ANALYSIS OF MARMATON AND CHEROKEE GROUP CUTTINGS SAMPLES FOR GAS CONTENT -- DART CHEROKEE BASIN OPERATING COMPANY #D4-26 GRITTON; SW SW SW sec. 26-T.33S.-R.14E.; MONTGOMERY COUNTY, KANSAS

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OCTOBER 30, 2003
(to be held proprietary to August 25, 2005)

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Kansas Geological Survey
Open-file Report no. 2005-45

SUMMARY

Six cuttings samples from the Pennsylvanian Marmaton Group and Cherokee Group were collected from the Dart Cherokee Basin #D4-26 Gritton well, SW SW SW sec. 26-T.33S.-R.14E. in Montgomery County, KS. One sample (Little Osage Shale) did not have any coal present. The samples calculate as having the following gas contents:

- Little Osage Shale at 943' to 945' depth[1] (4.7 scf/ton)
- Bevier/Iron Post coal at 983' to 988' depth[2] (97.0 scf/ton)
- Croweburg coal at 1020' to 1022' depth[3] (----- scf/ton)
- Weir-Pittsburg coal at 1105' to 1107' depth[3] (----- scf/ton)
- Aw(?) coal at 1335' to 1337' depth[3] (----- scf/ton)
- Riverton coal at 1350' to 1352' depth[3] (----- scf/ton)

[1]no coal in sample
[2]assuming accompanying dark shales in sample desorb 3 scf/ton
[3]no results returned due to lack of coal in sample and no appreciable gas evolved

BACKGROUND

The Dart Cherokee Basin #D4-26 Gritton well (SW SW SW sec. 26-T.33S.-R.14E.) 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 August 25 and 26, 2003 by K.D. Newell, T.A. Johnson, and W.M. Brown 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 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.

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

- Little Osage Shale at 943' to 945' depth (2785 grams dry wt.)
- Bevier/Iron Post coal at 983' to 988' depth (1835 grams dry wt.)
- Croweburg coal at 1020' to 1022' depth (1190 grams dry wt.)
- Weir-Pittsburg coal at 1105' to 1107' depth (534 grams dry wt.)
- Aw(?) coal at 1335' to 1337' depth (559 grams dry wt.)
- Riverton coal at 1350' to 1352' depth (648 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. Formation water from a nearby well (Dart Cherokee Basin #A3-35

Butler; sec. 35-T.33S.-R.14E.), with zephryn chloride biocide, was added to the cuttings before the canisters were sealed. In case of small sample size (i.e., for the Croweburg and deeper samples -- 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 80 °F. The canistered samples at the end of each 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 #D4-26 Gritton well, the maximum time of desorption was 41 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. For a general understanding of the lithologic-component-sensitivity-analyses diagrams, the calculated *gas content*$_{coal}$ is given for assumed *gas content*$_{dark\ shale}$ at 30 scf/ton and 50 scf/ton. For most samples gathered in east-central and northeastern Kansas, the resultant *gas content*$_{coal}$ is a negative number for 30 scf/ton and 50 scf/ton *gas content*$_{dark\ shale}$. The only conclusion is that the *gas content*$_{dark\ shale}$ or most samples taken from this region has to be lower than 30-50 scf/ton. 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.

In all the lithologic-component-sensitivity-analysis diagrams, a "break-even" point is 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.

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.

The Bevier/Iron Post sample contained 6.3% coal. Although this is a relatively small amount, the sample also had a considerable amount of light-colored shale and limestone, which do not generate significant amounts of gas. The ratio of dark-colored shale to coal is thus not excessive, an a reasonable estimate for gas content for the coal in this sample can be made, assuming the admixed dark shale in the sample desorb 3 scf/ton.

The value of 3 scf/ton for average dark shales is based on the assay of the gas content of the dark shales in nearby wells. High-gamma-ray shales (such as the Excello Shale), also colloquially known as "hot shales", however, typically have more organic matter and associated gas content than normal shales. 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.

Significant problems were encountered for the Croweburg coal sample at 1020' to 1022' depth, and all samples below it. After the Bevier/Iron Post sample was taken, the sample return became erratic due to excessive water entering the hole. Coal also was difficult to detect in the cuttings (the Croweburg sample only contained 1.6% coal) and the driller speculated that coals in particular were being milled to powder by the coal not being effectively lifted from the vicinity of the percussion bit. The daytime temperatures were also approaching 110 °F and this may have caused significant desorption of gas from the cuttings as the cuttings were traveling up the hole to the surface. The initial volume of gas desorbed from the samples (important for lost-gas determinations) became minimal, and even negative for the Weir-Pittsburg sample. Temperature of the air stream at the exit pipe was recorded to be 115 °F. Excessive daytime temperature was a new problem encountered by us with the gathering of cuttings from an air-drilled rig, and it indicates that sampling for cuttings desorption may be less than effective during summertime heat.

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

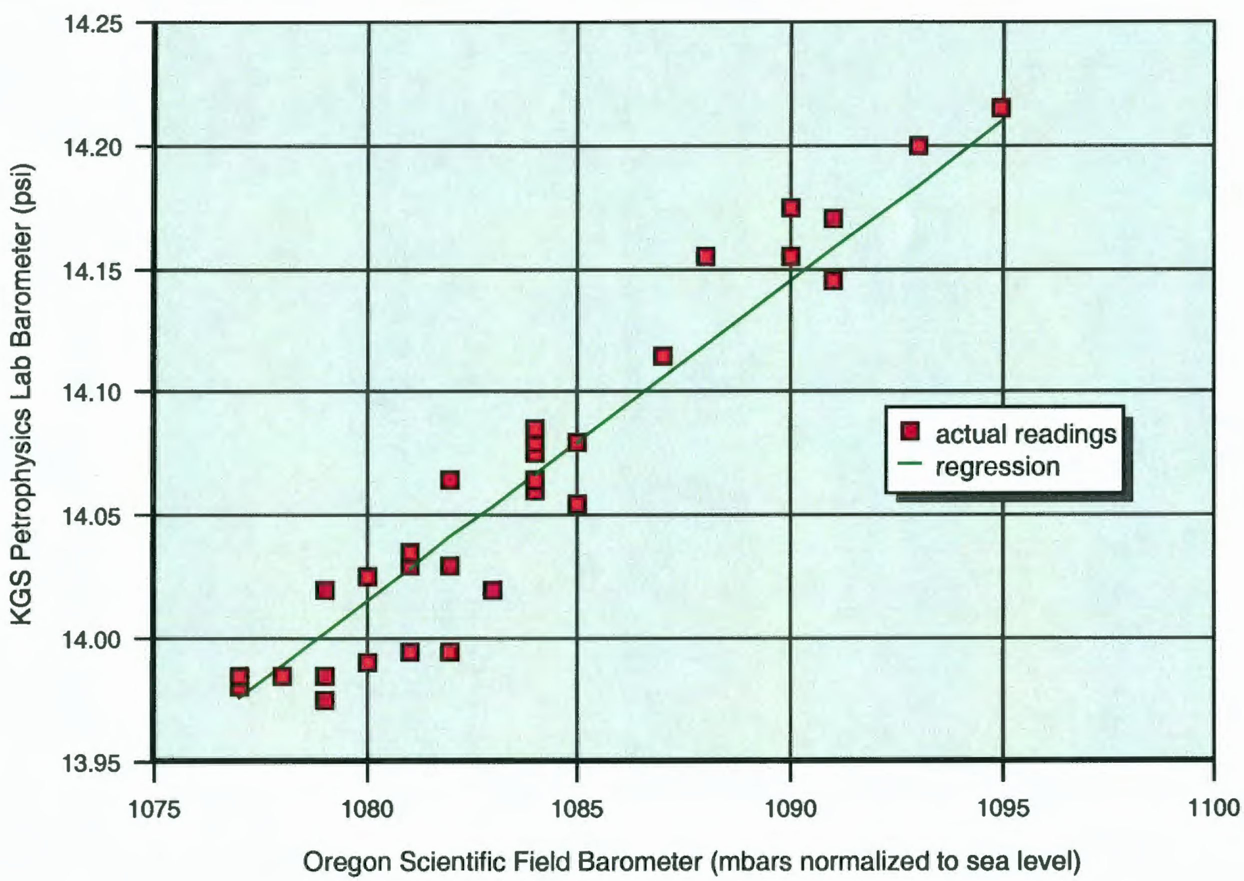


FIGURE 1.

Dart Cherokee Basin #C4-26 Gritton; SW SW SW sec. 26-T.33S.-R.14E., Montgomery County, KS
lag-time to surface for well cuttings

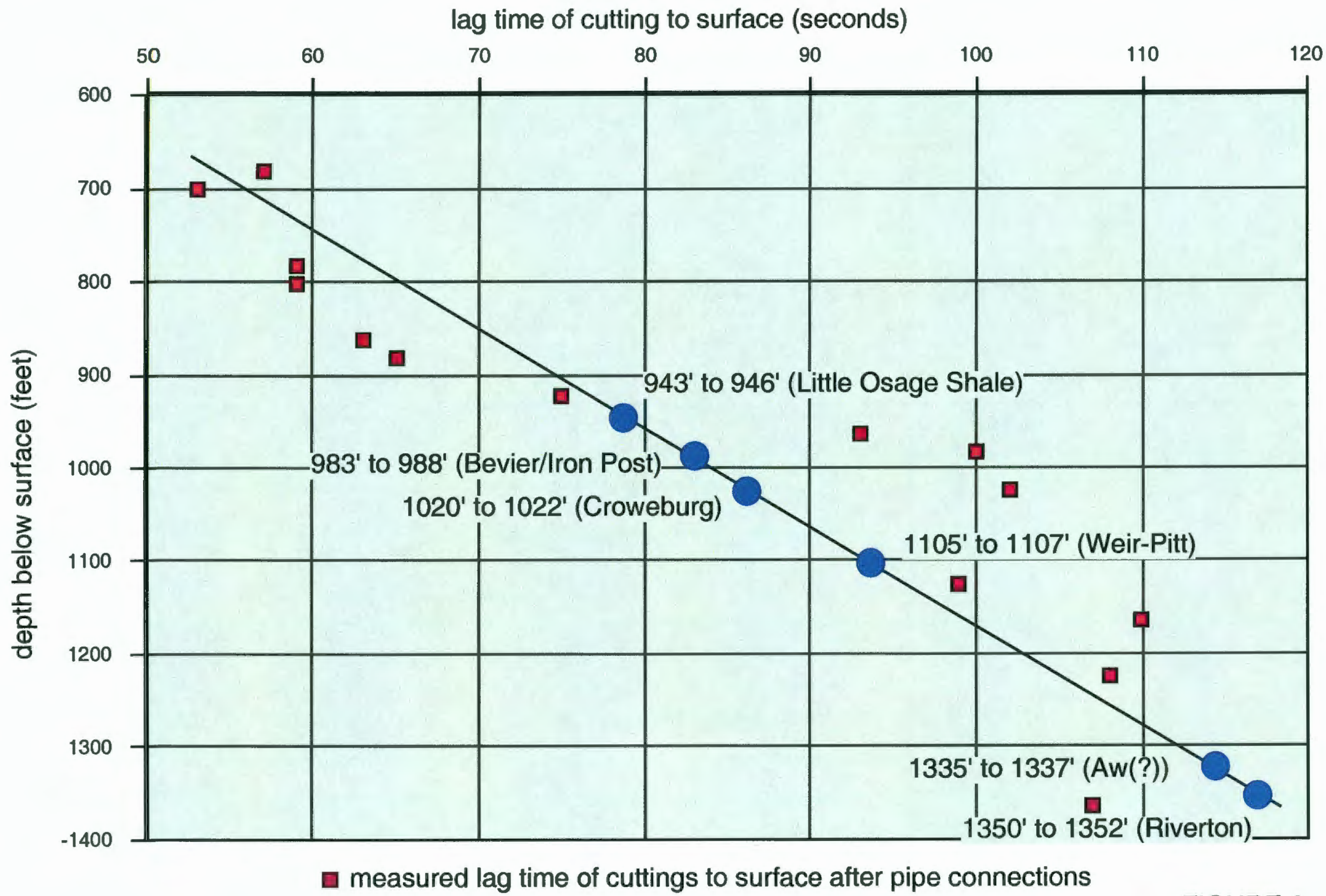


FIGURE 2.

TABLE 1 -- Desorption data for Dart Cherokee Basin #D4-26 Gritton, SW SW SW 26-T.33S.-R.14E.

SAMPLE: 943' to 945' (Summit "coal" -- Little Osage Shale) in canister Maggy 4

DENSITIES:

DRY WEIGHT lbs. grams

sample weight: 4.4976 2040.16

est. lost gas (cc) = 72

TIME OF: off bottom 8/25/03 13:39; in canister 8/25/03 13:47; at surface 8/25/03 13:41

elapsed time (off bottom to canistering) 7.6 minutes; 0.126 hours; 0.355121263 SQRT (hrs)

CONVERSION OF VOLUMES TO STP

RIG MEASUREMENTS			CONVERSION OF RIG MEASUREMENTS TO STP (cubic ft; @60 degrees; @14.7 psi)					CUMULATIVE VOLUMES		SCF/TON	SCF/TON		TIME SINCE		
measured cc	measured T (F)	measured P	cubic ft (@rig)	ABSOLUTE T (F) (@rig)	psia (@rig)	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	80	1067	0.00081224	540	14.109	0.000750701	21.2574	0.000750701	21.2574	0.333809244	1.464439958	8/25/03 13:51	0:11:19	0:03:45	0.434293807
4	80	1087	0.000141259	540	14.109	0.000130557	3.696939	0.000881257	24.95434	0.391663025	1.52249374	8/25/03 13:52	0:12:19	0:04:45	0.453075907
3	80	1067	0.000105944	540	14.109	9.79175E-05	2.772704	0.000979175	27.72704	0.435403361	1.566034076	8/25/03 13:53	0:13:19	0:05:45	0.471109801
5	80	1067	0.000176574	540	14.109	0.000163196	4.621173	0.001142371	32.34821	0.507970566	1.638601303	8/25/03 13:54	0:14:49	0:07:15	0.49693505
4	80	1067	0.000141259	540	14.109	0.000130557	3.696939	0.001272927	36.04515	0.56602437	1.696655084	8/25/03 13:56	0:16:19	0:08:45	0.521482928
9	80	1067	0.000317833	540	14.109	0.000293752	8.316112	0.00156668	44.36326	0.696645376	1.827276093	8/25/03 13:59	0:19:19	0:11:45	0.567401484
1	80	1067	3.53148E-05	540	14.109	3.26392E-05	0.924235	0.001599319	45.2875	0.711158824	1.841789538	8/25/03 14:03	0:23:19	0:15:45	0.623388807
1	80	1087	3.53148E-05	540	14.109	3.26392E-05	0.924235	0.001631958	46.21173	0.725672269	1.856302984	8/25/03 14:05	0:25:49	0:16:15	0.655955622
6	80	1087	0.000211669	540	14.109	0.000195635	5.545406	0.001827793	51.75714	0.812752941	1.943383656	8/25/03 14:12	0:33:04	0:25:30	0.742368582
4	80	1087	0.000141259	540	14.109	0.000130557	3.696939	0.00195635	55.45408	0.870806723	2.001437437	8/25/03 14:15	0:35:34	0:28:00	0.769920631
5	80	1087	0.000176574	540	14.109	0.000163196	4.621173	0.002121545	60.07525	0.94337395	2.074004664	8/25/03 14:18	0:38:19	0:30:45	0.799131473
13	80	1087	0.000459092	540	14.109	0.000424309	12.01505	0.002545655	72.0903	1.13204674	2.262679454	8/25/03 14:24	0:44:34	0:37:00	0.861845565
18	80	1086	0.000635666	540	14.096	0.000586964	16.62092	0.003132819	66.71122	1.393050423	2.523681138	6/25/03 14:35	0:55:19	0:47:45	0.960179381
45	80	1086	0.001569166	540	14.096	0.001467411	41.5523	0.00460023	130.2835	2.045554633	3.176185347	8/25/03 15:13	1:33:34	1:26:00	1.24877718
18	80	1086	0.000635666	540	14.096	0.000586964	16.62092	0.005167194	146.6844	2.306556316	3.437187031	8/25/03 15:38	1:58:19	1:50:45	1.404259394
7	80	1066	0.000247204	540	14.096	0.000228264	6.463691	0.005415458	153.3461	2.408056971	3.538687686	8/25/03 15:57	2:17:19	2:09:45	1.512615624
-3	80	1066	-0.00010594	540	14.096	-9.78274E-05	-2.77015	0.005317631	150.576	2.364558691	3.495187405	8/25/03 16:26	2:46:19	2:38:45	1.664915747
3	80	1086	0.000105944	540	14.096	9.78274E-05	2.770153	0.005415456	153.3481	2.408056971	3.538687686	8/25/03 16:46	3:06:19	2:58:45	1.762179837
18	75	1083	0.000635666	535	14.057	0.000590613	16.72991	0.006006272	170.078	2.670770166	3.6014009	8/25/03 19:56	6:16:19	6:06:45	2.504365043
27	75	1082	0.0009535	535	14.044	0.000885402	25.0717	0.006891674	195.1497	3.064476139	4.195106853	8/26/03 5:22	15:42:19	15:34:45	3.962988491
7	76	1079	0.000247204	536	14.005	0.000228465	6.469953	0.007120159	201.6197	3.166075139	4.296705853	8/26/03 16:37	26:57:19	26:49:45	5.191847241
27	83	1082	0.0009535	543	14.044	0.000672357	24.70231	0.007992516	226.322	3.553980635	4.68461135	8/27/03 14:11	48:31:19	48:23:45	6.96576948
-21	82	1079	-0.00074161	542	14.005	-0.000677867	-19.195	0.007314649	207.127	3.252557772	4.363166487	8/28/03 16:41	75:01:19	74:53:45	8.661520908
-18	80	1084	-0.00063567	540	14.070	-0.000585883	-16.5903	0.006726765	190.5367	2.992036754	4.122667469	8/29/03 14:10	96:30:19	96:22:45	9.82370998

DECANISTERED 08/29/03

SAMPLE: 983' to 988' (Bevier/Iron Post) in canister Brady 23

DRY WEIGHT lbs. grams

sample weight: 2.5379 1151.18

est. lost gas (cc) = 50

TIME OF: off bottom 8/25/03 14:26; in canister 8/25/03 14:34; at surface 8/25/03 14:27

elapsed time (off bottom to canistering) 7.9 minutes; 0.132 hours; 0.362659018 SQRT (hrs)

CONVERSION OF VOLUMES TO STP

RIG MEASUREMENTS			CONVERSION OF RIG MEASUREMENTS TO STP (cubic ft; @60 degrees; @14.7 psi)					CUMULATIVE VOLUMES		SCF/TON	SCF/TON		TIME SINCE		
measured cc	measured T (F)	measured P	cubic ft (@rig)	ABSOLUTE T (F) (@rig)	psia (@rig)	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)
30	80	1088	0.001059444	540	14.096	0.000978274	27.70153	0.000978274	27.70153	0.770926636	2.162414042	8/25/03 14:45	0:19:09	0:11:15	0.564948375
9	80	1088	0.000317833	540	14.096	0.000293462	8.310459	0.001271756	36.01199	1.002204627	2.393692033	8/25/03 14:49	0:22:39	0:14:45	0.614410286
7	80	1088	0.000247204	540	14.096	0.000228264	6.463691	0.00150002	42.47568	1.182067509	2.573574915	8/25/03 14:53	0:26:54	0:19:00	0.669576981
14	80	1088	0.000494407	540	14.096	0.000456526	12.92736	0.001956548	55.40306	1.541853273	2.933340678	8/25/03 15:05	0:39:09	0:31:15	0.807774721
6	80	1086	0.000211889	540	14.096	0.000195655	5.540306	0.002152203	60.94337	1.6960366	3.087526005	8/25/03 15:11	0:45:09	0:37:15	0.867467579
5	80	1086	0.000176574	540	14.096	0.000163046	4.616922	0.002315249	65.56029	1.824526373	3.216013778	8/25/03 15:16	0:49:54	0:42:00	0.911957601
7	80	1088	0.000247204	540	14.096	0.000228264	6.463691	0.002543512	72.02398	2.004409255	3.39589666	8/25/03 15:22	0:55:24	0:47:30	0.960902354
1	80	1088	3.53148E-05	540	14.096	3.26091E-05	0.923364	0.002576122	72.94737	2.030106609	3.421594215	8/25/03 15:24	0:58:09	0:50:15	0.984462828
5	80	1088	0.000176574	540	14.096	0.000163046	4.616922	0.002739167	77.56429	2.156594562	3.550081987	8/25/03 15:37	1:10:24	1:02:30	1.083205121
11	80	1085	0.000366463	540	14.063	0.00035637	10.14786	0.003097537	67.71216	2.441007394	3.632494799	8/25/03 15:56	1:29:24	1:21:30	1.220655562
0	80	1085	0	540	14.083	0	0	0.003097537	87.71216	2.441007394	3.632494799	8/25/03 16:13	1:46:24	1:38:30	1.331665624
4	80	1085	0.000141259	540	14.063	0.000130316	3.690136	0.003227854	91.4023	2.543702961	3.935190387	8/25/03 16:25	1:58:24	1:50:30	1.404753834
3	80	1085	0.000105944	540	14.063	9.77373E-05	2.767602	0.003325591	94.1699	2.620724637	4.012212043	8/25/03 16:48	2:21:24	2:13:30	1.535143859
22	75	1083	0.000778926	535	14.057	0.000722105	20.44767	0.004047697	114.6176	3.189776121	4.561265527	8/25/03 19:57	5:30:24	5:22:30	2.346628788
39	75	1082	0.001377277	535	14.044	0.001278914	36.21467	0.00532661	150.8322	4.197623267	5.569110692	8/26/03 5:23	14:56:24	14:46:30	3.865229618
39	78	1079	0.001377277	536	14.005	0.001272986	36.04686	0.006599599	186.6791	5.200796963	6.592286366	8/26/03 16:38	26:11:24	26:03:30	5.117616633
55	83	1082	0.001942314	543	14.044	0.001777024	50.31953	0.008376623	237.1987	6.601178608	7.992666214	8/27/03 14:12	47:45:24	47:37:30	6.910619847
29	82	1079	0.001024129	542	14.005	0.000936102	26.50737	0.009312725	263.706	7.33887219	8.730359596	8/28/03 16:41	74:14:24	74:06:30	8.616263691
12	81	1084	0.000423776	541	14.070	0.000389867	11.03976	0.009702592	274.7458	7.646105991	9.037593397	8/29/03 14:11	95:44:24	95:36:30	9.784681906
20	77	1088	0.000706296	537	14.096	0.000655828	18.57066	0.010358419	293.3166	8.162926318	9.554415723	9/1/03 14:38	166:11:24	166:03:30	12.96880873
17	75	1084	0.000600352	535	14.070	0.000558506	15.81506	0.010916924	309.1317	8.603057467	9.994544893	9/2/03 18:42	196:15:24	196:07:30	14.00916367
7	78	1084	0.000247204	536	14.070	0.000229544	6.499935	0.011146468	315.6316	8.783949031	10.17543644	9/3/03 17:35	219:06:24	219:00:30	14.80337799
3	78	1087	0.000105944	536	14.109	9.86482E-05	2.793396	0.011245116	318.425	8.86166653	10.25317594	9/4/03 17:51	243:24:24	243:16:30	15.60149565
17	78	1084	0.000600352	536	14.070	0.000557464	15.76556	0.01160258	334.2106	9.300996563	10.69248397	9/7/03 17:36	315:11:24	315:03:30	17.75359119
3	78	1084	0.000105944	536	14.070	9.80102E-05	2.775331	0.01190059	336.9859	9.378233314	10.76972072	9/8/03 14:16	335:51:24	335:43:30	18.32639263

7	77	1082	0.000247204	537	14.044	0.000228694	6.47586	0.012129284	343.4618	9.558454874	10.94994228	9/9/03 17:36	363:09:24	363:01:30	19.05666987
9	76	1079	0.000317833	536	14.005	0.000293787	8.318511	0.012423051	351.7803	9.789956953	11.16144436	9/10/03 19:09	368:42:24	388:34:30	19.71564523
9	78	1079	0.000317833	536	14.005	0.000293787	8.318511	0.012716817	360.0988	10.02145903	11.41294844	9/12/03 14:07	431:40:24	431:32:30	20.77674983
3	80	1083	0.000105944	540	14.057	9.75572E-05	2.782501	0.012814374	362.8613	10.09833873	11.48982614	9/13/03 18:06	459:41:24	459:33:30	21.44038246
-4	81	1088	-0.00014128	541	14.122	-0.000130435	-3.6935	0.012683939	359.1678	9.995549584	11.38703697	9/14/03 19:37	485:10:24	485:02:30	22.02665052
3	80	1085	0.000105944	540	14.083	9.77373E-05	2.767602	0.012781677	361.9354	10.07257124	11.46405665	9/15/03 15:27	505:00:24	504:52:30	22.47235339
6	80	1079	0.000211889	540	14.005	0.000194394	5.504595	0.01297607	367.44	10.22576274	11.61725014	9/17/03 12:11	549:44:24	549:36:30	23.44653493
5	80	1086	0.000176574	540	14.096	0.000163046	4.616922	0.013139118	372.0569	10.35425051	11.74573792	9/18/03 16:30	578:03:24	577:55:30	24.04280904
0	79	1087	0	539	14.109	0	0	0.013139116	372.0569	10.35425051	11.74573792	9/19/03 17:21	602:54:24	602:46:30	24.55415783
5	82	1082	0.000178574	542	14.044	0.000161846	4.582943	0.013300982	376.6399	10.48179266	11.87328006	9/21/03 13:52	647:25:24	647:17:30	25.4445148
14	82	1084	0.000494407	542	14.070	0.000454006	12.85596	0.013754967	389.4958	10.83957076	12.23105817	9/23/03 11:02	692:35:24	692:27:30	26.3171047
7	79	1081	0.000247204	539	14.031	0.000227635	6.445868	0.013982602	395.9417	11.01895765	12.41044506	9/25/03 19:26	748:59:24	748:51:30	27.36768167
0	82	1081	0	542	14.031	0	0	0.013982602	395.9417	11.01895765	12.41044506	9/27/03 14:17	791:50:24	791:42:30	28.13965174
-8	82	1089	-0.00021189	542	14.135	-0.000195471	-5.53511	0.01378713	390.4068	10.86491692	12.25640433	9/28/03 19:21	820:54:24	820:46:30	28.65146884

DECANISTERED 10/06/03

SAMPLE: 1020' to 1022' (Croweburg) in canister J

DRY WEIGHT lbs. grams
sample weight: 1.4990 879.926

est. lost gas (cc) = 13

TIME OF: off bottom 8/25/03 14:43; in canister 8/25/03 14:52; at surface 8/25/03 14:45

elapsed time (off bottom to canistering): 8.4 minutes; 0.141 hours; 0.374907396 SQRT (hrs)

CONVERSION OF VOLUMES TO STP

RIG MEASUREMENTS measured cc	measured T (F)	measured P	CONVERSION OF RIG MEASUREMENTS TO STP (cubic ft; @60 degrees; @14.7 psi) cubic ft (@rig)	ABSOLUTE T (F) (@rig)	psia (@rig)	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)
4	80	1086	0.000141259	540	14.098	0.000130437	3.693537	0.000130437	3.893537	0.174033709	0.786573371	8/25/03 14:59	0:15:56	0:07:30	0.515320828
3	80	1086	0.000105944	540	14.096	9.78274E-05	2.770153	0.000228264	6.463691	0.30455899	0.917098653	8/25/03 15:01	0:18:11	0:09:45	0.550504819
3	80	1086	0.000105944	540	14.098	9.78274E-05	2.770153	0.000326091	9.233844	0.435084272	1.047623934	8/25/03 15:04	0:20:56	0:12:30	0.590668172
0	80	1086	0	540	14.098	0	0	0.000326091	9.233644	0.435084272	1.047623934	8/25/03 15:19	0:35:56	0:27:30	0.773879118
0	80	1086	0	540	14.096	0	0	0.000326091	9.233844	0.435084272	1.047623934	8/25/03 15:44	1:00:26	0:52:00	1.003604614
5	80	1086	0.000178574	540	14.096	0.000163046	4.816922	0.000469137	13.85077	0.652626407	1.26516607	8/25/03 15:54	1:10:26	1:02:00	1.083461531
0	80	1088	0	540	14.096	0	0	0.000489137	13.85077	0.652626407	1.26516607	8/25/03 16:02	1:16:26	1:10:00	1.143338192
-4	80	1085	-0.00014126	540	14.083	-0.000130316	-3.69014	0.000358821	10.16063	0.478752951	1.091292613	8/25/03 18:14	1:30:26	1:22:00	1.227689791
-3	80	1085	-0.00010594	540	14.083	-9.77373E-05	-2.7676	0.000261083	7.393027	0.348347858	0.960867521	8/25/03 16:24	1:40:26	1:32:00	1.29378858
2	80	1085	7.06296E-05	540	14.083	8.51582E-05	1.845068	0.000326241	9.238095	0.435284587	1.047824249	8/25/03 16:49	2:05:26	1:57:00	1.44587536
0	75	1083	0	535	14.057	0	0	0.000326241	9.238095	0.435284587	1.047824249	8/25/03 19:58	5:14:26	5:06:00	2.289225973
3	75	1082	0.000105944	535	14.044	9.8378E-05	2.785744	0.000424619	12.02384	0.566544481	1.179084144	8/28/03 5:23	14:39:26	14:31:00	3.828475182
0	76	1079	0	538	14.005	0	0	0.000424619	12.02384	0.566544481	1.179084144	8/28/03 16:39	25:55:26	25:47:00	5.091550735
15	83	1082	0.000529722	543	14.044	0.000484643	13.72351	0.000909262	25.74735	1.213174718	1.82571438	8/27/03 14:13	47:29:26	47:21:00	6.89133917
1	82	1079	3.53148E-05	542	14.005	3.22794E-05	0.914047	0.000941542	26.68139	1.256243191	1.868782854	8/28/03 16:43	73:59:26	73:51:00	8.601778302
-1	81	1084	-3.5315E-05	541	14.070	-3.24889E-05	-0.91998	0.000909053	25.74141	1.212895164	1.825434827	8/29/03 14:13	95:29:26	95:21:00	9.771926911
0	77	1086	0	537	14.096	0	0	0.000909053	25.74141	1.212895164	1.825434827	9/1/03 14:38	167:54:26	167:46:00	12.95790192
1	77	1084	3.53148E-05	537	14.070	3.27309E-05	0.926833	0.000941784	28.66825	1.256566082	1.869105744	9/2/03 18:44	196:00:26	195:52:00	14.00025793
1	76	1084	3.53148E-05	536	14.070	3.2792E-05	0.928562	0.000974578	27.59881	1.300318474	1.912658137	9/3/03 17:36	218:52:26	218:44:00	14.79438707
1	76	1087	3.53148E-05	538	14.109	3.28827E-05	0.931132	0.001007459	28.52794	1.344191953	1.956731616	9/4/03 17:52	243:08:26	243:00:00	15.59296494
1	78	1084	3.53148E-05	536	14.070	3.2792E-05	0.928562	0.001040251	29.4585	1.387944346	2.000484009	9/7/03 17:40	314:56:26	314:48:00	17.74656461
-2	78	1084	-7.063E-05	538	14.070	-6.53402E-05	-1.85022	0.00097491	27.60628	1.300764857	1.91330452	9/8/03 14:18	335:34:26	335:26:00	16.31867596
2	77	1082	7.08296E-05	537	14.044	6.53411E-05	1.850246	0.001040251	29.45853	1.387945544	2.000465207	9/9/03 17:38	362:54:26	362:48:00	19.05012394
4	78	1079	0.000141259	538	14.005	0.000130563	3.697116	0.001170614	33.15384	1.562147876	2.174667539	9/10/03 19:11	388:27:26	366:19:00	19.70931816
15	78	1079	0.000529722	536	14.005	0.000489611	13.86419	0.001660425	47.01783	2.215408622	2.827946284	9/12/03 14:08	431:24:26	431:16:00	20.77034478
-4	80	1083	-0.00014126	540	14.057	-0.000130076	-3.68333	0.001530349	43.3345	2.041853669	2.654393332	9/13/03 18:09	459:25:26	459:17:00	21.43417572
-11	81	1088	-0.00038846	541	14.122	-0.000358897	-10.1571	0.001171852	33.17737	1.563265858	2.17560552	9/14/03 19:38	484:54:26	484:46:00	22.02060903
2	80	1085	7.06298E-05	540	14.083	6.51582E-05	1.845068	0.00123881	35.02244	1.650202586	2.262742249	9/15/03 15:28	504:44:26	504:36:00	22.46643175

DECANISTERED 9/15/03

SAMPLE: 1105' to 1107' (Weir-Pitt coal) in canister E

DRY WEIGHT lbs. grams
sample weight: 1.1778 534.22

est. lost gas (cc) = 0

TIME OF: off bottom 8/25/03 15:29; in canister 8/25/03 15:41; at surface 8/25/03 15:31

elapsed time (off bottom to canistering): 12.3 minutes; 0.205 hours; 0.453075907 SQRT (hrs)

CONVERSION OF VOLUMES TO STP

RIG MEASUREMENTS measured cc	measured T (F)	measured P	CONVERSION OF RIG MEASUREMENTS TO STP (cubic ft; @60 degrees; @14.7 psi) cubic ft (@rig)	ABSOLUTE T (F) (@rig)	psia (@rig)	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	80	1086	-0.00017857	540	14.096	-0.000163048	-4.81692	-0.000163046	-4.61692	-0.276875733	-0.276875733	8/25/03 15:44	0:14:34	0:02:15	0.49272485
-3	80	1086	-0.00010594	540	14.096	-9.78274E-05	-2.77015	-0.000260873	-7.38707	-0.443001173	-0.443001173	8/25/03 15:52	0:22:34	0:10:15	0.613278983
0	80	1086	0	540	14.096	0	0	-0.000260873	-7.38707	-0.443001173	-0.443001173	8/25/03 15:58	0:28:34	0:16:15	0.690008052
-2	80	1088	-7.083E-05	540	14.096	-6.52183E-05	-1.84677	-0.000326091	-9.23384	-0.553751466	-0.553751466	8/25/03 16:03	0:33:34	0:21:15	0.747960189
-3	80	1085	-0.00010594	540	14.083	-9.77373E-05	-2.7678	-0.000423829	-12.0014	-0.719723936	-0.719723936	8/25/03 16:09	0:39:49	0:27:30	0.814623294
0	80	1085	0	540	14.083	0	0	-0.000423829	-12.0014	-0.719723936	-0.719723936	8/25/03 16:16	0:46:34	0:34:15	0.880971686
-2	80	1085	-7.063E-05	540	14.083	-8.51582E-05	-1.84507	-0.000488987	-13.8465	-0.83037225	-0.83037225	8/25/03 16:23	0:53:34	0:41:15	0.944869186

3	80	1085	0.000105944	540	14.083	9.77373E-05	2.767602	-0.00039125	-11.0789	-0.66439978	-0.66439978	8/25/03 16:49	1:19:34	1:07:15	1.151568978
-4	75	1063	-0.00014126	535	14.057	-0.000131292	-3.71778	-0.000522541	-14.7967	-0.887352667	-0.887352667	8/25/03 19:56	4:26:34	4:16:15	2.115662166
-8	75	1062	-0.00028252	535	14.044	-0.000262341	-7.42865	-0.000784883	-22.2253	-1.332847308	-1.332847308	8/26/03 5:24	13:54:34	13:42:15	3.72953676
-4	76	1079	-0.00014126	536	14.005	-0.000130563	-3.69712	-0.000915446	-25.9224	-1.554562509	-1.554562509	8/26/03 16:40	25:10:34	24:58:15	5.017580205
8	83	1082	0.000282518	543	14.044	0.000258476	7.319204	-0.000656969	-18.6032	-1.115631522	-1.115631522	8/27/03 14:14	48:44:34	48:32:15	6.838669004
-9	82	1079	-0.00031783	542	14.005	-0.000290515	-8.22642	-0.000947484	-26.8297	-1.608968298	-1.608968298	8/28/03 16:43	73:13:34	73:01:15	8.557225667
-8	81	1084	-0.00028252	541	14.070	-0.000259911	-7.35984	-0.001207395	-34.1895	-2.050338263	-2.050338263	8/29/03 14:13	94:43:34	94:31:15	9.732734

DECANISTERED 08/29/03

SAMPLE: 1335' to 1337' (Aw(?) coal) in canister MER C

DRY WEIGHT lbs. grams

sample weight: 1.2317 558.68

est. lost gas (cc) = 9

TIME OF: off bottom 8/26/03 8:45; at surface 8/26/03 8:49; in canister 8/26/03 8:59

elapsed time (off bottom to canistering) 14.2 minutes; 0.236 hours; 0.465912658 SQRT (hrs)

CONVERSION OF VOLUMES TO STP

RIG MEASUREMENTS			CONVERSION OF RIG MEASUREMENTS TO STP (cubic ft; @60 degrees; @14.7 psi)					CUMULATIVE VOLUMES		SCF/TON	SCF/TON		TIME SINCE		
measured cc	measured T (F)	measured P	cubic ft (@rig)	ABSOLUTE T (F) (@rig)	psia (@rig)	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)
1	80	1087	3.53146E-05	540	14.109	3.26392E-05	0.924235	3.26392E-05	0.924235	0.052999462	0.56909715	8/26/03 9:02	0:17:40	0:03:30	0.542627353
5	80	1087	0.000176574	540	14.109	0.000163196	4.621173	0.000195835	5.545408	0.317996693	0.834094561	8/26/03 9:23	0:38:40	0:24:30	0.802772972
3	80	1088	0.000105944	540	14.122	9.80076E-05	2.775255	0.000293843	8.320663	0.477141613	0.99323926	8/26/03 9:36	0:51:40	0:37:30	0.927960727
1	80	1088	3.53146E-05	540	14.122	3.26692E-05	0.925085	0.000326512	9.245747	0.530169652	1.04626752	8/26/03 9:43	0:58:10	0:44:00	0.984603699
6	80	1087	0.000211889	540	14.109	0.000195835	5.545408	0.000522347	14.79116	0.848186746	1.364264413	8/26/03 10:37	1:51:55	1:37:45	1.365751726
4	80	1087	0.000141259	540	14.109	0.000130557	3.696939	0.000652903	18.48809	1.060184675	1.576282342	8/26/03 11:20	2:34:55	2:20:45	1.606643006 estimate
-2	76	1079	-7.063E-05	536	14.005	-6.52815E-05	-1.84856	0.000587622	16.63954	0.954180616	1.470276284	8/26/03 16:42	7:56:55	7:42:45	2.819326131
5	63	1082	0.000176574	543	14.044	0.000161548	4.574503	0.00074917	21.21404	1.216501746	1.732599416	8/27/03 14:15	29:29:55	29:15:45	5.431262387
0	82	1079	0	542	14.005	0	0	0.00074917	21.21404	1.216501746	1.732599416	8/28/03 16:44	55:58:55	55:44:45	7.482108289
1	81	1083	3.53146E-05	541	14.057	3.24589E-05	0.919131	0.000781628	22.13317	1.269206595	1.785306262	8/29/03 14:15	77:29:55	77:15:45	8.803329547
-8	77	1086	-0.00028252	537	14.096	-0.00026233	-7.42834	0.000519296	14.70483	0.843236285	1.359333952	9/1/03 14:39	149:53:55	149:39:45	12.24330883
2	77	1064	7.06296E-05	537	14.070	6.54816E-05	1.853666	0.00058478	16.55849	0.949533243	1.46563091	9/2/03 16:45	177:59:55	177:45:45	13.34161201
-2	76	1084	-7.063E-05	536	14.070	-6.5584E-05	-1.85712	0.000519176	14.70137	0.84303797	1.359135637	9/3/03 17:37	200:51:55	200:37:45	14.1726946
-3	76	1087	-0.00010594	536	14.109	-9.86482E-05	-2.7934	0.000420528	11.90797	0.682852967	1.198950635	9/4/03 17:53	225:07:55	224:53:45	15.0043975

DECANISTERED 09/05/03

SAMPLE: 1350' to 1352' (Riverton coal) in canister MER H

DRY WEIGHT lbs. grams

sample weight: 1.4282 647.81

est. lost gas (cc) = 6

TIME OF: off bottom 8/26/03 9:13; at surface 8/26/03 9:15; in canister 8/26/03 9:35

elapsed time (off bottom to canistering) 22.4 minutes; 0.374 hours; 0.611691643 SQRT (hrs)

CONVERSION OF VOLUMES TO STP

RIG MEASUREMENTS			CONVERSION OF RIG MEASUREMENTS TO STP (cubic ft; @60 degrees; @14.7 psi)					CUMULATIVE VOLUMES		SCF/TON	SCF/TON		TIME SINCE		
measured cc	measured T (F)	measured P	cubic ft (@rig)	ABSOLUTE T (F) (@rig)	psia (@rig)	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)
2	80	1088	7.06296E-05	540	14.122	6.53384E-05	1.85017	6.53384E-05	1.85017	0.091499022	0.386225371	8/26/03 9:50	0:36:57	0:14:30	0.784750491
1	80	1088	3.53146E-05	540	14.122	3.26692E-05	0.925085	9.80076E-05	2.775255	0.137246532	0.433974662	8/26/03 9:58	0:44:57	0:22:30	0.865544145
2	80	1087	7.06296E-05	540	14.109	6.52783E-05	1.846469	0.000163288	4.623724	0.228663456	0.525389805	8/26/03 10:02	0:48:57	0:26:30	0.903234927
4	80	1087	0.000141259	540	14.109	0.000130557	3.696939	0.000293843	8.320663	0.411493302	0.708219652	8/26/03 10:25	1:11:57	0:49:30	1.095064666
7	80	1087	0.000247204	540	14.109	0.000228474	6.469642	0.000522317	14.7903	0.731445534	1.028171663	8/26/03 11:21	2:07:57	1:45:30	1.460308187
0	75	1079	0	535	14.005	0	0	0.000522317	14.7903	0.731445534	1.028171663	8/26/03 16:40	7:26:57	7:04:30	2.729316154
10	63	1082	0.000353148	543	14.044	0.000323095	9.149005	0.000845412	23.93931	1.163904033	1.460630382	8/27/03 14:15	29:01:57	28:39:30	5.388161511
3	82	1079	0.000105944	542	14.005	9.68362E-05	2.742142	0.00094225	26.68145	1.319514974	1.616241324	8/28/03 16:45	55:31:57	55:09:30	7.452013151
3	81	1063	0.000105944	541	14.057	9.73766E-05	2.757394	0.001039627	29.43885	1.455880241	1.752606591	8/29/03 14:16	77:02:57	76:40:30	8.777765471
-9	77	1086	-0.00031783	537	14.096	-0.000295122	-8.35689	0.000744505	21.08196	1.042595502	1.339321852	9/1/03 14:40	149:26:57	149:04:30	12.22494035
2	77	1064	7.06296E-05	537	14.070	6.54816E-05	1.853666	0.000809967	22.93563	1.134267419	1.430993769	9/2/03 18:46	177:32:57	177:10:30	13.32475766
-1	76	1084	-3.5315E-05	536	14.070	-3.2792E-05	-0.92856	0.000777175	22.00706	1.088345946	1.385072296	9/3/03 17:38	200:24:57	200:02:30	14.15662992
-2	76	1087	-7.063E-05	536	14.109	-6.57655E-05	-1.86226	0.00071141	20.1446	0.996248822	1.292975171	9/4/03 17:53	224:39:57	224:17:30	14.96665697

DECANISTERED 09/05/03

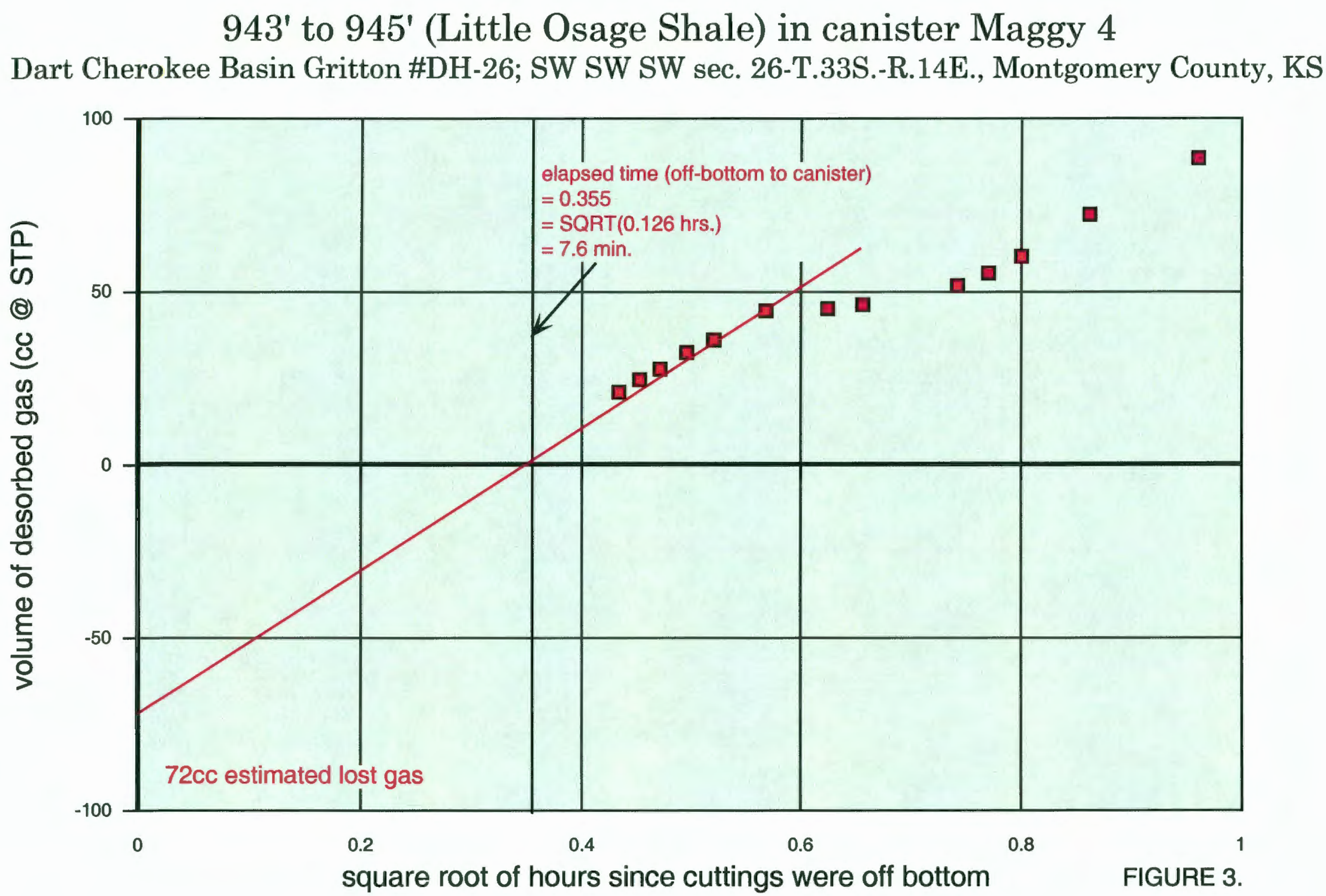

943' to 945' (Little Osage Shale) in canister Maggy 4
Dart Cherokee Basin Gritton #DH-26; SW SW SW sec. 26-T.33S.-R.14E., Montgomery County, KS
volume of desorbed gas (cc @ STP)
100
50
0
-50
-100
elapsed time (off-bottom to canister)
= 0.355
= SQRT(0.126 hrs.)
= 7.6 min.
72cc estimated lost gas
0
0.2
0.4
0.6
0.8
1
square root of hours since cuttings were off bottom

FIGURE 3.

983' to 988' (Bevier/Iron Post coal) in canister Brady 23

Dart Cherokee Basin Gritton #DH-26; SW SW SW sec. 26-T.33S.-R.14E., Montgomery County, KS

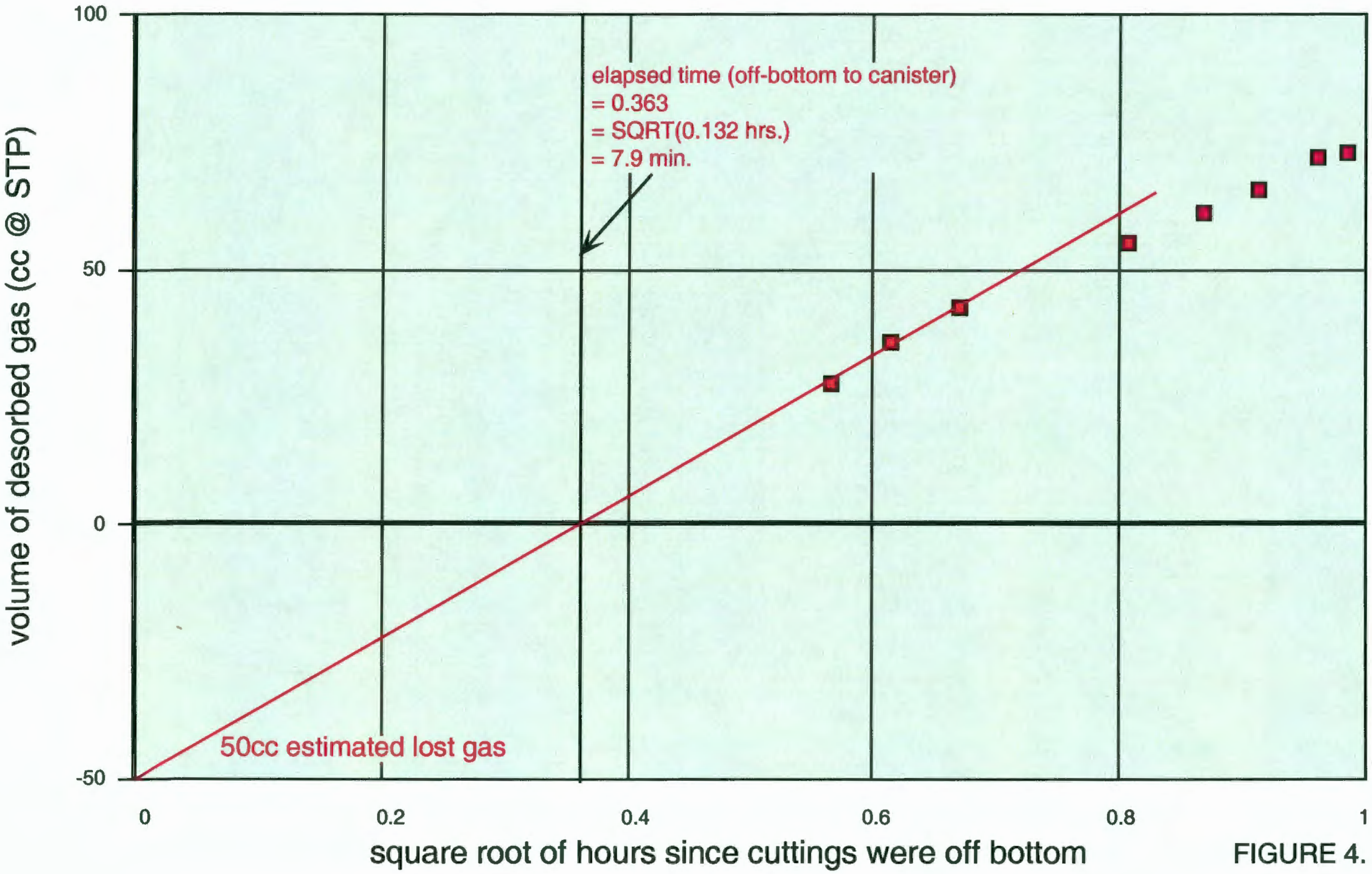


FIGURE 4.

1020' to 1022' (Croweburg coal) in canister J

Dart Cherokee Basin Gritton #DH-26; SW SW SW sec. 26-T.33S.-R.14E., Montgomery County, KS

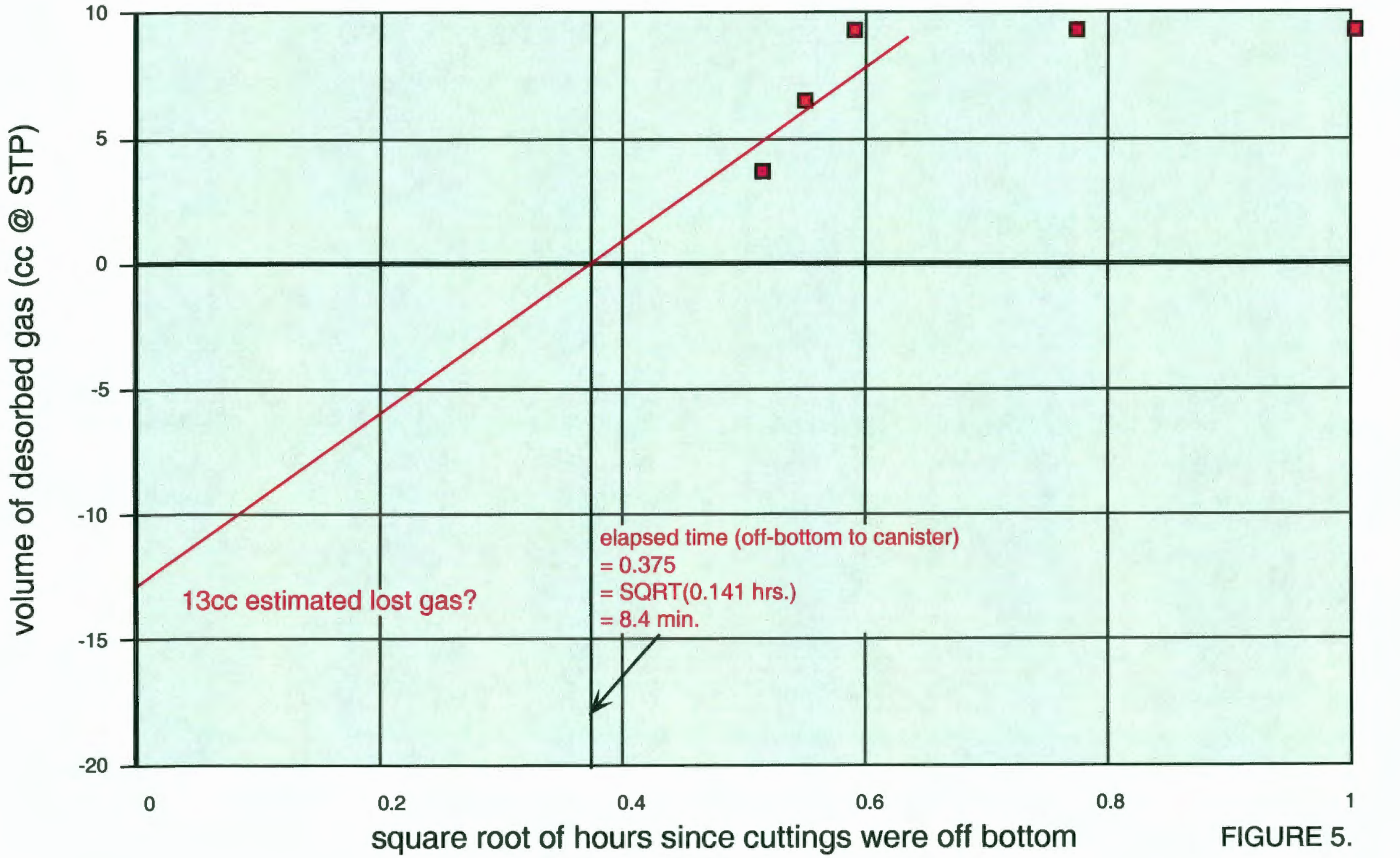


FIGURE 5.

1335' to 1337' (Aw coal?) in canister MER C

Dart Cherokee Basin Gritton #DH-26; SW SW SW sec. 26-T.33S.-R.14E., Montgomery County, KS

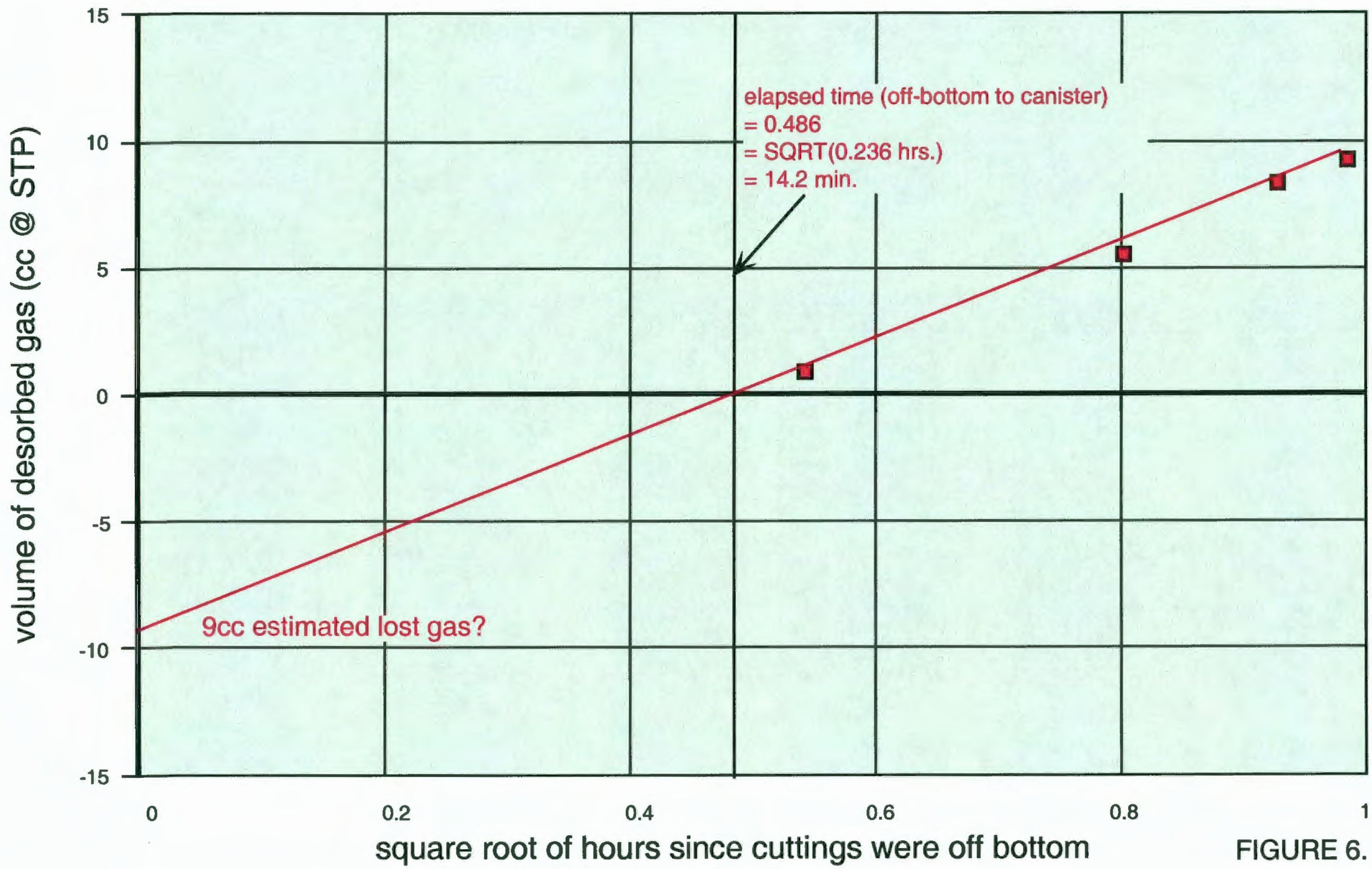


FIGURE 6.

1350' to 1352' (Riverton coal) in canister MER H

Dart Cherokee Basin Gritton #DH-26; SW SW SW sec. 26-T.33S.-R.14E., Montgomery County, KS

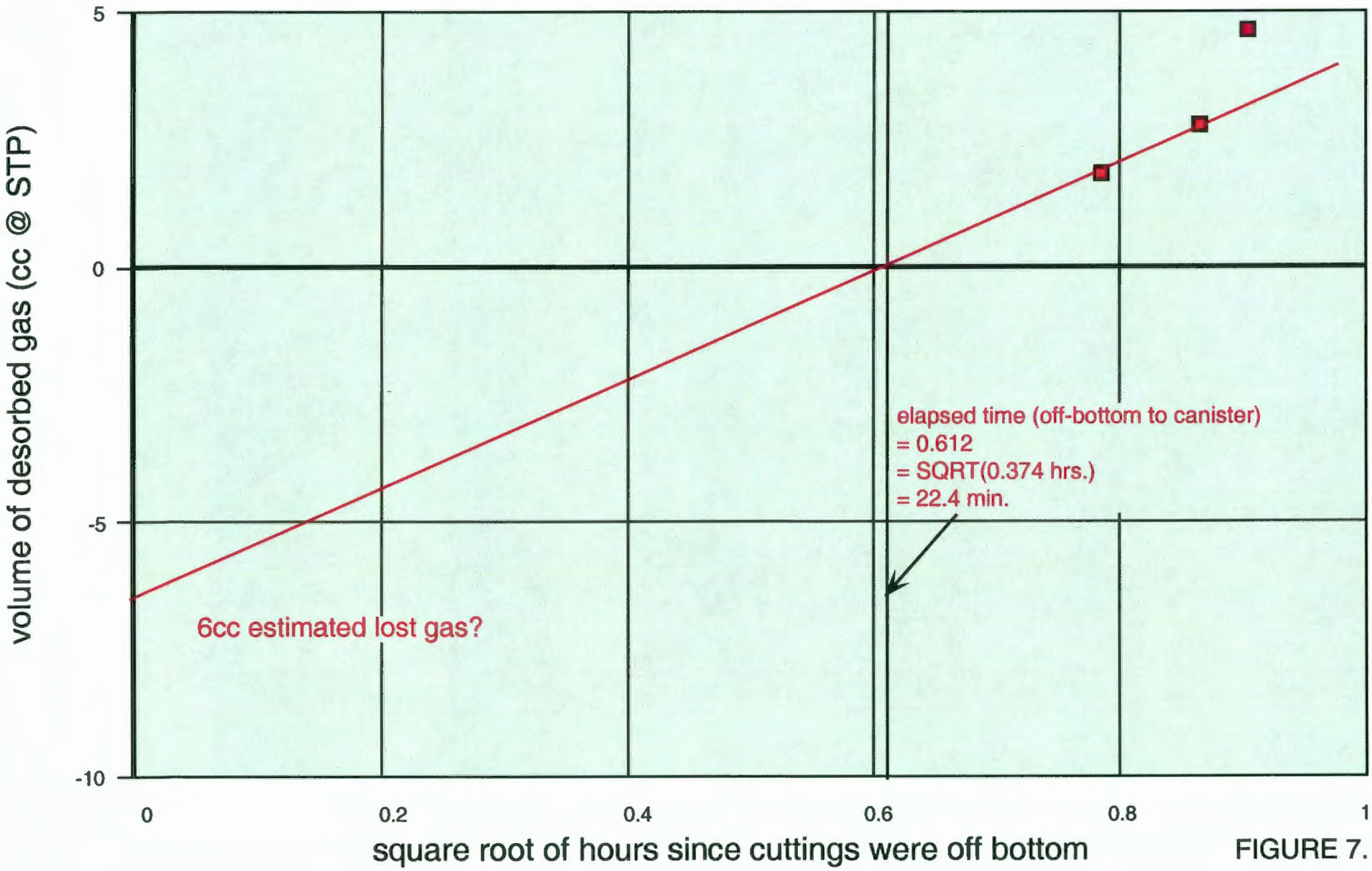


FIGURE 7.

Desorption Characteristics of Cuttings Samples

Dart Cherokee Basin Gritton #D4-26, SW SW SW 26-T.33S.-R.14E., Montgomery County, KS

LITHOLOGIC COMPONENT SENSITIVITY ANALYSIS for calculation of gas content of Little Osage Shale from 943-945'

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

total gas desorbed = 298 ccs

TOTAL DRY WEIGHT OF SAMPLE = 2785.42 grams

$\text{weight}_{light\text{-}colored\ lithologies}$ = 745.26 grams (26.8%)

$\text{weight}_{dark\ shale}$ = 2040.16 grams (72.2%)

weight_{coal} = 0.00 grams (0.0%)

sieve size	*grams*	*% coal / % dark shale / % light-colored liths*
>0.0930"	1832.75	0.00% / 76.80% / 15.09%
>0.0661"	416.79	0.00% / 87.48% / 12.52%
>0.0460"	233.63	0.00% / 65.94% / 34.06%
>0.0331"	120.22	0.00% / 49.30% / 50.70%
<0.0331"	182.03	0.00% / 30.00% / 70.00%
	2785.42 TOTAL	

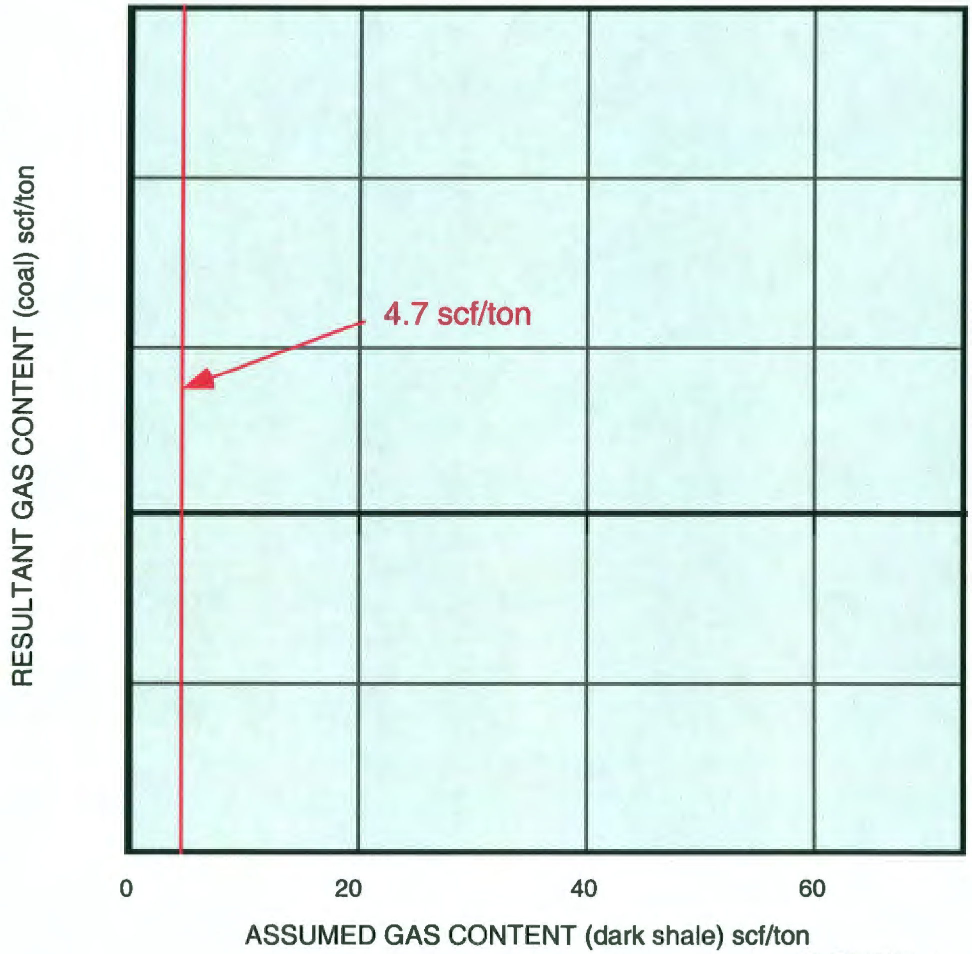


FIGURE 8.

Desorption Characteristics of Cuttings Samples

Dart Cherokee Basin Gritton #D4-26, SW SW SW 26-T.33S.-R.14E., Montgomery County, KS

LITHOLOGIC COMPONENT SENSITIVITY ANALYSIS for calculation of gas content of Bevier/Iron Post coals from 983-988'

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

total gas desorbed = 446 ccs

TOTAL DRY WEIGHT OF SAMPLE = 1835.11 grams

$\text{weight}_{light\text{-}colored\ lithologies}$ = 683.93 grams (37.3%)

$\text{weight}_{dark\ shale}$ = 1035.90 grams (56.5%)

weight_{coal} = 115.28 grams (6.3%)

sieve size	*grams*	*% coal / % dark shale / % light-colored liths*
>0.0930"	1231.08	5.37% / 58.08% / 36.55%
>0.0661"	274.59	8.03% / 57.68% / 34.29%
>0.0460"	211.22	8.84% / 50.91% / 40.24%
>0.0331"	77.24	7.08% / 43.33% / 49.58%
<0.0331"	40.98	7.33% / 52.50% / 40.17%
	1835.11 TOTAL	

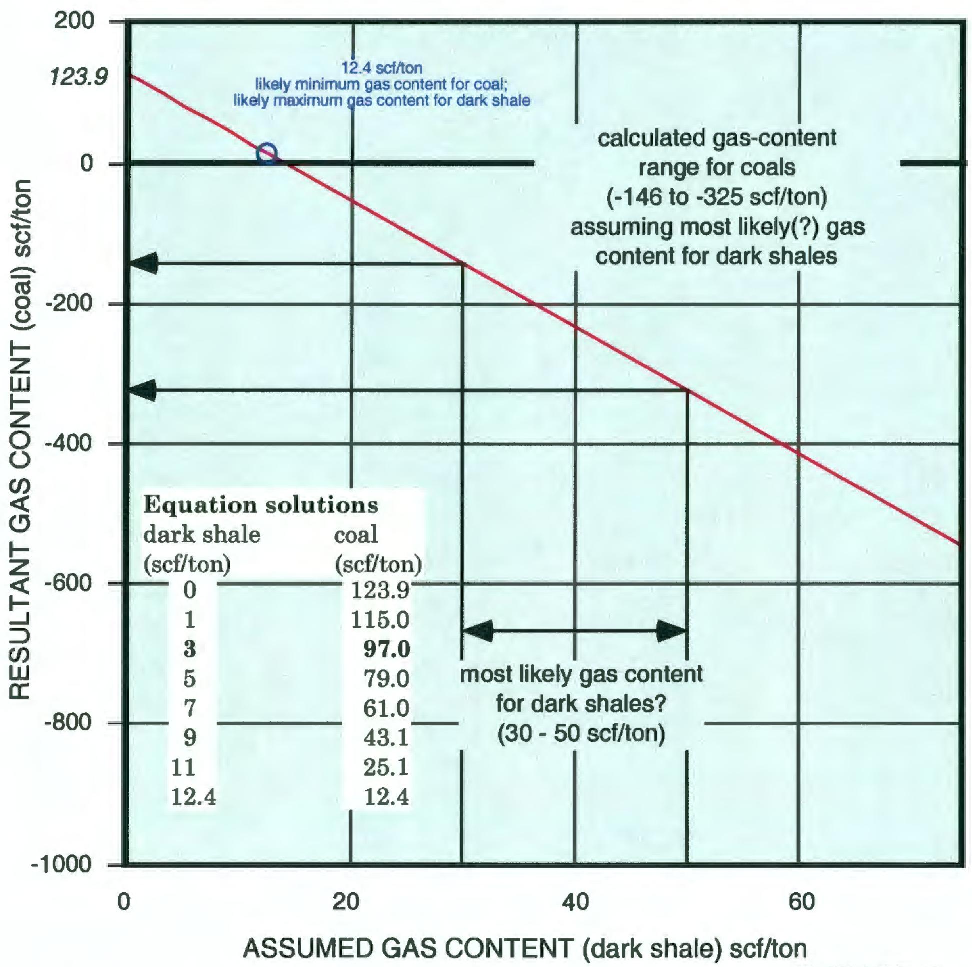
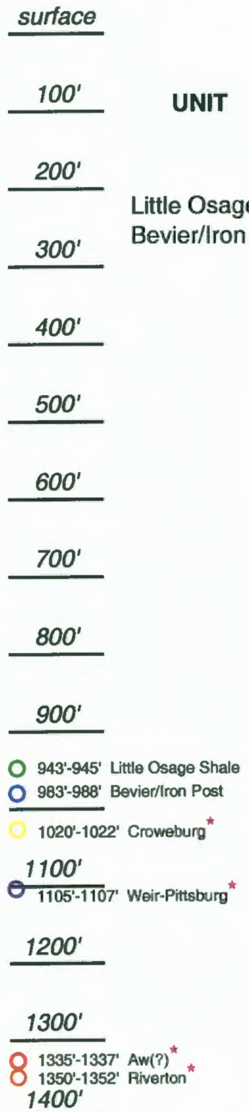


FIGURE 9.

Desorption Characteristics of Cuttings Samples

Dart Cherokee Basin Gritton #D4-26, SW SW SW 26-T.33S.-R.14E., 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
Little Osage Sh.	0%	------	4.7	4.7
Bevier/Iron Post	6%	97.0	124.9	12.4

*samples did not desorb any amount of gas sufficent for successful analysis

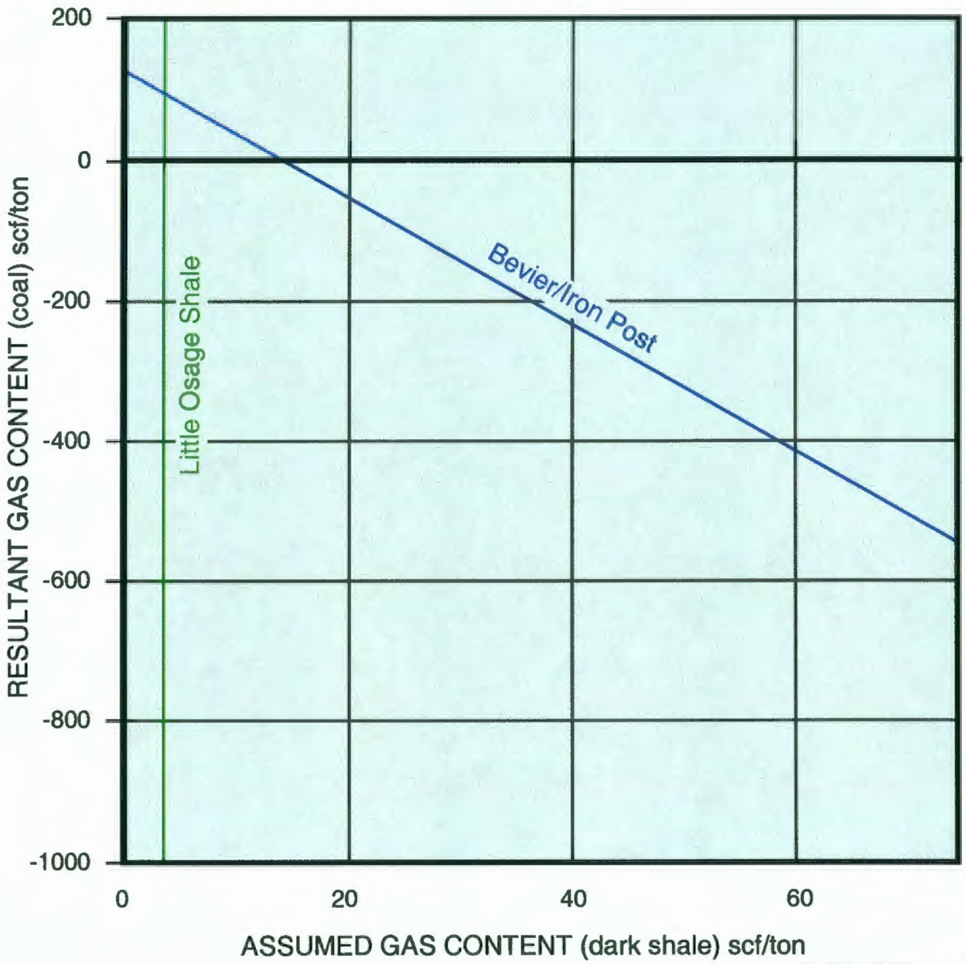


FIGURE 10.

Desorption Characteristics of Cuttings Samples

based on total weight of gas-generating lithologies (i.e., coal and dark shale) in sample
Dart Cherokee Basin Gritton #D4-26, SW SW SW 26-T.33S.-R.14E., Montgomery County, KS

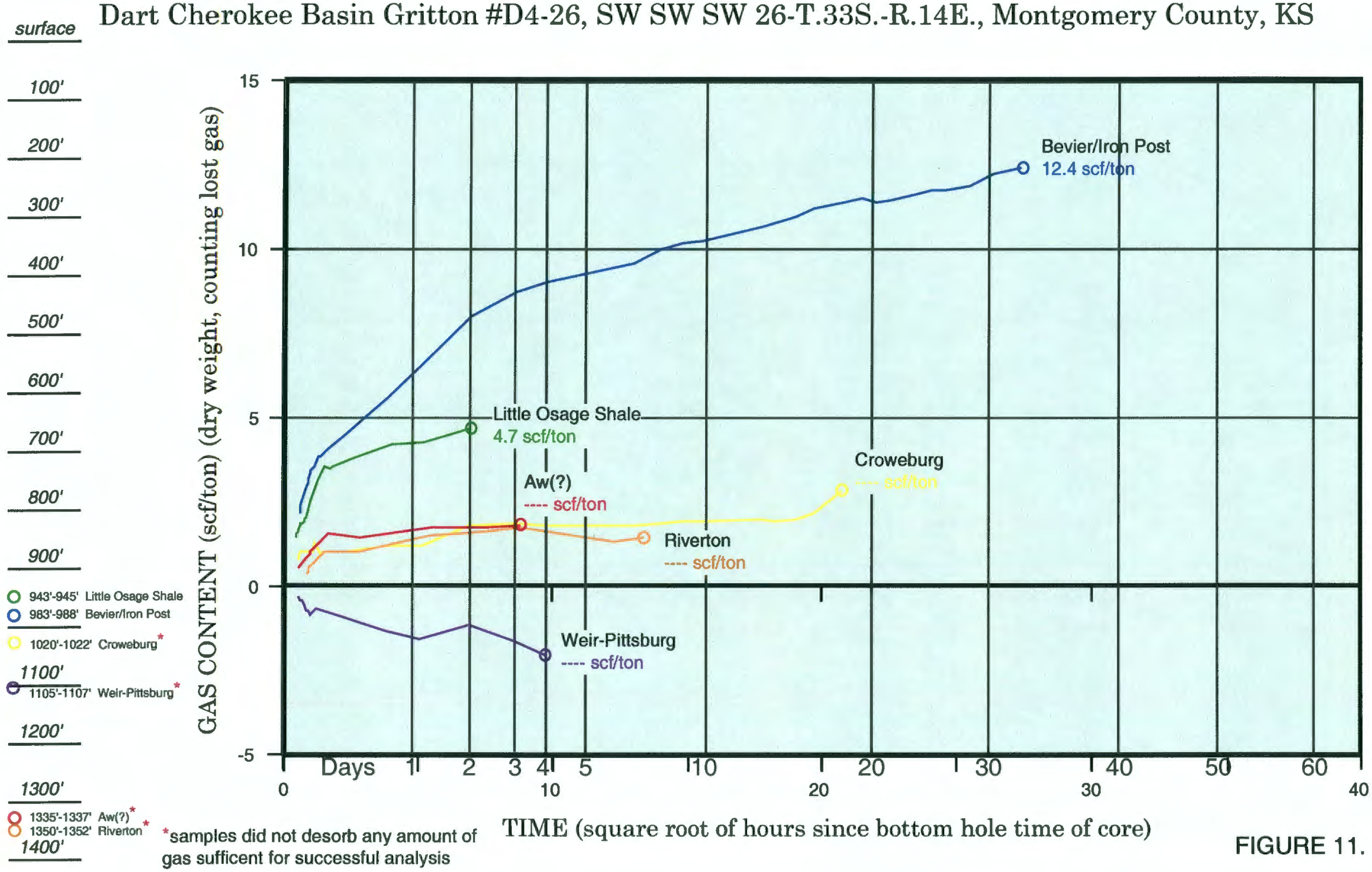


FIGURE 11.