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By Roy C. Lindholm

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INTRODUCTION

I studied sand samples provided by the U.S. Geological Survey (USGS) from six wells (fig. 1) designated Huntley Meadows ("HM"); Va. American Water 1 ("VAW-1"), T-5 ("VAWT-5"), and T-6 ("VAWT-6"); and Nike 1 ("N1") and 2 ("N2"). Samples from well "VAW-1" are entirely from within the Cretaceous Potomac Formation; samples from wells "N1" and "N2" are entirely from within Pleistocene deposits. The top 120 feet in well "HM," the top 76 feet in "VAWT-5," and the top 73 feet in "VAWT-6" are also Pleistocene; the deeper samples from these three wells are Cretaceous. Laboratory methods used in this study are the same as those described in Lindholm (1978). The samples studied from well "N1" at 100 feet are quite variable and are much coarser grained than other sieved samples.

RESULTS

Cretaceous Potomac Formation Sand (Kps)

The heavy-mineral suites in sand collected from well "VAW-1" and the lower part of well "HM" (150-300 ft) are essentially the same as those previously found in other wells penetrating the lower part of the Cretaceous Potomac Formation (Lindholm, 1978). Zircon, garnet, and apatite are the dominant nonopaque heavy minerals (table 1).

*Present address: George Washington University, Geology Department, Washington, D.C. 20052

Table 1.--Heavy-mineral content of Coastal Plain sand from six wells in Alexandria City and Fairfax County, Virginia

[ND, no data; Kps, Cretaceous Potomac Formation sand; Qte_2, Pleistocene sand]

	Depth below surface in feet	Heavy minerals in 2ϕ-4ϕ fraction (Wt. percent)	Magnetic fraction (Wt. percent)	Non-magnetic Minerals: Opaque minerals (Wt. percent)	Non-magnetic Minerals: Nonopaque minerals (Wt. percent)	Zircon	Tourmaline	Rutile	Staurolite	Chloritoid	Epidote	Kyanite	Garnet	Hornblende	Sillimanite	Apatite	Hypersthene	Zoisite(?)[a]	Alterites and unknowns	Formation
						Weight percent of non-magnetic, non-opaque minerals														
Va. Am. Water Well Co. "VAW-1"	180-210	No data	No data	86	14	56	1	-	-	-	12	-	3	-	-	12	-	16	-	
	230-270			81	19	64	-	-	-	1	3	-	17	-	-	9	-	2	4	Kps
	330-370			94	6	24	-	-	4	-	2	-	58	-	-	8	-	2	2	
Va. Am. Water Well Co. "VAWT-5"	30-40	1.0	17	80	20	34	11	-	-	2	23	-	3	4	-	-	-	-	21	Qte_2
	60-70	2.1	18	89	11	14	6	2	-	4	24	-	-	8	-	-	-	-	41	
	90-100[b]	2.1	18	81	19	56	16	1	-	-	2	-	5	-	-	14	-	-	6	
	120-130[b]	2.2	12	82	18	66	11	-	-	3	3	1	2	1	-	7	-	-	8	
	150-160	2.1	9	80	20	51	4	-	-	1	1	-	5	1	-	30	-	-	7	
	180-190	3.6	8	77	23	45	1	-	1	1	1	-	8	2	-	34	1	-	6	
	210-220	1.7	11	60	40	56	-	-	1	1	1	-	9	-	-	27	-	-	5	Kps
	240-250	9.4	2	97	3	66	2	-	2	-	2	-	6	-	-	18	-	-	4	
	270-280	3.9	7	72	28	90	-	-	-	-	-	-	3	-	-	6	-	-	1	
	300-310	2.2	3	88	12	64	1	-	-	-	4	-	11	-	-	20	-	-	-	
	330-340	3.3	ND	61	39	26	2	-	-	-	48	-	6	1	-	8	-	-	8	
	360-370	9.2	1	72	28	12	1	-	-	1	2	-	6	-	-	64	-	-	14	
Va. Am. Water Well Co. "VAWT-6"	10-20	1.7	3	78	22	19	14	3	-	1	32	-	-	-	-	2	-	-	28	
	40-50	2.4	18	67	33	35	6	-	2	2	12	-	4	17	-	2	-	-	20	Qte_2
	50-60	3.8	18	63	37	23	2	-	-	1	25	-	6	16	-	5	2	-	19	
	80-90[b]	3.3	20	56	44	10	3	-	-	1	15	-	4	21	-	2	-	-	44	
	100-110[b]	1.9	21	72	28	39	1	1	-	-	13	-	5	15	-	1	-	-	25	
	130-140[b]	2.0	10	61	39	42	1	1	2	1	15	-	4	3	-	10	-	-	21	
	160-170	6.7	5	59	41	62	-	-	-	-	4	-	5	3	-	24	-	-	2	Kps
	190-200	3.7	7	62	38	64	-	1	1	-	3	-	6	2	-	15	-	-	8	
	200-210	3.7	8	60	40	70	-	-	-	-	5	-	12	1	-	4	-	-	8	
	230-240	4.0	8	54	46	82	-	-	-	-	1	-	4	-	-	7	-	-	6	
Nike "N1"	48	No data	No data	80	20	66	2	-	1	1	8[c]	-	5[c]	-	-	-	-	-	16[d]	
	100			78	22	17	1	-	4	-	24[c]	-	24[c]	7	-	-	8	-	16[d]	Qte_2
Nike "N2"	60	No data	No data	89	11	16	-	-	1	-	14	-	6	10	-	-	2	-	52[d]	Qte_2
Huntley Meadows Obs. Well "HM"	10-20	No data	No data	89	11	91	2	-	1	-	-	-	2	-	-	-	-	-	4	
	35-75			95	5	86	3	1	3	-	1	-	2	-	-	-	-	-	4	Qte_2
	80-100			92	8	83	3	-	3	2	4	-	-	-	-	-	-	-	3	
	105-120			77	23	60	3	-	-	13	13	-	3	3	1	-	1	-	3	
	150-160			85	15	23	-	-	1	-	1	-	34	1	-	40	-	-	-	Kps
	170-180			83	17	33	-	-	-	1	1	-	26	-	-	38	-	-	1	
	270-275			78	22	62	-	-	-	-	-	-	30	1	-	4	-	-	3	
	290-300			91	9	60	-	-	-	-	2	-	16	-	-	20	-	-	2	

a) Zoisite(?) or clinozoisite(?) - uncertain identification.....no X-ray work done
b) Kps intervals 90'-130' in "VAWT-5" and 80'-140' in "VAWT-6" probably contaminated by uphole cavings of Qte_2 materials
c) Nike #1-100' is much coarser than #1-48', which may account for greater abundance of garnet and epidote in Nike #1-100'
d) Nike #2-60' contains considerable siderite; much of the "unknown" material in #1-48' and #1-100' is also carbonate

The heavy-mineral suites from the lower parts of wells "VAWT-5" and "VAWT-6" are similar to those from "VAW-1" and the lower part of "HM" except that garnet is less abundant in "VAWT-5" and "VAWT-6."

In all samples from all six wells, quartz is the most abundant "light mineral," although microcline composes approximately one-fourth of the total light minerals (table 2). Plagioclase is a minor constituent.

Pleistocene (Qte_2)

Mineralogy of nonopaque minerals in most of the upper part of all six wells is totally different from that in the Cretaceous Potomac Formation reported previously in Lindholm (1978). All the wells except "VAW-1" penetrate much younger fluviatile sands and gravels identified as Pleistocene (Froelich, Johnston, and Langer, 1978). In the light fraction, quartz is significantly more abundant relative to microcline and plagioclase than it is in the Cretaceous sand. The dominant nonopaque heavy minerals in the Pleistocene samples include zircon, epidote, hornblende, and tourmaline (table 1): chloritoid, hypersthene, and staurolite are locally abundant. Magnetic material is more abundant in the Pleistocene sand than in the Cretaceous sand. Siderite, a common authigenic carbonate mineral, composes as much as 52% of the sample from well "N2" at 60 ft; it is also present in well "N1" at 48 feet and 100 feet.

Boundary between the Cretaceous Potomac Formation and Pleistocene sand

In wells "HM" and "VAWT-5," the boundary between the Cretaceous sand and the Pleistocene sand is clearly delineated by the heavy-mineral content. The contact is between 120 and 150 feet below the surface in well "HM" and between 70 and 90 feet in well "VAWT-5." This placement of the contact agrees with geophysical logs, which indicate that the contact is 76 feet

Table 2 - Light-mineral content of Coastal Plain sand from wells in Alexandria City and Fairfax County, Virginia

	Depth below surface in feet	Plagioclase	Microcline	Quartz	Remarks
Huntley Meadows Well "HM" (elevation 150 feet)	9-25	0	18	82	Pleistocene (Qte_2) sand
	75-117	0	16	84	
	117-125	0	16	84	
	150-170	1	30	70	Cretaceous Potomac Formation sand (Kps)
	170-180	2	31	67	
	270-286	0	26	74	
Va. Am. Water Well Co. "VAW-1" (elevation 140 feet)	180-210	1	21	79	Cretaceous Potomac Formation sand (Kps)
	230-270	0	22	78	
	330-370	0	18	82	
Nike Wells "N1" (elevation 50 feet)	#1-48'	1	19	80	Pleistocene (Qte_2) sand
	#1-100'	0	4	96	
			4	96	
"N2" (elevation 35 feet)	#2-60'	0	4	96	Pleistocene (Qte_2) sand

below the surface (A.J. Froelich, personal communication, 1980). Epidote and hornblende are more abundant in the Cretaceous section of this well than in surface exposures or in other previously described wells in northern Virginia (Lindholm, 1978). The samples were probably contaminated by caving from the overlying Pleistocene sands during drilling.

Geophysical logs indicate that the Cretaceous-Pleistocene contact is at 73 feet in well "VAWT-6" (A.J. Froelich, personal communication, 1980). The top 60 feet contains a heavy-mineral suite that is typical of Pleistocene sand in this area. The lower most 80 feet (160-240 ft) of the Cretaceous section is similar to that in well "VAWT-5." The sand recovered from the top 60 feet of the Cretaceous section (80 to 140 ft) in well "VAWT-6" has a heavy-mineral suite composed of abundant epidote and hornblende, which is characteristic of the overlying Pleistocene sand. The samples probably were contaminated by extensive caving during drilling.

INTERPRETATION

The interpretation regarding the origin and significance of the mineralogy of the Potomac Formation sand in these wells is the same as that given in an earlier paper (Lindholm, 1978), to which the interested reader is referred.

The Pleistocene sand is markedly different from sand in the underlying Cretaceous Potomac Formation. Intrastratal solution has been invoked to explain similar relationships in the deep subsurface farther east (Pettijohn, 1975). Although this mechanism might account for the general paucity of epidote and hornblende in the Cretaceous sand, it cannot fully explain the sparsity of apatite and garnet in most of the overlying Pleistocene sand. The differences in the heavy-mineral suites are probably related to changes in the source area between Cretaceous and Pleistocene time. The nature of these changes is not presently known.

References Cited

Froelich, A.J., Johnston, R.H., and Langer, W.H., 1978, Preliminary report on the ancestral Potomac River deposits in Fairfax County, Virginia, and their potential hydrogeologic significance: U.S. Geological Survey Open-File Report 78-544, 37 p., 1 pl., 3 figs.

Lindholm, Roy C., 1978, Petrology of Potomac Group sands in Fairfax County, Virginia: U.S. Geological Survey Open-File Report 78-512, 38 p., 3 pls., 10 figs.

Pettijohn, F.J., 1975, Sedimentary rocks: Harper and Row, New York, 628 p.

EXPLANATION

N1 Well discussed in text

Figure 1.--Locations of six studied wells in Alexandria City and Fairfax County, Virginia