ANALYSIS OF MARMATON AND CHEROKEE GROUP CUTTINGS SAMPLES FOR GAS CONTENT
-- DART CHEROKEE BASIN OPERATING COMPANY #C4-19 SYCAMORE SPRINGS RANCH; N2 S2 NE SE sec. 19-T.31S.-R.15E.; MONTGOMERY COUNTY, KANSAS

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SUMMARY

Eight cuttings samples from the Pennsylvanian Marmaton Group and Cherokee Group were collected from the Dart Cherokee Basin #C4-19 Sycamore Springs Ranch well, N2 S2 NE SE sec. 19-T.31S.-R.15E. in Montgomery County, KS. One sample (Little Osage Shale) did not have any coal present. The samples calculate as having the following gas contents:

- Mulberry coal at 889' to 891' depth[2] (133.7 scf/ton)
- Little Osage Shale at 1010' to 1012' depth[1] (15.1 scf/ton)
- Mulky coal/Excello Sh. at 1037' to 1039' depth[3] (42.8 scf/ton)
- Bevier coal at 1070' to 1072' depth[2] (83.2 scf/ton)
- Croweburg coal at 1090' to 1092' depth[2] (46.5 scf/ton)
- Mineral coal at 1130' to 1132 depth[2] (216.8 scf/ton)
- Bluejacket coal at 1255' to 1257' depth[2] (163.1 scf/ton)
- Riverton coal at 1370' to 1372' depth[2] (333.4 scf/ton)

[1]no coal in sample
[2]assuming accompanying dark shales in sample desorb 3 scf/ton
[3]reliability of result is unclear due to small amount of coal in the sample; desorption value should be considered a minimum value for the Mulky coal and a maximum value for the accompanying dark shale

BACKGROUND

The Dart Cherokee Basin #C4-19 Sycamore Springs Ranch well, N2 S2 NE SE sec. 19-T.31S.-R.15E. in Montgomery County, KS was selected for cuttings desorption tests in association with an on-going coalbed gas research project at the Kansas Geological Survey. The samples were gathered December 3 and 4, 2003 by K.D. Newell of the Kansas Geological Survey. Samples were obtained during normal drilling of the well, with no cessation of drilling before zones of interest (i.e., coals and dark shales in the Marmaton Group and Cherokee Group) were penetrated. The well was drilled using an air rotary rig owned by McPherson Drilling.

Lag times for samples to reach the surface (important for assessing lost gas) were determined by using the lag times from a nearby air-drilled well (Dart Cherokee Basin #CH-1 Holder; sec. 1-T.30S.-R.14E., Wilson County, KS), which was also drilled using this particular drilling rig. The lag times were determined by periodically noting the time it took for cuttings to reach the surface following resumption of drilling after new pipe was added to the drill string.

Eight cuttings samples from the Pennsylvanian Marmaton and Cherokee Groups were collected:

- Mulberry coal at 889' to 891' depth (213 grams dry wt.)
- Little Osage Shale at 1010' to 1012' depth (1536 grams dry wt.)
- Mulky coal/Excello Sh. at 1037' to 1039' depth (967 grams dry wt.)
- Bevier coal at 1070' to 1072' depth (666 grams dry wt.)

- Croweburg coal at 1090' to 1092' depth (1205 grams dry wt.)
- Mineral coal at 1130' to 1132 depth (2035 grams dry wt.)
- Bluejacket coal at 1255' to 1257' depth (1486 grams dry wt.)
- Riverton coal at 1350' to 1352' depth (1616 grams dry wt.)

The cuttings were caught in kitchen strainers as they exited the air-stream pipe emptying to the mud pit. The samples were then washed in water while in the kitchen strainers to rid them of as much drilling mud as possible before the cuttings were placed in desorption canisters. In case of small sample size (i.e., for the Mulberry coal sample -- less than 600 grams dry wt.), a concrete plug was placed in the desorption canister to decrease the volume of free space within the canister. The volume of this plug was 77 cubic inches (1262 cm^3).

Temperature baths for the desorption canisters were on site, with temperature kept at approximately 75 °F. The canistered samples at the end of the second day were transported to the laboratory at the Kansas Geological Survey in Lawrence, KS and desorption measurements were continued at the same temperature. Desorption measurements were periodically made until the canisters produced negligible gas with daily testing for at least two successive days.

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 reading the difference in water level using the volumetric scale on the side of the burette.

The desorption canisters were made in-house at the Kansas Geological Survey. On average, these canisters are approximately 15 inches long (38.1 cm), 3 inches (7.6 cm) in diameter, and enclose a volume of approximately 106 cubic inches (1740 cm^3). Commercial canisters were also used, obtained from PEL-I-CANS (by J.R. Levine) in Richardson, TX. These canisters are 11.2 inches high (28.5 cm), 3.8 inches (9.7 cm) in diameter, and enclose a volume of approximately 127 cubic inches (2082 cm^3). Commercial canisters from SSD, Inc. in Grand Junction, CO were also used. These canisters are 12.5 inches high (32 cm), 3 1/2 inches (9 cm) in diameter, and enclose a volume of approximately 150 cubic inches (2450 cm^3).

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 pounds per square inch (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 (°R = 460 + °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 °R.

The desorbed gas was summed over the time period for which the coal samples evolved all of their gas. In the case of well cuttings from Dart Cherokee Basin #C4-19 Sycamore Springs Ranch well, the maximum time of desorption was 14 days.

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 the moment that the rock is cut and its cuttings circulated off bottom. 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 surface pressure conditions, therefore lost gas is determined by a line projected back to time zero. The period of linearity generally is about an hour for cuttings samples.

LITHOLOGIC ANALYSIS

Upon removal from the canisters, the cuttings were washed of drilling mud, and dried in an oven at 150 ˚F for 1 to 3 days. After drying, the cuttings were weighed and then dry sieved into 5 size fractions: >0.0930", >0.0661", >0.0460", >0.0331", and <0.0331". For large sample sizes, the cuttings were ran through a sample splitter and a lesser portion (approximately 75 grams) were sieved and weighed, and the derived size-fraction ratios were applied to the entire sample.

The size fractions were then inspected and sorted by hand under a dissecting microscope. Three major lithologic categories were differentiated: coal, dark shales (generally Munsell rock colors N3 (dark gray), N2 (grayish black), and N1 (black) on dry surface), and lighter-colored lithologies and/or dark and light-colored carbonates. The lighter-colored lithologies are considered to be incapable of generating significant amounts of gas. After sorting, and for every size class, each of these three lithologic categories was weighed and the proportion of coal dark shale and light-colored lithologies were determined for the entire cuttings sample based on the weight percentages.

DATA PRESENTATION

Data and analyses accompanying this report are presented in the following order: 1) lag time to surface for the well cuttings, 2) data tables for the desorption analyses, 3) lost-gas graphs, 4) "lithologic component sensitivity analyses" showing the interdependence of gas evolved from dark shale versus coal in each sample, 5) a summary component analysis for all samples showing relative reliability of the data from all the samples, and 6) a desorption graph for all the samples.

Graph of Lag-time to Surface for Well Cuttings (Figure 2)
Lag time of cuttings to surface varied, but there is a general trend of longer lag times for greater depth. The lag times accepted for cuttings were taken to be a visual average of

the trend (defined by the scatter of data points on this graph) at the depth at which the samples were taken.

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 cuttings 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 3-7)
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 is usually lost within the first hour after the cuttings leave the bottom of the hole, thus data are presented in the lost-gas graphs for only up to one hour after cuttings are off bottom. Lost-gas volumes derived from this analysis are incorporated in the data tables described above.

"Lithologic Component Sensitivity Analyses" (Figures 8-9)
The rapidity of penetration of an air-drilled well makes collection of pure lithologies from relatively thin-bedded strata rather difficult. Mixed lithologies are more the norm rather than the exception. Some of this mixing is due to cavings from strata farther up hole. The mixing may also be due to collection of two or more successively drilled lithologies in the kitchen sieve at the exit line, or differential lifting of relatively less-dense coal compared to other lithologies, all of which are more dense than coal.

The total gas evolved from the sample is due to gas being desorbed from both the coal and dark shale. Both lithologies are capable of generating gas, albeit the coal will be richer in gas than the dark-colored shale. Even though dark-colored shale is less rich in sorbed gas than coal, if a sample has a large proportion of dark, organic-rich shale and only a minor amount of coal, the total volume of gas evolved from the dark-shale component may be considerable. The lighter-colored lithologies are considered to be incapable of generating significant amounts of gas.

The total amount of gas evolved from a cuttings sample can be expressed by the following equation:

$$\text{Total gas (cm}^3\text{)} = [\text{weight}_{\text{coal}} \text{ (grams) X gas content}_{\text{coal}} \text{ (cm}^3\text{/gram)}] + [\text{weight}_{\text{dark shale}} \text{ (grams) X gas content}_{\text{dark shale}} \text{ (cm}^3\text{/gram)}]$$

A unique solution for *gas content*$_{coal}$ in this equation is not possible because *gas content*$_{dark\ shale}$ is not known exactly. An answer can only be expressed as a linear solution to the above equation. The richer in gas the dark shales are, the poorer in gas the admixed coal has to be, and visa versa. If there is little dark shale in a sample, a relatively well constrained answer for *gas content*$_{coal}$ can be obtained. Conversely, if considerable dark shale is in a sample, the gas content of a coal will be hard to precisely determine.

The lithologic-component-sensitivity-analysis diagram therefore expresses the bivariant nature inherent in the determination of gas content in mixed cuttings. The gas content of dark shales in Kansas can vary greatly. Proprietary desorption analyses of dark shales in cores from southeastern Kansas have registered as much as 50 scf/ton, but can be as low as 2-4 scf/ton.

A value of 3 scf/ton for average dark shale is based on the assay of the gas content of cores of dark shales in nearby wells. However, high-gamma-ray shales (such as the Excello Shale), also colloquially known as "hot shales", typically have more organic matter and associated gas content than dark shales with no excessive gamma-ray level. Determination of gas content for a coal associated with a "hot" shale therefore carries more uncertainty than if the coal were associated with a shale without a high gamma-ray value. For example, the Mulky/Excello sample is a coal associated with a "hot shale".

In general, shale gas content does not have to be very much greater that 10 scf/ton before the associated coal starts to have a gas content less than that of the dark shale. In all the lithologic-component-sensitivity-analysis diagrams, a "break-even" point is therefore noted where the gas content of the coal is equal to that of the dark shale. This "break-even" point corresponds to the minimum gas content assignable to the coal and maximum gas content assignable to the dark shale. It can also be thought of the scf/ton gas content of the cuttings sample minus the weight of any of the lighter-colored lithologies, which are assumed to have no inherent gas content. Conversely though, to assume that all the gas evolved from a cuttings sample is derived solely from the coal would result in an erroneously high gas content for the coal.

Summary Component Analysis for all Samples (Figure 10)
This diagram is a summary of the individual "lithologic component sensitivity analyses" for each sample, all set at a common scale. The steeper the angle of the line for a sample, the more uncertainty is attached to the results (i.e., *gas content*$_{coal}$) for that sample. If the coal content is miniscule (i.e., < approximately 5%), the results are a better reflection of the *gas content*$_{dark\ shale}$.

Desorption Graph (Figure 11)
This is a desorption graph (gas content per weight vs. square root of time) for all the samples. The rate at which gas is evolved from the samples is thus comparable at a common scale. The final value represents the standard cubic feet of gas per ton (scf/ton) calculated for the sample, using the combined weight of the coal and dark shale in the sample.

RESULTS and DISCUSSION

The Little Osage Shale sample did not contain any Summit coal. Colors of the shale were gradational between very dark gray (N1) and light gray (N7), thus it was impossible to pick out any single, distinct shale in this sample that could have been representative of the Summit interval. Nearby cores of the Summit are not dominated by coal, but rather this zone is a carbonaceous shale having varying amounts of carbonaceous material, thus the sample is probably reflective of the Summit zone at this locality.

All samples contained less than 5% coal, which indicates that the coal is probably pulverized to dust by the air-drill percussion bit and not retained in the catching sieve. This lack of coal in the samples imparts some uncertainty to the desorption measurements, but an approximation of their gas content is nevertheless obtained. An estimate for gas content for the coal in this samples can be made, assuming the admixed dark shale in the sample desorb 3 scf/ton.

This Mulky/Excello sample contained little coal (2.2%). This sample was dominated by a very dark to black shale (N1, N2). Due to the small amount of coal in the sample, the calculated gas content of the coal varies greatly with any slight variation in gas content assumed for the accompanying shale in the sample. The Excello, however, is very rich in organic matter, and it may have a gas content close to that of the average gas content for the entire sample (i.e., 42.8 scf/ton). A similar problem was encountered for the Mulky/Excello sample (820') at Dart Cherokee basin #CH-1 Holder well (SE NE 1-T.30S.-R.14E.).

According to the summary diagram for the sensitivity analyses (Figure 19), the best constrained results (in which the resultant coal gas content varies the least with shale gas content) is for the Mulberry coal. The least constrained results are for the Riverton coal.

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 and TABLES

Correlation of Field Barometer to KGS Petrophysics Lab Barometer

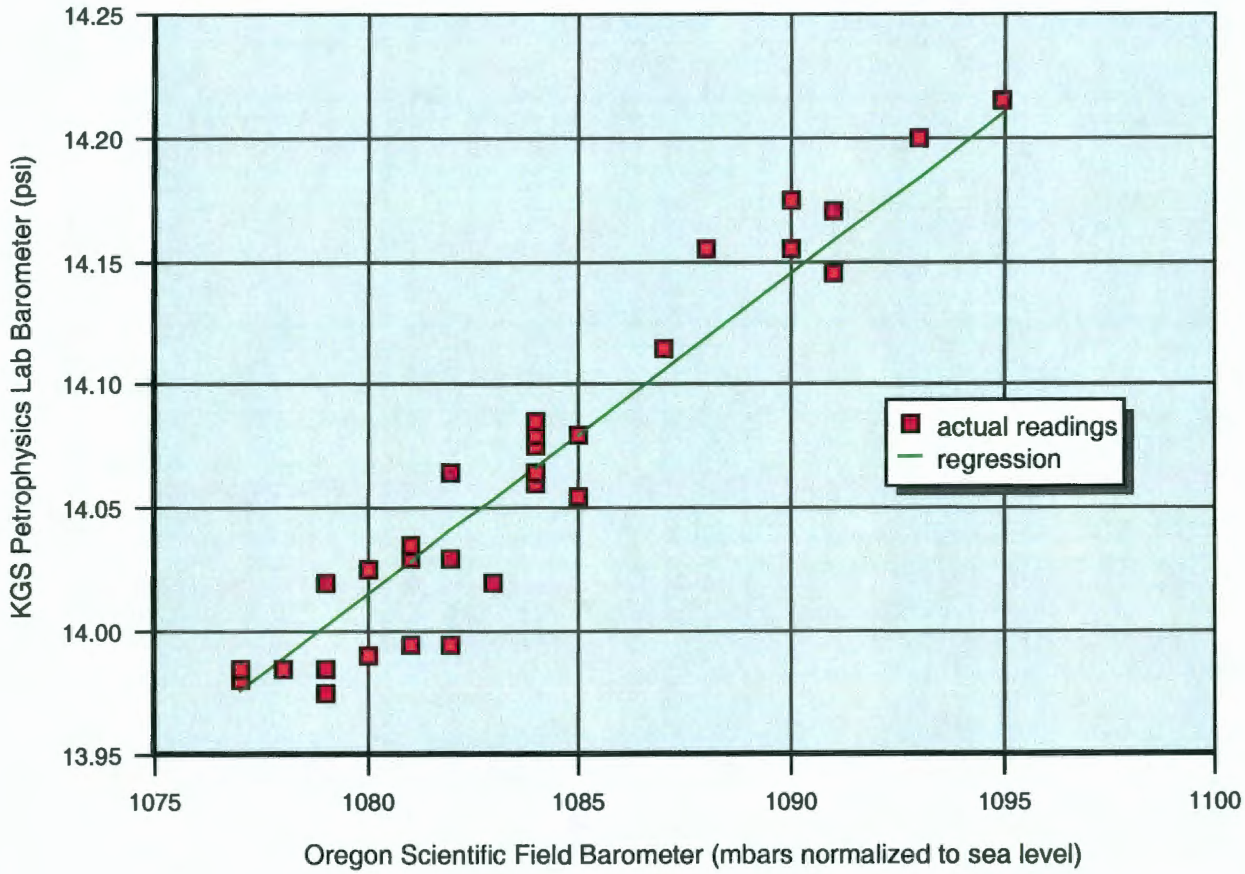
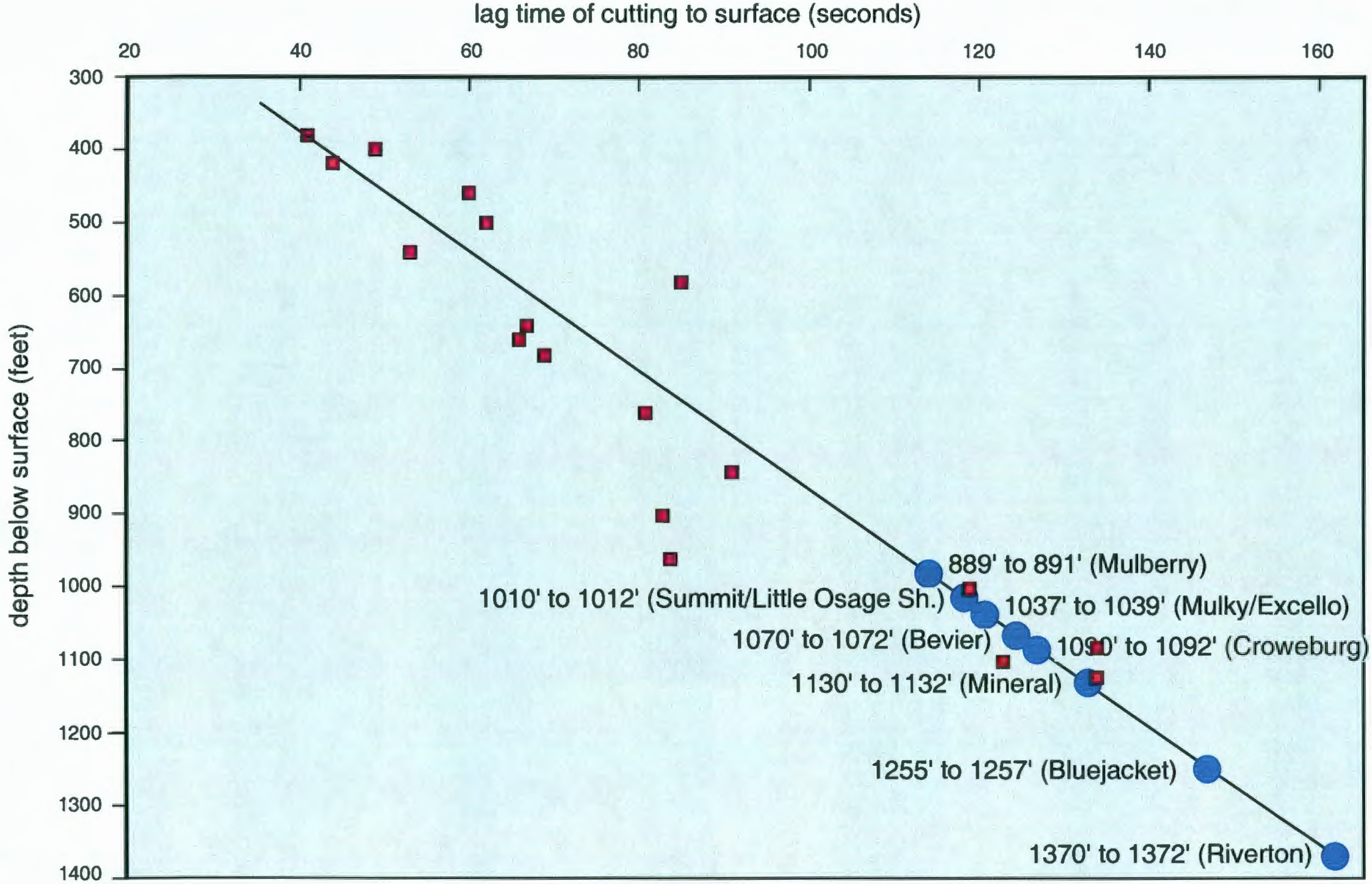


FIGURE 1.

Dart Cherokee Basin #C4-19 Sycamore Springs Ranch; N2 S2 NE SE sec. 19-T.31S.-R.15E., Montgomery County, KS

(based on lag times from Dart Cherokee Basin #CH-1 Holder; sec. 1-T.30S.-R.14E., Wilson County, KS

lag-time to surface for well cuttings



measured lag time of cuttings to surface after pipe connections

FIGURE 2.

TABLE 1 -- Desorption data for DART SYCAMORE SPRINGS RANCH #C4-19; N2 S2 NE SE 19-T.31S.-R.15E.

SAMPLE: 889' to 891' (Mulberry coal) in canister Maggy 2

	lbs.	grams
dry sample weight:	0.4690	212.74

est. lost gas (cc) = 74

TIME OF:	off bottom	at surface	in canister
	12/3/03 11:42	12/3/03 11:44	12/3/03 11:58

elapsed time (off bottom to canistering): 18.7 minutes; 0.278 hours; 0.527046277 SQRT (hrs)

RIG/LAB MEASUREMENTS measured cc	measured T (F)	measured P	CONVERSION OF RIG/LAB MEASUREMENTS TO STP (@60 deg F; 14.7 psi) cubic ft	absolute T (F)	psia	cubic ft (@STP)	cc (@STP)	CUMULATIVE VOLUMES cubic ft (@STP)	cc (@STP)	SCF/TON without lost gas	SCF/TON with lost gas	TIME OF MEASURE	TIME SINCE off bottom	in canister	SQRT hrs. (since off bottom)
9	75	1085	0.0003	535	14.083	0.000295952	8.38	0.000295952	8.38	1.28	12.41	12/3/03 12:01	0:19:40	0:03:00	0.572518801
4	75	1085	0.0001	535	14.083	0.000131534	3.72	0.000427487	12.11	1.82	12.97	12/3/03 12:03	0:20:55	0:04:15	0.590432986
7	75	1085	0.0002	535	14.083	0.000230185	6.52	0.000657672	18.62	2.80	13.95	12/3/03 12:07	0:25:10	0:08:30	0.647645308
6	75	1085	0.0002	535	14.083	0.000197302	5.59	0.000854973	24.21	3.65	14.79	12/3/03 12:11	0:29:25	0:12:45	0.700198385
3	75	1085	0.0001	535	14.083	9.86508E-05	2.79	0.000953624	27.00	4.07	15.21	12/3/03 12:13	0:31:25	0:14:45	0.723609778
1	75	1085	4E-05	535	14.083	3.28836E-05	0.93	0.000986508	27.93	4.21	15.35	12/3/03 12:23	0:40:55	0:24:15	0.825799276
3	75	1085	0.0001	535	14.083	9.86508E-05	2.79	0.001085158	30.73	4.63	15.77	12/3/03 12:27	0:44:55	0:28:15	0.865223157
1	75	1085	4E-05	535	14.083	3.28836E-05	0.93	0.001118042	31.66	4.77	15.91	12/3/03 12:30	0:48:10	0:31:30	0.89597867
4	75	1085	0.0001	535	14.083	0.000131534	3.72	0.001249576	35.38	5.33	16.47	12/3/03 12:36	0:54:40	0:38:00	0.954521404
1	75	1085	4E-05	535	14.083	3.28836E-05	0.93	0.00128246	36.32	5.47	16.61	12/3/03 12:39	0:56:55	0:40:15	0.973966689
21	71	1085	0.0007	531	14.083	0.000695757	19.70	0.001978217	56.02	8.44	19.58	12/3/03 13:41	1:58:55	1:42:15	1.407815487
-1	0	1085	-4E-05	460	14.083	-3.8245E-05	-1.08	0.001939972	54.93	8.27	19.42	12/3/03 14:04	2:21:55	2:05:15	1.537945961
-8	70	1085	-0.0003	530	14.083	-0.00026555	-7.52	0.001674422	47.41	7.14	18.28	12/3/03 14:50	3:07:55	2:51:15	1.769730048
-4	70	1087	-0.0001	530	14.109	-0.00013302	-3.77	0.001541402	43.65	6.57	17.72	12/3/03 15:51	4:08:55	3:52:15	2.036813961
0	71	1088	0	531	14.122	0	0.00	0.001541402	43.65	8.57	17.72	12/3/03 17:12	5:29:55	5:13:15	2.344911749
41	78	1094	0.0014	538	14.200	0.00135183	38.28	0.002893232	81.93	12.34	23.48	12/5/03 9:30	45:47:55	45:31:15	6.767467112
-25	75	1087	-0.0009	535	14.109	-0.000823605	-23.32	0.002069627	58.61	8.83	19.97	12/6/03 23:22	83:39:55	83:23:15	9.146872568
2	75	1076	7E-05	535	13.966	6.52216E-05	1.85	0.002134848	60.45	9.10	20.25	12/7/03 16:55	101:12:55	100:56:15	10.06058039
-3	77	1071	-0.0001	537	13.901	-9.70152E-05	-2.75	0.002037833	57.70	8.69	19.83	12/8/03 14:06	122:23:55	122:07:15	11.06339058
-25	74	1073	-0.0009	534	13.927	-0.00081452	-23.06	0.001223313	34.64	5.22	16.36	12/9/03 11:18	143:35:55	143:19:15	11.98326379

DESORPTION TERMINATED 12/10/2003 DUE TO NO MORE GAS BEING EVOLVED; dried in oven at 200 degrees F for 5 days

SAMPLE: 1010' to 1012' (Summit coal/Little Osage Sh.) in canister Maggy 3

	lbs.	grams
dry sample weight:	3.3872	1536.4

est. lost gas (cc) = 135

TIME OF:	off bottom	at surface	in canister
	12/3/03 12:52	12/3/03 12:54	12/3/03 13:04

elapsed time (off bottom to canistering): 12.0 minutes; 0.200 hours; 0.446902923 SQRT (hrs)

RIG/LAB MEASUREMENTS measured cc	measured T (F)	measured P	CONVERSION OF RIG/LAB MEASUREMENTS TO STP (@60 deg F; 14.7 psi) cubic ft	absolute T (F)	psia	cubic ft (@STP)	cc (@STP)	CUMULATIVE VOLUMES cubic ft (@STP)	cc (@STP)	SCF/TON without lost gas	SCF/TON with lost gas	TIME OF MEASURE	TIME SINCE off bottom	in canister	SQRT hrs. (since off bottom)
8	75	1085	0.0003	535	14.083	0.000263069	7.45	0.000263069	7.45	0.16	2.97	12/3/03 13:05	0:13:44	0:01:45	0.478423337
7	75	1085	0.0002	535	14.083	0.000230185	6.52	0.000493254	13.97	0.29	3.11	12/3/03 13:06	0:14:14	0:02:15	0.48705464
17	74	1085	0.0006	534	14.083	0.000560068	15.86	0.001053322	29.83	0.62	3.44	12/3/03 13:08	0:16:29	0:04:30	0.524139507
18	72	1085	0.0006	532	14.083	0.000595242	16.86	0.001648564	46.68	0.97	3.79	12/3/03 13:13	0:20:59	0:09:00	0.591373167
14	70	1085	0.0005	530	14.083	0.000464713	13.16	0.002113277	59.84	1.25	4.06	12/3/03 13:18	0:25:59	0:14:00	0.658069568
28	70	1085	0.001	530	14.083	0.000929427	26.32	0.003042704	86.16	1.80	4.61	12/3/03 13:31	0:39:44	0:27:45	0.813770374
18	71	1085	0.0006	531	14.083	0.000596363	16.89	0.003639067	103.05	2.15	4.96	12/3/03 13:40	0:48:29	0:36:30	0.898919104
17	71	1085	0.0006	531	14.083	0.000563232	15.95	0.004202299	119.00	2.48	5.30	12/3/03 13:52	1:00:29	0:48:30	1.004019699
7	71	1085	0.0002	531	14.083	0.000231919	6.57	0.004434218	125.56	2.62	5.43	12/3/03 14:03	1:11:14	0:59:15	1.089597275
17	70	1085	0.0006	530	14.083	0.000564295	15.98	0.004998513	141.54	2.95	5.77	12/3/03 14:23	1:30:59	1:19:00	1.231417431
20	70	1085	0.0007	530	14.083	0.000663876	18.80	0.005662389	160.34	3.34	6.16	12/3/03 14:46	1:53:59	1:42:00	1.378304111
43	70	1087	0.0015	530	14.109	0.001429965	40.49	0.007092354	200.83	4.19	7.00	12/3/03 15:50	2:57:59	2:46:00	1.722320786
33	71	1088	0.0012	531	14.122	0.001096356	31.05	0.00818871	231.88	4.84	7.65	12/3/03 17:10	4:17:59	4:06:00	2.073577156
284	78	1094	0.01	538	14.200	0.009363896	285.16	0.017552606	497.03	10.36	13.18	12/5/03 9:31	44:38:59	44:27:00	6.682044764
48	75	1087	0.0017	535	14.109	0.001581322	44.78	0.019133928	541.81	11.30	14.11	12/6/03 23:23	82:30:59	82:19:00	9.083853196
30	75	1076	0.0011	535	13.966	0.000978325	27.70	0.020112252	569.51	11.88	14.69	12/7/03 16:56	100:03:59	99:52:00	10.00331889
22	77	1071	0.0008	537	13.901	0.000711445	20.15	0.020823697	589.66	12.30	15.11	12/8/03 14:07	121:14:59	121:03:00	11.01134516
-18	74	1073	-0.0006	534	13.927	-0.000586454	-16.61	0.020237242	573.05	11.95	14.76	12/9/03 11:19	142:26:59	142:15:00	11.9352303
-34	70	1082	-0.0012	530	14.044	-0.001125469	-31.87	0.019111773	541.18	11.28	14.10	12/10/03 12:35	167:42:59	167:31:00	12.95053624

SAMPLE DECANISTERED 12/10/2003 DUE TO NO MORE GAS BEING EVOLVED; dried in oven at 200 degrees F for 14 days;

SAMPLE: 1037' to 1039' (Mulky coal/Excello Sh.) in canister Maggy 4

	lbs.	grams
dry sample weight:	2.1320	967.06

est. lost gas (cc) = 90

TIME OF:	off bottom	at surface	in canister
	12/3/03 13:07	12/3/03 13:09	12/3/03 13:17

elapsed time (off bottom to canistering): 10.7 minutes; 0.179 hours; 0.423280837 SQRT (hrs)

RIG/LAB MEASUREMENTS measured cc	measured T (F)	measured P	CONVERSION OF RIG/LAB MEASUREMENTS TO STP (@60 deg F; 14.7 psi) cubic ft	absolute T (F)	psia	cubic ft (@STP)	cc (@STP)	CUMULATIVE VOLUMES cubic ft (@STP)	cc (@STP)	SCF/TON without lost gas	SCF/TON with lost gas	TIME OF MEASURE	TIME SINCE off bottom	in canister	SQRT hrs. (since off bottom)
8	70	1085	0.0003	530	14.083	0.00026555	7.52	0.00026555	7.52	0.25	3.23	12/3/03 13:20	0:13:00	0:02:15	0.465474668

measured cc	measured T (F)	measured P	cubic ft	absolute T (F)	psia	cubic ft (@STP)	cc (@STP)	cumulative cubic ft (@STP)	cumulative cc (@STP)	SCF/TON without lost gas	SCF/TON with lost gas	TIME OF MEASURE		time since off bottom	time since in canister	SQRT hrs. (since off bottom)
35	70	1085	0.0012	530	14.083	0.001161783	32.90	0.001427334	40.42	1.34	4.32	12/3/03	13:29	0:22:30	0:11:45	0.612372436
3	70	1085	0.0001	530	14.083	9.95814E-05	2.82	0.001526915	43.24	1.43	4.41	12/3/03	13:30	0:23:45	0:13:00	0.62915287
26	70	1085	0.0009	530	14.083	0.000863039	24.44	0.002389954	67.68	2.24	5.22	12/3/03	13:39	0:32:45	0:22:00	0.738805342
29	70	1085	0.001	530	14.083	0.00096262	27.26	0.003352575	94.93	3.15	6.13	12/3/03	13:51	0:44:30	0:33:45	0.861200712
22	71	1085	0.0008	531	14.083	0.000728889	20.64	0.004081463	115.57	3.83	6.81	12/3/03	14:04	0:57:30	0:46:45	0.97894501
16	70	1085	0.0006	530	14.083	0.000531101	15.04	0.004612564	130.61	4.33	7.31	12/3/03	14:21	1:14:45	1:04:00	1.116189043
24	70	1085	0.0008	530	14.083	0.000796651	22.56	0.005409215	153.17	5.07	8.06	12/3/03	14:44	1:37:00	1:26:15	1.271482075
37	70	1087	0.0013	530	14.109	0.001230435	34.84	0.00663965	188.01	6.23	9.21	12/3/03	15:28	2:21:00	2:10:15	1.532970972
23	70	1087	0.0008	530	14.109	0.000764865	21.66	0.007404515	209.67	6.95	9.93	12/3/03	15:56	2:49:00	2:38:15	1.678292783
45	71	1088	0.0016	531	14.122	0.001495031	42.33	0.008899546	252.01	8.35	11.33	12/3/03	17:09	4:02:00	3:51:15	2.008316044
517	78	1094	0.0183	538	14.200	0.017046248	482.69	0.025945793	734.70	24.34	27.32	12/5/03	9:35	44:28:00	44:17:15	6.668333125
209	75	1087	0.0074	535	14.109	0.006885338	194.97	0.032831131	929.67	30.80	33.78	12/6/03	23:24	82:17:00	82:06:15	9.071016114
74	75	1076	0.0026	535	13.966	0.002413201	68.33	0.035244332	998.00	33.06	36.04	12/7/03	16:57	99:50:00	99:39:15	9.991663192
65	77	1071	0.0023	537	13.901	0.002101995	59.52	0.037346327	1057.53	35.03	38.02	12/8/03	14:08	121:01:00	120:50:15	11.00075755
26	74	1073	0.0009	534	13.927	0.000847101	23.99	0.038193428	1081.51	35.83	38.81	12/9/03	11:21	142:14:00	142:03:15	11.92616172
4	70	1082	0.0001	530	14.044	0.000132408	3.75	0.038325836	1085.26	35.95	38.93	12/10/03	12:36	167:29:00	167:18:15	12.9415352
29	70	1091	0.001	530	14.161	0.000967944	27.41	0.03929378	1112.67	36.86	39.84	12/12/03	10:31	213:24:00	213:13:15	14.60821687
30	71	1082	0.0011	531	14.044	0.000991191	28.07	0.04028497	1140.74	37.79	40.77	12/13/03	14:59	241:52:00	241:41:15	15.5520631
26	71	1079	0.0009	531	14.005	0.00085665	24.26	0.04114162	1165.00	38.59	41.58	12/14/03	14:23	265:16:00	265:05:15	16.28700914
40	71	1063	0.0014	531	13.797	0.00129838	36.77	0.042440001	1201.76	39.81	42.79	12/15/03	12:37	287:30:00	287:19:15	16.95582496
-19	69	1087	-0.0007	529	14.109	-0.000633039	-17.93	0.041806961	1183.84	39.22	42.20	12/16/03	11:57	310:50:00	310:39:15	17.63046606
15	70	1083	0.0005	530	14.057	0.000496989	14.07	0.042303951	1197.91	39.68	42.67	12/17/03	11:57	334:50:00	334:39:15	18.29845166

SAMPLE DECANISTERED 12/18/03 DUE TO NO MORE GAS BEING EVOLVED; dried in oven at 200 degrees F for 7 days

SAMPLE: 1070' to 1072' (Bevier coal) in canister Brady 27

	lbs.	grams
dry sample weight:	1.4683	665.99

est. lost gas (cc) = 27

TIME OF: off bottom	at surface	in canister
12/3/03 13:17	12/3/03 13:20	12/3/03 13:28

elapsed time (off bottom to canistering): 10.6 minutes; 0.176 hours; 0.419986772 SQRT (hrs)

RIG/LAB MEASUREMENTS measured cc	measured T (F)	measured P	CONVERSION OF RIG/LAB MEASUREMENTS TO STP (@60 deg F; 14.7 psi) cubic ft	absolute T (F)	psia	cubic ft (@STP)	cc (@STP)	CUMULATIVE VOLUMES cubic ft (@STP)	cc (@STP)	SCF/TON without lost gas	SCF/TON with lost gas	TIME OF MEASURE		TIME SINCE off bottom	in canister	SQRT hrs. (since off bottom)
5	70	1085	0.0002	530	14.083	0.000165969	4.70	0.000165969	4.70	0.23	1.52	12/3/03	13:32	0:14:50	0:04:15	0.497214463
3	70	1085	0.0001	530	14.083	9.95814E-05	2.82	0.00026555	7.52	0.36	1.66	12/3/03	13:35	0:17:35	0:07:00	0.541346059
2	70	1085	7E-05	530	14.083	6.63876E-05	1.88	0.000331938	9.40	0.45	1.75	12/3/03	13:37	0:19:20	0:08:45	0.567646212
1	70	1085	4E-05	530	14.083	3.31938E-05	0.94	0.000365132	10.34	0.50	1.80	12/3/03	13:38	0:20:50	0:10:15	0.589255651
8	71	1085	0.0003	531	14.083	0.00026505	7.51	0.000630182	17.84	0.86	2.16	12/3/03	13:47	0:29:20	0:18:45	0.699205899
2	71	1085	7E-05	531	14.083	6.62626E-05	1.88	0.000696445	19.72	0.95	2.25	12/3/03	13:50	0:32:20	0:21:45	0.734090518
6	71	1085	0.0002	531	14.083	0.000198788	5.63	0.000895233	25.35	1.22	2.52	12/3/03	14:01	0:43:35	0:33:00	0.852284512
10	70	1085	0.0004	530	14.083	0.000331938	9.40	0.001227171	34.75	1.67	2.97	12/3/03	14:20	1:02:35	0:52:00	1.021300913
8	70	1085	0.0003	530	14.083	0.00026555	7.52	0.001492721	42.27	2.03	3.33	12/3/03	14:43	1:25:05	1:14:30	1.190821378
9	70	1086	0.0003	530	14.096	0.00029902	8.47	0.001791741	50.74	2.44	3.74	12/3/03	15:25	2:07:05	1:56:30	1.4553541
5	70	1087	0.0002	530	14.109	0.000166275	4.71	0.001958016	55.44	2.67	3.97	12/3/03	15:58	2:40:05	2:29:30	1.633418365
6	71	1088	0.0002	531	14.122	0.000199337	5.64	0.002157353	61.09	2.94	4.24	12/3/03	17:08	3:50:05	3:39:30	1.958244679
33	75	1094	0.0012	535	14.200	0.00109416	30.98	0.003251513	92.07	4.43	5.73	12/5/03	9:40	44:22:05	44:11:30	6.660935036
-2	75	1087	-7E-05	535	14.109	-6.58884E-05	-1.87	0.003185624	90.21	4.34	5.64	12/6/03	23:27	82:09:05	81:58:30	9.063740337
3	75	1076	0.0001	535	13.966	9.78325E-05	2.77	0.003283457	92.98	4.47	5.77	12/7/03	16:59	99:41:05	99:30:30	9.984223666
3	77	1071	0.0001	537	13.901	9.70152E-05	2.75	0.003380472	95.72	4.60	5.90	12/8/03	14:09	120:51:05	120:40:30	10.99324287
-5	74	1073	-0.0002	534	13.927	-0.000162904	-4.61	0.003217568	91.11	4.38	5.68	12/9/03	11:24	142:06:05	141:55:30	11.92062871
-10	70	1082	-0.0004	530	14.044	-0.00033102	-9.37	0.002886548	81.74	3.93	5.23	12/10/03	12:36	167:18:05	167:07:30	12.93450381
-5	70	1091	-0.0002	530	14.161	-0.000166887	-4.73	0.002719661	77.01	3.70	5.00	12/12/03	10:32	213:14:05	213:03:30	14.60255876

SAMPLE DECANISTERED 12/12/2003 DUE TO NO MORE GAS BEING EVOLVED; dried in oven at 200 degrees F for 10 days

SAMPLE: 1090' to 1092' (Croweburg coal) in canister MER 1

	lbs.	grams
dry sample weight:	2.6575	1205.4

est. lost gas (cc) = 37

TIME OF: off bottom	at surface	in canister
12/3/03 13:40	12/3/03 13:43	12/3/03 13:45

elapsed time (off bottom to canistering): 4.9 minutes; 0.081 hours; 0.284800125 SQRT (hrs)

RIG/LAB MEASUREMENTS measured cc	measured T (F)	measured P	CONVERSION OF RIG/LAB MEASUREMENTS TO STP (@60 deg F; 14.7 psi) cubic ft	absolute T (F)	psia	cubic ft (@STP)	cc (@STP)	CUMULATIVE VOLUMES cubic ft (@STP)	cc (@STP)	SCF/TON without lost gas	SCF/TON with lost gas	TIME OF MEASURE		TIME SINCE off bottom	in canister	SQRT hrs. (since off bottom)
19	71	1085	0.0007	531	14.083	0.000629495	17.83	0.000629495	17.83	0.47	1.46	12/3/03	13:54	0:13:37	0:08:45	0.476386864
7	71	1085	0.0002	531	14.083	0.000231919	6.57	0.000861414	24.39	0.65	1.63	12/3/03	13:55	0:14:52	0:10:00	0.497772817
9	71	1085	0.0003	531	14.083	0.000298182	8.44	0.001159595	32.84	0.87	1.86	12/3/03	13:57	0:16:37	0:11:45	0.526255113
3	71	1085	0.0001	531	14.083	9.93939E-05	2.81	0.001258989	35.65	0.95	1.93	12/3/03	13:59	0:18:37	0:13:45	0.557025832
2	71	1085	7E-05	531	14.083	6.62626E-05	1.88	0.001325252	37.53	1.00	1.98	12/3/03	14:00	0:19:07	0:14:15	0.564456474
28	70	1085	0.001	530	14.083	0.000929427	26.32	0.002254678	63.85	1.70	2.68	12/3/03	14:19	0:38:37	0:33:45	0.80225377
7	69	1085	0.0002	529	14.083	0.000232796	6.59	0.002487474	70.44	1.87	2.86	12/3/03	14:26	0:45:22	0:40:30	0.869546497

11	69	1085	0.0004	529	14.083	0.000365822	10.36	0.002853296	80.80	2.15	3.13	12/3/03 14:38	0:57:37	0:52:45	0.97993764
10	70	1085	0.0004	530	14.083	0.000331938	9.40	0.003185235	90.20	2.40	3.38	12/3/03 14:52	1:11:07	1:06:15	1.088704633
16	70	1086	0.0006	530	14.096	0.00053159	15.05	0.003716825	105.25	2.80	3.78	12/3/03 15:22	1:41:07	1:36:15	1.29818249
14	70	1087	0.0005	530	14.109	0.00046557	13.18	0.004182395	118.43	3.15	4.13	12/3/03 15:59	2:18:07	2:13:15	1.517218018
16	71	1088	0.0006	531	14.122	0.000531566	15.05	0.004713961	133.48	3.55	4.53	12/3/03 17:07	3:26:07	3:21:15	1.853450236
26	75	1094	0.0009	535	14.200	0.000862065	24.41	0.005576027	157.89	4.20	5.18	12/5/03 9:43	44:02:07	43:57:15	6.63590821
-2	75	1087	-7E-05	535	14.109	-6.58884E-05	-1.87	0.005510138	156.03	4.15	5.13	12/6/03 23:28	81:47:07	81:42:15	9.043521315
7	75	1076	0.0002	535	13.966	0.000228276	6.46	0.005738414	162.49	4.32	5.30	12/7/03 16:59	99:18:07	99:13:15	9.965036099
3	77	1071	0.0001	537	13.901	9.70152E-05	2.75	0.005835429	165.24	4.39	5.38	12/8/03 14:09	120:28:07	120:23:15	10.97581938
-9	74	1073	-0.0003	534	13.927	-0.000293227	-8.30	0.005542202	156.94	4.17	5.15	12/9/03 11:24	141:43:07	141:38:15	11.90456262
-25	70	1082	-0.0009	530	14.044	-0.000827551	-23.43	0.004714651	133.50	3.55	4.53	12/10/03 12:37	166:56:07	166:51:15	12.92034356
-10	70	1091	-0.0004	530	14.161	-0.000333774	-9.45	0.004380877	124.05	3.30	4.28	12/12/03 10:33	212:52:07	212:47:15	14.59001752

SAMPLE DECANISTERED 10/14/03 DUE TO NO MORE GAS BEING EVOLVED; dried in oven at 200 degrees F for 10 days

SAMPLE: 1130' to 1132' (Mineral coal) in canister MER Fe

	lbs.	grams
dry sample weight:	4.4874	2035.4

est. lost gas (cc) = 80

TIME OF:	off bottom	at surface	in canister
	12/3/03 13:59	12/3/03 14:02	12/3/03 14:09

elapsed time (off bottom to canistering): 10.0 minutes; 0.166 hours; 0.407907942 SQRT (hrs)

RIG/LAB MEASUREMENTS			CONVERSION OF RIG/LAB MEASUREMENTS TO STP (@60 deg F; 14.7 psi)					CUMULATIVE VOLUMES		SCF/TON	SCF/TON		TIME SINCE		
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)
10	70	1085	0.0004	530	14.083	0.000331938	9.40	0.000331938	9.40	0.15	1.41	12/3/03 14:12	0:12:14	0:02:15	0.451540573
12	70	1085	0.0004	530	14.083	0.000398326	11.28	0.000730264	20.68	0.33	1.58	12/3/03 14:15	0:15:44	0:05:45	0.512076383
8	70	1085	0.0003	530	14.083	0.00026555	7.52	0.000995814	28.20	0.44	1.70	12/3/03 14:18	0:18:14	0:08:15	0.55126118
27	70	1085	0.001	530	14.083	0.000896233	25.38	0.001892047	53.58	0.84	2.10	12/3/03 14:28	0:28:44	0:18:45	0.692017983
4	69	1085	0.0001	529	14.083	0.000133026	3.77	0.002025073	57.34	0.90	2.16	12/3/03 14:30	0:30:44	0:20:45	0.715697018
6	69	1085	0.0002	529	14.083	0.000199539	5.65	0.002224613	62.99	0.99	2.25	12/3/03 14:34	0:34:14	0:24:15	0.75535128
5	69	1085	0.0002	529	14.083	0.000166283	4.71	0.002390895	67.70	1.07	2.32	12/3/03 14:37	0:37:14	0:27:15	0.787753487
25	70	1085	0.0009	530	14.083	0.000829845	23.50	0.003220741	91.20	1.44	2.69	12/3/03 14:54	0:54:14	0:44:15	0.950730713
5	70	1085	0.0002	530	14.083	0.000165969	4.70	0.00338671	95.90	1.51	2.77	12/3/03 14:59	0:59:14	0:49:15	0.993590571
7	70	1086	0.0002	530	14.096	0.000232571	6.59	0.00361928	102.49	1.61	2.87	12/3/03 15:05	1:05:44	0:55:45	1.046687898
5	70	1086	0.0002	530	14.096	0.000166122	4.70	0.003785402	107.19	1.69	2.95	12/3/03 15:12	1:12:29	1:02:30	1.099115806
6	70	1086	0.0002	530	14.096	0.000199346	5.64	0.003984749	112.84	1.78	3.04	12/3/03 15:20	1:20:14	1:10:15	1.156383251
24	70	1087	0.0008	530	14.109	0.00079812	22.60	0.004782869	135.44	2.13	3.39	12/3/03 16:01	2:01:14	1:51:15	1.421462471
26	71	1088	0.0009	531	14.122	0.000863795	24.46	0.005646664	159.90	2.52	3.78	12/3/03 17:05	3:05:14	2:55:15	1.757049294
160	78	1094	0.0057	538	14.200	0.005275435	149.38	0.010922099	309.28	4.87	6.13	12/5/03 9:44	43:44:14	43:34:15	6.613412298
35	75	1087	0.0012	535	14.109	0.001153047	32.65	0.012075146	341.93	5.38	6.64	12/6/03 23:28	81:28:14	81:18:15	9.026104118
28	75	1076	0.001	535	13.966	0.000913103	25.86	0.012988249	367.78	5.79	7.05	12/7/03 17:00	99:00:14	98:50:15	9.950069793
25	77	1071	0.0009	537	13.901	0.00080846	22.89	0.013796708	390.68	6.15	7.41	12/8/03 14:10	120:10:14	120:00:15	10.96223315
5	74	1073	0.0002	534	13.927	0.000162904	4.61	0.013959612	395.29	6.22	7.48	12/9/03 11:25	141:25:14	141:15:15	11.89203749
-13	70	1082	-0.0005	530	14.044	-0.000430326	-12.19	0.013529286	383.11	6.03	7.29	12/10/03 12:38	166:38:14	166:28:15	12.90880406
9	70	1091	0.0003	530	14.161	0.000300396	8.51	0.013829682	391.61	6.16	7.42	12/12/03 10:35	212:35:14	212:25:15	14.58037113
22	71	1082	0.0008	531	14.044	0.000726873	20.58	0.014556555	412.19	8.49	7.75	12/13/03 14:59	240:59:14	240:49:15	15.52378315
21	71	1079	0.0007	531	14.005	0.00069191	19.59	0.015248465	431.79	6.80	8.06	12/14/03 14:24	264:24:14	264:14:15	16.26050088
35	71	1063	0.0012	531	13.797	0.001136083	32.17	0.016384548	463.96	7.30	8.56	12/15/03 12:38	286:38:14	286:28:15	16.93036391
-24	69	1087	-0.0008	529	14.109	-0.000799629	-22.64	0.015584919	441.31	6.95	8.21	12/16/03 11:59	309:59:14	309:49:15	17.60645399

SAMPLE DECANISTERED 10/14/03 DUE TO NO MORE GAS BEING EVOLVED; dried in oven at 200 degrees F for 5 days

SAMPLE: 1255' to 1257' (Bluejacket coal) in canister J

	lbs.	grams
dry sample weight:	3.2766	1486.2

est. lost gas (cc) = 81

TIME OF:	off bottom	at surface	in canister
	12/4/03 7:34	12/4/03 7:37	12/4/03 7:44

elapsed time (off bottom to canistering): 9.7 minutes; 0.162 hours; 0.402077936 SQRT (hrs)

RIG/LAB MEASUREMENTS			CONVERSION OF RIG/LAB MEASUREMENTS TO STP (@60 deg F; 14.7 psi)					CUMULATIVE VOLUMES		SCF/TON	SCF/TON		TIME SINCE		
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)
21	80	1090	0.0007	540	14.148	0.000687314	19.46	0.000687314	19.46	0.42	2.17	12/4/03 7:49	0:15:12	0:05:30	0.503322296
20	80	1090	0.0007	540	14.148	0.000654585	18.54	0.001341899	38.00	0.82	2.57	12/4/03 7:55	0:21:12	0:11:30	0.594418483
11	80	1090	0.0004	540	14.148	0.000360022	10.19	0.001701921	48.19	1.04	2.78	12/4/03 8:01	0:26:27	0:18:45	0.66395281
7	80	1090	0.0002	540	14.148	0.000229105	6.49	0.001931025	54.68	1.18	2.92	12/4/03 8:04	0:29:57	0:20:15	0.70651728
10	80	1090	0.0004	540	14.148	0.000327292	9.27	0.002258318	63.95	1.38	3.12	12/4/03 8:09	0:35:12	0:25:30	0.765941686
6	79	1090	0.0002	539	14.148	0.00019674	5.57	0.002455057	69.52	1.50	3.24	12/4/03 8:12	0:38:12	0:28:30	0.797913947
4	79	1090	0.0001	539	14.148	0.00013116	3.71	0.002586217	73.23	1.58	3.32	12/4/03 8:15	0:40:57	0:31:15	0.826135582
6	79	1090	0.0002	539	14.148	0.00019674	5.57	0.002782957	78.80	1.70	3.44	12/4/03 8:19	0:44:27	0:34:45	0.860716756
15	79	1091	0.0005	539	14.161	0.000492301	13.94	0.003275258	92.74	2.00	3.75	12/4/03 8:28	0:53:57	0:44:15	0.948243991
5	79	1091	0.0002	539	14.161	0.0001641	4.65	0.003439358	97.39	2.10	3.85	12/4/03 8:33	0:58:42	0:49:00	0.989107342
4	78	1091	0.0001	538	14.161	0.000131524	3.72	0.003570882	101.12	2.18	3.93	12/4/03 8:36	1:01:57	0:52:15	1.016120072

16	77	1091	0.0006	537	14.161	0.000527077	14.93	0.004097959	116.04	2.50	4.25	12/4/03 8:52	1:17:42	1:08:00	1.137980668
65	76	1091	0.0023	536	14.161	0.002145243	60.75	0.006243202	176.79	3.81	5.58	12/4/03 10:04	2:29:27	2:19:45	1.578237414
223	78	1094	0.0079	538	14.200	0.007352637	208.20	0.013595839	384.99	8.30	10.04	12/5/03 9:48	26:13:27	26:03:45	5.120953687
41	75	1087	0.0014	535	14.109	0.001350712	38.25	0.014946551	423.24	9.12	10.87	12/6/03 23:31	63:56:27	63:46:45	7.996301228
29	76	1076	0.001	536	13.966	0.000943949	26.73	0.0158905	449.97	9.70	11.45	12/7/03 17:03	81:28:27	81:18:45	9.026304153
18	76	1071	0.0006	536	13.901	0.000583177	18.51	0.016473677	466.48	10.06	11.80	12/8/03 14:12	102:37:27	102:27:45	10.13035866
-14	74	1073	-0.0005	534	13.927	-0.000456131	-12.92	0.016017546	453.56	9.78	11.52	12/9/03 11:25	123:50:27	123:40:45	11.12637964
-28	73	1082	-0.001	533	14.044	-0.00092164	-26.10	0.015095906	427.47	9.21	10.96	12/10/03 12:37	149:02:27	148:52:45	12.2082281
-14	75	1091	-0.0005	535	14.161	-0.000462916	-13.11	0.01463299	414.36	8.93	10.68	12/12/03 10:35	195:00:27	194:50:45	13.96450858

SAMPLE DECANISTERED 12/13/2003 DUE TO NO MORE GAS BEING EVOLVED; dried in oven at 200 degrees F for 5 days

SAMPLE: 1370' to 1372' (Riverton coal) in canister 6

dry sample weight: 3.5633 lbs. 1616.28 grams

est. lost gas (cc) = 46

TIME OF: off bottom 12/4/03 8:40; at surface 12/4/03 8:43; in canister 12/4/03 8:50

elapsed time (off bottom to canistering): 9.7 minutes; 0.162 hours; 0.402077936 SQRT (hrs)

RIG/LAB MEASUREMENTS			CONVERSION OF RIG/LAB MEASUREMENTS TO STP (@60 deg F; 14.7 psi)					CUMULATIVE VOLUMES		SCF/TON	SCF/TON		TIME SINCE		
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)
14	77	1091	0.0005	537	14.161	0.000461192	13.06	0.000461192	13.06	0.26	1.17	12/4/03 8:56	0:16:12	0:06:30	0.519615242
2	77	1091	7E-05	537	14.161	6.58846E-05	1.87	0.000527077	14.93	0.30	1.21	12/4/03 8:58	0:17:42	0:08:00	0.543139025
7	77	1091	0.0002	537	14.161	0.000230596	6.53	0.000757672	21.45	0.43	1.34	12/4/03 9:01	0:21:27	0:11:45	0.597913037
4	77	1091	0.0001	537	14.161	0.000131769	3.73	0.000889442	25.19	0.50	1.41	12/4/03 9:04	0:23:57	0:14:15	0.631796381
5	76	1091	0.0002	536	14.161	0.000165019	4.67	0.00105446	29.86	0.59	1.50	12/4/03 9:08	0:27:42	0:18:00	0.67946057
4	76	1091	0.0001	536	14.161	0.000132015	3.74	0.001186475	33.60	0.67	1.58	12/4/03 9:10	0:30:12	0:20:30	0.709459888
4	76	1091	0.0001	536	14.161	0.000132015	3.74	0.00131849	37.34	0.74	1.65	12/4/03 9:13	0:32:42	0:23:00	0.736241153
19	76	1091	0.0007	536	14.161	0.000627071	17.76	0.001945561	55.09	1.09	2.00	12/4/03 9:24	0:44:27	0:34:45	0.860716756
9	76	1091	0.0003	536	14.161	0.000297034	8.41	0.002242595	63.50	1.26	2.17	12/4/03 9:31	0:50:57	0:41:15	0.921502396
4	76	1091	0.0001	536	14.161	0.000132015	3.74	0.00237461	67.24	1.33	2.24	12/4/03 9:35	0:54:57	0:45:15	0.956991815
6	76	1091	0.0002	536	14.161	0.000198022	5.61	0.002572632	72.85	1.44	2.36	12/4/03 9:39	0:59:27	0:49:45	0.995406115
20	76	1091	0.0007	536	14.161	0.000660075	18.69	0.003232707	91.54	1.81	2.73	12/4/03 10:01	1:21:27	1:11:45	1.16511802
151	78	1094	0.0053	538	14.200	0.004978691	140.98	0.008211399	232.52	4.61	5.52	12/5/03 9:50	25:09:42	25:00:00	5.016140615
6	79	1087	0.0002	539	14.109	0.000196198	5.56	0.008407597	238.08	4.72	5.63	12/6/03 23:33	62:52:42	62:43:00	7.92958595
-5	73	1076	-0.0002	533	13.966	-0.000163666	-4.63	0.008243931	233.44	4.63	5.54	12/7/03 17:04	80:23:42	80:14:00	8.966325892
-2	76	1071	-7E-05	536	13.901	-6.47974E-05	-1.83	0.008179133	231.61	4.59	5.50	12/8/03 14:06	101:25:42	101:16:00	10.07116345
-29	70	1073	-0.001	530	13.927	-0.000951974	-26.96	0.007227159	204.65	4.06	4.97	12/9/03 11:25	122:44:42	122:35:00	11.07903425

SAMPLE DECANISTERED 12/09/2003 DUE TO NO MORE GAS BEING EVOLVED; dried in oven at 200 degrees F for 5 days

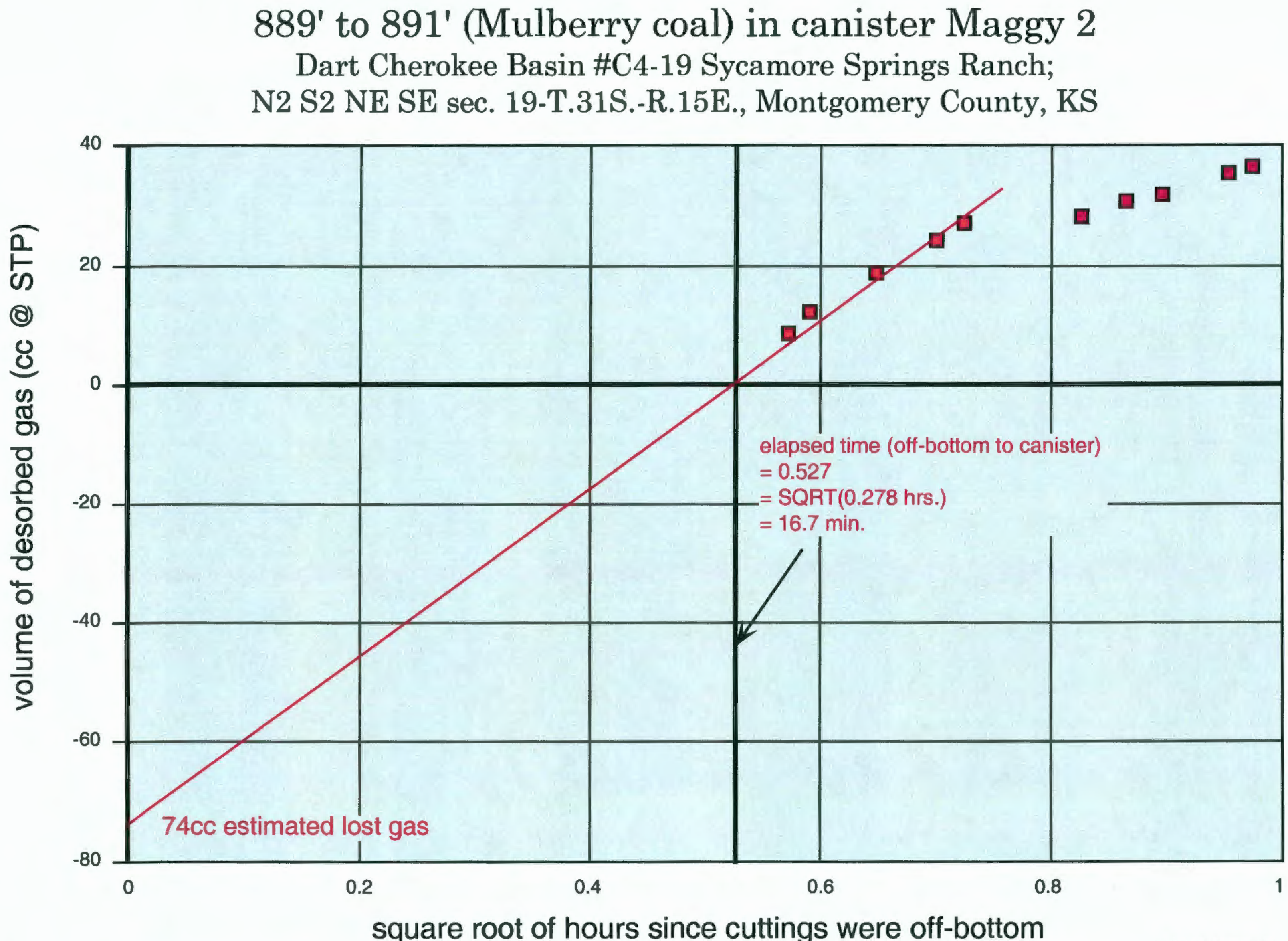

889' to 891' (Mulberry coal) in canister Maggy 2
Dart Cherokee Basin #C4-19 Sycamore Springs Ranch;
N2 S2 NE SE sec. 19-T.31S.-R.15E., Montgomery County, KS
volume of desorbed gas (cc @ STP)
40
20
0
-20
-40
-60
-80
elapsed time (off-bottom to canister)
= 0.527
= SQRT(0.278 hrs.)
= 16.7 min.
74cc estimated lost gas
0
0.2
0.4
0.6
0.8
1
square root of hours since cuttings were off-bottom

FIGURE 3.

1010' to 1012' (Summit coal/Little Osage Sh.) in canister Maggy 3

Dart Cherokee Basin #C4-19 Sycamore Springs Ranch;
N2 S2 NE SE sec. 19-T.31S.-R.15E., Montgomery County, KS

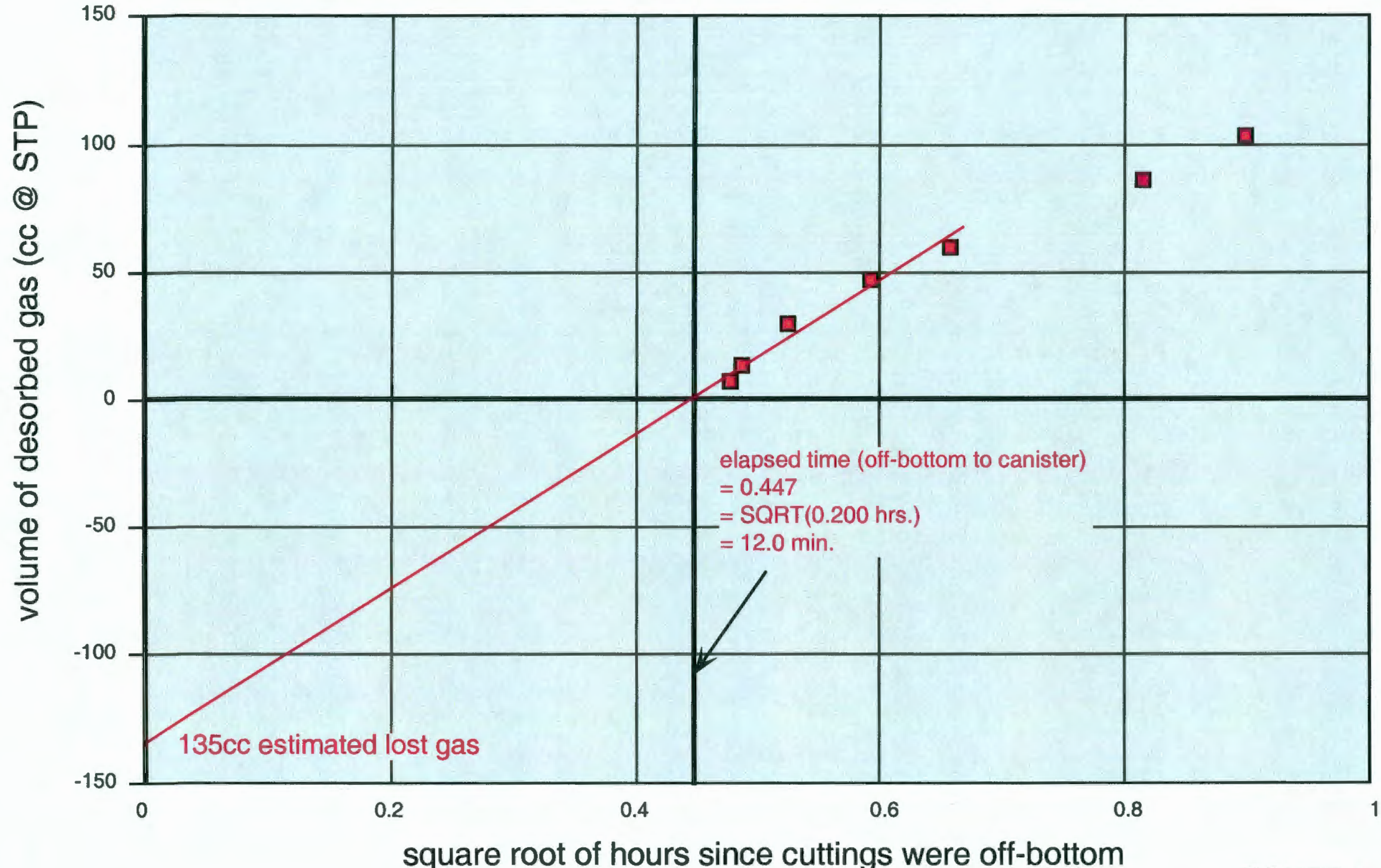


FIGURE 4.

1037' to 1039' (Mulky coal/Excello Sh.) in canister Maggy 4

Dart Cherokee Basin #C4-19 Sycamore Springs Ranch;
N2 S2 NE SE sec. 19-T.31S.-R.15E., Montgomery County, KS

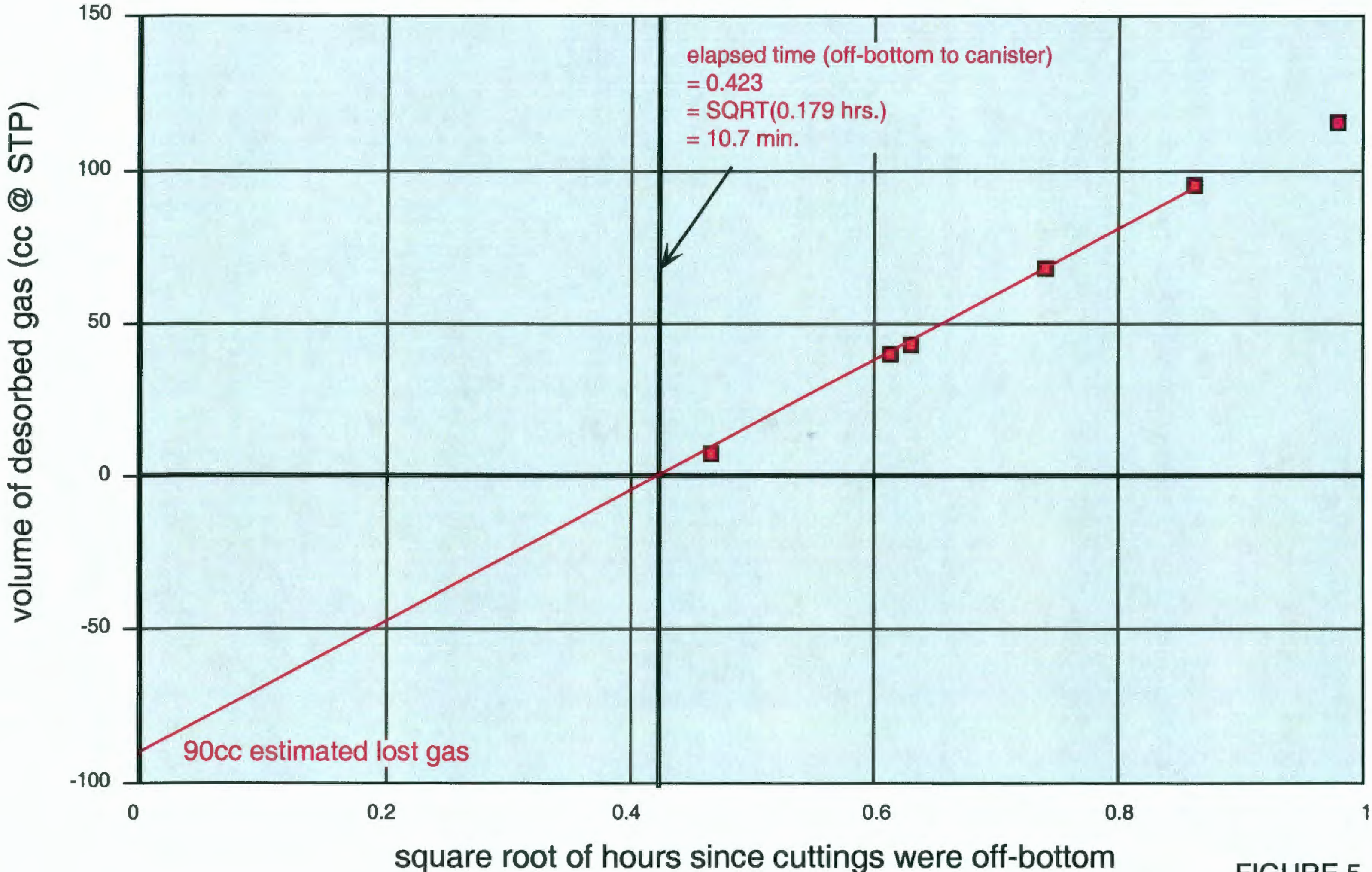


FIGURE 5.

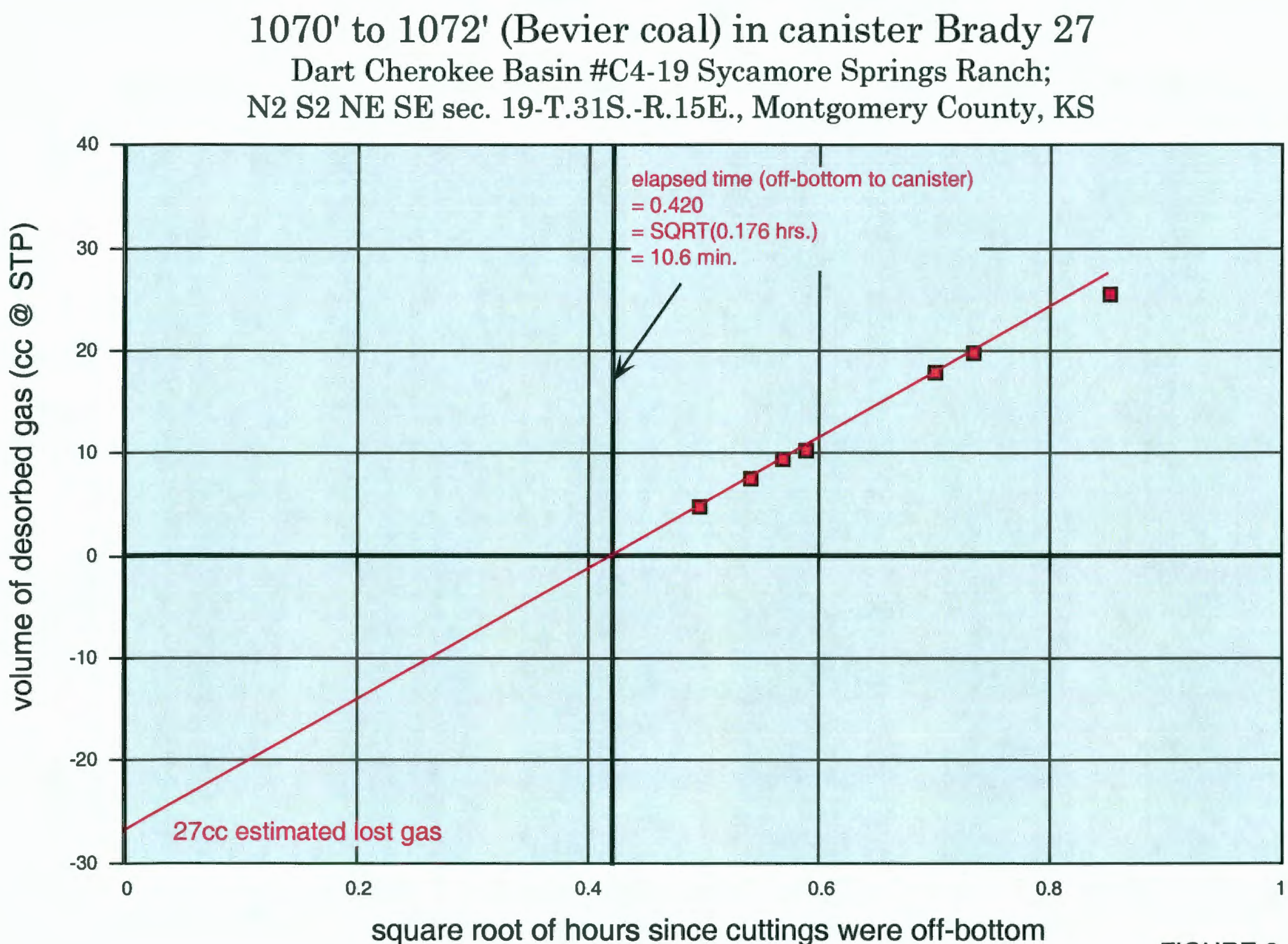

1070' to 1072' (Bevier coal) in canister Brady 27
Dart Cherokee Basin #C4-19 Sycamore Springs Ranch;
N2 S2 NE SE sec. 19-T.31S.-R.15E., Montgomery County, KS
elapsed time (off-bottom to canister)
= 0.420
= SQRT(0.176 hrs.)
= 10.6 min.
27cc estimated lost gas
volume of desorbed gas (cc @ STP)
square root of hours since cuttings were off-bottom
40
30
20
10
0
-10
-20
-30
0
0.2
0.4
0.6
0.8
1

FIGURE 6.

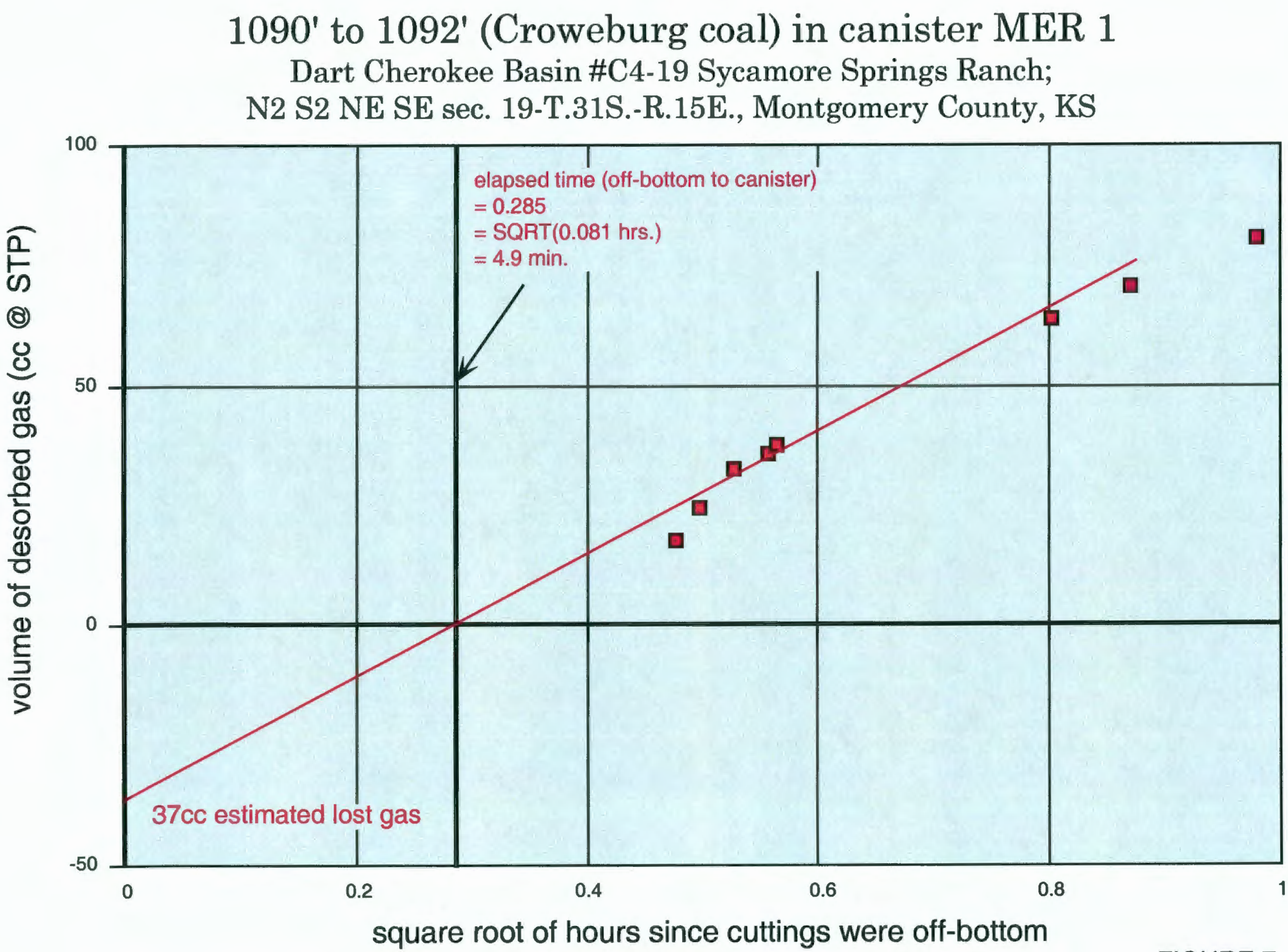

1090' to 1092' (Croweburg coal) in canister MER 1
Dart Cherokee Basin #C4-19 Sycamore Springs Ranch;
N2 S2 NE SE sec. 19-T.31S.-R.15E., Montgomery County, KS
elapsed time (off-bottom to canister)
= 0.285
= SQRT(0.081 hrs.)
= 4.9 min.
37cc estimated lost gas
volume of desorbed gas (cc @ STP)
100
50
0
-50
0
0.2
0.4
0.6
0.8
1
square root of hours since cuttings were off-bottom

FIGURE 7.

1130' to 1132' (Mineral coal) in canister MER Fe

Dart Cherokee Basin #C4-19 Sycamore Springs Ranch;
N2 S2 NE SE sec. 19-T.31S.-R.15E., Montgomery County, KS

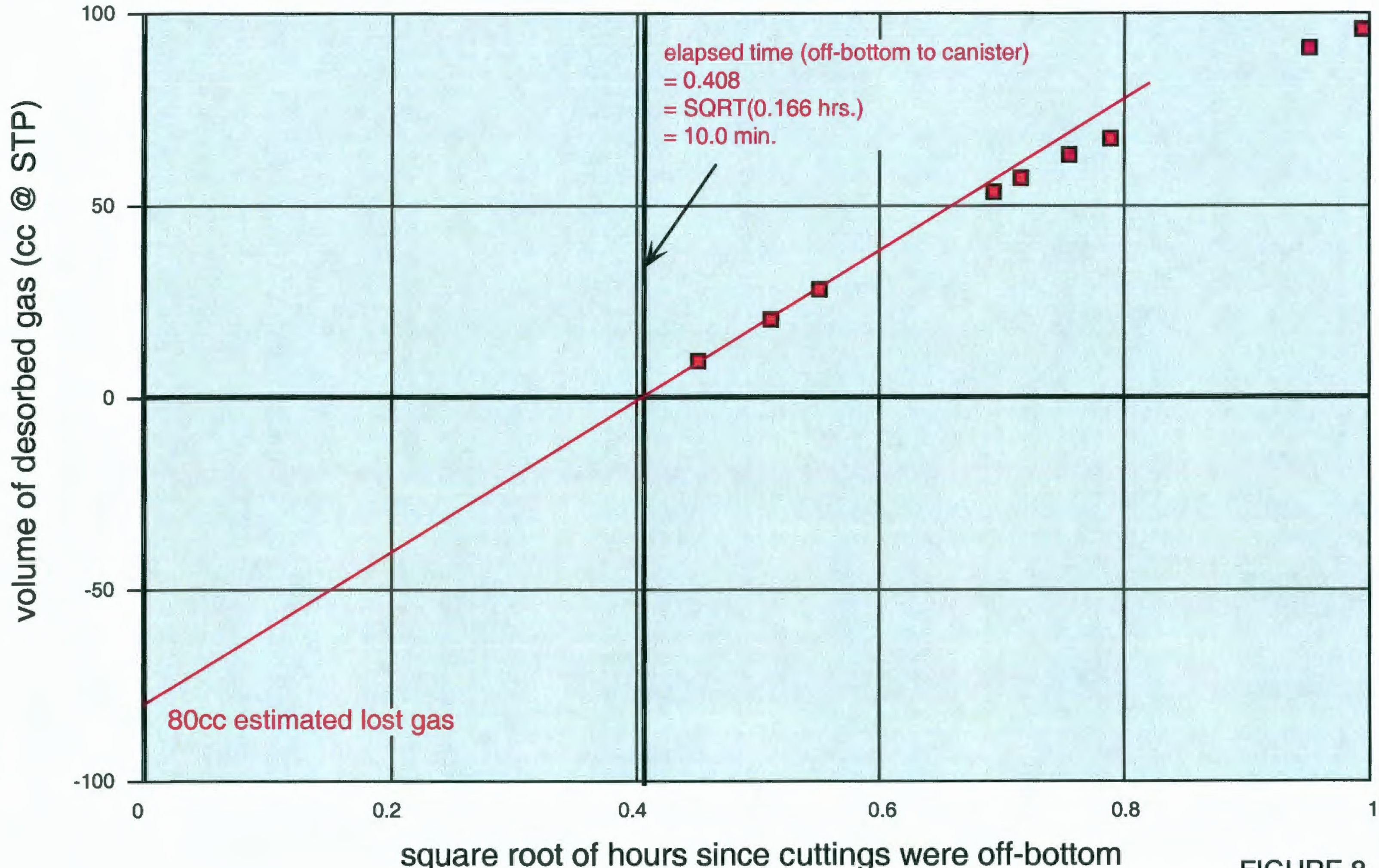
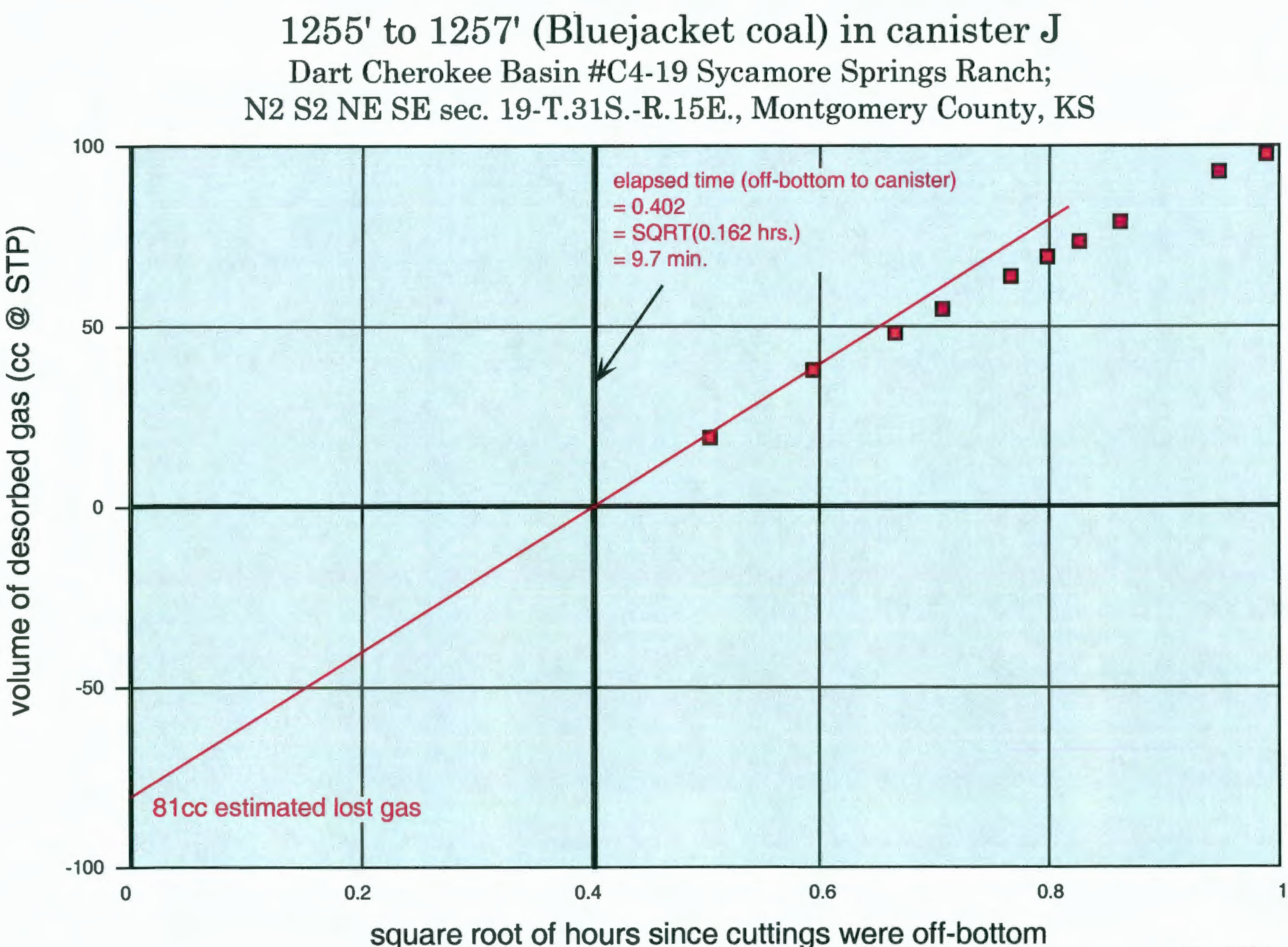


FIGURE 8.



1255' to 1257' (Bluejacket coal) in canister J
Dart Cherokee Basin #C4-19 Sycamore Springs Ranch;
N2 S2 NE SE sec. 19-T.31S.-R.15E., Montgomery County, KS
elapsed time (off-bottom to canister)
= 0.402
= SQRT(0.162 hrs.)
= 9.7 min.
81cc estimated lost gas
volume of desorbed gas (cc @ STP)
square root of hours since cuttings were off-bottom
100
50
0
-50
-100
0
0.2
0.4
0.6
0.8
1

FIGURE 9.

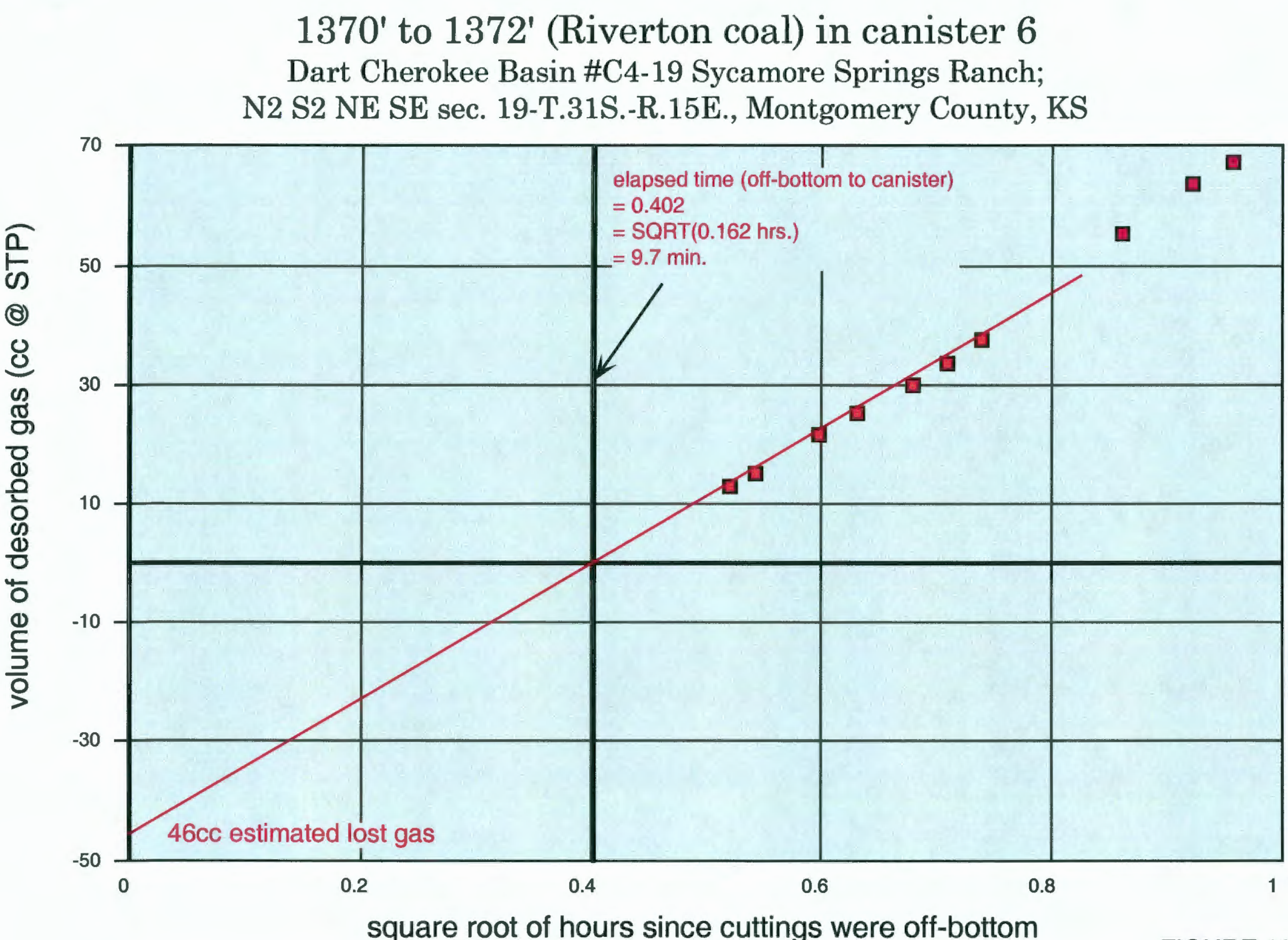

1370' to 1372' (Riverton coal) in canister 6
Dart Cherokee Basin #C4-19 Sycamore Springs Ranch;
N2 S2 NE SE sec. 19-T.31S.-R.15E., Montgomery County, KS
elapsed time (off-bottom to canister)
= 0.402
= SQRT(0.162 hrs.)
= 9.7 min.
46cc estimated lost gas
volume of desorbed gas (cc @ STP)
70
50
30
10
-10
-30
-50
0
0.2
0.4
0.6
0.8
1
square root of hours since cuttings were off-bottom

FIGURE 10.

Desorption Characteristics of Cuttings Samples

Dart Cherokee Basin #C4-19 Sycamore Springs Ranch; N2 S2 NE SE sec. 19-T.31S.-R.15E., Montgomery County, KS

LITHOLOGIC COMPONENT SENSITIVITY ANALYSIS for calculation of gas content of Mulberry coal from 889-891'

$$\text{GAS CONTENT}_{coal} = \frac{\text{total gas desorbed} - ((\text{gas content}_{dark\ shale}) * (\text{weight}_{dark\ shale}))}{\text{weight}_{coal}}$$

total gas desorbed = 156 ccs

TOTAL DRY WEIGHT OF SAMPLE = 2572.02 grams

$\text{weight}_{light\text{-}colored\ lithologies}$ = 2359.28 grams (91.7%)

$\text{weight}_{dark\ shale}$ = 179.40 grams (7.0%)

weight_{coal} = 33.34 grams (1.3%)

sieve size	*grams*	*% coal / % dark shale / % light-colored liths*
>0.0930"	2258.50	1.25% / 7.56% / 91.20%
>0.0661"	208.39	1.34% / 2.08% / 96.58%
>0.0460"	85.28	2.54% / 4.35% / 93.12%
>0.0331"	12.09	1.07% / 2.67% / 96.26%
<0.0331"	7.75	1.55% / 4.17% / 94.29%
	2572.02 TOTAL	

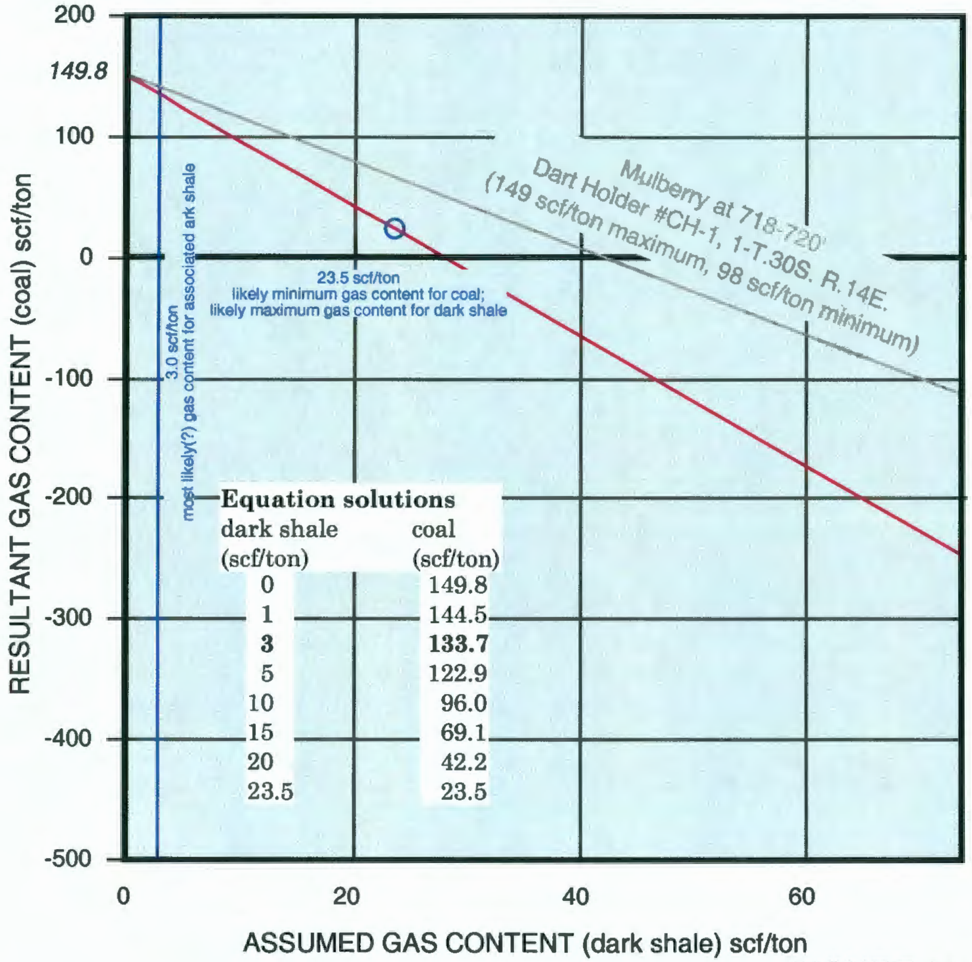


FIGURE 11.

Desorption Characteristics of Cuttings Samples

Dart Cherokee Basin #C4-19 Sycamore Springs Ranch;
N2 S2 NE SE sec. 19-T.31S.-R.15E., Montgomery County, KS

LITHOLOGIC COMPONENT SENSITIVITY ANALYSIS for calculation of gas content of Little Osage Shale from 1010-1012'

$$\text{GAS CONTENT}_{coal} = \frac{\text{total gas desorbed} - ((\text{gas content}_{dark\ shale}) * (\text{weight}_{dark\ shale}))}{\text{weight}_{coal}}$$

total gas desorbed = 725 ccs

TOTAL DRY WEIGHT OF SAMPLE = 1899.61 grams
$\text{weight}_{light\text{-}colored\ lithologies}$ = 363.21 grams (19.1%)
$\text{weight}_{dark\ shale}$ = 1536.40 grams (80.9%)
weight_{coal} = 0.00 grams (0.0%)

sieve size	grams	% coal / % dark shale / % light-colored liths
>0.0930"	1449.87	0.00% / 82.15% / 17.85%
>0.0661"	259.97	0.00% / 81.17% / 18.83%
>0.0460"	138.84	0.00% / 73.50% / 26.50%
>0.0331"	34.17	0.00% / 65.18% / 34.82%
<0.0331"	16.77	0.00% / 60.00% / 40.00%
	1899.61 TOTAL	

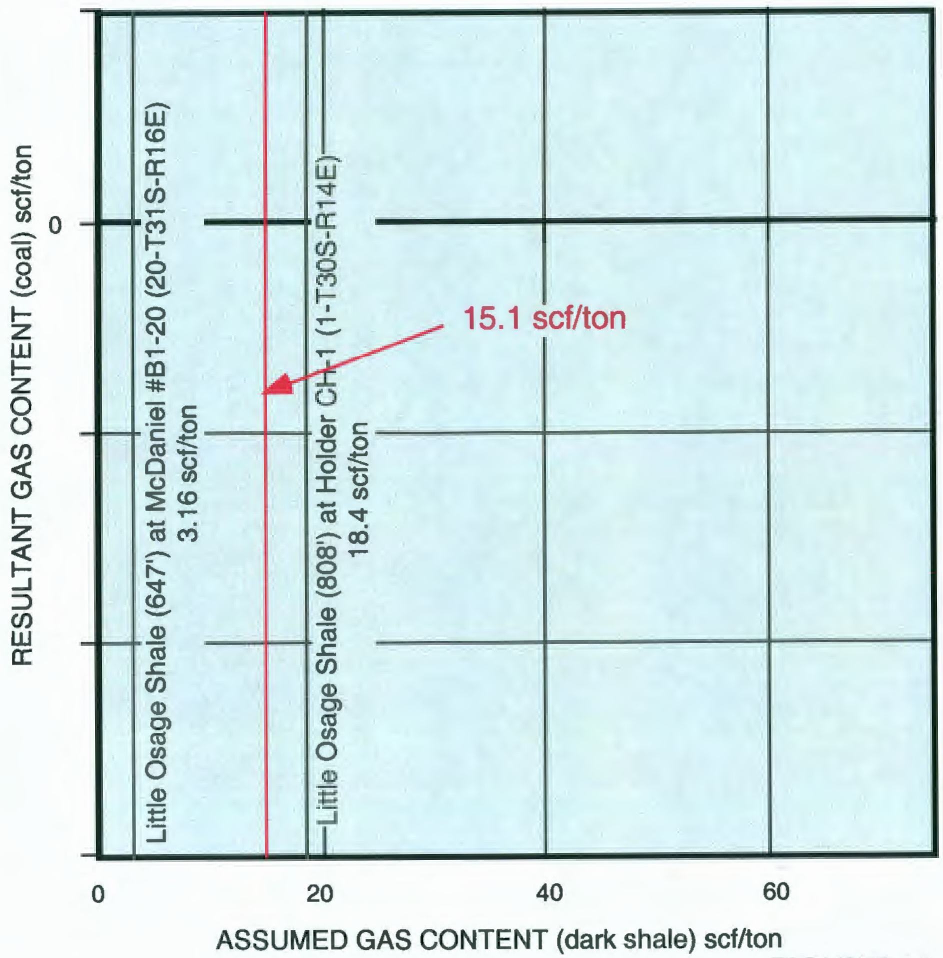


FIGURE 12.

Desorption Characteristics of Cuttings Samples

Dart Cherokee Basin #C4-19 Sycamore Springs Ranch; N2 S2 NE SE sec. 19-T.31S.-R.15E., Montgomery County, KS

LITHOLOGIC COMPONENT SENSITIVITY ANALYSIS for calculation of gas content of Mulky coal from 1037-1039'

$$\text{GAS CONTENT}_{coal} = \frac{\text{total gas desorbed} - ((\text{gas content}_{\text{dark shale}}) * (\text{weight}_{\text{dark shale}}))}{\text{weight}_{coal}}$$

total gas desorbed = 1292 ccs

TOTAL DRY WEIGHT OF SAMPLE = 1324.38 grams

$\text{weight}_{\text{light-colored lithologies}}$ = 357.32 grams (27.0%)

$\text{weight}_{\text{dark shale}}$ = 938.60 grams (70.9%)

$\text{weight}_{\text{coal}}$ = 28.46 grams (2.2%)

sieve size	grams	% coal / % dark shale / % light-colored liths
>0.0930"	1079.99	2.29% / 69.99% / 22.03%
>0.0661"	148.21	1.47% / 77.11% / 21.43%
>0.0460"	67.84	1.61% / 73.49% / 24.90%
>0.0331"	16.62	1.67% / 61.67% / 36.67%
<0.0331"	11.72	1.76% / 70.57% / 27.68%
	1324.38 TOTAL	

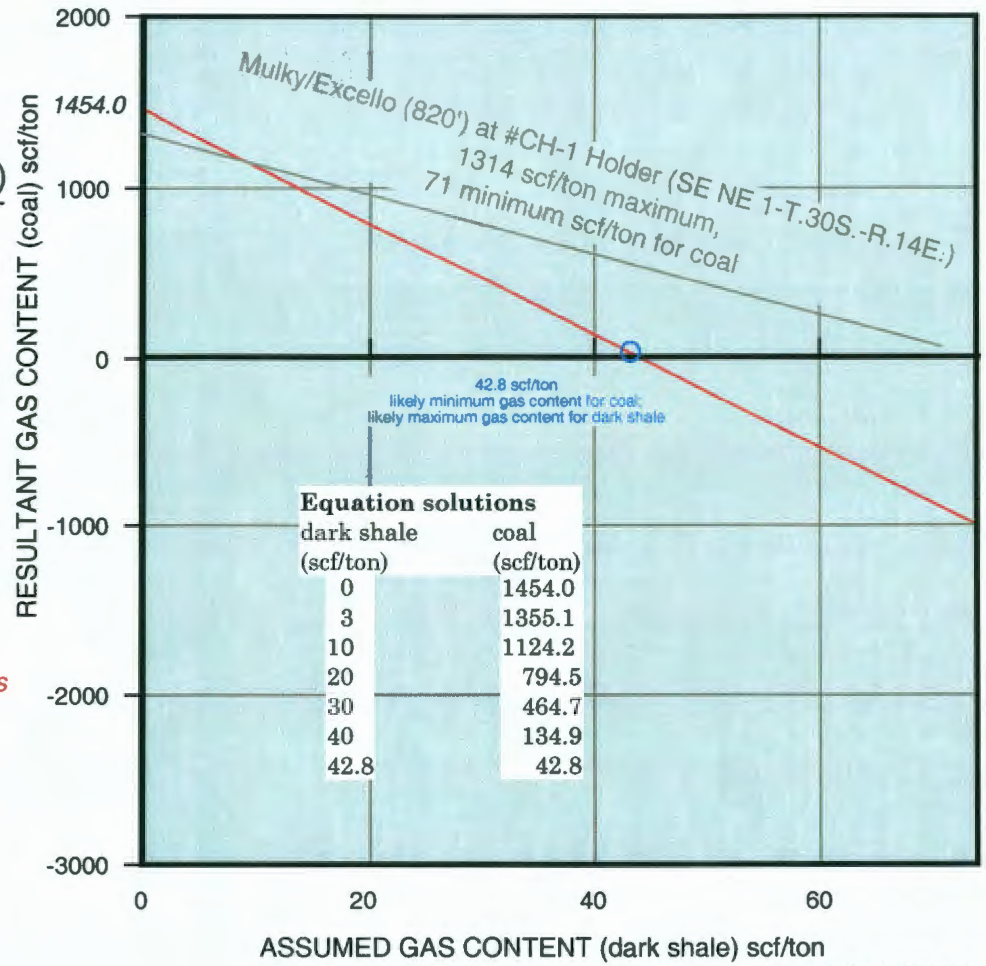


FIGURE 13.

Desorption Characteristics of Cuttings Samples

Dart Cherokee Basin #C4-19 Sycamore Springs Ranch;
N2 S2 NE SE sec. 19-T.31S.-R.15E., Montgomery County, KS

LITHOLOGIC COMPONENT SENSITIVITY ANALYSIS for calculation of gas content of Bevier coal from 1070-1072'

$$\text{GAS CONTENT}_{coal} = \frac{\text{total gas desorbed} - ((\text{gas content}_{dark\ shale}) * (\text{weight}_{dark\ shale}))}{\text{weight}_{coal}}$$

total gas desorbed = 123 ccs

TOTAL DRY WEIGHT OF SAMPLE = 1065.05 grams

$\text{weight}_{light\text{-}colored\ lithologies}$ = 399.06 grams (37.5%)

$\text{weight}_{dark\ shale}$ = 641.88 grams (60.3%)

weight_{coal} = 24.11 grams (2.3%)

sieve size	grams	% coal / % dark shale / % light-colored liths
>0.0930"	805.44	1.75% / 59.53% / 38.72%
>0.0661"	165.59	4.16% / 65.10% / 30.75%
>0.0460"	71.27	3.66% / 60.22% / 36.13%
>0.0331"	14.13	2.15% / 47.31% / 50.54%
<0.0331"	9.01	2.93% / 60.00% / 40.00%
	1065.05 TOTAL	

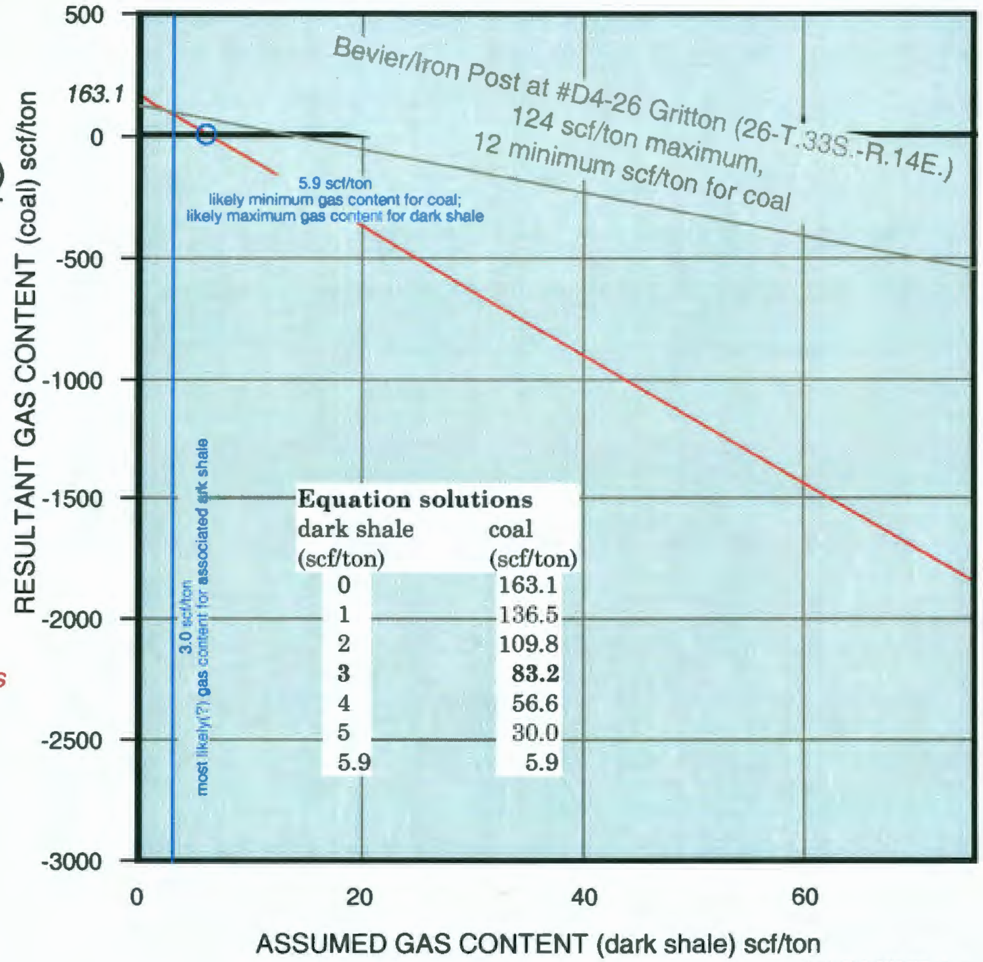


FIGURE 14.

Desorption Characteristics of Cuttings Samples

Dart Cherokee Basin #C4-19 Sycamore Springs Ranch; N2 S2 NE SE sec. 19-T.31S.-R.15E., Montgomery County, KS

LITHOLOGIC COMPONENT SENSITIVITY ANALYSIS for calculation of gas content of Croweburg coal from 1090-1092'

$$\text{GAS CONTENT}_{coal} = \frac{\text{total gas desorbed} - ((\text{gas content}_{dark\ shale}) * (\text{weight}_{dark\ shale}))}{\text{weight}_{coal}}$$

total gas desorbed = 202 ccs

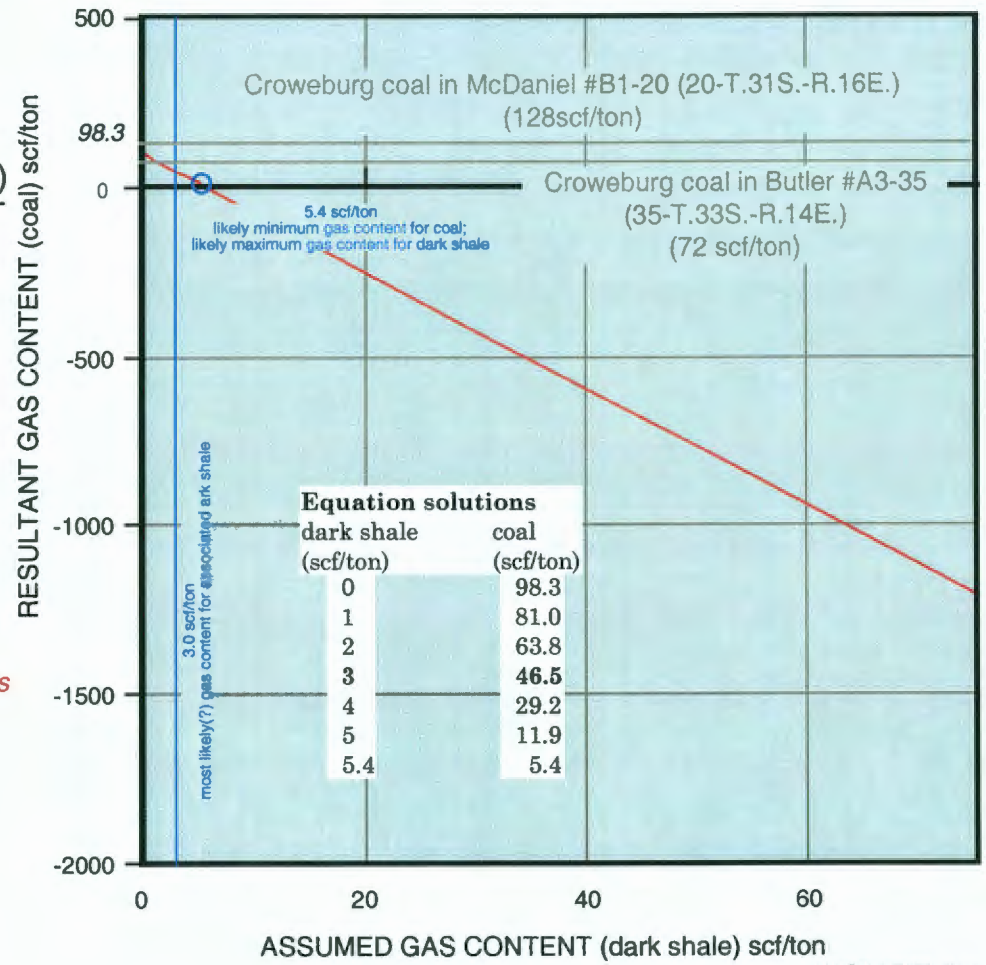
TOTAL DRY WEIGHT OF SAMPLE = 2100.39 grams

$\text{weight}_{light\text{-}colored\ lithologies}$ = 894.97 grams (42.6%)

$\text{weight}_{dark\ shale}$ = 1139.53 grams (54.3%)

weight_{coal} = 65.89 grams (3.1%)

sieve size	grams	% coal / % dark shale / % light-colored liths
>0.0930"	1230.90	3.90% / 46.05% / 50.05%
>0.0661"	470.13	2.38% / 65.55% / 32.07%
>0.0460"	309.17	1.64% / 66.32% / 32.04%
>0.0331"	63.17	1.46% / 67.96% / 30.58%
<0.0331"	9.78	2.35% / 61.47% / 36.19%
	2100.39 TOTAL	



Equation solutions

dark shale (scf/ton)	coal (scf/ton)
0	98.3
1	81.0
2	63.8
3	**46.5**
4	29.2
5	11.9
5.4	5.4

FIGURE 15.

Desorption Characteristics of Cuttings Samples

Dart Cherokee Basin #C4-19 Sycamore Springs Ranch;
N2 S2 NE SE sec. 19-T.31S.-R.15E., Montgomery County, KS

LITHOLOGIC COMPONENT SENSITIVITY ANALYSIS for calculation of gas content of Mineral coal from 1130-1132'

$$\text{GAS CONTENT}_{coal} = \frac{\text{total gas desorbed} - ((\text{gas content}_{dark\ shale}) * (\text{weight}_{dark\ shale}))}{\text{weight}_{coal}}$$

total gas desorbed = 544 ccs

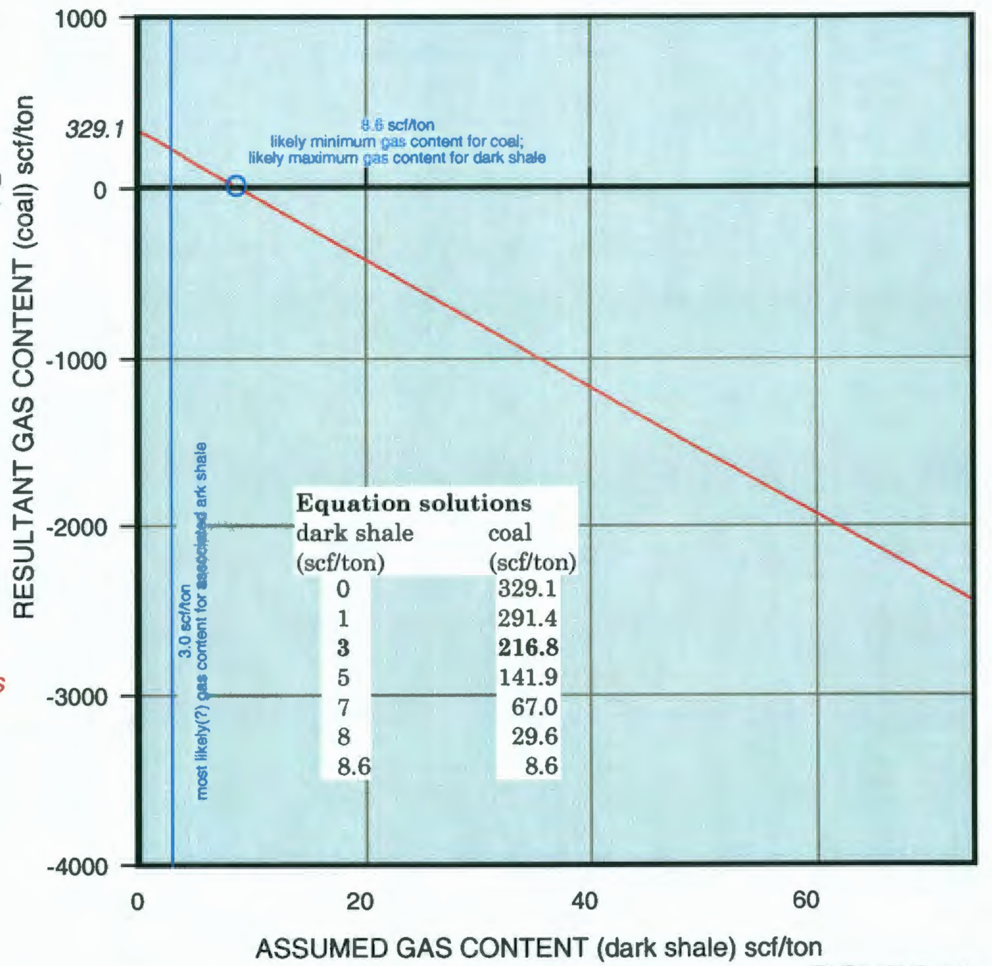
TOTAL DRY WEIGHT OF SAMPLE = 2711.45 grams

$\text{weight}_{light\text{-}colored\ lithologies}$ = 676.01 grams (24.9%)

$\text{weight}_{dark\ shale}$ = 1982.48 grams (73.1%)

weight_{coal} = 52.96 grams (2.0%)

sieve size	*grams*	*% coal / % dark shale / % light-colored liths*
>0.0930"	2223.69	2.02% / 75.09% / 22.89%
>0.0661"	301.99	1.38% / 66.61% / 32.01%
>0.0460"	143.31	1.95% / 60.62% / 37.43%
>0.0331"	29.89	2.97% / 55.45% / 41.58%
<0.0331"	12.57	2.08% / 64.44% / 33.48%
	2711.45 TOTAL	



Equation solutions

dark shale (scf/ton)	coal (scf/ton)
0	329.1
1	291.4
3	**216.8**
5	141.9
7	67.0
8	29.6
8.6	8.6

FIGURE 16.

Desorption Characteristics of Cuttings Samples

Dart Cherokee Basin #C4-19 Sycamore Springs Ranch;
N2 S2 NE SE sec. 19-T.31S.-R.15E., Montgomery County, KS

LITHOLOGIC COMPONENT SENSITIVITY ANALYSIS for calculation of gas content of Bluejacket coal from 1255-1257'

$$\text{GAS CONTENT}_{coal} = \frac{\text{total gas desorbed} - ((\text{gas content}_{dark\ shale}) * (\text{weight}_{dark\ shale}))}{\text{weight}_{coal}}$$

total gas desorbed = 547 ccs

TOTAL DRY WEIGHT OF SAMPLE = 1561.11 grams
$\text{weight}_{light\text{-}colored\ lithologies}$ = 74.89 grams (4.8%)
$\text{weight}_{dark\ shale}$ = 1404.52 grams (90.0%)
weight_{coal} = 81.70 grams (5.2%)

sieve size	*grams*	*% coal / % dark shale / % light-colored liths*
>0.0930"	1321.15	5.58% / 89.74% / 4.69%
>0.0661"	164.92	3.66% / 91.59% / 4.75%
>0.0460"	59.31	2.04% / 91.33% / 6.63%
>0.0331"	11.20	5.41% / 86.49% / 8.11%
<0.0331"	4.54	4.17% / 89.78% / 6.05%
	1561.11 TOTAL	

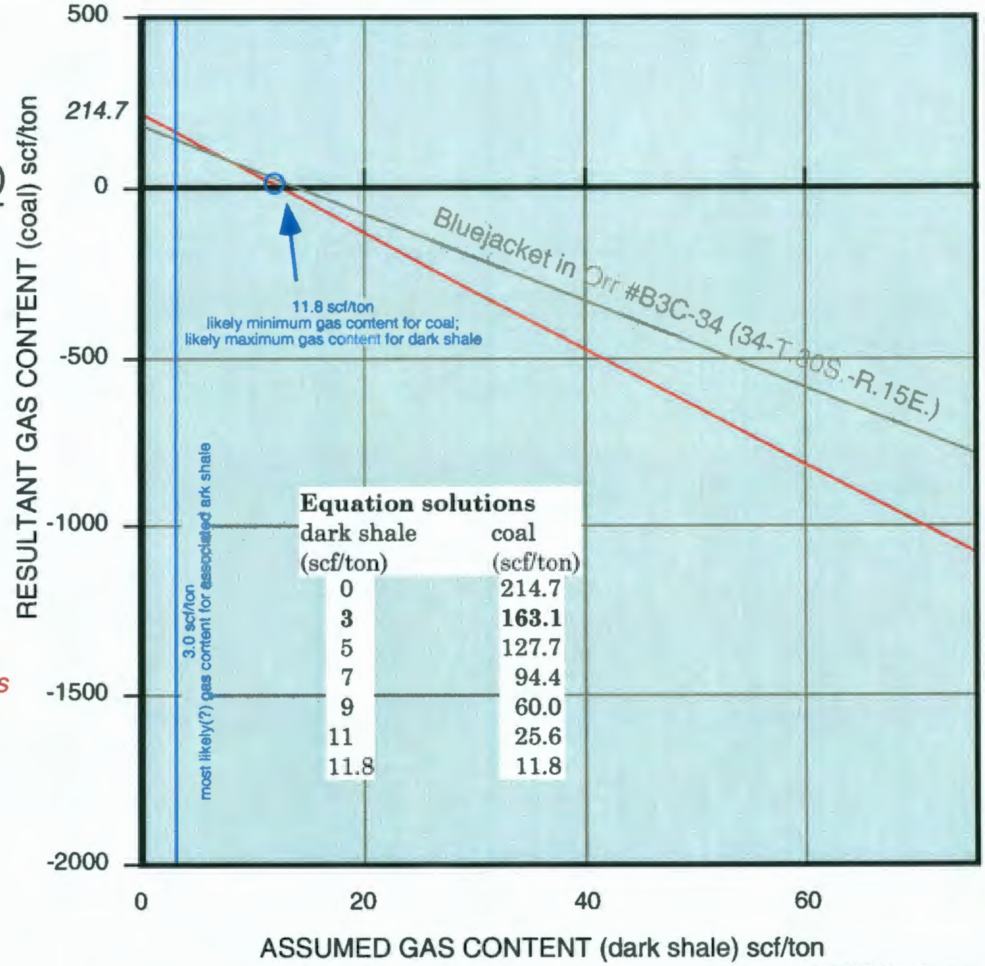


FIGURE 17.

Desorption Characteristics of Cuttings Samples

Dart Cherokee Basin #C4-19 Sycamore Springs Ranch;
N2 S2 NE SE sec. 19-T.31S.-R.15E., Montgomery County, KS

LITHOLOGIC COMPONENT SENSITIVITY ANALYSIS for calculation of gas content of Riverton coal from 1370-1372'

$$\text{GAS CONTENT}_{coal} = \frac{\text{total gas desorbed} - ((\text{gas content}_{dark\ shale}) * (\text{weight}_{dark\ shale}))}{\text{weight}_{coal}}$$

total gas desorbed = 284 ccs

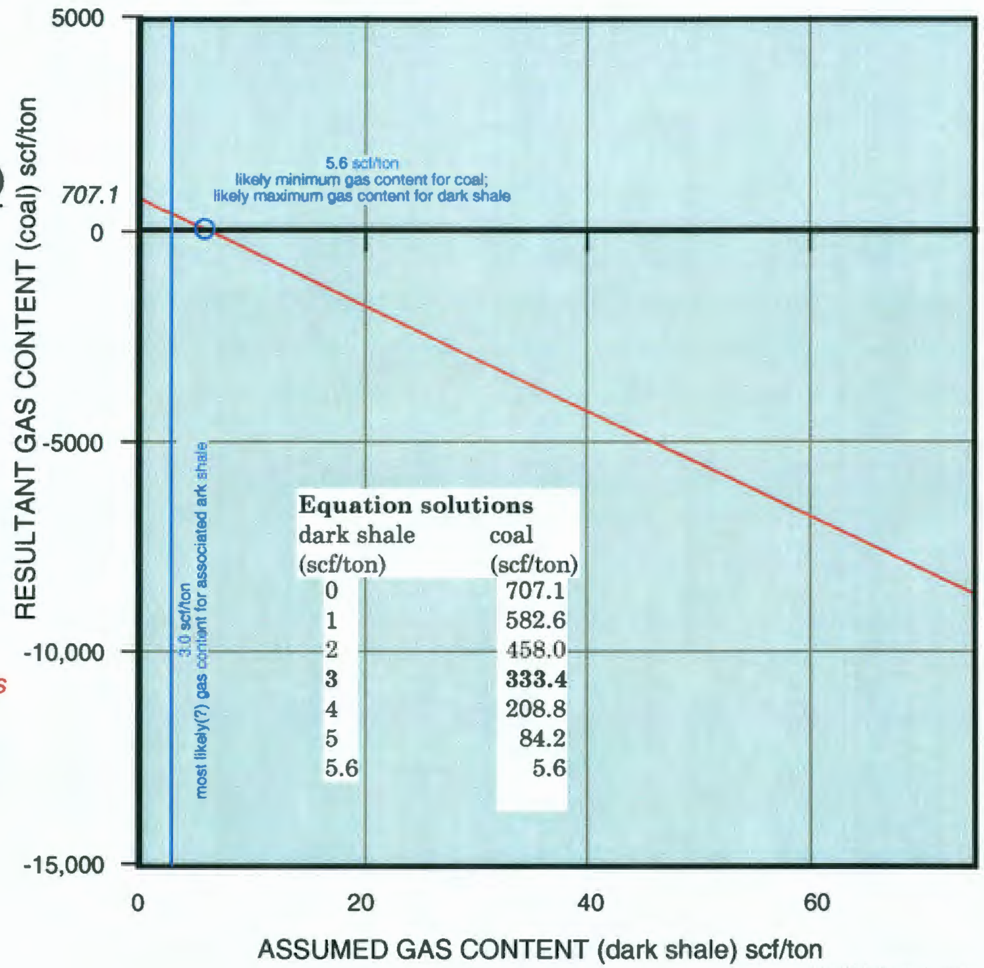
TOTAL DRY WEIGHT OF SAMPLE = 2018.08 grams

$\text{weight}_{light\text{-}colored\ lithologies}$ = 401.80 grams (19.9%)

$\text{weight}_{dark\ shale}$ = 1603.41 grams (79.5%)

weight_{coal} = 12.87 grams (0.6%)

sieve size	*grams*	*% coal / % dark shale / % light-colored liths*
>0.0930"	1639.31	0.11% / 77.86% / 22.03%
>0.0661"	202.65	3.25% / 86.69% / 10.06%
>0.0460"	120.63	3.27% / 85.93% / 10.80%
>0.0331"	31.97	0.38% / 87.29% / 12.33%
<0.0331"	23.52	1.75% / 84.44% / 13.81%
	2018.08 TOTAL	



Equation solutions

dark shale (scf/ton)	coal (scf/ton)
0	707.1
1	582.6
2	458.0
3	**333.4**
4	208.8
5	84.2
5.6	5.6

FIGURE 18.

surface
100'
200'
300'
500'
600'
700'
800'
889'-891' Mulberry
1000'
1010'-1012' Little Osage Sh.
1037'-1039' Mulky/Excello
1070'-1072' Bevier
1090'-1092' Croweburg
1130'-1132' Mineral
1200'
1255'-1257' Bluejacket
1300'
1370'-1372' Riverton

Desorption Characteristics of Cuttings Samples

Dart Dart Cherokee Basin #C4-19 Sycamore Springs Ranch; N2 S2 NE SE sec. 19-T.31S.-R.15E., Montgomery County, KS

LITHOLOGIC COMPONENT SENSITIVITY ANALYSIS for all samples

UNIT	coal in sample	scf/ton w/ shale @ 3 scf/ton	maximum scf/ton	minimum scf/ton
Mulberry	1%	133.7	149.8	23.5
Little Osage Sh.	0%	-------	15.1	15.1
Mulky/Excello	2%	1355.1	1454.0	42.8
Bevier	2%	83.2	163.1	5.9
Croweburg	3%	46.5	98.3	5.3
Mineral	2%	216.8	329.1	8.6
Bluejacket	5%	163.1	214.7	11.8
Riverton	1%	333.4	707.1	5.6

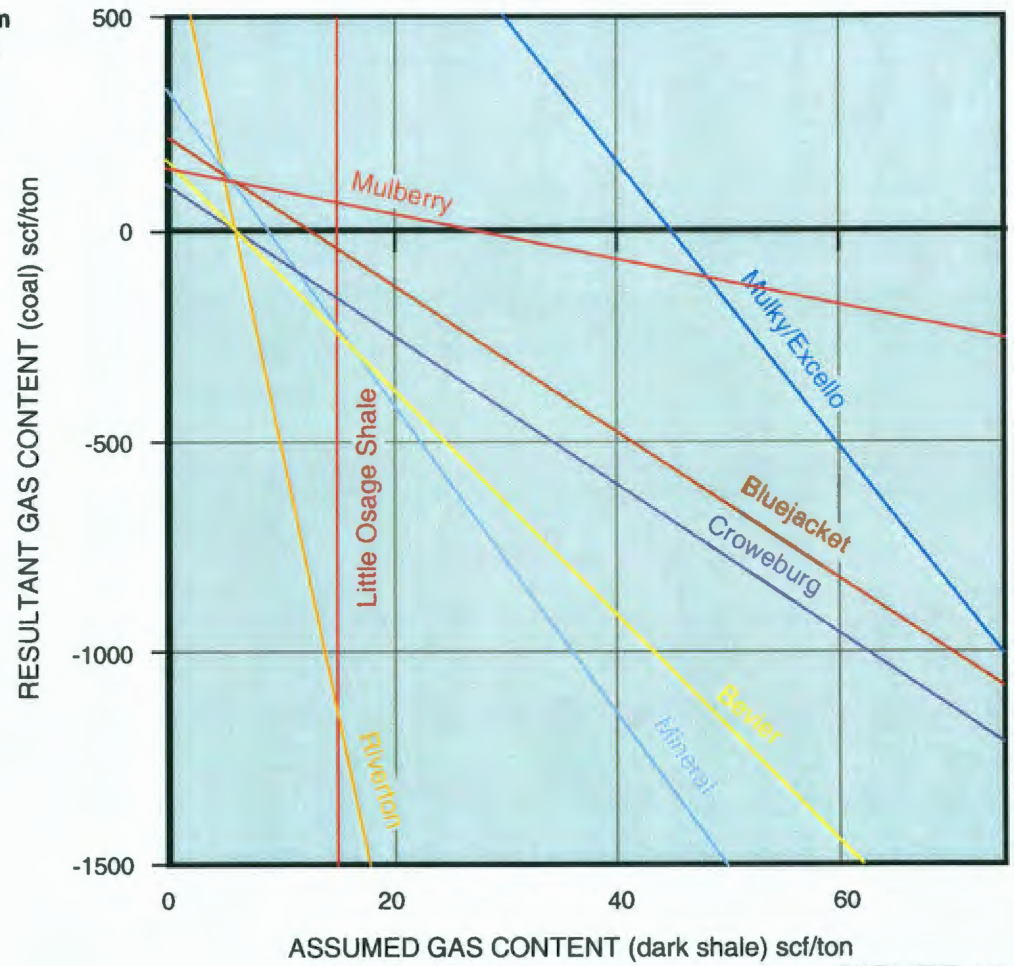


FIGURE 19.

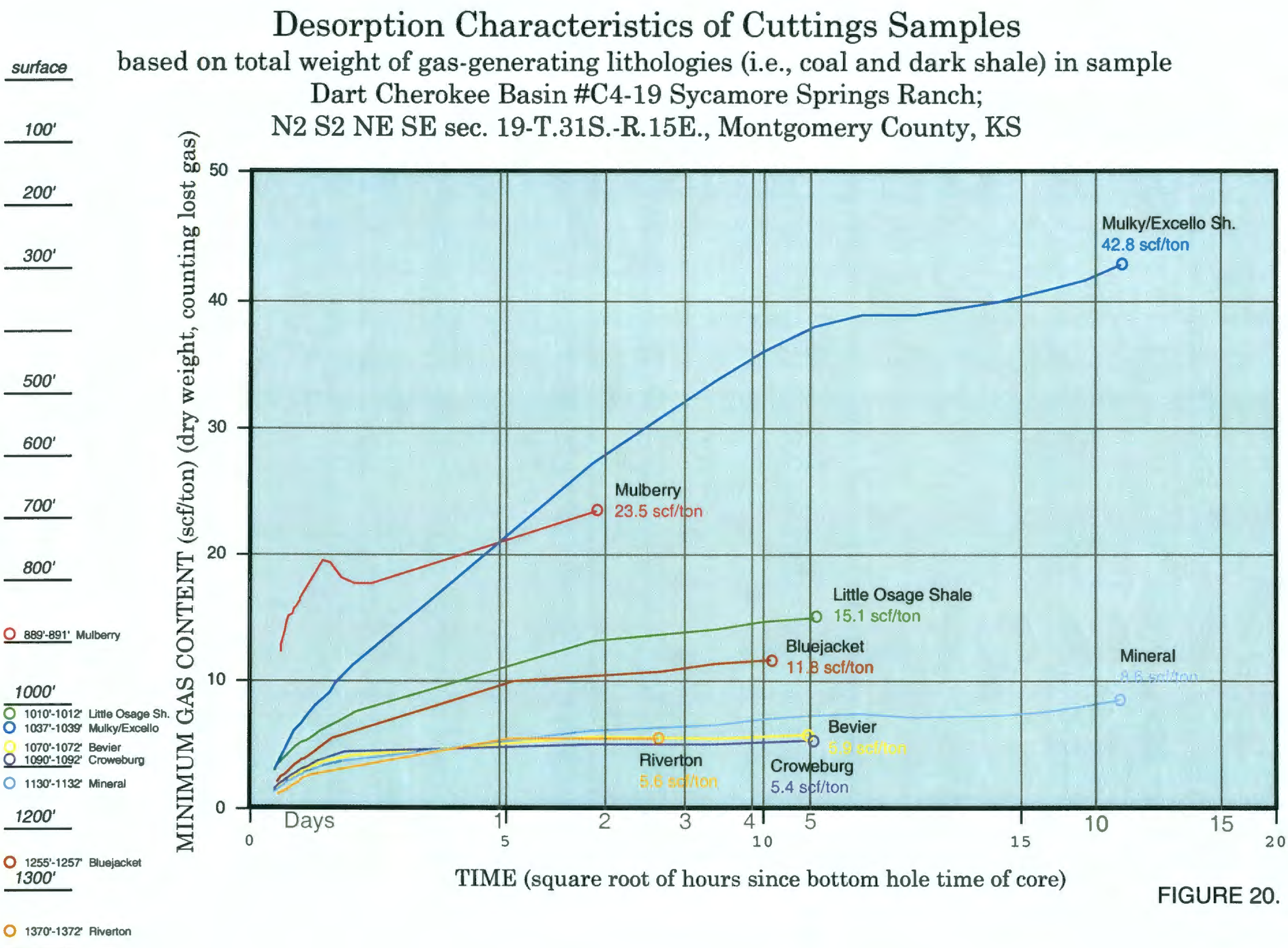

Desorption Characteristics of Cuttings Samples
based on total weight of gas-generating lithologies (i.e., coal and dark shale) in sample
Dart Cherokee Basin #C4-19 Sycamore Springs Ranch;
N2 S2 NE SE sec. 19-T.31S.-R.15E., Montgomery County, KS
surface
100'
200'
300'
500'
600'
700'
800'
889'-891' Mulberry
1000'
1010'-1012' Little Osage Sh.
1037'-1039' Mulky/Excello
1070'-1072' Bevier
1090'-1092' Croweburg
1130'-1132' Mineral
1200'
1255'-1257' Bluejacket
1300'
1370'-1372' Riverton
MINIMUM GAS CONTENT (scf/ton) (dry weight, counting lost gas)
0
10
20
30
40
50
Mulky/Excello Sh.
42.8 scf/ton
Mulberry
23.5 scf/ton
Little Osage Shale
15.1 scf/ton
Bluejacket
11.8 scf/ton
Mineral
8.6 scf/ton
Bevier
5.9 scf/ton
Riverton
5.6 scf/ton
Croweburg
5.4 scf/ton
Days
1
2
3
4
5
10
15
0
5
10
15
20
TIME (square root of hours since bottom hole time of core)

FIGURE 20.