ANALYSIS OF MARMATON AND CHEROKEE GROUP CUTTINGS SAMPLES FOR GAS CONTENT -- DART CHEROKEE BASIN OPERATING COMPANY #A1-22 HUSER; W2 NE NW NW sec. 22-T.30S.-R.14E.; WILSON COUNTY, KANSAS

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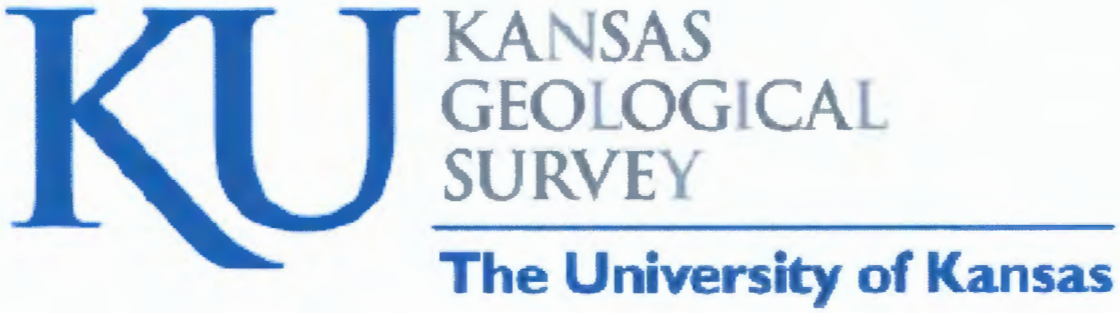

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SUMMARY

Eleven cuttings samples from the Pennsylvanian Marmaton Group and Cherokee Group were collected from the Dart Cherokee Basin #A1-22 Huser well; W2 NE NW NW sec. 22-T.30S.-R.14E.; Wilson County, KS. The samples calculate as having the following gas contents:

- Tulsa "coal" at 706' to 707' depth[1] (---- scf/ton)
- Lexington "coal" at 924' to 926' depth[2] (20 scf/ton)
- Little Osage Shale at 984' to 986' depth[2] (22 scf/ton)
- Excello(?) Shale at 1001'-1004' depth[2, 3] (4 scf/ton)
- shale at 1058'-1060' depth, near Bevier coal[2] (5 scf/ton)
- Tebo coal at 1162'-1164' depth[4, 5] (566 scf/ton)
- Weir-Pittsburg coal at 1186' to 1189' depth[4] (153 scf/ton)
- "Dry Wood equivalent" at 1235' to 1238' depth[4, 6] (101 scf/ton)
- Rowe coal at 1263' to 1265' depth[4, 6] (167 scf/ton)
- "Rowe rider equivalent" at 1270' to 1273' depth[4, 6] (78 scf/ton)
- Riverton coal at 1307' to 1309' depth[4] (97 scf/ton)

[1]a leak was detected in the canister after desorption finished, no valid gas content measure is possible
[2]no coal in sample
[3]abnormally low gas content suggest that actual Excello Shale may have not been collected in this sample
[4]assuming accompanying dark shales in sample desorb 3 scf/ton
[5]coal gas content difficult to assess due to gas-rich shales admixed with the coal
[6]reliability of result is unclear due to small amount of coal in the sample

BACKGROUND

The Dart Cherokee Basin #A1-22 Huser well; W2 NE NW NW sec. 22-T.30S.-R.14E. in Wilson 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 31 and April 1, 2004, by Tom O'Neill of Dart Cherokee Basin L.L.C., and turned over to LeaAnn Davidson of the Kansas Geological Survey on April 1, 2004. 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.

The samples obtained by Tom O'Neill were canistered, with surface time and canistering times noted. These samples were collected in canisters that were supplied by Dart Cherokee Basin L.L.C. and the Kansas Geological Survey. Lag times for samples to reach the surface (important for assessing lost gas) were determined using the lag times from a nearby air-drilled well (Dart Cherokee Basin #CH-1 Holder; sec. 1-T.30S.-R.14E., Wilson County, KS), which was also drilled using this particular drilling rig. The lag

times were determined by periodically noting the time it took for cuttings to reach the surface following resumption of drilling after new pipe was added to the drill string.

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

- Tulsa "coal" at 706' to 707' depth (----grams dry wt.)
- Lexington "coal" at 924' to 926' depth (155 grams dry wt.)
- Little Osage Shale at 984' to 986' depth (793 grams dry wt.)
- Excello(?) Shale at 1001'-1004' depth (239 grams dry wt.)
- shale at 1058'-1060' depth, near Bevier coal (185 grams dry wt.)
- Tebo coal at 1162'-1164' depth (313 grams dry wt.)
- Weir-Pittsburg coal at 1186' to 1189' depth (109 grams dry wt.)
- "Dry Wood equivalent" at 1235' to 1238' depth (441 grams dry wt.)
- Rowe coal at 1263' to 1265' depth (269 grams dry wt.)
- "Rowe rider equivalent" at 1270' to 1273' depth (272 grams dry wt.)
- Riverton coal at 1307' to 1309' depth (84 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. Water with zephyrn chloride biocide was then added to the canisters, with a headspace of 1 to 2 inches being preserved at the top of the canister.

All samples were transported April 1 to the laboratory at the Kansas Geological Survey in Lawrence, KS, and desorption measurements were continued at approximately 70 °F . 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 obtained from SSD, Inc., in Grand Junction, CO. 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. 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 Vstp 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, the customary measuring 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.

Lost gas for samples (i.e., the gas lost from the sample from the time it was drilled, brought to the surface, to the time it was canistered) are normally 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. Lost gas, however, had to be inferred for the samples collected from this well because no desorption apparatus was on site when those samples were collected. The procedure used to infer lost gas for these samples is outlined in the section below on Lost Gas.

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 run 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 (Figure 3)
To infer an approximate lost-gas value for each sample, a correlation of the total gas desorbed from a sample after it had been canistered to its rate of lost gas was developed using desorption data accumulated for 42 cuttings samples obtained from air-drilled wells in the Cherokee basin in southeastern Kansas (Figure 3). The rate of lost gas used in this correlation was that amount of gas lost 0.6 (the square root of 0.36 hours). By knowing the total gas given up by the sample after canistering (i.e., the total gas desorbed) a hypothetical rate of lost-gas could be calculated using the a regression line:

lost gas rate per square root of 0.36 hours = 0.1241 X (total gas desorbed in ccs) + 48.14

Once the hypothetical lost-gas rate was calculated, the lost gas could be calculated by taking the square root of the bottom-hole to canister time (derived from subtracting the lag time from the surface time), and multiplying it by the hypothetical lost-gas rate. Analysis of the lithology of the cuttings used in this correlation revealed no consistent relationship (see Figure 3), therefore further refinement of the relationship of the rate of lost gas to the total gas desorbed after canistering is not possible at this point in time.

"Lithologic Component Sensitivity Analyses" (Figures 4-13)
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:

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

A unique solution for gas content_{coal} in this equation is not possible because gas $\text{content}_{\text{dark shale}}$ 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 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.

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 as 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 14)
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 15)
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

A leak was detected in the canister containing the Tulsa "coal" at 706'-707' depth, thus data collected for this sample are considered invalid. No material was retained from this canister for any further analyses. The next four samples (Lexington "coal" at 924' to 926' depth; Little Osage Shale at 984' to 986' depth; Excello(?) Shale at 1001'-1004' depth; shale at 1058'-1060' depth, near Bevier coal) contained no coal. The Excello sample is questionable because this shale is usually rich in gas, but the sample assayed only at 4 scf/ton. This suggests that the sampling may have missed the actual Excello Shale.

The Tebo coal sample (1162'-1164' depth) registered an exceptionally high gas content (566 scf/ton, assuming the accompanying black shales desorbed 3 scf/ton). This sample was dominated by a very dark to black shale (N1, N2) that displays a high-gamma ray value on wireline logs. This shale likely has a high gas content, perhaps close to that of the average gas content for the entire sample (i.e., 50 scf/ton).

The best constrained data are associated with the Weir-Pittsburg sample (1186'-1189'), which contained 28% coal. However, the next three samples ("Dry Wood equivalent" at 1235' to 1238' depth; Rowe coal at 1263' to 1265' depth; "Rowe rider equivalent" at 1270' to 1273' depth) contained only 1% to 2% coal, thus the calculated gas content for the coal in these samples varies greatly with whatever value is assumed for the accompanying black shales. The subsidiary amount of coal in the samples imparts some uncertainty to the desorption measurements, but an approximation of their gas content is nevertheless obtained. An estimate for gas content for the coal in this samples can be made, assuming the admixed dark shale in the sample desorb 3 scf/ton. The Riverton coal sample (1307'-1309') contained 9% coal, thus its gas content is almost as well constrained as the Weir-Pittsburg sample.

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

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

FIGURE 2. Lag-time to surface for well cuttings.

TABLE 1. Desorption measurements for samples.

FIGURE 3. Correlation of the rate of lost gas to the total gas desorbed after canistering.

FIGURE 4. Sensitivity analysis for Lexington "coal" at 924' to 926' depth.
FIGURE 5. Sensitivity analysis for Little Osage Shale at 984' to 986' depth.
FIGURE 6. Sensitivity analysis for Excello(?) Shale at 1001'-1004' depth.
FIGURE 7. Sensitivity analysis for shale at 1058'-1060' depth, near Bevier coal.
FIGURE 8. Sensitivity analysis for Tebo coal at 1162'-1164' depth.
FIGURE 9. Sensitivity analysis for Weir-Pittsburg coal at 1186' to 1189' depth.
FIGURE 10. Sensitivity analysis for "Dry Wood equivalent" at 1235' to 1238' depth.
FIGURE 11. Sensitivity analysis for Rowe coal at 1263' to 1265' depth.
FIGURE 12. Sensitivity analysis for "Rowe rider equivalent" at 1270' to 1273' depth.
FIGURE 13. Sensitivity analysis for Riverton coal at 1307' to 1309' depth.

FIGURE 14. Lithologic component sensitivity analyses for all samples.

FIGURE 15. Desorption graph for all samples.

Correlation of Field Barometer to KGS Petrophysics Lab Barometer

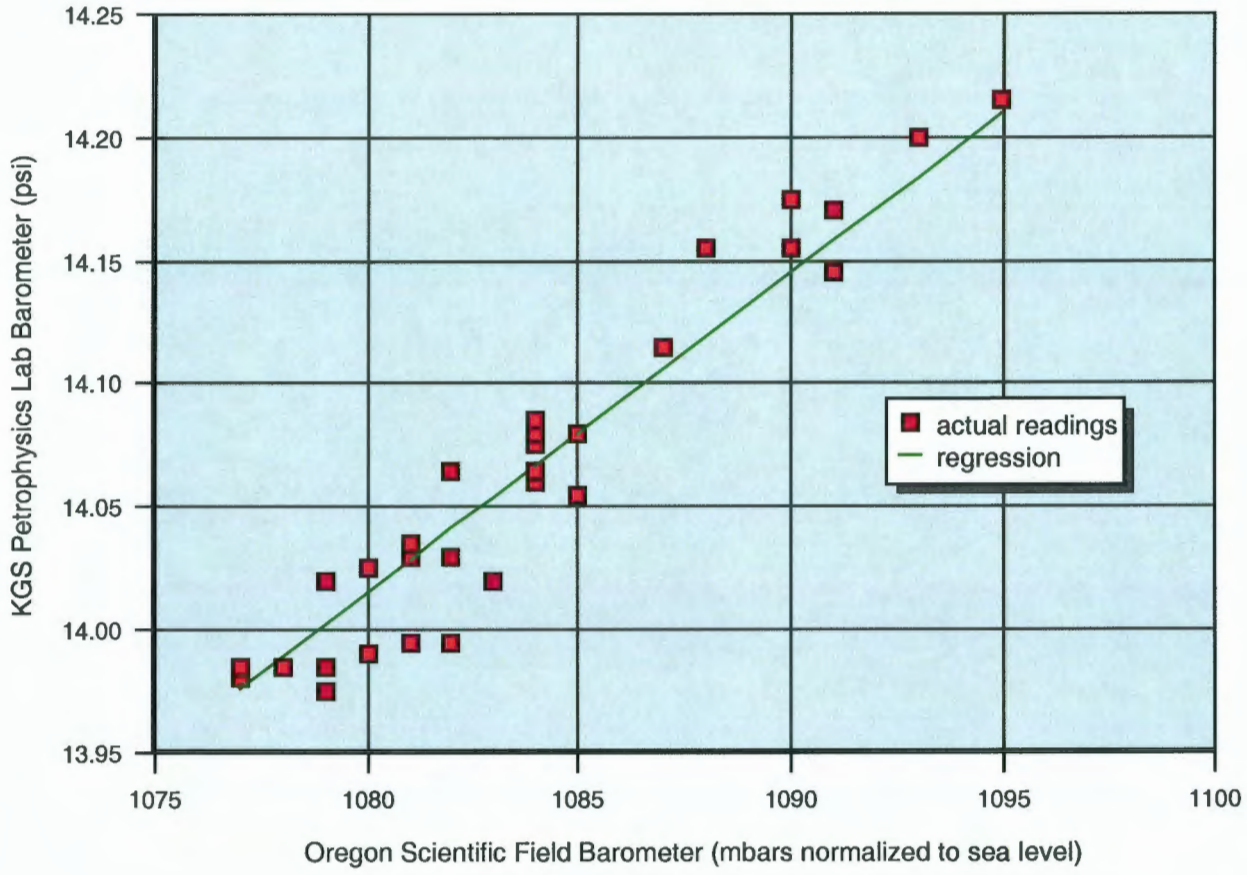


FIGURE 1.

Dart Cherokee Basin #A1-21 Huser, 21-T.30S.-R.14E., Wilson County, KS

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

lag-time to surface for well cuttings

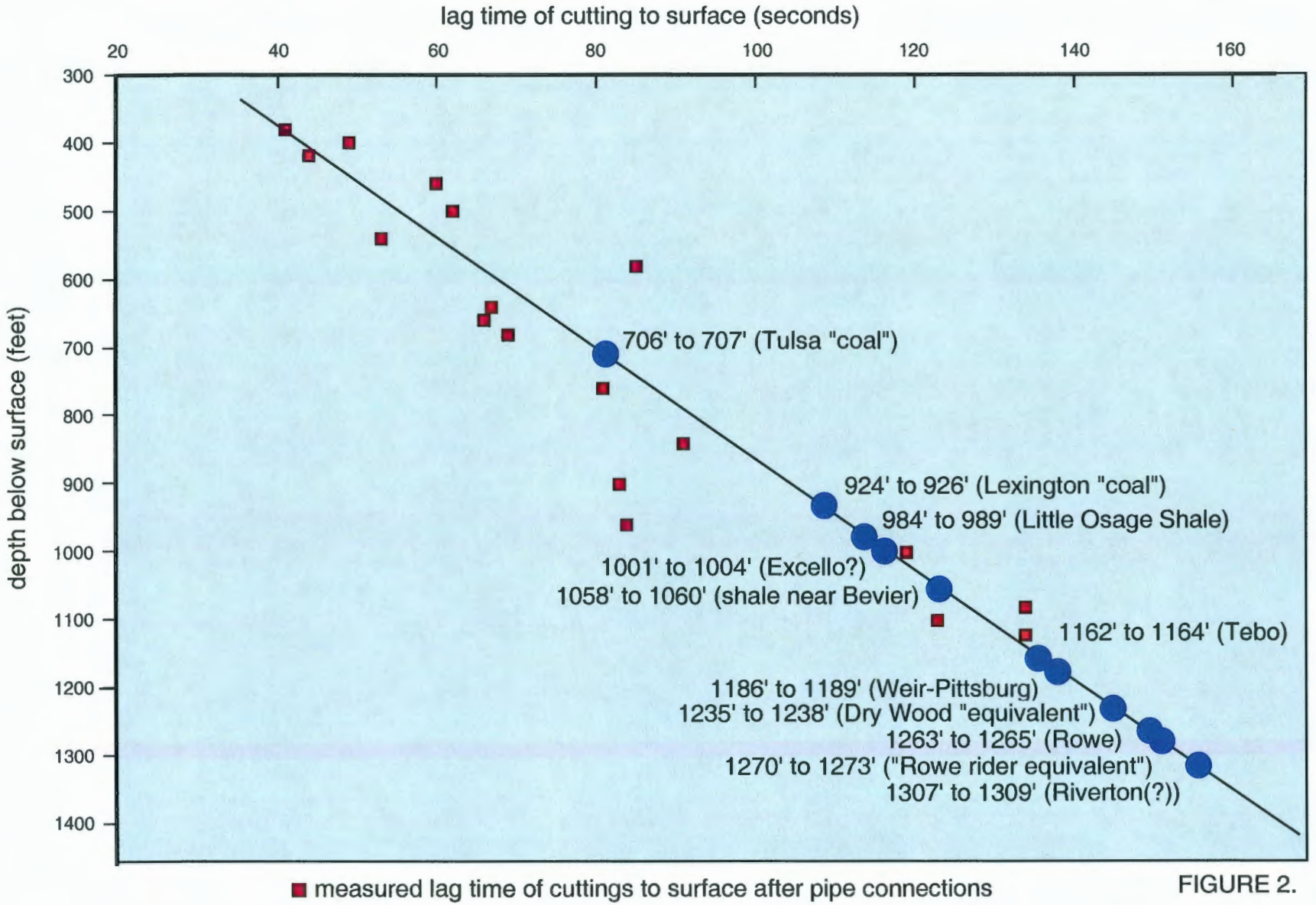


FIGURE 2.

TABLE 1 -- Desorption data for DART CHEROKEE BASIN HUSER #A1-22; W2 NE NW NW 22-T.30S.-R.14E.

SAMPLE: 706' to 707' (Tulsa coal) cuttings in Dart SSD canister

	lbs.	grams
dry sample weight:	0.0000	0

NOTE: los gas is estimated by time interval between at surface and canister times, and total gas evolved

est. lost gas (cc) =	TIME 0F:						elapsed time (off bottom to canistering)
0	off bottom		at surface		in canister		4.2 minutes
	3/31/04	11:33	3/31/04	11:34	3/31/04	11:37	0.070 hours

RIG/LAB MEASUREMENTS			CONVERSION OF RIG/LAB MEASUREMENTS TO STP (@60 deg F; 14.7 psi)				CUMULATIVE VOLUMES		SCF/TON	SCF/TON		TIME SINCE		0.264575131 SQRT (hrs)
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)
0	65	1089	0	525	14.135	0	0.00	0	0.00	#DIV/0!	#DIV/0!	4/2/04 12:05	48:31:27	48:27:15	6.965928988
0	6	1088	0	466	14.122	0	0.00	0	0.00	#DIV/0!	#DIV/0!	4/3/04 17:20	77:46:27	77:42:15	8.818966304

DESORPTION TERMINATED 4/03/2004 DUE TO NO GAS BEING EVOLVED (CANISTER LEAKY!); sample not saved

SAMPLE: 924' to 926' (Lexington "coal") cuttings in Dart SSD canister

	lbs.	grams
dry sample weight:	0.3253	147.57

NOTE: los gas is estimated by time interval between at surface and canister times, and total gas evolved

est. lost gas (cc) =	TIME 0F:						elapsed time (off bottom to canistering)
18	off bottom		at surface		in canister		5.9 minutes
	3/31/04	13:15	3/31/04	13:17	3/31/04	13:21	0.098 hours

RIG/LAB MEASUREMENTS			CONVERSION OF RIG/LAB MEASUREMENTS TO STP (@60 deg F; 14.7 psi)				CUMULATIVE VOLUMES		SCF/TON	SCF/TON		TIME SINCE		0.312694384 SQRT (hrs)
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)
60	65	1089	0.0021	525	14.135	0.002018009	57.14	0.002018009	57.14	12.41	16.31	4/2/04 12:43	47:27:17	47:21:25	6.888738798
11	66	1088	0.0004	526	14.122	0.000368926	10.45	0.002386935	67.59	14.67	18.58	4/3/04 17:21	78:05:17	75:59:25	8.722846758
0	65	1087	0	525	14.109	0	0.00	0.002386935	67.59	14.67	18.58	4/4/04 15:33	98:17:17	98:11:25	9.914033264
1	65	1082	4E-05	525	14.044	3.34173E-05	0.95	0.002420352	68.54	14.88	18.79	4/5/04 21:22	128:08:17	128:00:25	11.31833566
2	67	1080	7E-05	527	14.018	6.64579E-05	1.88	0.00248681	70.42	15.29	19.20	4/6/04 14:28	145:12:17	145:06:25	12.05009221
2	68	1076	7E-05	528	13.966	6.60863E-05	1.87	0.002552896	72.29	15.69	19.60	4/7/04 14:05	168:49:17	168:43:25	12.99312853
-3	67	1082	-0.0001	527	14.044	-9.98714E-05	-2.83	0.002453025	69.46	15.08	18.99	4/8/04 14:13	192:57:17	192:51:25	13.89081431
-1	66	1081	-4E-05	526	14.031	-3.33229E-05	-0.94	0.002419702	88.52	14.87	18.78	4/9/04 16:48	219:32:17	219:26:25	14.81681665

DESORPTION TERMINATED 4/09/2004 DUE TO NO MORE GAS BEING EVOLVED; sample air dried for 30 days

SAMPLE: 987' to 989' (Little Osage Shale) cuttings in Dart SSD canister

	lbs.	grams
dry sample weight:	1.3518	613.14

NOTE: los gas is estimated by time interval between at surface and canister times, and total gas evolved

est. lost gas (cc) =	TIME 0F:						elapsed time (off bottom to canistering)
31	off bottom		at surface		in canister		8.0 minutes
	3/31/04	13:50	3/31/04	13:52	3/31/04	13:56	0.100 hours

RIG/LAB MEASUREMENTS			CONVERSION OF RIG/LAB MEASUREMENTS TO STP (@60 deg F; 14.7 psi)				CUMULATIVE VOLUMES		SCF/TON	SCF/TON		TIME SINCE		0.315788255 SQRT (hrs)
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)
243	65	1089	0.0086	525	14.135	0.008172935	231.43	0.008172935	231.43	12.09	13.71	4/2/04 11:59	46:08:24	46:02:25	6.792643079
53	66	1088	0.0019	526	14.122	0.001777552	50.33	0.009950487	281.77	14.72	16.34	4/3/04 17:21	75:30:24	75:24:25	8.689457214
20	65	1087	0.0007	525	14.109	0.000671434	19.01	0.010621921	300.78	15.72	17.34	4/4/04 15:34	97:43:24	97:37:25	9.885511283
19	65	1082	0.0007	525	14.044	0.000634928	17.98	0.011256849	318.76	16.66	18.27	4/5/04 21:23	127:32:24	127:26:25	11.29336088
10	67	1087	0.0004	527	14.109	0.000334443	9.47	0.011591292	328.23	17.15	18.77	4/8/04 14:29	144:38:24	144:32:25	12.0266371
12	68	1076	0.0004	528	13.966	0.000396518	11.23	0.01198781	339.46	17.74	19.36	4/7/04 14:05	168:14:24	168:08:25	12.97073629
6	67	1082	0.0002	527	14.044	0.000199743	5.68	0.012187553	345.11	18.03	19.65	4/8/04 14:14	192:23:24	192:17:25	13.87047223
5	66	1081	0.0002	526	14.031	0.000186615	4.72	0.012354168	349.83	18.28	19.90	4/9/04 16:48	218:57:24	218:51:25	14.79718442
2	63	1084	7E-05	523	14.070	6.72142E-05	1.90	0.012421382	351.73	18.38	20.00	4/11/04 22:46	272:55:24	272:49:25	16.52039144
3	62	1086	0.0001	522	14.096	0.000101201	2.87	0.012522583	354.60	18.53	20.15	4/12/04 14:47	288:56:24	288:50:25	16.9982352
1	61	1088	4E-05	521	14.122	3.38608E-05	0.96	0.012556443	355.56	18.58	20.20	4/13/04 14:11	312:20:24	312:14:25	17.67314347
4	62	1085	0.0001	522	14.083	0.00013481	3.82	0.012691253	359.37	18.78	20.40	4/14/04 14:09	338:18:24	336:12:25	18.33866589
6	64	1076	0.0002	524	13.966	0.000199772	5.68	0.012891026	385.03	19.07	20.69	4/15/04 14:27	360:36:24	380:30:25	18.9896463
5	68	1078	0.0002	528	13.992	0.000185523	4.89	0.013056549	369.72	19.32	20.94	4/16/04 13:53	384:02:24	383:58:25	19.59693854
4	71	1081	0.0001	531	14.031	0.000132037	3.74	0.013188585	373.46	19.51	21.13	4/17/04 19:31	413:40:24	413:34:25	20.33896097
4	71	1079	0.0001	531	14.005	0.000131792	3.73	0.013320378	377.19	19.71	21.33	4/18/04 16:01	434:10:24	434:04:25	20.83682637
-1	68	1088	-4E-05	528	14.122	-3.34117E-05	-0.95	0.013286966	378.24	19.66	21.28	4/19/04 14:02	458:11:24	458:05:25	21.35860482
8	71	1071	0.0003	531	13.901	0.00026163	7.41	0.013548596	383.85	20.05	21.67	4/20/04 12:57	479:06:24	479:00:25	21.88850535
1	68	1075	4E-05	528	13.953	3.30124E-05	0.93	0.013581809	384.59	20.09	21.71	4/21/04 13:14	503:23:24	503:17:25	22.43635443
0	68	1080	0	528	14.018	0	0.00	0.013581609	384.59	20.09	21.71	4/22/04 16:15	530:24:24	530:18:25	23.03055941
-2	66	1088	-7E-05	526	14.122	-6.70774E-05	-1.90	0.013514531	382.69	20.00	21.82	4/23/04 14:21	552:30:24	552:24:25	23.50546036
4	69	1078	0.0001	529	13.992	0.000132168	3.74	0.013646899	386.43	20.19	21.81	4/24/04 12:10	574:19:24	574:13:25	23.96504399
-2	66	1090	-7E-05	526	14.148	-8.72007E-05	-1.90	0.013579499	384.53	20.09	21.71	4/26/04 11:17	621:26:24	621:20:25	24.92869832
1	65	1087	4E-05	525	14.109	3.35717E-05	0.95	0.01381307	385.48	20.14	21.78	4/27/04 12:33	846:42:24	846:38:25	25.43042797
6	68	1072	0.0002	528	13.914	0.000197522	5.59	0.013810592	391.07	20.43	22.05	4/28/04 15:29	873:38:24	673:32:25	25.9545757
0	68	1079	0	528	14.005	0	0.00	0.013810592	391.07	20.43	22.05	4/29/04 14:28	896:37:24	896:31:25	28.39362297
-1	66	1086	-4E-05	526	14.098	-3.34771E-05	-0.96	0.013777115	390.12	20.38	22.00	5/1/04 17:44	747:53:24	747:47:25	27.34757759

DESORPTION TERMINATED 5/02/2004 DUE TO NO MORE GAS BEING EVOLVED; sample air dried for 33 days

SAMPLE: 1001' to 1004' (Excello Shale) cuttings in canister D

	lbs.	grams
dry sample weight:	0.4593	208.32

NOTE: los gas is estimated by time interval between at surface and canister times, and total gas evolved

est. lost gas (cc) = 19

TIME OF:			elapsed time (off bottom to canistering)
off bottom			8.7 minutes
	3/31/04 14:07	3/31/04 14:10	3/31/04 14:15 0.145 hours

RIG/LAB MEASUREMENTS			CONVERSION OF RIG/LAB MEASUREMENTS TO STP (@60 deg F; 14.7 psi)					CUMULATIVE VOLUMES		SCF/TON	SCF/TON		TIME SINCE		0.380423740 SQRT (hrs)
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)
9	65	1089	0.0003	525	14.135	0.000302701	8.57	0.000302701	8.57	1.32	4.24	4/2/04 12:19	48:11:56	48:03:15	8.796976452
0	66	1088	0	528	14.122	0	0.00	0.000302701	8.57	1.32	4.24	4/3/04 17:22	75:14:56	75:06:15	8.674611743
-1	65	1087	-4E-05	525	14.109	-3.35717E-05	-0.95	0.00026913	7.62	1.17	4.09	4/4/04 15:34	97:26:56	97:18:15	9.871620378
0	65	1082	0	525	14.044	0	0.00	0.00026913	7.62	1.17	4.09	4/5/04 21:24	127:16:56	127:08:15	11.28194231

DESORPTION TERMINATED 4/6/2004 DUE TO NO MORE GAS BEING EVOLVED; sample air dried for 17 days

SAMPLE: 1058' to 1060' (shale associated with Bevier coal) cuttings in Dart SSD canister

	lbs.	grams
dry sample weight:	0.3129	141.92

NOTE: los gas is estimated by time interval between at surface and canister times, and total gas evolved

est. lost gas (cc) = 18

TIME OF:			elapsed time (off bottom to canistering)
off bottom			8.4 minutes
	3/31/04 14:27	3/31/04 14:29	3/31/04 14:35 0.140 hours

RIG/LAB MEASUREMENTS			CONVERSION OF RIG/LAB MEASUREMENTS TO STP (@60 deg F; 14.7 psi)					CUMULATIVE VOLUMES		SCF/TON	SCF/TON		TIME SINCE		0.374536751 SQRT (hrs)
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)
4	65	1089	0.0001	525	14.135	0.000134534	3.81	0.000134534	3.81	0.86	4.92	4/2/04 11:51	45:23:30	45:15:05	6.737333795
0	66	1088	0	526	14.122	0	0.00	0.000134534	3.81	0.86	4.92	4/3/04 17:22	74:54:30	74:48:05	8.654960042
-2	65	1087	-7E-05	525	14.109	-8.71434E-05	-1.90	6.73905E-05	1.91	0.43	4.49	4/4/04 15:35	97:07:30	96:59:05	9.855201672
-1	65	1082	-4E-05	525	14.044	-3.34173E-05	-0.95	3.39732E-05	0.96	0.22	4.28	4/5/04 21:25	126:57:30	126:49:05	11.26757886
1	67	1080	4E-05	527	14.018	3.32289E-05	0.94	6.72021E-05	1.90	0.43	4.49	4/8/04 14:30	144:02:30	143:54:05	12.00173599
1	68	1076	4E-05	528	13.966	3.30432E-05	0.94	0.000100245	2.84	0.64	4.70	4/7/04 14:08	167:38:30	187:30:05	12.94765101

DESORPTION TERMINATED 4/7/2004 DUE TO NO MORE GAS BEING EVOLVED (LEAKY CANISTER?); sample air dried for 16 days

SAMPLE: 1162' to 1164' (Tebo coal) cuttings in Dart SSD canister

	lbs.	grams
dry sample weight:	0.4392	199.23

NOTE: los gas is estimated by time interval between at surface and canister times, and total gas evolved

est. lost gas (cc) = 24

TIME OF:			elapsed time (off bottom to canistering)
off bottom			4.9 minutes
	3/31/04 3:27	3/31/04 3:28	3/31/04 3:32 0.082 hours

RIG/LAB MEASUREMENTS			CONVERSION OF RIG/LAB MEASUREMENTS TO STP (@60 deg F; 14.7 psi)					CUMULATIVE VOLUMES		SCF/TON	SCF/TON		TIME SINCE		0.285773803 SQRT (hrs)
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)
170	65	1089	0.006	525	14.135	0.005717691	161.91	0.005717691	161.91	26.03	29.89	4/2/04 11:29	56:01:39	55:56:45	7.485151969
44	66	1088	0.0018	526	14.122	0.001475703	41.79	0.007193395	203.69	32.75	36.61	4/3/04 17:23	85:55:39	85:50:45	9.269708733
16	65	1087	0.0006	525	14.109	0.000537147	15.21	0.007730542	218.90	35.20	39.06	4/4/04 15:36	108:08:39	108:03:45	10.39923875
14	65	1082	0.0005	525	14.044	0.000467842	13.25	0.008198384	232.15	37.33	41.19	4/5/04 21:25	137:57:39	137:52:45	11.74567296
8	67	1080	0.0003	527	14.018	0.000285831	7.53	0.008484215	239.68	38.54	42.40	4/6/04 14:30	155:02:39	154:57:45	12.45167325
10	68	1076	0.0004	528	13.966	0.000330432	9.36	0.008794647	249.04	40.05	43.90	4/7/04 14:08	178:38:39	178:33:45	13.36578343
5	67	1082	0.0002	527	14.044	0.000186452	4.71	0.008961099	253.75	40.80	44.66	4/8/04 14:15	202:47:39	202:42:45	14.24058168
5	66	1081	0.0002	526	14.031	0.000166615	4.72	0.009127714	258.47	41.56	45.42	4/9/04 16:49	229:21:39	229:18:45	15.14466353
1	63	1084	4E-05	523	14.070	3.36071E-05	0.95	0.009181321	259.42	41.71	45.57	4/11/04 22:47	283:19:39	283:14:45	16.83233495
1	62	1082	4E-05	522	14.044	3.36093E-05	0.95	0.00919493	260.37	41.87	45.73	4/12/04 2:47	287:19:39	287:14:45	16.95073745
1	62	1088	4E-05	522	14.122	3.37957E-05	0.98	0.009228726	261.33	42.02	45.88	4/13/04 14:13	322:45:39	322:40:45	17.96554573
3	62	1085	0.0001	522	14.083	0.000101108	2.88	0.009329834	264.19	42.48	46.34	4/14/04 14:09	346:41:39	346:36:45	18.8197252
6	64	1076	0.0002	524	13.986	0.000199772	5.88	0.009529606	269.85	43.39	47.25	4/15/04 14:27	370:59:39	370:54:45	19.26120888
5	68	1078	0.0002	528	13.992	0.000165523	4.69	0.009695129	274.53	44.15	48.00	4/16/04 13:53	394:25:39	394:20:45	19.86019889
4	71	1081	0.0001	531	14.031	0.000132037	3.74	0.009827165	278.27	44.75	48.61	4/17/04 19:31	424:03:39	423:58:45	20.59273739
4	71	1079	0.0001	531	14.005	0.000131792	3.73	0.009958958	282.01	45.35	49.21	4/18/04 18:01	444:33:39	444:28:45	21.08461129
-1	68	1088	-4E-05	528	14.122	-3.34117E-05	-0.95	0.009925546	281.06	45.19	49.05	4/19/04 14:02	468:34:39	468:29:45	21.60040509
7	71	1071	0.0002	531	13.901	0.000228927	6.48	0.010154473	287.54	46.24	50.10	4/20/04 12:57	489:29:39	489:24:45	22.12451506
1	68	1075	4E-05	528	13.953	3.30124E-05	0.93	0.010187485	288.48	46.39	50.25	4/21/04 13:14	513:46:39	513:41:45	22.66666054
-1	68	1080	-4E-05	528	14.018	-3.3168E-05	-0.94	0.010154319	287.54	46.24	50.10	4/22/04 18:15	540:47:39	540:42:45	23.25498155
-3	66	1088	-0.0001	526	14.122	-0.000100616	-2.85	0.010053703	284.69	45.78	49.64	4/23/04 14:51	563:23:39	563:18:45	23.73592565
3	69	1078	0.0001	529	13.992	9.9128E-05	2.81	0.010152829	287.50	48.23	50.09	4/24/04 12:10	584:42:39	584:37:45	24.18079472
0	0	0	0	460	0.000	0	0.00	0.010152829	287.50	46.23	50.09	4/27/04 16:19	660:51:39	680:46:45	25.70721384

SAMPLE DECANISTERED 3/30/2004 DUE TO NO MORE GAS BEING EVOLVED; sample air dried for 18 days

SAMPLE: 1186' to 1189' (Weir-Pittsburg coal) cuttings in Dart SSD canister

	lbs.	grams

NOTE: los gas is estimated by time interval between at surface and canister times, and total gas evolved

est. lost gas (cc) = TIME OF: elapsed time (off bottom to canistering)

dry sample weight: 0.1338 60.68

20 off bottom 4/1/04 7:32 | at surface 4/1/04 7:33 | in canister 4/1/04 7:37 | 5.6 minutes | 0.093 hours | 0.305505046 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)
77	65	1089	0.0027	525	14.135	0.002589778	73.33	0.002589778	73.33	38.72	49.28	4/2/04 12:11	28:38:56	28:33:20	5.352465683
25	66	1088	0.0009	526	14.122	0.000838468	23.74	0.003428246	97.08	51.26	61.81	4/3/04 17:25	57:52:56	57:47:20	7.608036686
7	65	1087	0.0002	525	14.109	0.000235002	6.65	0.003663248	103.73	54.77	65.33	4/4/04 15:37	80:04:56	79:59:20	8.948867092
8	65	1082	0.0003	525	14.044	0.000287338	7.57	0.003930586	111.30	58.77	69.33	4/5/04 21:27	109:54:58	109:49:20	10.48406198
6	67	1080	0.0002	527	14.018	0.000199374	5.65	0.004129959	116.95	61.75	72.31	4/6/04 14:31	126:58:56	126:53:20	11.26863888
7	68	1076	0.0002	528	13.966	0.000231302	6.55	0.004361262	123.50	65.20	75.78	4/7/04 14:07	150:34:56	150:29:20	12.27119482
2	67	1082	7E-05	527	14.044	6.65809E-05	1.89	0.004427842	125.38	66.20	76.76	4/8/04 14:15	174:42:58	174:37:20	13.21800119
3	66	1081	0.0001	526	14.031	9.99688E-05	2.83	0.004527811	128.21	67.89	78.25	4/9/04 16:50	201:17:58	201:12:20	14.18798396
0	63	1084	0	523	14.070	0	0.00	0.004527811	128.21	67.69	78.25	4/11/04 22:48	255:15:56	255:10:20	15.97703213
0	62	1086	0	522	14.096	0	0.00	0.004527811	128.21	67.69	78.25	4/12/04 14:48	271:15:56	271:10:20	16.47014133
0	61	1088	0	521	14.122	0	0.00	0.004527811	128.21	67.69	78.25	4/13/04 14:13	294:40:56	294:35:20	17.16631068

SAMPLE DECANISTERED 4/13/2004 DUE TO NO MORE GAS BEING EVOLVED; sample air dried for 14 days

SAMPLE: 1235' to 1238' (Dry Wood "equivalent" interval) cuttings in Dart SSD canister

lbs. grams

dry sample weight: 0.4994 226.53

NOTE: los gas is estimated by time interval between at surface and canister times, and total gas evolved

est. lost gas (cc) = TIME OF: elapsed time (off bottom to canistering)

17 off bottom 4/1/04 8:04 | at surface 4/1/04 8:06 | in canister 4/1/04 8:10 | 8.4 minutes | 0.107 hours | 0.327448045 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)
23	65	1089	0.0008	525	14.135	0.00077357	21.90	0.00077357	21.90	3.10	5.50	4/2/04 11:49	27:44:46	27:38:20	5.267457746
1	66	1088	4E-05	526	14.122	3.35387E-05	0.95	0.000807109	22.85	3.23	5.64	4/3/04 17:26	57:21:48	57:15:20	7.573821874
-1	65	1087	-4E-05	525	14.109	-3.35717E-05	-0.95	0.000773537	21.90	3.10	5.50	4/4/04 15:38	79:33:46	79:27:20	8.919796958
-1	65	1082	-4E-05	525	14.044	-3.34173E-05	-0.95	0.00074012	20.96	2.96	5.37	4/5/04 21:28	109:23:48	109:17:20	10.45925959
1	67	1080	4E-05	527	14.018	3.32289E-05	0.94	0.000773349	21.90	3.10	5.50	4/6/04 14:31	128:28:46	128:20:20	11.24482597
1	68	1076	4E-05	528	13.986	3.30432E-05	0.94	0.000806392	22.83	3.23	5.63	4/7/04 14:07	150:02:46	149:56:20	12.24933105

SAMPLE DECANISTERED 4/07/2004 DUE TO NO MORE GAS BEING EVOLVED; sample air dried for 17 days

SAMPLE: 1263' to 1265' (Rowe coal) cuttings in Dart SSD canister

lbs. grams

dry sample weight: 0.2586 117.29

NOTE: los gas is estimated by time interval between at surface and canister times, and total gas evolved

est. lost gas (cc) = TIME OF: elapsed time (off bottom to canistering)

17 off bottom 4/1/04 8:17 | at surface 4/1/04 8:19 | in canister 4/1/04 8:25 | 7.4 minutes | 0.123 hours | 0.350792753 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)
13	65	1089	0.0005	525	14.135	0.000437235	12.38	0.000437235	12.38	3.38	8.03	4/2/04 11:44	27:28:03	27:18:40	5.237763518
-1	66	1088	-4E-05	526	14.122	-3.35387E-05	-0.95	0.000403897	11.43	3.12	7.77	4/3/04 17:27	57:09:03	57:01:40	7.559817017
-1	65	1087	-4E-05	525	14.109	-3.35717E-05	-0.95	0.000370125	10.48	2.86	7.51	4/4/04 15:38	79:20:03	79:12:40	8.906972924
-1	65	1082	-4E-05	525	14.044	-3.34173E-05	-0.95	0.000336708	9.53	2.60	7.25	4/5/04 21:28	109:10:03	109:02:40	10.44832522
1	67	1080	4E-05	527	14.018	3.32289E-05	0.94	0.000369936	10.48	2.86	7.50	4/6/04 14:32	128:14:03	126:06:40	11.23539793
1	68	1076	4E-05	528	13.966	3.30432E-05	0.94	0.00040298	11.41	3.12	7.78	4/7/04 14:07	149:49:03	149:41:40	12.23999592

SAMPLE DECANISTERED 4/07/2004 DUE TO NO MORE GAS BEING EVOLVED; sample air dried for 17 days

SAMPLE: 1270' to 1273' (Rowe "rider" "equivalent" interval) cuttings in Dart SSD canister

lbs. grams

dry sample weight: 0.4164 188.85

NOTE: los gas is estimated by time interval between at surface and canister times, and total gas evolved

est. lost gas (cc) = TIME OF: elapsed time (off bottom to canistering)

15 off bottom 4/1/04 8:35 | at surface 4/1/04 8:37 | in canister 4/1/04 8:41 | 5.6 minutes | 0.093 hours | 0.305505048 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)
14	65	1089	0.0005	525	14.135	0.000470869	13.33	0.000470869	13.33	2.26	4.81	4/2/04 11:37	27:01:38	26:56:00	5.198717791
0	66	1088	0	526	14.122	0	0.00	0.000470869	13.33	2.26	4.81	4/3/04 17:24	56:48:38	56:43:00	7.537240874
-6	65	1087	-0.0002	525	14.109	-0.00020143	-5.70	0.000269438	7.63	1.29	3.84	4/4/04 15:36	79:00:36	78:55:00	8.888756943
-4	65	1082	-0.0001	525	14.044	-0.000133669	-3.79	0.000135769	3.84	0.65	3.20	4/5/04 21:25	108:49:38	108:44:00	10.43200204
-2	67	1080	-7E-05	527	14.018	-6.64579E-05	-1.88	6.93114E-05	1.96	0.33	2.88	4/6/04 14:30	125:54:36	125:49:00	11.22096253
-2	68	1076	-7E-05	526	13.966	-6.60863E-05	-1.87	3.22513E-06	0.09	0.02	2.58	4/7/04 14:07	149:31:36	149:28:00	12.22810969

SAMPLE DECANISTERED 4/07/2004 DUE TO NO MORE GAS BEING EVOLVED (LEAKY CANISTER?); sample air dried for 14 days

SAMPLE: 1307' to 1309' (Riverton(?) coal) cuttings in Dart SSD canister

NOTE: los gas is estimated by time interval between at surface and canister times, and total gas evolved

	lbs.	grams
dry sample weight:	0.0696	31.58

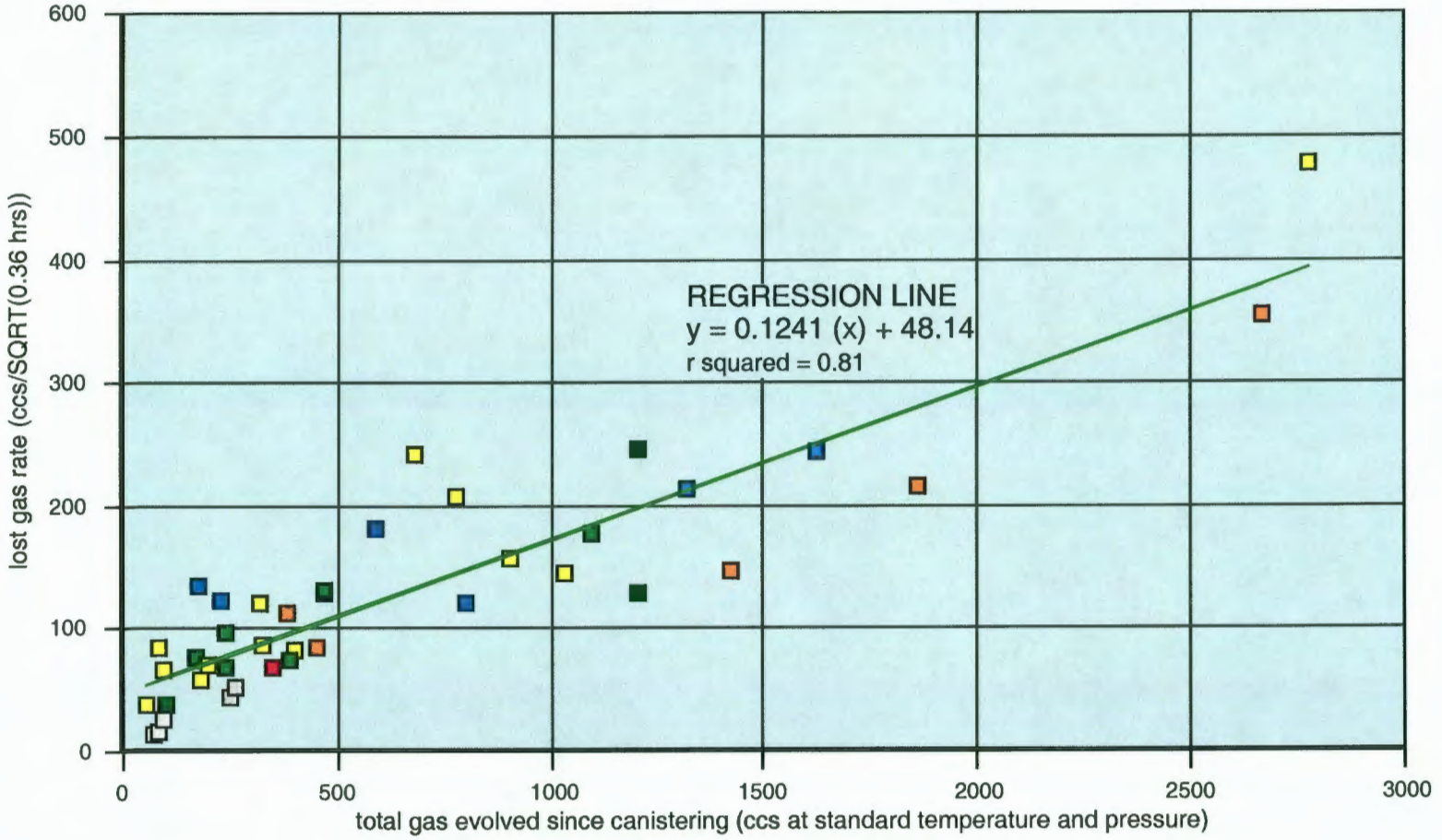
est. lost gas (cc) = 15

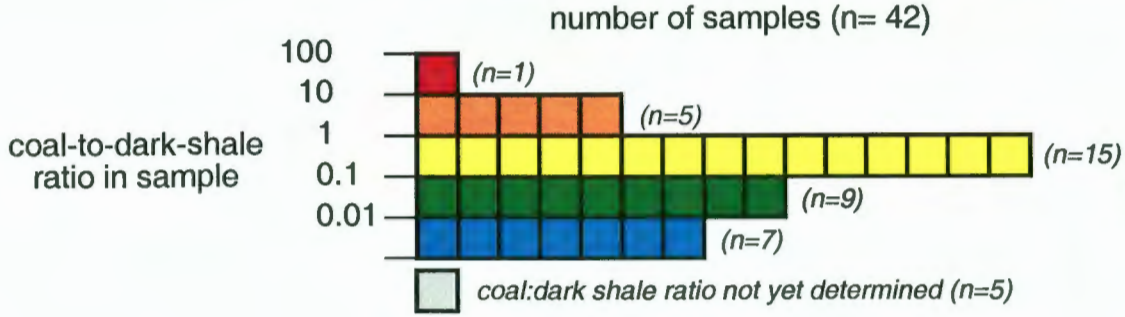
TIME OF:		elapsed time (off bottom to canistering)
off bottom	4/1/04 8:47	6.8 minutes
at surface	4/1/04 8:49	0.113 hours
in canister	4/1/04 8:53	0.336650165 SQRT (hrs)

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)
8	65	1089	0.0003	525	14.135	0.000269068	7.62		0.000269068	7.62	7.73	23.96	4/2/04 11:33	26:45:53	26:39:05	5.173463272
-1	66	1088	-4E-05	526	14.122	-3.35387E-05	-0.95		-3.35387E-05	-0.95	-0.96	15.27	4/3/04 17:28	56:40:53	56:34:05	7.52870433
-4	65	1087	-0.0001	525	14.109	-0.000134287	-3.80		-0.000134287	-3.80	-3.86	12.37	4/4/04 15:39	78:51:53	78:45:05	8.880581187
-3	65	1082	-0.0001	525	14.044	-0.000100252	-2.84		-0.000100252	-2.84	-2.88	13.35	4/5/04 21:29	108:41:53	108:35:05	10.42583596
-1	67	1080	-4E-05	527	14.018	-3.32289E-05	-0.94		-3.32289E-05	-0.94	-0.95	15.23	4/6/04 14:32	125:44:53	125:38:05	11.21374405
-1	68	1076	-4E-05	528	13.966	-3.30432E-05	-0.94		-3.30432E-05	-0.94	-0.95	15.23	4/7/04 14:08	149:20:53	149:14:05	12.22080421

SAMPLE DECANISTERED 4/07/2004 DUE TO NO MORE GAS BEING EVOLVED; sample air dried for 17 days

RELATIONSHIP of TOTAL GAS EVOLVED FROM a CUTTINGS SAMPLE to RATE of LOST-GAS
(from 42 cuttings samples from air-drilled wells, Cherokee basin, southeastern Kansas)





LOST-GAS ALGORITHM

ccs lost gas = $\sqrt{X}$ (Y)

where X = bottom-hole to canister time (in hours)
where Y = ccs lost gas at 0.36 hours
(i.e., value Y from regression equation)

FIGURE 3.

Desorption Characteristics of Cuttings Samples

Dart Cherokee Basin #A1-22 Huser, 22-T.30S.-R.14E., Wilson County, KS

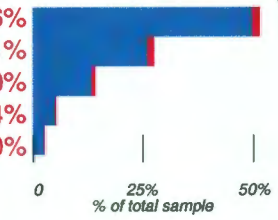
LITHOLOGIC COMPONENT SENSITIVITY ANALYSIS for calculation of gas content of shale associated with Lexington "coal" from 924' to 926'

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

total gas desorbed
(including estimated lost gas) = 90.3 ccs

TOTAL DRY WEIGHT OF SAMPLE = 155.19 grams
$\text{weight}_{light\text{-}colored\ lithologies}$ = 7.62 grams (4.9%)
$\text{weight}_{dark\ shale}$ = 147.57 grams (95.1%)
weight_{coal} = 0.00 grams (0.0%)

sieve size	*grams*	*% coal / % dark shale / % light-colored liths*
>0.0930"	79.19	0.00% / 96.64% / 3.36%
>0.0661"	42.36	0.00% / 94.19% / 5.81%
>0.0460"	21.50	0.00% / 92.90% / 7.10%
>0.0331"	8.11	0.00% / 93.06% / 6.94%
<0.0331"	4.03	0.00% / 90.00% / 10.00%
	155.19 TOTAL	



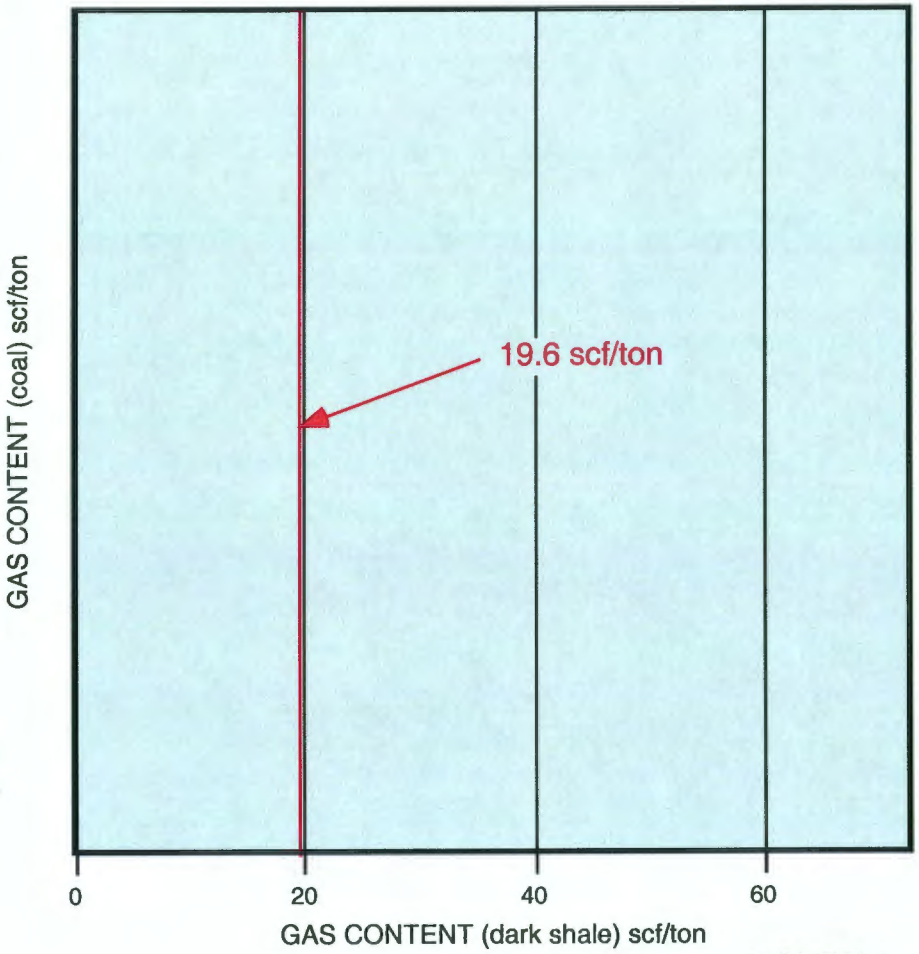


FIGURE 4.

Desorption Characteristics of Cuttings Samples

Dart Cherokee Basin #A1-22 Huser, 22-T.30S.-R.14E., Wilson County, KS

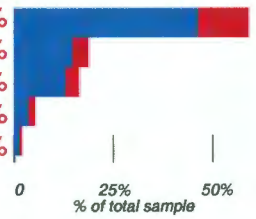
LITHOLOGIC COMPONENT SENSITIVITY ANALYSIS for calculation of gas content of Little Osage Shale from 987' to 989'

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

total gas desorbed
(including estimated lost gas) = 422.1 ccs

TOTAL DRY WEIGHT OF SAMPLE = 792.67 grams
$\text{weight}_{light\text{-}colored\ lithologies}$ = 179.53 grams (22.7%)
$\text{weight}_{dark\ shale}$ = 613.14 grams (77.4%)
weight_{coal} = 0.00 grams (0.0%)

sieve size	*grams*	*% coal / % dark shale / % light-colored liths*
>0.0930"	463.87	0.00% / 78.05% / 21.95%
>0.0661"	146.52	0.00% / 77.70% / 22.30%
>0.0460"	127.58	0.00% / 78.43% / 21.57%
>0.0331"	40.34	0.00% / 67.29% / 32.71%
<0.0331"	14.36	0.00% / 70.00% / 30.00%
	792.67 TOTAL	



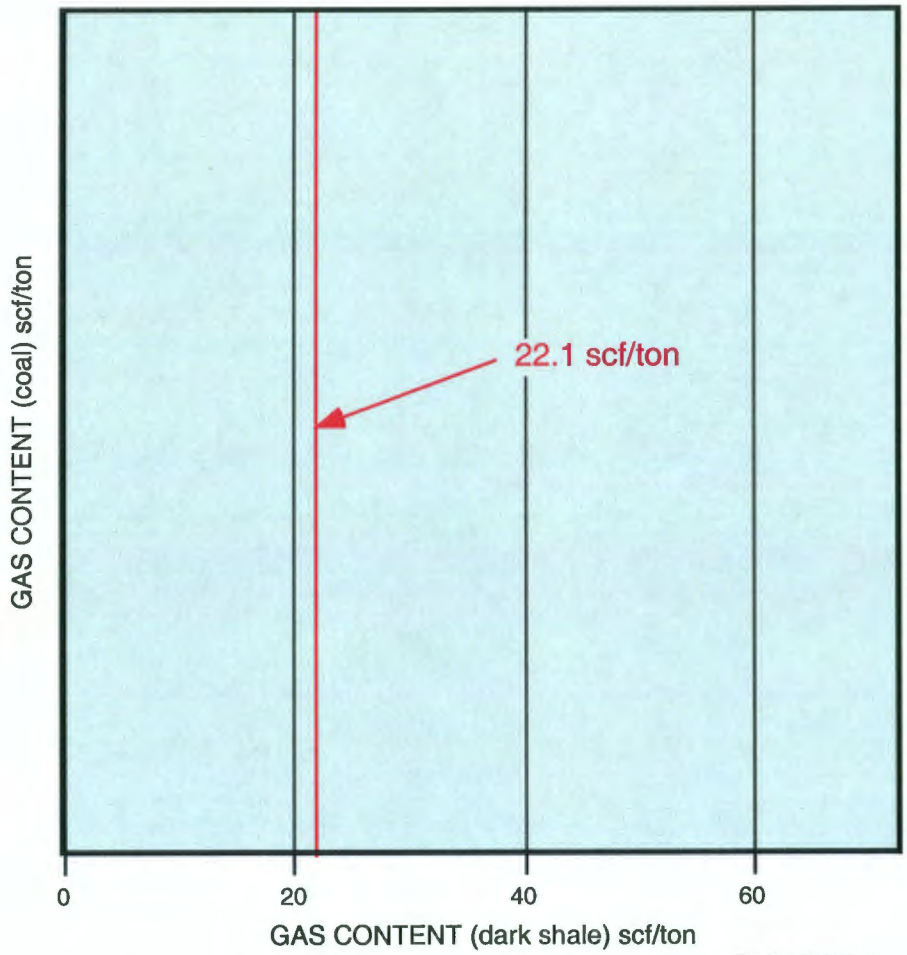


FIGURE 5.

Desorption Characteristics of Cuttings Samples

Dart Cherokee Basin #A1-22 Huser, 22-T.30S.-R.14E., Wilson County, KS

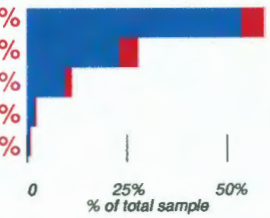
LITHOLOGIC COMPONENT SENSITIVITY ANALYSIS for calculation of gas content of Excello Shale from 1001' to 1004'

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

total gas desorbed
(including estimated lost gas) = 27.6 ccs

TOTAL DRY WEIGHT OF SAMPLE = 238.75 grams
$\text{weight}_{light\text{-}colored\ lithologies}$ = 30.43 grams (12.8%)
$\text{weight}_{dark\ shale}$ = 208.32 grams (87.3%)
weight_{coal} = 0.00 grams (0.0%)

sieve size	*grams*	*% coal / % dark shale / % light-colored liths*
>0.0930"	140.25	0.00% / 90.06% / 9.94%
>0.0661"	65.16	0.00% / 83.02% / 16.98%
>0.0460"	26.29	0.00% / 84.23% / 15.77%
>0.0331"	5.13	0.00% / 82.35% / 17.65%
<0.0331"	1.91	0.00% / 80.00% / 20.00%
	238.75 TOTAL	



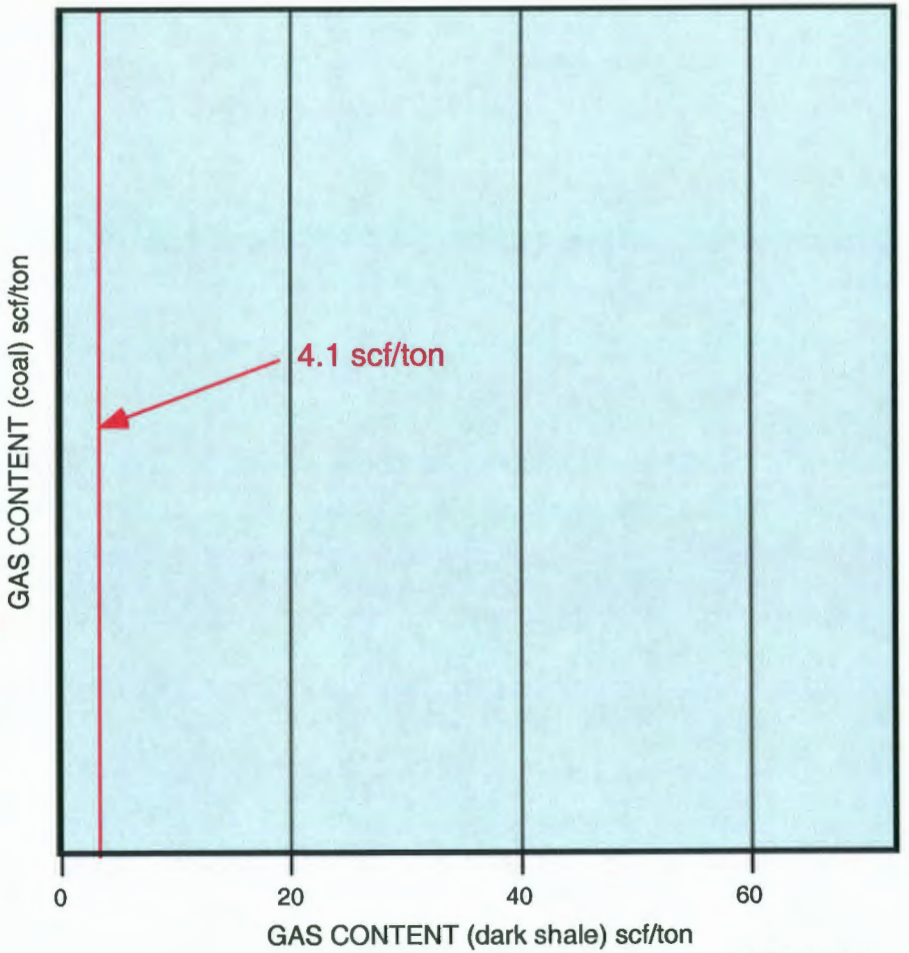


FIGURE 6.

Desorption Characteristics of Cuttings Samples

Dart Cherokee Basin #A1-22 Huser, 22-T.30S.-R.14E., Wilson County, KS

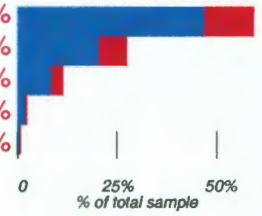
LITHOLOGIC COMPONENT SENSITIVITY ANALYSIS for calculation of gas content of shale from 1058' to 1060'

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

total gas desorbed
(including estimated lost gas) = 21.8 ccs

TOTAL DRY WEIGHT OF SAMPLE = 183.85 grams
$\text{weight}_{light\text{-}colored\ lithologies}$ = 41.93 grams (22.8%)
$\text{weight}_{dark\ shale}$ = 141.92 grams (77.2%)
weight_{coal} = 0.00 grams (0.0%)

sieve size	*grams*	*% coal / % dark shale / % light-colored liths*
>0.0930"	107.67	0.00% / 79.20% / 20.80%
>0.0661"	49.99	0.00% / 73.97% / 26.03%
>0.0460"	20.73	0.00% / 73.50% / 26.50%
>0.0331"	4.04	0.00% / 81.63% / 18.37%
<0.0331"	1.41	0.00% / 80.00% / 20.00%
	183.85 TOTAL	



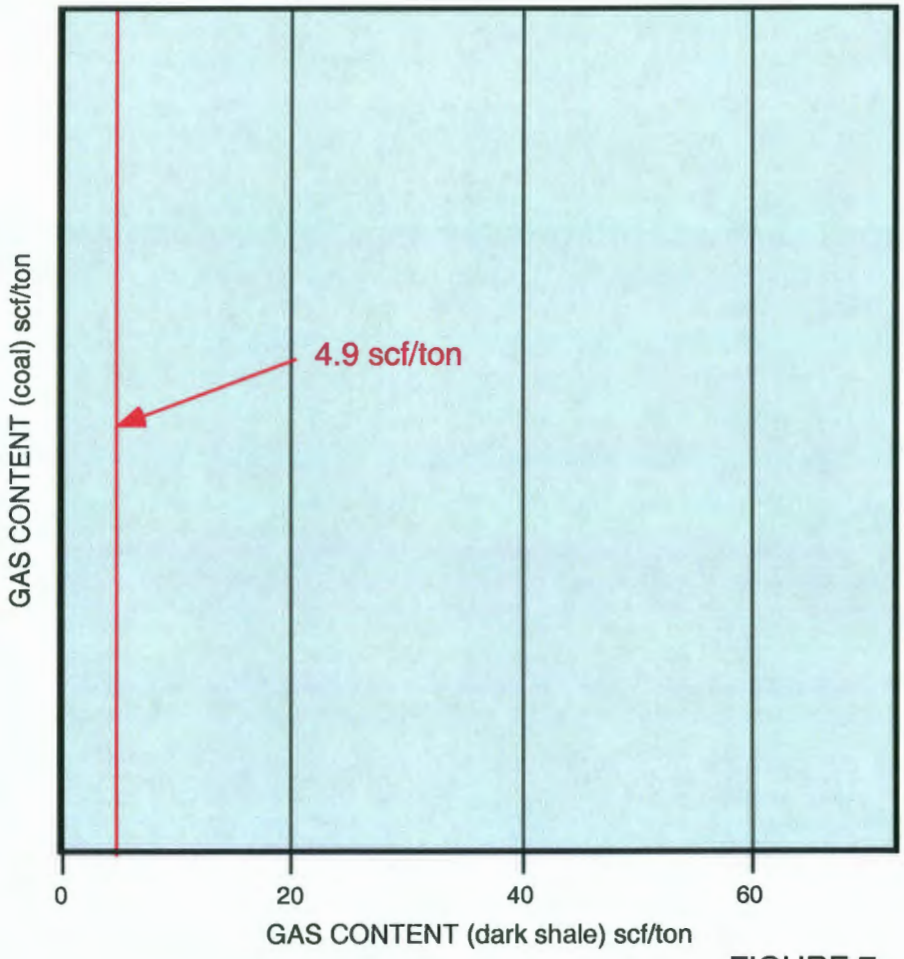


FIGURE 7.

Desorption Characteristics of Cuttings Samples

Dart Cherokee Basin #A1-22 Huser, 22-T.30S.-R.14E., Wilson County, KS

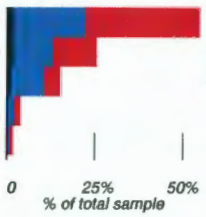
LITHOLOGIC COMPONENT SENSITIVITY ANALYSIS for calculation of gas content of Tebo coal from 1162' to 1164'

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

total gas desorbed
(including estimated lost gas) = 312.5 ccs

TOTAL DRY WEIGHT OF SAMPLE = 411.78 grams
$\text{weight}_{light\text{-}colored\ lithologies}$ = 212.55 grams (51.6%)
$\text{weight}_{dark\ shale}$ = 182.51 grams (44.3%)
weight_{coal} = 16.72 grams (4.1%)

sieve size	*grams*	*% coal / % dark shale / % light-colored liths*
>0.0930"	223.76	2.84% / 37.66% / 59.50%
>0.0661"	103.90	6.12% / 45.36% / 48.52%
>0.0460"	61.56	5.28% / 64.53% / 30.19%
>0.0331"	15.55	3.53% / 52.94% / 43.53%
<0.0331"	7.00	3.00% / 45.00% / 52.00%
	411.78 TOTAL	



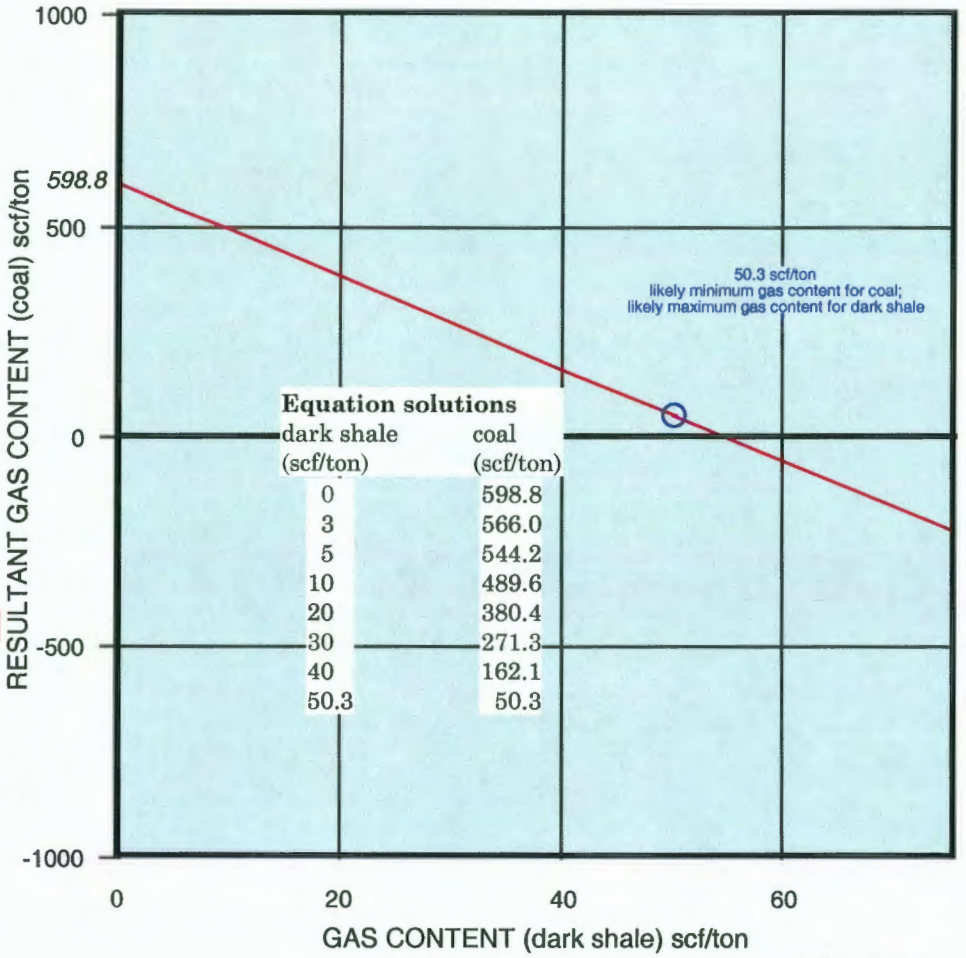


FIGURE 8.

Desorption Characteristics of Cuttings Samples

Dart Cherokee Basin #A1-22 Huser, 22-T.30S.-R.14E., Wilson County, KS

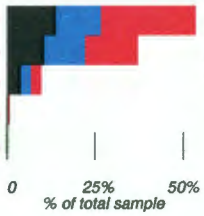
LITHOLOGIC COMPONENT SENSITIVITY ANALYSIS for calculation of gas content of Weir-Pittsburg coal from 1186' to 1189'

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

total gas desorbed
(including estimated lost gas) = 148.2 ccs

TOTAL DRY WEIGHT OF SAMPLE = 109.46 grams
$\text{weight}_{light\text{-}colored\ lithologies}$ = 48.78 grams (44.6%)
$\text{weight}_{dark\ shale}$ = 30.20 grams (27.6%)
weight_{coal} = 30.48 grams (27.9%)

sieve size	*grams*	*% coal / % dark shale / % light-colored liths*
>0.0930"	57.89	25.63% / 24.07% / 50.31%
>0.0661"	40.22	27.92% / 31.59% / 40.49%
>0.0460"	10.45	38.41% / 31.16% / 30.43%
>0.0331"	0.71	44.44% / 33.33% / 22.22%
<0.0331"	0.20	45.00% / 35.00% / 20.00%
	109.46 TOTAL	



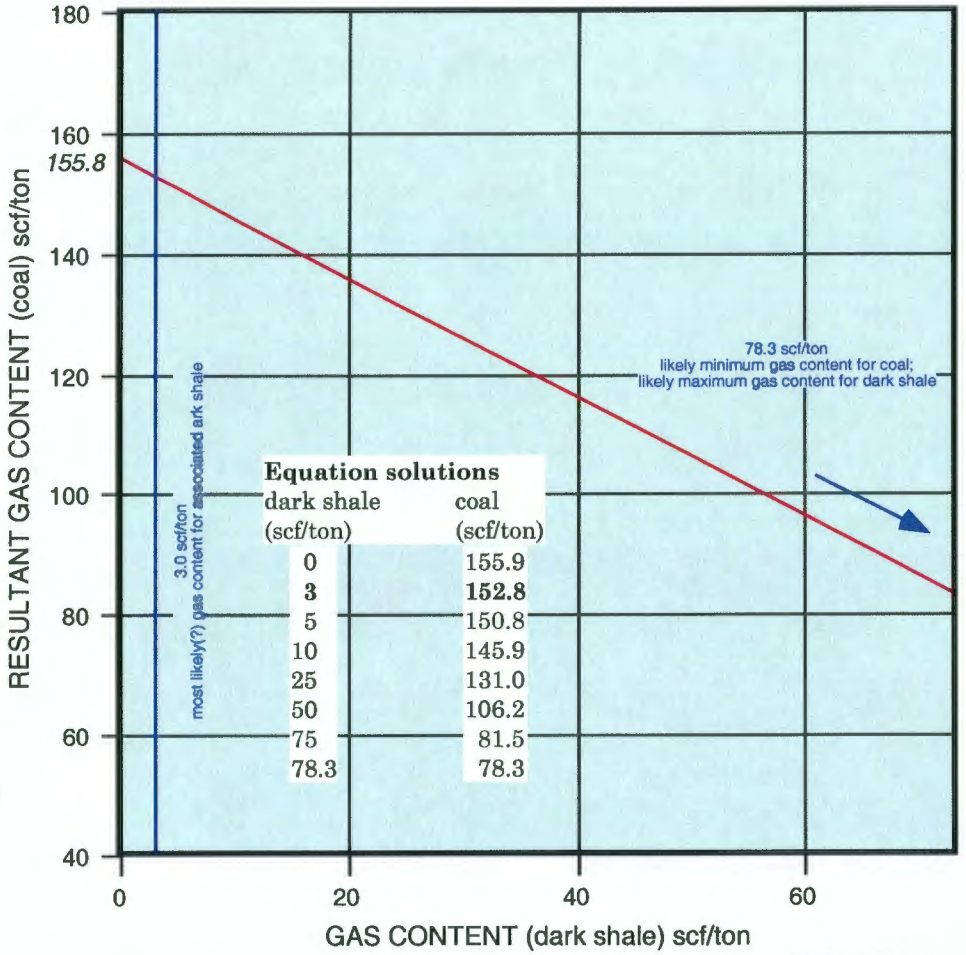


FIGURE 9.

Desorption Characteristics of Cuttings Samples

Dart Cherokee Basin #A1-22 Huser, 22-T.30S.-R.14E., Wilson County, KS

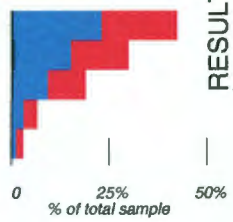
LITHOLOGIC COMPONENT SENSITIVITY ANALYSIS for calculation of gas content of "Dry Wood equivalent" interval from 1235' to 1238'

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

total gas desorbed
(including estimated lost gas) = 39.8 ccs

TOTAL DRY WEIGHT OF SAMPLE = 441.06 grams
$\text{weight}_{light\text{-}colored\ lithologies}$ = 214.53 grams (49.6%)
$\text{weight}_{dark\ shale}$ = 220.45 grams (50.0%)
weight_{coal} = 6.08 grams (1.4%)

sieve size	*grams*	*% coal / % dark shale / % light-colored liths*
>0.0930"	185.50	0.73% / 53.30% / 45.97%
>0.0661"	131.68	2.23% / 48.56% / 49.21%
>0.0460"	82.48	1.51% / 47.86% / 50.63%
>0.0331"	28.74	1.47% / 45.59% / 52.94%
<0.0331"	12.66	1.00% / 40.00% / 59.00%
	441.06 TOTAL	



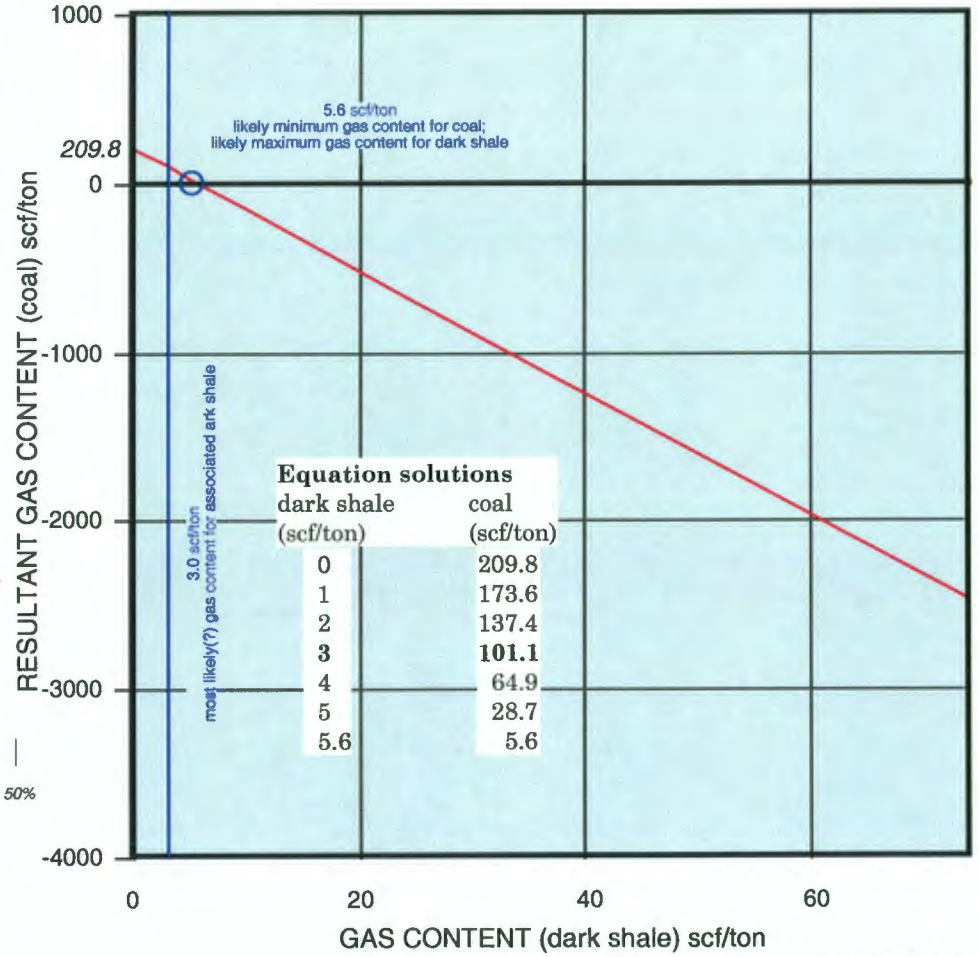


FIGURE 10.

Desorption Characteristics of Cuttings Samples

Dart Cherokee Basin #A1-22 Huser, 22-T.30S.-R.14E., Wilson County, KS

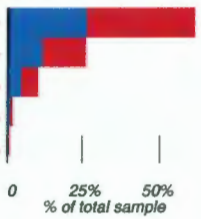
LITHOLOGIC COMPONENT SENSITIVITY ANALYSIS for calculation of gas content of Rowe coal from 1263' to 1265'

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

total gas desorbed
(including estimated lost gas) = 29.4 ccs

TOTAL DRY WEIGHT OF SAMPLE = 269.47 grams
$\text{weight}_{light\text{-}colored\ lithologies}$ = 152.18 grams (56.5%)
$\text{weight}_{dark\ shale}$ = 113.69 grams (42.2%)
weight_{coal} = 3.60 grams (1.3%)

sieve size	*grams*	*% coal / % dark shale / % light-colored liths*
>0.0930"	165.30	1.11% / 41.47% / 57.43%
>0.0661"	70.16	1.81% / 42.44% / 55.76%
>0.0460"	27.32	1.55% / 42.64% / 55.81%
>0.0331"	4.81	1.30% / 49.35% / 49.35%
<0.0331"	1.98	1.00% / 70.00% / 29.00%
	269.47 TOTAL	



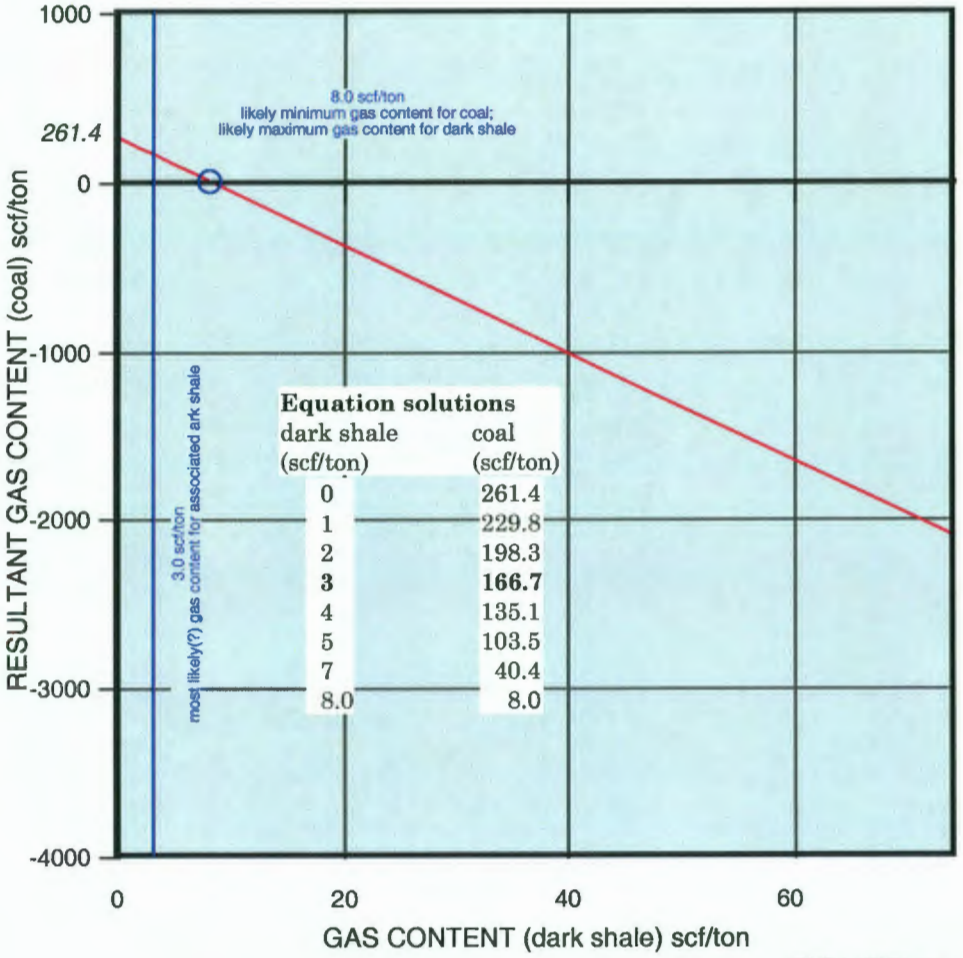


FIGURE 11.

Desorption Characteristics of Cuttings Samples

Dart Cherokee Basin #A1-22 Huser(?), 22-T.30S.-R.14E., Wilson County, KS

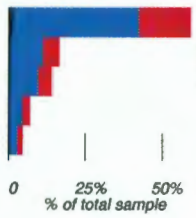
)LOGIC COMPONENT SENSITIVITY ANALYSIS for calculation of gas content of "Rowe rider equivalent" coal from 1270' to 1273'

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

total gas desorbed
(including estimated lost gas) = 28.3 ccs

TOTAL DRY WEIGHT OF SAMPLE = 271.84 grams
$\text{weight}_{light\text{-}colored\ lithologies}$ = 82.99 grams (30.5%)
$\text{weight}_{dark\ shale}$ = 184.30 grams (67.8%)
weight_{coal} = 4.55 grams (1.7%)

sieve size	*grams*	*% coal / % dark shale / % light-colored liths*
>0.0930"	159.13	1.67% / 70.04% / 28.29%
>0.0661"	44.18	2.15% / 65.41% / 32.44%
>0.0460"	37.88	1.47% / 66.57% / 31.96%
>0.0331"	18.39	1.47% / 62.50% / 36.03%
<0.0331"	12.26	1.00% / 59.00% / 40.00%
	271.84 TOTAL	



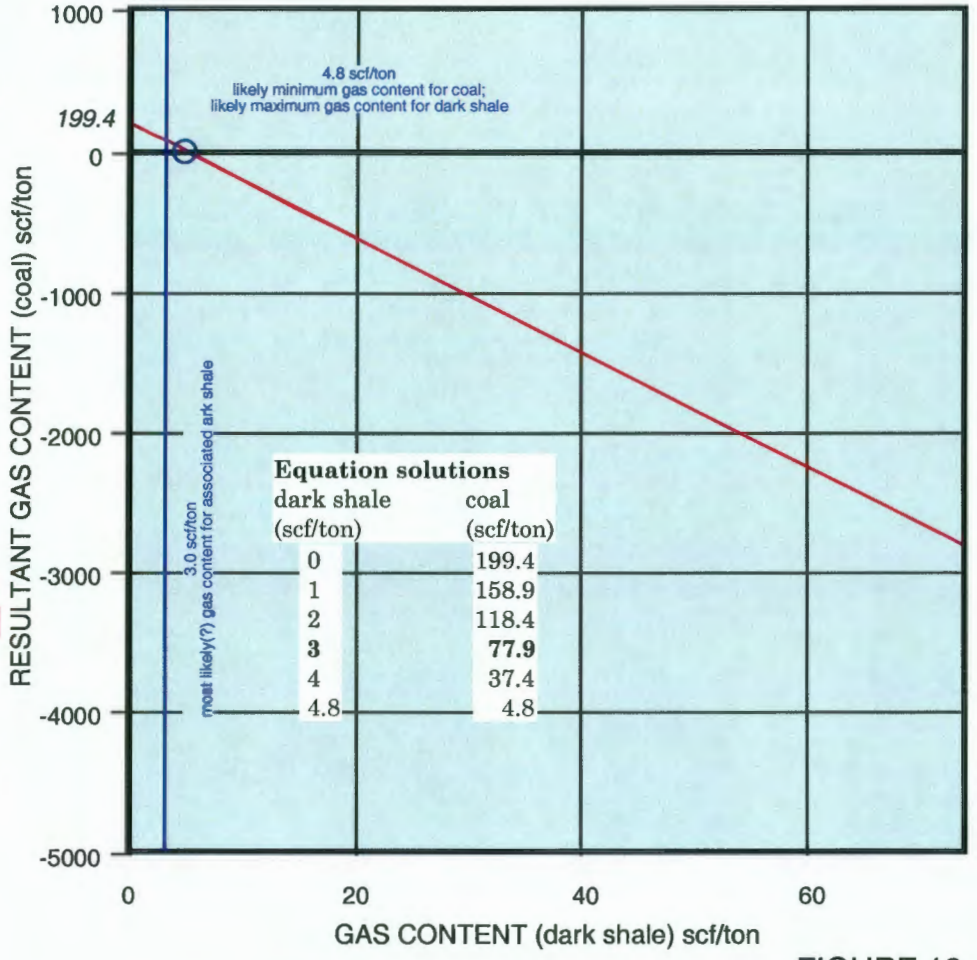


FIGURE 12.

Desorption Characteristics of Cuttings Samples

Dart Cherokee Basin #A1-22 Huser, 22-T.30S.-R.14E., Wilson County, KS

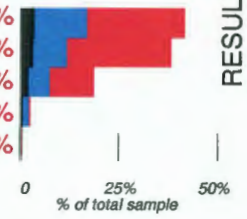
LITHOLOGIC COMPONENT SENSITIVITY ANALYSIS for calculation of gas content of Riverton(?) coal from 1307' to 1309'

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

total gas desorbed
(including estimated lost gas) = 23.6 ccs

TOTAL DRY WEIGHT OF SAMPLE = 83.71 grams
$\text{weight}_{light\text{-}colored\ lithologies}$ = 52.13 grams (62.3%)
$\text{weight}_{dark\ shale}$ = 24.51 grams (29.3%)
weight_{coal} = 7.07 grams (8.5%)

sieve size	*grams*	*% coal / % dark shale / % light-colored liths*
>0.0930"	34.47	7.98% / 32.44% / 59.58%
>0.0661"	31.62	7.86% / 22.71% / 55.76%
>0.0460"	15.33	9.71% / 30.00% / 69.43%
>0.0331"	2.00	16.00% / 68.00% / 16.00%
<0.0331"	0.28	10.00% / 65.00% / 25.00%
	83.71 TOTAL	



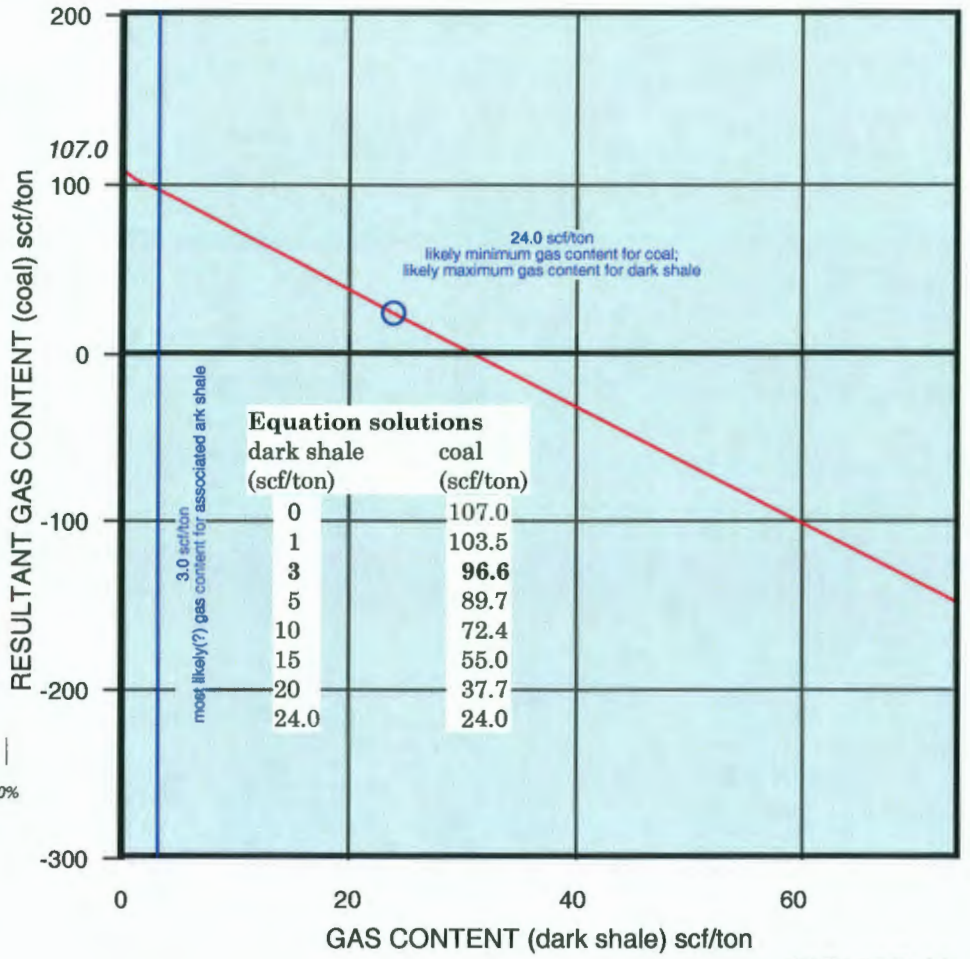


FIGURE 13.

Desorption Characteristics of Cuttings Samples

Dart Cherokee Basin #A1-22 Huser, 22-T.30S.-R.14E., Wilson County, KS

surface

100'

200'

300'

400'

500'

600'

700'

706'-707' Tulsa "coal"

800'

900'

924'-926' Lexington "coal"

984'-986' Little Osage Shale

1001'-1004' Excello(?)

1058'-1056' shale near Bevier

1100'

1162'-1164' Tebo

1186'-1189' Weir-Pittsburg

1235'-1238' "Dry Wood equiv."

1263'-1265' Rowe
1270'-1273' "Rowe rider equiv."

1307'-1309' Riverton(?)

1400'

LITHOLOGIC COMPONENT SENSITIVITY ANALYSIS for all samples

UNIT	coal in sample	scf/ton w/ shale @ 3 scf/ton	maximum scf/ton	minimum scf/ton
Tulsa "coal"	----%	*no valid data*		
Lexington "coal"	0%	----	----	19.6
Little Osage Sh.	0%	----	----	22.1
Excello(?)	0%	----	----	4.1
sh. near Bevier	0%	----	----	4.9
Tebo coal	4%	566.0	598.0	50.3
Weir-Pittsburg	28%	152.8	155.9	78.3
"Dry Wood equiv."	1%	101.1	209.8	5.6
Rowe coal	1%	166.7	261.4	8.0
"Rowe rider equiv."	2%	77.9	199.4	4.8
Riverton(?) coal	9%	96.6	107.0	24.0

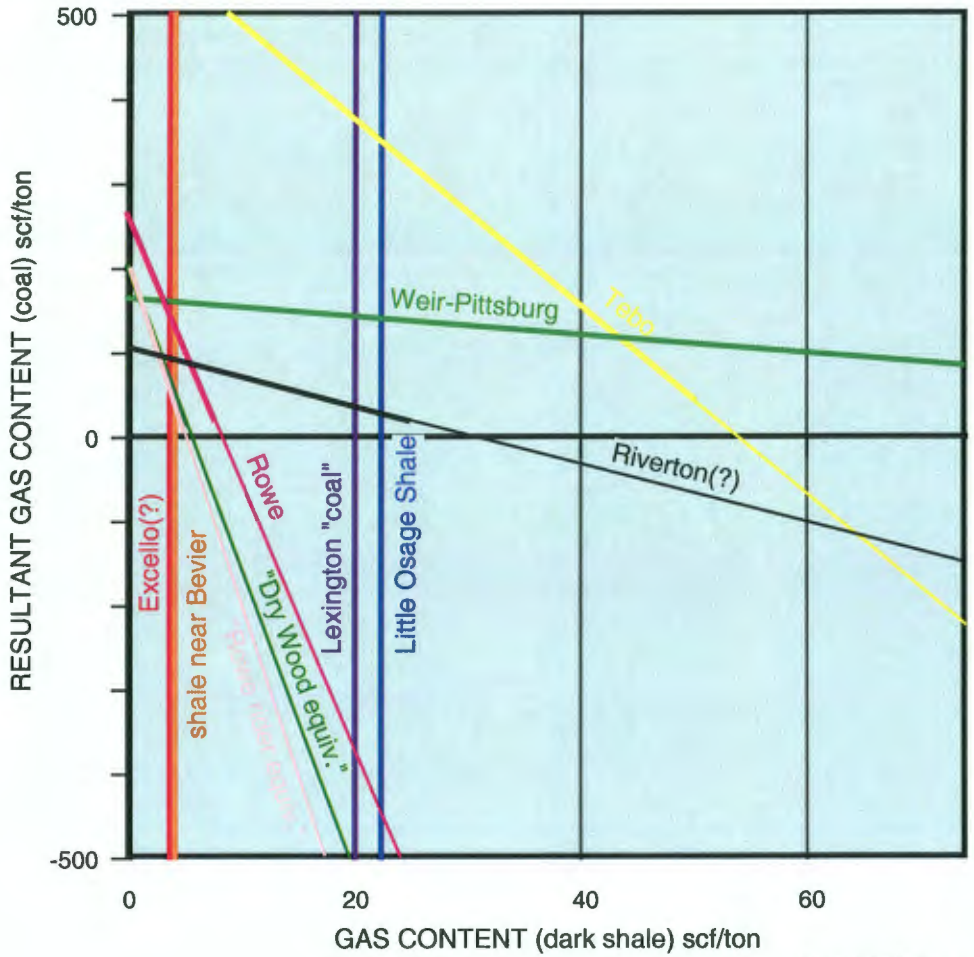


FIGURE 14.

Desorption Characteristics of Cuttings Samples

based on total weight of gas-generating lithologies (i.e., coal and dark shale) in sample
Dart Cherokee Basin #A1-22 Huser, 22-T.30S.-R.14E., Wilson County, KS

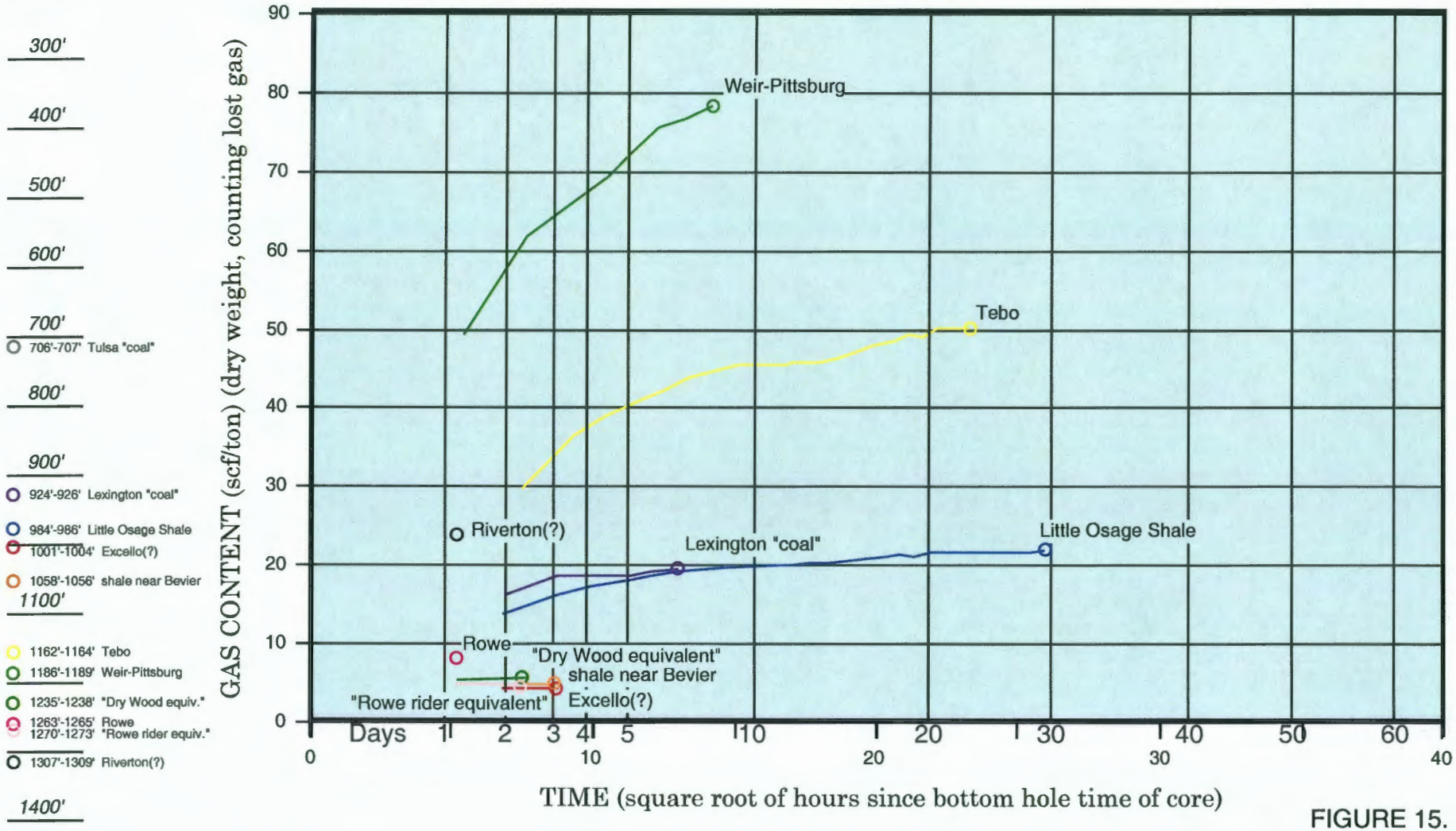


FIGURE 15.