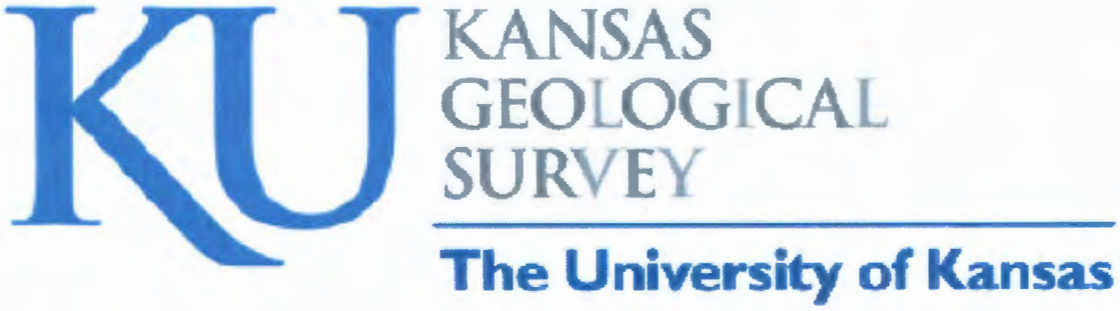
ANALYSIS OF MARMATON AND CHEROKEE GROUP CUTTINGS SAMPLES FOR GAS CONTENT -- DART CHEROKEE BASIN OPERATING COMPANY #B3-23 HUSER; SW SE SW NE sec. 23-T.30S.-R.14E.; WILSON COUNTY, KANSAS

By
K. David Newell
and
Galen A. Worthington



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

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SUMMARY

Six cuttings samples from the Pennsylvanian Marmaton Group and Cherokee Group were collected from the Dart Cherokee Basin #B3-23 Huser well; SW SE SW NE sec. 23-T.30S.-R.14E. in Wilson County, KS. The samples calculate as having the following gas contents:

- Tulsa "coal" at 687' to 688' depth[1] (19.9 scf/ton)
- Mulberry coal at 862' to 864' depth[2] (97.3 scf/ton)
- Mulky coal/Excello Shale at 975' to 980' depth[2, 3] (1462.4 scf/ton)
- Shale near Bevier coal at 1021' to 1022' depth[1] (2.5 scf/ton)
- Mineral coal at 1088' to 1090' depth[2] (182.7 scf/ton)
- Weir-Pittsburg coal at 1156' to 1158' depth[2] (255.3 scf/ton)

[1]no coal in sample
[2]assuming accompanying dark shales in sample desorb 3 scf/ton
[3]coal gas content difficult to assess due to gas-rich shales admixed with the coal

BACKGROUND

The Dart Cherokee Basin #B3-23 Huser well, SW SE SW NE sec. 23-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 29 and 30, 2004, by Tom O'Neill of Dart Cherokee Basin L.L.C., and turned over to K.D. Newell of the Kansas Geological Survey on March 30, 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 March 29 and 30, 2004, 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. Lag times for samples to reach the surface (important for assessing lost gas) were determined by using the lag times from a nearby air-drilled well (Dart Cherokee Basin #CH-1 Holder; sec. 1-T.30S.-R.14E., Wilson County, KS), which was also drilled using this particular drilling rig. The lag times were determined by periodically noting the time it took for cuttings to reach the surface following resumption of drilling after new pipe was added to the drill string.

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

- Tulsa "coal" at 687' to 688' depth (241 grams dry wt.)
- Mulberry coal at 862' to 864' depth (365 grams dry wt.)
- Mulky coal/Excello Shale at 975' to 980' depth (517 grams dry wt.)
- Shale near Bevier coal at 1021' to 1022' depth (511 grams dry wt.)
- Mineral coal at 1088' to 1090' depth (170 grams dry wt.)

- Weir-Pittsburg coal at 1156' to 1158' depth (425 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 March 30th 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. 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 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, 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.

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 ran through a sample splitter and a lesser portion (approximately 75 grams) were sieved and weighed, and the derived size-fraction ratios were applied to the entire sample.

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

DATA PRESENTATION

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

Graph of Lag-time to Surface for Well Cuttings (Figure 2)
Lag time of cuttings to surface varied, but there is a general trend of longer lag times for greater depth. The lag times accepted for cuttings were taken to be a visual average of the trend (defined by the scatter of data points on this graph) at the depth at which the samples were taken.

Data Tables of the Desorption Analyses (Table 1)
These are the basic data used for lost-gas analysis and determination of total gas desorbed from the cuttings samples. Basic temperature, volume, and barometric measurements are listed at left. Farther to the right, these are converted to standard temperature, pressure, and volumes. The volumes are cumulatively summed, and converted to scf/ton based on the total weight of coal and dark shale in the sample. At the right of the table, the time of the measurements are listed and converted to hours (and square root of hours) since the sample was drilled.

Lost-Gas Graphs (Figures 3)
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 by the square root of 0.6 hours (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 substracting 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.

"Lithologic Component Sensitivity Analyses" (Figures 4-9)
The rapidity of penetration of an air-drilled well makes collection of pure lithologies from relatively thin-bedded strata rather difficult. Mixed lithologies are more the norm rather than the exception. Some of this mixing is due to cavings from strata farther up hole. The mixing may also be due to collection of two or more successively drilled lithologies in the kitchen sieve at the exit line, or differential lifting of relatively less-dense coal compared to other lithologies, all of which are more dense than coal.

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

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

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

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

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

RESULTS and DISCUSSION

The Tulsa "coal" and the "shale at 1021'-1022' associated with the Bevier coal" contained no coal. The Tulsa interval is a dark carbonaceous coal and contains some gas, but the shale at 1021'-1022' evidently completely missed the Bevier coal. The shale, although dark in color, is not gassy.

Gas content of coal is best constrained in for the Weir-Pittsburg sample (with 22% coal), and nearly as well constrained for the Mulberry sample (with 14% coal). The Mineral coal sample, with 7% coal, has a coal gas content that varies somewhat more with assumed gas content for the accompanying 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 Mulky coal/Excello Shale sample contained little coal (2%). This sample was dominated by a very dark to black shale (N1, N2). Due to the small amount of coal in the sample, the calculated gas content of the coal varies greatly with any slight variation in gas content assumed for the accompanying shale in the sample. The Excello Shale, however, is very rich in organic matter, and it may have a gas content close to that of the average gas content for the entire sample (i.e., 51.7 scf/ton). Similar problems are encountered for the Mulky/Excello sample at the Dart Cherokee Basin #CH-1 Holder well (1-T.30S.-R.14E.) and the Dart Cherokee Basin #C4-19 Sycamore Springs Ranch well (19-T.31S.-R.15E.).

REFERENCES

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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 Tulsa "coal" at 687' to 688' depth.
FIGURE 5. Sensitivity analysis for Mulberry coal at 862' to 864' depth.
FIGURE 6. Sensitivity analysis for Mulky coal/Excello Shale at 975' to 980' depth.
FIGURE 7. Sensitivity analysis for Shale near Bevier coal at 1021' to 1022' depth.
FIGURE 8. Sensitivity analysis for Mineral coal at 1088' to 1090' depth.
FIGURE 9. Sensitivity analysis for Weir-Pittsburg coal at 1156' to 1158' depth.

FIGURE 10. Lithologic component sensitivity analyses for all samples.

FIGURE 11. Desorption graph for all samples.

Correlation of Field Barometer to KGS Petrophysics Lab Barometer

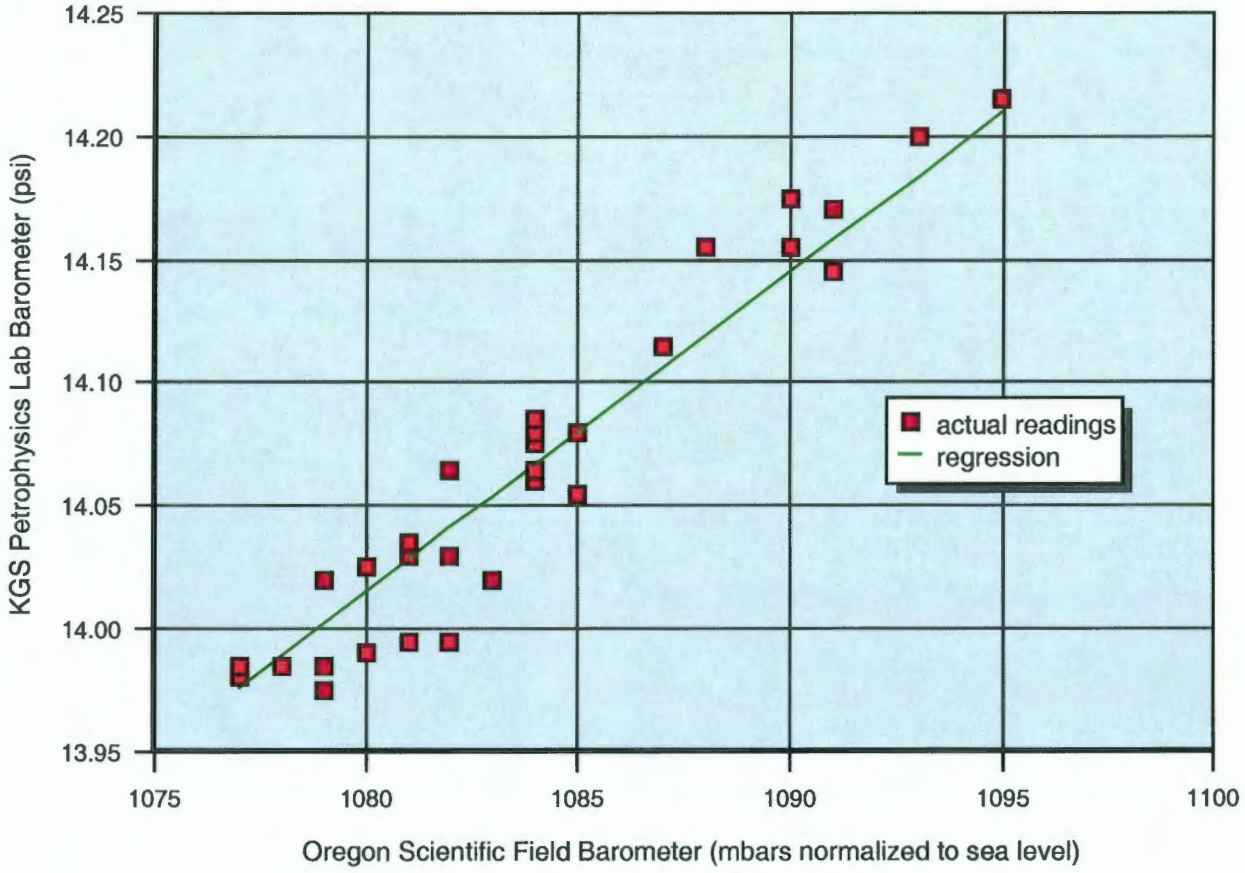


FIGURE 1.

TABLE 1 -- Desorption data for DART CHEROKEE BASIN HUSER #83-23; SW SE SW NE 23-T.30S.-R.14E.

SAMPLE: 687' to 688' (Tulsa "coal") cuttings in Dart SSD canister

	lbs.	grams
dry sample weight:	0.4112	186.53

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)
14	off bottom	at surface	in canister		3.1 minutes
	3/29/04 12:11	3/29/04 12:12	3/29/04 12:14		0.052 hours
					0.229128784 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)
60	63	1088	0.0021	523	14.122	0.002023866	57.31	0.002023866	57.31	9.84	12.25	3/30/04 20:13	32:01:55	31:58:46	5.659677062
17	64	1088	0.0006	524	14.122	0.000572334	16.21	0.0025962	73.52	12.63	15.03	3/31/04 14:18	50:06:55	50:03:46	7.079214489
15	69	1084	0.0005	529	14.070	0.000498389	14.11	0.003094588	87.63	15.05	17.45	4/1/04 9:52	69:40:55	89:37:46	8.34757117
2	65	1089	7E-05	525	14.135	6.7287E-05	1.90	0.003161855	89.53	15.38	17.78	4/2/04 11:21	95:09:55	95:06:46	9.755269231
3	66	1088	0.0001	526	14.122	0.000100616	2.85	0.003262471	92.38	15.87	18.27	4/3/04 17:11	124:59:55	124:56:46	11.18027777
0	65	1087	0	525	14.109	0	0.00	0.003262471	92.38	15.87	18.27	4/4/04 15:29	147:17:55	147:14:46	12.13666392
1	65	1082	4E-05	525	14.044	3.34173E-05	0.95	0.003295889	93.33	16.03	18.43	4/5/04 21:17	177:05:55	177:02:46	13.30784021
4	67	1080	0.0001	527	14.018	0.000132918	3.76	0.003428804	97.09	16.68	19.08	4/6/04 14:28	194:14:55	194:11:46	13.93731004
5	68	1076	0.0002	528	13.966	0.000165216	4.68	0.00359402	101.77	17.48	19.88	4/7/04 14:03	217:51:55	217:48:46	14.76028009
-2	67	1082	-7E-05	527	14.044	-6.65809E-05	-1.89	0.003527439	99.89	17.16	19.56	4/8/04 14:12	242:00:55	241:57:46	15.55684022
-1	66	1081	-4E-05	526	14.031	-3.33229E-05	-0.94	0.003494116	98.94	16.99	19.40	4/9/04 14:42	266:30:55	286:27:46	16.32529564

DESORPTION TERMINATED 4/9/2004 DUE TO NO MORE GAS BEING EVOLVED; sample air dried for 17 days

SAMPLE: 862' to 864' (Mulberry coal) cuttings in Dart SSD canister

	lbs.	grams
dry sample weight:	0.4636	210.29

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)
20	off bottom	at surface	in canister		5.5 minutes
	3/29/04 13:57	3/29/04 13:59	3/29/04 14:03		0.092 hours
					0.303681119 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)
65	63	1088	0.0023	523	14.122	0.002192521	62.09	0.002192521	62.09	9.46	12.51	3/30/04 20:13	30:15:12	30:09:40	5.500303022
24	64	1088	0.0008	524	14.122	0.000808001	22.88	0.003000522	84.97	12.94	15.99	3/31/04 14:19	48:21:12	48:15:40	6.953656113
23	69	1084	0.0008	529	14.070	0.000784198	21.84	0.003764718	106.80	16.24	19.29	4/1/04 9:52	87:54:12	87:48:40	8.240347889
10	85	1089	0.0004	525	14.135	0.000336335	9.52	0.004101053	118.13	17.69	20.74	4/2/04 11:22	93:24:12	93:18:40	9.664539996
11	66	1088	0.0004	526	14.122	0.000368928	10.45	0.004469979	126.58	19.28	22.33	4/3/04 17:12	123:14:12	123:08:40	11.10120114
2	65	1087	7E-05	525	14.109	6.71434E-05	1.90	0.004537122	128.48	19.57	22.62	4/4/04 15:29	145:31:12	145:25:40	12.06316708
6	65	1082	0.0002	525	14.044	0.000200504	5.68	0.004737626	134.15	20.44	23.49	4/5/04 21:18	175:20:12	175:14:40	13.24147525
6	67	1080	0.0002	527	14.018	0.000199374	5.65	0.004936999	139.80	21.30	24.35	4/6/04 14:28	192:28:12	192:22:40	13.87335576
8	68	1076	0.0003	528	13.966	0.000284345	7.49	0.005201345	147.29	22.44	25.49	4/7/04 14:03	218:05:12	215:59:40	14.69988662
1	67	1082	4E-05	527	14.044	3.32905E-05	0.94	0.005234635	148.23	22.58	25.63	4/8/04 14:12	240:14:12	240:08:40	15.49956989
2	66	1081	7E-05	526	14.031	6.88459E-05	1.89	0.005301281	150.11	22.87	25.92	4/9/04 14:45	264:47:12	284:41:40	16.2722668
-1	63	1084	-4E-05	523	14.070	-3.36071E-05	-0.95	0.005267674	149.16	22.72	25.77	4/11/04 22:45	320:47:12	320:41:40	17.91051832
-1	62	1086	-4E-05	522	14.098	-3.37336E-05	-0.98	0.00523394	148.21	22.58	25.63	4/12/04 14:41	336:43:12	338:37:40	18.34993188

DESORPTION TERMINATED 4/12/2004 DUE TO NO MORE GAS BEING EVOLVED; sample air dried for 14 days

SAMPLE: 975' to 980' (Mulky coal/Excello Shale) cuttings in Dart SSD canister

	lbs.	grams
dry sample weight:	0.7066	320.52

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)
37	off bottom	at surface	in canister		7.0 minutes
	3/29/04 15:21	3/29/04 15:23	3/29/04 15:28		0.117 hours
					0.342782730 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)
286	63	1088	0.0101	523	14.122	0.009647093	273.17	0.009647093	273.17	27.30	31.00	3/30/04 20:17	28:55:23	28:48:20	5.37801595
75	64	1088	0.0026	524	14.122	0.002525004	71.50	0.012172097	344.67	34.45	38.15	3/31/04 14:20	46:58:23	46:51:20	6.853689193
54	69	1084	0.0019	529	14.070	0.001794199	50.81	0.013966295	395.48	39.53	43.23	4/1/04 9:53	66:31:23	86:24:20	8.156166719
30	65	1089	0.0011	525	14.135	0.001009004	28.57	0.0149753	424.05	42.38	46.08	4/2/04 11:23	92:01:23	91:54:20	9.592864825
20	66	1088	0.0007	526	14.122	0.000670774	18.99	0.015646074	443.05	44.28	47.98	4/3/04 17:13	121:51:23	121:44:20	11.03885813
9	65	1087	0.0003	525	14.109	0.000302145	8.56	0.015948219	451.60	45.14	48.84	4/4/04 15:30	144:08:23	144:01:20	12.00582035
9	65	1082	0.0003	525	14.044	0.000300756	8.52	0.016248975	460.12	45.99	49.69	4/5/04 21:19	173:57:23	173:50:20	13.18925278
8	67	1080	0.0003	527	14.018	0.000265831	7.53	0.016514806	467.65	46.74	50.44	4/6/04 14:26	191:04:23	190:57:20	13.82291777
9	68	1076	0.0003	528	13.966	0.000297388	8.42	0.016812195	476.07	47.58	51.28	4/7/04 14:03	214:41:23	214:34:20	14.65229409
2	67	1082	7E-05	527	14.044	6.65809E-05	1.89	0.016878776	477.95	47.77	51.47	4/8/04 14:12	238:50:23	238:43:20	15.45444021
2	66	1081	7E-05	526	14.031	6.66459E-05	1.89	0.016945422	479.84	47.96	51.66	4/9/04 14:46	283:24:23	263:17:20	16.22979941
-1	63	1084	-4E-05	523	14.070	-3.36071E-05	-0.95	0.016911815	478.89	47.87	51.58	4/11/04 22:46	319:24:23	319:17:20	17.87194418
-1	62	1086	-4E-05	522	14.098	-3.37336E-05	-0.96	0.016878081	477.93	47.77	51.47	4/12/04 14:46	335:24:23	335:17:20	18.31410355

DESORPTION TERMINATED 4/12/2004 DUE TO NO MORE GAS BEING EVOLVED; sample air dried for 14 days

SAMPLE: 1021' to 1022' (shale associated with Bevier coal) cuttings in Dart SSD canister

	lbs.	grams
dry sample weight:	1.0656	492.42

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	at surface	in canister
	3/29/04 15:46	3/29/04 15:48	3/29/04 15:53
			6.6 minutes
			0.110 hours
			0.331662479 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)
9	63	1088	0.0003	523	14.122	0.00030356	8.60	0.00030358	8.60	0.56	1.67	3/30/04 20:18	28:31:18	28:24:40	5.340515997
4	64	1088	0.0001	524	14.122	0.000134667	3.81	0.000438247	12.41	0.81	1.91	3/31/04 14:20	46:33:16	46:26:40	6.823081741
9	69	1084	0.0003	529	14.070	0.000299033	8.47	0.00073728	20.88	1.36	2.46	4/1/04 9:53	66:06:16	65:59:40	8.130463975
-5	65	1089	-0.0002	525	14.135	-0.000166167	-4.78	0.000569112	16.12	1.05	2.15	4/2/04 11:24	91:37:18	91:30:40	9.571891721
-1	66	1088	-4E-05	526	14.122	-3.35387E-05	-0.95	0.000535574	15.17	0.99	2.09	4/3/04 17:13	121:26:16	121:19:40	11.01988102
-2	65	1087	-7E-05	525	14.109	-6.71434E-05	-1.90	0.00046843	13.26	0.86	1.97	4/4/04 15:31	143:44:16	143:37:40	11.9890691
1	65	1082	4E-05	525	14.044	3.34173E-05	0.95	0.000501848	14.21	0.92	2.03	4/5/04 21:20	173:33:16	173:26:40	13.17400639

DESORPTION TERMINATED 4/6/2004 DUE TO NO MORE GAS BEING EVOLVED; sample air dried for 20 days

SAMPLE: 1088' to 1090' (Mineral coal) cuttings in Dart SSD canister DCB4

	lbs.	grams
dry sample weight:	0.2282	102.62

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)
16	off bottom	at surface	in canister
	3/30/04 7:41	3/30/04 7:43	3/30/04 7:48
			4.8 minutes
			0.080 hours
			0.282351239 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)
37	63	1088	0.0013	523	14.122	0.00124805	35.34	0.00124805	35.34	11.03	16.03	3/30/04 20:20	12:38:17	12:33:30	3.555004298
12	64	1086	0.0004	524	14.122	0.000404001	11.44	0.001652051	46.76	14.60	19.60	3/31/04 14:20	30:38:17	30:33:30	5.535165359
10	69	1084	0.0004	529	14.070	0.000332259	9.41	0.00198431	56.19	17.54	22.54	4/1/04 9:54	50:12:17	50:07:30	7.085529071
0	65	1089	0	525	14.135	0	0.00	0.00198431	56.19	17.54	22.54	4/2/04 11:26	75:44:17	75:39:30	8.702761375
1	66	1088	4E-05	526	14.122	3.35387E-05	0.95	0.002017849	57.14	17.84	22.83	4/3/04 17:15	105:33:17	105:28:30	10.27398278
0	65	1087	0	525	14.109	0	0.00	0.002017849	57.14	17.84	22.83	4/4/04 15:31	127:49:17	127:44:30	11.30581217
1	65	1082	4E-05	525	14.044	3.34173E-05	0.95	0.002051268	58.09	18.13	23.13	4/5/04 21:21	157:39:17	157:34:30	12.55606317
2	67	1080	7E-05	527	14.018	6.64579E-05	1.86	0.002117724	59.97	18.72	23.72	4/6/04 14:27	174:45:17	174:40:30	13.21948268
3	68	1076	0.0001	528	13.966	9.91295E-05	2.81	0.002216853	62.77	19.60	24.59	4/7/04 14:04	196:22:17	198:17:30	14.08443783
-2	67	1082	-7E-05	527	14.044	-6.65809E-05	-1.89	0.002150273	60.89	19.01	24.00	4/8/04 14:13	222:31:17	222:26:30	14.91715083
-1	66	1081	-4E-05	526	14.031	-3.33229E-05	-0.94	0.00211695	59.95	18.71	23.71	4/9/04 14:46	247:04:17	246:59:30	15.71850466

DESORPTION TERMINATED 4/9/2004 DUE TO NO MORE GAS BEING EVOLVED; sample air dried for 17 days

SAMPLE: 1156' to 1158' (Weir-Pittsburg coal) cuttings in Dart SSD canister

	lbs.	grams
dry sample weight:	0.6138	278.42

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)
39	off bottom	at surface	in canister
	3/30/04 6:18	3/30/04 8:20	3/30/04 8:23
			4.9 minutes
			0.081 hours
			0.285287379 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)
236	63	1088	0.0083	523	14.122	0.007960538	225.42	0.007960538	225.42	25.94	30.43	3/30/04 20:23	12:04:23	11:59:30	3.474630276
108	64	1088	0.0038	524	14.122	0.003836006	102.96	0.011596544	328.38	37.79	42.27	3/31/04 14:25	30:06:23	30:01:30	5.486928912
74	69	1084	0.0026	529	14.070	0.002456717	69.62	0.014055261	398.00	45.80	50.28	4/1/04 9:55	49:36:23	49:31:30	7.043180311
52	65	1089	0.0018	525	14.135	0.001748941	49.52	0.015804202	447.52	51.50	55.98	4/2/04 11:26	75:07:23	75:02:30	8.667355742
36	66	1088	0.0013	526	14.122	0.001207394	34.19	0.017011595	481.71	55.43	59.92	4/3/04 17:15	104:56:23	104:51:30	10.24400909
19	65	1087	0.0007	525	14.109	0.000637682	18.06	0.017649458	499.78	57.51	62.00	4/4/04 15:32	127:13:23	127:08:30	11.27931982
21	65	1082	0.0007	525	14.044	0.000701763	19.87	0.018351221	519.85	59.79	64.28	4/5/04 21:21	157:02:23	158:57:30	12.53154908
13	67	1080	0.0005	527	14.018	0.000431976	12.23	0.018783197	531.66	61.20	65.69	4/6/04 14:26	174:09:23	174:04:30	13.19683253
16	68	1076	0.0006	528	13.966	0.000526691	14.97	0.019311887	546.65	62.92	67.41	4/7/04 14:04	197:45:23	197:40:30	14.08258827
11	67	1082	0.0004	527	14.044	0.000368195	10.37	0.019678082	557.22	64.12	68.61	4/8/04 14:13	221:54:23	221:49:30	14.89652271
11	66	1081	0.0004	526	14.031	0.000386552	10.38	0.020044635	567.60	65.31	69.80	4/9/04 14:47	246:26:23	246:23:30	15.69946036
2	62	1087	7E-05	522	14.109	6.75293E-05	1.91	0.020112164	569.51	65.53	70.02	4/10/04 16:28	272:09:23	272:04:30	16.49716306
3	62	1086	0.0001	522	14.098	0.000101201	2.87	0.020213365	572.38	65.86	70.35	4/12/04 14:46	318:27:23	318:22:30	17.84534642
4	61	1088	0.0001	521	14.122	0.000135442	3.84	0.020348807	576.21	66.30	70.79	4/13/04 14:12	341:53:23	341:48:30	18.4902602
6	62	1085	0.0002	522	14.083	0.000202215	5.73	0.020551022	581.94	66.96	71.45	4/14/04 14:08	365:49:23	365:44:30	19.12650139
10	64	1076	0.0004	524	13.986	0.000332954	9.43	0.020883976	591.37	68.05	72.53	4/15/04 14:26	390:07:23	390:02:30	19.75153299
9	68	1078	0.0003	526	13.992	0.000297941	8.44	0.021181917	599.80	69.02	73.51	4/16/04 13:53	413:34:23	413:29:30	20.33649566
8	71	1081	0.0003	531	14.031	0.000264073	7.48	0.02144599	607.26	69.88	74.37	4/17/04 19:30	443:11:23	443:06:30	21.05207168
7	71	1079	0.0002	531	14.005	0.000230637	6.53	0.021676627	613.81	70.63	75.12	4/18/04 18:01	463:42:23	463:37:30	21.53384287
3	68	1088	0.0001	528	14.122	0.000100235	2.84	0.021776862	616.65	70.98	75.44	4/19/04 14:02	485:43:23	485:38:30	22.03912556

11	71	1071	0.0004	531	13.901	0.000359742	10.19	0.022136804	626.84	72.13	76.62	4/20/04	12:57	508:38:23	508:33:30	22.55304242
5	68	1075	0.0002	528	13.953	0.000165062	4.67	0.022301866	631.51	72.87	77.15	4/21/04	13:13	532:54:23	532:49:30	23.0847653
3	68	1080	0.0001	526	14.018	9.9498E-05	2.82	0.022401164	634.33	72.99	77.48	4/22/04	16:15	559:56:23	559:51:30	23.6830455
-1	66	1088	-4E-05	526	14.122	-3.35387E-05	-0.95	0.022367625	633.38	72.88	77.37	4/23/04	14:21	582:02:23	581:57:30	24.12549942
6	69	1078	0.0002	529	13.992	0.000198252	5.61	0.022565877	638.99	73.53	78.01	4/24/04	12:09	603:50:23	603:45:30	24.57315043
1	66	1090	4E-05	526	14.148	3.36004E-05	0.95	0.022599478	639.94	73.64	78.12	4/26/04	11:17	650:58:23	650:53:30	25.51417362
4	65	1087	0.0001	525	14.109	0.000134287	3.80	0.022733764	643.75	74.07	78.56	4/27/04	12:32	676:13:23	676:08:30	26.00428918
9	68	1072	0.0003	528	13.914	0.000296283	8.39	0.023030047	652.14	75.04	79.53	4/28/04	15:28	703:09:23	703:04:30	26.51709616
2	68	1079	7E-05	528	14.005	8.62706E-05	1.88	0.023096318	654.01	75.26	79.74	4/29/04	14:27	726:08:23	726:03:30	26.94897983
2	66	1088	7E-05	528	14.122	6.70774E-05	1.90	0.023163395	655.91	75.47	79.96	5/1/04	17:42	777:23:23	777:18:30	27.88170946
1	64	1084	4E-05	524	14.070	3.35429E-05	0.95	0.023196938	656.86	75.58	80.07	5/3/04	18:39	826:20:23	826:15:30	28.74612534
4	66	1081	0.0001	526	14.031	0.000133292	3.77	0.02333023	660.64	76.02	80.51	5/5/04	9:35	885:16:23	865:11:30	29.41552406
4	69	1079	0.0001	529	14.005	0.000132291	3.75	0.023462521	664.38	78.45	80.94	5/8/04	10:52	890:33:23	890:28:30	29.84219142
3	71	1084	0.0001	531	14.070	9.93023E-05	2.81	0.023561823	667.19	76.77	81.26	5/7/04	13:27	917:08:23	917:03:30	30.28431479
4	70	1080	0.0001	530	14.018	0.000132163	3.74	0.023693986	670.94	77.20	81.69	5/8/04	14:25	942:06:23	942:01:30	30.69375163
5	71	1078	0.0002	531	13.992	0.000184588	4.66	0.023858574	675.60	77.74	82.23	5/9/04	19:47	971:28:23	971:23:30	31.16846252
2	71	1081	7E-05	531	14.031	6.60183E-05	1.87	0.023924592	677.47	77.95	82.44	5/10/04	13:50	989:31:23	989:26:30	31.45668539
4	71	1077	0.0001	531	13.979	0.000131548	3.73	0.02405614	681.19	78.38	82.87	5/11/04	14:10	1013:51:23	1013:46:30	31.84111162
4	72	1076	0.0001	532	13.968	0.000131179	3.71	0.024187319	684.91	78.81	83.30	5/12/04	10:35	1034:16:23	1034:11:30	32.16011591
0	72	1081	0	532	14.031	0	0.00	0.024187319	684.91	78.81	83.30	5/13/04	14:20	1062:01:23	1061:56:30	32.58869521
-5	65	1088	-0.0002	525	14.122	-0.000168013	-4.78	0.024019306	680.15	78.26	82.75	5/15/04	23:20	1119:01:23	1118:56:30	33.45180198
3	68	1082	0.0001	528	14.044	9.96822E-05	2.82	0.024118988	682.97	78.59	83.08	5/17/04	9:34	1153:15:23	1153:10:30	33.95962881
2	70	1083	7E-05	530	14.057	6.62652E-05	1.88	0.024185254	684.85	78.80	83.29	5/18/04	14:29	1182:10:23	1182:05:30	34.38274357
5	72	1081	0.0002	532	14.031	0.000164738	4.68	0.024349989	689.51	79.34	83.83	5/20/04	13:49	1229:30:23	1229:25:30	35.06431789
4	73	1079	0.0001	533	14.005	0.000131298	3.72	0.024481287	693.23	79.77	84.26	5/21/04	13:49	1253:30:23	1253:25:30	35.40489216
6	72	1074	0.0002	532	13.940	0.000196403	5.56	0.02467769	698.79	80.41	84.90	5/23/04	14:58	1302:39:23	1302:34:30	36.09233144
2	73	1075	7E-05	533	13.953	6.54055E-05	1.85	0.024743095	700.64	80.62	85.11	5/24/04	10:22	1322:03:23	1321:58:30	36.36009336
-2	72	1080	-7E-05	532	14.018	-6.58333E-05	-1.68	0.024677262	698.78	80.41	84.89	5/25/04	11:49	1347:30:23	1347:25:30	36.70839671
1	70	1075	4E-05	530	13.953	3.28879E-05	0.93	0.02471015	699.71	80.51	85.00	5/26/04	12:34	1372:15:23	1372:10:30	37.04397912
3	70	1070	0.0001	530	13.888	9.82047E-05	2.78	0.024808354	702.49	80.83	85.32	5/27/04	11:11	1394:52:23	1394:47:30	37.34799935
-1	72	1078	-4E-05	532	13.992	-3.28557E-05	-0.93	0.024775499	701.56	80.73	85.21	5/28/04	13:10	1420:51:23	1420:46:30	37.69424875
4	71	1069	0.0001	531	13.875	0.000130571	3.70	0.02490607	705.26	81.15	85.64	5/29/04	14:18	1445:59:23	1445:54:30	38.02617154
3	71	1067	0.0001	531	13.849	9.7745E-05	2.77	0.025003815	708.03	81.47	85.96	5/30/04	12:43	1468:24:23	1468:19:30	38.31979109
-2	70	1077	-7E-05	530	13.979	-6.58981E-05	-1.87	0.024937917	708.18	81.26	85.74	8/1/04	10:47	1514:28:23	1514:23:30	38.91623126
-3	70	1085	-0.0001	530	14.083	-9.95814E-05	-2.82	0.024838335	703.34	80.93	85.42	6/2/04	13:33	1541:14:23	1541:09:30	39.25862609
-2	70	1090	-7E-05	530	14.148	-6.66935E-05	-1.89	0.024771842	701.45	80.71	85.20	6/3/04	11:07	1562:48:23	1562:43:30	39.53234611
2	71	1087	7E-05	531	14.109	6.63847E-05	1.88	0.024838026	703.33	80.93	85.42	6/4/04	13:41	1589:22:23	1589:17:30	39.86694189

DESORPTION TERMINATED 6/4/2004 DUE TO NO MORE GAS BEING EVOLVED; sample air dried for 14 days

Dart Cherokee Basin #B3-23 Huser, 23-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

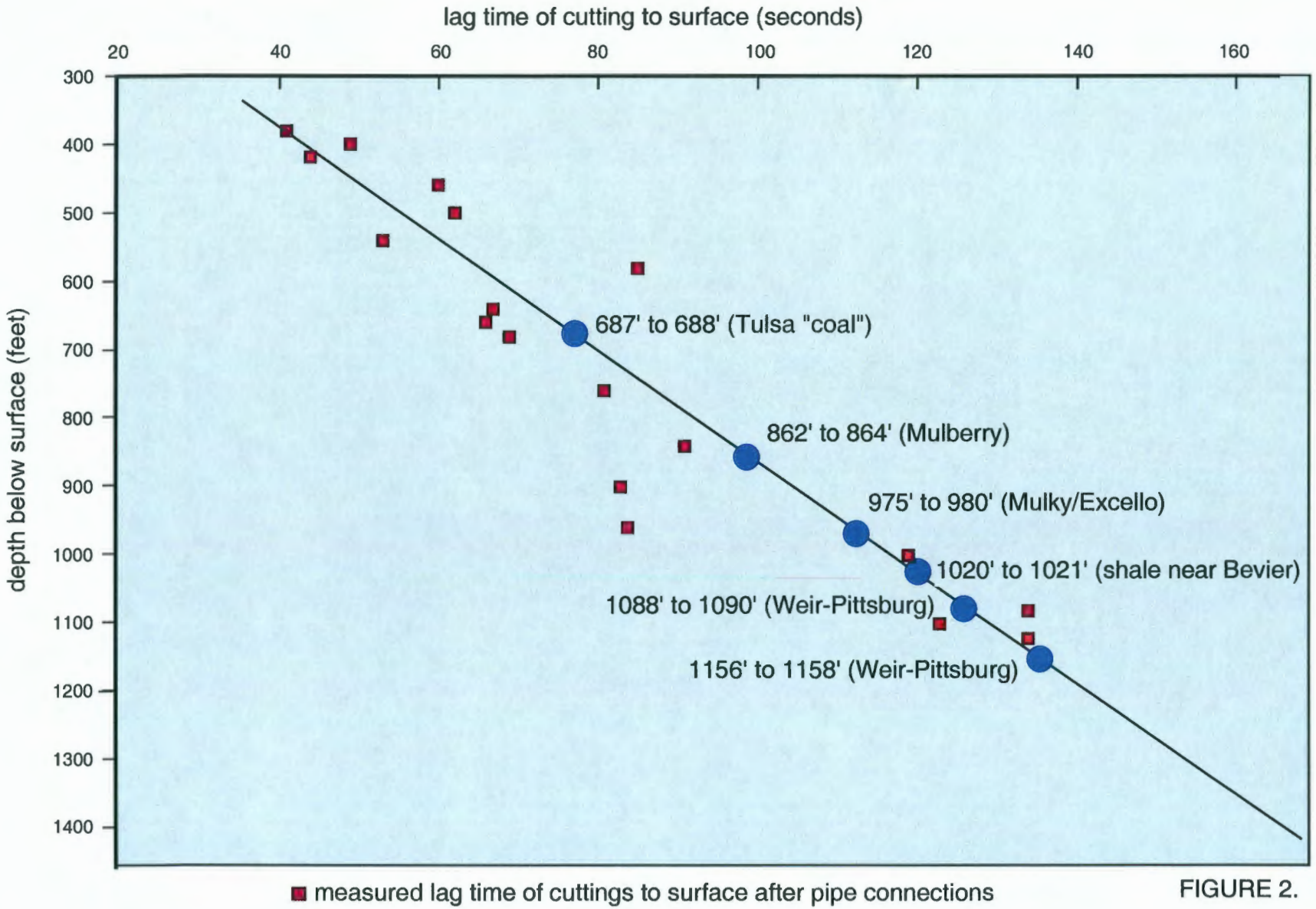
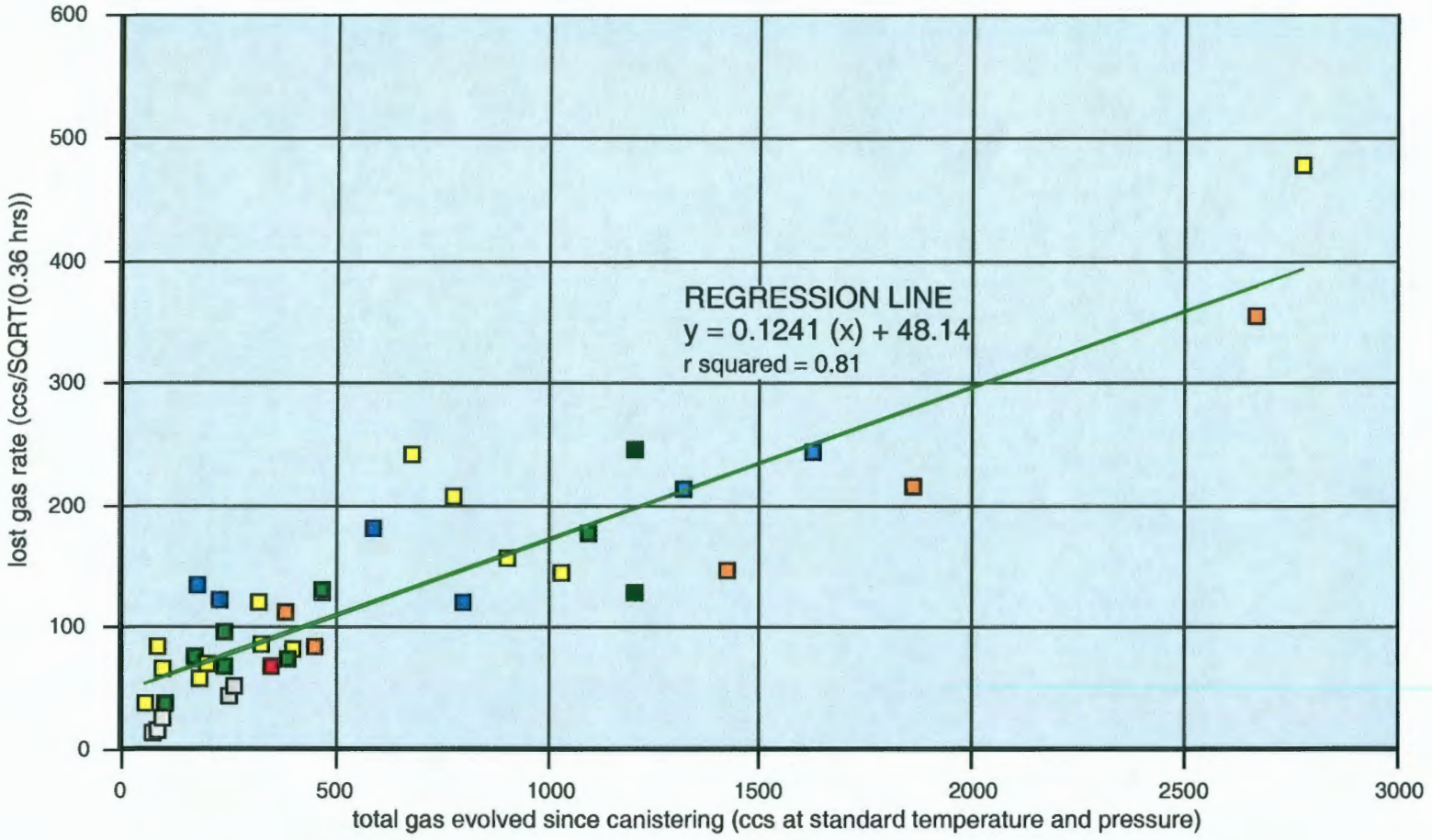
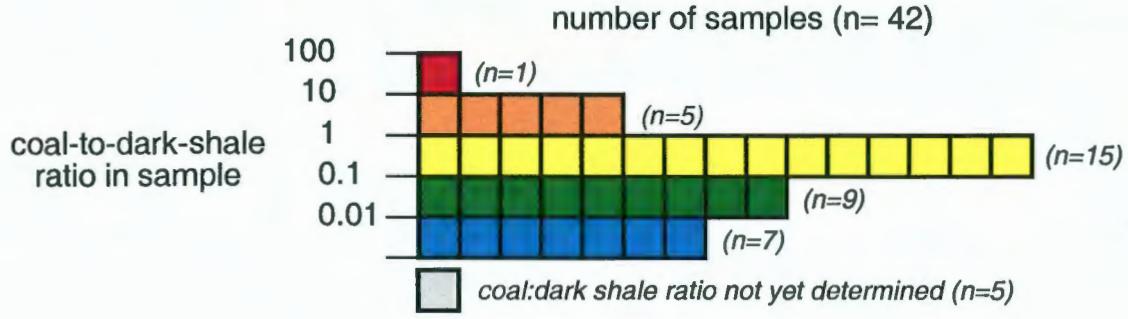


FIGURE 2.

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 #B3-23 Huser, 23-T.30S.-R.14E., Wilson County, KS

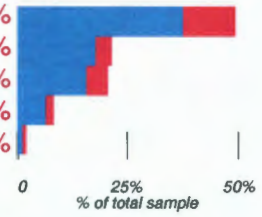
LITHOLOGIC COMPONENT SENSITIVITY ANALYSIS for calculation of gas content of Tulsa "coal" from 687' to 688'

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

total gas desorbed
(including estimated lost gas) = 115.8 ccs

TOTAL DRY WEIGHT OF SAMPLE = 241.46 grams
$\text{weight}_{light\text{-}colored\ lithologies}$ = 54.93 grams (22.8%)
$\text{weight}_{dark\ shale}$ = 186.53 grams (77.3%)
weight_{coal} = 0.00 grams (0.0%)

sieve size	*grams*	*% coal / % dark shale / % light-colored liths*
>0.0930"	117.96	0.00% / 75.96% / 24.04%
>0.0661"	50.91	0.00% / 82.82% / 17.18%
>0.0460"	48.86	0.00% / 76.21% / 23.79%
>0.0331"	19.28	0.00% / 78.26% / 21.74%
<0.0331"	4.45	0.00% / 55.00% / 45.00%
	241.46 TOTAL	



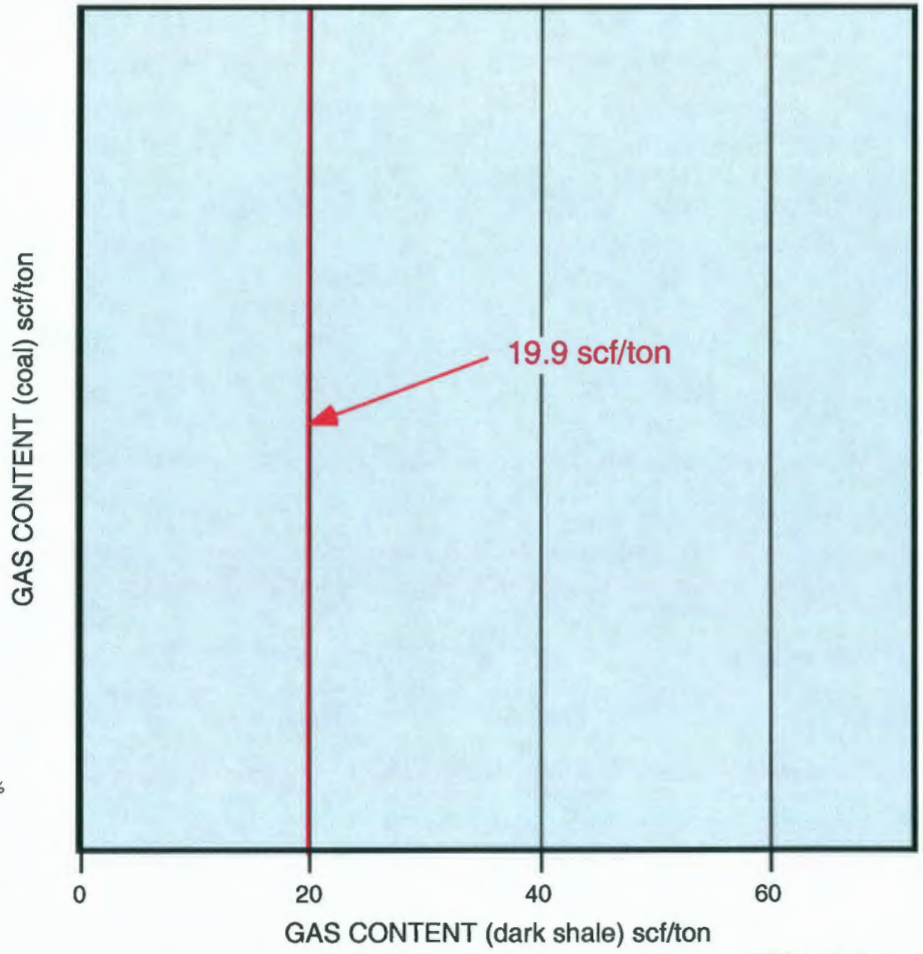


FIGURE 4.

Desorption Characteristics of Cuttings Samples

Dart Cherokee Basin #B3-23 Huser, 23-T.30S.-R.14E., Wilson County, KS

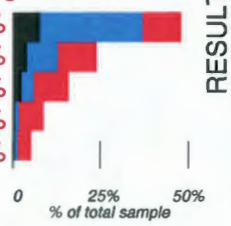
LITHOLOGIC COMPONENT SENSITIVITY ANALYSIS for calculation of gas content of Mulberry coal from 862' to 864'

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

total gas desorbed
(including estimated lost gas) = 170.1 ccs

TOTAL DRY WEIGHT OF SAMPLE = 365.13 grams
$\text{weight}_{light\text{-}colored\ lithologies}$ = 154.84 grams (42.4%)
$\text{weight}_{dark\ shale}$ = 159.20 grams (43.6%)
weight_{coal} = 51.09 grams (14.0%)

sieve size	*grams*	*% coal / % dark shale / % light-colored liths*
>0.0930"	173.19	15.54% / 61.34% / 23.13%
>0.0661"	85.82	16.10% / 37.27% / 46.63%
>0.0460"	56.95	14.44% / 22.38% / 63.18%
>0.0331"	30.97	3.96% / 14.85% / 81.19%
<0.0331"	18.21	5.00% / 20.00% / 75.00%
	365.13 TOTAL	



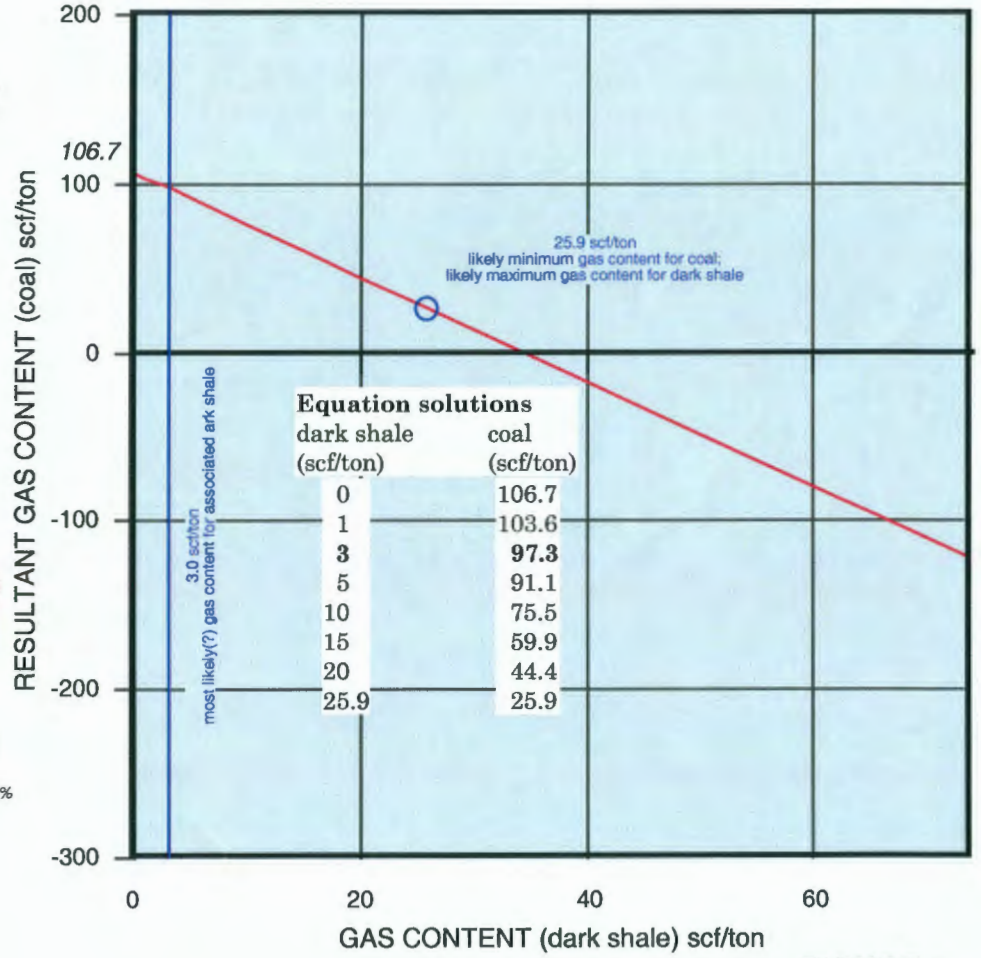


FIGURE 5.

Desorption Characteristics of Cuttings Samples

Dart Cherokee Basin #B3-23 Huser, 23-T.30S.-R.14E., Wilson County, KS

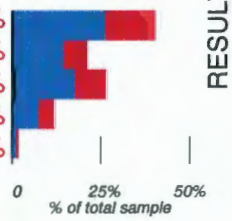
LITHOLOGIC COMPONENT SENSITIVITY ANALYSIS for calculation of gas content of Mulky coal/Excello Shale from 975' to 980'

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

total gas desorbed
(including estimated lost gas) = 516.8 ccs

TOTAL DRY WEIGHT OF SAMPLE = 484.93 grams
$\text{weight}_{light\text{-}colored\ lithologies}$ = 164.41 grams (33.9%)
$\text{weight}_{dark\ shale}$ = 309.84 grams (63.9%)
weight_{coal} = 10.69 grams (2.2%)

sieve size	*grams*	*% coal / % dark shale / % light-colored liths*
>0.0930"	192.05	1.26% / 64.05% / 34.69%
>0.0661"	101.29	1.88% / 66.35% / 31.77%
>0.0460"	125.93	3.55% / 63.27% / 33.18%
>0.0331"	56.61	2.86% / 60.95% / 36.19%
<0.0331"	9.05	3.00% / 60.00% / 37.00%
	484.93 TOTAL	



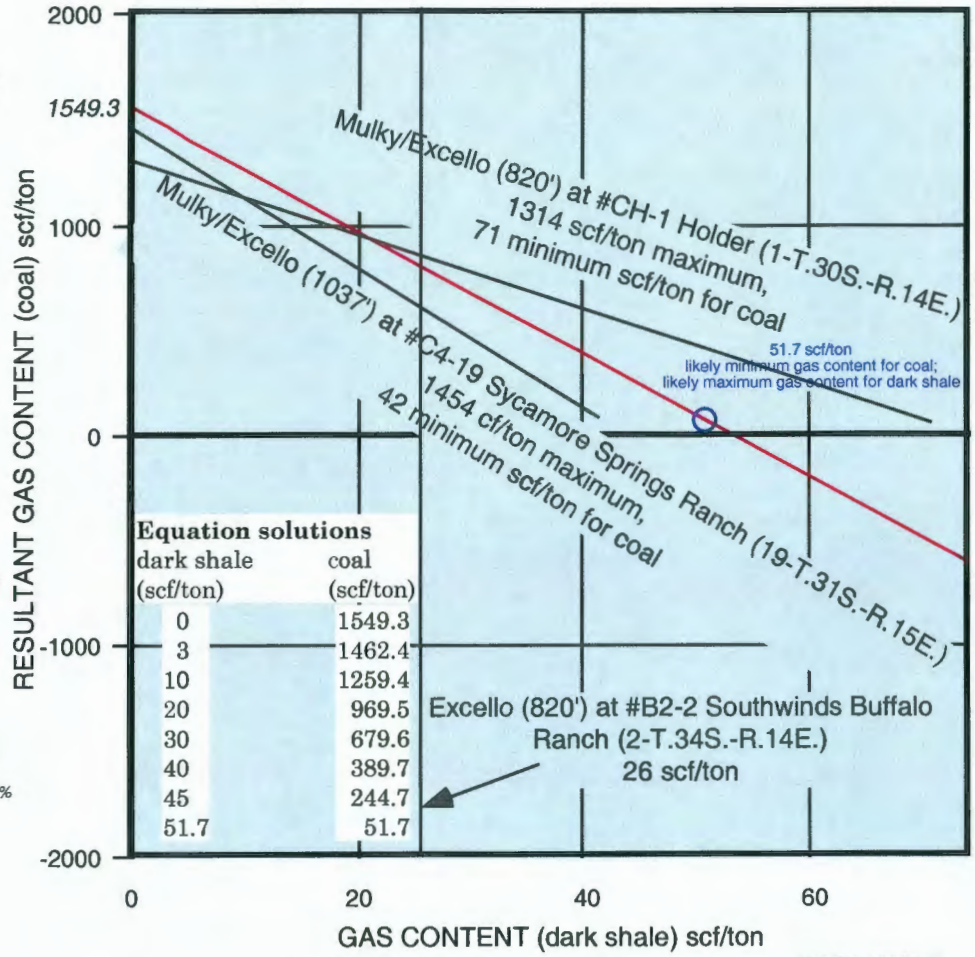


FIGURE 6.

Desorption Characteristics of Cuttings Samples

Dart Cherokee Basin #B3-23 Huser, 23-T.30S.-R.14E., Wilson County, KS

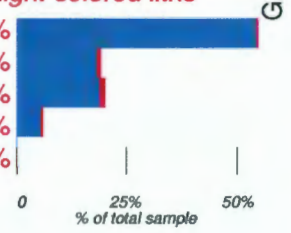
LITHOLOGIC COMPONENT SENSITIVITY ANALYSIS for calculation of gas content of shale associated with Bevier coal from 1021' to 1022'

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

total gas desorbed
(including estimated lost gas) = 38.9 ccs

TOTAL DRY WEIGHT OF SAMPLE = 511.48 grams
$\text{weight}_{light\text{-}colored\ lithologies}$ = 19.06 grams (3.7%)
$\text{weight}_{dark\ shale}$ = 492.42 grams (96.3%)
weight_{coal} = 0.00 grams (0.0%)

sieve size	*grams*	*% coal / % dark shale / % light-colored liths*
>0.0930"	278.20	0.00% / 98.97% / 1.03%
>0.0661"	97.25	0.00% / 94.45% / 5.55%
>0.0460"	101.82	0.00% / 93.30% / 6.70%
>0.0331"	29.95	0.00% / 88.83% / 11.17%
<0.0331"	4.26	0.00% / 85.00% / 15.00%
	511.48 TOTAL	



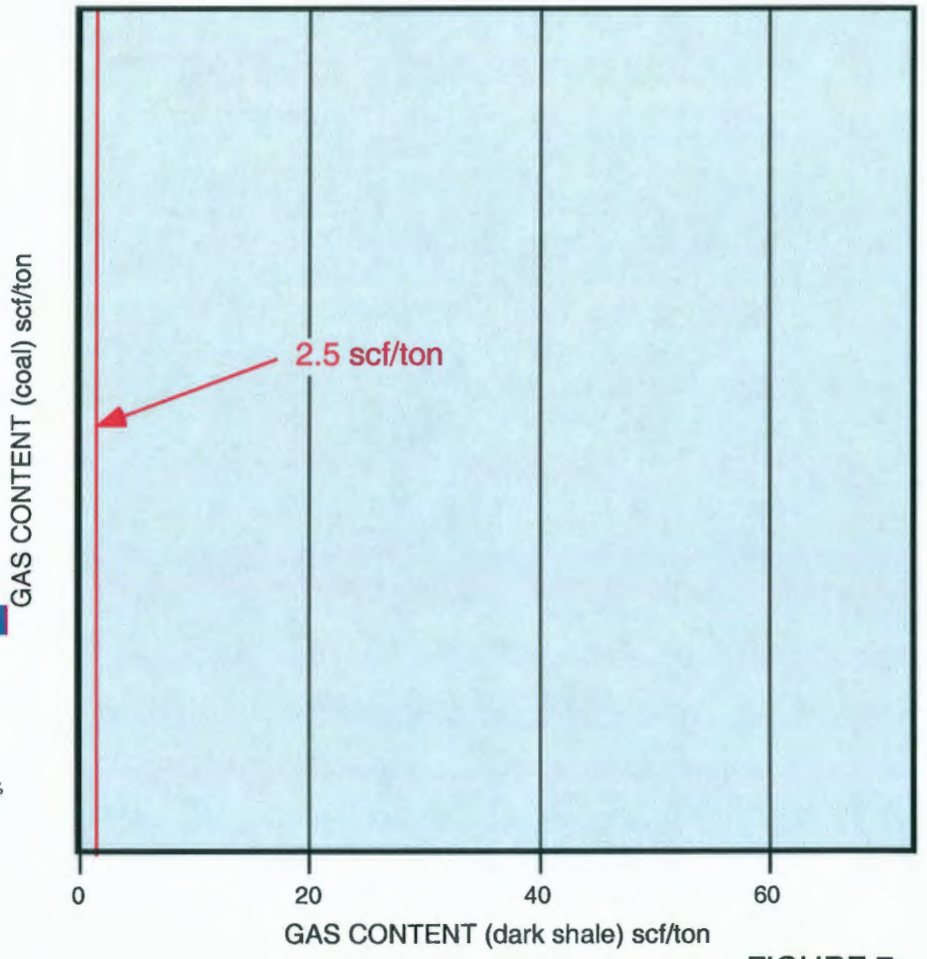


FIGURE 7.

Desorption Characteristics of Cuttings Samples

Dart Cherokee Basin #B3-23 Huser, 23-T.30S.-R.14E., Wilson County, KS

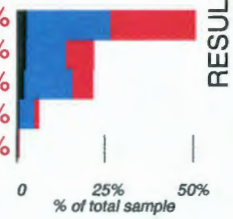
LITHOLOGIC COMPONENT SENSITIVITY ANALYSIS for calculation of gas content of Mineral coal from 1088' to 1090'

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

total gas desorbed
(including estimated lost gas) = 78.8 ccs

TOTAL DRY WEIGHT OF SAMPLE = 169.63 grams
$\text{weight}_{light\text{-}colored\ lithologies}$ = 67.01 grams (39.5%)
$\text{weight}_{dark\ shale}$ = 90.29 grams (53.2%)
weight_{coal} = 12.33 grams (7.3%)

sieve size	*grams*	*% coal / % dark shale / % light-colored liths*
>0.0930"	85.14	5.05% / 47.26% / 47.69%
>0.0661"	36.56	11.04% / 51.94% / 37.01%
>0.0460"	36.36	8.64% / 64.20% / 27.16%
>0.0331"	10.50	7.61% / 68.48% / 23.91%
<0.0331"	1.07	5.00% / 50.00% / 45.00%
	169.63 TOTAL	



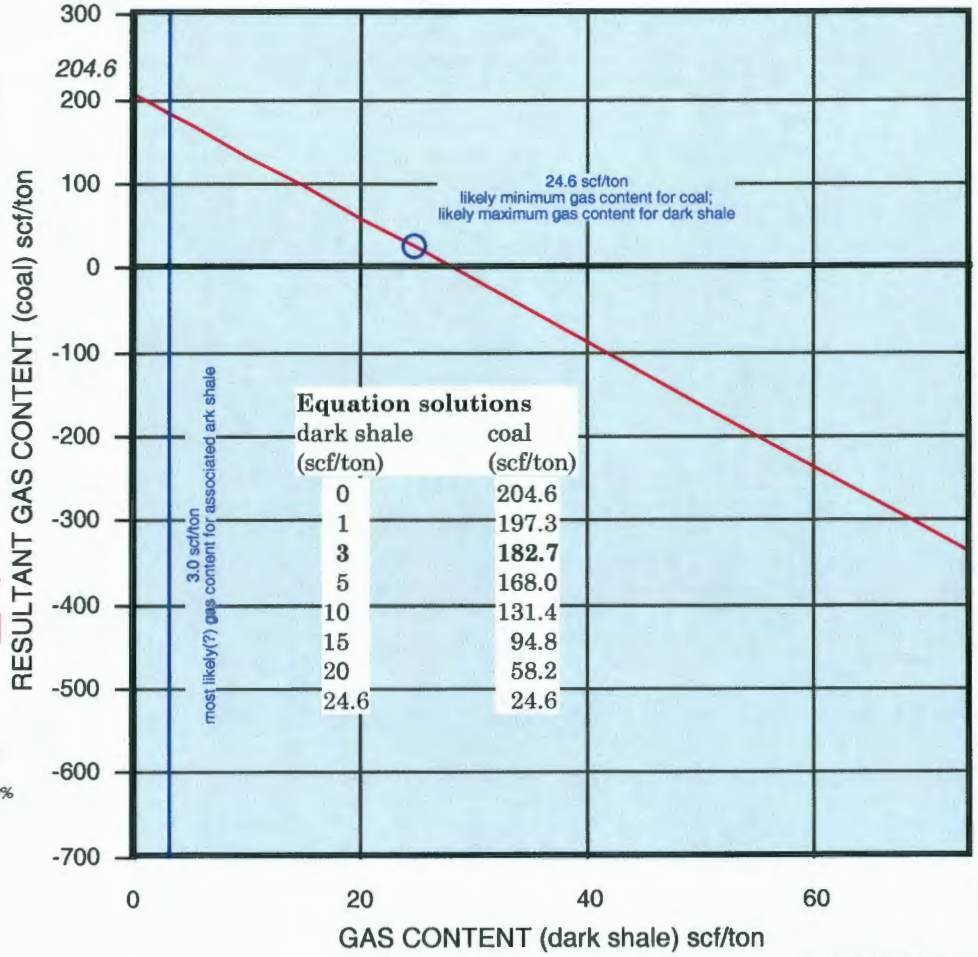


FIGURE 8.

Desorption Characteristics of Cuttings Samples

Dart Cherokee Basin #B3-23 Huser, 23-T.30S.-R.14E., Wilson County, KS

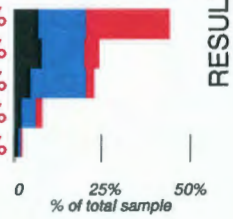
LITHOLOGIC COMPONENT SENSITIVITY ANALYSIS for calculation of gas content of Weir-Pittsburg coal from 1156' to 1158'

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

total gas desorbed
(including estimated lost gas) = 747.0 ccs

TOTAL DRY WEIGHT OF SAMPLE = 425.02 grams
$\text{weight}_{light\text{-}colored\ lithologies}$ = 146.60 grams (34.5%)
$\text{weight}_{dark\ shale}$ = 186.50 grams (43.9%)
weight_{coal} = 91.92 grams (21.6%)

sieve size	*grams*	*% coal / % dark shale / % light-colored liths*
>0.0930"	185.34	15.24% / 30.86% / 53.91%
>0.0661"	101.66	31.42% / 50.63% / 17.95%
>0.0460"	95.30	20.00% / 59.68% / 20.32%
>0.0331"	33.25	23.89% / 53.10% / 23.01%
<0.0331"	9.47	50.00% / 35.00% / 15.00%
	425.02 TOTAL	



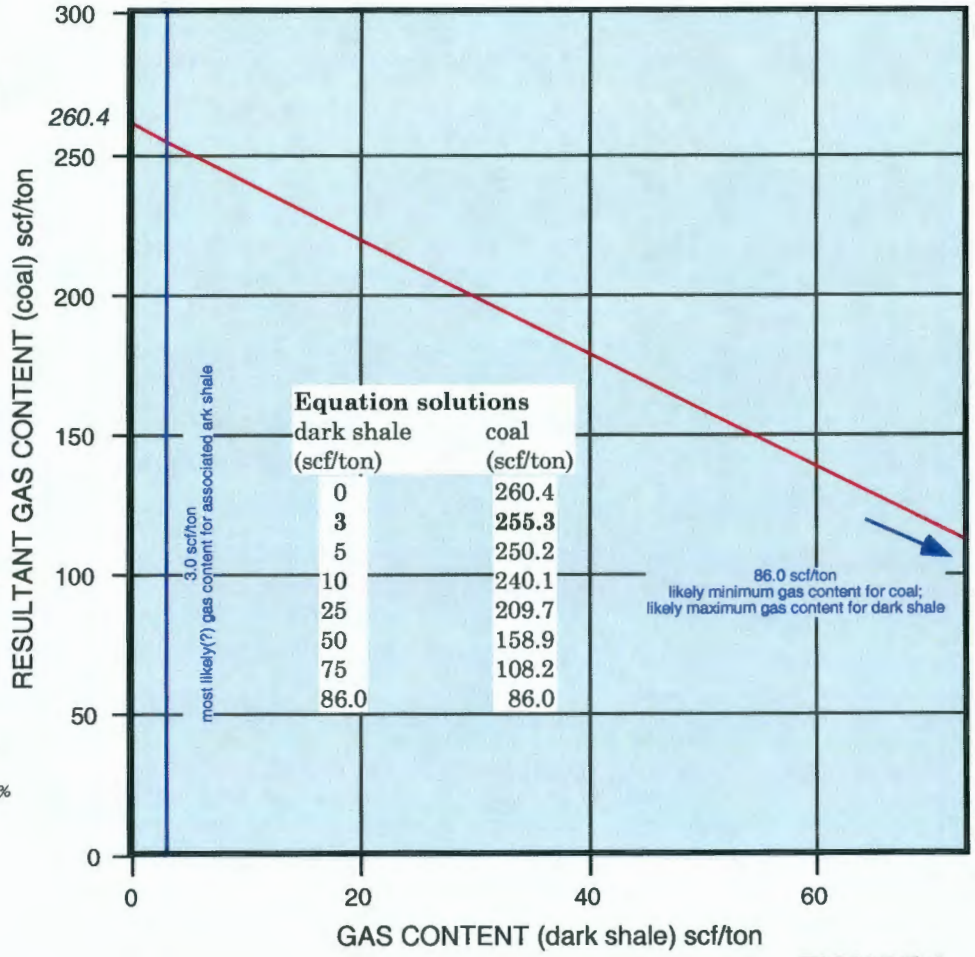


FIGURE 9.

Desorption Characteristics of Cuttings Samples

Dart Cherokee Basin #B3-23 Huser, 23-T.30S.-R.14E., Wilson County, KS

LITHOLOGIC COMPONENT SENSITIVITY ANALYSIS for all samples

surface

100'

200'

300'

400'

500'

687'-688' Tulsa "coal"

700'

800'

862'-864' Mulberry

900'

975'-980' Mulky/Excello

1021-1022' shale near Bevier

1088'-1090' Mineral

1156'-1158' Weir-Pittsburg

1200'

UNIT	coal in sample	scf/ton w/ shale @ 3 scf/ton	maximum scf/ton	minimum scf/ton
Tulsa "coal"	0%	----	----	19.9
Mulberry	14%	97.3	106.7	25.9
Mulky/Excello	2%	1462.4	1549.3	51.7
sh. near Bevier	0%	----	----	2.5
Mineral	7%	182.7	204.6	24.6
Weir-Pittsburg	22%	255.3	260.4	86.0

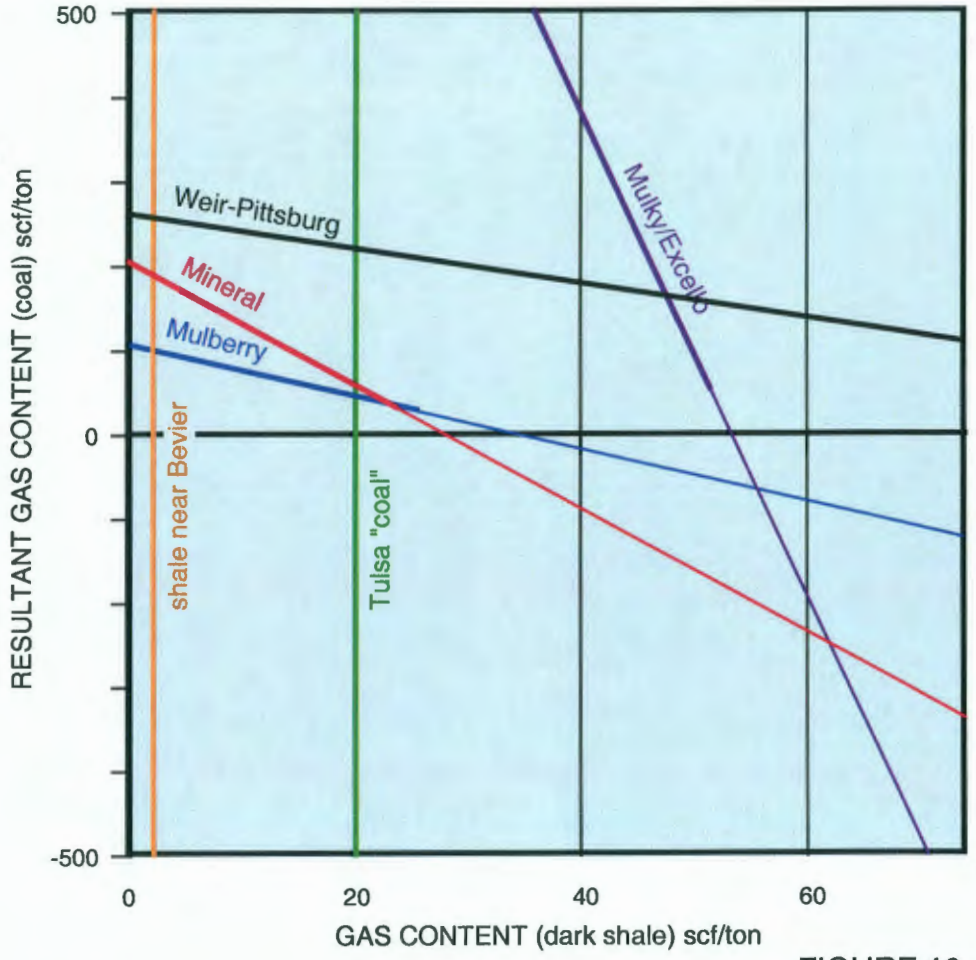


FIGURE 10.

Desorption Characteristics of Cuttings Samples

based on total weight of gas-generating lithologies (i.e., coal and dark shale) in sample
Dart Cherokee Basin #B3-23 Huser, 23-T.30S.-R.14E., Wilson County, KS

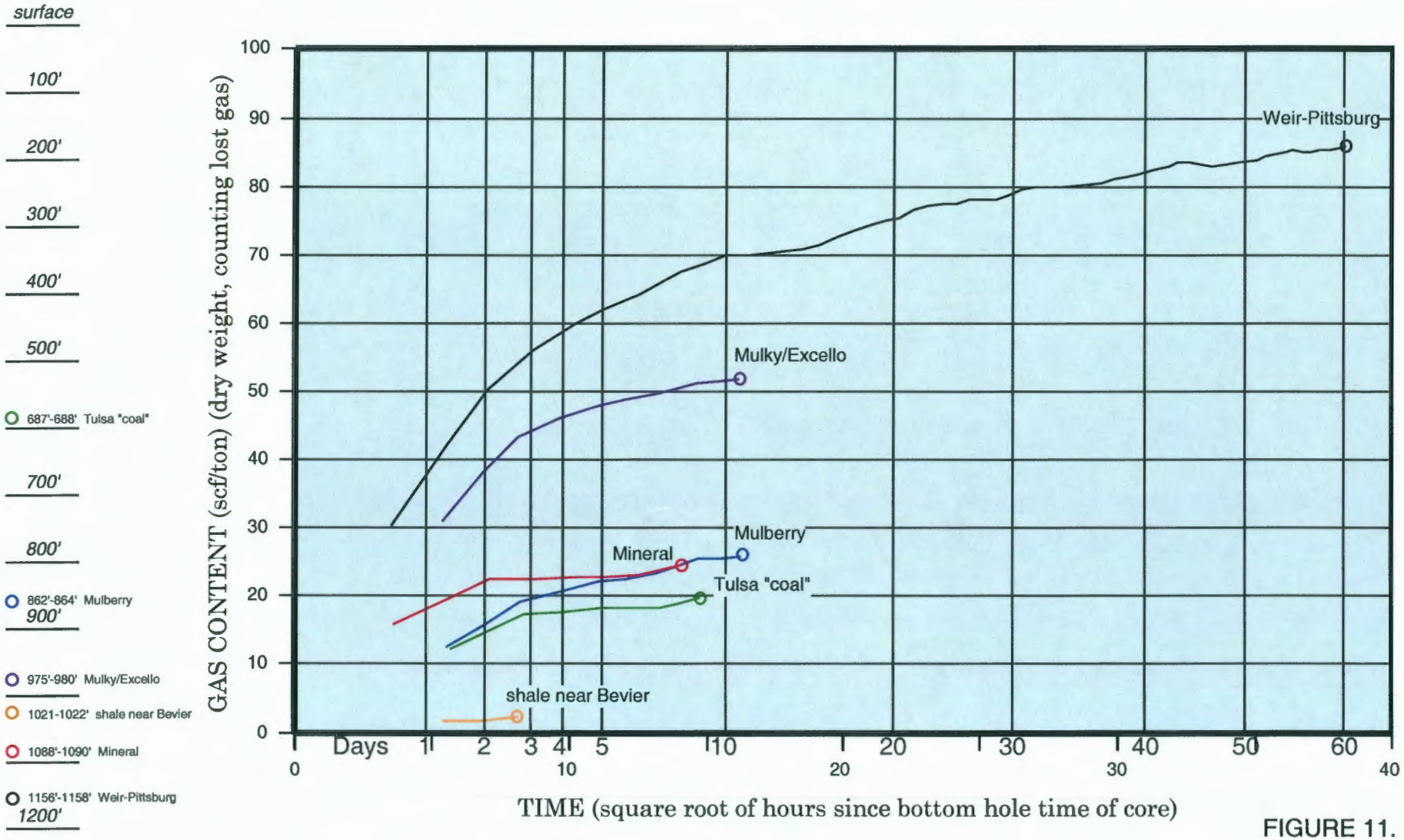


FIGURE 11.