Dulled 11/66 VC-T-10 COL-P Conoco CONFIDENTIAL, LIE/G Geologic Leg INTERVAL SHEET Strip Log ELEV. : 10' VDMR Well No: WELL NO. 2102 Page / of / Date rec'd: 7/18/67 Sample Interval: from 0.5 Miles N.E. Visitor's Center at PROP: Number of samples: 3x 42 Vamestown Fort , E. side Colonial COMP: Total Depth: 370' Parkway. (SURRY SHEET) COUNTY: Vomes City Oil or Gas: Water: Exploratory: From-To From-To From-To From-To 10 10 300

370

to



pronounced variations in gypsum habit w/ depth .

Page 1	of	1	VDMR Well No: 2102	
Date rec'd:	2-5-68		Sample Interval: from 10 to: 370)
PROP: JC-	T-10		Number of samples: 37	
COMP:			Total Depth: 370	
COUNTY: Ja:	mes City		Oil or Gas: Water: Exploratory: X	ζ

From-To	From-To	From-To	From-To
10 -	300 _		·
20 -	310 -	-	-
20 -	320 -		
40 -	330 -	-	-
50 -	340 -	~	-
60 -	350 -	- 1 -1	-
70 -	360 -		-
80 -	370 -	-	-
90 -	-	-	
100 -		<u></u>	<u></u>
110 -	-	-	-
120 -	-		-
130 -	·		-
140 -		3 4	-
-	-	-	-
160-	-	-	-
170-		-	
180-	-	-	-
181-5	-	-	-
188 -	.e.	-	(_)
200 -		-	-
210 -	2 — 1	s — s	
220 -		.=	1-1
230 -	-	; . .	2 - 2 - 2
240 -	-	-	-
250 -		-	
260 -		-	<u> </u>
270 -	-		-
280 -	.=:	-	-
290 -	-	-	- 3

All intervals have both washed and unwashed samples

VDMR Well No. 2102 County: James City

Well: JC-T-10
Property: Jamestown Fort
Driller: Norfolk and Western Railway
Location: 0.5 miles NE of Visitors' Center of Jamestown Fort, on E side of Colonial Parkway: 76° 45' 30" W, 37° 13' 30" N
Elevation: 10 feet
Total Depth: 370 feet
Started drilling: November, 1966 Completed drilling: November, 1966
Sample description by: R.H. Teifke, Virginia Division of Mineral

Resources, October, 1968

GEOLOGIC LOG*

Depth in feet

40'

11

COLUMBIA GROUP (0-30')

Clay -- orange-brown, sandy; sand is fine- to mediumgrained, well-sorted, angular; clear and ironoxidestained (orange) quartz; slightly feldspathic and micaceous; traces of magnetite, epidote, and weathered glauconite

20

10

30

40

Gravel -- Orange-brown; rounded pebbles (5-30 mm) of quartz, quartzite, and chert

quartzo-feldspathic gravel

brown; with 10% fine-grained (2-10 mm)

30-40 No Sample YORKTOWN 83' ST.-MARYS FORMATION (40-70')

> Sand -- dark brownish-gray, locally yellow and reddishbrown, moderately clayey; fine- to very finegrained, very well-sorted, angular; clear quartz, with accessory glauconite, gypsum, magnetite, and muscovite; echinoid spines abundant; a very few foraminifers

50 Sand - dark greenish-gray, moderately clayey; 15% coarse pelecypod shell fragments; fine- to very fine-grained, well-sorted, angular; clear quartz with a trace of glauconite; echinoid spines common; a very few foraminifers, mostly Nonion (also Lagena, Textularia, Cibicides) trace of shell 60 Ħ 70 11 trace of shell 70-80 No Sample (83-182') CALVERT FORMATION (80-140') 80 Clay - greenish-brown, locally pale-yellow, very silty, moderately sandy; sand is fine-grained, wellsorted, angular, quartzose, with yellow cast; abundant slender crystals of selenite tt : 90 100 Clay - gray, locally orange-brown, compact; small amount of fine, well-sorted quartz sand; very abundant stubby crystals of selenite 110 11 locally pale-yellow 120 11 locally pale-yellow; slightly sandy 130 11 locally pale-yellow; slightly sandy 11 i40 locally pale-yellow; slightly to moderately sandy; a few Uvigerina, Nonion and Siphogenerina 140-143 No Sample CHICKAHOMINY-FORMATION-(143-180) 143 Sand - abundant matrix of brown clay, a few shell fragments; fine- to medium-grained, fairly wellsorted; clear, angular to subangular quartz,

with 10% small fragments of bone phosphorite, and 2-3% lignite; abundant anhydrite pseudomorphs after gypsum; foraminifers abundant (Siphogenerina, Robulus and Dentalina dominant) Shell and sand — binder of drab-brown clay, dolomitic (encrusting, cavernous), abundant anhydrite pseudomorphs after gypsum (as attached crystals and as dendrites on shell fragments); 60% shell and 25% fine- to medium-grained, fairly wellsorted, angular to subangular sand; sand is 90% clear quartz, 10% fragmental phosphorite; foraminifers abundant (globigerinids and <u>Cibicides</u>); a few ostracods

-3-

 Sand - abundant matrix of greenish-gray clay, 10% fine, rounded quartz gravel, a few shell fragments; medium- to very coarse-grained, rather poorly sorted, angular to subrounded; clear quartz, with 5% fragmental phosphorite; pyrite nodules and gypsum crystals common; a few foraminifers

with 20% shell fragments and fragments of dolomitic quartz sandstone

with 20% shell fragments and a few fragments of dolomitic quartz sandstone; 1-2% phosphorite

180-181.5 No Sample

NANJEMOY FORMATION (182 - 250')

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181.5

187

188

Sand and sandstone - light-gray, moderately clayey; 80% fine- to coarse-grained, moderately-sorted sand, of which 70% is clear and pale-green quartz, and 30% is dark-green glauconite; small amounts phosphorite and gypsum; 15% white, calcitic sandstone, with quartz and black glauconite; small foraminifers common

Sand -- matrix of brown gypsiferous clay; medium-grained, fairly well-sorted; 55% greenish quartz, 20% darkto light-green glauconite, 5% gypsum and anhydrite pseudomorphs after gypsum

 Sand — abundant matrix of gray clay; medium-grained, moderately sorted; 60% clear and greenish quartz, 20% brown, light-green, and dark-green glauconite; gypsum common; foraminifers and ostracods common

160

170

180

192	Sand — matrix of brownish-black clay; medium- to coarse-grained, predominantly reddish-brown glauconite, with 10% stained, rounded quartz
193	with matrix of brown and yellow clays; 15-20% stained and rounded quartz
200	Sand — matrix of brownish-gray clay, a few shell frag- ments and small pebbles; medium- to very coarse- grained, moderately sorted; 40% clear and iron- stained, subangular to rounded quartz, 40% fresh and weathered glauconite; traces of gypsum, pyrite, phosphorite; a few foraminifers and ostracods
210	" 60% glauconite, 25% quartz
220	" 65% glauconite, 15% quartz
230	Sand — abundant matrix of drab gray clay, 5% pelecypod shell fragments and a few fragments of phosphate rock, bedded (?) pyrite, and sandstone; fine- to medium-grained, fairly well-sorted; 25% clear, angular quartz, 55% dark-green glauconite; trace of gypsum; a very few foraminifers
240	Clay — laminated orange-pink, light-gray, and yellow, essentially sand-free clays (80%), and blackish- green lenses of clayey, glauconitic sand (20%); clay laminae contain fresh, authegenic glauconite and selenite
240-250	No Sample
MATTAPONI F	ORMATION (250- 280)
250	Sand — black, slightly to moderately clayey; medium- grained, well-sorted; fresh black glauconite with 5-10% clear, angular quartz; trace of selenite
260	with a few fragments of calcitic, glauconite- bearing sandstone

-4-

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270 Sand and sandstone - abundant matrix of grass-green clay; 15-20% calcitic, white, glauconite-bearing sandstone; 70-75% fine- to medium-grained, wellsorted, dull, dark- and light-green glauconite, with 10% quartz; a few shell fragments 280 with 40% fine (10-20 mm), rounded, stainedquartz gravel 280-290 No Sample PATUXENT FORMATION (295-370') 290 Gravel and sand - binder of green clay, a few shell fragments; 60% fine (2-20 mm), moderately sorted, rounded gravel comprised of quartz and a few pebbles of chert, quartzite and phosphorite; 30% coarse- to very coarse-grained, subangular to subrounded feldspathic sand; trace of garnet 300 Ħ 50% gravel, 40% sand 310 11 50% gravel, 40% sand 320 Sand and gravel - yellowish-gray, slightly clayey; 30% fine, quartzo-feldspathic gravel; 65% medium- to very coarse-grained, rather poorly sorted, angular to subangular feldspathic sand; trace of garnet 11 330 п 340 80% sand, 15% gravel ţ; 350 85% sand, 10% gravel 360 Sand - brownish-gray, clayey, 5% fine gravel; finegrained, well-sorted, angular; moderately feldspathic; slightly glauconitic and micaceous; trace of garnet 370 ŧŧ

-5-

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*The use of the lithologic term, "clay" includes all size ranges of particles less than 1/16 mm.

GEOLOGIC SUMMARY

Rock Unit

Age

	0 -30+ 40	Columbia Group	Pleistocene
:	30-401	No-Sample	
	40 -70 '83	St. Mary's Formation Yorkfown	Late Miocene
	20-80	No Sample Formation	
8	3 80-140' 182	Calvert Formation	Middle Miocene
	140-143	No Sample	
	[43-180]	Chickahominy Formation	Late Eocene
	<u>[180-181-5]</u>	No Sample	
1 8Z	- 181, 5-240 250	Nanjemoy Formation	Middle Eocene
	240-250	No Sample	
	250- 280 -285	Mattaponi Formation	Paleocene-Late Gretaceous
	[280-290]	No Sample	
2.85	: - 290 -370'	Patuxent Formation	Early Cretaceous

R.H. Telle 3/1/12

Sand - dark greenish-gray, moderately clayey; 15% 50 coarse pelecypod shell fragments; fine- to very fine-grained, well-sorted, angular; clear quartz with a trace of glauconite; echinoid spines common; a very few foraminifers, mostly Nonion (also Lagena, Textularia, Cibicides) 11 trace of shell 60 11 70 trace of shell No Sample 70-80 some, as 70 - Foot internal 80-83 23-180 CALVERT FORMATION (80-40) 8Ø Clay - greenish-brown, locally pale-yellow, very silty, moderately sandy; sand is fine-grained, wellsorted, angular, quartzose, with yellowicast; abundant slender crystals of selenite #1 : 90 Clay - gray, locally orange-brown, compact; small 100 amount of fine, well-sorted quartz sand; very abundant stubby crystals of selenite 11 110 locally pale-yellow 120 ŧŧ locally pale-yellow; slightly sandy 11 130 locally pale-yellow; slightly sandy 11 140 locally pale-yellow; slightly to moderately sandy; a few Uvigerina, Nonion and Siphogenerina 140-143 No Sample CHICKAHOMINY FORMATION (143-180') Sand - abundant matrix of brown clay, a few shell frag-143 shards ments; fine- to medium-grained, fairly wellsorted; clear, angular to subangular quartz, 12rge coulor bit was bone with 10% small fragments of bone phosphorite, P205 31⁰⁶⁻

and 2-3% lignite; abundant anhydrite pseudomorphs after gypsum; foraminifers abundant (Siphogenerina, Robulus and Dentalina dominant)

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clares

148

Shell and sand — binder of drab-brown clay, dolomitic (encrusting, cavernous), abundant anhydrite pseudomorphs after gypsum (as attached crystals and as dendrites on shell fragments); 60% shell and 25% fine- to medium-grained, fairly wellsorted, angular to subangular sand; sand is 90% clear quartz, 10% fragmental phosphorite; foraminifers abundant (globigerinids and <u>Cibicides</u>); a few ostracods

160

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Sand — abundant matrix of greenish-gray clay, 10% fine, rounded quartz gravel, a few shell fragments; medium- to very coarse-grained, rather poorly sorted, angular to subrounded; clear quartz, with 5% fragmental phosphorite; pyrite nodules and gypsum crystals common; a few foraminifers

170

180

181.5

- with 20% shell fragments and fragments of dolomitic quartz sandstone
- with 20% shell fragments and a few fragments of dolomitic quartz sandstone; 1-2% phosphorite

180-181.5 No Sample

NANJEMOY FORMATION (181, 5-240')

11

11

Sand and sandstone - light-gray, moderately clayey; 80% fine- to coarse-grained, moderately-sorted sand, of which 70% is clear and pale-green quartz, and 30% is dark-green glauconite; small amounts phosphorite and gypsum; 15% white, calcitic sandstone, with quartz and black glauconite; small foraminifers common

187

188

Sand — matrix of brown gypsiferous clay; medium-grained, fairly well-sorted; 55% greenish quartz, 20% darkto light-green glauconite, 5% gypsum and anhydrite pseudomorphs after gypsum

Sand - abundant matrix of gray, clay; medium-grained, moderately sorted; 60% clear and greenish quartz, 20% brown, light-green, and dark-green glauconite; gypsum common; foraminifers and ostracods common

192	Sand — matrix of brownish-black clay; medium- to coarse-grained, predominantly reddish-brown glauconite, with 10% stained, rounded quartz
193	" with matrix of brown and yellow clays; 15-20% stained and rounded quartz
200	Sand — matrix of brownish-gray clay, a few shell frag- ments and small pebbles; medium- to very coarse- grained, moderately sorted; 40% clear and iron- stained, subangular to rounded quartz, 40% fresh and weathered glauconite; traces of gypsum, pyrite, phosphorite; a few foraminifers and ostracods
210	" 60% glauconite, 25% quartz
220	" 65% glauconite, 15% quartz
230	Sand — abundant matrix of drab gray clay, 5% pelecypod shell fragments and a few fragments of phosphate rock, bedded (?) pyrite, and sandstone; fine- to medium-grained, fairly well-sorted; 25% clear, angular quartz, 55% dark-green glauconite; trace of gypsum; a very few foraminifers
240	Clay - laminated orange-pink, light-gray, and yellow, essentially sand-free clays (80%), and blackish- green lenses of clayey, glauconitic sand (20%); clay laminae contain fresh, authegenic glauconite and selenite
240-250	No Sample
MATTAPONI F	ORMATION (250-280')
250	Sand — black, slightly to moderately clayey; medium- grained, well-sorted; fresh black glauconite with 5-10% clear, angular quartz; trace of selenite
260	" with a few fragments of calcitic, glauconite- bearing sandstone

VDMR Well No. 2102

Sand and sandstone - abundant matrix of grass-green 270 clay; 15-20% calcitic, white, glauconite-bearing sandstone; 70-75% fine- to medium-grained, wellsorted, dull, dark- and light-green glauconite, with 10% quartz; a few shell fragments 280 ŧ t with 40% fine (10-20 mm), rounded, stainedquartz gravel 280-290 No Sample PATUXENT FORMATION (290-370') Gravel and sand - binder of green clay, a few shell 290 fragments; 60% fine (2-20 mm), moderately sorted, rounded gravel comprised of quartz and a few pebbles of chert, quartzite and phosphorite; 30% coarse- to very coarse-grained, subangular to subrounded feldspathic sand; trace of garnet 11 300 50% gravel, 40% sand 310 50% gravel, 40% sand 320 Sand and gravel - yellowish-gray, slightly clayey; 30% fine, quartzo-feldspathic gravel; 65% medium- to very coarse-grained, rather poorly sorted, angular to subangular feldspathic sand; trace of garnet 11 330 11 340 80% sand, 15% gravel 350 11 85% sand, 10% gravel Sand - brownish-gray, clayey, 5% fine gravel; fine-360 grained, well-sorted, angular; moderately feldspathic; slightly glauconitic and micaceous; trace of garnet ŧt 370

-5- ⁶⁰⁻⁷

*The use of the lithologic term, "clay" includes all size ranges of particles less than 1/16 mm.

GEOLOGIC SUMMARY

Rock Unit

Age	
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0-30'	Columbia Group	Pleistocene
30-40'	No Sample	
40-,70' 83'	[St. Mary's] Formation	Late Miocene
(70=8 0'	No-Sample]	
8380-1401/80	Calvert Formation	Middle Miocene
(140-143'	No Sample]	
[143-180'	Ghickahominy Formation	Late Eocene
180-181.5*	No Sample	
181.5-240'	Nanjemoy Formation	Middle Eocene
240-250'	No Sample	
250-280'	Mattaponi Formation	Paleocene
280-2901	No Sample	
290 -370'	Patuxent Formation	Early Cretaceous

Virginia D of 191 R Robert H. Teilke, Geologist october 1968 Revised March 1992

VDMR Well No. 2102 County: James City

GEOLOGIC LOG*

Depth in feet

COLUMBIA GROUP (0-30')

10 Clay -- orange-brown, sandy; sand is fine- to mediumgrained, well-sorted, angular; clear and ironoxidestained (orange) quartz; slightly feldspathic and micaceous; traces of magnetite, epidote, and weathered glauconite

20 " brown; with 10% fine-grained (2-10 mm) quartzo-feldspathic gravel

30 Gravel -- orange-brown; rounded pebbles (5-30 mm) of quartz, quartzite, and chert

30=40 No Sample

YORKTOWN FORMATION (40-83')

40 Sand -- dark brownish-gray, locally yellow and reddish-brown, moderately clayey; fine- to very fine-grained, very well-sorted, angular; clear quartz, with accessory glauconite, gypsum, magnetite, and muscovite; echinoid spines abundant; a very few foraminifers

50 Sand -- dark greenish-gray, moderately clayey; 15% coarse pelecypod shell fragments; fine- to very fine-grained, well-sorted, angular; clear quartz with a trace of glauconite; echinoid spines common; a very few foraminifers, mostly Nonion (also Lagena, Textularia, Cibicides) 60 Sand -- dark greenish-gray, moderately clayey; trace of coarse pelecypod shell fragments; fine-to very fine-grained, well-sorted, angular; clear quartz with trace of glauconite; echinoid spines common; a very few foraminifers, mostly Nonion (also Lagena, Textularia, Cibicides)

70

- 70-80 No Sample
- 80-83 Same as 70-foot interval

CALVERT FORMATION (83-180')

83 Clay -- greenish-brown, locally pale-yellow, very silty, moderately sandy; sand is fine-grained, wellsorted, angular, quartzose, with yellow cast; abundant slender crystals of selenite

90

100

- Clay -- gray, locally orange-brown, compact; small amount of fine, well-sorted quartz sand; very abundant stubby crystals of selenite
- 110 " locally pale-yellow

11

- 120 " locally pale-yellow; slightly sandy
- 130 " locally pale-yellow; slightly sandy
- 140 " locally pale-yellow; slightly to moderately sandy; a few <u>Uvigerina</u>, <u>Nonion</u> and <u>Sipho-</u> generina
 - Sand -- abundant matrix of brown clay, a few shell fragments; fine- to medium-grained, fairly well-sorted; clear, angular to subangular quartz, with 10% small fragments of bone phosphorite, and 2-3% lignite; abundant anhydrite pseudomorphs after gypsum; foraminifers abundant (Siphogenerina, Robulus and Dentalina dominant)

148

143

Shell and sand -- binder of drab-brown clay, dolomitic (encrusting, cavernous), abundant anhydrite pseudomorphs after gypsum (as attached crystals and as dendrites on shall fragments); 60% shell and 25% fine- to medium-grained, fairly well sorted, angular to subangular sand; sand is 90% clear quartz, 10% fragmental phosphorite; forami nifers abundant (globigerinids and <u>Cibicides</u>); a few ostracods

VDMR Well No. 2102

160 Sand -- abundant matrix of greenish-gray clay, 10% fine, rounded quartz gravel, a few shell fragments; medium- to very coarse-grained, rather poorly sorted, angular to subrounded; clear quartz, with 5% fragmental phosphorite; pyrite nodules and gypsum crystals common; a few foraminifers 170 78 with 20% shell fragments and fragments of dolomitic quartz sandstone 11 with 20% shell fragments and a few fragments 180 of dolomitic quartz sandstone; 1-2% phosphorite 180-181.5 No Sample NANJEMOY FORMATION (181.5-240') Sand and sandstone -- light-gray, moderately clayey; 80% 181.5 fine- to coarse-grained, moderately-sorted sand, of which 70% is clear and pale-green quartz, and 30% is dark-green glauconite; small amounts phosphorite and gypsum; 15% white, calcitic sandstone, with quartz and black glauconite; small foraminifers common Sand -- matrix of brown gypsiferous clay; medium-grained, 187 fairly well-sorted; 55% greenish quartz, 20% darkto light-green glauconite, 5% gypsum and anhydrite pseudomorphs after gypsum abundant matrix of brown clay; medium-grained, Sand --188 moderately sorted; 60% clear and greenish quartz, 20% brown, light-green, and dark-green glauconite; gypsum common; foraminifers and ostracods common matrix of brownish-black clay; medium- to coarse-192 Sand --grained, predominantly reddish-brown glauconite, with 10% stained, rounded quartz with matrix of brown and yellow clays; 15-20% 193 stained and rounded quartz matrix of brownish-gray clay, a few shell fragments 200 Sand -and small pebbles; medium- to very coarse-grained, moderately sorted; 40% clear and iron-stained, subangular to rounded quartz, 40% fresh and weathered

glauconite; traces of gypsum, pyrite, phosphorite; a

few foraminifers and ostracods

210 " 60% glauconite, 25% quartz

220 " 65% glauconite, 15% quartz

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VDMR Well No. 2102

- 230 Sand -- abundant matrix of drab gray clay, 5% pelecypod shell fragments and a few fragments of phosphate rock, bedded (?) pyrite, and sandstone; fine- to medium-grained, fairly well-sorted; 25% clear, angular quartz, 55% dark-green glauconite; trace of gypsum; a very few foraminifers
 - 240 Clay -- laminated orange-pink, light-gray, and yellow, essentially sand-free clays (80%), and blackishgreen lenses of clayey, glauconitic sand (20%); clay laminae contain fresh, authegenic glauconite and selenite

240-250 No Sample

MATTAPONI FORMATION (250-280')

- 250 Sand -- black, slightly to moderately clayey; mediumgrained, well-sorted; fresh black glauconite with 5-10% clear, angular quartz; trace of selenite
- 260 " with a few fragments of calcitic, glauconitebearing sandstone
- 270 Sand and sandstone -- abundant matrix of grass-green clay; 15-20% calcitic, white, glauconite-bearing sandstone; 70-75% fine- to medium-grained, well-sorted, dull, dark- and light-green glauconite, with 10% quartz; a few shell fragments
- 280 " with 40% fine (10-20 mm), rounded, stainedquartz gravel

280-290 No Sample

PATUXENT FORMATION (290-370')

290 Gravel and sand -- binder of green clay, a few shell fragments; 60% fine (2-20 mm), moderately sorted, rounded gravel comprised of quartz and a few pebbles of chert, quartzite and phosphorite; 30% coarse- to very coarsegrained, subangular to subrounded feldspathic sand; trace of garnet

330

340 " 80% sand, 15% gravel

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350 " 85% sand, 10% gravel

Age

360 Sand — brownish-gray, clayey, 5% fine gravel; fine-grained, well sorted, angular; moderately feldspathic; slightly glauconitic and micaceous; trace of garnet

370

*The use of the lithologic term, "clay" includes all size ranges of particles less than 1/16 mm.

GEOLOGIC SUMMARY

Rock Unit

15

0- 30'	Columbia Group	Pleistocene
30-40'	No Sample	
40-83	Yorktown Formation	Late Miocene
83-180'	Calvert Formation	Middle Miocene
180-181.5'	No Sample	
181.5-240'	Nanjemoy Formation	Middle Eocene
240-250'	No Sample	
250-280°	Mattaponi Formation	Paleocene
280-290'	No Sample	
290-370'	Patuxent Formation	Early Cretaceous

Virginia Division of Mineral Resources Robert H. Teifke, Geologist October 1968 Revised March, 1972

INTERVAL SHEET

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Pel	of	1 .	VDMR Well No: 2102
Date rec'd:	2-5-68		Sample Interval: from 10 to: 370
PROP: JC-	T - 1 0		Number of samples: 37
COMP:			Total Depth: 370
COUNTY: Ja	mes City		Oil or Gas: Water: Exploratory: X

From-To	From-To	From-To	From-To
10 -	300 _	-	_
20 -	310 -	-	_
30 -	320 -	-	-
40 -	330 -	_	-
50 -	340 -	-	-
•			
60 -	350 -	-	-
70 -	360 -	-	-
80 -	370 -	-	-
90 -	-	-	-
100-	.	-	· _
110-	-		-
120 -	-	-	-
130-	-	-	-
140 -	-	-	· –
-	-	· _	-
160-	-	-	· _
170-	-	-	-
180-	-	-	· •
181-5	-	-	-
188 -	-	-	. –
200 -	-	-	-
210 -	-	. · –	-
220 -	-	· -	-
230 -	-	-	-
240 -	-	-	-
250	,		
250-	-	-	-
200-	-	-	-
290	-	-	-
200-	-	-	-
290-	-	-	-

All intervals have both washed and unwashed samples

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0-35 nange sand w/ 30 min & grovel at bace (USGS: 38')

35-75' greenish slaggy silt - fine sand w/ Domion ; NO 9475UM

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(US 95 : Late Miocene)

Coll grow they are the

15-135' clay w/ abundant gypsum NO BUGS, NO DIATOMS (USGS : Late Miscene)

VDMR Well No. 2102 County: James City

Well: JC-T-10 Property: Jamestown Fort Driller: Norfolk and Western Railway Location: 0.5 miles NE of Visitors' Center of Jamestown Fort, on E side of Colonial Parkway: 76° 45' 30" W, 37° 13' 30" N Elevation: 10 feet Total Depth: 370 feet Started drilling: November, 1966 Completed drilling: November, 1966

GEOLOGIC LOG*

Depth in feet	
COLUMBIA GRO	DUP (0-30')
10	Clay orange-brown, sandy; sand is fine- to medium- grained, well-sorted, angular; clear and ironoxide- stained (orange) quartz; slightly feldspathic and micaceous; traces of magnetite, epidote, and weathered glauconite
20	" brown; with 10% fine-grained (2-10 mm) quartzo-feldspathic gravel
30	Gravel orange-brown; rounded pebbles (5-30 mm) of quartz, quartzite, and chert
30-40	No Sample
YORKTOWN FOI	RMATION (40-83')
40	Sand dark brownish-gray, locally yellow and reddish-brown moderately clayey; fine- to very fine-grained, very well-sorted, angular; clear quartz, with accessory glauconite, gypsum, magnetite, and muscovite; echino.

50

- -- dark brownish-gray, locally yellow and reddish-brown, moderately clayey; fine- to very fine-grained, very well-sorted, angular; clear quartz, with accessory glauconite, gypsum, magnetite, and muscovite; echinoid spines abundant; a very few foraminifers
- Sand -- dark greenish-gray, moderately clayey; 15% coarse pelecypod shell fragments; fine- to very fine-grained, well-sorted, angular; clear quartz with a trace of glauconite; echinoid spines common; a very few foraminifers, mostly Nonion (also Lagena, Textularia, Cibicides)

60 Sand -- dark greenish-gray, moderately clayey; trace of coarse pelecypod shell fragments; fine-to very fine-grained, well-sorted, angular; clear quartz with trace of glauconite; echinoid spines common; a very few foraminifers, mostly <u>Nonion</u> (also <u>Lagena</u>, <u>Textularia</u>, <u>Cibicides</u>)

70

- 70-80 No Sample
- 80-83 Same as 70-foot interval

CALVERT FORMATION (83-180')

- 83 Clay -- greenish-brown, locally pale-yellow, very silty, moderately sandy; sand is fine-grained, wellsorted, angular, quartzose, with yellow cast; abundant slender crystals of selenite 90 100 gray, locally orange-brown, compact; small amount Clay -of fine, well-sorted quartz sand; very abundant stubby crystals of selenite Ħ 110 locally pale-yellow 11 120 locally pale-yellow; slightly sandy 11 locally pale-yellow; slightly sandy 130 11 locally pale-yellow; slightly to moderately 140 sandy; a few Uvigerina, Nonion and Siphogenerina
 - Sand -- abundant matrix of brown clay, a few shell fragments; fine- to medium-grained, fairly well-sorted; clear, angular to subangular quartz, with 10% small fragments of bone phosphorite, and 2-3% lignite; abundant anhydrite pseudomorphs after gypsum; foraminifers abundant (Siphogenerina, Robulus and Dentalina dominant)

148

143

Shell and sand -- binder of drab-brown clay, dolomitic (encrusting, cavernous), abundant anhydrite pseudomorphs after gypsum (as attached crystals and as dendrites on shall fragments); 60% shell and 25% fine- to medium-grained, fairly well sorted, angular to subangular sand; sand is 90% clear quartz, 10% fragmental phosphorite; forami nifers abundant (globigerinids and <u>Cibicides</u>); a few ostracods

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160 Sand -- abundant matrix of greenish-gray clay, 10% fine, rounded quartz gravel, a few shell fragments; medium- to very coarse-grained, rather poorly sorted, angular to subrounded; clear quartz, with 5% fragmental phosphorite; pyrite nodules and gypsum crystals common; a few foraminifers 170 11 with 20% shell fragments and fragments of dolomitic quartz sandstone 180 11 with 20% shell fragments and a few fragments of dolomitic quartz sandstone; 1-2% phosphorite 180-181.5 No Sample NANJEMOY FORMATION (181.5-240') 181.5 Sand and sandstone -- light-gray, moderately clayey; 80% fine- to coarse-grained, moderately-sorted sand, of which 70% is clear and pale-green quartz, and 30% is dark-green glauconite; small amounts phosphorite and gypsum; 15% white, calcitic sandstone, with quartz and black glauconite; small foraminifers common 187 Sand -- matrix of brown gypsiferous clay; medium-grained, fairly well-sorted; 55% greenish quartz, 20% darkto light-green glauconite, 5% gypsum and anhydrite pseudomorphs after gypsum 188 Sand -abundant matrix of brown clay; medium-grained, moderately sorted; 60% clear and greenish quartz, 20% brown, light-green, and dark-green glauconite; gypsum common; foraminifers and ostracods common 192 Sand -matrix of brownish-black clay; medium- to coarsegrained, predominantly reddish-brown glauconite, with 10% stained, rounded quartz 193 11 with matrix of brown and yellow clays; 15-20% stained and rounded quartz 200 Sand -matrix of brownish-gray clay, a few shell fragments and small pebbles; medium- to very coarse-grained, moderately sorted; 40% clear and iron-stained, subangular to rounded quartz, 40% fresh and weathered glauconite; traces of gypsum, pyrite, phosphorite; a few foraminifers and ostracods 210 60% glauconite, 25% guartz 220 65% glauconite, 15% quartz

- 3 -

- 230 Sand -- abundant matrix of drab gray clay, 5% pelecypod shell fragments and a few fragments of phosphate rock, bedded (?) pyrite, and sandstone; fine- to medium-grained, fairly well-sorted; 25% clear, angular quartz, 55% dark-green glauconite; trace of gypsum; a very few foraminifers
- 240 Clay -- laminated orange-pink, light-gray, and yellow, essentially sand-free clays (80%), and blackishgreen lenses of clayey, glauconitic sand (20%); clay laminae contain fresh, authegenic glauconite and selenite

240-250 No Sample

MATTAPONI FORMATION (250-280')

- 250 Sand -- black, slightly to moderately clayey; mediumgrained, well-sorted; fresh black glauconite with 5-10% clear, angular quartz; trace of selenite
- 260 " with a few fragments of calcitic, glauconitebearing sandstone
- 270 Sand and sandstone -- abundant matrix of grass-green clay; 15-20% calcitic, white, glauconite-bearing sandstone; 70-75% fine- to medium-grained, well-sorted, dull, dark- and light-green glauconite, with 10% quartz; a few shell fragments
- 280 " with 40% fine (10-20 mm), rounded, stainedquartz gravel

280-290 No Sample

PATUXENT FORMATION (290-370')

290 Gravel and sand -- binder of green clay, a few shell fragments; 60% fine (2-20 mm), moderately sorted, rounded gravel comprised of quartz and a few pebbles of chert, quartzite and phosphorite; 30% coarse- to very coarsegrained, subangular to subrounded feldspathic sand; trace of garnet

330

340 " 80% sand, 15% gravel

11

350 " 85% sand, 10% gravel

360

Sand — brownish-gray, clayey, 5% fine gravel; fine-grained, well sorted, angular; moderately feldspathic; slightly glauconitic and micaceous; trace of garnet

370

0-30'

30-40'

40-83

83-180'

180-181.5'

181.5-240'

240-250'

250-280'

280-290'

290-370'

*The use of the lithologic term, "clay" includes all size ranges of particles less than 1/16 mm.

GEOLOGIC SUMMARY

Rock Unit

No Sample

No Sample

No Sample

No Sample

Columbia Group

Yorktown Formation

Calvert Formation

Nanjemoy Formation

Mattaponi Formation

Patuxent Formation

11

Age

Pleistocene

Late Miocene Middle Miocene

Middle Eocene

Paleocene

Early Cretaceous

Virginia Division of Mineral Resources Robert H. Teifke, Geologist October 1968 Revised March, 1972

- 5 -

VDMR Well No. 2102 County: James City

Well: JC-T-10
Property: Jamestown Fort
Driller: Norfolk and Western Railway
Location: 0.5 miles NE of Visitors' Center of Jamestown Fort, on E side of Colonial Parkway: 76° 45' 30" W, 37° 13' 30" N
Elevation: 10 feet
Total Depth: 370 feet
Started drilling: November, 1966 Completed drilling: November, 1966
Sample description by: R.H. Teifke, Virginia Division of Mineral Resources, October, 1968

GEOLOGIC LOG*

Depth in feet

COLUMBIA GROUP (0-30')

10 Clay -- orange-brown, sandy; sand is fine- to mediumgrained, well-sorted, angular; clear and ironoxidestained (orange) quartz; slightly feldspathic and micaceous; traces of magnetite, epidote, and weathered glauconite

20 "brown; with 10% fine-grained (2-10 mm) quartzo-feldspathic gravel

30 Gravel -- orange-brown; rounded pebbles (5-30 mm) of quartz, quartzite, and chert

30-40 No Sample

ST. MARYS FORMATION (40-70')

40 Sand -- dark brownish-gray, locally yellow and reddishbrown, moderately clayey; fine- to very finegrained, very well-sorted, angular; clear quartz, with accessory glauconite, gypsum, magnetite, and muscovite; echinoid spines abundant; a very few foraminifers

50	Sand — dark greenish-gray, moderately clayey; 15% coarse pelecypod shell fragments; fine- to very fine-grained, well-sorted, angular; clear quartz with a trace of glauconite; echinoid spines common; a very few foraminifers, mostly Nonion (also Lagena, Textularia, Cibicides)
60	" trace of shell
70	" trace of shell
70-80	No Sample
CALVERT FOR	MATION (80-140')
80	Clay — greenish-brown, locally pale-yellow, very silty, moderately sandy; sand is fine-grained, well- sorted, angular, quartzose, with yellow cast; abundant slender crystals of selenite
90	
100	Clay — gray, locally orange-brown, compact; small amount of fine, well-sorted quartz sand; very abundant stubby crystals of selenite
110	" locally pale-yellow
120	" locally pale-yellow; slightly sandy
130	" locally pale-yellow; slightly sandy
140	'' locally pale-yellow; slightly to moderately sandy; a few Uvigerina, Nonion and Sipho- generina
140-143	No Sample
CHICKAHOMIN	Y FORMATION (143-180')
1.4.2	Contraction of the second seco

143 Sand — abundant matrix of brown clay, a few shell fragments; fine- to medium-grained, fairly wellsorted; clear, angular to subangular quartz, with 10% small fragments of bone phosphorite, and 2-3% lignite; abundant anhydrite pseudomorphs after gypsum; foraminifers abundant (Siphogenerina, Robulus and Dentalina dominant)

148 Shell and sand - binder of drab-brown clay, dolomitic (encrusting, cavernous), abundant anhydrite pseudomorphs after gypsum (as attached crystals and as dendrites on shell fragments); 60% shell and 25% fine- to medium-grained, fairly wellsorted, angular to subangular sand; sand is 90% clear quartz, 10% fragmental phosphorite; foraminifers abundant (globigerinids and Cibicides); a few ostracods 160 Sand - abundant matrix of greenish-gray clay, 10% fine, rounded quartz gravel, a few shell fragments; medium- to very coarse-grained, rather poorly sorted, angular to subrounded; clear quartz, with 5% fragmental phosphorite; pyrite nodules and gypsum crystals common; a few foraminifers 170 11 with 20% shell fragments and fragments of dolomitic quartz sandstone 180 11 with 20% shell fragments and a few fragments of dolomitic guartz sandstone; 1-2% phosphorite 180-181.5 No Sample NANJEMOY FORMATION (181.5-240') 181.5 Sand and sandstone - light-gray, moderately clayey; 80% fine- to coarse-grained, moderately-sorted sand, of which 70% is clear and pale-green quartz, and 30% is dark-green glauconite; small amounts phosphorite and gypsum; 15% white, calcitic sandstone, with quartz and black glauconite; small foraminifers common

- 187 Sand matrix of brown gypsiferous clay; medium-grained, fairly well-sorted; 55% greenish quartz, 20% darkto light-green glauconite, 5% gypsum and anhydrite pseudomorphs after gypsum
- 188 Sand abundant matrix of gray clay; medium-grained, moderately sorted; 60% clear and greenish quartz, 20% brown, light-green, and dark-green glauconite; gypsum common; foraminifers and ostracods common

192	Sand — matrix of brownish-black clay; medium- to coarse-grained, predominantly reddish-brown glauconite, with 10% stained, rounded quartz	
193	" with matrix of brown and yellow clays; 15-20% stained and rounded quartz	
200	Sand — matrix of brownish-gray clay, a few shell frag- ments and small pebbles; medium- to very coarse- grained, moderately sorted; 40% clear and iron- stained, subangular to rounded quartz, 40% fresh and weathered glauconite; traces of gypsum, pyrite, phosphorite; a few foraminifers and ostracods	
210	" 60% glauconite, 25% quartz	
220	" 65% glauconite, 15% quartz	
230	Sand — abundant matrix of drab gray clay, 5% pelecypod shell fragments and a few fragments of phosphate rock, bedded (?) pyrite, and sandstone; fine- to medium-grained, fairly well-sorted; 25% clear, angular quartz, 55% dark-green glauconite; trace of gypsum; a very few foraminifers	
240	Clay — laminated orange-pink, light-gray, and yellow, essentially sand-free clays (80%), and blackish- green lenses of clayey, glauconitic sand (20%); clay laminae contain fresh, authegenic glauconite and selenite	
240-250	No Sample	
MATTAPONI FO	DRMATION (250-280')	
250	Sand — black, slightly to moderately clayey; medium- grained, well-sorted; fresh black glauconite with 5-10% clear, angular quartz; trace of selenite	
260	with a few fragments of calcitic, glauconite- bearing sandstone	

270	Sand and sandstone — abundant matrix of grass-green clay; 15-20% calcitic, white, glauconite-bearing sandstone; 70-75% fine- to medium-grained, well- sorted, dull, dark- and light-green glauconite, with 10% quartz; a few shell fragments			
280	" with 40% fine (10-20 mm), rounded, stained- quartz gravel			
280-290	No Sample			
PATUXENT FORMATION (290-370')				
290	Gravel and sand — binder of green clay, a few shell fragments; 60% fine (2-20 mm), moderately sorted, rounded gravel comprised of quartz and a few pebbles of chert, quartzite and phos- phorite; 30% coarse- to very coarse-grained, subangular to subrounded feldspathic sand; trace of garnet			
300	" 50% gravel, 40% sand			
310	" 50% gravel, 40% sand			
320	Sand and gravel - yellowish-gray, slightly clayey; 30% fine, quartzo-feldspathic gravel; 65% medium- to very coarse-grained, rather poorly sorted, angular to subangular feldspathic sand; trace of garnet			
330				
340	" 80% sand, 15% gravel			
350	" 85% sand, 10% gravel			
360	Sand — brownish-gray, clayey, 5% fine gravel; fine- grained, well-sorted, angular; moderately feld- spathic; slightly glauconitic and micaceous; trace of garnet			
370	II.			

*The use of the lithologic term, "clay" includes all size ranges of particles less than 1/16 mm.

VDMR Well No. 2102

GEOLOGIC SUMMARY

Rock Unit

Age

0-301	Columbia Group	Pleistocene
30-40 ^r	No Sample	
40 - 70 ¹	St. Mary's Formation	Late Miocene
70-801	No Sample	
80-140'	Calvert Formation	Middle Miocene
140-143'	No Sample	
143-180'	Chickahominy Formation	Late Eocene
180-181.51	No Sample	
181.5-240'	Nanjemoy Formation	Middle Eocene
240-2501	No Sample	
250-280'	Mattaponi Formation	Paleocene
280-290'	No Sample	
290-3701	Patuxent Formation	Early Cretaceous