.35	0.231		52.5	0.0	47.5	2.75	3	4	3
2675.4	14.12	0.659		51.4	0.0	48.6	2.70	3	4	3
2676.5	13.03	0.387		59.6	0.0	40.4	2.70	3	4	3
2677.4	13.48	0.564		53.5	0.0	46.5	2.71	3	4	3
2678.3	13.14	0.323		58.4	0.0	41.6	2.72	3	4	3
2679.5	12.79	0.411		61.2	0.0	38.8	2.71	3	4	3
2680.3	13.75	0.639		57.9	0.0	42.1	2.71	3	4	3
2681.3	10.67	0.111		56.4	0.0	43.6	2.71	3	4	3
2682.2	10.98	0.140		53.1	0.0	46.9	2.70	3	4	3
2683.5	11.59	0.164		56.8	0.0	43.2	2.72	3	4	3

TABLE 3 (CONTINUED)

CONVENTIONAL CORE ANALYSIS

Anadarko Petroleum Corporation
Youngren H-2H Well
Stevens County, Kansas

Depth (ft)	Porosity (% BV)	Permeability to gas (md)		Saturation (% PV) Water	Oil	Gas	Grain Density (g/cc)	Core	Facies	Shoal Zone
2684.4	9.91	0.059		61.0	0.0	39.0	2.71	3	4	3
2685.4	10.26	0.068		62.2	0.0	37.8	2.73	3	4	3
2686.6	12.14	0.028		69.3	0.0	30.7	2.76	3	5	
2687.5	10.35	0.015		69.8	0.0	30.2	2.78	3	5	
2688.6	10.86	0.006		67.3	0.0	32.7	2.76	3	5	
2689.4	10.07	0.012	[1]	65.4	0.0	34.6	2.77	3	5	
2690.3	11.40	0.044		60.8	0.0	39.2	2.77	3	5	
2691.5	13.45	0.153		81.1	0.0	18.9	2.73	3	5	
2692.6	10.87	0.004		62.1	0.0	37.9	2.72	3	5	
2693.5	9.88	0.011		53.8	0.0	46.2	2.72	3	5	
2694.7	10.85	0.059		60.7	0.0	39.3	2.68	3	5	
2695.8	8.35	0.005		53.5	0.0	46.5	2.70	3	5	
Minimum:	3.91	0.002		27.6	0.0	15.8	2.67			
Maximum:	28.65	331.		84.2	0.0	72.4	2.86			
Average:	14.51	27.4		56.7	0.0	43.3	2.75			

[1] - Sample contains fracture(s), permeability to gas may be anomalously high.
[2] - Broken / non-cylindrical sample, permeability to gas indeterminable.

Facies Codes

1 - Paleosol
2 - Tidal Flat
3 - Lagoon
4 - Shoal (w/ zones 1, 2, 3)
5 - Shallow Shelf

PLATE 1

CLOSE CORE PHOTOGRAPHS

ANADARKO PETROLEUM CORPORATION YOUNGREN H-2H WELL

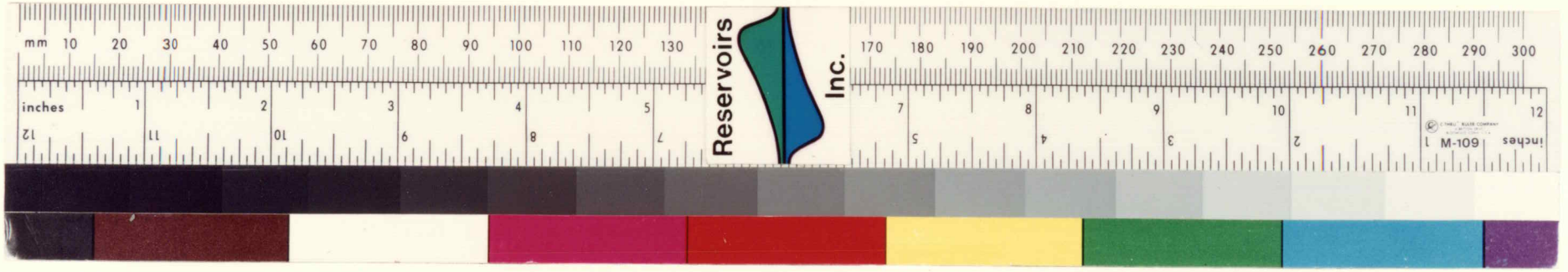
A. Depth: 2648 Feet Depositional Facies: Paleosol/Coastal Plain

The oxidized, red-brown color, anhydrite nodules and root mottling are typical of the paleosol/coastal plain facies. Routine core analysis measurements in these deposits indicate low permeability and variable porosity. In general, the paleosol/coastal plain facies have poor reservoir potential.

B. Depth: 2472 Feet Depositional Facies: Tidal Flat

Ripple cross-stratification and alternating laminae of fine-grained sandstone and very argillaceous siltstone are typical of the tidal flat facies. These sandy, ripple-laminated strata were probably deposited in high-energy, upper intertidal regime. Where burrowing is more extensive and clay content is higher, a lower energy, lower intertidal setting is suggested.


B


Reservoirs
Inc.
inches
M-109


A
2648

PLATE 1 (CONTINUED)

CLOSE CORE PHOTOGRAPHS

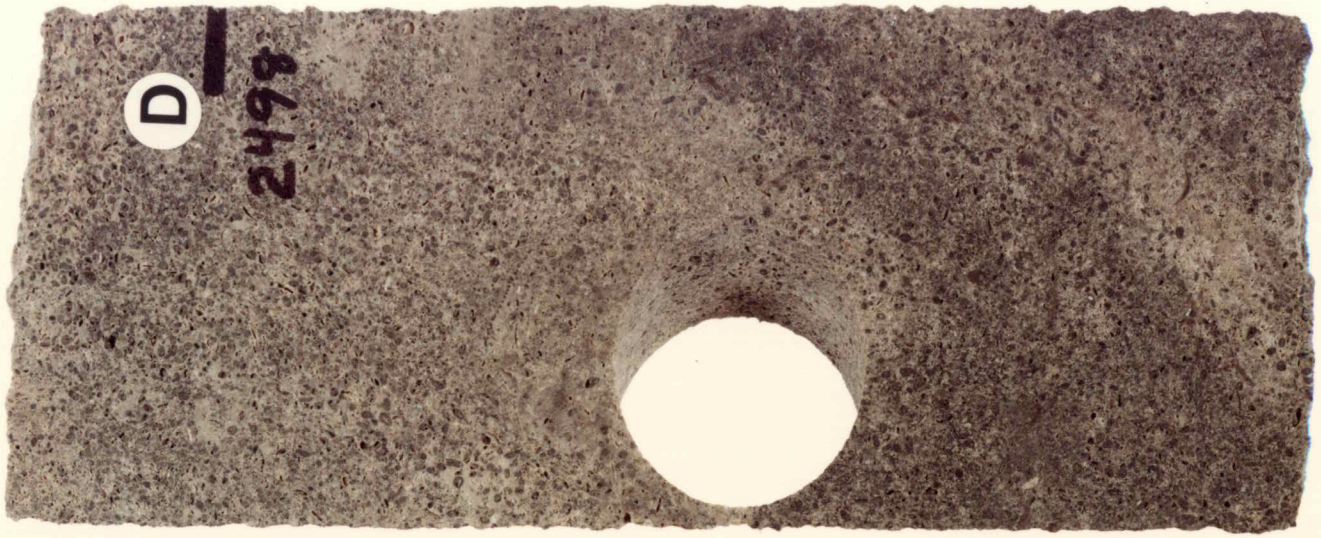
ANADARKO PETROLEUM CORPORATION YOUNGREN H-2H WELL

C. Depth: 2475 Feet Depositional Facies: Lagoon

This brown, argillaceous siltstone to very fine-grained sandstone is bioturbated and contains scattered anhydrite nodules. These argillaceous deposits are typical of quiet water subtidal deposition, between the shoal and tidal flat environments. Porosity in this sample is 11.71%, while permeability is only 0.009 md.

D. Depth: 2498 Feet Depositional Facies: Shoal

This dolomitized grainstone has well developed moldic and intercrystalline pores. These various pore types combine to form an effective pore network, yielding rather high porosity and permeability. Routine core analysis measurements indicate this sample has a porosity of 19.65% and a permeability of 55.8 md.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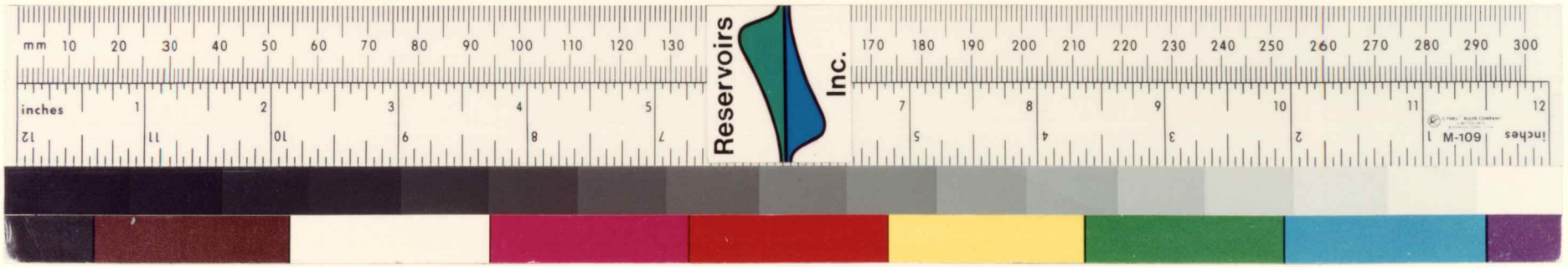
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Reservoirs Inc.
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5 4 3 2 1
M-109
inches

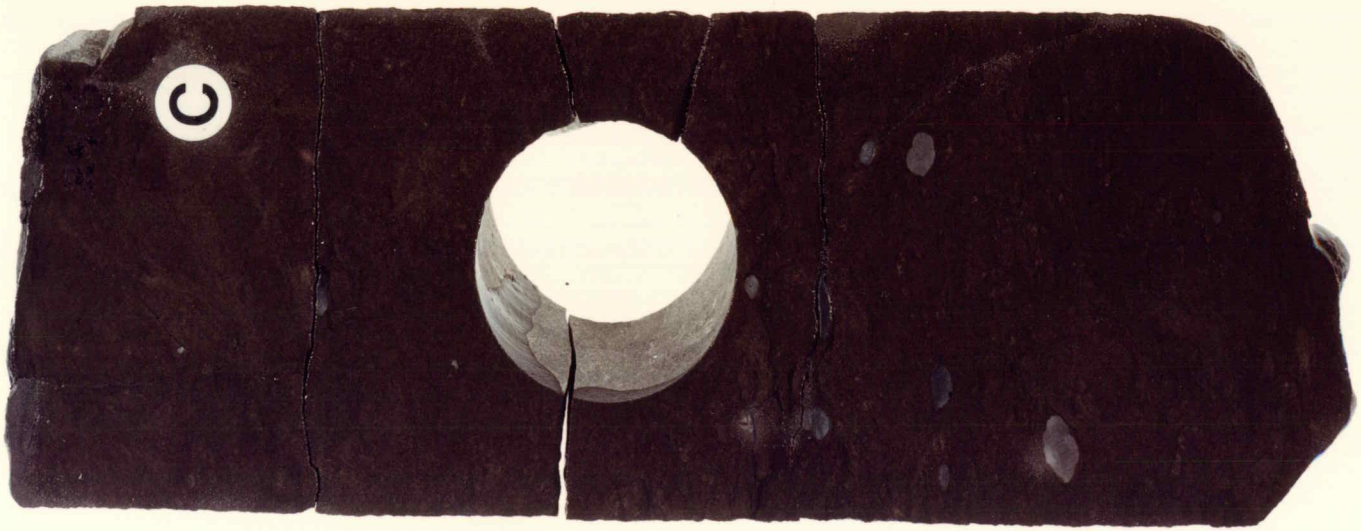

C

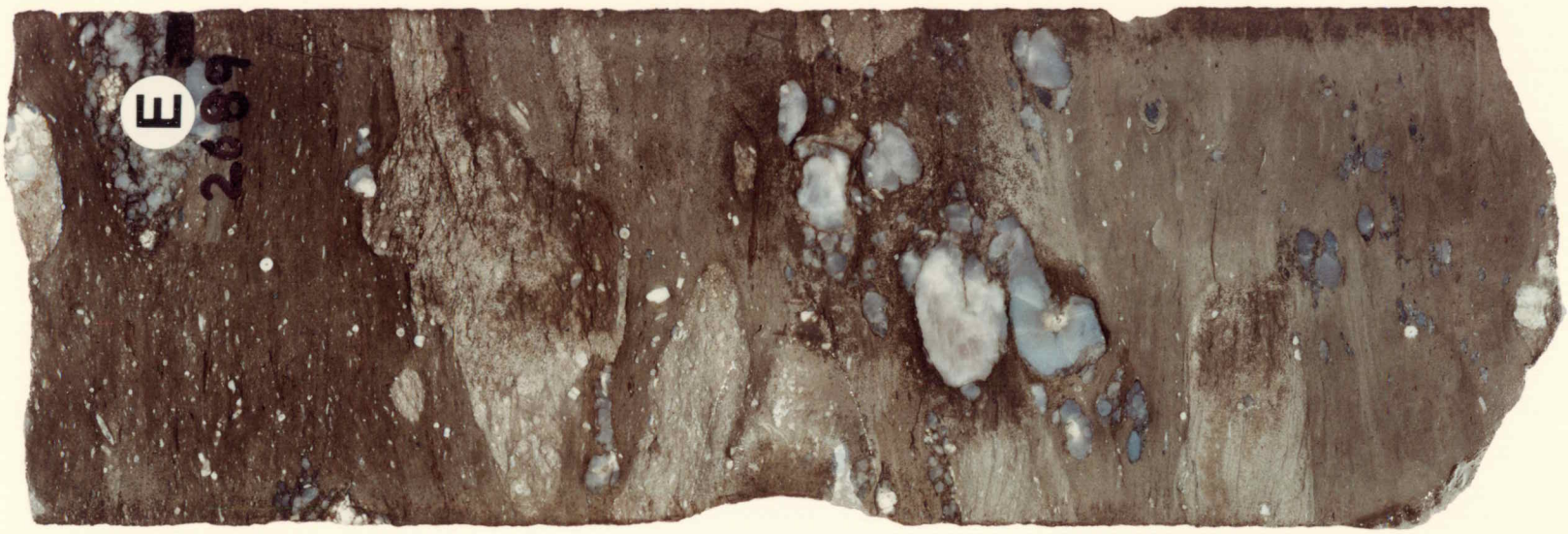
PLATE 1 (CONTINUED)

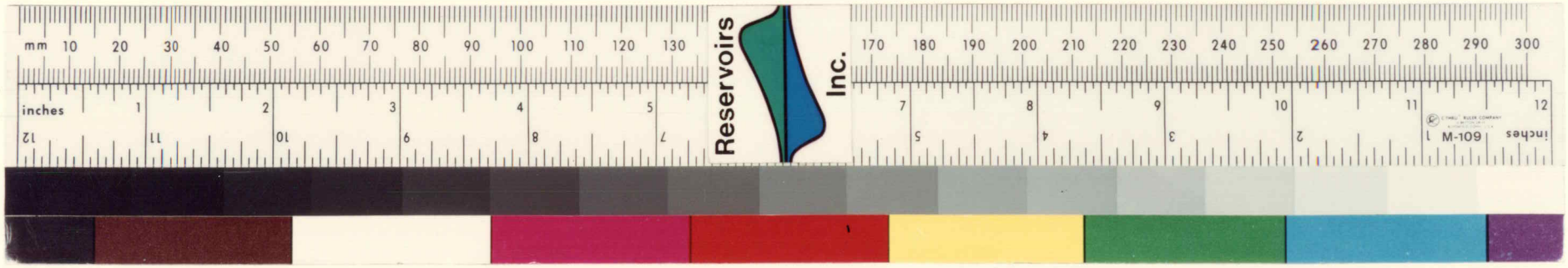
CLOSE CORE PHOTOGRAPHS

ANADARKO PETROLEUM CORPORATION YOUNGREN H-2H WELL

E. Depth: 2689 Feet Depositional Facies: Shallow Shelf

This argillaceous, slightly fossiliferous wackestone is typical of the shallow shelf facies. Bioturbation, crinoid osicals, complete bivalves, and undulatory laminae indicate fairly quiet, normal marine deposition. Light gray anhydrite nodules are probably authigenic. Routine core analysis measurements indicate that this facies has poor reservoir potential.


E
2189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M-109
Reservoirs Inc.

PLATES 2-12

CONTINUOUS CORE PHOTOGRAPHS

ANADARKO PETROLEUM CORPORATION

YOUNGREN H-2H WELL

PLATES 2-12

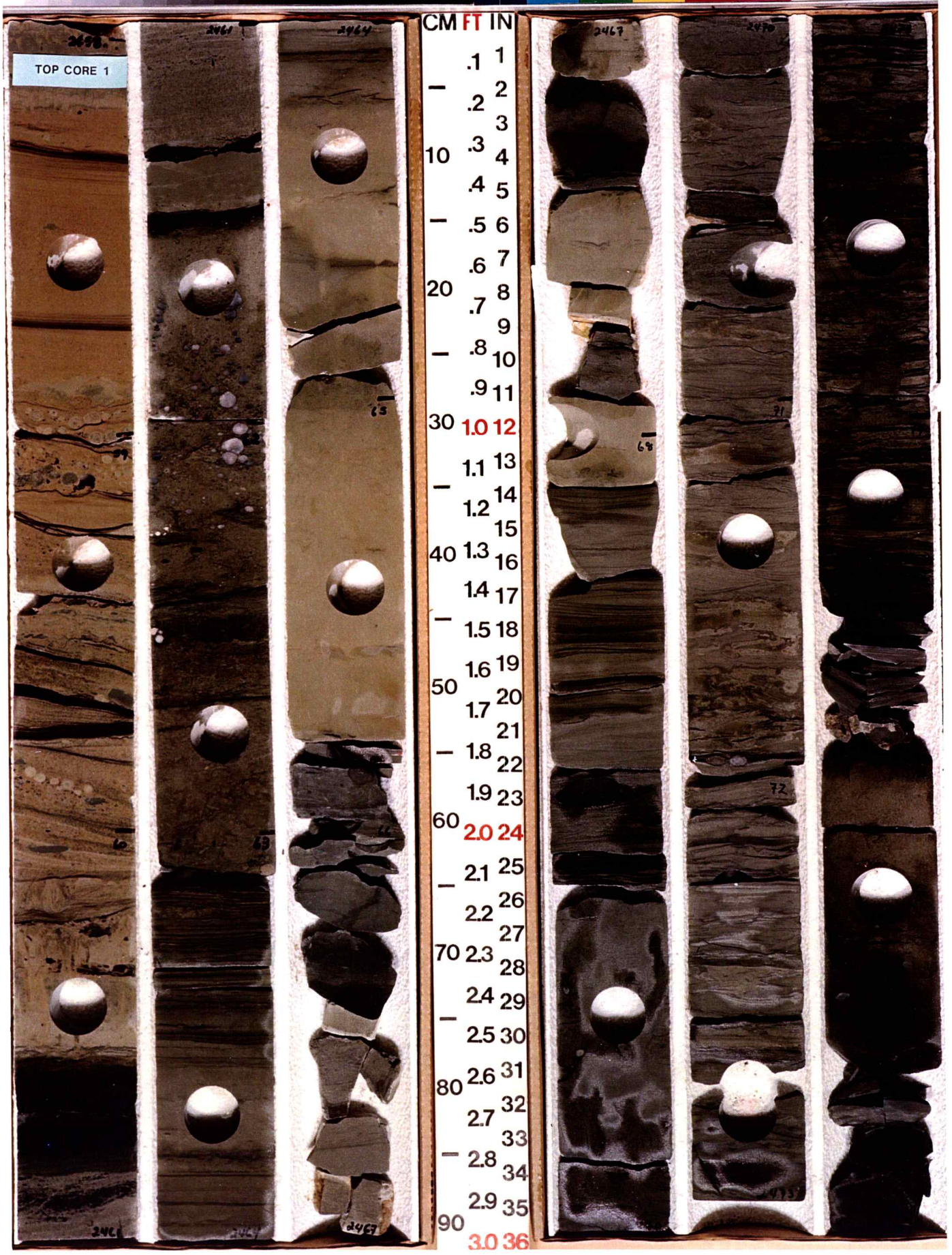
CONTINUOUS CORE PHOTOGRAPHS

ANADARKO PETROLEUM CORPORATION

YOUNGREN H-2H WELL

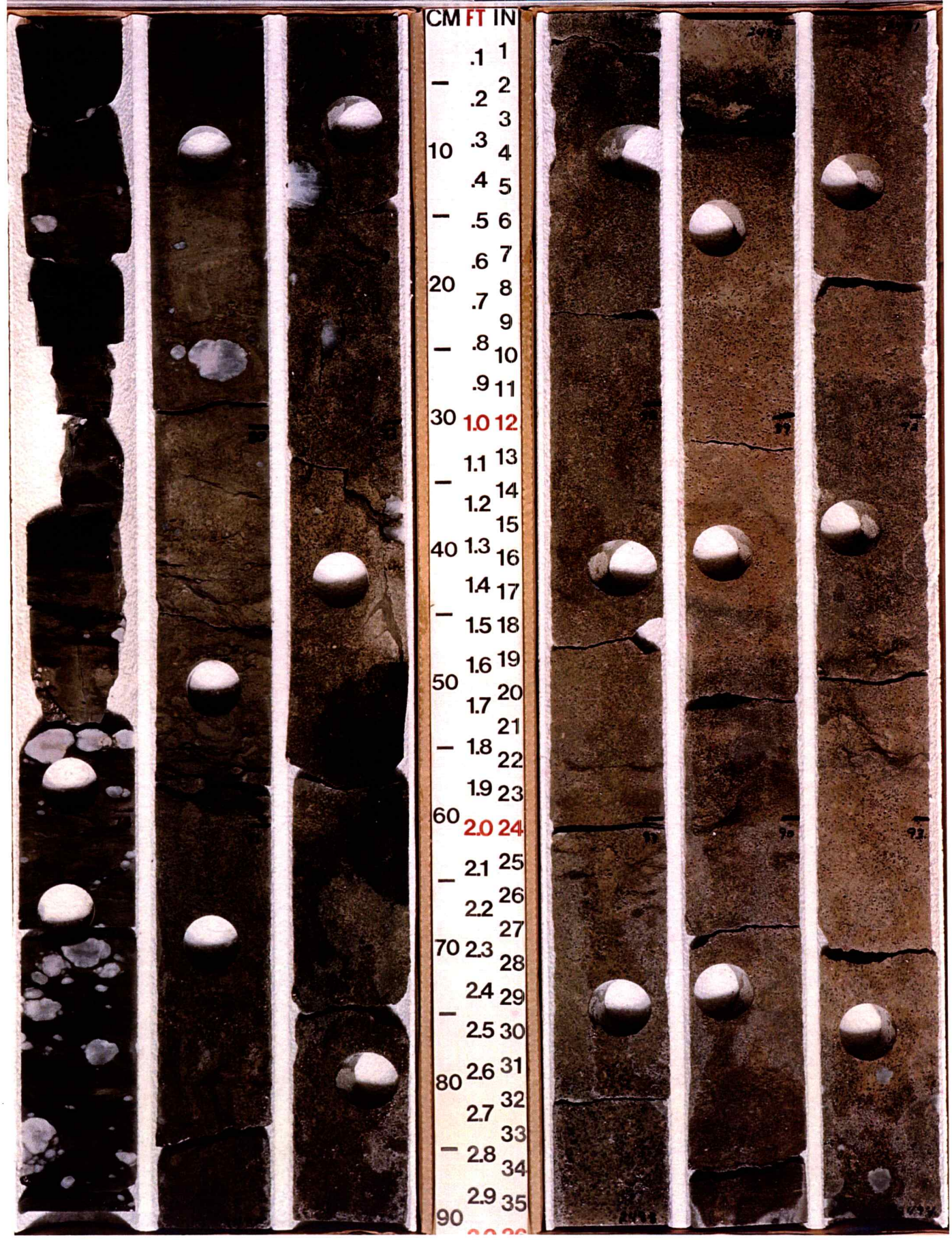
ANADARKO PETROLEUM CORPORATION
YOUNGREN H-2H
STEVENS COUNTY, KANSAS
2458.0 - 2476.0

RESERVOIRS INC.



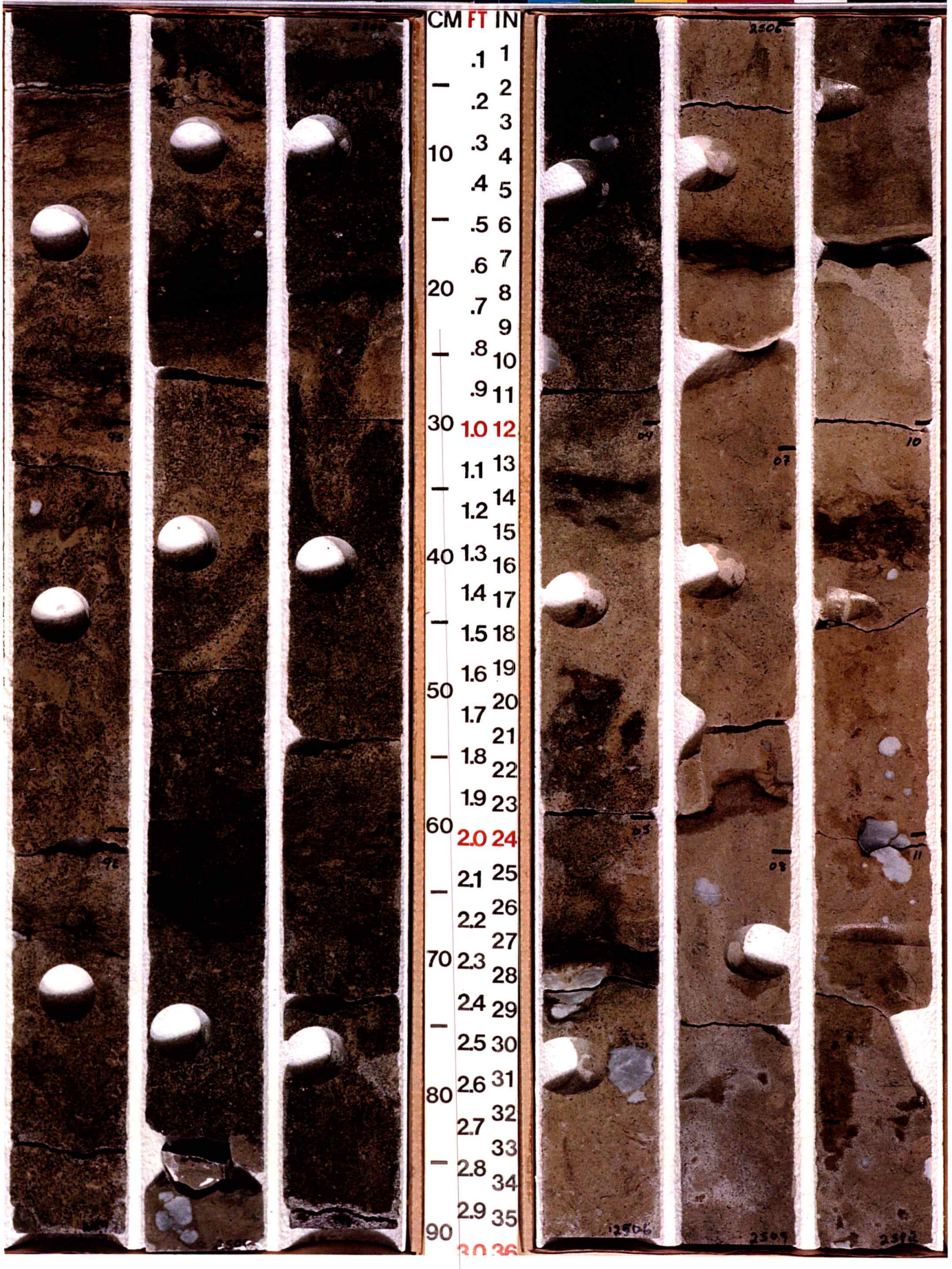
ANADARKO PETROLEUM CORPORATION
YOUNGREN H-2H
STEVENS COUNTY, KANSAS
2476.0 - 2494.0

RESERVOIRS INC.



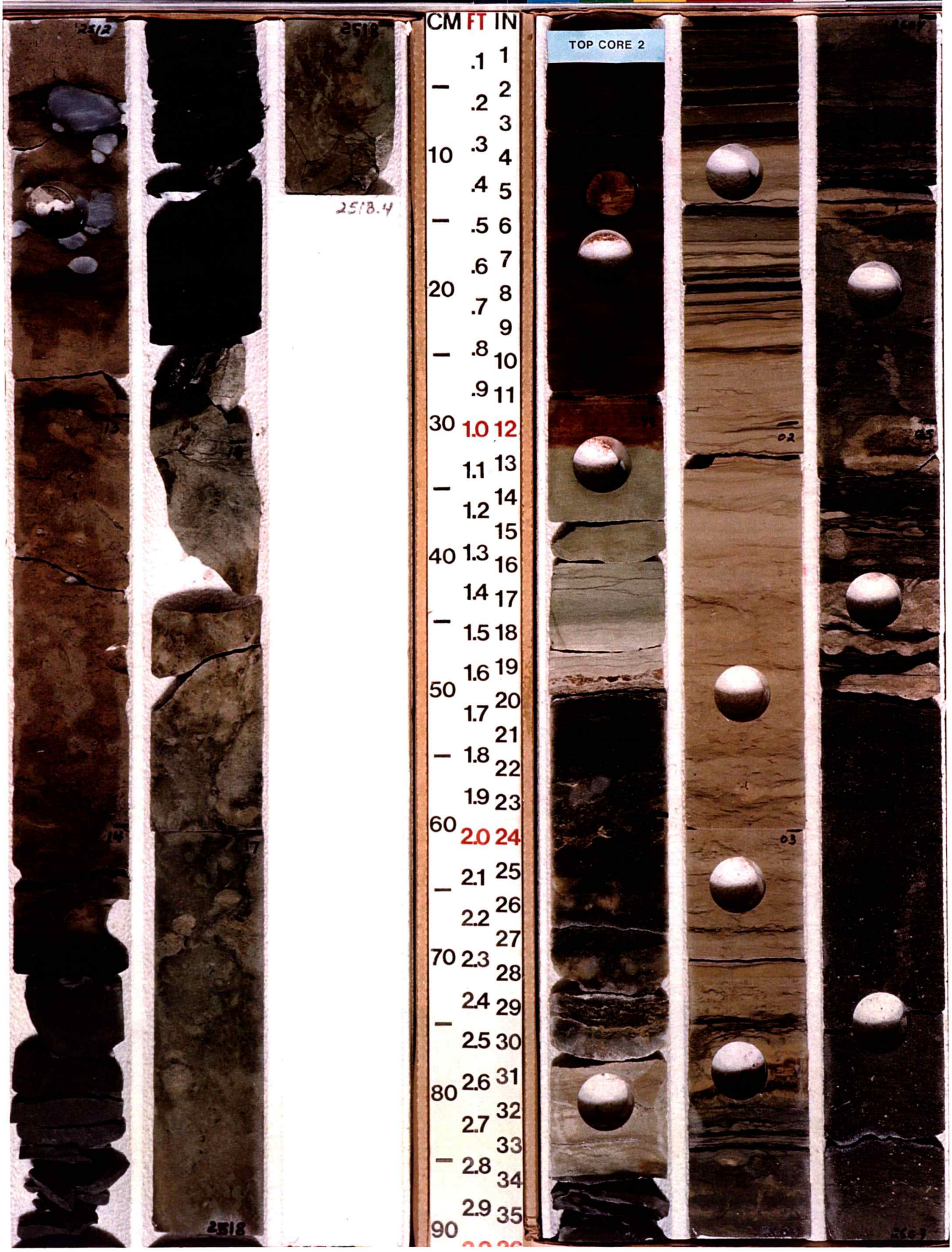
ANADARKO PETROLEUM CORPORATION
YOUNGREN H-2H
STEVENS COUNTY, KANSAS
2494.0 - 2512.0

RESERVOIRS INC.



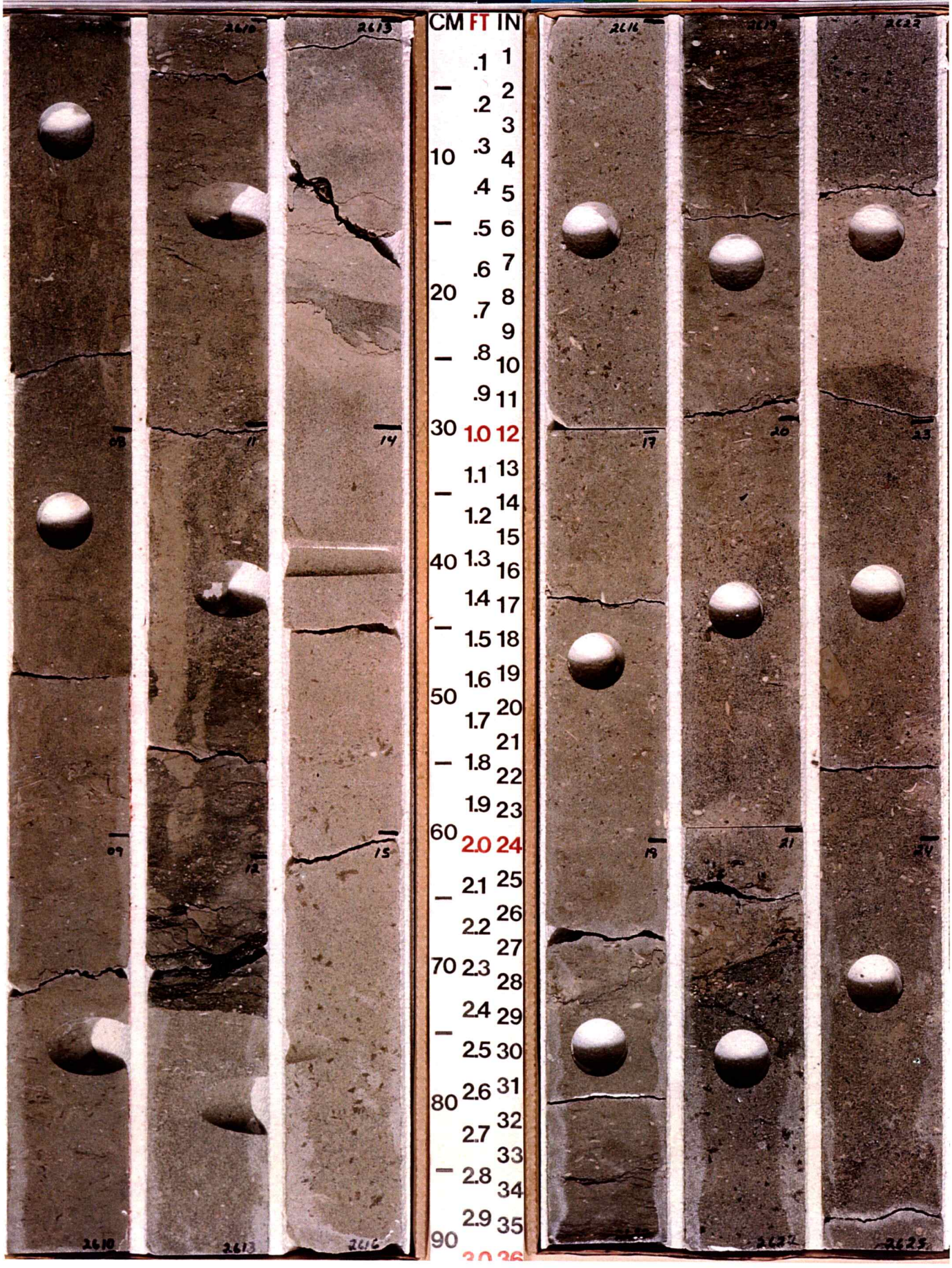
ANADARKO PETROLEUM CORPORATION
YOUNGREN H-2H
STEVENS COUNTY, KANSAS
2512.0 - 2607.0

Reservoirs Inc.

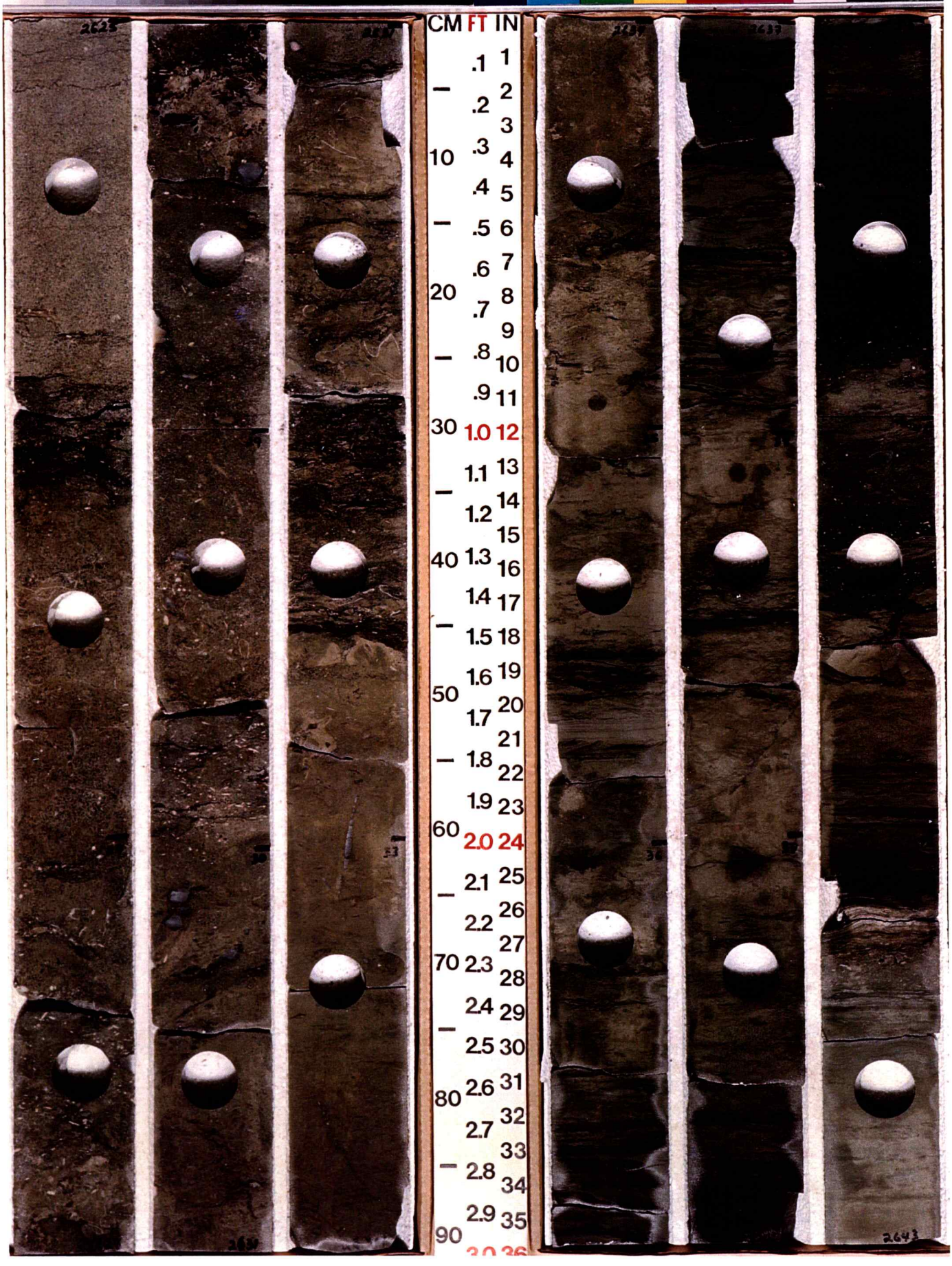


ANADARKO PETROLEUM CORPORATION
YOUNGREN H-2H
STEVENS COUNTY, KANSAS
2607.0 - 2625.0

RESERVOIRS INC.

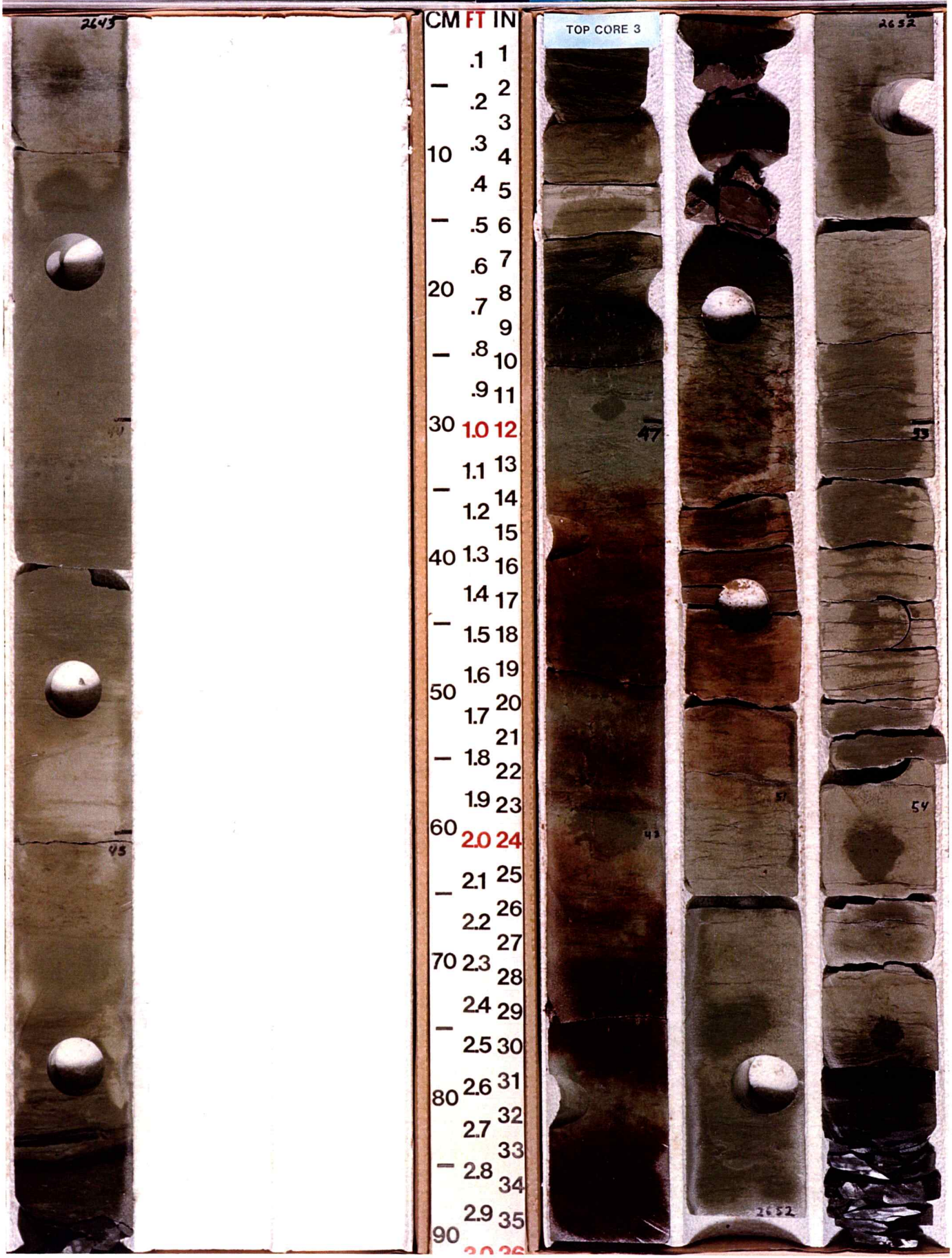


ANADARKO PETROLEUM CORPORATION
YOUNGREN H-2H
STEVENS COUNTY, KANSAS
2625.0 - 2643.0

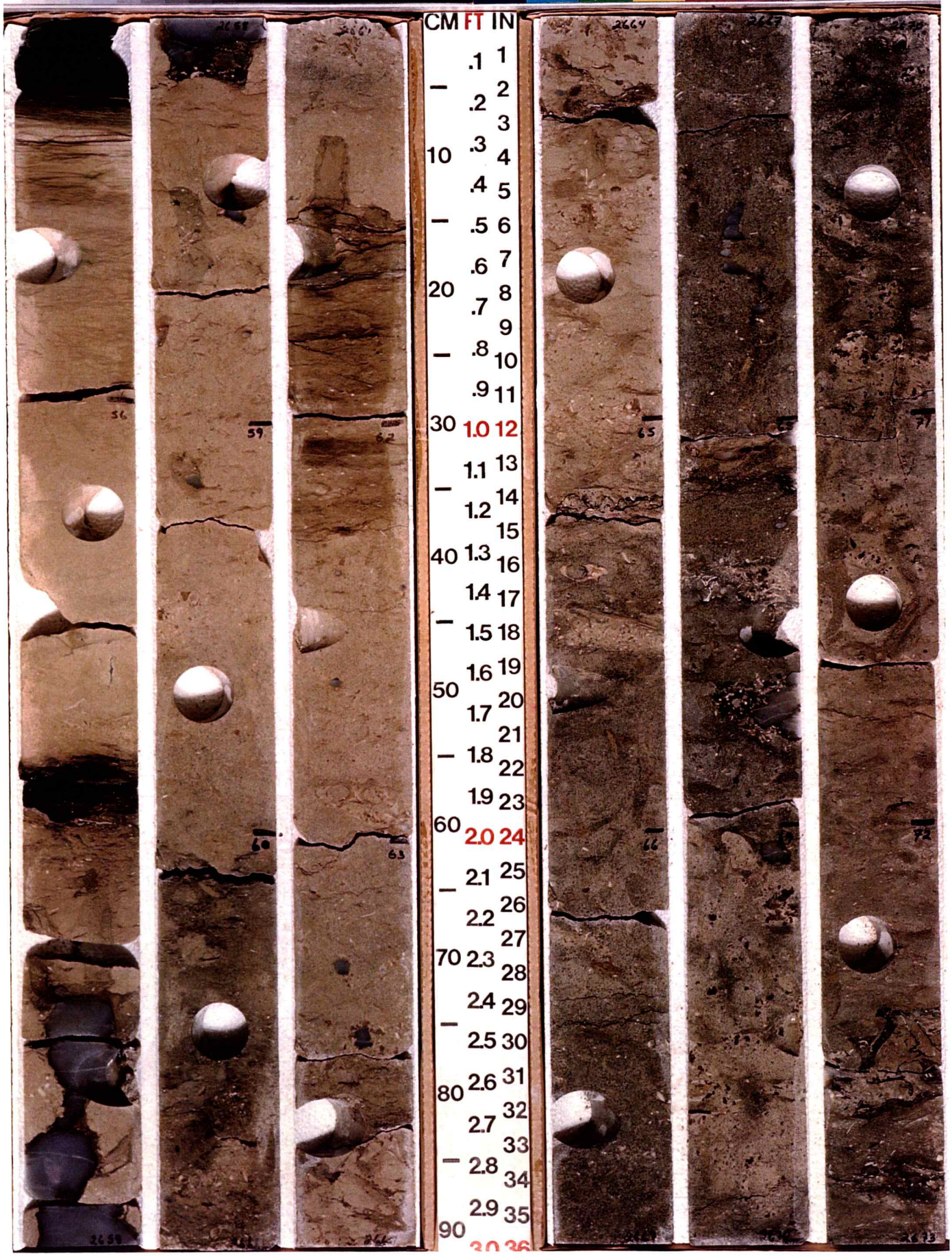


ANADARKO PETROLEUM CORPORATION
YOUNGREN H-2H
STEVENS COUNTY, KANSAS
2643.0 - 2655.0

Reservoirs Inc.

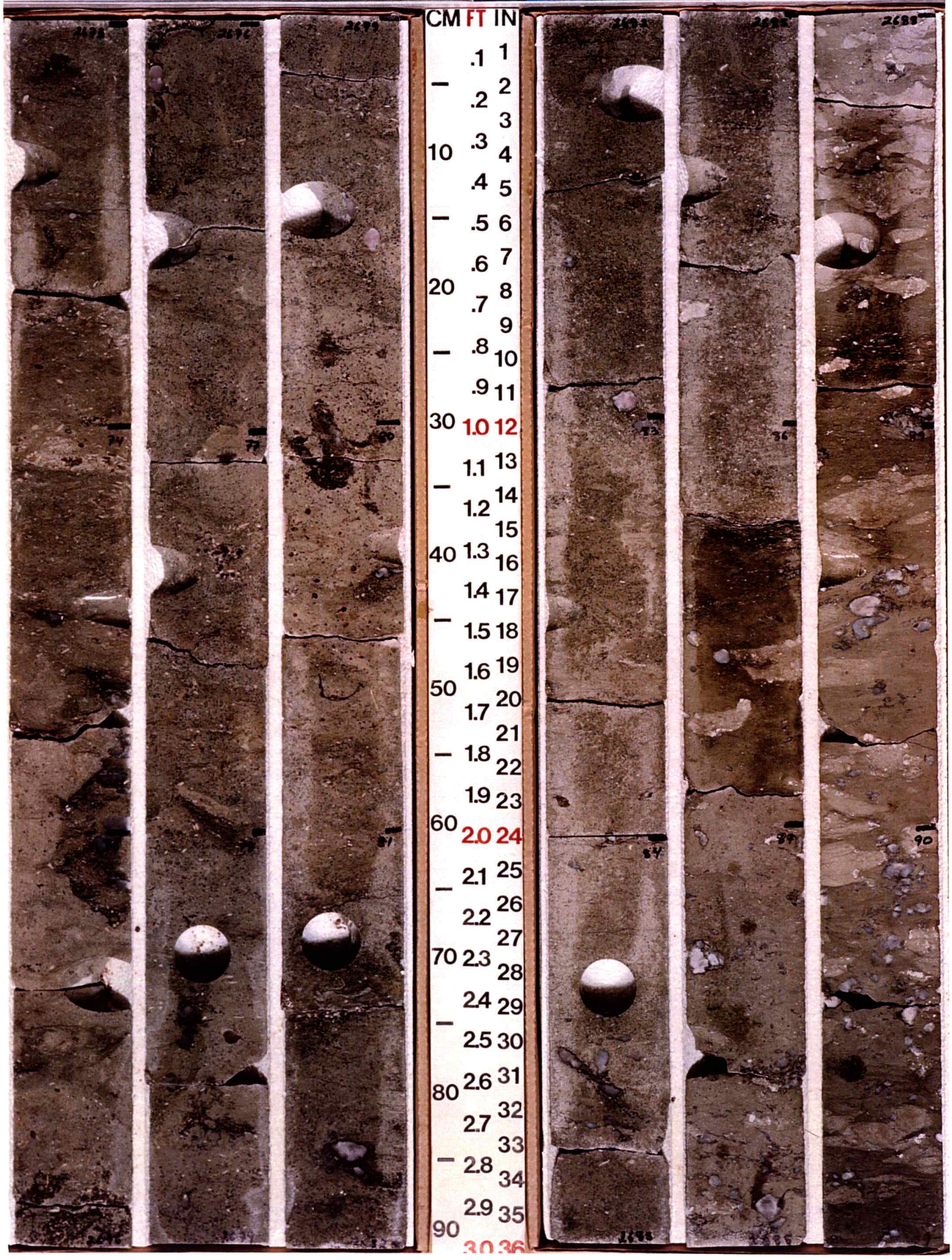


ANADARKO PETROLEUM CORPORATION
YOUNGREN H-2H
STEVENS COUNTY, KANSAS
2655.0 - 2673.0



ANADARKO PETROLEUM CORPORATION
YOUNGREN H-2H
STEVENS COUNTY, KANSAS
2673.0 - 2691.0

RESERVOIRS INC.



ANADARKO PETROLEUM CORPORATION
YOUNGREN H-2H
STEVENS COUNTY, KANSAS
2691.0-2696.0

RESERVOIRS INC.