

ANALYSIS OF MARMATON AND CHEROKEE GROUP CORE SAMPLES FOR
GAS CONTENT
-- DART CHEROKEE BASIN OPERATING COMPANY
#B1-20 McDANIEL; SW NW 20-T.31S.-R.16E., MONTGOMERY COUNTY,
KANSAS

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December 1, 2004

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SUMMARY

Five three-inch diameter core samples from the Pennsylvanian Marmaton and Cherokee Groups were collected from the Dart Cherokee Basin #B1-20 McDaniel; SW NW 20-T.31S.-R.16E., in Montgomery County, KS over November 8th, 2002. The following gas contents have been measured, based on the dry weight of the sample:

- 647.2' to 648.2' (Little Osage Shale) (3.2 scf/ton)
- 721.9' to 722.7' ('V shale") (23.9 scf/ton)
- 722.7' to 723.2' (Croweburg coal) (116.2 scf/ton)
- 998.9' to 999.7' (black shale 50' above Riverton coal) (2.7 scf/ton)
- 1124.3' to 1125.3' (black shale above Riverton coal) (3.7 scf/ton)

BACKGROUND

The Dart Cherokee Basin #B1-20 McDaniel well in sec. 20-T.31S.-R.16E (Montgomery County, KS) was selected for desorption tests in association with an on-going coalbed gas research project at the Kansas Geological Survey. The samples (3-inch-diameter core) were gathered November 8th, 2002 by K. David Newell of the Kansas Geological Survey. Samples were obtained during wireline coring. The well was drilled by a rig owned by Layne Christensen, Canada. Tichora, Inc., was charged with the responsibility to collect most of the coals from this well, but results for shale and minor coals collected separately by the Kansas Geological Survey are reported in this document.

Bottom-hole times (i.e., the time the core sample was lifted from the bottom of the hole) and canistering times (i.e., the time the sample was placed in the desorption canister) were noted in order to determine lost gas and start of desorption. Approximate wet weight of the sample was determined by subtraction of the weight of the empty canister from the weight of the canister with the sample in it. After the sample was removed from the canister, it was weighed again before air- or oven-drying, then weighed after drying. The weight loss is noted in the desorption table (Table 1).

Temperature baths for the desorption canisters were on site, with temperatures at 75 degrees F for the three shallower samples. The two deeper samples were desorbed at 80 degrees F. The canistered samples were later transported to the laboratory at the Kansas Geological Survey in Lawrence, KS and desorption measurements were continued at these temperatures. Desorption measurements were periodically made until the canisters produced no more gas upon testing for at least two successive measurements.

DESORPTION MEASUREMENTS

The equipment and method for measuring desorption gas is that prescribed by McLennan and others (1995). The volumetric displacement apparatus is a set of connected dispensing burettes, one of which measures the gas evolved from the desorption canister. The other burette compensates for the compression that occurs when the desorbed gas

displaces the water in the measuring burette. This compensation is performed by adjusting the cylinders so that their water levels are identical, then figuring the amount of gas that evolved by simply reading the difference in water level using the volumetric scale on the side of the burette.

Four of the five desorption canisters were commercially obtained from SSD, Inc. in Grand Junction, CO. On average, these canisters were approximately 12.5 inches high (32 cm), 3 1/2 inches (9 cm) in diameter, and enclosed a volume of approximately 150 cubic inches (2450 cm³). The one canister not commercially obtained was canister Brady #27, which was constructed in-house at the Kansas Geological Survey. This canister was approximately 15 inches high (38 cm), 3 inches (7.5 cm) in diameter, and enclosed a volume of approximately 106 cubic inches (1738 cm³).

The desorbed gas that collected in the desorption canisters was periodically released into the volumetric displacement apparatus and measured as a function of time, temperature and atmospheric pressure.

The time and atmospheric pressure were measured in the field using a portable weather station (model BA928) marketed by Oregon Scientific (Tualatin, OR). The atmospheric pressure was displayed in millibars on this instrument, however, this measurement was not the actual barometric pressure, but rather an altitude-compensated barometric pressure automatically converted to a sea-level-equivalent pressure. In order to translate this measurement to actual atmospheric pressure, a regression correlation was determined over several weeks by comparing readings from the Oregon Scientific instrument to that from a pressure transducer in the Petrophysics Laboratory in the Kansas Geological Survey in Lawrence, Kansas (Figure 1). The regression equation shown graphically in Figure 1 was entered into a spreadsheet and was used to automatically convert the millibar measurement to barometric pressure in psi.

A spreadsheet program written by K.D. Newell (Kansas Geological Survey) was used to convert all gas volumes at standard temperature and pressure. Conversion of gas volumes to standard temperature and pressure was by application of the perfect-gas equation, obtainable from basic college chemistry texts:

$$n = PV/RT$$

where n is moles of gas, T is degrees Kelvin (i.e., absolute temperature), V is in liters, and R is the universal gas constant, which has a numerical value depending on the units in which it is measured (for example, in the metric system $R = 0.0820$ liter atmosphere per degree mole). The number of moles of gas (i.e., the value n) is constant in a volumetric conversion, therefore the conversion equation, derived from the ideal gas equation, is:

$$(P_{stp} V_{stp}) / (RT_{stp}) = (P_{rig} V_{rig}) / (RT_{rig})$$

Customarily, standard temperature and pressure for gas volumetric measurements in the oil industry are 60 °F and 14.7 psi (see Dake, 1978, p. 13), therefore P_{stp} , V_{stp} , and T_{stp} , respectively, are pressure, volume and temperature at standard temperature and pressure, where standard temperature is degrees Rankine ($^{\circ}R = 460 + ^{\circ}F$). P_{rig} , V_{rig} , and T_{rig} , respectively, are ambient pressure, volume and temperature measurements taken at the rig site or in the desorption laboratory.

The universal gas constant R drops out as this equation is simplified and the determination of V_{stp} becomes:

$$V_{stp} = (T_{stp}/T_{rig}) (P_{rig}/P_{stp}) V_{rig}$$

The conversion calculations in the spreadsheet were carried out in the English metric system, as this is the customary measure system used in American coal and oil industry. V is therefore converted to cubic feet; P is psia; T is $^{\circ}R$.

The desorbed gas was summed over the time period for which the coal samples evolved all of their gas.

Lost gas (i.e., the gas lost from the sample from the time it was drilled, brought to the surface, to the time it was canistered) was determined using the direct method (Kissel and others, 1975; also see McLennan and others, 1995, p. 6.1-6.14) in which the cumulative gas evolved is plotted against the square root of elapsed time. Time zero is assumed to be instant the core sample is lifted from the bottom of the hole. Characteristically, the cumulative gas evolved from the sample, when plotted against the square root of time, is linear for a short time period after the sample reaches ambient pressure conditions, therefore lost gas is determined by a line projected back to time zero. The period of linearity generally is about two hours for core samples.

LITHOLOGIC ANALYSIS

Upon removal from the canisters, the cores were washed of drilling mud, and air-dried for several days. After drying, the cores were weighed again to obtain a dry-weight based gas content.

DATA PRESENTATION

Data and analyses accompanying this report are presented in the following order: 1) data tables for the desorption analyses, 2) lost-gas graphs, 3) desorption graphs for individual samples, and 4) desorption graph for all samples at a common scale.

Data Tables of the Desorption Analyses (Table 1)

These are the basic data used for lost-gas analysis and determination of total gas desorbed from the core samples. Basic temperature, volume, and barometric measurements are

listed at left. Farther to the right, these are converted to standard temperature, pressure and volumes. The volumes are cumulatively summed, and converted to scf/ton based on the total weight of coal and dark shale in the sample. At the right of the table, the time of the measurements are listed and converted to hours (and square root of hours) since the sample was drilled.

Lost-Gas Graphs (Figures 2-6)

Gas lost prior to the canistering of the sample was estimated by extrapolation of the first few data points after the sample was canistered. The linear characteristic of the initial desorption measurements was usually lost within the first two hours after canistering, thus data are presented in the lost-gas graphs for only up to 9 hours after canistering. Lost-gas volumes derived from this analysis are incorporated in the data tables described above.

Desorption Graphs (Figures 7-12)

These are desorption graph (gas content per weight vs. square root of time) for all the samples. The last graph in the series has all the desorption curves on it at a common scale.

RESULTS and DISCUSSION

The following gas contents are calculated, based on dry weight of the sample:

- 647.2' to 648.2' (Little Osage Shale) (3.2 scf/ton)
- 721.9' to 722.7' ("V shale") (23.9 scf/ton)
- 722.7' to 723.2' (Croweburg coal) (116.2 scf/ton)
- 998.9' to 999.7' (black shale 50' above Riverton coal) (2.7 scf/ton)
- 1124.3' to 1125.3' (black shale above Riverton coal) (3.7 scf/ton)

Simple ashing of the samples at the Kansas Geological Survey were carried out in a muffle furnace in which the samples were first weighed and then subjected to 110 °C until their weight stabilized. This first firing approximates moisture content. A second firing at 750 °C for three to four days essentially ashed the sample. Two crucibles of sample were utilized for both the 110 °C and 750 °C firings. Each crucible was filled with approximately 1.5 grams of pulverized material (i.e., < 0.0460" sieve size). Results were accepted if the difference in weight loss for each sample was less than 2%. The analyses are as follows:

<i>unit</i>	<i>depth</i>	<i>moisture</i>	<i>ash</i>	<i>moisture-free ash</i>
Little Osage Shale	647.2'	1.02%	87.91%	88.82%
"V shale"	721.9'	1.80%	76.40%	77.80%
Croweburg	722.7'	0.44%	11.05%	11.10%
sh. 50' over Riverton	998.9'	1.44%	91.82%	93.16%
sh. over Riverton	1124.3'	1.16%	92.05%	93.13%

Using the equation from McLennan and others (1995):

$$G_c = G_{pc} (1 - a_d)$$

where:

G_c = gas content, scf/ton

G_{pc} = "pure coal", gas content, scf/ton

a_d = dry ash content, weight fraction

the gas content of the samples converts to:

<i>unit</i>	<i>depth</i>	<i>moisture-free ash</i>	G_c	G_{pc}
Little Osage Shale	647.2'	88.82%	3.2 scf/ton	28.3 scf/ton
"V shale"	721.9'	76.40%	23.9 scf/ton	107.7 scf/ton
Croweburg	722.7'	11.10%	116.2 scf/ton	131.5 scf/ton
sh. 50' over Riverton	998.9'	93.16%	2.7 scf/ton	39.9 scf/ton
sh. over Riverton	1124.3'	93.13%	3.7 scf/ton	53.1 scf/ton

Samples were also tested for their density. The samples were weighed and immersed in water in a beaker filled to its brim. With placing the sample in the beaker, the displaced water was spilled from the beaker and subsequently weighed. The volume of the sample is thus easily converted to volume using 1 gram/cc for the density of the water. The following density measurements were calculated:

<i>unit</i>	<i>depth</i>	<i>density and uncertainty</i>
Little Osage Shale	647.2'	2.25 g/cc \pm 0.07
"V shale"	721.9'	2.34 g/cc \pm 0.11
Croweburg	722.7'	1.28 g/cc \pm 0.04
sh. 50' over Riverton	998.9'	2.27 g/cc \pm 0.10
sh. over Riverton	1124.3'	2.59 g/cc \pm 0.10

REFERENCES

- Dake, L.P., 1978, Fundamentals of Reservoir Engineering, Elsevier Scientific Publishing, New York, NY, 443 p.
- Kissel, F.N., McCulloch, C.M., and Elder, C.H., 1975, The direct method of determining methane content of coals for ventilation design: U.S. Bureau of Mines, Report of Investigations, RI7767.
- McLennan, J.D., Schafer, P.S., and Pratt, T.J., 1995, A guide to determining coalbed gas content: Gas Research Institute, Chicago, IL, Reference No. GRI-94/0396, 180 p.

FIGURES, TABLES, and APPENDICES

FIGURE 1. Correlation of field barometer to Petrophysics Lab pressure transducer.

TABLE 1. Desorption measurements for samples.

FIGURE 2. Lost-gas graph for 647.2' to 648.2' (Little Osage Shale).

FIGURE 3. Lost-gas graph for 721.9' to 722.7' ('V shale").

FIGURE 4. Lost-gas graph for 722.7' to 723.2' (Croweburg coal).

FIGURE 5. Lost-gas graph for 998.9' to 999.7' (black shale 50' above Riverton coal).

FIGURE 6. Lost-gas graph for 1124.3' to 1125.3' (black shale above Riverton coal).

FIGURE 7. Desorption graph for 647.2' to 648.2' (Little Osage Shale).

FIGURE 8. Desorption graph for 721.9' to 722.7' ('V shale").

FIGURE 9. Desorption graph for 722.7' to 723.2' (Croweburg coal).

FIGURE 10. Desorption graph for 998.9' to 999.7' (black shale 50' above Riverton coal).

FIGURE 11. Desorption graph for 1124.3' to 1125.3' (black shale above Riverton coal).

FIGURE 12. Desorption graph for all samples.

Correlation of Field Barometer to KGS Petrophysics Lab Barometer

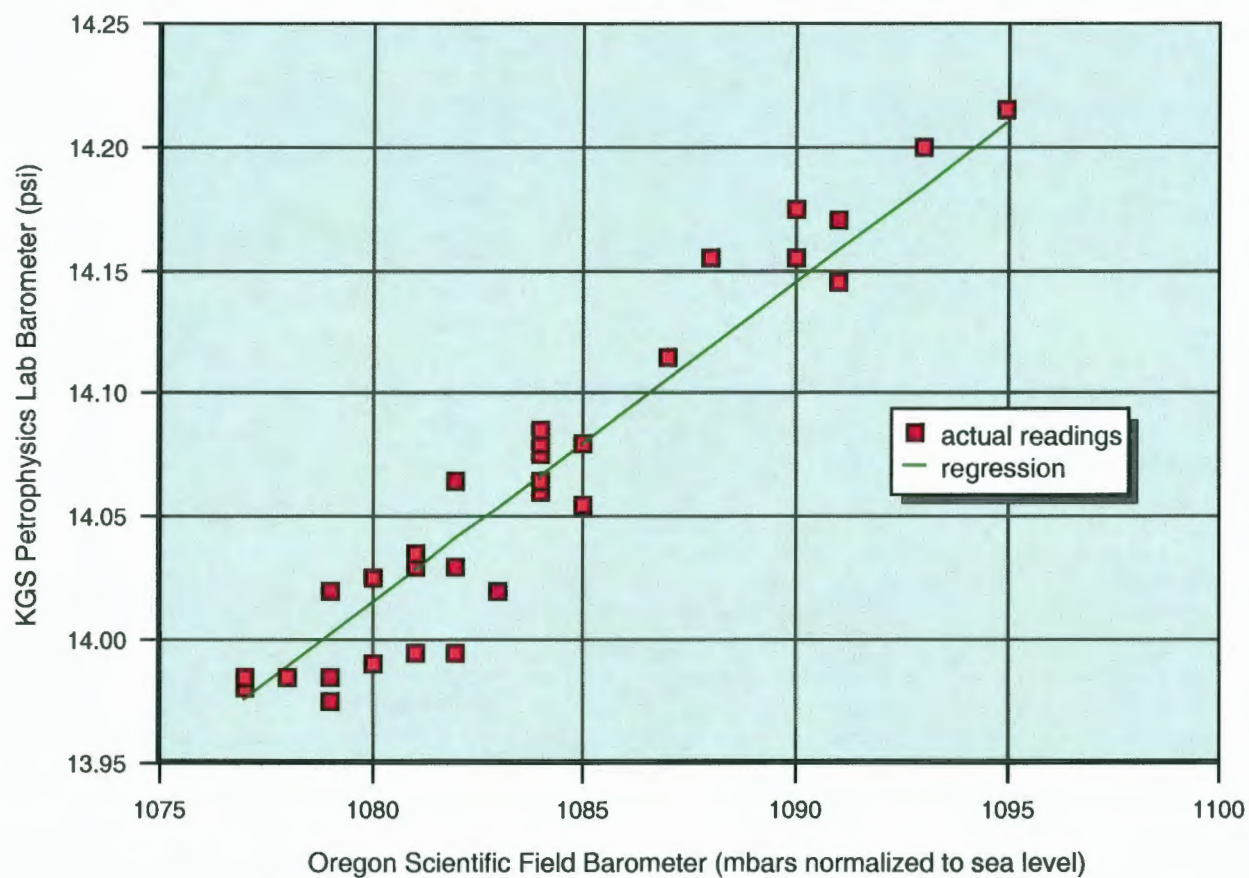


FIGURE 1.

TABLE 1 -- Description data for DART McDANIEL #B1-20; SW NW 20-T.31S.-R.16E.

SAMPLE: 647.2' to 648.2' (Little Osage Shale) in canister 10

dry sample weight:			lbs.	grams	wet sample weight:			lbs.	grams	moisture weight	est. lost gas (cc) =	TIME OF:		elapsed time (off bottom to canistering)		
			7.3536	3335.6				7.5334	3417.1	2.4%	11	off bottom	in canister	6.7 minutes		
												11/8/02 0:14	11/8/02 0:21	0.112 hours		
RIG/LAB MEASUREMENTS			CONVERSION OF RIG/LAB MEASUREMENTS TO STP (@60 deg F; 14.7 psi)						CUMULATIVE VOLUMES		SCF/TON	SCF/TON	TIME SINCE		0.335410197 SQRT (hrs)	
measured cc	measured T (F)	measured P	cubic ft	absolute T (F)	psia	cubic ft (@STP)	cc (@STP)	cubic ft (@STP)	cc (@STP)	without lost gas	with lost gas	TIME OF MEASURE	off bottom	in canister	SQRT hrs. (since off bottom)	
5	75	1086	0.0002	535	14.096	0.000164569	4.66	0.000164569	4.66	0.04	0.15	11/8/02 0:28	0:14:18	0:07:33	0.488193951	
1	75	1086	4E-05	535	14.096	3.29139E-05	0.93	0.000197483	5.59	0.05	0.16	11/8/02 0:31	0:17:10	0:10:25	0.534893551	
1	75	1086	4E-05	535	14.096	3.29139E-05	0.93	0.000230397	6.52	0.06	0.17	11/8/02 0:32	0:18:25	0:11:40	0.554025871	
2	75	1086	7E-05	535	14.096	6.58278E-05	1.86	0.000296225	8.39	0.08	0.19	11/8/02 0:35	0:21:10	0:14:25	0.593950989	
1	75	1086	4E-05	535	14.096	3.29139E-05	0.93	0.000329139	9.32	0.09	0.20	11/8/02 0:37	0:23:15	0:16:30	0.62249498	
1	75	1086	4E-05	535	14.096	3.29139E-05	0.93	0.000362053	10.25	0.10	0.20	11/8/02 0:40	0:28:00	0:19:15	0.658280589	
2	75	1086	7E-05	535	14.096	6.58278E-05	1.86	0.000427881	12.12	0.12	0.22	11/8/02 0:46	0:31:45	0:25:00	0.727438428	
2	75	1086	7E-05	535	14.096	6.58278E-05	1.86	0.000493708	13.98	0.13	0.24	11/8/02 0:50	0:36:00	0:29:15	0.774596669	
1	75	1086	4E-05	535	14.096	3.29139E-05	0.93	0.000526622	14.91	0.14	0.25	11/8/02 0:53	0:39:15	0:32:30	0.808805704	
1	75	1085	4E-05	535	14.083	3.28836E-05	0.93	0.000559506	15.84	0.15	0.26	11/8/02 1:13	0:58:45	0:52:00	0.989528507	
20	75	1085	0.0007	535	14.083	0.000657672	18.62	0.001217178	34.47	0.33	0.44	11/8/02 1:31	1:16:45	1:10:00	1.131002505	estimate
17	75	1085	0.0006	535	14.083	0.000559021	15.83	0.001776199	50.30	0.48	0.59	11/8/02 1:38	1:23:45	1:17:00	1.181453907	
2	75	1085	7E-05	535	14.083	6.57672E-05	1.86	0.001841966	52.16	0.50	0.61	11/8/02 1:40	1:25:45	1:19:00	1.195477589	
4	75	1085	0.0001	535	14.083	0.000131534	3.72	0.0019735	55.88	0.54	0.64	11/8/02 1:54	1:39:45	1:33:00	1.289379696	
3	75	1085	0.0001	535	14.083	9.86508E-05	2.79	0.002072151	58.68	0.56	0.67	11/8/02 2:01	1:46:45	1:40:00	1.333854065	
6	75	1085	0.0002	535	14.083	0.000197302	5.59	0.002269452	64.26	0.62	0.72	11/8/02 2:26	2:11:45	2:05:00	1.481834449	
9	75	1085	0.0003	535	14.083	0.000295952	8.38	0.002565405	72.64	0.70	0.80	11/8/02 3:06	2:51:45	2:45:00	1.691892432	
6	75	1085	0.0002	535	14.083	0.000197302	5.59	0.002762706	78.23	0.75	0.86	11/8/02 3:42	3:27:45	3:21:00	1.860779407	
9	75	1085	0.0003	535	14.083	0.000295952	8.38	0.003058658	86.61	0.83	0.94	11/8/02 4:42	4:27:45	4:21:00	2.112463017	
5	75	1085	0.0002	535	14.083	0.000164418	4.66	0.003223076	91.27	0.88	0.98	11/8/02 5:12	4:57:45	4:51:00	2.227666941	
53	75	1079	0.0019	535	14.005	0.001733192	49.08	0.004956269	140.35	1.35	1.45	11/8/02 10:22	10:07:45	10:01:00	3.182635176	estimate
10	75	1078	0.0004	535	13.992	0.000326714	9.25	0.005282983	149.60	1.44	1.54	11/8/02 11:14	10:59:45	10:53:00	3.315996582	
14	75	1076	0.0005	535	13.966	0.000456651	12.93	0.005739534	162.52	1.56	1.67	11/8/02 13:14	12:59:45	12:53:00	3.604973416	
6	75	1075	0.0002	535	13.953	0.000195483	5.54	0.005935017	168.06	1.61	1.72	11/8/02 14:17	14:02:45	13:56:00	3.747777119	
7	75	1076	0.0002	535	13.966	0.000228276	6.46	0.006163293	174.52	1.68	1.78	11/8/02 18:09	15:54:45	15:48:00	3.989047505	
2	75	1076	7E-05	535	13.966	6.52216E-05	1.65	0.006228515	176.37	1.69	1.80	11/8/02 17:15	17:00:45	16:54:00	4.124621195	
3	75	1077	0.0001	535	13.979	9.79234E-05	2.77	0.006326438	179.14	1.72	1.83	11/8/02 20:08	19:53:45	19:47:00	4.460474564	
34	75	1070	0.0012	535	13.888	0.001102585	31.22	0.007429023	210.37	2.02	2.13	11/9/02 10:16	34:01:45	33:55:00	5.83345238	
39	75	1087	0.0014	535	14.109	0.001284824	36.38	0.008713847	246.75	2.37	2.48	11/11/02 16:04	87:49:45	87:43:00	9.371721649	
11	75	1094	0.0004	535	14.200	0.00036472	10.33	0.009078567	257.08	2.47	2.57	11/12/02 9:39	105:24:45	105:18:00	10.26705898	
0	75	1091	0	535	14.181	0	0.00	0.009078567	257.08	2.47	2.57	11/12/02 19:07	114:52:45	114:46:00	10.71816993	
38	75	1081	0.0013	535	14.031	0.00124497	35.25	0.010323536	292.33	2.81	2.91	11/14/02 18:25	162:10:45	162:04:00	12.73495845	
15	75	1087	0.0005	535	14.109	0.000494163	13.99	0.010817699	306.32	2.94	3.05	11/16/02 22:31	214:16:45	214:10:00	14.63827745	
13	75	1085	0.0005	535	14.083	0.000427487	12.11	0.011245186	318.43	3.06	3.16	11/19/02 17:51	281:36:45	281:30:00	16.78131401	

SAMPLE DECANISTERED 11/24/02 DUE TO NO MORE GAS BEING EVOLVED; air dried 10 days

SAMPLE: 721.9' to 722.7' ("V shale") in canister H

dry sample weight:			lbs.	grams	wet sample weight:			lbs.	grams	moisture weight	est. lost gas (cc) =	TIME OF:		elapsed time (off bottom to canistering)		
			6.0478	2743.2				6.1110	2771.9	1.0%	28	off bottom	in canister	11.5 minutes		
											11/8/02 3:04		11/8/02 3:15	0.192 hours		
RIG/LAB MEASUREMENTS				CONVERSION OF RIG/LAB MEASUREMENTS TO STP (@60 deg F; 14.7 psi)						CUMULATIVE VOLUMES		SCF/TON	SCF/TON	TIME SINCE		0.437797518 SQRT (hrs)
measured cc	measured T (F)	measured P	cubic ft	absolute T (F)	psia	cubic ft (@STP)	cc (@STP)	cubic ft (@STP)	cc (@STP)	without lost gas	with lost gas	TIME OF MEASURE	off bottom	in canister	SQRT hrs. (since off bottom)	
3	75	1084	0.0001	535	14.070	9.85598E-05	2.79	9.85598E-05	2.79	0.03	0.36	11/8/02 3:20	0:16:15	0:04:45	0.5204185	
4	75	1084	0.0001	535	14.070	0.000131413	3.72	0.000229973	8.51	0.08	0.40	11/8/02 3:22	0:18:30	0:07:00	0.555277708	
5	75	1084	0.0002	535	14.070	0.000164266	4.65	0.000394239	11.18	0.13	0.48	11/8/02 3:29	0:25:00	0:13:30	0.645497224	
5	75	1084	0.0002	535	14.070	0.000164266	4.65	0.000558506	15.82	0.18	0.51	11/8/02 3:35	0:30:45	0:19:15	0.715891053	
4	75	1084	0.0001	535	14.070	0.000131413	3.72	0.000689919	19.54	0.23	0.56	11/8/02 3:41	0:36:45	0:25:15	0.782623792	
6	75	1083	0.0002	535	14.057	0.000196938	5.58	0.000868687	25.11	0.29	0.62	11/8/02 3:51	0:47:15	0:35:45	0.887411967	
5	75	1083	0.0002	535	14.057	0.000164115	4.65	0.001050972	29.76	0.35	0.67	11/8/02 4:01	0:57:15	0:45:45	0.976814551	
8	75	1083	0.0003	535	14.057	0.000262584	7.44	0.001313555	37.20	0.43	0.76	11/8/02 4:14	1:10:30	0:59:00	1.083974169	
13	75	1083	0.0005	535	14.057	0.000426699	12.08	0.001740254	49.28	0.58	0.90	11/8/02 4:41	1:36:45	1:25:15	1.26984251	
13	75	1083	0.0005	535	14.057	0.000426699	12.08	0.002166953	61.36	0.72	1.04	11/8/02 5:11	2:06:45	1:55:15	1.453444185	
90	75	1079	0.0032	535	14.005	0.002943157	83.34	0.005110109	144.70	1.69	2.02	11/8/02 10:23	7:18:45	7:07:15	2.704163457	
16	75	1078	0.0006	535	13.992	0.000522743	14.80	0.005632852	159.50	1.86	2.19	11/8/02 11:16	8:11:45	8:00:15	2.862836589	
25	75	1076	0.0009	535	13.966	0.00081527	23.09	0.006448123	182.59	2.13	2.46	11/8/02 13:16	10:11:45	10:00:15	3.193091501	
11	75	1075	0.0004	535	13.953	0.000358386	10.15	0.006806508	192.74	2.25	2.58	11/8/02 14:19	11:14:45	11:03:15	3.353480779	

17	75	1076	0.0006	535	13.966	0.000554384	15.70	0.007360892	208.44	2.43	2.76	11/8/02	16:10	13:05:45	12:54:15	3.618816565
8	75	1078	0.0003	535	13.966	0.000260887	7.39	0.007621779	215.82	2.52	2.85	11/8/02	17:12	14:07:45	13:56:15	3.758878379
18	75	1077	0.0006	535	13.979	0.00058754	16.64	0.008209319	232.46	2.71	3.04	11/8/02	20:05	17:00:45	16:49:15	4.124621195
73	75	1070	0.0026	535	13.888	0.002367315	67.03	0.010576834	299.50	3.50	3.82	11/9/02	10:10	31:05:45	30:54:15	5.576363809
138	75	1087	0.0049	535	14.109	0.0045463	128.74	0.015122934	428.23	5.00	5.33	11/11/02	14:10	83:05:45	82:54:15	9.115691599
57	75	1094	0.002	535	14.200	0.001889912	53.52	0.017012846	481.75	5.63	5.95	11/12/02	9:31	102:26:45	102:15:15	10.12155291
19	75	1091	0.0007	535	14.161	0.000682843	17.79	0.017641089	499.54	5.83	6.16	11/12/02	19:03	111:58:45	111:47:15	10.58202092
75	75	1081	0.0026	535	14.031	0.002457177	69.58	0.020098266	569.12	6.65	6.97	11/14/02	18:23	159:18:45	159:07:15	12.62190556
73	75	1087	0.0026	535	14.109	0.002404927	68.10	0.022503192	637.22	7.44	7.77	11/16/02	22:32	211:27:45	211:16:15	14.54175024
67	75	1085	0.0024	535	14.083	0.0022032	62.39	0.024706392	699.60	8.17	8.50	11/19/02	17:52	278:47:45	278:36:15	16.6971804
51	75	1085	0.0018	535	14.083	0.001677063	47.49	0.026383455	747.09	8.72	9.05	11/22/02	17:35	350:30:45	350:19:15	18.72197906
21	75	1092	0.0007	535	14.174	0.00069501	19.68	0.027078466	786.77	8.95	9.28	11/24/02	17:26	398:21:45	398:10:15	19.95902052
17	75	1093	0.0006	535	14.187	0.000563143	15.95	0.027641608	782.72	9.14	9.47	11/25/02	18:45	423:40:45	423:29:15	20.58346829
29	75	1092	0.001	535	14.174	0.000959776	27.18	0.028601385	809.90	9.46	9.79	11/27/02	18:40	471:35:45	471:24:15	21.71625735
46	75	1096	0.0016	535	14.226	0.00152798	43.27	0.030129365	853.17	9.96	10.29	12/3/02	18:54	615:49:45	615:38:15	24.81590552
38	75	1088	0.0013	535	14.122	0.001253031	35.48	0.031382397	888.65	10.38	10.71	12/6/02	14:26	683:21:45	683:10:15	26.14120311
40	75	1087	0.0014	535	14.109	0.001317768	37.31	0.032700165	925.96	10.81	11.14	12/10/02	10:39	775:34:45	775:23:15	27.84922201
28	75	1082	0.001	535	14.044	0.000918195	26.00	0.033618359	951.96	11.12	11.44	12/12/02	18:01	830:56:45	830:45:15	28.82613109
37	75	1074	0.0013	535	13.940	0.001204358	34.10	0.034822717	986.07	11.52	11.84	12/16/02	15:45	924:40:45	924:29:15	30.40853773
26	75	1078	0.0009	535	13.992	0.000849457	24.05	0.035672174	1010.12	11.80	12.12	12/19/02	20:44	1001:39:45	1001:28:15	31.64905212
14	75	1075	0.0005	535	13.953	0.000456127	12.92	0.036128301	1023.04	11.95	12.27	12/21/02	18:00	1046:55:45	1046:44:15	32.35628481
17	75	1088	0.0006	535	14.122	0.000560567	15.87	0.036688868	1038.91	12.13	12.46	12/23/02	19:19	1096:14:45	1096:03:15	33.10960334
56	75	1067	0.002	535	13.849	0.001810931	51.28	0.038499799	1090.19	12.73	13.06	12/29/02	21:41	1242:38:45	1242:25:15	35.25070921
14	75	1082	0.0005	535	14.044	0.000459097	13.00	0.038958896	1103.19	12.88	13.21	12/31/02	21:05	1290:00:45	1289:49:15	35.91674401
16	75	1087	0.0008	535	14.109	0.000527107	14.93	0.039486003	1118.11	13.06	13.39	1/3/03	12:28	1353:21:45	1353:10:15	36.78807551
28	75	1088	0.0009	535	14.122	0.000857337	24.28	0.04034334	1142.39	13.34	13.67	1/7/03	13:39	1450:34:45	1450:23:15	38.0864696
35	75	1088	0.0012	535	14.122	0.001154108	32.68	0.041497448	1175.07	13.72	14.05	1/13/03	18:18	1597:13:45	1597:02:15	39.96534958
36	75	1100	0.0013	535	14.278	0.001200175	33.99	0.042697623	1209.06	14.12	14.45	1/22/03	15:33	1812:28:45	1812:17:15	42.57322124
36	75	1095	0.0013	535	14.213	0.00119472	33.83	0.043892343	1242.89	14.52	14.84	1/29/03	13:50	1978:45:45	1978:34:15	44.48328338
30	75	1075	0.0011	535	13.953	0.000977415	27.68	0.044869758	1270.57	14.84	15.17	2/3/03	14:04	2098:59:45	2098:48:15	45.81479928
26	75	1083	0.0009	535	14.057	0.000853397	24.17	0.045723155	1294.73	15.12	15.45	2/10/03	14:22	2267:17:45	2267:06:15	47.61612997
28	75	1084	0.001	535	14.070	0.000919892	26.05	0.046643047	1320.78	15.42	15.75	2/17/03	14:06	2435:01:45	2434:50:15	49.3460147
16	75	1100	0.0006	535	14.278	0.000533411	15.10	0.047176458	1335.88	15.60	15.93	2/24/03	14:21	2603:16:45	2603:05:15	51.02233988
35	75	1076	0.0012	535	13.966	0.001141379	32.32	0.048317837	1368.20	15.98	16.31	3/8/03	14:01	2890:56:45	2890:45:15	53.76751653
20	75	1089	0.0007	535	14.135	0.000660096	18.69	0.048977933	1386.90	16.20	16.52	3/10/03	14:06	2939:01:45	2938:50:15	54.21281368
21	75	1072	0.0007	535	13.914	0.000682281	19.32	0.049660215	1406.22	16.42	16.75	3/20/03	11:51	3176:46:45	3176:35:15	56.36292369
10	75	1073	0.0004	535	13.927	0.000325199	9.21	0.049985414	1415.42	16.53	16.88	3/24/03	14:01	3274:56:45	3274:45:15	57.22714245
6	75	1077	0.0003	535	13.979	0.000261129	7.39	0.050246543	1422.82	16.82	16.94	3/31/03	17:20	3446:15:45	3446:04:15	58.70487629
32	75	1090	0.0011	535	14.148	0.001057124	29.93	0.051303687	1452.75	16.97	17.29	4/9/03	18:22	3663:17:45	3663:06:15	60.52516694
12	75	1078	0.0004	535	13.992	0.000392057	11.10	0.051695724	1463.85	17.10	17.42	4/14/03	15:18	3780:11:45	3780:00:15	61.48329719
6	75	1085	0.0002	535	14.083	0.000197302	5.59	0.051893025	1469.44	17.16	17.49	4/21/03	15:23	3948:18:45	3948:07:15	62.83559899
10	65	1081	0.0004	525	14.031	0.000333864	9.45	0.052226889	1478.90	17.27	17.60	4/28/03	11:09	4112:04:45	4111:53:15	64.12549545
33	75	1069	0.0012	535	13.875	0.001069156	30.28	0.053296045	1509.17	17.62	17.95	5/5/03	14:42	4283:37:45	4283:26:15	65.44943977
12	75	1088	0.0004	535	14.122	0.000395694	11.20	0.053691739	1520.38	17.78	18.08	5/12/03	14:21	4451:16:45	4451:05:15	66.71790739
18	75	1083	0.0006	535	14.057	0.000590813	16.73	0.054282553	1537.10	17.95	18.28	5/19/03	14:24	4619:19:45	4619:08:15	67.96564696
28	74	1082	0.001	534	14.044	0.000919914	26.05	0.055202467	1563.15	18.26	18.58	6/1/03	14:56	4931:51:45	4931:40:15	70.22722051
7	74	1081	0.0002	534	14.031	0.000229766	6.51	0.055432233	1569.66	18.33	18.66	6/3/03	11:00	4975:55:45	4975:44:15	70.54026628
9	76	1078	0.0003	536	13.992	0.000293494	8.31	0.055725727	1577.97	18.43	18.76	6/9/03	13:54	5122:49:45	5122:38:15	71.57394195
12	76	1087	0.0004	536	14.109	0.000394593	11.17	0.05612032	1589.14	18.58	18.89	6/16/03	1:14	5278:09:45	5277:58:15	72.65096352
19	78	1079	0.0007	538	14.005	0.000617868	17.50	0.056738188	1606.64	18.76	19.09	6/23/03	11:38	5456:33:45	5456:22:15	73.66854879
7	75	1088	0.0002	535	14.122	0.000230822	6.54	0.05696901	1613.18	18.84	19.17	6/30/03	11:12	5824:07:45	5823:56:15	74.99419422
22	78	1078	0.0008	538	13.992	0.000714764	20.24	0.057683773	1633.42	19.08	19.40	7/5/03	19:46	5752:41:45	5752:30:15	75.84652816
4	75	1081	0.0001	535	14.031	0.000131049	3.71	0.057814823	1637.13	19.12	19.45	7/7/03	14:00	5794:55:45	5794:44:15	76.12443213
15	79	1084	0.0005	539	14.070	0.000489142	13.85	0.058303965	1650.98	19.28	19.61	7/15/03	13:51	5986:46:45	5986:35:15	77.37427975
14	78	1079	0.0005	538	14.005	0.000455271	12.89	0.058759236	1663.87	19.43	19.76	7/21/03	16:24	6133:19:45	6133:08:15	78.31557423
12	77	1081	0.0004	537	14.031	0.000391684	11.09	0.05915092	1674.96	19.56	19.89	7/28/03	20:20	6305:15:45	6305:04:15	79.40568305
0	70	1079	0	530	14.005	0	0.00	0.05915092	1674.96	19.56	19.89	8/4/03	13:41	6466:36:45	6466:25:15	80.41525042
18	78	1086	0.0006	538	14.096	0.000589146	16.86	0.059740067	1691.84	19.76	20.08	8/11/03	13:56	6634:51:45	6634:40:15	81.45466531
22	84	1082	0.0008	544	14.044	0.000709503	20.09	0.06044957	1711.73	19.99	20.32	8/18/03	19:57	6808:52:45	6808:41:15	82.5159328
9	80	1083	0.0003	540	14.057	0.000292671	8.29	0.060742241	1720.02	20.09	20.41	8/24/03	22:43	6955:38:45	6955:27:15	83.40051459
12	84	1086	0.0004	544	14.096	0.000388432	11.00	0.061130674	1731.02	20.22	20.54	9/1/03	14:45	7139:40:45	7139:29:15	84.49662222
-4	73	1084	-0.0001	533	14.070	-0.000131906	-3.74	0.060998767	1727.29	20.17	20.50	9/8/03	14:01	7306:58:45	7306:45:15	85.4808752
6	76	1085	0.0002	536	14.083	0.000196933	5.58	0.061195701	1732.86							

-6	72	1091	-0.0002	532	14.161	-0.000199511	-5.65	0.061322284	1736.45	20.28	20.61	9/29/03	18:50	7815:45:45	7815:34:15	88.40680121
11	77	1085	0.0004	537	14.083	0.000360372	10.20	0.061682656	1746.85	20.40	20.73	10/6/03	12:03	7976:58:45	7976:47:15	89.31393602
23	80	1084	0.0008	540	14.070	0.000748629	21.20	0.062431285	1767.85	20.65	20.97	10/14/03	23:00	8179:55:45	8179:44:15	90.44296085
5	78	1081	0.0002	538	14.031	0.000162898	4.61	0.062594184	1772.46	20.70	21.03	10/20/03	15:38	8316:33:45	8316:22:15	91.19518902
-1	69	1075	-4E-05	529	13.953	-3.295E-05	-0.93	0.062561234	1771.53	20.69	21.02	10/27/03	15:02	8483:57:45	8483:46:15	92.10842795
9	73	1080	0.0003	533	14.018	0.000295694	8.37	0.062856927	1779.90	20.79	21.11	11/3/03	10:10	8647:05:45	8648:54:15	92.98976198
5	75	1085	0.0002	535	14.083	0.000164418	4.66	0.063021345	1784.56	20.84	21.17	11/10/03	11:15	8816:10:45	8815:59:15	93.89451084
16	75	1069	0.0006	535	13.875	0.000518379	14.68	0.063539724	1799.24	21.01	21.34	11/17/03	16:24	8989:19:45	8989:08:15	94.8120729
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6	70	1083	0.0002	530	14.057	0.000198796	5.63	0.083772293	1805.82	21.09	21.42	12/10/03	14:58	9539:53:45	9539:42:15	97.67239033
12	76	1087	0.0004	536	14.109	0.000394593	11.17	0.064166886	1817.00	21.22	21.55	12/16/03	14:22	9683:17:45	9683:06:15	98.40373892
5	75	1081	0.0002	535	14.031	0.000163812	4.64	0.064330698	1821.64	21.27	21.60	12/22/03	16:07	9829:02:45	9828:51:15	99.14154444
11	73	1082	0.0004	533	14.044	0.000362073	10.25	0.064692771	1831.89	21.39	21.72	12/29/03	14:34	9995:29:45	9995:18:15	99.97747663
-4	73	1103	-0.0001	533	14.316	-0.000134218	-3.80	0.064558552	1828.09	21.35	21.68	1/6/04	15:11	10188:06:45	10187:55:15	100.9361803
9	75	1093	0.0003	535	14.187	0.000298134	8.44	0.064856687	1836.53	21.45	21.78	1/12/04	11:45	10328:40:45	10328:29:15	101.6301095
9	73	1089	0.0003	533	14.135	0.000298158	8.44	0.065154845	1844.97	21.55	21.87	1/21/04	10:35	10543:30:45	10543:19:15	102.6816074
3	70	1091	0.0001	530	14.181	0.000100132	2.84	0.065254977	1847.81	21.58	21.91	1/27/04	10:11	10687:06:45	10686:55:15	103.3784915
13	73	1085	0.0005	533	14.083	0.000429091	12.15	0.065684068	1859.96	21.72	22.05	2/2/04	15:42	10836:37:45	10836:26:15	104.0991314
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7	75	1091	0.0002	535	14.161	0.000231458	6.55	0.066081162	1871.20	21.85	22.18	2/18/04	14:24	11171:19:45	11171:08:15	105.6945087
10	75	1086	0.0004	535	14.096	0.000329139	9.32	0.066410301	1880.52	21.96	22.29	2/23/04	14:31	11339:26:45	11339:15:15	106.4868341
5	75	1091	0.0002	535	14.161	0.000165327	4.68	0.066575628	1885.20	22.02	22.34	3/2/04	10:46	11527:41:45	11527:30:15	107.3671078
7	75	1088	0.0002	535	14.122	0.000230822	6.54	0.06680645	1891.74	22.09	22.42	3/8/04	10:06	11671:01:45	11670:50:15	108.0325375
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0	77	1097	0	537	14.239	0	0.00	0.067134687	1901.04	22.20	22.53	3/22/04	10:08	12007:01:45	12006:50:15	109.5765904
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12	75	1080	0.0004	535	14.018	0.000392785	11.12	0.067692653	1916.84	22.39	22.71	4/6/04	14:44	12371:39:45	12371:28:15	111.2279753
-1	74	1086	-4E-05	534	14.096	-3.29755E-05	-0.93	0.067659677	1915.90	22.38	22.70	4/12/04	15:02	12515:57:45	12515:46:15	111.8747626
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3	76	1090	0.0001	536	14.148	9.89205E-05	2.80	0.068087115	1928.01	22.52	22.84	4/26/04	11:35	12848:30:45	12848:19:15	113.3512792
7	74	1083	0.0002	534	14.057	0.000230191	6.52	0.068317306	1934.52	22.59	22.92	5/3/04	19:11	13024:06:45	13023:55:15	114.1232338
11	76	1081	0.0004	536	14.031	0.000359714	10.19	0.068677019	1944.71	22.71	23.04	5/10/04	14:04	13186:59:45	13186:48:15	114.8346456
1	75	1082	4E-05	535	14.044	3.27927E-05	0.93	0.068709812	1945.64	22.72	23.05	5/17/04	9:46	13350:41:45	13350:30:15	115.5452112
14	76	1075	0.0005	538	13.953	0.000453584	12.84	0.069163396	1958.48	22.87	23.20	5/24/04	10:33	13519:28:45	13519:17:15	116.2732952
2	75	1077	7E-05	535	13.979	6.52823E-05	1.85	0.069228678	1960.33	22.89	23.22	6/1/04	10:57	13711:52:45	13711:41:15	117.0977334
6	76	1076	0.0002	536	13.966	0.0001953	5.53	0.069423978	1965.86	22.96	23.29	6/7/04	10:38	13855:33:45	13855:22:15	117.7096534
9	79	1078	0.0003	539	13.992	0.000291861	8.26	0.069715839	1974.13	23.05	23.38	6/14/04	10:51	14023:46:45	14023:35:15	118.4220383
1	76	1082	4E-05	536	14.044	3.27315E-05	0.93	0.06974857	1975.05	23.07	23.39	6/23/04	16:27	14245:22:45	14245:11:15	119.3540078
5	77	1082	0.0002	537	14.044	0.000163353	4.83	0.069911923	1979.68	23.12	23.45	7/1/04	11:55	14432:50:45	14432:39:15	120.1387797
5	78	1081	0.0002	538	14.031	0.000162898	4.61	0.070074821	1984.29	23.17	23.50	7/7/04	10:34	14575:29:45	14575:18:15	120.7290182
6	79	1082	0.0002	539	14.044	0.000195296	5.53	0.070270117	1989.82	23.24	23.57	7/13/04	14:22	14723:17:45	14723:06:15	121.3395889
4	75	1080	0.0001	535	14.018	0.000130928	3.71	0.070401045	1993.53	23.28	23.61	7/19/04	11:23	14864:18:45	14864:07:15	121.9192868
-2	76	1091	-7E-05	536	14.161	-8.60075E-05	-1.87	0.070335038	1991.66	23.26	23.59	7/26/04	10:24	15031:19:45	15031:08:15	122.6023212
9	77	1079	0.0003	537	14.005	0.00029322	8.30	0.070628257	1999.96	23.38	23.68	8/2/04	14:44	15203:39:45	15203:28:15	123.3031326
2	78	1086	7E-05	538	14.096	6.54607E-05	1.85	0.070693718	2001.82	23.38	23.71	8/9/04	14:00	15370:55:45	15370:44:15	123.9795514
0	76	1088	0	536	14.122	0	0.00	0.070693718	2001.82	23.38	23.71	8/16/04	11:06	15536:01:45	15535:50:15	124.6436086
7	75	1076	0.0002	535	13.966	0.000228276	6.46	0.070921994	2008.28	23.45	23.78	8/23/04	14:10	15707:05:45	15706:54:15	125.3279531
3	76	1087	0.0001	536	14.109	9.86482E-05	2.79	0.071020642	2011.07	23.49	23.81	8/30/04	16:45	15877:40:45	15877:29:15	126.0066632
1	75	1088	4E-05	535	14.122	3.29745E-05	0.93	0.071053616	2012.01	23.50	23.82	9/7/04	15:57	16068:52:45	16068:41:15	126.7630828
10	76	1073	0.0004	536	13.927	0.000324592	9.19	0.071378209	2021.20	23.60	23.93	9/14/04	18:40	16239:35:45	16239:24:15	127.4346728
-1	76	1083	-4E-05	536	14.057	-3.27617E-05	-0.93	0.071345447	2020.27	23.59	23.92	9/21/04	18:46	16405:41:45	16405:30:15	128.0847213
-2	75	1089	-7E-05	535	14.135	-6.80096E-05	-1.87	0.071279437	2018.40	23.57	23.90	9/28/04	21:04	16577:59:45	16577:48:15	128.7555662

SAMPLE DECANISTERED 09/29/04 DUE TO NO MORE GAS BEING EVOLVED; air dried 15 days

SAMPLE: 722.7' to 723.2' (Croweburg coal) in canister 1

SAMPLE: 722.7 TO 723.2 (ROWING)		lbs.		grams	lbs.		grams	moisture weight	est. lost gas (cc) =		TIME OF:		elapsed time (off bottom to canistering)				
dry sample weight:		1.9778		897.11	wet sample weight:		1.9973		905.94	1.0%	70		off bottom	in canister	7.9 minutes		
											11/8/02 3:04		11/8/02 3:12	0.132 hours			
RIG/LAB MEASUREMENTS				CONVERSION OF RIG/LAB MEASUREMENTS TO STP (@60 deg F; 14.7 psi)						SCF/TON		SCF/TON		TIME SINCE		0.363241579 SQRT (hrs)	
measured cc	measured T (F)	measured P	cubic ft absolute	T (F)	psia	cubic ft (@STP)	cc (@STP)	cubic ft (@STP)	cc (@STP)	without lost gas	with lost gas	TIME OF MEASURE	off bottom	in canister	SQRT hrs. (since off bottom)		
23	75	1084	0.0008	535	14.070	0.000755625	21.40	0.000755625	21.3968	0.78	3.26	11/8/02 3:18	0:13:45	0:05:50	0.478713554		
7	75	1084	0.0002	535	14.070	0.000229973	8.51	0.000985598	27.9089	1.00	3.50	11/8/02 3:19	0:15:15	0:07:20	0.504149449		
12	75	1084	0.0004	535	14.070	0.000394239	11.16	0.001379838	39.0725	1.40	3.90	11/8/02 3:23	0:19:15	0:11:20	0.586421516		

15	75	1084	0.0005	535	14.070	0.000492799	13.95	0.001872837	53.027	1.89	4.39	11/8/02	3:28	0:24:15	0:16:20	0.835741037
6	75	1084	0.0002	535	14.070	0.00019712	5.58	0.002069757	58.6088	2.09	4.59	11/8/02	3:31	0:27:00	0:19:05	0.670820393
4	75	1084	0.0001	535	14.070	0.000131413	3.72	0.00220117	62.3299	2.23	4.73	11/8/02	3:32	0:28:15	0:20:20	0.686172962
5	75	1084	0.0002	535	14.070	0.000164266	4.85	0.002365436	66.9814	2.39	4.89	11/8/02	3:34	0:29:45	0:21:50	0.704154339
10	75	1084	0.0004	535	14.070	0.000328533	9.30	0.002693969	76.2844	2.72	5.22	11/8/02	3:37	0:33:30	0:25:35	0.747217059
15	75	1084	0.0005	535	14.070	0.000492799	13.95	0.003186768	90.2389	3.22	5.72	11/8/02	3:44	0:39:45	0:31:50	0.81394103
15	75	1083	0.0005	535	14.057	0.000492345	13.94	0.003679113	104.18	3.72	6.22	11/8/02	3:50	0:45:45	0:37:50	0.87321246
20	75	1083	0.0007	535	14.057	0.000656459	18.59	0.004335572	122.769	4.38	6.88	11/8/02	4:00	0:55:45	0:47:50	0.983392916
20	75	1083	0.0007	535	14.057	0.000656459	18.59	0.004992031	141.358	5.05	7.55	11/8/02	4:13	1:08:45	1:00:50	1.070436048
36	75	1083	0.0013	535	14.057	0.001181627	33.46	0.006173658	174.818	6.24	8.74	11/8/02	4:40	1:35:45	1:27:50	1.263262971
35	75	1083	0.0012	535	14.057	0.001148804	32.53	0.007322462	207.348	7.40	9.90	11/8/02	5:10	2:05:45	1:57:50	1.447699324
216	75	1079	0.0076	535	14.005	0.007063576	200.02	0.014386038	407.366	14.55	17.05	11/8/02	10:20	7:15:45	7:07:50	2.694902596
39	75	1078	0.0014	535	13.992	0.001274186	36.08	0.015660224	443.446	15.84	18.34	11/8/02	11:15	8:10:45	8:02:50	2.859924241
62	75	1076	0.0022	535	13.966	0.002021871	57.25	0.017682095	500.699	17.88	20.38	11/8/02	13:15	10:10:45	10:02:50	3.190480633
30	75	1075	0.0011	535	13.953	0.000977415	27.68	0.01865951	528.376	18.87	21.37	11/8/02	14:18	11:13:45	11:05:50	3.350994877
45	75	1076	0.0016	535	13.966	0.001487487	41.55	0.020126997	569.931	20.35	22.85	11/8/02	16:08	13:03:45	12:55:50	3.614208074
25	75	1076	0.0009	535	13.966	0.00081527	23.09	0.020942267	593.017	21.18	23.68	11/8/02	17:14	14:09:45	14:01:50	3.763309714
50	75	1077	0.0018	535	13.979	0.001632056	46.21	0.022574324	639.231	22.83	25.33	11/8/02	18:07	15:02:45	14:54:50	3.87895891
184	75	1070	0.0065	535	13.888	0.005966931	168.96	0.028541255	808.195	28.86	31.36	11/9/02	10:13	31:08:45	31:00:50	5.580845217
372	75	1087	0.0131	535	14.109	0.012255242	347.03	0.040796497	1155.22	41.25	43.75	11/11/02	14:07	83:02:45	82:54:50	9.112948663
152	75	1094	0.0054	535	14.200	0.005039766	142.71	0.045836263	1297.93	46.35	48.85	11/12/02	9:36	102:31:45	102:23:50	10.1256687
54	75	1091	0.0019	535	14.161	0.001785533	50.56	0.047621796	1348.49	48.16	50.66	11/12/02	19:05	112:00:45	111:52:50	10.5835958
102	75	1080	0.0036	535	14.018	0.003338669	94.54	0.050960465	1443.03	51.53	54.03	11/13/02	18:48	135:43:45	135:35:50	11.65028612
96	75	1081	0.0034	535	14.031	0.003145186	89.06	0.054105651	1532.1	54.71	57.21	11/14/02	18:22	159:17:45	159:09:50	12.62124532
175	75	1087	0.0062	535	14.109	0.005785235	163.25	0.059870886	1695.35	60.54	63.04	11/16/02	22:35	211:30:45	211:22:50	14.54346932
180	75	1085	0.0064	535	14.083	0.005919045	167.61	0.065789932	1862.96	66.53	69.03	11/19/02	17:54	278:49:45	278:41:50	16.69817854
115	75	1085	0.0041	535	14.083	0.003781612	107.08	0.069571544	1970.04	70.35	72.85	11/22/02	17:36	350:31:45	350:23:50	18.72242417
55	75	1092	0.0019	535	14.174	0.001820266	51.54	0.071391809	2021.58	72.19	74.69	11/24/02	17:28	398:23:45	398:15:50	19.95985554
36	75	1093	0.0013	535	14.187	0.001192538	33.77	0.072584347	2055.35	73.40	75.90	11/25/02	19:47	424:42:45	424:34:50	20.60855405
57	75	1092	0.002	535	14.174	0.001888457	53.42	0.074470804	2108.77	75.31	77.81	11/27/02	18:42	471:37:45	471:29:50	21.71702481
89	75	1096	0.0031	535	14.226	0.00295631	83.71	0.077427114	2192.48	78.30	80.80	12/3/02	18:55	615:50:45	615:42:50	24.81624132
71	75	1088	0.0025	535	14.122	0.00234119	66.29	0.079768304	2258.78	80.66	83.16	12/6/02	14:38	683:33:45	683:25:50	26.14502821
73	75	1087	0.0026	535	14.109	0.002404927	68.10	0.082173231	2326.88	83.10	85.60	12/10/02	10:40	775:35:45	775:27:50	27.84952124
51	75	1082	0.0018	535	14.044	0.001672426	47.36	0.083845657	2374.24	84.79	87.29	12/12/02	18:02	830:57:45	830:49:50	28.82642017
67	75	1074	0.0024	535	13.940	0.002180864	61.75	0.08602652	2435.99	86.99	89.49	12/16/02	15:46	924:41:45	924:33:50	30.40881177
48	75	1078	0.0017	535	13.992	0.001568229	44.41	0.087594749	2480.4	88.58	91.08	12/19/02	20:45	1001:40:45	1001:32:50	31.64931542
74	75	1075	0.0026	535	13.953	0.002410958	68.27	0.090005707	2548.67	91.02	93.52	12/21/02	18:03	1046:58:45	1046:50:50	32.35705745
31	75	1088	0.0011	535	14.122	0.00102221	28.95	0.091027917	2577.61	92.05	94.55	12/23/02	19:21	1096:16:45	1096:08:50	33.11010671
90	75	1067	0.0032	535	13.849	0.002910425	82.41	0.093938341	2660.03	94.99	97.49	12/29/02	21:42	1242:37:45	1242:29:50	35.25094561
24	75	1082	0.0008	535	14.044	0.000787024	22.29	0.094725385	2682.31	95.79	98.29	12/31/02	21:07	1290:02:45	1289:54:50	35.91720804
38	75	1087	0.0013	535	14.109	0.00125188	35.45	0.095977245	2717.76	97.06	99.55	1/3/03	12:27	1353:22:45	1353:14:50	36.78830204
43	75	1088	0.0015	535	14.122	0.001417904	40.15	0.097395149	2757.91	98.49	100.99	1/7/03	13:40	1450:35:45	1450:27:50	38.0866884
57	75	1088	0.002	535	14.122	0.001879547	53.22	0.099274695	2811.14	100.39	102.89	1/13/03	18:19	1597:14:45	1597:06:50	39.96555809
58	75	1100	0.002	535	14.278	0.001933615	54.75	0.101208311	2865.89	102.34	104.84	1/22/03	15:34	1812:29:45	1812:21:50	42.57341698
55	75	1095	0.0019	535	14.213	0.001825266	51.69	0.103033577	2917.57	104.19	106.69	1/29/03	13:51	1978:46:45	1978:38:50	44.48347071
46	75	1075	0.0016	535	13.953	0.001498703	42.44	0.104532281	2960.01	105.71	108.21	2/3/03	14:05	2099:00:45	2098:52:50	45.81498117
40	75	1083	0.0014	535	14.057	0.001312919	37.18	0.1058452	2997.19	107.03	109.53	2/10/03	14:23	2267:18:45	2267:10:50	47.61630498
40	75	1084	0.0014	535	14.070	0.001314131	37.21	0.107159331	3034.4	108.36	110.86	2/17/03	14:07	2435:02:45	2434:54:50	49.34818357
25	75	1100	0.0009	535	14.278	0.000833455	23.60	0.107992786	3058	109.21	111.71	2/24/03	14:21	2603:18:45	2603:08:50	51.02233988
49	75	1076	0.0017	535	13.966	0.00159793	45.25	0.109590716	3103.25	110.82	113.32	3/8/03	14:02	2890:57:45	2890:49:50	53.76767151
25	75	1089	0.0009	535	14.135	0.00082512	23.36	0.110415836	3126.82	111.66	114.16	3/10/03	14:06	2939:01:45	2938:53:50	54.21281368
21	75	1072	0.0007	535	13.914	0.000682281	19.32	0.111098117	3145.94	112.35	114.85	3/20/03	11:53	3176:48:45	3176:40:50	56.36321939
10	75	1073	0.0004	535	13.927	0.000325199	9.21	0.111423316	3155.15	112.67	115.17	3/24/03	14:02	3274:57:45	3274:49:50	57.22728807
4	75	1077	0.0001	535	13.979	0.000130565	3.70	0.111553881	3158.84	112.81	115.31	3/31/03	17:21	3446:18:45	3446:08:50	58.70501824
34	75	1090	0.0012	535	14.148	0.001123194	31.81	0.112677075	3190.65	113.94	116.44	4/9/03	18:24	3663:19:45	3663:11:50	60.52544231
12	75	1078	0.0004	535	13.992	0.000392057	11.10	0.113069132	3201.75	114.34	116.84	4/14/03	15:16	3780:11:45	3780:03:50	61.48329719
3	75	1085	0.0001	535	14.083	9.86508E-05	2.79	0.113167783	3204.54	114.44	116.94	4/21/03	15:24	3948:19:45	3948:11:50	62.83573161
9	65	1081	0.0003	525	14.031	0.000300478	8.51	0.113468261	3213.05	114.74	117.24	4/28/03	11:10	4112:05:45	4111:57:50	64.1256254
40	75	1069	0.0014	535	13.875	0.001295947	38.70	0.114764207	3249.75	116.05	118.55	5/5/03	14:43	4283:38:45	4283:30:50	65.4495671
13	75	1088	0.0005	535	14.122	0.000428669	12.14	0.115192876	3261.89	116.49	118.99	5/12/03	14:22	4451:17:45	4451:09:50	66.7180323
21	75	1083	0.0007	535	14.057	0.000689282	19.52	0.115882158	3281.4	117.18	119.68	5/19/03	14:25	4619:20:45	4619:12:50	67.95576957
30	75	1083	0.0011	535	14.057	0.000984689	27.88	0.116866847	3309.29	118.18	120.68	6/30/03	16:35	4885:30:45	4885:22:50	69.89644125
12	74	1081	0.0004	534	14.031	0.000393884	11.15	0.117280732	3320.							

18	76	1087	0.0006	536	14.109	0.000591889	16.78	0.118178726	3346.44	119.51	122.01	6/16/03	1:15	5278:10:45	5278:02:50	72.65107822
21	78	1079	0.0007	538	14.005	0.000682907	19.34	0.118861633	3385.77	120.20	122.70	6/23/03	11:38	5456:33:45	5456:25:50	73.86854879
5	75	1088	0.0002	535	14.122	0.000164873	4.67	0.119026506	3370.44	120.36	122.86	6/30/03	11:13	5624:08:45	5624:00:50	74.99430534
28	78	1078	0.001	538	13.992	0.000909699	25.76	0.119936205	3396.2	121.28	123.78	7/5/03	19:48	5752:43:45	5752:35:50	75.8467479
4	75	1081	0.0001	535	14.031	0.000131049	3.71	0.120067254	3399.91	121.42	123.92	7/7/03	14:01	5794:56:45	5794:48:50	76.1245416
17	79	1084	0.0006	539	14.070	0.000554361	15.70	0.120621615	3415.61	121.98	124.48	7/15/03	13:51	5986:46:45	5986:38:50	77.37427975
15	78	1079	0.0005	538	14.005	0.000487791	13.81	0.121109406	3429.42	122.47	124.97	7/21/03	16:24	6133:19:45	6133:11:50	78.31557423
13	77	1081	0.0005	537	14.031	0.000424324	12.02	0.121533373	3441.44	122.90	125.40	7/28/03	20:20	6305:15:45	6305:07:50	79.40568305
-5	70	1079	-0.0002	530	14.005	-0.000165051	-4.67	0.121368679	3436.77	122.73	125.23	8/4/03	13:42	6466:37:45	6466:29:50	80.41535405
21	78	1086	0.0007	538	14.096	0.000687338	19.46	0.122056016	3456.23	123.43	125.93	8/11/03	13:57	6634:52:45	6634:44:50	81.45476761
27	84	1082	0.001	544	14.044	0.000870754	24.66	0.12292677	3480.89	124.31	128.81	8/18/03	19:58	6808:53:45	6808:45:50	82.5160338
10	80	1083	0.0004	540	14.057	0.000325191	9.21	0.123251961	3490.09	124.64	127.14	8/24/03	22:43	6955:38:45	6955:30:50	83.40051459
14	84	1086	0.0005	544	14.096	0.000453171	12.83	0.123705132	3502.93	125.09	127.59	9/1/03	14:46	7139:41:45	7139:33:50	84.49672084
-10	73	1084	-0.0004	533	14.070	-0.000329766	-9.34	0.123375366	3493.59	124.76	127.26	9/8/03	14:01	7306:56:45	7306:48:50	85.4806752
2	76	1085	7E-05	536	14.083	6.56445E-05	1.86	0.123441011	3495.45	124.83	127.33	9/15/03	15:10	7476:05:45	7475:57:50	86.46441946
8	79	1084	0.0003	539	14.070	0.000260876	7.39	0.123701886	3502.83	125.09	127.59	9/23/03	10:42	7663:37:45	7663:29:50	87.54215651

SAMPLE DECANISTERED 09/28/03 DUE TO NO MORE GAS BEING EVOLVED; air dried 10 days

SAMPLE: 998.9' to 999.7' black shale 50' above Riverton coal in canister Brady #27

dry sample weight:		lbs.	grams	wet sample weight:		lbs.	grams	moisture weight	est. lost gas (cc) =		TIME OF:		elapsed time (off bottom to canistering)	
		3.8780	1759.1				4.0007	1814.6800	3.1%	42		off bottom	in canister	16.0 minutes
												11/8/02 14:25	11/8/02 14:41	0.267 hours
RIG/LAB MEASUREMENTS				CONVERSION OF RIG/LAB MEASUREMENTS TO STP (@60 deg F, 14.7 psi)				CUMULATIVE VOLUMES		SCF/TON	SCF/TON	TIME SINCE		0.516397779 SQRT (hrs)
measured cc	measured T (F)	measured P	cubic ft	absolute T (F) psia	cubic ft (@STP)	cc (@STP)	cubic ft (@STP)	cc (@STP)	without lost gas	with lost gas	TIME OF MEASURE	off bottom	in canister	SQRT hrs. (since off bottom)
7	80	1074	0.0002	540 13.940	0.000225742	6.39	0.000225742	6.39	0.12	0.88	11/8/02 14:45	0:20:30	0:04:30	0.584522597
2	80	1074	7E-05	540 13.940	6.44976E-05	1.83	0.000290239	8.22	0.15	0.91	11/8/02 14:47	0:22:00	0:06:00	0.605530071
1	80	1075	4E-05	540 13.953	3.22788E-05	0.91	0.000322518	9.13	0.17	0.93	11/8/02 14:48	0:23:10	0:07:10	0.621378396
3	80	1075	0.0001	540 13.953	9.68365E-05	2.74	0.000419355	11.87	0.22	0.98	11/8/02 14:51	0:26:00	0:10:00	0.658280589
4	80	1075	0.0001	540 13.953	0.000129115	3.66	0.00054847	15.53	0.28	1.05	11/8/02 14:57	0:32:00	0:16:00	0.730296743
4	80	1075	0.0001	540 13.953	0.000129115	3.66	0.000677585	19.19	0.35	1.11	11/8/02 15:01	0:36:00	0:20:00	0.774596669
4	80	1075	0.0001	540 13.953	0.000129115	3.66	0.000806701	22.84	0.42	1.18	11/8/02 15:06	0:41:00	0:25:00	0.826639784
4	80	1075	0.0001	540 13.953	0.000129115	3.66	0.000935816	26.50	0.48	1.25	11/8/02 15:12	0:47:00	0:31:00	0.885061203
3	80	1075	0.0001	540 13.953	9.68365E-05	2.74	0.001032653	29.24	0.53	1.30	11/8/02 15:19	0:54:00	0:38:00	0.948683298
7	80	1075	0.0002	540 13.953	0.000225952	6.40	0.001258604	35.64	0.65	1.41	11/8/02 15:34	1:09:00	0:53:00	1.072380529
14	80	1076	0.0005	540 13.966	0.000452324	12.81	0.001710929	48.45	0.88	1.65	11/8/02 16:07	1:42:00	1:26:00	1.303840481
17	80	1076	0.0006	540 13.966	0.000549251	15.55	0.002260179	64.00	1.17	1.93	11/8/02 17:11	2:46:00	2:30:00	1.663329993
10	80	1077	0.0004	540 13.979	0.000323389	9.16	0.002583568	73.16	1.33	2.10	11/8/02 18:05	3:40:00	3:24:00	1.914854215
22	80	1070	0.0008	540 13.888	0.000706832	20.02	0.0032904	93.17	1.70	2.46	11/9/02 10:08	19:43:00	19:27:00	4.440345332
-2	80	1087	-7E-05	540 14.109	-6.52783E-05	-1.85	0.003225121	91.32	1.66	2.43	11/11/02 16:12	73:47:00	73:31:00	8.589722541
-3	80	1094	-0.0001	540 14.200	-9.8548E-05	-2.79	0.003126573	88.53	1.61	2.38	11/12/02 9:29	91:04:00	90:48:00	9.542885657
6	80	1091	0.0002	540 14.161	0.000196556	5.57	0.003323129	94.10	1.71	2.48	11/12/02 19:09	100:44:00	100:28:00	10.03659969
13	80	1080	0.0005	540 14.018	0.000421577	11.94	0.003744706	106.04	1.93	2.70	11/13/02 18:50	124:25:00	124:09:00	11.15422192
2	80	1081	7E-05	540 14.031	6.4918E-05	1.84	0.003809624	107.88	1.96	2.73	11/14/02 18:21	147:56:00	147:40:00	12.16278477

SAMPLE DECANISTERED 11/20/02 DUE TO NO MORE GAS BEING EVOLVED; air dried 10 days

SAMPLE: 1053.6' to 1054.5' (shale above Riverton coal) in canister 11

dry sample weight:		lbs.	grams	wet sample weight:		lbs.	grams	moisture weight	est. lost gas (cc) =	TIME OF:		elapsed time (off bottom to canistering)		
		5.9601	2703.5				6.2228	2822.61	4.2%	45	off bottom	in canister	14.0 minutes	
											11/8/02 18:48	11/8/02 19:02	0.233 hours	
RIG/LAB MEASUREMENTS		CONVERSION OF RIG/LAB MEASUREMENTS TO STP (@60 deg F; 14.7 psi)												
measured cc	measured T (F)	measured P	cubic ft	absolute T (F)	psia	cubic ft (@STP)	cc (@STP)	CUMULATIVE VOLUMES	SCF/TON	SCF/TON	TIME SINCE	off bottom	in canister	SQRT hrs. (since off bottom)
								without lost gas	with lost gas	TIME OF MEASURE	off bottom	in canister		
8	80	1077	0.0003	540	13.979	0.000258711	7.33	0.000258711	7.33	11/8/02 19:06	0:18:15	0:04:15	0.55151307	
3	80	1077	0.0001	540	13.979	9.70167E-05	2.75	0.000355728	10.07	11/8/02 19:08	0:20:15	0:06:15	0.580947502	
4	80	1077	0.0001	540	13.979	0.000129356	3.66	0.000485083	13.74	11/8/02 19:11	0:23:30	0:09:30	0.625832779	
5	80	1077	0.0002	540	13.979	0.000161694	4.58	0.000646778	18.31	11/8/02 19:14	0:26:00	0:12:00	0.658280589	
1	80	1077	4E-05	540	13.979	3.23389E-05	0.92	0.000679117	19.23	11/8/02 19:16	0:28:45	0:14:45	0.692218655	
5	80	1077	0.0002	540	13.979	0.000161694	4.58	0.000840811	23.81	11/8/02 19:20	0:32:15	0:18:15	0.733143915	
4	80	1077	0.0001	540	13.979	0.000129356	3.66	0.000970167	27.47	11/8/02 19:25	0:37:15	0:23:15	0.787929777	
15	80	1077	0.0005	540	13.979	0.000485083	13.74	0.00145525	41.21	11/8/02 19:43	0:55:30	0:41:30	0.961769203	
9	80	1077	0.0003	540	13.979	0.00029105	8.24	0.0017463	49.45	11/8/02 19:58	1:10:00	0:56:00	1.08012345	
1	80	1077	4E-05	540	13.979	3.23389E-05	0.92	0.001778639	50.37	11/8/02 20:04	1:16:00	1:02:00	1.125462868	
110	80	1070	0.0039	540	13.888	0.003534158	100.08	0.005312797	150.44	11/9/02 10:07	15:19:00	15:05:00	3.913651322	
62	80	1087	0.0022	540	14.109	0.002023628	57.30	0.007336425	207.74	11/11/02 16:12	69:24:00	69:10:00	8.33066624	
21	80	1094	0.0007	540	14.200	0.000689836	19.53	0.008026261	227.28	11/12/02 9:27	86:39:00	86:25:00	9.308598176	
9	80	1091	0.0003	540	14.161	0.000294833	8.35	0.008321094	235.63	11/12/02 19:10	96:22:00	96:08:00	9.818652518	

18	80	1081	0.0006	540	14.031	0.000584262	16.54	0.008905356	252.17	2.99	3.52	11/14/02	18:21	143:33:00	143:19:00	11.98123533
4	80	1086	0.0001	540	14.096	0.000130437	3.69	0.009035793	255.86	3.03	3.57	11/16/02	22:38	195:50:00	195:36:00	13.99404635
5	80	1085	0.0002	540	14.083	0.000162896	4.61	0.009198689	260.48	3.09	3.62	11/19/02	17:51	263:03:00	262:49:00	16.21881623
3	80	1085	0.0001	540	14.083	9.77373E-05	2.77	0.009296426	263.24	3.12	3.65	11/22/02	17:38	334:50:00	334:36:00	18.29845168

SAMPLE DECANISTERED 12/04/02 DUE TO NO MORE GAS BEING EVOLVED; air dried 10 days

647.2' to 648.2' (Little Osage Shale) in canister 10
Dart McDaniel #B1-20; sec. 20-T.31S.-R.16E., Montgomery Co., KS

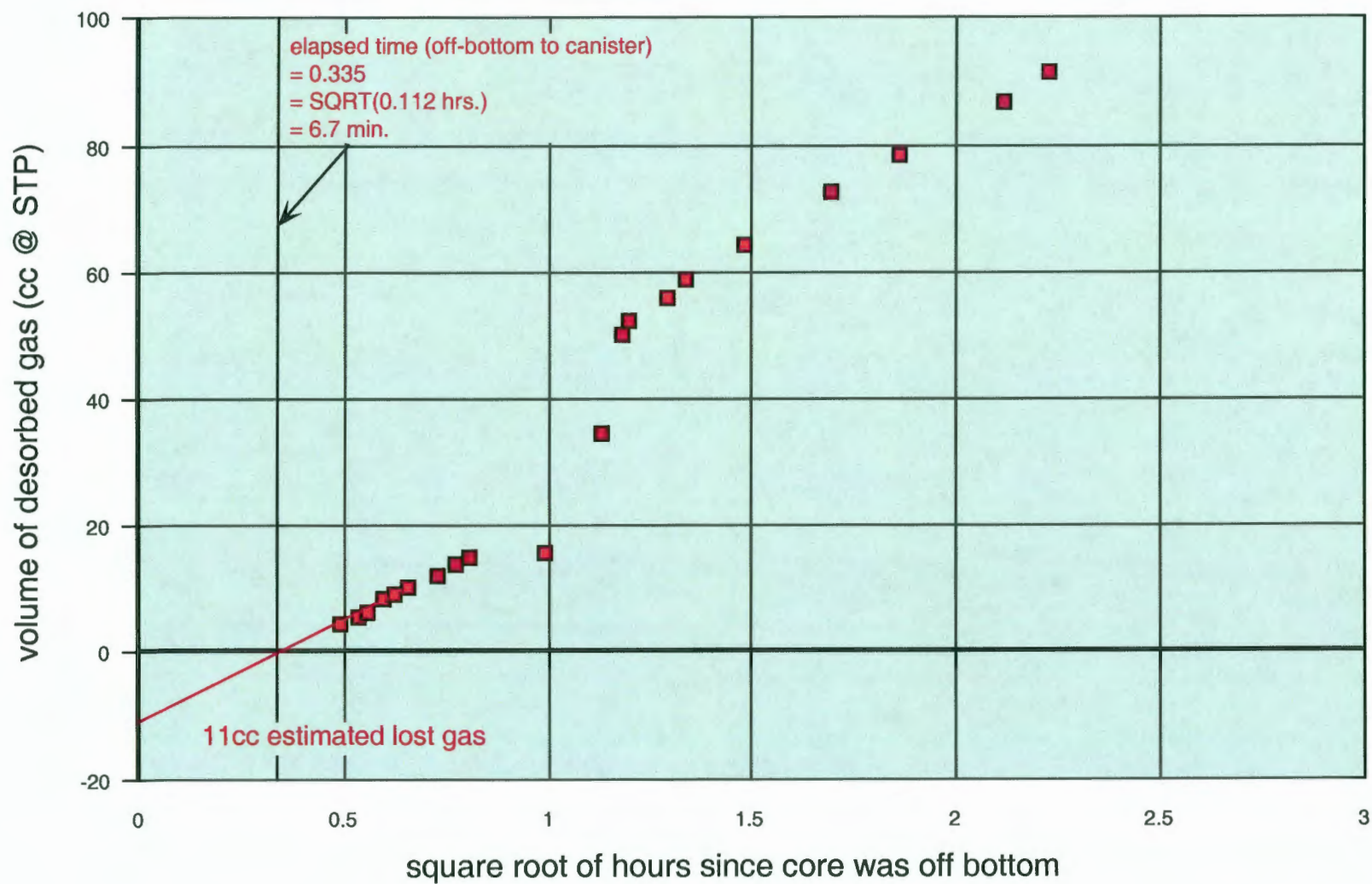


FIGURE 2.

721.9' to 722.7' ("V shale" [shale above Croweburg Coal]) in canister H
Dart McDaniel #B1-20; sec. 20-T.31S.-R.16E., Montgomery Co., KS

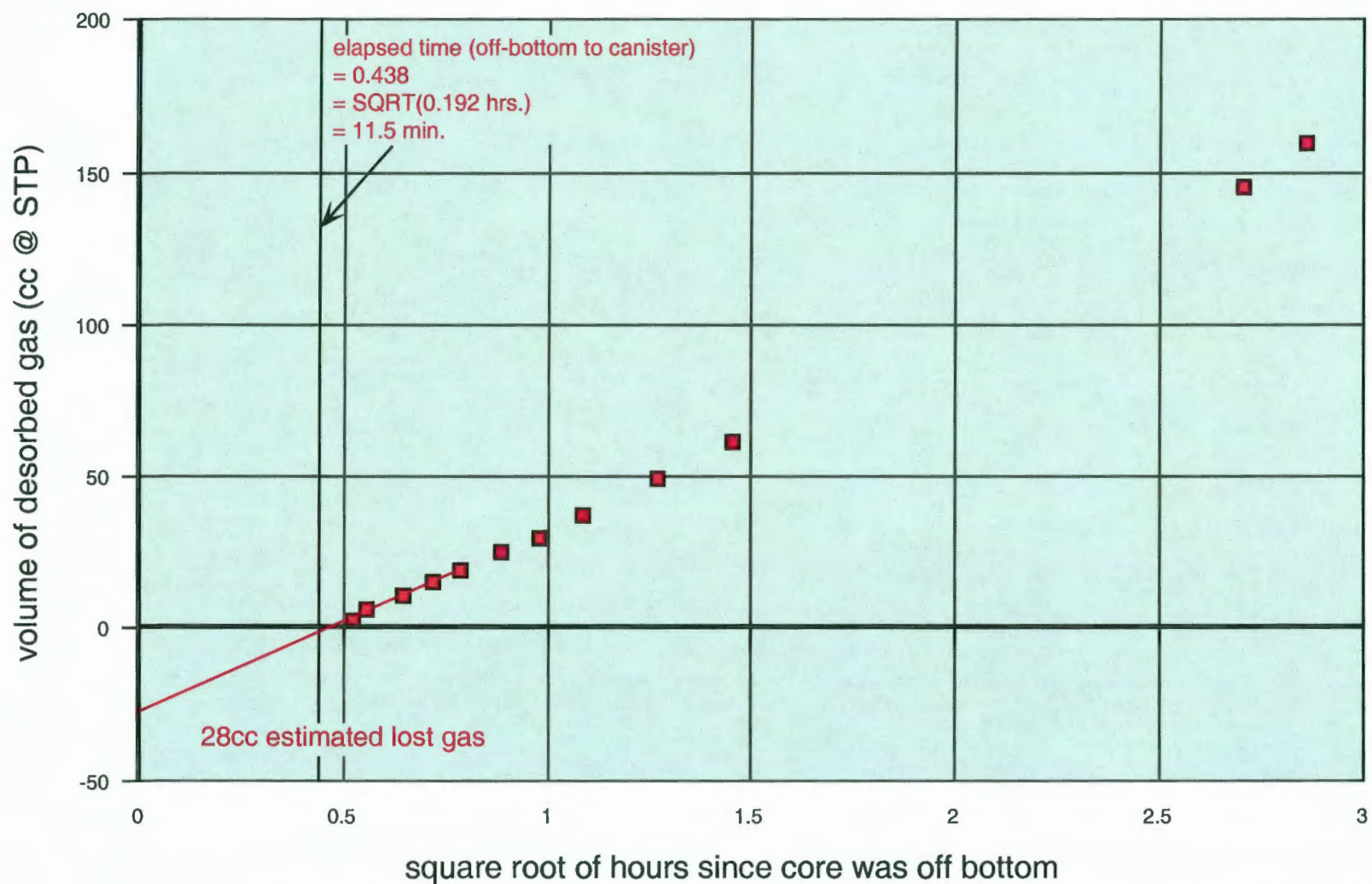


FIGURE 3.

722.7' to 723.2' (Croweburg Coal) in canister 1
Dart McDaniel #B1-20; sec. 20-T.31S.-R.16E., Montgomery Co., KS

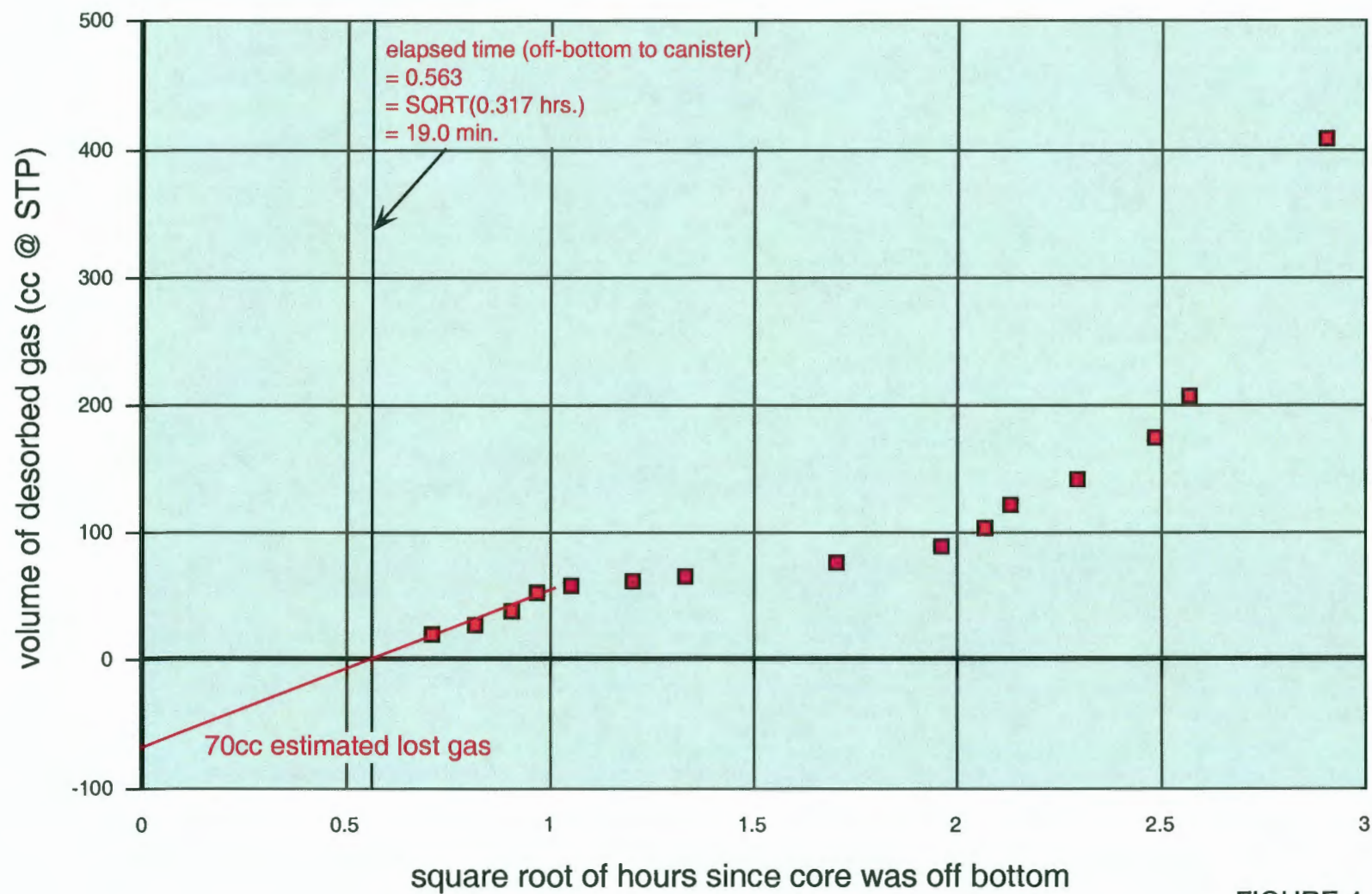


FIGURE 4.

998.9' to 999.7' (black shale 50' above Riverton coal) in canister Brady #27
Dart McDaniel #B1-20; sec. 20-T.31S.-R.16E., Montgomery Co., KS

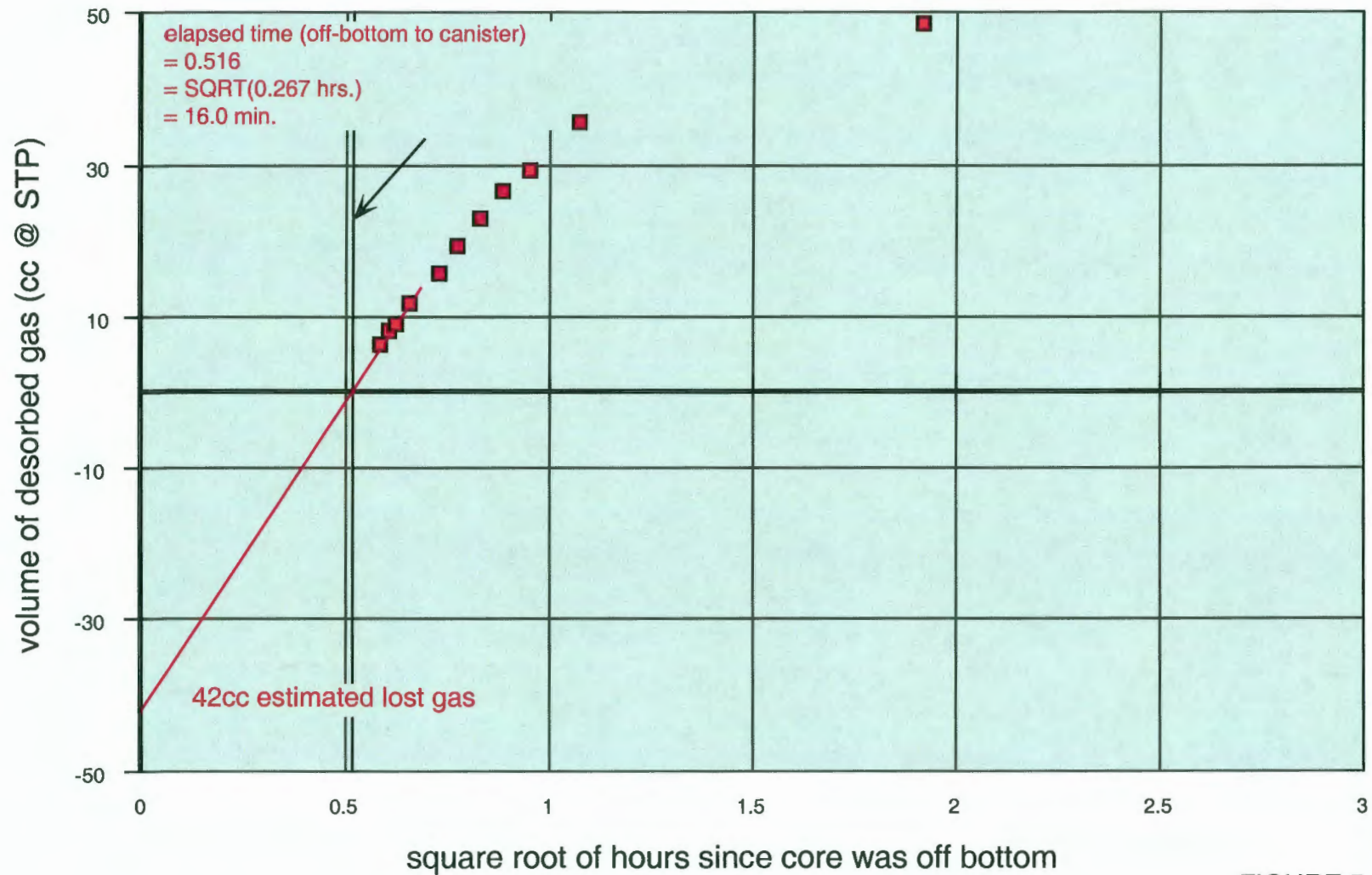


FIGURE 5.

1053.6' to 1054.5' (shale above Riverton) in canister 11

Dart McDaniel #B1-20; sec. 20-T.31S.-R.16E., Montgomery Co., KS

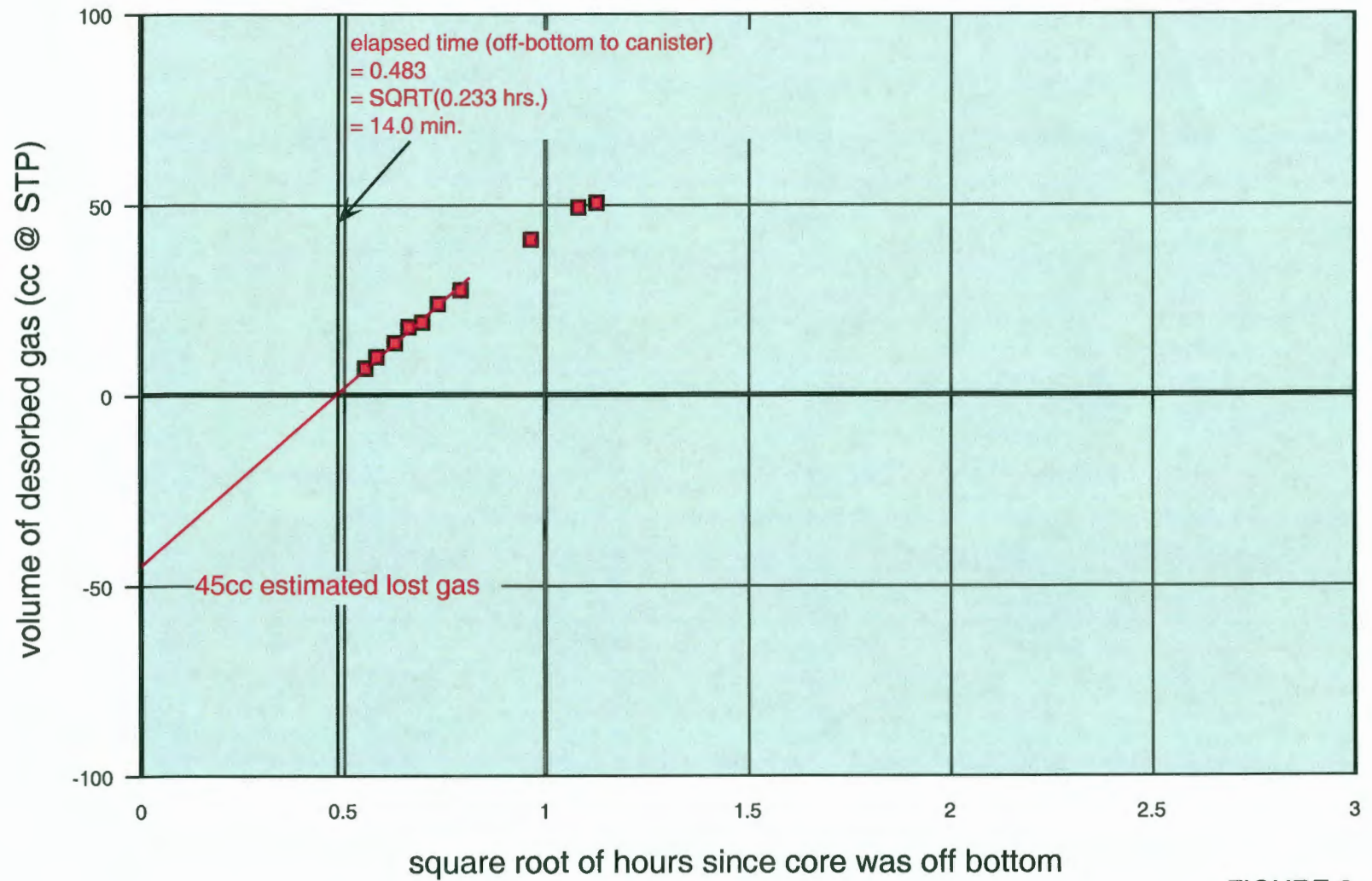


FIGURE 6.

Desorption Characteristics of Dart Butler #B1-20;
 Little Osage Shale at 647.2' to 648.2';
 sec. 20-T.31S.-R.16E., Montgomery Co., KS

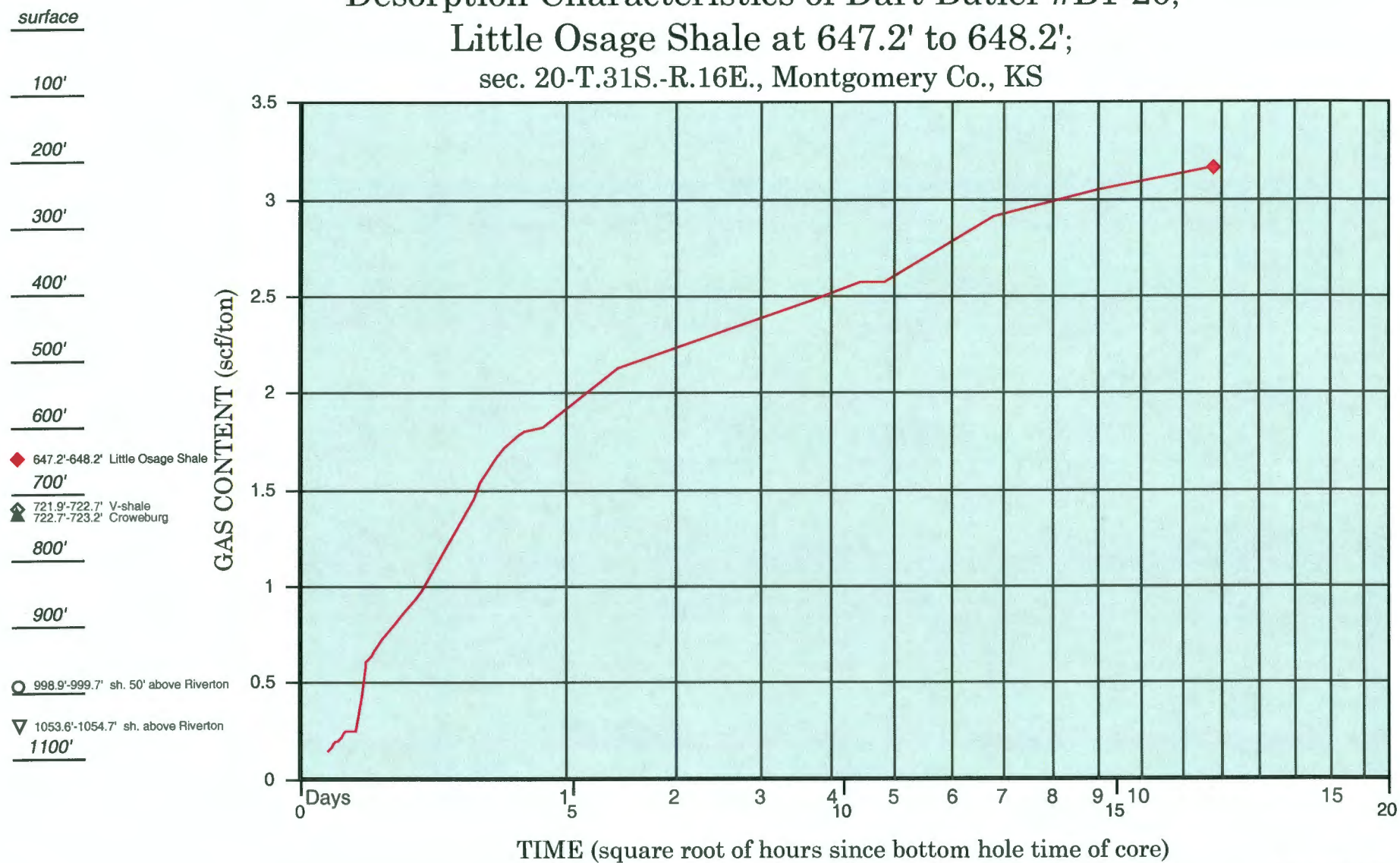


FIGURE 7.

Desorption Characteristics of Dart Butler #B1-20;
 "V shale" at 721.9' to 722.7';
 sec. 20-T.31S.-R.16E., Montgomery Co., KS

surface

100'

200'

300'

400'

500'

600'

700'

800'

900'

647.2'-648.2' Little Osage Shale

721.9'-722.7' V-shale

722.7'-723.2' Croweburg

998.9'-999.7' sh. 50' above Riverton

1053.6'-1054.7' sh. above Riverton

1100'

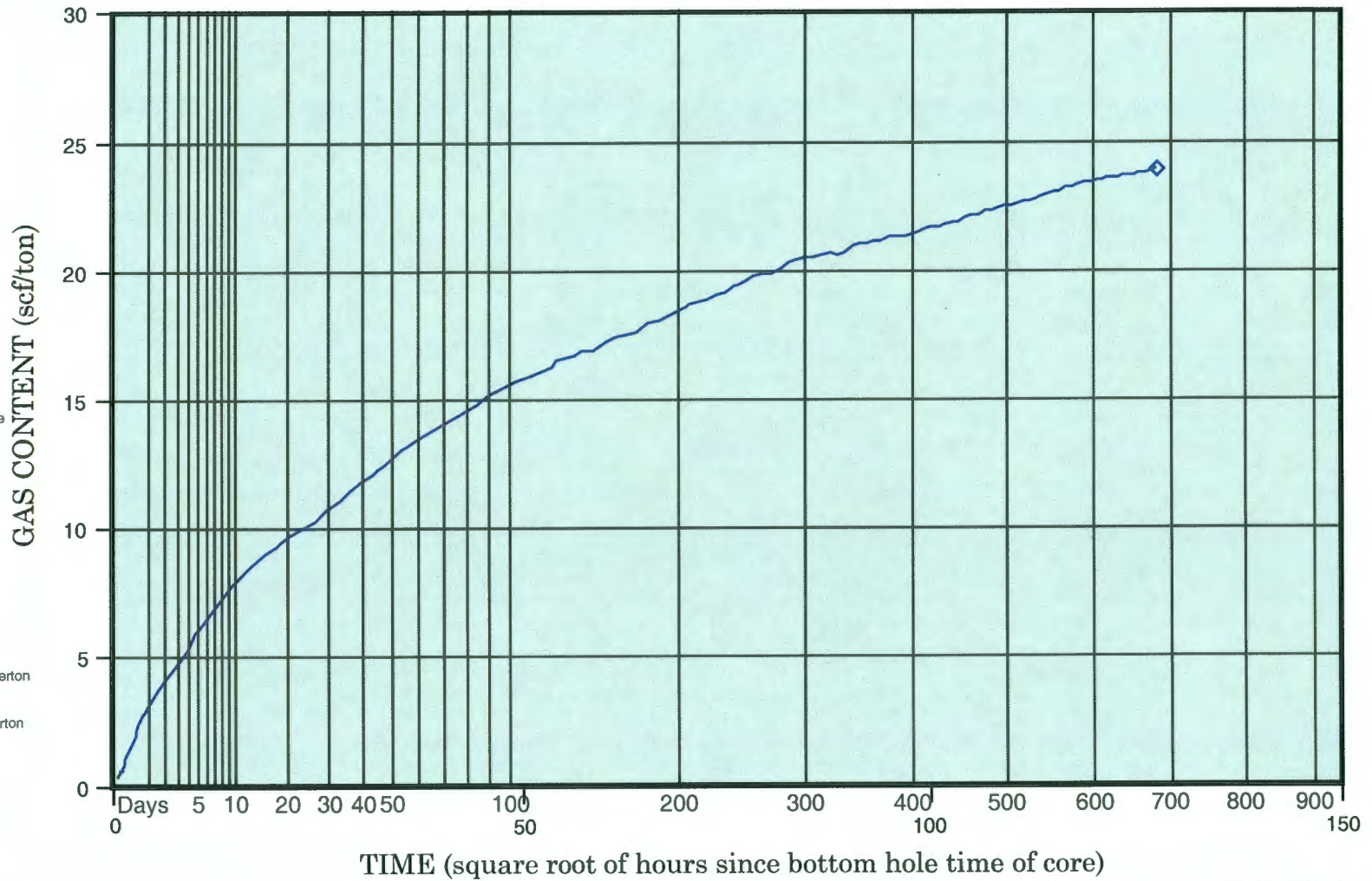


FIGURE 8.

Desorption Characteristics of Dart Butler #B1-20;
Croweburg coal at 722.7' to 723.2';
sec. 20-T.31S.-R.16E., Montgomery Co., KS

surface

100'

200'

300'

400'

500'

600'

◆ 647.2'-648.2' Little Osage Shale

700'

▲ 721.9'-722.7' V-shale
722.7'-723.2' Croweburg

800'

900'

○ 998.9'-999.7' sh. 50' above Riverton

▽ 1053.6'-1054.7' sh. above Riverton

1100'

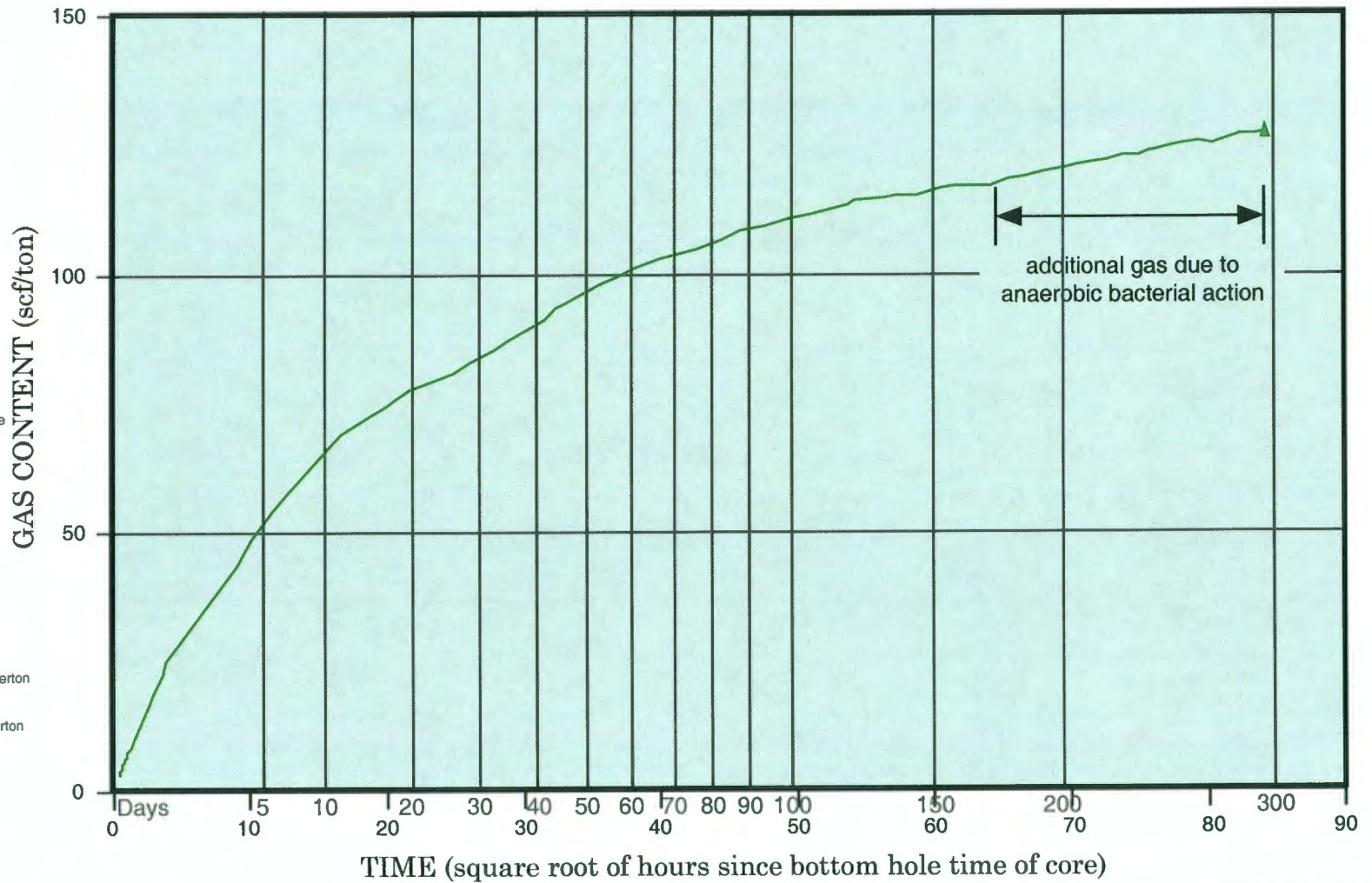


FIGURE 9.

surface

100'

200'

300'

400'

500'

600'

◆ 647.2'-648.2' Little Osage Shale

700'

▲ 721.9'-722.7' V-shale
722.7'-723.2' Croweburg

800'

900'

○ 998.9'-999.7' sh. 50' above Riverton

▽ 1053.6'-1054.7' sh. above Riverton
1100'

Desorption Characteristics of Dart Butler #B1-20;
shale 50' above Riverton coal at 998.9' to 999.7';
sec. 20-T.31S.-R.16E., Montgomery Co., KS

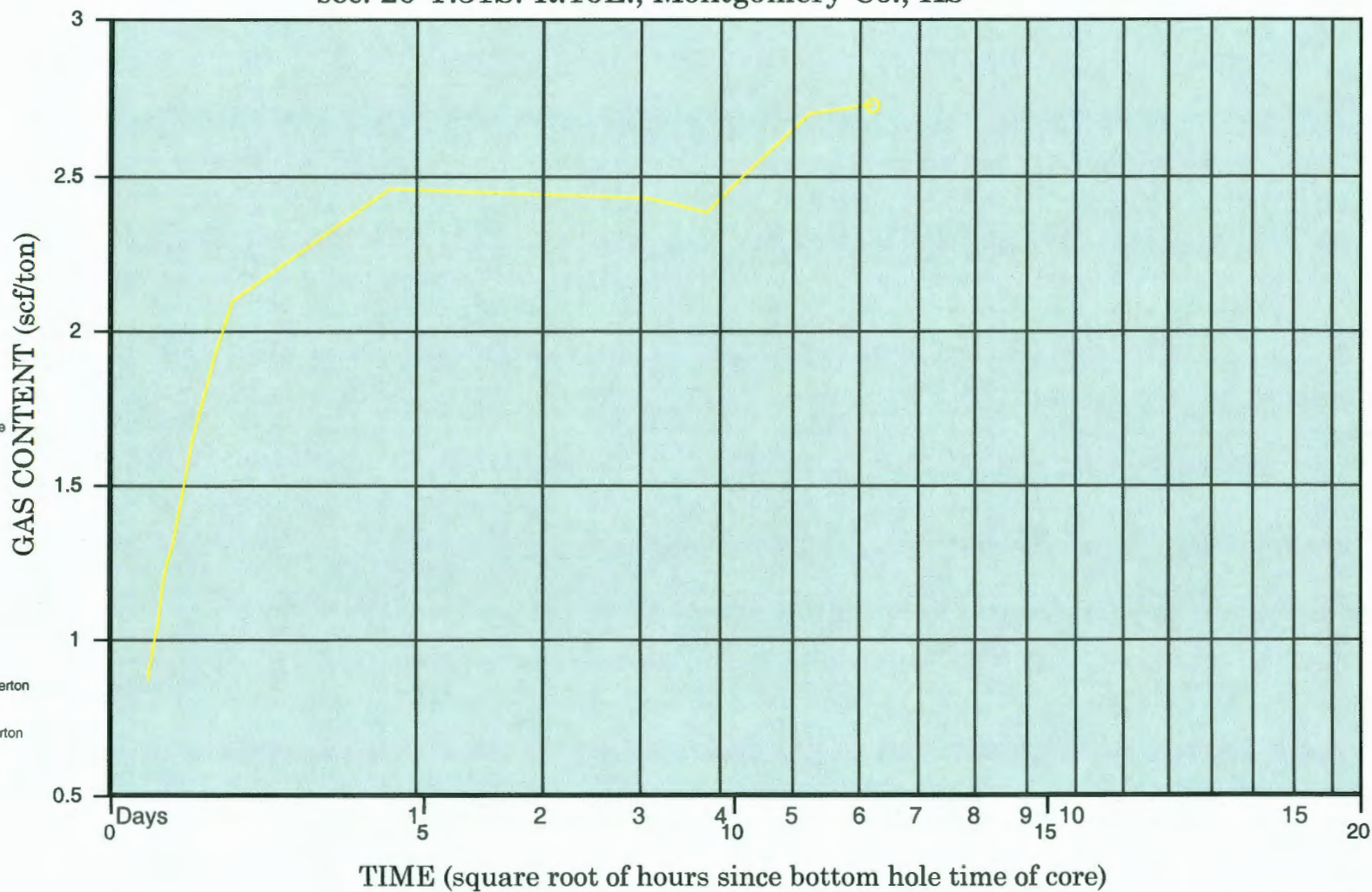


FIGURE 10.

Desorption Characteristics of Dart Butler #B1-20;
shale above Riverton coal at 1053.6' to 1054.7';
sec. 20-T.31S.-R.16E., Montgomery Co., KS

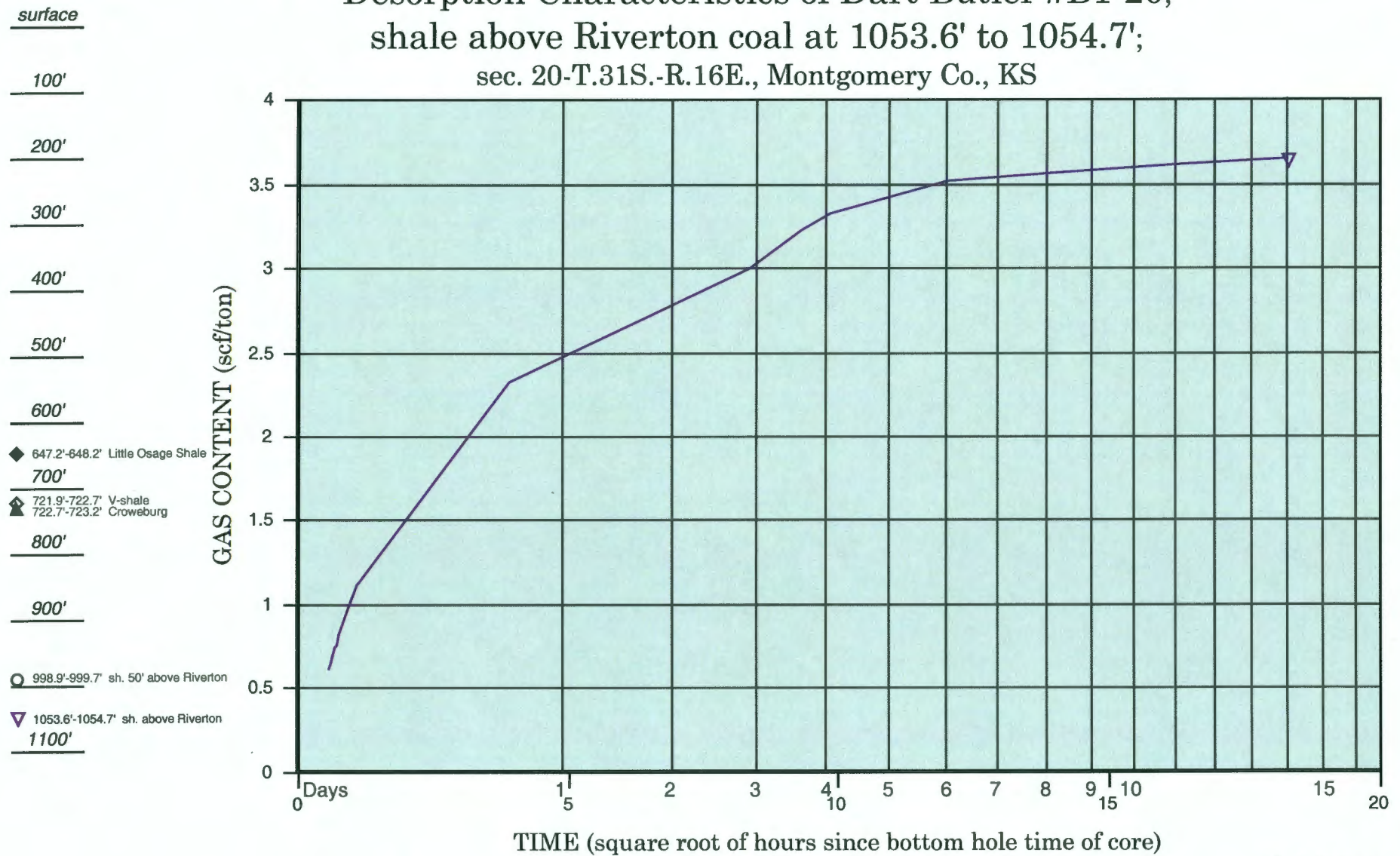


FIGURE 11.

FIGURE 12.