Appendix 11. Location, physical characteristics, borehole-geophysical logs and interpreted structures for well May 2.

The town of Maynard, MA commissioned the drilling of five bedrock wells off of Rockland Ave in 1999. Three of the wells were found to be extremely productive, with yields of well over 100 gallons per minute, and are now used as public water supply wells. The fourth well yielded 60 gallons per minute and is currently unused; that well was used for this study. The well ID is may2.061307 and its elevation is approximately 61 meters above sea level. The well was logged from May 29 through June 13, 2007. The well is in a densely wooded area between a soccer field, a swampy area and the Maynard water treatment facility.

The well is cased through ten meters of surficial overburden. The material is thick nonsorted, nonstratified till with a matrix of sand with some clay, silt and boulders. The bedrock is an unnamed amphibolite-gneiss unit. It is primarily a fine to medium-grained hornblende-actinolite-biotite-quartz-plagioclase orthogneiss with strongly defined lineation. The unit lies between the schist of the Nashoba Formation and a large mapped fault in the Nashoba Terrane.

The well is 183 meters deep with 14.8 meters of casing. A total of 83 fractures were identified over that length. Of the total fractures measured 6 were subhorizontal and 77 were tectonic joints. The static water level in the well was 8.16 meters. The well was pumped at 0.5 gpm for 3 hours 7 minutes and showed a drawdown of 0.13 meters. Heat pulse flow meter testing revealed 4 flowing fractures at 48.7, 76.5, 90.2 and 100.8 meters. Of the flowing fractures two were tectonic joints and two were subhorizontal sheeting joints. Efforts were made to coordinate the heat pulse flow meter testing when the other water supply wells were not pumping. However, during the pumping test there was a significant outflow of water at approximately 270 feet. This may be associated with turning on one of the other water supply wells.

Appendix 11, continued. Midpoint depth, strike and dip of features identified in optical televiewer log, fracture type and heat pulse flowmeter data from May 2 (azimuth and dip reported using right hand rule convention; t = tectonic fractures, s = sheeting joints, p = foliation parallel fractures). Data shown under the pumping test have not been normalized.

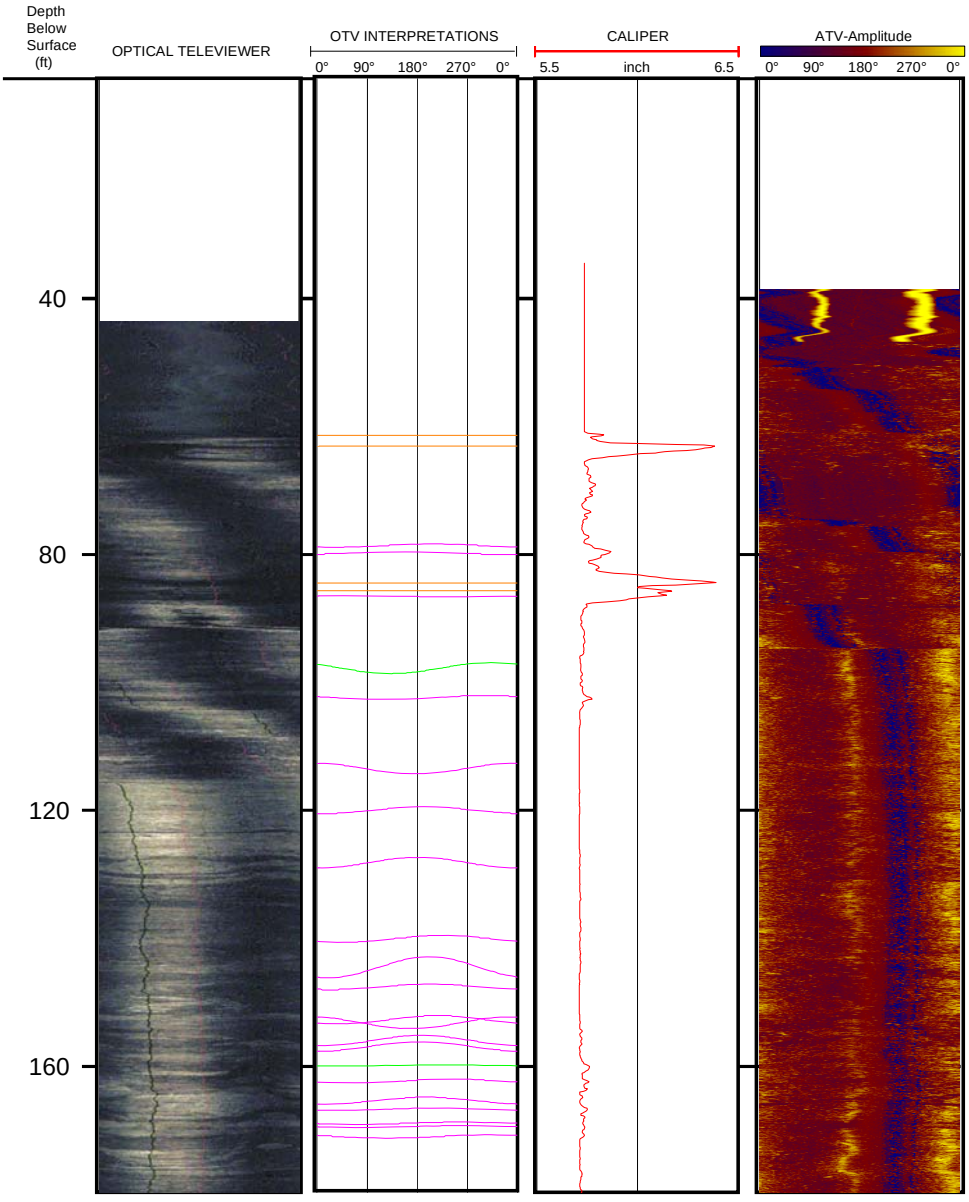
Site ID:	may2.061307				
Location:	"Maynard PWS" Maynard, MA				
Elevation (m)	61				
Reported Yield (gpm)	60				
Rock Type:	Amphibolite-gneiss				
Depth to water:	26.77	ft	8.16	m	
Depth of casing:	48.7	ft	14.84	m	
Depth of well:	600	ft	182.87	m	
Land surface to MP:	0.8	ft	0.24	m	

Fractures						Ambient			Pump	at 0.5 gpm	
Number	Depth(m)	depth (ft)	Azimuth	Dip	Type	Flow (y/n)	gpm (amb)	notes	Flow (y/n)	gpm (pump)	notes
1	18.72	61.4	270	1	s	n	0		n	0.2	
2	19.25	63.2	272	3	s	n	0		n	0.2	
3	23.98	78.7	298	55	t	n	0		n	0.2	
4	24.34	79.9	245	48	t	n	0		n	0.2	
5	25.77	84.5	8	14	s	n	0		n	0.2	
6	26.12	85.7	270	3	s	n	0		n	0.2	
7	26.39	86.6	146	26	t	n	0		n	0.2	
8	29.79	97.8	42	79	t	y	0		n	0.2	
9	31.22	102.4	31	62	t	n	0.07	flow out	n	0.2	
10	34.58	113.5	86	79	t	n	0.07		n	0.2	
11	36.56	119.9	282	73	t	n	0.07		n	0.2	
12	39.06	128.2	271	79	t	n	0.07		n	0.2	
13	42.70	140.1	316	74	t	n	0.07		n	0.2	
14	44.05	144.5	291	84	t	n	0.07		n	0.2	
15	44.97	147.6	293	69	t	n	0.07		n	0.2	
16	46.56	152.8	307	76	t	n	0.07		n	0.2	
17	46.69	153.2	78	80	t	n	0.07		n	0.2	
18	47.55	156.0	278	78	t	n	0.07		n	0.2	
19	47.83	156.9	276	77	t	n	0.07		n	0.2	
20	48.72	159.9	319	28	t	y	0.07	flow out	y	0.2	flow in
21	49.46	162.3	331	60	t	n	0.24		n	0.18	
22	50.41	165.4	285	73	t	n	0.24		n	0.18	
23	50.81	166.7	304	50	t	n	0.24		n	0.18	
24	51.48	168.9	345	43	t	n	0.24		n	0.18	
25	51.63	169.4	346	45	t	n	0.24		n	0.18	
26	52.11	171.0	37	55	t	n	0.24		n	0.18	
27	56.03	183.8	44	60	t	n	0.24		n	0.18	
28	61.84	202.9	271	68	t	n	0.24		n	0.18	
29	63.66	208.9	259	74	t	n	0.24		n	0.18	
30	65.69	215.5	221	74	t	n	0.24		n	0.18	
31	69.82	229.1	246	72	t	n	0.24		n	0.18	
32	70.67	231.9	154	49	t	n	0.24		n	0.18	
33	71.11	233.3	205	64	t	n	0.24		n	0.18	
34	72.75	238.7	87	86	t	n	0.24		n	0.18	
35	76.47	250.9	197	36	t	y	0.24	flow out	y	0.18	flow in
36	82.10	269.4	340	65	t	n	0.86		n	0.1	
37	90.18	295.9	270	3	s	y	0.86	flow in	y	0.1	flow out
38	91.95	301.7	114	85	t	n	0		n	0.08	
39	92.96	305.0	166	71	t	n	0		n	0.08	
40	93.77	307.6	301	77	t	n	0		n	0.08	
41	94.67	310.6	320	65	t	n	0		n	0.08	
42	96.66	317.1	313	85	t	n	0		n	0.08	
43	97.79	320.8	305	52	t	n	0		n	0.08	
44	99.28	325.7	162	87	t	n	0		n	0.08	
45	99.39	326.1	277	70	t	n	0		n	0.08	
46	99.50	326.5	292	68	t	n	0		n	0.08	
47	100.15	328.6	165	63	t	n	0		n	0.08	
48	100.78	330.6	263	15	s	n	0		y	0.08	flow in
49	101.60	333.3	320	66	t	n	0		n	0	
50	102.41	336.0	129	85	t	n	0		n	0	
51	102.96	337.8	317	52	t	n	0		n	0	
52	104.72	343.6	274	58	t	n	0		n	0	
53	104.92	344.2	287	72	t	n	0		n	0	

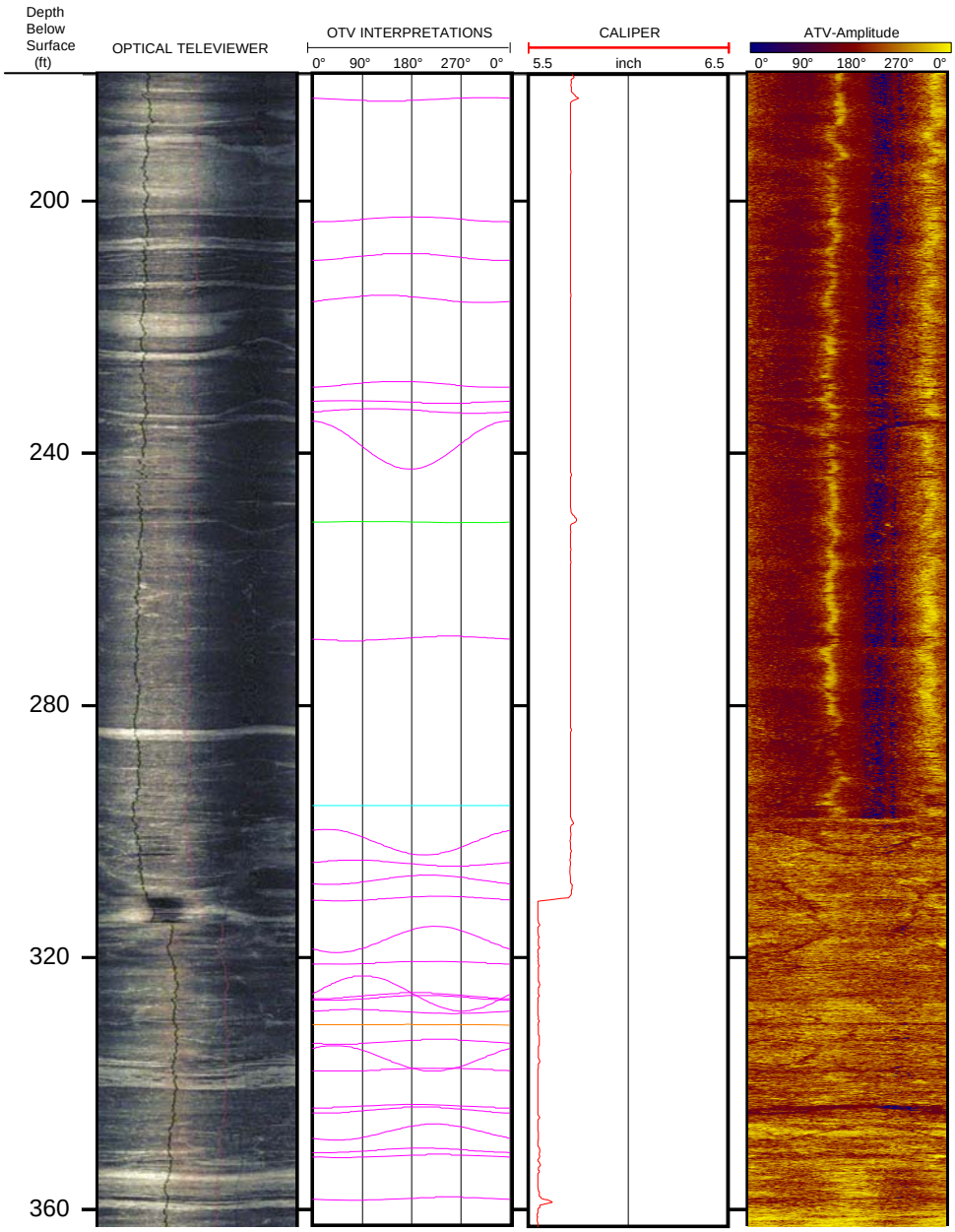
Appendix 11, continued. Midpoint depth, strike and dip of features identified in optical televiewer log, fracture type and heat pulse flowmeter data from May 2 (azimuth and dip reported using right hand rule convention; t = tectonic fractures, s = sheeting joints, p = foliation parallel fractures). Data shown under the pumping test have not been normalized.

54	105.98	347.7	312	83	t	n	0	n	0
55	106.85	350.6	289	65	t	n	0	n	0
56	107.14	351.5	321	56	t	n	0	n	0
57	109.20	358.3	339	57	t	n	0	n	0
58	110.93	363.9	181	54	t	n	0	n	0
59	111.61	366.2	161	84	t	n	0	n	0
60	112.32	368.5	31	35	t	n	0	n	0
61	115.15	377.8	18	45	t	n	0	n	0
62	115.15	377.8	203	77	t	n	0	n	0
63	117.70	386.2	349	69	t	n	0	n	0
64	118.20	387.8	67	80	t	n	0	n	0
65	120.44	395.2	303	82	t	n	0	n	0
66	122.81	402.9	164	79	t	n	0	n	0
67	123.10	403.9	100	39	t	n	0	n	0
68	123.68	405.8	331	83	t	n	0	n	0
69	126.89	416.3	65	74	t	n	0	n	0
70	129.58	425.1	54	59	t	n	0	n	0
71	130.18	427.1	95	82	t	n	0	n	0
72	132.04	433.2	29	85	t	n	0	n	0
73	142.70	468.2	200	57	t	n	0	n	0
74	150.25	493.0	21	75	t	n	0	n	0
75	151.30	496.4	217	64	t	n	0	n	0
76	153.24	502.8	144	83	t	n	0	n	0
77	161.28	529.1	1	72	t	n	0	n	0
78	162.60	533.5	188	48	t	n	0	n	0
79	163.97	538.0	171	63	t	n	0	n	0
80	165.98	544.6	189	41	t	n	0	n	0
81	169.29	555.4	12	77	t	n	0	n	0
82	171.63	563.1	108	58	t	n	0	n	0
83	175.05	574.3	272	83	t	n	0	n	0

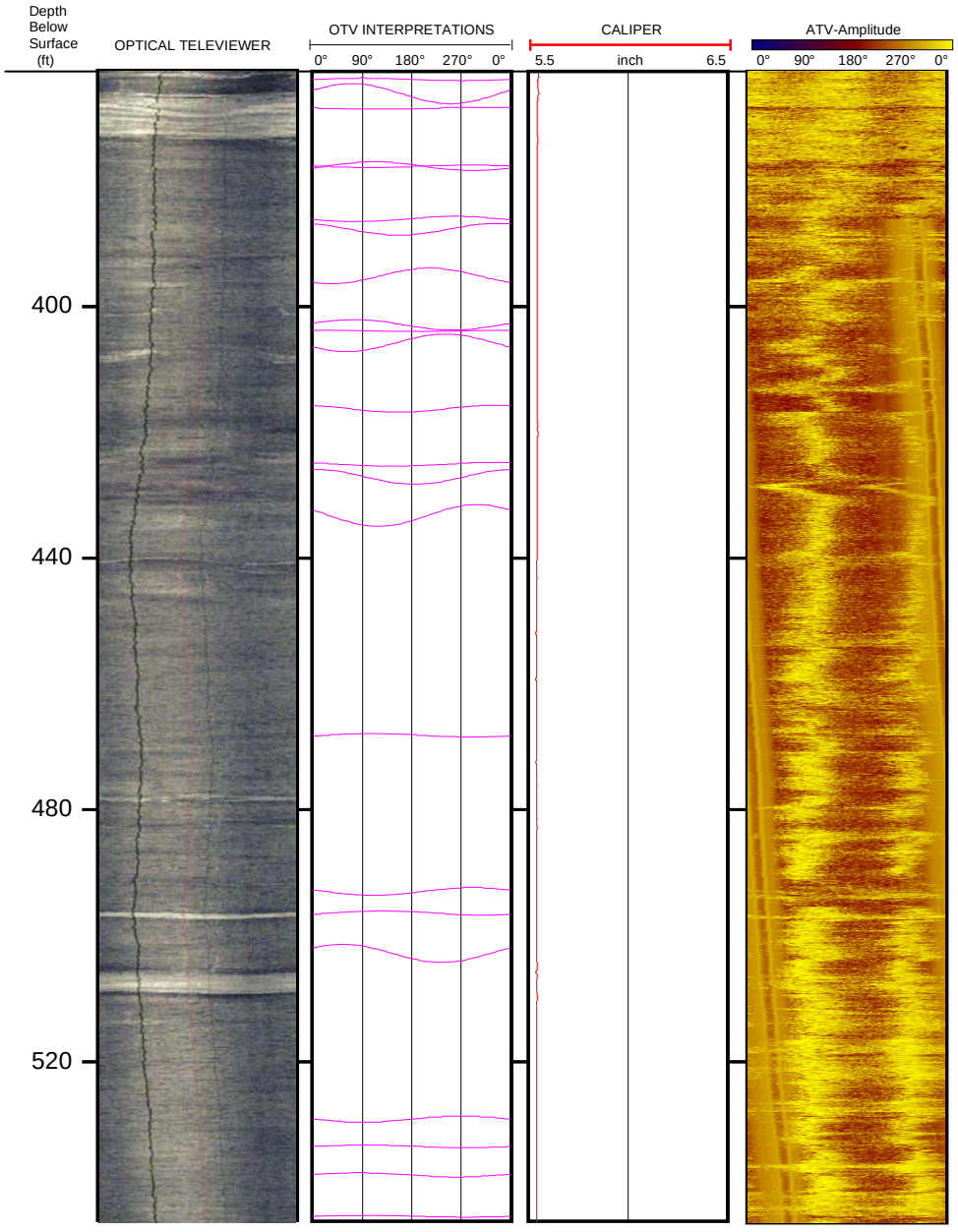
Appendix 11, continued. Interpreted features for May 2. Optical televiewer interpretations indicated by color: orange – subhorizontal sheeting joint; magenta – tectonic joint; red – foliation parallel fracture (FPF); cyan – transmissive subhorizontal sheeting joint; green – transmissive tectonic joint; grey – transmissive foliation parallel fracture (FPF). OTV – optical televiewer; ATV – acoustic televiewer.



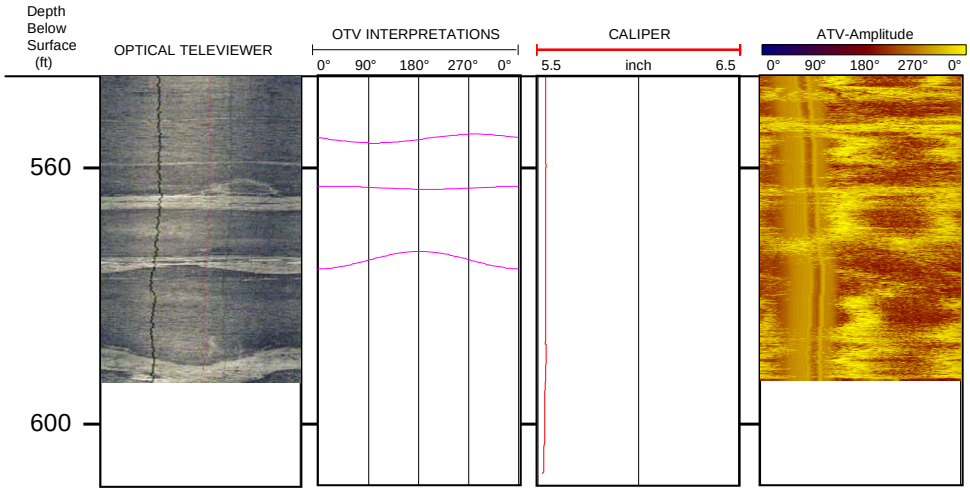
Appendix 11, continued. Interpreted features for May 2. Optical televiewer interpretations indicated by color: orange – subhorizontal sheeting joint; magenta – tectonic joint; red – foliation parallel fracture (FPF); cyan – transmissive subhorizontal sheeting joint; green – transmissive tectonic joint; grey – transmissive foliation parallel fracture (FPF). OTV – optical televiewer; ATV – acoustic televiewer.



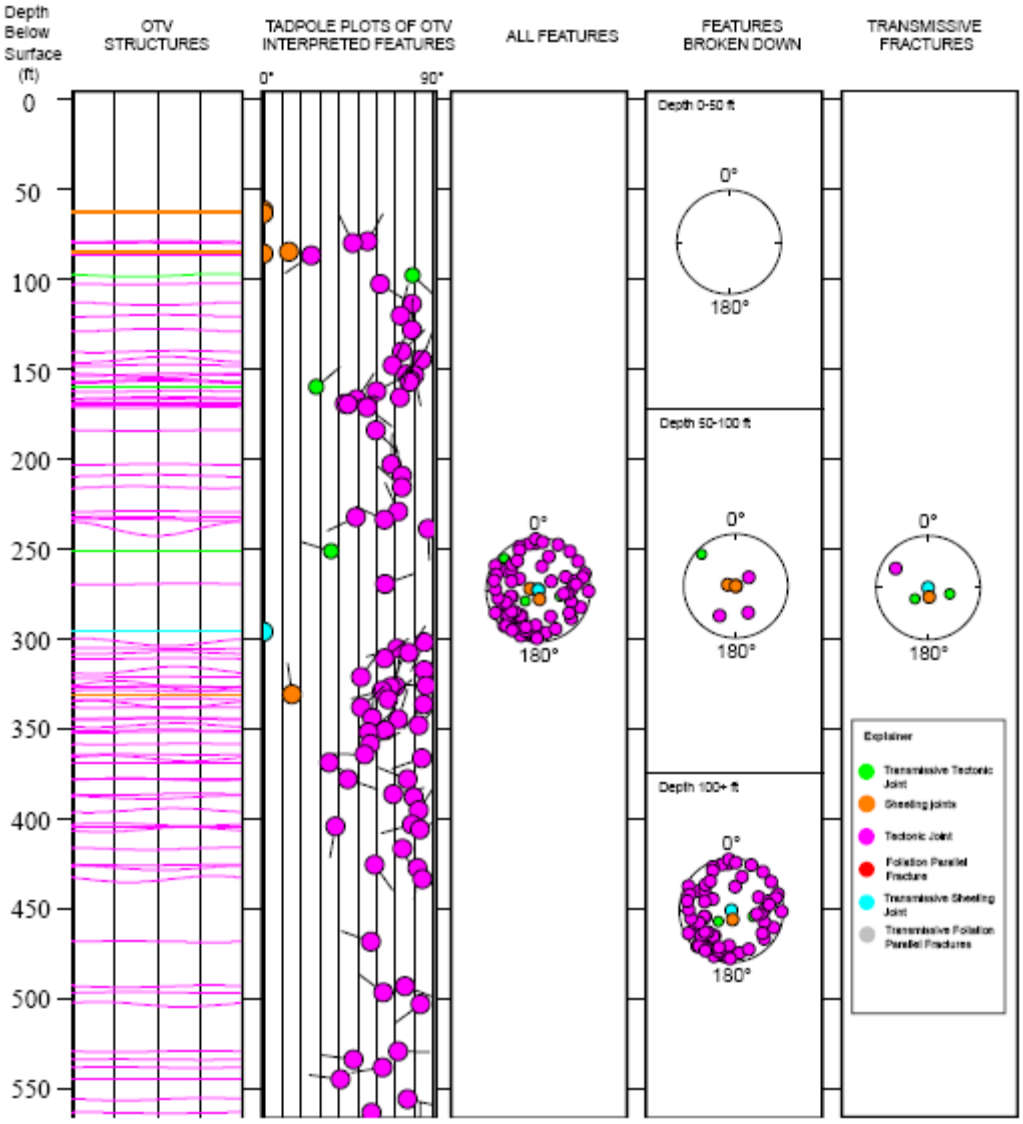
Appendix 11, continued. Interpreted features for May 2. Optical televiewer interpretations indicated by color: orange – subhorizontal sheeting joint; magenta – tectonic joint; red – foliation parallel fracture (FPF); cyan – transmissive subhorizontal sheeting joint; green – transmissive tectonic joint; grey – transmissive foliation parallel fracture (FPF). OTV – optical televiewer; ATV – acoustic televiewer.



Appendix 11, continued. Interpreted features for May 2. Optical televiewer interpretations indicated by color: orange – subhorizontal sheeting joint; magenta – tectonic joint; red – foliation parallel fracture (FPF); cyan – transmissive subhorizontal sheeting joint; green – transmissive tectonic joint; grey – transmissive foliation parallel fracture (FPF). OTV – optical televiewer; ATV – acoustic televiewer.



Appendix 11, continued. Tadpole plots and stereoplots of interpreted optical televiewer (OTV) structures for May 2. In the tadpole plot depth is plotted along the y-axis and magnitude of the dip plotted on the x-axis. The tail of the tadpole points in the direction of the dip, relative to true north, which is toward the top of the page. The stereonets represent poles to planar features plotted on a lower-hemisphere equal-area stereonet. Stereonets use right hand rule convention. Colors on the OTV structures plot correspond to those in the tadpole explanation.



Appendix 11, continued. Composite log for May 2 of natural gamma, fluid resistivity, fluid temperature and heat pulse flowmeter data under ambient and stressed (pumping) conditions. For the heat pulse flowmeter data collected under pumping conditions, the well was pumped at 0.5 gallons per minute and data have been normalized. The large outflow at approximately 270 feet may be associated with turning on one of the other water supply wells during the heat pulse flow meter test. Gamma tool not functioning from 0 to 420 feet.