ANALYSIS OF CHEROKEE GROUP CUTTINGS SAMPLES FOR GAS CONTENT -- DART CHEROKEE BASIN OPERATING COMPANY #D1-30 KINCAID TRUST; SW SW sec. 30-T.34S.-R.14E.; MONTGOMERY COUNTY, KANSAS

By
K. David Newell

Kansas Geological Survey
The University of Kansas
1930 Constant Avenue
Lawrence, KS 66047-3726

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SUMMARY

Five cuttings samples from the Pennsylvanian Cherokee Group were collected from the Dart Cherokee Basin #D1-30 Kincaid Trust well, SW SW sec. 30-T.34S.-R.14E. in Montgomery County, KS. The samples calculate as having the following gas contents:

- Mineral coal at 1213' to 1214' depth[1] (171.4 scf/ton)
- Weir-Pittsburg coal at 1291' to 1292' depth[1] (53.6 scf/ton)
- Dry Wood coal. at 1427' to 1429' depth[1] (45.6 scf/ton)
- Riverton coal at 1510' to 1512' depth[1] (87.0 scf/ton)
- Riverton "rider" coal at 1522' to 1524' depth[1] (125.3 scf/ton)

[1]assuming accompanying dark shales in sample desorb 3 scf/ton

BACKGROUND

The Dart Cherokee Basin #D1-30 Kincaid Trust well, SW SW sec. 30-T.34S.-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 March 18, 2004, 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 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 #C4-26 Gritton; sec. 26-T.33S.-R.14E., Montgomery County, KS). 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.

Five cuttings samples from the Pennsylvanian Cherokee Group were collected:

- Mineral coal at 1213' to 1214' depth (516 grams dry wt.)
- Weir-Pittsburg coal at 1291' to 1292' depth (747 grams dry wt.)
- Dry Wood coal. at 1427' to 1429' depth (581 grams dry wt.)
- Riverton coal at 1510' to 1512' depth (970 grams dry wt.)
- Riverton "rider" coal at 1522' to 1524' depth (227 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 Riverton "rider" 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). Water with zephyrn chloride biocide was added to the sample before sealing the canister. A headspace of approximately 5 cm was left in each canister.

Temperature baths for the desorption canisters were on site, with temperature kept at approximately 80 °F. The canistered samples at the end of the day were transported to the laboratory at the Kansas Geological Survey in Lawrence, KS, and desorption measurements were continued at approximately 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 and bought commercially. The Maggy canisters were made in-house. 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. The Mer I canister was obtained from PEL-I-CANS (by J.R. Levine) in Richardson, TX. This canister is 11.2 inches high (28.5 cm), 3.8 inches (9.7 cm) in diameter, and encloses a volume of approximately 127 cubic inches (2082 cm^3). Commercial canisters from SSD, Inc. in Grand Junction, CO, were used for the remaining samples. 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, KS (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 #D1-30 Kincaid Trust well, the maximum time of desorption was 11 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 air for several 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. The well used for this graph was the nearby Dart Cherokee basin #c4-26 Gritton, drilled in sec. 26-T.33S.-R.14E.

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 8-12)
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:

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

A unique solution for $\textit{gas content}_{coal}$ in this equation is not possible because $\textit{gas content}_{dark\ shale}$ 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 vice versa. If there is little dark shale in a sample, a relatively well constrained answer for $\textit{gas content}_{coal}$ 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, 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 13)
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., $\textit{gas content}_{coal}$) for that sample. If the coal content is miniscule (i.e., < approximately 5%), the results are a better reflection of the $\textit{gas content}_{dark\ shale}$.

Desorption Graph (Figure 14)
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.

ASHING and DENSITY EXPERIMENTS

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

unit	*depth*	*moisture*	*ash*	*moisture-free ash*
Mineral	1213'	1.24%	19.33%	19.46%
Weir-Pittsburg	1291'	1.17%	16.04%	16.23%
Dry Wood	1427'	0.78%	25.59%	25.74%

Riverton	1510'	0.90%	37.25%	37.55%
Riverton "rider"	1522'	0.88%	22.11%	22.21%

Using the equation from McLennan and others (1995):

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

where:
G_c = gas content, scf/ton
G_{pc} = "pure coal", gas content, scf/ton
a_d = dry ash content, weight fraction

the gas content of the samples converts to:

unit	*depth*	*moisture-free ash*	G_c	G_{pc}
Mineral	1213'	19.46%	171.4 scf/ton	213.1 scf/ton
Weir-Pittsburg	1291'	16.23%	53.6 scf/ton	64.0 scf/ton
Dry Wood	1427'	25.74%	45.6 scf/ton	61.4 scf/ton
Riverton	1510'	37.55%	87.0 scf/ton	139.4 scf/ton
Riverton "rider"	1522'	22.21%	125.3 scf/ton	161.3 scf/ton

Coal samples, 4 to 5 grams in weight, were also weighed for determination of their density. The weighed samples were then placed in water in a 10-cc graduated cylinder to determine the volume of the sample. The following density measurements were then calculated:

unit	*depth*	*density and uncertainty*
Mineral	1213'	1.40 g/cc ± 0.07
Weir-Pittsburg	1291'	1.41 g/cc ± 0.07
Dry Wood	1427'	1.48 g/cc ± 0.07
Riverton	1510'	1.79 g/cc ± 0.07
Riverton "rider"	1522'	1.42 g/cc ± 0.07

RESULTS and DISCUSSION

According to the summary diagram for the sensitivity analyses (Figure 13), the best constrained results (in which the resultant coal gas content varies the least with shale gas content) is for the Riverton "rider" coal. The least constrained results are for the Weir-Pittsburg coal.

An estimate for gas content for the coal in these samples can be made, assuming the admixed dark shale in the samples desorb 3 scf/ton. Shale cuttings accompanying the Mineral coal were fossiliferous and very dark. This, and the elevated gamma-ray response of this shale on wireline logs, suggests that this shale may have a gas content greater than 3 scf/ton. Shale cuttings accompanying the other samples were hues of lighter gray, hence the 3 scf/ton assumption for these shales is likely appropriate.

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

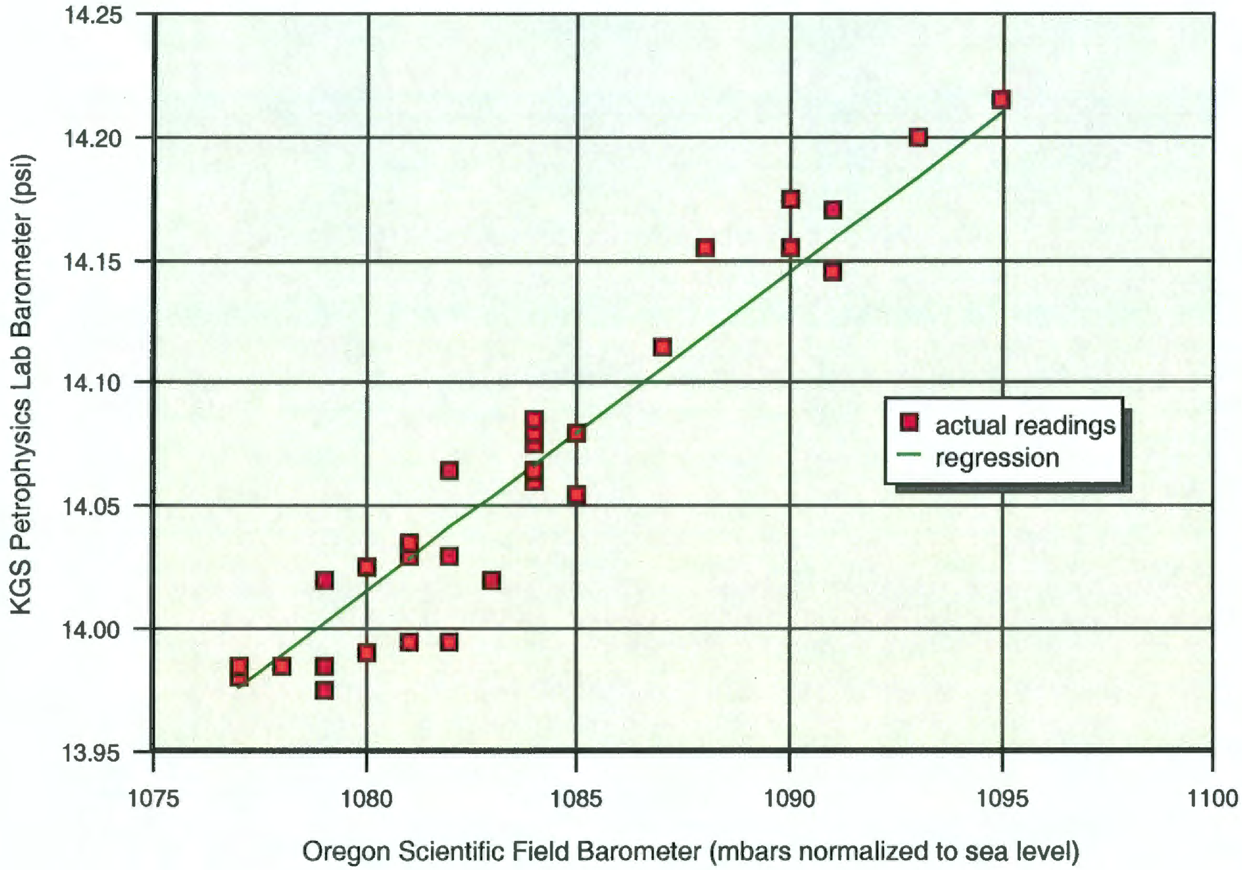


FIGURE 1.

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

(used for the lag-time estimation for the Dart Cherokee Basin #D1-30 Kincaid Trust well; SW SW sec. 30-T.34S.-R.14E., Montgomery County, KS

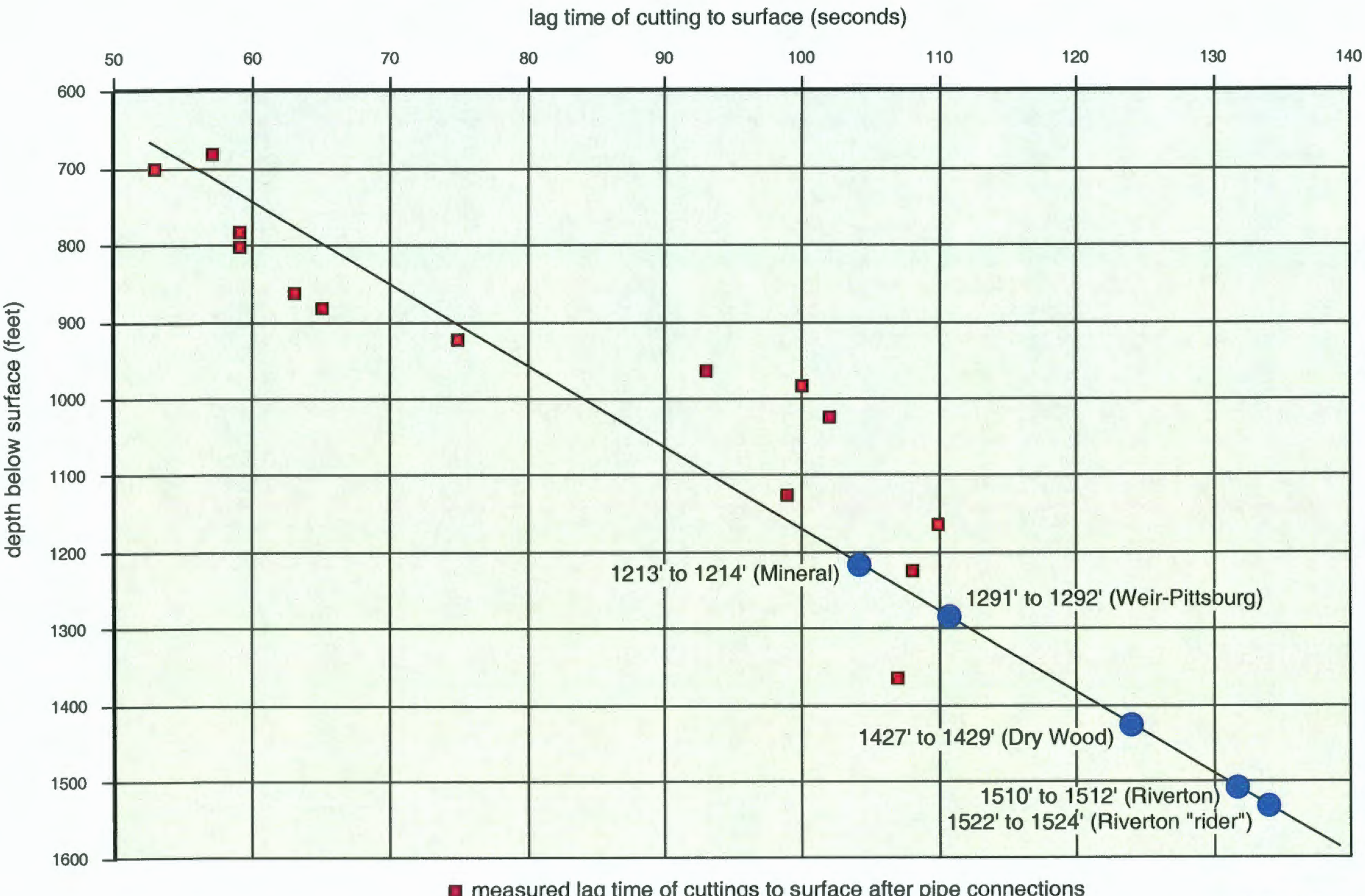


FIGURE 2.

TABLE 1 -- Desorption data for DART CHEROKEE BASIN KINCAID TRUST #D1-30; 30-T.34S.-R.14E.

SAMPLE: 1213' to 1214' (Mineral coal) cuttings in canister Maggy 4

	lbs.	grams
dry sample weight:	1.1160	506.21

est. lost gas (cc) = 33

TIME OF:	off bottom	at surface	in canister
	3/18/04 7:28	3/18/04 7:28	3/18/04 7:38

elapsed time (off bottom to canistering): 12.4 minutes; 0.206 hours; 0.453994616 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 (R)	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)
2	78	1089	7E-05	538	14.135	6.56415E-05	1.86	6.56415E-05	1.86	0.12	2.21	3/18/04 7:39	0:13:22	0:01:00	0.471993409
2	78	1089	7E-05	538	14.135	6.56415E-05	1.86	0.000131283	3.72	0.24	2.32	3/18/04 7:41	0:15:37	0:03:15	0.510174262
4	78	1089	0.0001	538	14.135	0.000131283	3.72	0.000262566	7.44	0.47	2.56	3/18/04 7:44	0:18:22	0:06:00	0.553273089
2	78	1089	7E-05	538	14.135	6.56415E-05	1.86	0.000328208	9.29	0.59	2.68	3/18/04 7:45	0:19:22	0:07:00	0.568135352
1	78	1089	4E-05	538	14.135	3.28208E-05	0.93	0.000361029	10.22	0.65	2.74	3/18/04 7:47	0:21:22	0:09:00	0.59675046
5	78	1089	0.0002	538	14.135	0.000164104	4.65	0.000525132	14.87	0.94	3.03	3/18/04 7:52	0:26:22	0:14:00	0.66290606
2	78	1089	7E-05	538	14.135	6.56415E-05	1.86	0.000590774	16.73	1.06	3.15	3/18/04 7:54	0:28:22	0:16:00	0.687588378
3	78	1089	0.0001	538	14.135	9.84623E-05	2.79	0.000689236	19.52	1.24	3.32	3/18/04 7:59	0:33:22	0:21:00	0.745728577
3	78	1089	0.0001	538	14.135	9.84623E-05	2.79	0.000787699	22.31	1.41	3.50	3/18/04 8:01	0:35:22	0:23:00	0.767752854
7	78	1089	0.0002	538	14.135	0.000229745	6.51	0.001017444	28.81	1.82	3.91	3/18/04 8:12	0:45:52	0:33:30	0.874325137
3	79	1089	0.0001	539	14.135	9.82796E-05	2.78	0.001115724	31.59	2.00	4.09	3/18/04 8:15	0:49:07	0:36:45	0.904771303
31	79	1090	0.0011	539	14.148	0.001016489	28.78	0.002132213	60.38	3.82	5.91	3/18/04 9:19	1:52:52	1:40:30	1.371536041
9	77	1090	0.0003	537	14.148	0.000296209	8.39	0.002428421	68.76	4.35	6.44	3/18/04 9:40	2:14:07	2:01:45	1.495084539
45	78	1090	0.0016	538	14.148	0.001478291	41.86	0.003906712	110.63	7.00	9.09	3/18/04 11:08	3:41:52	3:29:30	1.92296068
7	78	1090	0.0002	538	14.148	0.000229956	6.51	0.004136669	117.14	7.41	9.50	3/18/04 11:27	4:00:52	3:48:30	2.003607857
22	80	1087	0.0008	540	14.109	0.000718062	20.33	0.00485473	137.47	8.70	10.79	3/18/04 18:07	10:40:52	10:28:30	3.268196921
48	79	1087	0.0017	539	14.109	0.001569586	44.45	0.006424317	181.92	11.51	13.60	3/19/04 10:12	26:45:52	26:33:30	5.173436425
22	80	1094	0.0008	540	14.200	0.000722686	20.46	0.007147002	202.38	12.81	14.90	3/20/04 13:03	53:36:52	53:24:30	7.322186501
3	79	1102	0.0001	539	14.303	9.94529E-05	2.82	0.007246455	205.20	12.99	15.08	3/21/04 13:27	78:00:52	77:48:30	8.832576584
11	81	1097	0.0004	541	14.239	0.000361684	10.24	0.007608119	215.44	13.63	15.72	3/22/04 9:48	98:21:52	98:09:30	9.917885079
15	80	1084	0.0005	540	14.070	0.000488236	13.83	0.008096355	229.26	14.51	16.60	3/23/04 9:17	121:50:52	121:38:30	11.03846809
8	81	1081	0.0003	541	14.031	0.000259192	7.34	0.008355547	236.60	14.97	17.06	3/24/04 13:36	150:09:52	149:57:30	12.25416029
-5	73	1082	-0.0002	533	14.044	-0.000164579	-4.66	0.008190969	231.94	14.68	16.77	3/25/04 11:37	172:10:52	171:58:30	13.12178003
10	82	1084	0.0004	542	14.070	0.00032429	9.18	0.008515259	241.12	15.26	17.35	3/26/04 14:31	199:04:52	198:52:30	14.10961059
6	81	1076	0.0002	541	13.968	0.000193495	5.48	0.008708753	246.60	15.61	17.70	3/27/04 16:21	224:54:52	224:42:30	14.99714788
-7	80	1084	-0.0002	540	14.070	-0.000227844	-6.45	0.00848091	240.15	15.20	17.29	3/28/04 12:20	244:53:52	244:41:30	15.64921013
-6	80	1086	-0.0002	540	14.096	-0.000195655	-5.54	0.008285255	234.61	14.85	16.94	3/29/04 16:45	273:18:52	273:08:30	16.53222443

DESORPTION TERMINATED 3/30/2004 DUE TO NO MORE GAS BEING EVOLVED; sample air dried for 14 days

SAMPLE: 1291' to 1292' (Weir-Pittsburg coal) cuttings in canister Maggy 3

	lbs.	grams
dry sample weight:	0.9005	408.46

est. lost gas (cc) = 7

TIME OF:	off bottom	at surface	in canister
	3/18/04 8:06	3/18/04 8:06	3/18/04 8:11

elapsed time (off bottom to canistering): 5.3 minutes; 0.088 hours; 0.295803989 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 (R)	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)
0.5	78	1089	2E-05	538	14.135	1.64104E-05	0.46	1.64104E-05	0.46	0.04	0.59	3/18/04 8:16	0:10:30	0:05:15	0.418330013
1	79	1090	4E-05	539	14.148	3.279E-05	0.93	4.92004E-05	1.39	0.11	0.66	3/18/04 8:19	0:13:45	0:08:30	0.478713554
3	79	1090	0.0001	539	14.148	9.83699E-05	2.79	0.00014757	4.18	0.33	0.88	3/18/04 8:23	0:17:30	0:12:15	0.540061725
1	79	1090	4E-05	539	14.148	3.279E-05	0.93	0.00018036	5.11	0.40	0.95	3/18/04 8:29	0:23:30	0:18:15	0.625832778
2	79	1090	7E-05	539	14.148	6.55799E-05	1.86	0.00024594	6.96	0.55	1.10	3/18/04 8:33	0:27:30	0:22:15	0.6770032
3	80	1090	0.0001	540	14.148	9.81877E-05	2.78	0.000344128	9.74	0.78	1.31	3/18/04 8:39	0:33:30	0:28:15	0.747217059
2	80	1090	7E-05	540	14.148	6.54585E-05	1.85	0.000409586	11.60	0.91	1.46	3/18/04 8:44	0:38:00	0:32:45	0.795822426
2	80	1090	7E-05	540	14.148	6.54585E-05	1.85	0.000475045	13.45	1.06	1.60	3/18/04 8:49	0:43:30	0:38:15	0.851469318
1	80	1090	4E-05	540	14.148	3.27292E-05	0.93	0.000507774	14.38	1.13	1.68	3/18/04 8:55	0:49:00	0:43:45	0.903696114
5	79	1090	0.0002	539	14.148	0.00018395	4.84	0.000671724	19.02	1.49	2.04	3/18/04 9:17	1:11:00	1:05:45	1.087811258
6	77	1090	0.0002	537	14.148	0.000197473	5.59	0.000869196	24.61	1.93	2.48	3/18/04 9:40	1:34:45	1:29:30	1.256648983
25	78	1090	0.0009	538	14.148	0.000821273	23.26	0.001690469	47.87	3.75	4.30	3/18/04 11:07	3:01:00	2:55:45	1.736855396
11	78	1090	0.0004	538	14.148	0.00036136	10.23	0.002051829	58.10	4.56	5.11	3/18/04 11:29	3:23:00	3:17:45	1.839383955
-6	80	1087	-0.0002	540	14.109	-0.000195835	-5.55	0.001855994	52.56	4.12	4.67	3/18/04 18:09	10:03:00	9:57:45	3.170173497
18	79	1087	0.0006	539	14.109	0.000588595	16.67	0.002444589	69.22	5.43	5.98	3/19/04 10:11	26:05:00	25:59:45	5.107184482
-1	80	1094	-4E-05	540	14.200	-3.28493E-05	-0.93	0.00241174	68.29	5.36	5.91	3/20/04 13:04	52:58:00	52:52:45	7.277820186
-5	79	1102	-0.0002	539	14.303	-0.000165755	-4.69	0.002245985	63.60	4.99	5.54	3/21/04 13:28	77:22:00	77:16:45	8.795832346
3	81	1097	0.0001	541	14.239	9.86356E-05	2.79	0.002344621	66.39	5.21	5.76	3/22/04 9:49	97:43:00	97:37:45	9.885174084
8	80	1084	0.0003	540	14.070	0.000260393	7.37	0.002605013	73.77	5.79	6.33	3/23/04 9:18	121:12:00	121:06:45	11.00908716
0	81	1081	0	541	14.031	0	0.00	0.002605013	73.77	5.79	6.33	3/24/04 13:37	149:31:00	149:25:45	12.22770079
-10	73	1082	-0.0004	533	14.044	-0.000329157	-9.32	0.002275858	64.44	5.05	5.60	3/25/04 11:38	171:32:00	171:26:45	13.09707346

measured cc	measured T (F)	measured P	cubic ft	absolute T (R)	psia	cubic ft (@STP)	cc (@STP)	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	82	1084	0.0001	542	14.070	0.000129716	3.87	0.002405572	68.12	5.34	5.89	3/26/04	14:32	198:26:00	198:20:45	14.08663669
2	81	1076	7E-05	541	13.986	6.44983E-05	1.83	0.00247007	69.94	5.49	6.04	3/27/04	16:22	224:16:00	224:10:45	14.97553561
-8	80	1084	-0.0003	540	14.070	-0.000260393	-7.37	0.002209678	62.57	4.91	5.46	3/28/04	12:21	244:15:00	244:09:45	15.62849961
-6	80	1086	-0.0002	540	14.098	-0.000195655	-5.54	0.002014023	57.03	4.47	5.02	3/29/04	16:47	272:41:00	272:35:45	16.51312609

DESORPTION TERMINATED 3/30/2004 DUE TO NO MORE GAS BEING EVOLVED; sample air dried for 14 days

SAMPLE: 1427' to 1429' (Dry Wood coal) cuttings in canister D

	lbs.	grams
dry sample weight:	0.8566	388.55

est. lost gas (cc) = 12

TIME OF:	off bottom	at surface	in canister
	3/18/04 9:05	3/18/04 9:08	3/18/04 9:18

elapsed time (off bottom to canistering): 10.1 minutes; 0.168 hours; 0.409945796 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 (R)	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)
1.5	80	1090	5E-05	540	14.148	4.90939E-05	1.39	4.90939E-05	1.39	0.11	1.10	3/18/04	9:21	0:15:50	0:05:45	0.513701187
2.5	79	1090	9E-05	539	14.148	8.19749E-05	2.32	0.000131069	3.71	0.31	1.30	3/18/04	9:24	0:18:20	0:08:15	0.552770798
6	78	1090	0.0002	538	14.148	0.000197105	5.58	0.000328174	9.29	0.77	1.76	3/18/04	9:38	0:32:20	0:22:15	0.734090518
5	76	1090	0.0002	536	14.148	0.000164867	4.67	0.000493042	13.96	1.15	2.14	3/18/04	10:12	1:06:35	0:56:30	1.053433539
4	77	1090	0.0001	537	14.148	0.000131648	3.73	0.00062469	17.69	1.46	2.45	3/18/04	10:25	1:19:50	1:09:45	1.153497098
3	77	1090	0.0001	537	14.148	9.87363E-05	2.80	0.000723426	20.49	1.69	2.68	3/18/04	10:41	1:35:35	1:25:30	1.262163046
3	77	1090	0.0001	537	14.148	9.87363E-05	2.80	0.000822163	23.28	1.92	2.91	3/18/04	11:04	1:58:35	1:48:30	1.40584099
4	77	1090	0.0001	537	14.148	0.000131648	3.73	0.000953811	27.01	2.23	3.22	3/18/04	11:26	2:20:05	2:10:00	1.527979785
8	77	1087	0.0003	537	14.109	0.000262572	7.44	0.001216383	34.44	2.84	3.83	3/18/04	18:10	9:04:05	8:54:00	3.011321231
22	79	1087	0.0008	539	14.109	0.000719394	20.37	0.001935777	54.81	4.52	5.51	3/19/04	10:13	25:07:05	24:57:00	5.011791651
8	80	1094	0.0003	540	14.200	0.000262795	7.44	0.002198571	62.26	5.13	6.12	3/20/04	13:05	51:59:05	51:49:00	7.21004315
2	79	1102	7E-05	539	14.303	6.63019E-05	1.88	0.002284873	64.13	5.29	6.28	3/21/04	13:28	76:22:05	76:12:00	8.738881825
6	81	1097	0.0002	541	14.239	0.000197271	5.59	0.002462145	69.72	5.75	6.74	3/22/04	9:50	96:44:05	96:34:00	9.835381143
7	80	1084	0.0002	540	14.070	0.000227844	6.45	0.002689988	76.17	6.28	7.27	3/23/04	9:18	120:12:05	120:02:00	10.9636394
3	81	1081	0.0001	541	14.031	9.7197E-05	2.75	0.002787185	78.92	6.51	7.50	3/24/04	13:37	148:31:05	148:21:00	12.18679841
-4	73	1082	-0.0001	533	14.044	-0.000131863	-3.73	0.002655522	75.20	6.20	7.19	3/25/04	11:39	170:33:05	170:23:00	13.05953249
5	82	1084	0.0002	542	14.070	0.000162145	4.59	0.002817667	79.79	6.58	7.57	3/26/04	14:32	197:26:05	197:18:00	14.05114665
3	81	1078	0.0001	541	13.966	9.67474E-05	2.74	0.002914415	82.53	6.80	7.79	3/27/04	16:22	223:16:05	223:06:00	14.94215699
-4	80	1084	-0.0001	540	14.070	-0.000130198	-3.69	0.002784218	78.84	6.50	7.49	3/28/04	12:22	243:16:05	243:06:00	15.59705278
-2	80	1086	-7E-05	540	14.096	-6.52183E-05	-1.85	0.002719	76.99	6.35	7.34	3/29/04	16:48	271:42:05	271:32:00	16.48336704

DESORPTION TERMINATED 3/30/2004 DUE TO NO MORE GAS BEING EVOLVED; sample air dried for 14 days

SAMPLE: 1510' to 1512' (Riverton coal) cuttings in canister K

	lbs.	grams
dry sample weight:	1.9863	900.98

est. lost gas (cc) = 39

TIME OF:	off bottom	at surface	in canister
	3/18/04 9:25	3/18/04 9:28	3/18/04 9:38

elapsed time (off bottom to canistering): 12.2 minutes; 0.203 hours; 0.450924975 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 (R)	psia	cubic ft (@STP)	cc (@STP)	cubic ft (@STP)	cc (@STP)	without lost gas	with lost gas	TIME OF MEASURE		off bottom	in canister	SQRT hrs. (since off bottom)
5	77	1090	0.0002	537	14.148	0.00016456	4.66	0.00016456	4.66	0.17	1.55	3/18/04	9:42	0:16:12	0:04:00	0.519615242
20	77	1090	0.0007	537	14.148	0.000658242	18.64	0.000822802	23.30	0.83	2.22	3/18/04	9:56	0:30:57	0:18:45	0.718215381
4	77	1090	0.0001	537	14.148	0.000131648	3.73	0.000954451	27.03	0.96	2.35	3/18/04	10:00	0:34:42	0:22:30	0.760482303
10	76	1090	0.0004	536	14.148	0.000329735	9.34	0.001284185	36.36	1.29	2.68	3/18/04	10:11	0:45:57	0:33:45	0.87511904
9	77	1090	0.0003	537	14.148	0.000296209	8.39	0.001580394	44.75	1.59	2.98	3/18/04	10:22	0:56:12	0:44:00	0.967815409
2	77	1090	7E-05	537	14.148	6.58242E-05	1.86	0.001646218	46.62	1.68	3.04	3/18/04	10:25	0:59:12	0:47:00	0.993310962
10	77	1090	0.0004	537	14.148	0.000329121	9.32	0.001975339	55.94	1.99	3.38	3/18/04	10:40	1:14:27	1:02:15	1.113926987
7	77	1090	0.0002	537	14.148	0.000230385	6.52	0.002205724	62.46	2.22	3.61	3/18/04	10:51	1:25:42	1:13:30	1.195129003
15	78	1090	0.0005	538	14.148	0.000492784	13.95	0.002698488	76.41	2.72	4.10	3/18/04	11:23	1:57:12	1:45:00	1.39761702
45	80	1087	0.0016	540	14.109	0.001468762	41.59	0.00416725	118.00	4.20	5.58	3/18/04	18:12	8:46:12	8:34:00	2.961418579
55	79	1087	0.0019	539	14.109	0.001798484	50.93	0.005965734	168.93	6.01	7.39	3/19/04	10:14	24:48:12	24:36:00	4.980294503
33	80	1094	0.0012	540	14.200	0.001084029	30.70	0.007049763	199.63	7.10	8.49	3/20/04	13:06	51:40:12	51:28:00	7.18818475
12	79	1102	0.0004	539	14.303	0.000397811	11.26	0.007447574	210.89	7.50	8.89	3/21/04	1:29	64:03:12	63:51:00	8.003332639
13	81	1097	0.0005	541	14.239	0.000427421	12.10	0.007874995	222.99	7.93	9.32	3/22/04	9:50	96:24:12	96:12:00	9.818519916
15	80	1084	0.0005	540	14.070	0.000488236	13.83	0.008363231	236.82	8.42	9.81	3/23/04	9:19	119:53:12	119:41:00	10.94927699
11	83	1081	0.0004	543	14.031	0.000355076	10.05	0.008718308	246.87	8.78	10.17	3/24/04	13:37	148:11:12	147:59:00	12.1731946
-3	73	1082	-0.0001	533	14.044	-9.87471E-05	-2.80	0.008619561	244.08	8.68	10.07	3/25/04	11:39	170:13:12	170:01:00	13.0468387
12	82	1084	0.0004	542	14.070	0.000389148	11.02	0.009008708	255.10	9.07	10.46	3/26/04	14:32	197:06:12	196:54:00	14.03934946
7	81	1076	0.0002	541	13.966	0.000225744	6.39	0.009234452	261.49	9.30	10.68	3/27/04	16:22	222:56:12	222:44:00	14.93106382
-3	80	1084	-0.0001	540	14.070	-9.76472E-05	-2.77	0.009136805	258.72	9.20	10.59	3/28/04	12:23	242:57:12	242:45:00	15.58696036
-1	80	1086	-4E-05	540	14.098	-3.26091E-05	-0.92	0.009104196	257.80	9.17	10.55	3/29/04	16:49	271:23:12	271:11:00	16.47381781

DESORPTION TERMINATED 3/30/2004 DUE TO NO MORE GAS BEING EVOLVED; sample air dried for 14 days

SAMPLE: 1522' to 1524' (Riverton "rider" coal) cuttings in canister MER I

	lbs.	grams
dry sample weight:	0.3748	170.01

est. lost gas (cc) = 15

TIME OF:	off bottom	at surface	in canister
	3/18/04 9:51	3/18/04 9:54	3/18/04 10:00

elapsed time (off bottom to canistering)
8.3 minutes
0.138 hours
0.370809924 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 (R)	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)
2	77	1090	7E-05	537	14.148	6.58242E-05	1.86	6.58242E-05	1.86	0.35	3.18	3/18/04	10:02	0:11:00	0:02:45	0.428174419
3	76	1090	0.0001	536	14.148	9.89205E-05	2.80	0.000184745	4.67	0.88	3.71	3/18/04	10:05	0:14:00	0:05:45	0.483045892
2	76	1090	7E-05	536	14.148	6.5947E-05	1.87	0.000230692	6.53	1.23	4.06	3/18/04	10:10	0:18:30	0:10:15	0.555277708
4	76	1090	0.0001	536	14.148	0.000131894	3.73	0.000362586	10.27	1.93	4.78	3/18/04	10:16	0:24:15	0:16:00	0.635741037
4	77	1090	0.0001	537	14.148	0.000131646	3.73	0.000494234	14.00	2.64	5.46	3/18/04	10:21	0:29:30	0:21:15	0.701189466
3	77	1090	0.0001	537	14.148	9.87363E-05	2.80	0.00059297	16.79	3.16	5.99	3/18/04	10:29	0:37:15	0:29:00	0.787929777
3	77	1090	0.0001	537	14.148	9.87363E-05	2.80	0.000691706	19.59	3.69	6.52	3/18/04	10:38	0:46:45	0:38:30	0.882704178
2	78	1090	7E-05	538	14.148	6.57018E-05	1.86	0.000757408	21.45	4.04	6.87	3/18/04	10:50	0:58:30	0:50:15	0.987420883
5	78	1090	0.0002	538	14.148	0.000164255	4.65	0.000921663	26.10	4.92	7.74	3/18/04	11:22	1:30:15	1:22:00	1.226444726
16	80	1087	0.0006	540	14.109	0.000522227	14.79	0.001443889	40.89	7.70	10.53	3/18/04	18:13	8:21:15	8:13:00	2.890357533
22	79	1087	0.0006	539	14.109	0.000719394	20.37	0.002163283	61.26	11.54	14.37	3/19/04	10:14	24:22:15	24:14:00	4.936682422
11	80	1094	0.0004	540	14.200	0.000361343	10.23	0.002524626	71.49	13.47	16.30	3/20/04	13:06	51:14:15	51:06:00	7.158037441
2	79	1102	7E-05	539	14.303	6.63019E-05	1.88	0.002590928	73.37	13.83	16.65	3/21/04	1:29	63:37:15	63:29:00	7.97626688
5	81	1097	0.0002	541	14.239	0.000164393	4.66	0.002755321	78.02	14.70	17.53	3/22/04	9:51	95:59:15	95:51:00	9.797321062
8	80	1084	0.0003	540	14.070	0.000260393	7.37	0.003015713	85.40	16.09	18.92	3/23/04	9:19	119:27:15	119:19:00	10.92950899
4	81	1081	0.0001	541	14.031	0.000129596	3.67	0.003145309	89.08	18.78	19.61	3/24/04	13:38	147:46:15	147:38:00	12.15610272
-9	73	1082	-0.0003	533	14.044	-0.000296241	-8.39	0.002849068	80.68	15.20	18.03	3/25/04	11:40	169:48:15	169:40:00	13.03089278
9	82	1084	0.0003	542	14.070	0.000291861	8.26	0.003140929	88.94	16.76	19.59	3/26/04	14:33	196:41:15	196:33:00	14.02453208
4	81	1076	0.0001	541	13.966	0.000128997	3.65	0.003269925	92.59	17.45	20.28	3/27/04	16:22	222:30:15	222:22:00	14.91657356
-5	80	1084	-0.0002	540	14.070	-0.000162745	-4.61	0.00310718	87.99	16.58	19.41	3/28/04	12:24	242:32:15	242:24:00	15.57361551
-4	80	1086	-0.0001	540	14.096	-0.000130437	-3.69	0.002976743	84.29	15.88	18.71	3/29/04	16:49	270:57:15	270:49:00	16.46068549

DESORPTION TERMINATED 3/30/2004 DUE TO NO MORE GAS BEING EVOLVED; sample air dried for 14 days

1213' to 1214' (Mineral coal) cuttings in canister Maggy 4

Dart Cherokee Basin Kincaid Trust #D1-30; sec. 30-T.34S.-R.14E., Montgomery County, KS

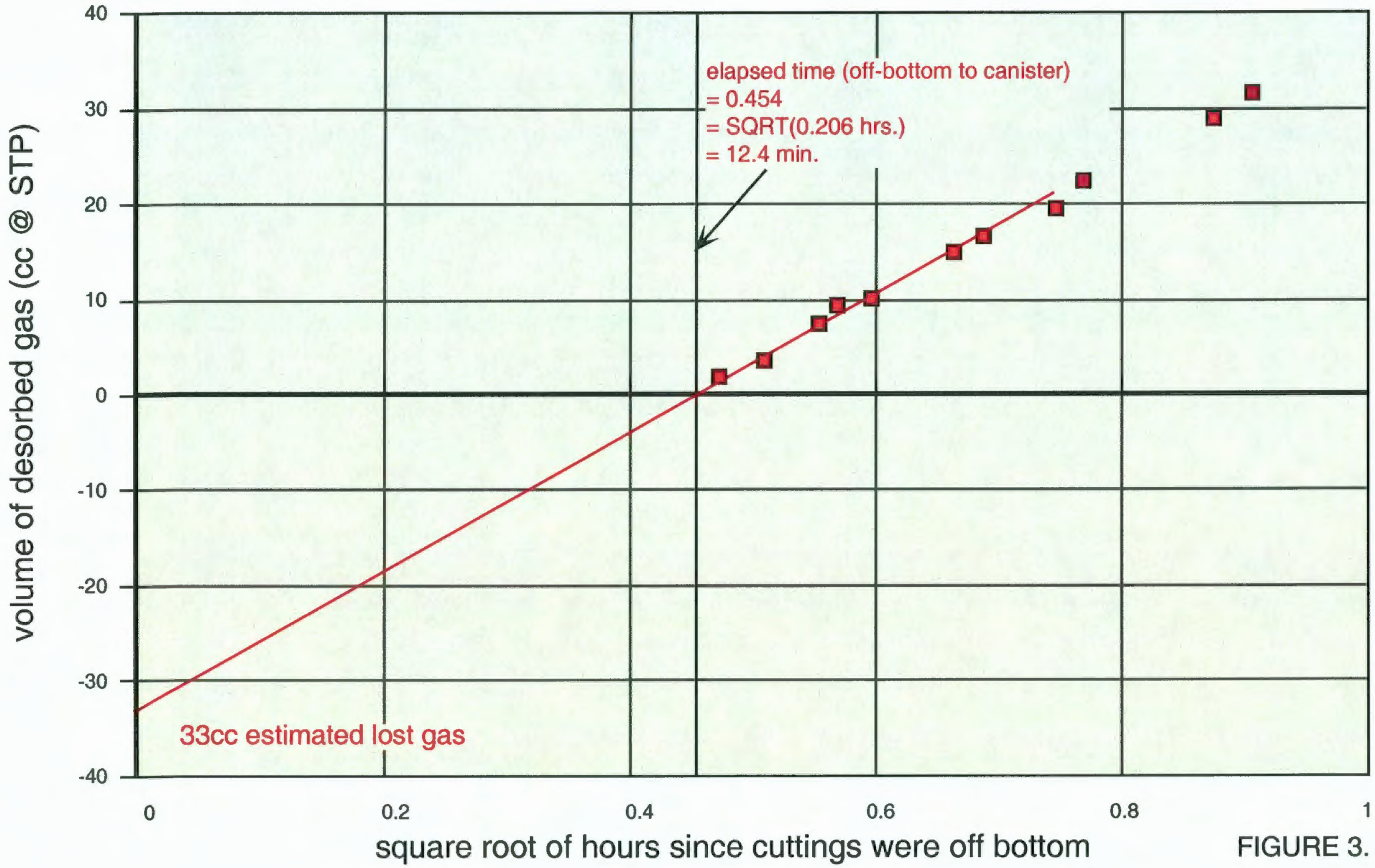


FIGURE 3.

1291' to 1292' (Weir-Pittsburg coal) cuttings in canister Maggy 3

Dart Cherokee Basin Kincaid Trust #D1-30; sec. 30-T.34S.-R.14E., Montgomery County, KS

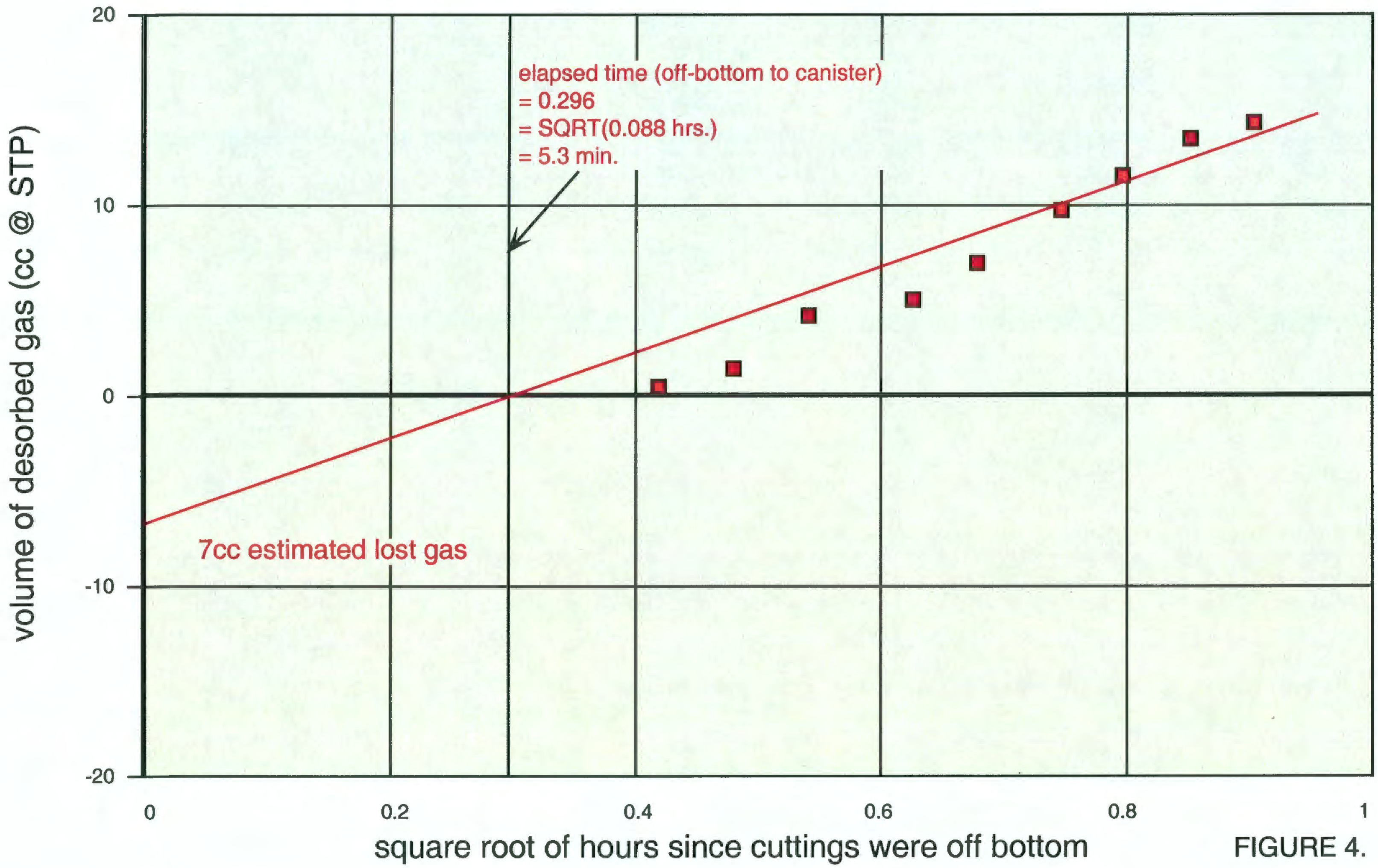


FIGURE 4.

1427' to 1429' (Dry Wood coal) cuttings in canister D

Dart Cherokee Basin Kincaid Trust #D1-30; sec. 30-T.34S.-R.14E., Montgomery County, KS

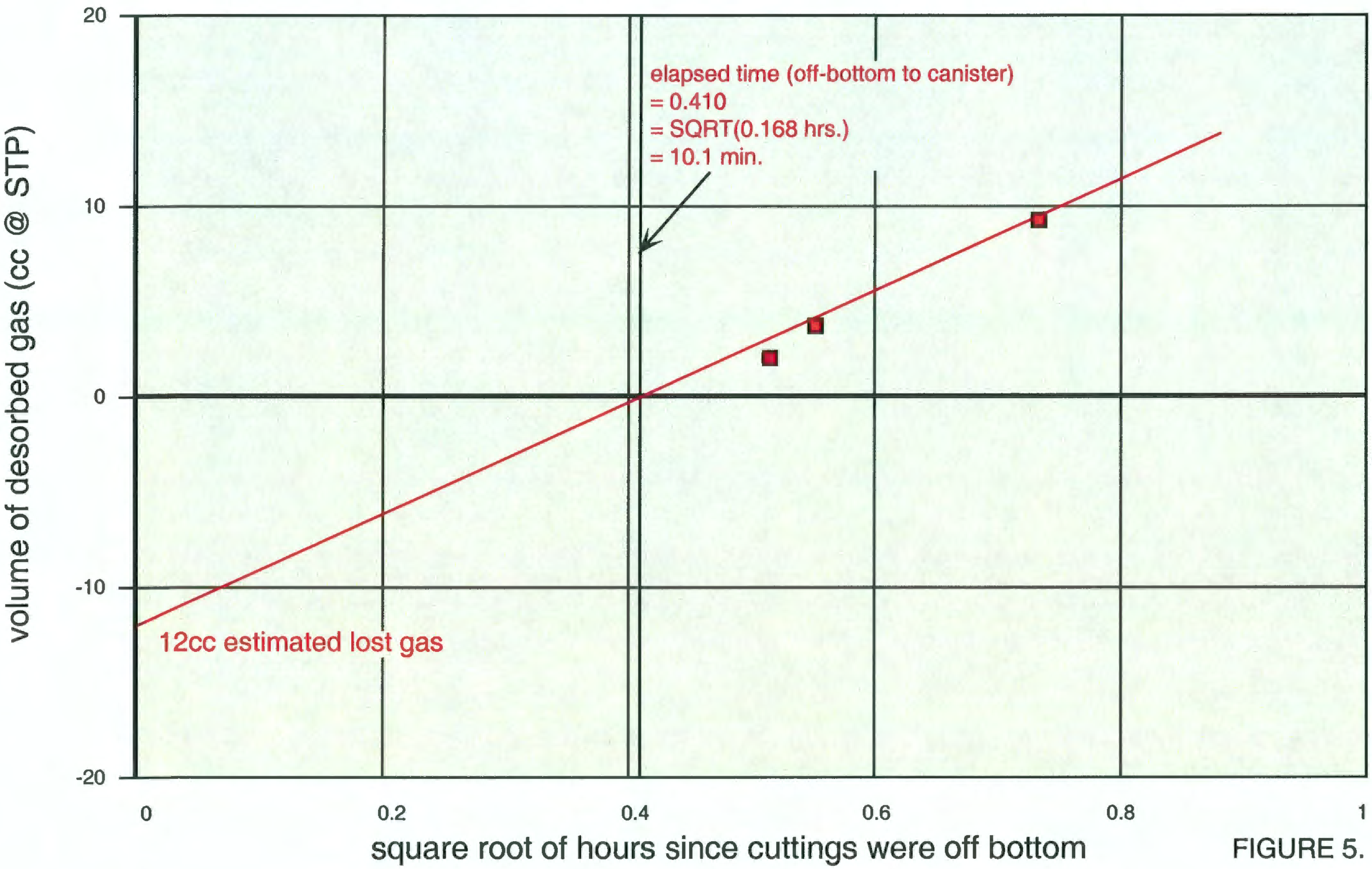


FIGURE 5.

1510' to 1512' (Riverton coal) cuttings in canister K

Dart Cherokee Basin Kincaid Trust #D1-30; sec. 30-T.34S.-R.14E., Montgomery County, KS

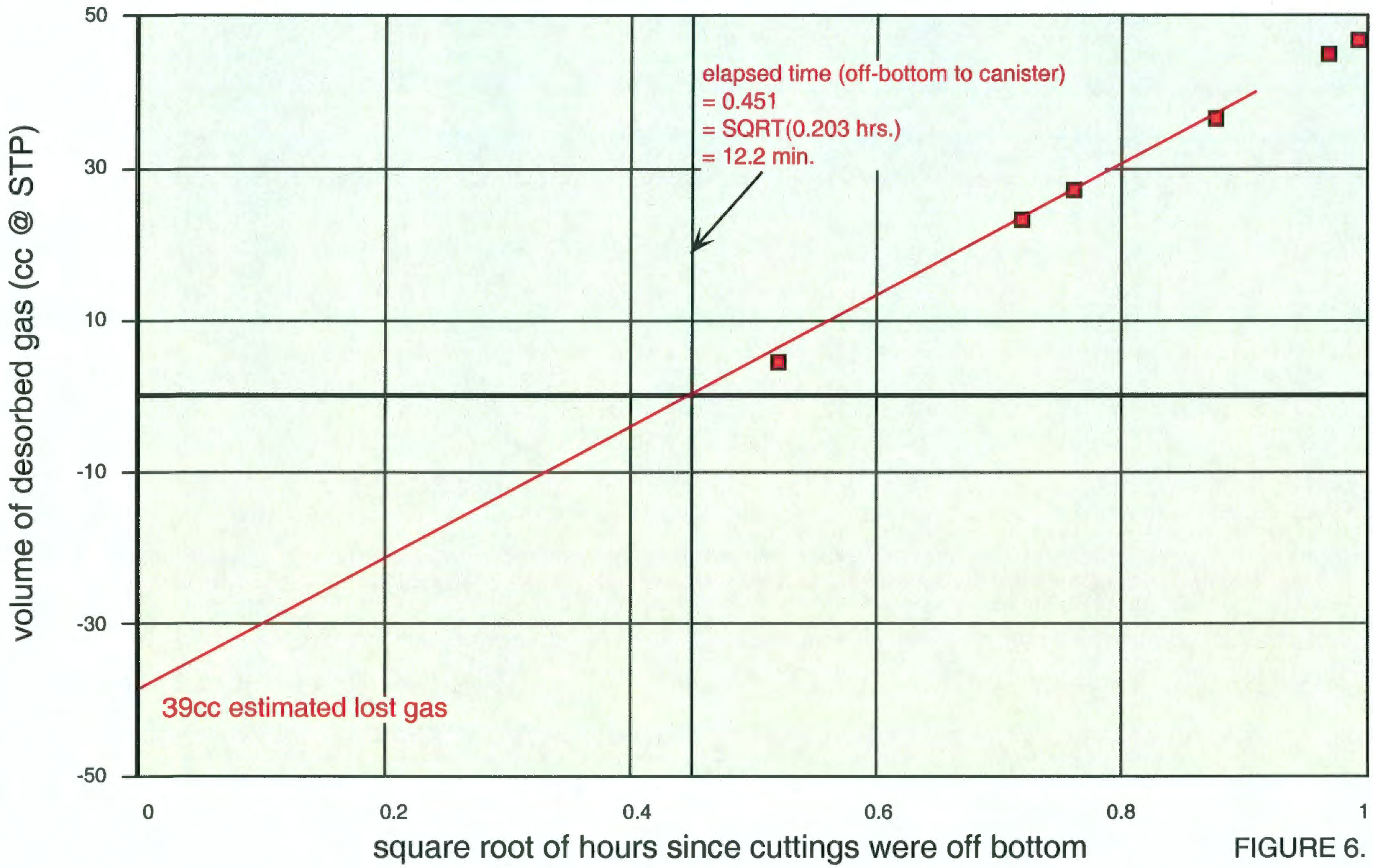


FIGURE 6.

1522' to 1524' (Riverton "rider" coal) cuttings in canister MER I

Dart Cherokee Basin Kincaid Trust #D1-30; sec. 30-T.34S.-R.14E., Montgomery County, KS

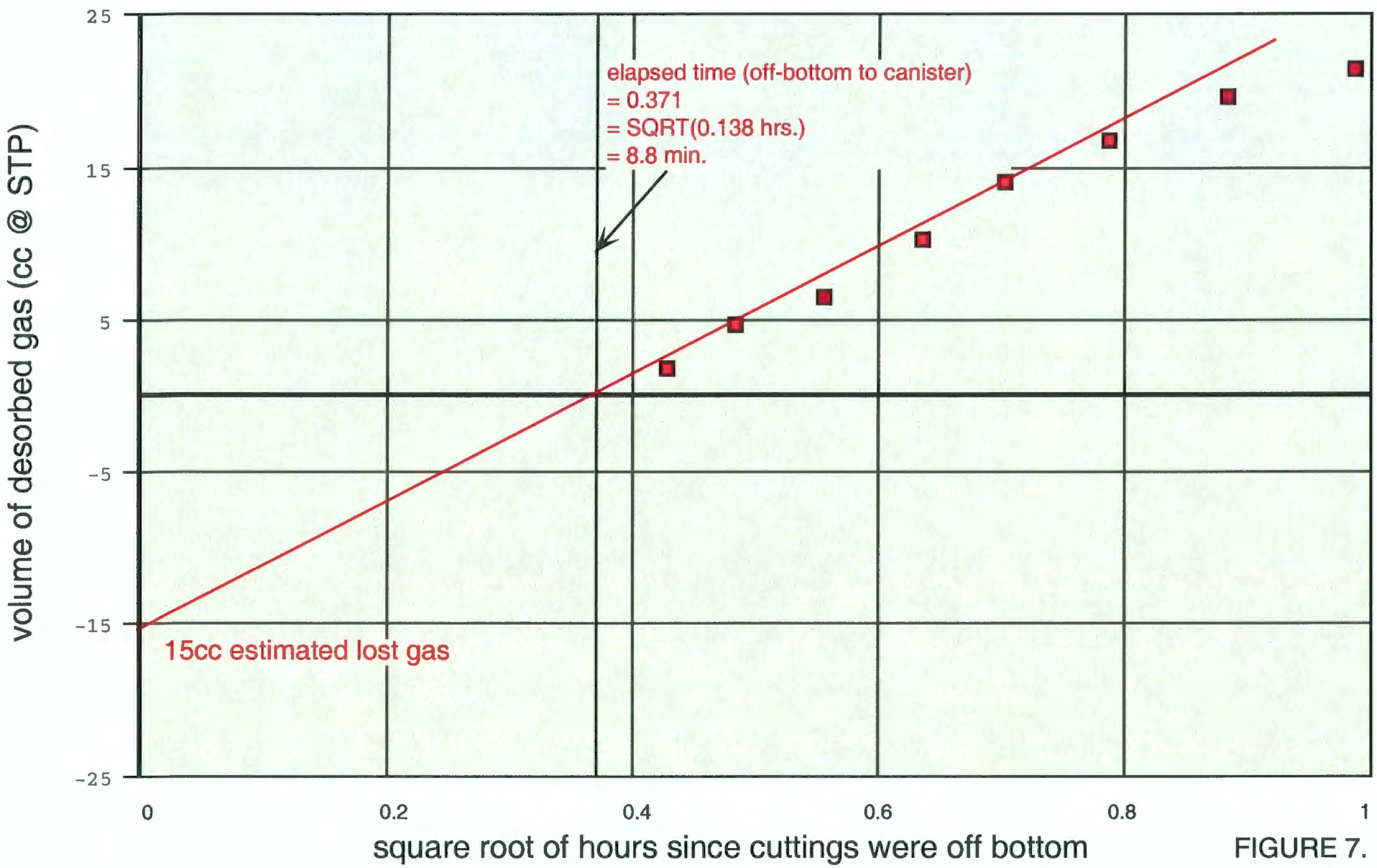


FIGURE 7.

Desorption Characteristics of Cuttings Samples

Dart Cherokee basin #D1-30 Kincaid Trust, 30-T.34S.-R.14E., Montgomery County, KS

LITHOLOGIC COMPONENT SENSITIVITY ANALYSIS for calculation of gas content of Mineral coal from 1213' to 1214'

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

total gas desorbed = 279.6 ccs

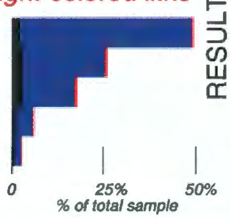
TOTAL DRY WEIGHT OF SAMPLE = 515.56 grams

$\text{weight}_{light\text{-}colored\ lithologies}$ = 9.35 grams (1.8%)

$\text{weight}_{dark\ shale}$ = 462.04 grams (89.6%)

weight_{coal} = 44.17 grams (8.6%)

sieve size	*grams*	*% coal / % dark shale / % light-colored liths*
>0.0930"	251.66	3.94% / 95.14% / 0.92%
>0.0661"	132.11	9.96% / 88.18% / 1.86%
>0.0460"	89.54	15.04% / 81.91% / 3.05%
>0.0331"	29.62	17.19% / 78.73% / 4.07%
<0.0331"	12.64	20.00% / 75.00% / 5.00%
	515.56 TOTAL	



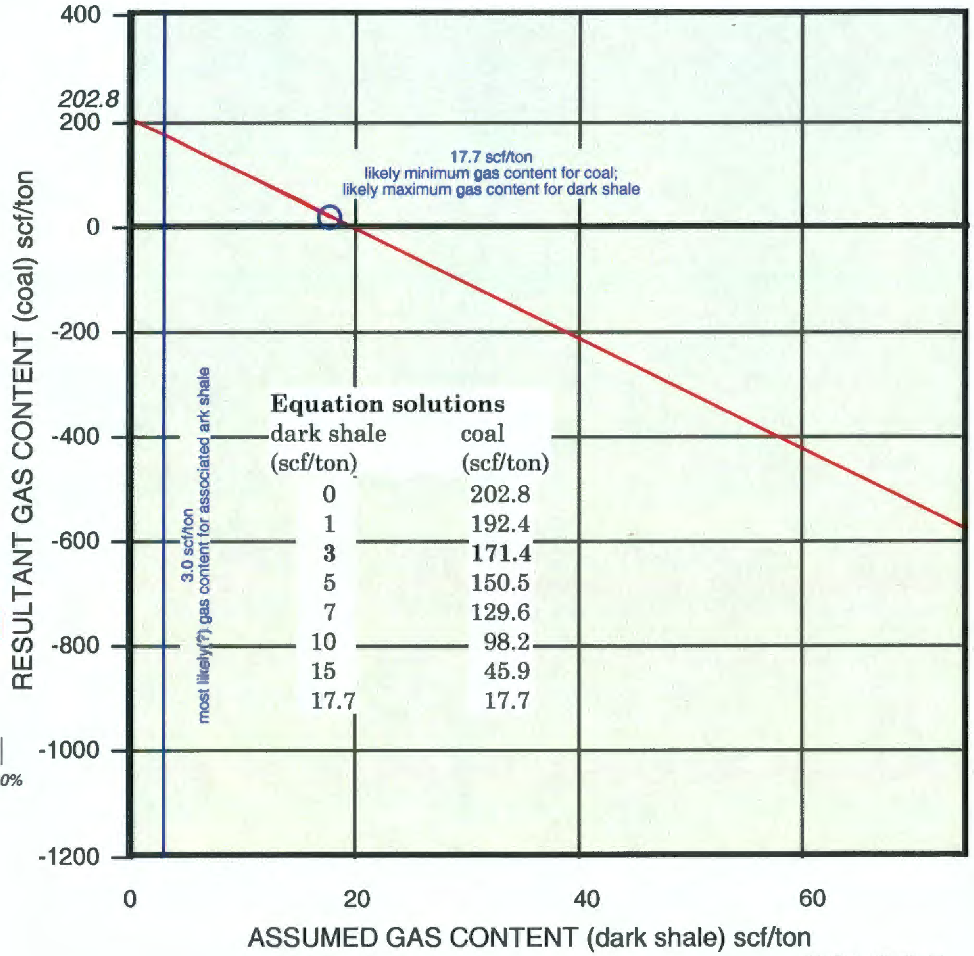


FIGURE 8.

Desorption Characteristics of Cuttings Samples

Dart Cherokee basin #D1-30 Kincaid Trust, 30-T.34S.-R.14E., Montgomery County, KS

LITHOLOGIC COMPONENT SENSITIVITY ANALYSIS for calculation of gas content of Weir-Pittsburg coal from 1291' to 1292'

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

total gas desorbed = 80.8 ccs

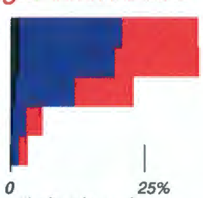
TOTAL DRY WEIGHT OF SAMPLE = 746.79 grams

$\text{weight}_{light\text{-}colored\ lithologies}$ = 338.33 grams (45.3%)

$\text{weight}_{dark\ shale}$ = 381.53 grams (51.1%)

weight_{coal} = 26.93 grams (3.6%)

sieve size	*grams*	*% coal / % dark shale / % light-colored liths*
>0.0930"	256.63	3.90% / 55.19% / 40.91%
>0.0661"	258.02	4.00% / 50.84% / 45.17%
>0.0460"	167.13	3.04% / 48.34% / 48.62%
>0.0331"	42.82	2.54% / 43.48% / 53.99%
<0.0331"	22.18	2.00% / 42.00% / 56.00%
	746.79 TOTAL	



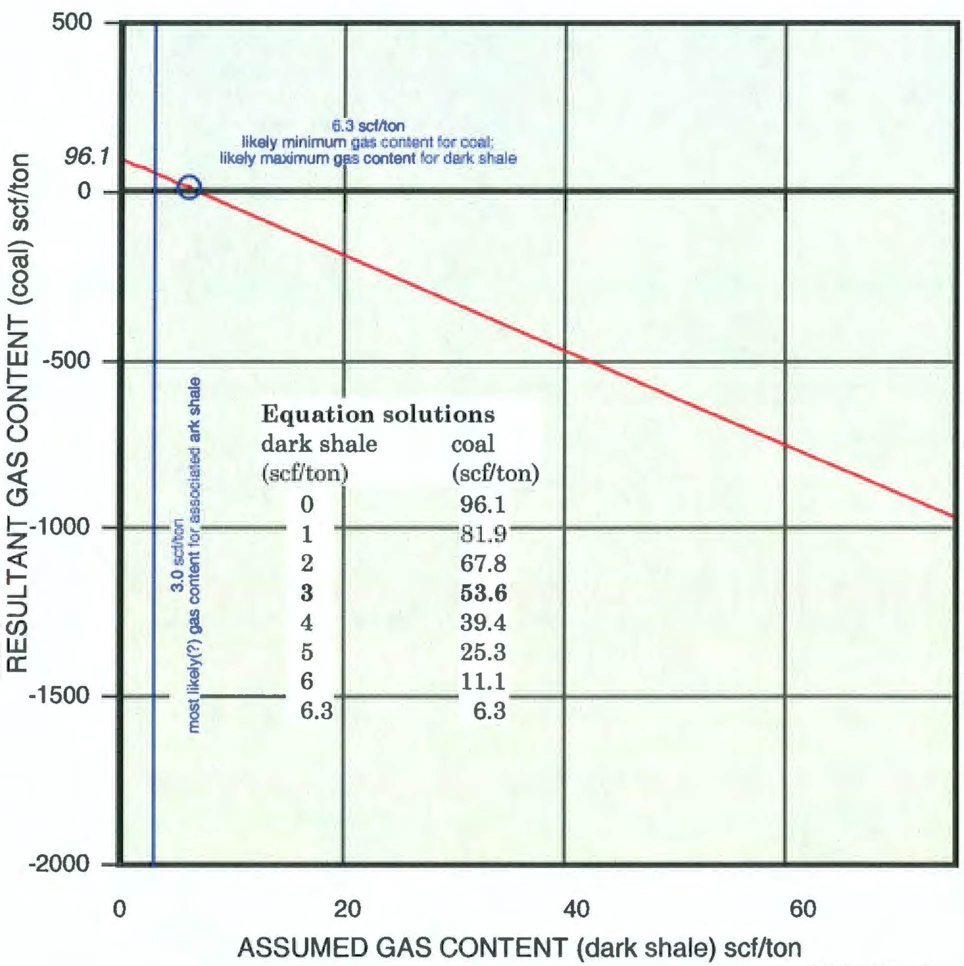


FIGURE 9.

Desorption Characteristics of Cuttings Samples

Dart Cherokee basin #D1-30 Kincaid Trust, 30-T.34S.-R.14E., Montgomery County, KS

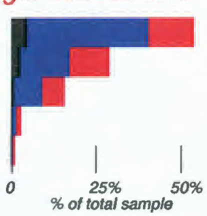
LITHOLOGIC COMPONENT SENSITIVITY ANALYSIS for calculation of gas content of Dry Wood coal from 1427' to 1429'

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

total gas desorbed = 94.5 ccs

TOTAL DRY WEIGHT OF SAMPLE = 580.80 grams
$\text{weight}_{light\text{-}colored\ lithologies}$ = 192.26 grams (33.1%)
$\text{weight}_{dark\ shale}$ = 344.79 grams (59.4%)
weight_{coal} = 43.76 grams (7.5%)

sieve size	grams	% coal / % dark shale / % light-colored liths
>0.0930"	306.40	8.32% / 66.78% / 24.90%
>0.0661"	164.64	8.46% / 50.59% / 40.95%
>0.0460"	88.68	4.13% / 53.91% / 41.96%
>0.0331"	15.85	3.48% / 44.78% / 51.74%
<0.0331"	5.23	2.00% / 38.00% / 56.00%
	580.80 TOTAL	



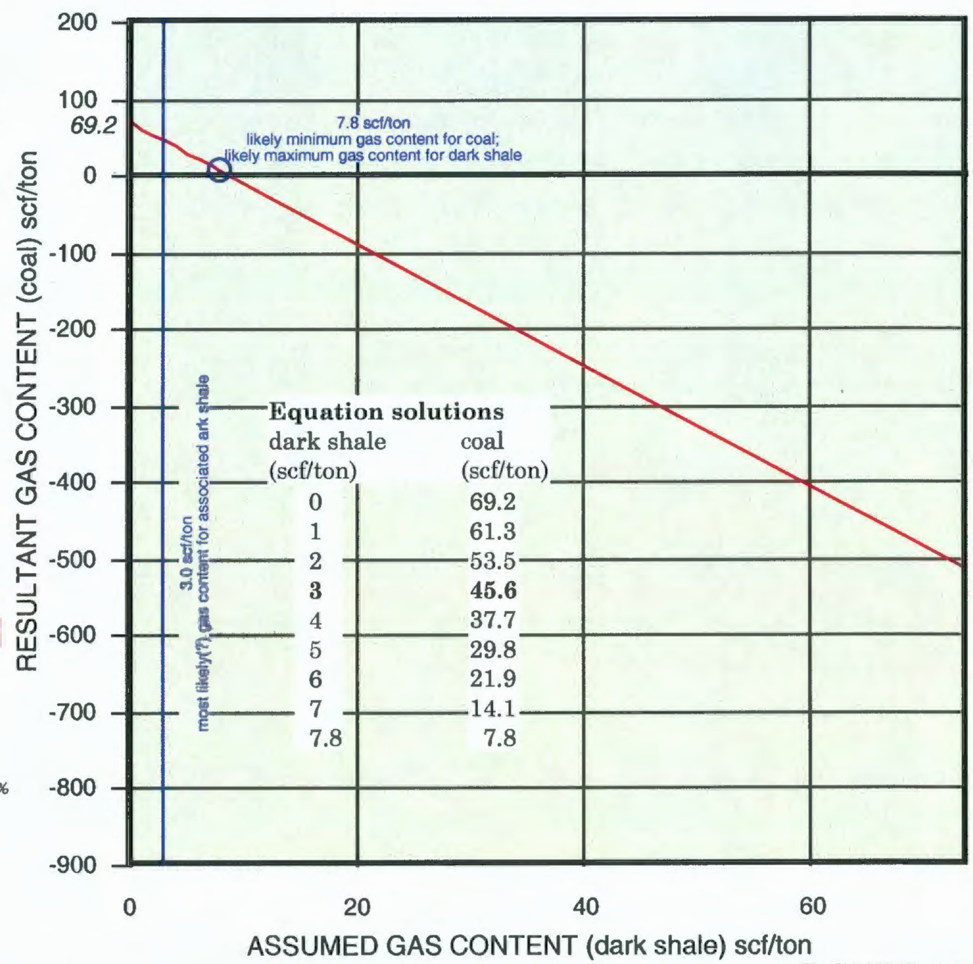


FIGURE 10.

Desorption Characteristics of Cuttings Samples

Dart Cherokee basin #D1-30 Kincaid Trust, 30-T.34S.-R.14E., Montgomery County, KS

LITHOLOGIC COMPONENT SENSITIVITY ANALYSIS for calculation of gas content of Riverton coal from 1510' to 1512'

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

total gas desorbed = 300.5 ccs

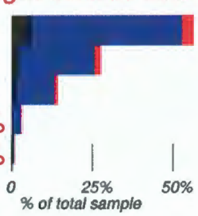
TOTAL DRY WEIGHT OF SAMPLE = 970.00 grams

$\text{weight}_{light\text{-}colored\ lithologies}$ = 69.04 grams (7.1%)

$\text{weight}_{dark\ shale}$ = 818.51 grams (84.4%)

weight_{coal} = 82.45 grams (8.5%)

sieve size	*grams*	*% coal / % dark shale / % light-colored liths*
>0.0930"	537.23	10.04% / 83.70% / 6.26%
>0.0661"	263.00	6.83% / 85.42% / 7.75%
>0.0460"	133.92	6.95% / 84.75% / 8.30%
>0.0331"	27.91	3.89% / 85.56% / 10.56%
<0.0331"	7.95	2.00% / 86.00% / 12.00%
	970.00 TOTAL	



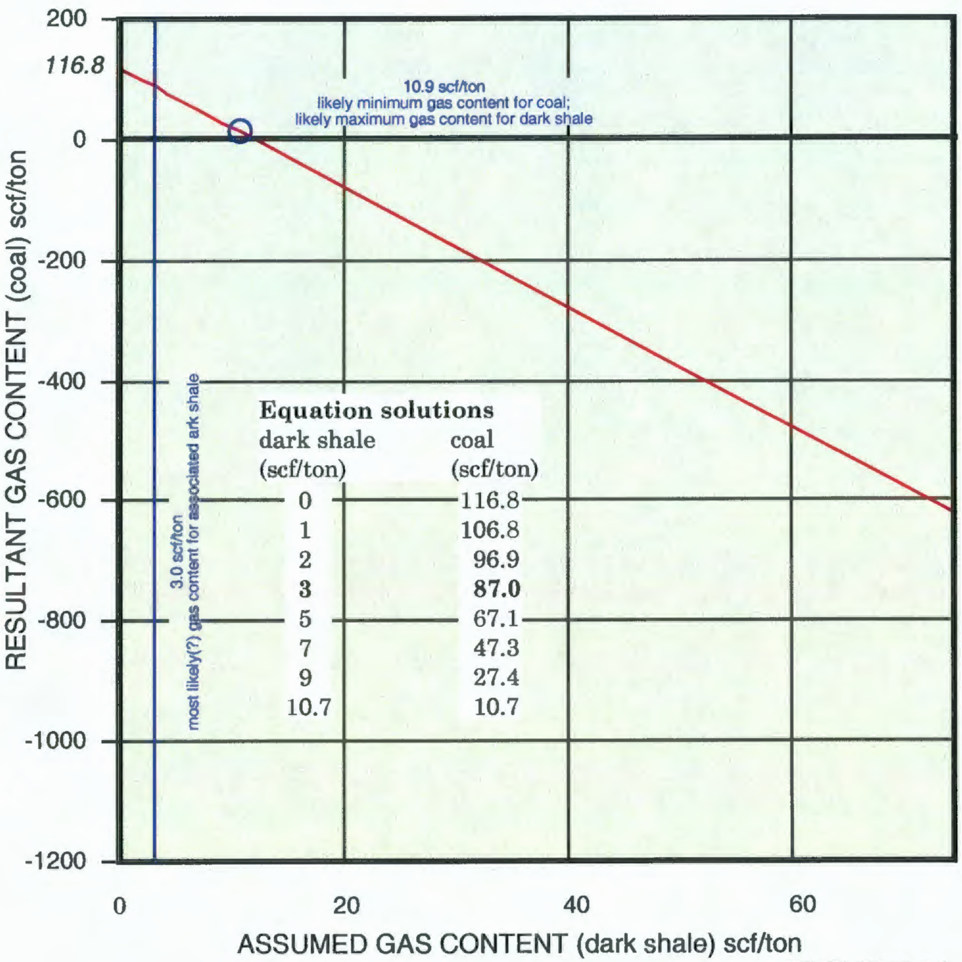


FIGURE 11.

Desorption Characteristics of Cuttings Samples

Dart Cherokee basin #D1-30 Kincaid Trust, 30-T.34S.-R.14E., Montgomery County, KS

LITHOLOGIC COMPONENT SENSITIVITY ANALYSIS for calculation of gas content of Riverton "rider" coal from 1522' to 1524'

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

total gas desorbed = 107.6 ccs

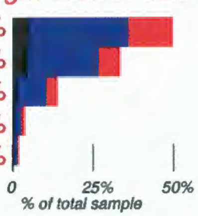
TOTAL DRY WEIGHT OF SAMPLE = 227.35 grams

$\text{weight}_{\text{light-colored lithologies}}$ = 57.34 grams (25.2%)

$\text{weight}_{\text{dark shale}}$ = 145.98 grams (64.2%)

weight_{coal} = 24.02 grams (10.6%)

sieve size	*grams*	*% coal / % dark shale / % light-colored liths*
>0.0930"	110.92	9.31% / 62.66% / 28.03%
>0.0661"	74.00	13.16% / 66.58% / 20.26%
>0.0460"	30.60	8.76% / 65.99% / 25.25%
>0.0331"	8.00	11.22% / 56.59% / 32.20%
<0.0331"	3.82	10.00% / 65.00% / 25.00%
	227.35 TOTAL	



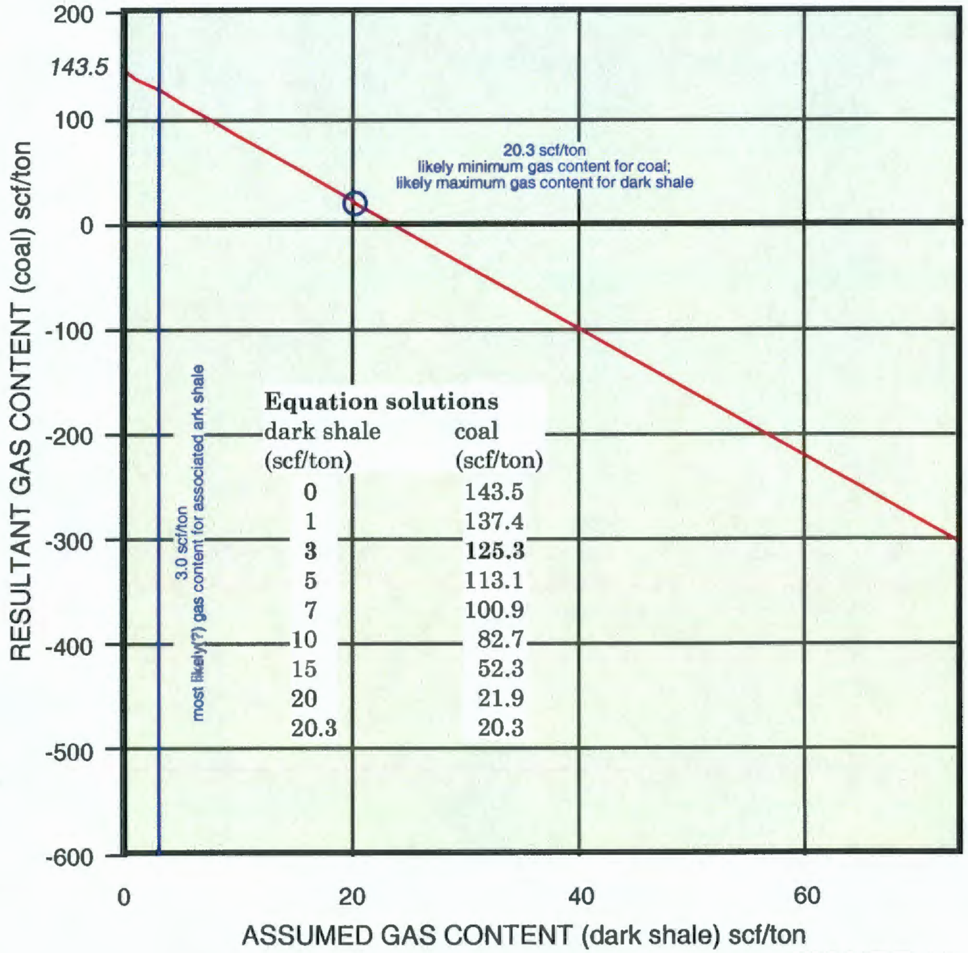


FIGURE 12.

100'

200'

300'

400'

500'

600'

700'

800'

900'

1000'

1100'

1200'

1213'-1214' Mineral

1291'-1292' Weir-Pittsburg

1400'

1427'-1429' Dry Wood

1500'

1510'-1512' Riverton

1522'-1524' Riverton "rider"

1600'

Desorption Characteristics of Cuttings Samples

Dart Cherokee basin #D1-30 Kincaid Trust, 30-T.34S.-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
Mineral	9%	171.4	202.8	17.7
Weir-Pittsburg	4%	53.6	96.1	6.3
Dry Wood	8%	45.6	69.2	7.8
Riverton	9%	87.0	116.8	10.7
Riverton "rider"	11%	125.3	143.5	20.3

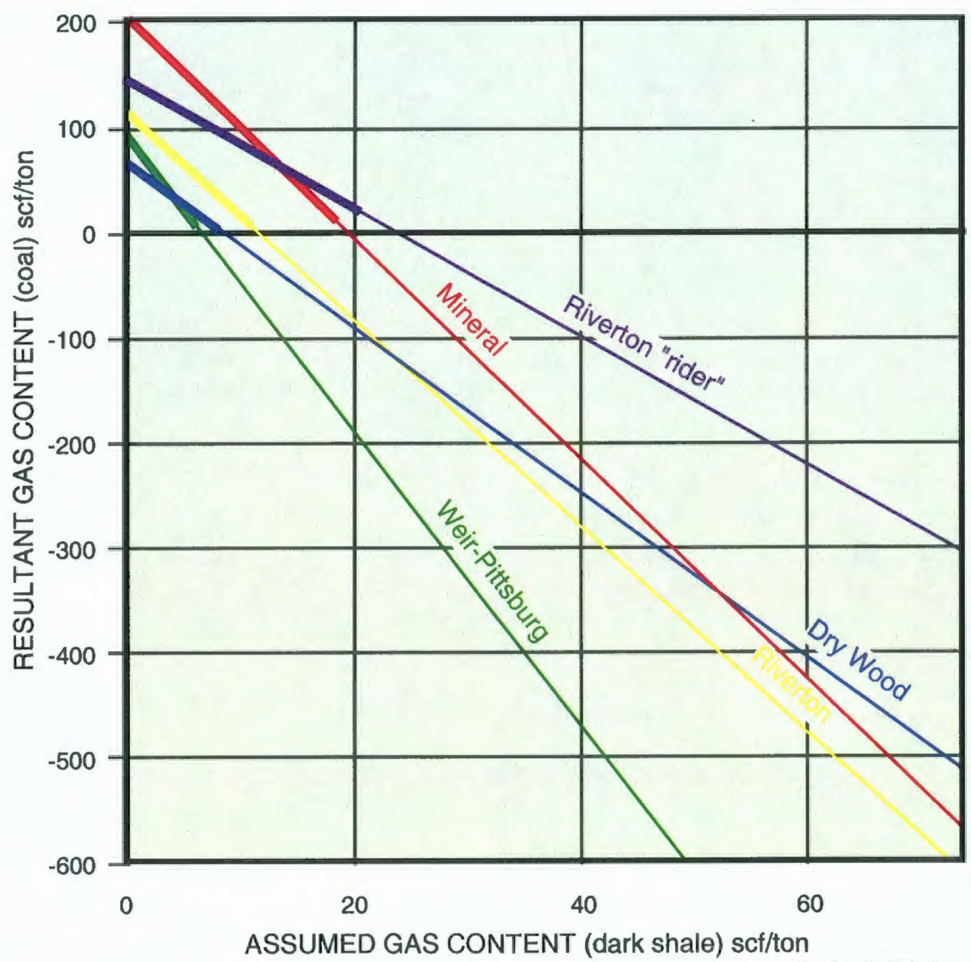


FIGURE 13.

Desorption Characteristics of Cuttings Samples

based on total weight of gas-generating lithologies (i.e., coal and dark shale) in sample

Dart Cherokee Basin #D1-30 Kincaid Trust;

30-T.34S.-R.14E., Montgomery County, KS

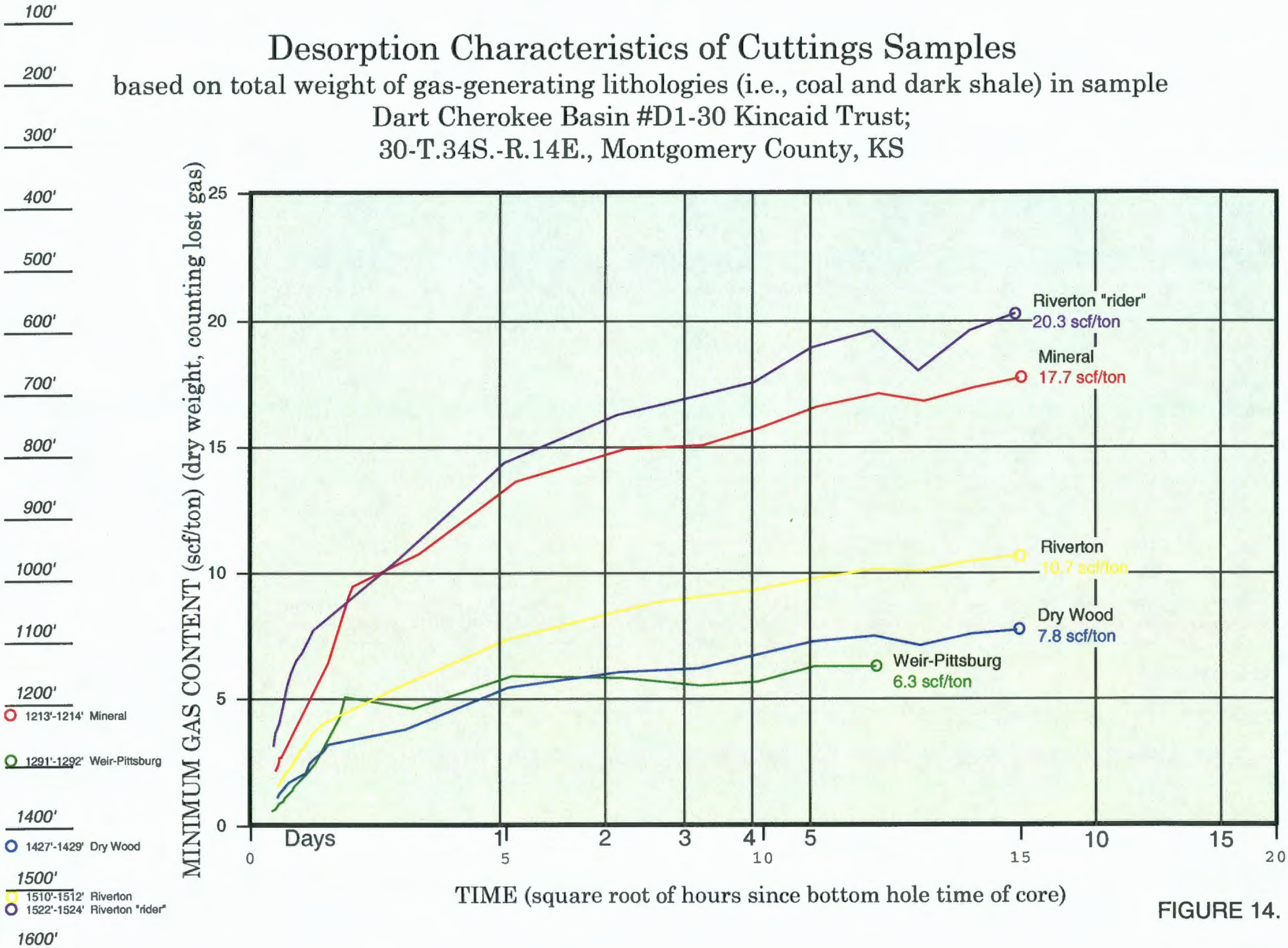


FIGURE 14.