ANALYSIS OF MARMATON AND CHEROKEE GROUP CUTTINGS SAMPLES FOR GAS CONTENT -- MERITAGE KCM #26-13 GARRISON SWD (NE SW 26-T.19S.-R.19E.), ANDERSON COUNTY, KANSAS

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SUMMARY

Nine cuttings samples from the Pennsylvanian Marmaton and Cherokee Group were collected from the Meritage KCM #26-13 Garrison SWD well in NE SW 26-T.19S.-R.19E. in Anderson County, KS:

- Mulberry coal at 673' to 676' depth
- shale above Summit at 755' to 758' depth[1]
- Summit "coal" at 760' to 762' depth[1]
- Bevier coal at 853' to 855' depth
- Mineral coal at 898 to 900' depth
- Riverton "A" coal at 1108' to 1110' depth
- Riverton "A" coal (sieved coarse) at 1113' to 1115' depth
- Riverton "A" coal (sieved fine) at 1113' to 1115' depth
- Riverton "B" coal at 1120' to 1122' depth

Assuming the dark shale that is usually admixed with the coal cuttings has approximately 3 scf/ton gas content, the samples calculated as having the following gas contents:

- Mulberry coal at 673' to 676' depth (35.1 scf/ton)
- shale above Summit at 755' to 758' depth[1] (3.3 scf/ton)
- Summit "coal" at 760' to 762' depth[1] (5.2 scf/ton)
- Bevier coal at 853' to 855' depth (17.7 scf/ton)
- Mineral coal at 898 to 900' depth (12.2 scf/ton)
- Riverton "A" coal at 1108' to 1110' depth (82.0 scf/ton)
- Riverton "A" coal (sieved coarse) at 1113' to 1115' depth[2] (85.1 scf/ton)
- Riverton "A" coal (sieved fine) at 1113' to 1115' depth[2] (85.1 scf/ton)
- Riverton "B" coal at 1120' to 1122' depth[3] (240.0 scf/ton)

[1]no coal in sample
[2]calculated using 4.5 scf/ton for admixed dark shale
[3]results uncertain due to only small amount of coal in sample

The most reliable result, which is largely controlled by the amount of coal in the cuttings, is from the Mulberry coal sample. The least constrained results are from the Riverton "B" sample, which had only 1.3% coal. The sample of the shale above the Summit "coal" and the Summit "coal" sample had no coal in them, nevertheless, they respectively contained 69% and 59% dark shale, thus their results were reasonable good. The results for the Bevier and Mineral, samples all carry some uncertainly because they contain less than 10% coal. The Riverton "A" coarse and fine samples respectively contained 20% and 11% coal, however, both of these samples and the Riverton "A" sample from 1108' to 1110' have internally consistent results that fortify the reliability of the calculations for the gas content for this coal.

BACKGROUND

The Meritage KCM #26-13 Garrison SWD well in NE SW 26-T.19S.-R.19E. well in (Anderson County, KS) well 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 January 2, 2003 by K. David Newell and Jonathan P. Lange of the Kansas Geological Survey, with well site collection aided by Lawrence A. Weis (consultant for Meritage KCM). Samples were obtained during normal drilling of the well, with no cessation of drilling before zones of interest (i.e., coals in the Marmaton and Cherokee Group) were penetrated. The well was drilled using an air rotary rig owned by MOKAT Drilling. Lag times for samples to reach the surface (important for assessing lost gas) were determined by periodically noting the time it took for cuttings to reach the surface following resumption of drilling after new pipe was added to the drill string.

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

- Mulberry coal at 673' to 676' depth (275 grams dry wt.)
- shale above Summit at 755' to 758' depth (460 grams dry wt.)
- Summit "coal" at 760' to 762' depth (2421 grams dry wt.)
- Bevier coal at 853' to 855' depth (1356 grams dry wt.)
- Mineral coal at 898 to 900' depth (924 grams dry wt.)
- Riverton "A" coal at 1108' to 1110' depth (622 grams dry wt.)
- Riverton "A" coal (sieved coarse) at 1113' to 1115' depth (1101 grams dry wt.)
- Riverton "A" coal (sieved fine) at 1113' to 1115' depth (126 grams dry wt.)
- Riverton "B" coal at 1120' to 1122' depth (456 grams dry wt.)

The cuttings samples were caught in a kitchen strainer at the air stream exit by the mud pit. The samples were washed in the kitchen strainer to rid them of drilling mud before they were placed in desorption canisters. A temperature bath for the desorption canisters was on site, with temperatures ranging between 66 and 69 degrees F. The canistered samples were later that day transported to the laboratory at the Kansas Geological Survey and desorption measurements were continued at 66 to 69 degrees F ambient temperature. Desorption measurements were periodically made until the canisters produced no more gas upon 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 simply reading the difference in water level using the volumetric scale on the side of the burette.

The desorption canisters were both home-made, using PVC pipe and plumbing materials available at hardware stores, and commercial, obtained from SSD, Inc. in Grand Junction, CO. On average, the canisters were approximately 12.5 inches high (32 cm), 3 1/2 inches (9 cm) in diameter, and enclosed a volume of approximately 150 cubic inches (2450 cm^3). In case of small sample size (generally sample weighing less than 300 grams dry wt.), a concrete plug was placed in the desorption canister to decrease the volume of free space within the canister. This volume of this plug was 77 cubic inches (1262 cm^3).

The desorbed gas that collected in the desorption canisters was periodically released into the volumetric displacement apparatus and measured as a function of time, temperature and atmospheric pressure.

The time and atmospheric pressure were measured in the field using a portable weather station (model BA928) marketed by Oregon Scientific (Tualatin, OR). The atmospheric pressure was displayed in millibars on this instrument, however, this measurement was not the actual barometric pressure, but rather an altitude-compensated barometric pressure automatically converted to a sea-level-equivalent pressure. In order to translate this measurement to actual atmospheric pressure, a regression correlation was determined over several weeks by comparing readings from the Oregon Scientific instrument to that from a pressure transducer in the Petrophysics Laboratory in the Kansas Geological Survey in Lawrence, Kansas (Figure 1). The regression equation shown graphically in Figure 1 was entered into a spreadsheet and was used to automatically convert the millibar measurement to barometric pressure in psi.

A spreadsheet program written by K.D. Newell (Kansas Geological Survey) was used to convert all gas volumes at standard temperature and pressure. Conversion of gas volumes to standard temperature and pressure was by application of the perfect-gas equation, obtainable from basic college chemistry texts:

$$n = PV/RT$$

where n is moles of gas, T is degrees Kelvin (i.e., absolute temperature), V is in liters, and R is the universal gas constant, which has a numerical value depending on the units in which it is measured (for example, in the metric system R = 0.0820 liter atmosphere per degree mole). The number of moles of gas (i.e., the value n) is constant in a volumetric conversion, therefore the conversion equation, derived from the ideal gas equation, is:

$$(P_{stp}V_{stp})/(RT_{stp}) = (P_{rig}V_{rig})/(RT_{rig})$$

Customarily, standard temperature and pressure for gas volumetric measurements in the oil industry are 60 °F and 14.7 psi (see Dake, 1978, p. 13), therefore P_{stp}, V_{stp}, and T_{stp}, respectively, are pressure, volume and temperature at standard temperature and pressure, where standard temperature is degrees Rankine (°R = 460 + °F). P_{rig}, V_{rig}, and T_{rig}, respectively, are ambient pressure, volume and temperature measurements taken at the rig site or in the desorption laboratory.

The universal gas constant R drops out as this equation is simplified and the determination of V_{stp} becomes:

$$V_{stp} = (T_{stp}/T_{rig})\ (P_{rig}/P_{stp})\ V_{rig}$$

The conversion calculations in the spreadsheet were carried out in the English metric system, as this is the customary measure system used in American coal and oil industry. V is therefore converted to cubic feet; P is psia; T is °R.

The desorbed gas was summed over the time period for which the coal samples evolved all of their gas. In the case of well cuttings from Meritage KCM #26-13 Garrison SWD well, the maximum time of desorption was 33 days.

Lost gas (i.e., the gas lost from the sample from the time it was drilled, brought to the surface, to the time it was canistered) was determined using the direct method (Kissel and others, 1975; also see McLennan and others, 1995, p. 6.1-6.14) in which the cumulative gas evolved is plotted against the square root of elapsed time. Time zero is assumed to be instant the cuttings sample is lifted from the bottom of the hole, or in the case of cuttings, when the drilled rock is cut and circulated off bottom. Characteristically, the cumulative gas evolved from the sample, when plotted against the square root of time, is linear for a short time period after the sample reaches ambient pressure conditions, therefore lost gas is determined by a line projected back to time zero. The period of linearity generally is about an hour for cuttings samples.

LITHOLOGIC ANALYSIS

As an experiment for comparison of desorption results, the Riverton "A" sample from 1113'-1115' depth was sieved into two size fractions before canistering at the well site. The coarser size fraction was composed of all cuttings >0.0930" in size. The finer size fraction was composed of cuttings >0.0930", but >0.0661" in size.

Upon removal from the canisters, cuttings were washed of drilling mud, and dried in an oven at 150 °F for 1 to 3 days. After drying (and with the exception of the already-sieved Riverton "A" sample from depth 1113'-1115' depth) 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. 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. The light-colored lithologies were discounted as gas-generating in the calculation of gas content.

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 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 3-11)
Gas lost prior to the canistering of the sample was estimated by extrapolation of the first few data points after the sample was canistered. The linear characteristic of the initial desorption measurements was usually lost within the first hour after canistering, thus data are presented in the lost-gas graphs for only up to one hour after canistering. Lost-gas volumes derived from this analysis are incorporated in the data tables described above.

"Lithologic Component Sensitivity Analyses" (Figures 12-20)
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 total amount of gas evolved from a cuttings sample can be expressed by the following equation:

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

A unique solution for *gas content*$_{coal}$ in this equation is not possible because *gas content*$_{\text{dark shale}}$ 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 visa versa. If there is little dark shale in a sample, a relatively well constrained answer for *gas content*$_{coal}$ can be obtained. Conversely, if considerable dark shale is in a sample, the gas content of a coal will be hard to precisely determine.

The lithologic-component-sensitivity-analysis diagram therefore expresses the bivariant nature inherent in the determination of gas content in mixed cuttings. The gas content of dark shales in Kansas can vary greatly. Proprietary desorption analyses of dark shales in cores from southeastern Kansas have registered as much as 50 scf/ton, but can be as low as 2-4 scf/ton. For a general understanding of the lithologic-component-sensitivity-analyses diagrams, the calculated *gas content*$_{coal}$ is given for assumed *gas content*$_{\text{dark shale}}$ at 30 scf/ton and 50 scf/ton. For most samples gathered in east-central and northeastern Kansas, the resultant *gas content*$_{coal}$ is a negative number for 30 scf/ton and 50 scf/ton *gas content*$_{\text{dark shale}}$. The only conclusion is that the *gas content*$_{\text{dark shale}}$ or most samples taken from this region has to be lower than 30-50 scf/ton. Conversely though, to assume that all the gas evolved from a cuttings sample is derived solely from the coal would result in an erroneously high gas content for the coal.

In all the lithologic-component-sensitivity-analysis diagrams, a "break-even" point is noted where the gas content of the coal is equal to that of the dark shale. This "break-even" point corresponds to the minimum gas content assignable to the coal and maximum gas content assignable to the dark shale. It can also be thought of the scf/ton gas content of the cuttings sample minus the weight of any of the lighter-colored lithologies, which are assumed to have no inherent gas content.

Summary Component Analysis for all Samples (Figure 21)
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 22)
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.

RESULTS and DISCUSSION

No bona fide coal was in the shale sample (755'-758') taken above the Summit "coal", or at the Summit "coal" itself (760'-762'. Gas content was calculated for a very dark shale that was present in both of these samples. Other lithologies, which are not gas generating, include light-gray shales and limestones.

The Riverton "A" sample at 1108-1110' was originally intended to sample the dark shale above the Riverton coal rather than the coal itself, however, coal constituted 7.5% of this sample and thus the linear relationship of the coal and admixed dark shale (Figure 17) could be established.

The Riverton "A" coal from 1113' to 1115' was the subject of a sieving experiment at the well site in which a coarse fraction (0.0930") was canistered separately from a fine fraction (<0.0930" and >0.0661"). If finer-sized cuttings desorb faster than coarser-sized cuttings, one would expect that the finer-sized fraction would calculate to having less gas per ton than the coarser-sized fraction. However, the finer-sized fraction only yields less gas per ton than the coarser-sized fraction ONLY IF shale gas-content is assumed to be less than 4.5 scf/ton. At 3 scf/ton shale gas, the fine fraction yields about 6% less gas than the coarse fraction (i.e., 88.3 vs. 93.2 scf/ton). The simultaneous solution for both size fractions is 4.5 scf/ton for shale and 85.1 scf/ton for coal (Figure 18).

The Riverton "B" sample at 1120-1122' only contained 1.5% coal. Due to this small amount of coal and the minuscule amount of gas evolved, the solution to the linear relationship of the coal and its admixed dark shale carries much uncertainty (Figure 19). When the 1120-1122' line is plotted against the linear solutions for the 1108-1110' and 1113-1115' samples (Figure 20), the solutions to these simultaneous equations (i.e., expressed as the points of intersection of these lines with the 1120-1122' line) are:

9.0 scf/ton (dark shale), 53.9 scf/ton (coal) for the 1108-1110' sample
8.7 scf/ton (dark shale), 64.7 scf/ton (coal) for the 1113-1115' sample

These unique solutions, however, are not necessarily valid though, due to the depth differences for the samples, and uncertainty inherent with small gas yield and low coal content in the 1120-1122' sample. One reasonable conclusion though is that the shale sampled with the Riverton "B" at 1120-1122' is capable of desorbing around 8 scf/ton, whereas shale higher up in around the Riverton "A" at 1108-1115' depth desorb less -- likely 4.5 scf/ton.

The Bevier and Mineral coal samples higher in the well desorbed only minor amounts of gas, respectively 17.7 and 12.2 scf/ton, assuming admixed shales desorb at 3 scf/ton (see Figure 21). The Mulberry had slightly greater gas content, assaying at 35.1 scf/ton. This sample had the least uncertainly associated with it (Figure 21), since it had the greatest amount of coal (60%) of all the samples obtained from this well.

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. Lost-gas graph for Mulberry coal at 673'-676' depth.
FIGURE 4. Lost-gas graph for shale above Summit "coal" at 755'-758' depth.
FIGURE 5. Lost-gas graph for Summit "coal" at 760'-762' depth.
FIGURE 6. Lost-gas graph for Bevier coal at 853'-855' depth.
FIGURE 7. Lost-gas graph for Mineral coal at 898-900'.
FIGURE 8. Lost-gas graph for Riverton "A" coal at 1108'-1110' depth.
FIGURE 9. Lost-gas graph for Riverton "A" coal (coarse fraction) at 1113'-1115' depth.
FIGURE 10. Lost-gas graph for Riverton "A" coal (fine fraction) at 1113'-1115' depth.
FIGURE 11. Lost-gas graph for Riverton "B" coal at 1120'-1122' depth.

FIGURE 12. Sensitivity analysis for Mulberry coal at 673'-676' depth.
FIGURE 13. Sensitivity analysis for shale above Summit "coal" at 755'-758' depth.
FIGURE 14. Sensitivity analysis for Summit "coal" at 760'-762' depth.
FIGURE 15. Sensitivity analysis for Bevier coal at 853'-855' depth.
FIGURE 16. Sensitivity analysis for Mineral coal at 898-900'.
FIGURE 17. Sensitivity analysis for Riverton "A" coal at 1108'-1110' depth.
FIGURE 18. Sensitivity analysis for Riverton "A" coal (coarse and fine fractions) at 1113'-1115' depth.

FIGURE 19. Sensitivity analysis for Riverton "B" coal at 1120'-1122' depth.
FIGURE 20. Sensitivity analysis for all Riverton coal samples.

FIGURE 21. Lithologic component sensitivity analyses for all samples.

FIGURE 22. Desorption graph for all samples.

Correlation of Field Barometer to KGS Petrophysics Lab Barometer

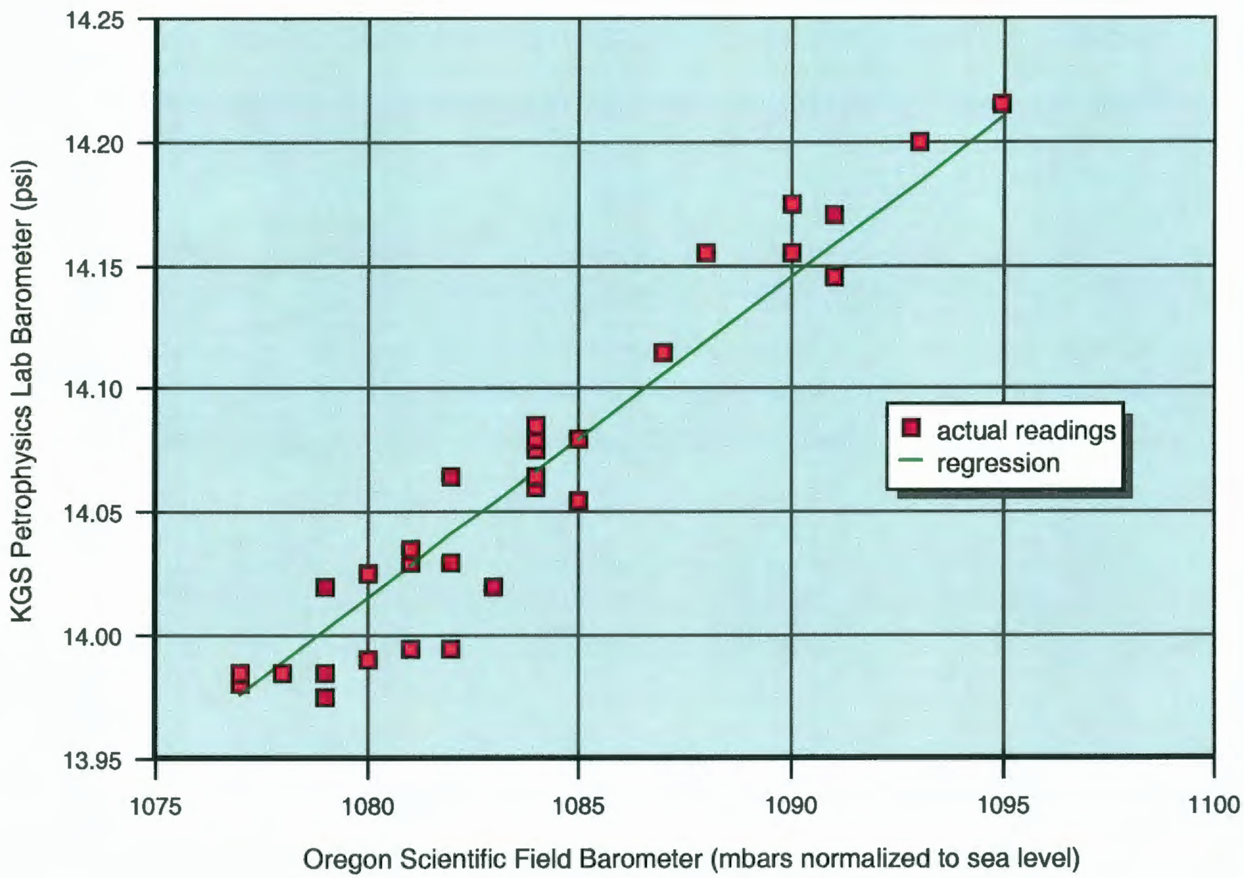


FIGURE 1.

Meritage KCM #26-13 Garrison SWD; NE NW sec. 26-T.19S.-R.19E., Anderson County, KS
lag-time to surface for well cuttings

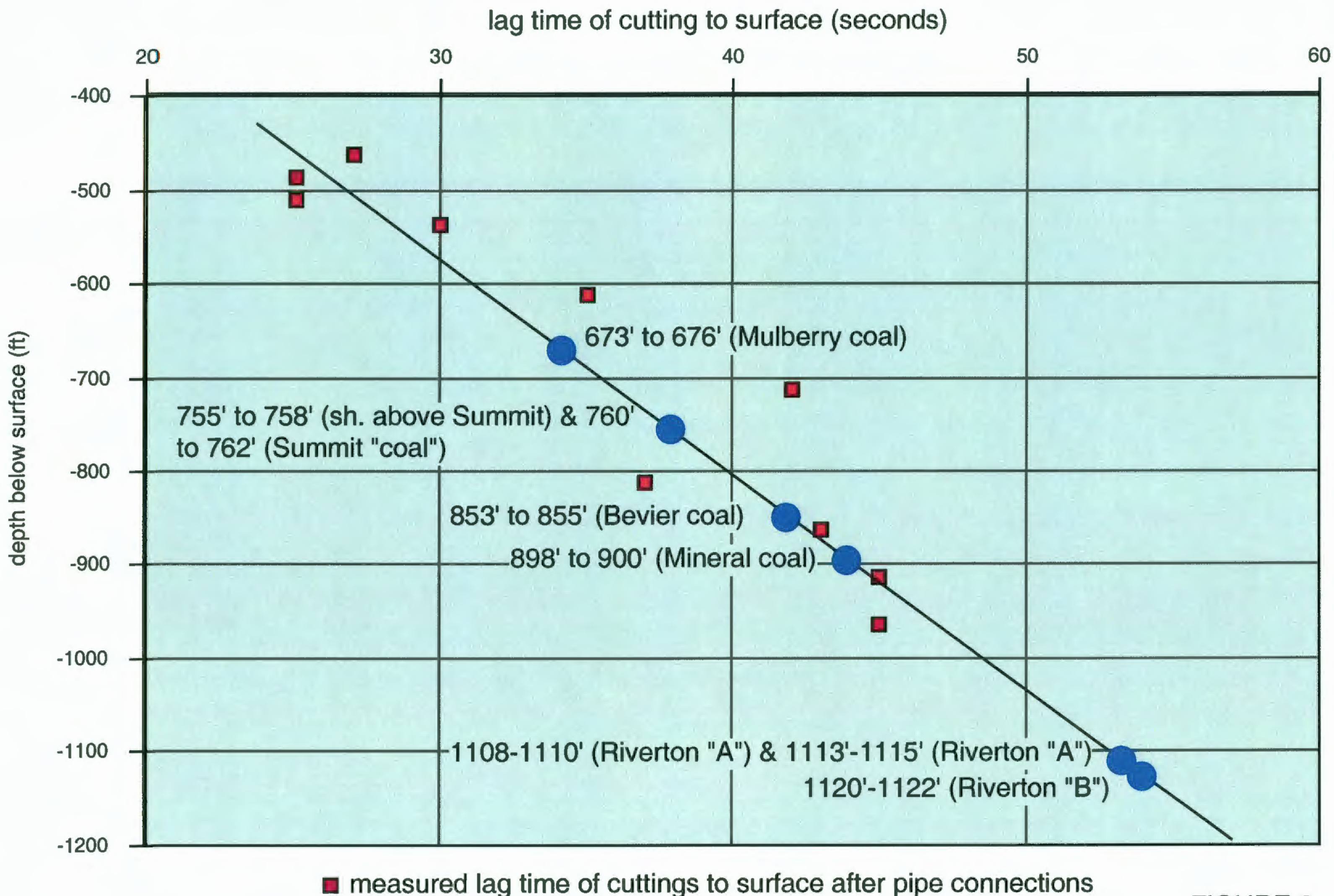


FIGURE 2.

Meritage KCM Garrison #26-13, NE SW 26-T.19S.-R.19E.

SAMPLE: 673' to 676' (Mulberry coal) in canister Brady 27

DENSITIES:

DRY WEIGHT lbs. grams

sample weight: 0.3933 178.403

est. lost gas (cc) = 25

TIME OF: off bottom 1/2/03 13:04; in canister (at surface) 1/2/03 13:06

1/2/03 13:04 elapsed time (off bottom to canistering) 1.8 minutes; 0.031 hours; 0.174801475 SQRT (hrs)

CONVERSION OF VOLUMES TO STP

RIG MEASUREMENTS			CONVERSION OF RIG MEASUREMENTS TO STP (cubic ft; @60 degrees; @14.7 psi)					CUMULATIVE VOLUMES		SCF/TON	SCF/TON		TIME SINCE		
measured cc	measured T (F)	measured P	cubic ft (@rig)	ABSOLUTE T (F) (@rig)	psia (@rig)	cubic ft (@STP)	cc (@STP)	cubic ft (@STP)	cc (@STP)	without lost gas	with lost gas	TIME OF MEASURE	off bottom	in canister	SQRT hrs. (since off bottom)
16	66	1064	0.00056504	526	14.070	0.000534646	15.1394	0.000534646	15.1394	2.718694036	7.208115376	1/2/03 13:09	0:04:50	0:03:00	0.283623106
7	66	1064	0.0002472	526	14.070	0.000233908	6.62351	0.000766554	21.763	3.908122677	8.397544019	1/2/03 13:09	0:05:35	0:03:45	0.305050087
6	66	1064	0.00021189	526	14.070	0.000200492	5.67729	0.000969047	27.4402	4.92763294	9.417054282	1/2/03 13:11	0:07:20	0:05:30	0.34960295
3	66	1064	0.00010594	526	14.070	0.000100246	2.83865	0.001069293	30.2789	5.437366072	9.926809414	1/2/03 13:13	0:09:20	0:07:30	0.394405319
7	66	1084	0.0002472	526	14.070	0.000233908	6.62351	0.001303201	36.9024	6.626816713	11.11623805	1/2/03 13:16	0:12:20	0:10:30	0.45338235
2	66	1084	7.063E-05	526	14.070	6.68308E-05	1.89243	0.001370032	38.7948	6.966653467	11.45607481	1/2/03 13:19	0:15:20	0:13:30	0.50552503
4	66	1084	0.00014126	526	14.070	0.000133662	3.76486	0.001503693	42.5797	7.646326976	12.13574832	1/2/03 13:22	0:17:50	0:18:00	0.545180906
2	66	1084	7.063E-05	526	14.070	6.68306E-05	1.89243	0.001570524	44.4721	7.986163731	12.47558507	1/2/03 13:25	0:21:20	0:19:30	0.598284794
2	67	1084	7.063E-05	527	14.070	6.6704E-05	1.88664	0.001637228	46.361	8.325355634	12.81477698	1/2/03 13:28	0:24:20	0:22:30	0.636832439
6	67	1084	0.00021189	527	14.070	0.000200112	5.66652	0.00183734	52.0275	9.342931343	13.83235268	1/2/03 13:32	0:28:35	0:26:45	0.690209306
2	67	1084	7.063E-05	527	14.070	6.6704E-05	1.88884	0.001904044	53.9163	9.682123246	14.17154459	1/2/03 13:36	0:31:50	0:30:00	0.728392446
3	66	1084	0.00010594	528	14.070	9.98665E-05	2.82789	0.002003911	56.7442	10.18994749	14.67936883	1/2/03 13:43	0:39:20	0:37:30	0.809663853
4	66	1064	0.00014126	528	14.070	0.000133155	3.77052	0.002137066	60.5147	10.86704648	15.35646782	1/2/03 13:46	0:43:50	0:42:00	0.854725427
3	66	1084	0.00010594	528	14.070	9.96665E-05	2.82789	0.002236932	63.3426	11.37487072	15.86429206	1/2/03 13:51	0:47:05	0:45:15	0.885845484
7	69	1084	0.0002472	529	14.070	0.000232581	6.58595	0.002469514	69.9286	12.55755401	17.04697536	1/2/03 14:05	1:01:20	0:59:30	1.011050059
7	69	1084	0.0002472	529	14.070	0.000232581	6.58595	0.002702095	76.5145	13.74023731	16.22965866	1/2/03 14:25	1:20:50	1:19:00	1.160699023
27	69	1085	0.0009535	529	14.083	0.000897927	25.4264	0.003600022	101.941	18.30622403	22.79564538	1/2/03 15:40	2:35:50	2:34:00	1.611569987
-4	69	1085	-0.0001413	529	14.083	-0.00013303	-3.7669	0.003466996	98.174	17.62978156	22.1192029	1/2/03 16:04	2:59:50	2:58:00	1.731248747
2	69	1085	7.063E-05	529	14.083	6.65131E-05	1.88343	0.003533509	100.057	17.9680028	22.45742414	1/2/03 16:52	3:47:50	3:46:00	1.948646254
-17	45	1089	-0.0006004	505	14.135	-0.00059441	-16.832	0.002939096	83.2256	14.94539195	19.43461329	1/2/03 21:42	8:37:50	8:36:00	2.937780719
54	66	1087	0.001907	528	14.109	0.001802572	51.043	0.004741667	134.269	24.1115258	28.60094715	1/3/03 12:16	23:11:50	23:10:00	4.816349471
23	66	1077	0.00081224	528	13.979	0.000760699	21.5405	0.005502366	155.809	27.97970363	32.46912497	1/4/03 14:49	49:44:50	49:43:00	7.053171076
-12	69	1085	-0.0004236	529	14.083	-0.00039908	-11.301	0.005103266	144.508	25.95037619	30.43979754	1/5/03 15:05	74:00:50	73:59:00	8.603132504

DECANISTERED 1/09/03

SAMPLE: 755' to 758' (shale above Summit "coal") in canister Maggy 1

DRY WEIGHT lbs. grams

sample weight: 0.8966 315.97

est. lost gas (cc) = 8

TIME OF: off bottom 1/2/03 13:47; in canister (at surface) 1/2/03 13:50

1/2/03 13:48 elapsed time (off bottom to canistering) 2.9 minutes; 0.048 hours; 0.219215774 SQRT (hrs)

CONVERSION OF VOLUMES TO STP

RIG MEASUREMENTS			CONVERSION OF RIG MEASUREMENTS TO STP (cubic ft; @60 degrees; @14.7 psi)					CUMULATIVE VOLUMES		SCF/TON	SCF/TON		TIME SINCE		
measured cc	measured T (F)	measured P	cubic ft (@rig)	ABSOLUTE T (F) (@rig)	psia (@rig)	cubic ft (@STP)	cc (@STP)	cubic ft (@STP)	cc (@STP)	without lost gas	with lost gas	TIME OF MEASURE	off bottom	in canister	SQRT hrs. (since off bottom)
5	69	1064	0.00017657	529	14.070	0.00016613	4.70425	0.00016613	4.70425	0.476976224	1.288117774	1/2/03 13:53	0:05:53	0:03:00	0.313138237
1	69	1064	3.5315E-05	529	14.070	3.32259E-05	0.94085	0.000199355	5.6451	0.572371469	1.383513019	1/2/03 13:55	0:07:53	0:05:00	0.362476053
6	69	1064	0.00021189	529	14.070	0.000199355	5.6451	0.000398711	11.2902	1.144742938	1.955884487	1/2/03 14:04	0:16:53	0:14:00	0.530461015
0	69	1064	0	529	14.070	0	0	0.000396711	11.2902	1.144742938	1.955884487	1/2/03 14:06	0:19:06	0:16:15	0.564702478
1	69	1084	3.5315E-05	529	14.070	3.32259E-05	0.94085	0.000431937	12.231	1.240136183	2.051279732	1/2/03 14:10	0:22:53	0:20:00	0.61756691
2	69	1084	7.063E-05	529	14.070	6.64518E-05	1.8817	0.000498369	14.1127	1.430928672	2.242070222	1/2/03 14:24	0:36:23	0:33:30	0.778709759
3	69	1084	0.00010594	529	14.070	9.96777E-05	2.82255	0.000598066	16.9353	1.717114407	2.528255956	1/2/03 14:37	0:49:23	0:46:30	0.907224093
3	69	1084	0.00010594	529	14.070	9.96777E-05	2.82255	0.000697744	19.7578	2.003300141	2.814441691	1/2/03 14:57	1:09:53	1:07:00	1.079222972
5	69	1085	0.00017657	529	14.083	0.000166283	4.70859	0.000864027	24.4664	2.48071638	3.29185793	1/2/03 15:39	1:51:23	1:48:30	1.362493629
-3	69	1085	-0.0001059	529	14.083	-9.977E-05	-2.6252	0.000764257	21.6413	2.194266637	3.005408186	1/2/03 16:03	2:15:23	2:12:30	1.50212612
-1	69	1065	-3.531E-05	529	14.083	-3.3257E-05	-0.9417	0.000731001	20.6996	2.098783369	2.909924939	1/2/03 16:51	3:03:23	3:00:30	1.748253096
-40	45	1069	-0.0014126	505	14.135	-0.00139862	-39.604	-0.00066762	-18.905	-1.916808883	-1.105667333	1/2/03 21:43	7:55:23	7:52:30	2.814792276
26	66	1067	0.00098681	528	14.109	0.000934667	26.4667	0.000267048	7.56192	0.766723063	1.577864613	1/3/03 12:17	22:29:23	22:26:30	4.742332994

DECANISTERED 1/05/03

SAMPLE: 760' to 762' (Summit "coal") in canister Maggy 2

DRY WEIGHT lbs. grams

sample weight: 3.1493 1426.46

est. lost gas (cc) = 24

TIME OF: off bottom 1/2/03 13:51; in canister (at surface) 1/2/03 13:55

1/2/03 13:52 elapsed time (off bottom to canistering) 3.9 minutes; 0.065 hours; 0.254405625 SQRT (hrs)

CONVERSION OF VOLUMES TO STP

RIG MEASUREMENTS			CONVERSION OF RIG MEASUREMENTS TO STP (cubic ft; @60 degrees; @14.7 psi)					CUMULATIVE VOLUMES		SCF/TON	SCF/TON		TIME SINCE		
measured cc	measured T (F)	measured P	cubic ft (@rig)	ABSOLUTE T (F) (@rig)	psia (@rig)	cubic ft (@STP)	cc (@STP)	cubic ft (@STP)	cc (@STP)	without lost gas	with lost gas	TIME OF MEASURE	off bottom	in canister	SQRT hrs. (since off bottom)
3	69	1064	0.00010594	529	14.070	9.96777E-05	2.82255	9.96777E-05	2.82255	0.063302326	0.601559205	1/2/03 13:56	0:04:53	0:01:00	0.285287379
4	69	1084	0.00014126	529	14.070	0.000132904	3.7634	0.000232581	6.58595	0.147705427	0.685962306	1/2/03 13:58	0:06:36	0:02:45	0.332498956
3	69	1084	0.00010594	529	14.070	9.96777E-05	2.82255	0.000332259	9.40849	0.211007753	0.749264632	1/2/03 13:59	0:07:53	0:04:00	0.362476053
4	69	1084	0.00014126	529	14.070	0.000132904	3.7634	0.000465163	13.1719	0.295410654	0.833667733	1/2/03 14:01	0:10:08	0:06:15	0.410960934

4	69	1084	0.00014126	529	14.070	0.000132904	3.7634	0.000598066	16.9353	0.379813955	0.918070834	1/2/03	14:03	0:12:08	0:08:15	0.449691252
14	69	1084	0.00049441	529	14.070	0.000465163	13.1719	0.001063229	30.1072	0.67522461	1.213461689	1/2/03	14:11	0:19:23	0:15:30	0.568379763
5	69	1084	0.00017657	529	14.070	0.00016613	4.70425	0.001229356	34.8114	0.780726686	1.318985565	1/2/03	14:15	0:23:23	0:19:30	0.62427736
3	69	1084	0.00010594	529	14.070	9.96777E-05	2.82255	0.001329036	37.634	0.844031012	1.382287891	1/2/03	14:18	0:27:08	0:23:15	0.6724747
5	69	1084	0.00017657	529	14.070	0.00016613	4.70425	0.001495166	42.3382	0.949534869	1.487791766	1/2/03	14:23	0:31:23	0:27:30	0.723225796
6	69	1084	0.00021189	529	14.070	0.000199355	5.6451	0.001694521	47.9833	1.076139541	1.614396419	1/2/03	14:26	0:36:53	0:33:00	0.784042232
4	69	1084	0.00014126	529	14.070	0.000132904	3.7634	0.001627425	51.7467	1.160542642	1.698799521	1/2/03	14:32	0:40:53	0:37:00	0.825462633
3	69	1084	0.00010594	529	14.070	9.96777E-05	2.82255	0.001927102	54.5693	1.223844968	1.762101848	1/2/03	14:35	0:44:08	0:40:15	0.857645355
7	69	1084	0.0002472	529	14.070	0.000232581	6.58595	0.002159684	61.1552	1.371550395	1.909807274	1/2/03	14:42	0:50:38	0:46:45	0.916634252
5	69	1084	0.00017657	529	14.070	0.00016613	4.70425	0.002325813	65.8595	1.477054271	2.01531115	1/2/03	14:47	0:55:36	0:51:45	0.962923788
8	69	1084	0.00028252	529	14.070	0.000265807	7.52679	0.002591621	73.3862	1.645860474	2.184117353	1/2/03	14:56	1:04:53	1:01:00	1.039698499
33	69	1065	0.00116539	529	14.063	0.001097466	31.0767	0.003689087	104.463	2.342828426	2.881085304	1/2/03	15:37	1:45:23	1:41:30	1.325268229
10	69	1085	0.00035315	529	14.063	0.000332566	9.41717	0.004021652	113.88	2.554030835	3.092287714	1/2/03	16:02	2:10:23	2:06:30	1.474126745
10	69	1065	0.00035315	529	14.063	0.000332566	9.41717	0.004354218	123.297	2.765233245	3.303490124	1/2/03	16:50	2:58:23	2:54:30	1.724255073
25	68	1067	0.00088287	528	14.109	0.000834524	23.631	0.005188742	146.928	3.295214407	3.833471266	1/3/03	12:18	22:26:23	22:22:30	4.737056393
17	69	1077	0.00060035	529	13.979	0.000561193	15.8912	0.005749935	162.819	3.651611173	4.189868052	1/4/03	14:52	49:00:23	48:56:30	7.000456334
-6	68	1065	-0.0002119	528	14.063	-0.00019992	-5.661	0.005550016	157.158	3.524649725	4.062906604	1/5/03	15:06	73:14:23	73:10:30	8.556020929
8	69	1089	0.00028252	529	14.135	0.000267033	7.56151	0.005817051	164.72	3.694234554	4.232491432	1/7/03	13:33	119:41:23	119:37:30	10.94027961
15	66	1062	0.00052972	526	14.044	0.000500306	14.167	0.006317357	178.887	4.011964062	4.550220961	1/9/03	13:23	167:31:23	167:27:30	12.94306979
3	67	1095	0.00010594	527	14.213	0.000101071	2.86201	0.006418429	181.749	4.076151449	4.614408328	1/11/03	16:01	220:09:23	220:05:30	14.83766791
9	67	1068	0.00031783	527	14.122	0.000301276	8.53114	0.006719704	190.28	4.26748256	4.805739439	1/13/03	16:03	266:11:23	266:07:30	16.3153217
10	69	1089	0.00035315	529	14.135	0.000333792	9.45189	0.007053496	199.732	4.479463596	5.017720475	1/15/03	15:26	313:34:23	313:30:30	17.70799411
-7	68	1098	-0.0002472	528	14.252	-0.00023603	-6.6836	0.006817465	193.048	4.329567176	4.867824055	1/17/03	14:16	360:26:23	360:22:30	18.98525012
17	67	1062	0.00060035	527	14.044	0.000565938	16.0255	0.007383402	209.074	4.688977352	5.227234231	1/19/03	12:26	408:34:23	408:30:30	20.1636568

DECANISTERED 1/23/03

SAMPLE: 853' to 855' (Bevier coal) in canister Maggy 3

DRY WEIGHT lbs. grams
sample weight: 1.2071 547.55

est. lost gas (cc) = 45

		at surface		
TIME OF:		1/2/03 14:45	elapsed time (off bottom to canistering)	
off bottom		in canister	3.4	minutes
1/2/03	14:44	1/2/03 14:46	0.057	hours
			0.239791576	SQRT (hrs)

CONVERSION OF VOLUMES TO STP

RIG MEASUREMENTS			CONVERSION OF RIG MEASUREMENTS TO STP (cubic ft; @60 degrees; @14.7 psi)					CUMULATIVE VOLUMES		SCF/TON	SCF/TON			TIME SINCE		
measured cc	measured T (F)	measured P	cubic ft (@rig)	ABSOLUTE T (F) (@rig)	psia (@rig)	cubic ft (@STP)	cc (@STP)	cubic ft (@STP)	cc (@STP)	without lost gas	with lost gas	TIME OF MEASURE		off bottom	in canister	SQRT hrs. (since off bottom)
12	68	1064	0.00042378	528	14.070	0.000399466	11.3116	0.000399466	11.3116	0.661636138	3.294779831	1/2/03	14:50	0:05:57	0:02:30	0.314907394
7	68	1084	0.0002472	528	14.070	0.000233022	6.59842	0.000632486	17.91	1.047910385	3.680652078	1/2/03	14:51	0:06:57	0:03:30	0.340342964
14	66	1084	0.00049441	526	14.070	0.000466044	13.1968	0.001098531	31.1068	1.820054879	4.452998572	1/2/03	14:54	0:09:57	0:06:30	0.407226391
6	66	1064	0.00021189	526	14.070	0.000199733	5.65579	0.001298264	36.7626	2.150973948	4.783915841	1/2/03	14:55	0:10:57	0:07:30	0.427200167
6	66	1064	0.00021189	526	14.070	0.000199733	5.65579	0.001497997	42.4184	2.481893017	5.11463471	1/2/03	15:00	0:15:12	0:11:45	0.503322296
4	69	1084	0.00014126	529	14.070	0.000132904	3.7634	0.001630901	46.1818	2.702066692	5.335030385	1/2/03	15:03	0:18:57	0:15:30	0.56199051
14	69	1064	0.00049441	529	14.070	0.000465163	13.1719	0.002096064	59.3537	3.472773556	6.105715249	1/2/03	15:07	0:22:42	0:19:15	0.61506807
5	69	1064	0.00017657	529	14.070	0.00016613	4.70425	0.002262193	64.0579	3.74801615	6.380959843	1/2/03	15:11	0:26:12	0:22:45	0.660607587
-2	69	1084	-7.063E-05	529	14.070	-6.6452E-05	-1.8817	0.002195741	62.1762	3.637920312	6.270862006	1/2/03	15:24	0:39:42	0:36:15	0.813428956
0	69	1065	0	529	14.063	0	0	0.002195741	62.1762	3.637920312	6.270862006	1/2/03	15:36	0:51:27	0:48:00	0.926012959
-2	69	1065	-7.063E-05	529	14.063	-6.6513E-05	-1.8834	0.002129228	60.2928	3.527720906	6.160662602	1/2/03	16:01	1:16:12	1:12:45	1.126942767
4	69	1085	0.00014126	529	14.083	0.000133026	3.76687	0.002262255	64.0597	3.748119716	6.38106141	1/2/03	16:50	2:05:12	2:01:45	1.444529912
-6	66	1067	-0.0002119	526	14.109	-0.00020029	-5.6714	0.002061969	58.3862	3.41628462	6.049226513	1/3/03	12:20	21:35:12	21:31:45	4.646145356

DECANISTERED 1/05/03

SAMPLE: 898' to 900' (Mineral coal) in canister Maggy 4

DRY WEIGHT lbs. grams
sample weight: 0.6700 303.9

est. lost gas (cc) = 13

		at surface		
TIME OF:		1/2/03 15:10	elapsed time (off bottom to canistering)	
off bottom		in canister	3.7	minutes
1/2/03	15:09	1/2/03 15:13	0.062	hours
			0.249443826	SQRT (hrs)

CONVERSION OF VOLUMES TO STP

RIG MEASUREMENTS			CONVERSION OF RIG MEASUREMENTS TO STP (cubic ft; @60 degrees; @14.7 psi)					CUMULATIVE VOLUMES		SCF/TON	SCF/TON			TIME SINCE		
measured cc	measured T (F)	measured P	cubic ft (@rig)	ABSOLUTE T (F) (@rig)	psia (@rig)	cubic ft (@STP)	cc (@STP)	cubic ft (@STP)	cc (@STP)	without lost gas	with lost gas	TIME OF MEASURE		off bottom	in canister	SQRT hrs. (since off bottom)
5	69	1064	0.00017657	529	14.070	0.00016613	4.70425	0.00016613	4.70425	0.495920295	1.666376506	1/2/03	15:17	0:07:44	0:04:00	0.359010967
3	69	1064	0.00010594	529	14.070	9.96777E-05	2.82255	0.000265807	7.52679	0.793472471	2.163928682	1/2/03	15:16	0:09:29	0:05:45	0.397562015
2	69	1084	7.063E-05	529	14.070	6.64518E-05	1.8817	0.000332259	9.40849	0.991840569	2.3622966	1/2/03	15:21	0:11:59	0:08:15	0.446902923
3	69	1084	0.00010594	529	14.070	9.96777E-05	2.82255	0.000431937	12.231	1.289392766	2.659846977	1/2/03	15:24	0:14:44	0:11:00	0.495535625
2	69	1064	7.063E-05	529	14.070	6.64518E-05	1.8817	0.000498389	14.1127	1.487760884	2.858217095	1/2/03	15:28	0:19:29	0:15:45	0.569844033
2	69	1085	7.063E-05	529	14.063	6.65131E-05	1.88343	0.000564902	15.9962	1.686311998	3.056768209	1/2/03	15:35	0:25:44	0:22:00	0.65489609
4	69	1085	0.00014126	529	14.083	0.000133026	3.76687	0.000697928	19.763	2.083414227	3.453870438	1/2/03	15:45	0:35:44	0:32:00	0.77172246
3	69	1065	0.00010594	529	14.063	9.97697E-05	2.82515	0.000797698	22.5882	2.381240898	3.751697109	1/2/03	15:59	0:50:29	0:46:45	0.917272527
1	69	1065	3.5315E-05	529	14.063	3.32566E-05	0.94172	0.000830954	23.5299	2.460516455	3.850972666	1/2/03	16:14	1:04:44	1:01:00	1.036695763
4	69	1065	0.00014126	529	14.083	0.000133026	3.76687	0.00096398	27.2968	2.877616664	4.248074895	1/2/03	16:49	1:39:44	1:36:00	1.289271974
-6	66	1067	-0.0002119	526	14.109	-0.00020029	-5.6714	0.000763695	21.6253	2.279737152	3.650193363	1/3/03	12:20	21:10:44	21:07:00	4.602052662

DECANISTERED 1/05/03

SAMPLE: 1108' to 1110' (Riverton "A" coal) in canister 10

DRY WEIGHT	lbs.	grams	est. lost gas (cc) =	TIME 0F: off bottom	at surface in canister	elapsed time (off bottom to canistering)
sample weight:	0.5951	269.942	11	1/2/03 18:55	1/2/03 18:56 (at surface); 1/2/03 18:59 (in canister)	3.6 minutes; 0.061 hours; 0.246080384 SQRT (hrs)

CONVERSION OF VOLUMES TO STP

RIG MEASUREMENTS measured cc	measured T (F)	measured P	CONVERSION OF RIG MEASUREMENTS TO STP (cubic ft; @60 degrees; @14.7 psi) cubic ft (@rig)	ABSOLUTE T (F) (@rig)	psia (@rig)	cubic ft (@STP)	cc (@STP)	CUMULATIVE VOLUMES cubic ft (@STP)	cc (@STP)	SCF/TON without lost gas	SCF/TON with lost gas	TIME OF MEASURE	TIME SINCE off bottom	in canister	SQRT hrs. (since off bottom)
14	69	1087	0.00049441	529	14.109	0.00046645	13.2083	0.00046645	13.2083	1.567582525	2.873076069	1/2/03 19:12	0:17:08	0:13:30	0.534373985
2	69	1087	7.063E-05	529	14.109	6.66357E-05	1.88691	0.000533086	15.0953	1.791522886	3.09701645	1/2/03 19:17	0:21:23	0:17:45	0.596983156
2	69	1087	7.063E-05	529	14.109	6.66357E-05	1.88691	0.000599721	16.9822	2.015463246	3.32095681	1/2/03 19:22	0:26:53	0:23:15	0.669369521
2	69	1087	7.063E-05	529	14.109	6.66357E-05	1.88691	0.000666357	18.8691	2.239403607	3.544897171	1/2/03 19:27	0:31:23	0:27:45	0.723225798
2	69	1087	7.063E-05	529	14.109	6.66357E-05	1.88691	0.000732993	20.756	2.463343968	3.768837532	1/2/03 19:33	0:38:06	0:34:30	0.797217383
2.5	69	1087	8.8267E-05	529	14.109	8.32946E-05	2.35863	0.000816288	23.1146	2.743269419	4.048762963	1/2/03 19:41	0:45:53	0:42:15	0.874483975
3	69	1087	0.00010594	529	14.109	9.99536E-05	2.83036	0.000916241	25.945	3.07917996	4.384673524	1/2/03 19:48	0:53:08	0:49:30	0.941039614
3	69	1087	0.00010594	529	14.109	9.99536E-05	2.83036	0.001016195	28.7753	3.415090501	4.720564065	1/2/03 20:00	1:04:38	1:01:00	1.037893165
3	69	1087	0.00010594	529	14.109	9.99536E-05	2.83036	0.001116148	31.6057	3.751001042	5.056494606	1/2/03 20:10	1:14:53	1:11:15	1.117164068
2	69	1088	7.063E-05	529	14.122	6.6697E-05	1.88864	0.001182845	33.4943	3.975147419	5.280640984	1/2/03 20:19	1:23:23	1:19:45	1.176864802
69	68	1087	0.00243672	528	14.109	0.002303266	65.2216	0.003486132	98.7159	11.71572233	13.02121589	1/3/03 12:21	17:25:23	17:21:45	4.174093381
33	69	1077	0.00116539	529	13.979	0.001089374	30.8475	0.004575506	129.563	15.37674549	16.68223906	1/4/03 14:55	43:59:23	43:55:45	6.632474819
-6	68	1085	-0.0002119	528	14.083	-0.00019992	-5.681	0.004375589	123.902	14.70469047	16.01038403	1/5/03 15:11	68:15:23	68:11:45	8.261742485

DECANISTERED 1/09/03

SAMPLE: 1113' to 1115' (Riverton "A" sieved sample -- >0.090") in canister 9

DRY WEIGHT	lbs.	grams	est. lost gas (cc) =	TIME 0F: off bottom	at surface in canister	elapsed time (off bottom to canistering)
sample weight:	1.6391	743.474	34	1/2/03 18:58	1/2/03 18:59 (at surface); 1/2/03 19:06 (in canister)	8.6 minutes; 0.144 hours; 0.379326889 SQRT (hrs)

CONVERSION OF VOLUMES TO STP

RIG MEASUREMENTS measured cc	measured T (F)	measured P	CONVERSION OF RIG MEASUREMENTS TO STP (cubic ft; @60 degrees; @14.7 psi) cubic ft (@rig)	ABSOLUTE T (F) (@rig)	psia (@rig)	cubic ft (@STP)	cc (@STP)	CUMULATIVE VOLUMES cubic ft (@STP)	cc (@STP)	SCF/TON without lost gas	SCF/TON with lost gas	TIME OF MEASURE	TIME SINCE off bottom	in canister	SQRT hrs. (since off bottom)
12	69	1087	0.00042376	529	14.109	0.000399814	11.3214	0.000399814	11.3214	0.467852236	1.952946752	1/2/03 19:13	0:15:23	0:06:45	0.506348584
3	69	1087	0.00010594	529	14.109	9.99536E-05	2.83038	0.000499766	14.1518	0.609815295	2.074909611	1/2/03 19:16	0:17:53	0:09:15	0.545944645
4	69	1087	0.00014126	529	14.109	0.000133271	3.77361	0.000633039	17.9256	0.772432707	2.237527223	1/2/03 19:18	0:20:23	0:11:45	0.582856948
5	69	1087	0.00017657	529	14.109	0.000166589	4.71727	0.000799629	22.6429	0.975704471	2.440798988	1/2/03 19:23	0:25:23	0:16:45	0.65042721
4	69	1087	0.00014126	529	14.109	0.000133271	3.77361	0.0009329	26.4167	1.138321683	2.6034164	1/2/03 19:27	0:29:38	0:21:00	0.702772288
5	69	1087	0.00017657	529	14.109	0.000166589	4.71727	0.001099489	31.134	1.341593648	2.806866165	1/2/03 19:34	0:36:08	0:27:30	0.776029782
7	69	1087	0.0002472	529	14.109	0.000233225	6.60417	0.001332714	37.7381	1.626174119	3.091268635	1/2/03 19:42	0:44:08	0:35:30	0.857645355
5	69	1087	0.00017657	529	14.109	0.000166589	4.71727	0.001499304	42.4554	1.829445864	3.2945404	1/2/03 19:49	0:51:08	0:42:30	0.923158828
7	69	1087	0.0002472	529	14.109	0.000233225	6.60417	0.001732529	49.0596	2.114026355	3.579120871	1/2/03 20:00	1:02:38	0:54:00	1.021708808
7	69	1087	0.0002472	529	14.109	0.000233225	6.60417	0.001965754	55.6637	2.398606826	3.863701342	1/2/03 20:11	1:12:53	1:04:15	1.102144374
5	69	1088	0.00017657	529	14.122	0.000166743	4.72161	0.002132496	60.3853	2.602065593	4.067160109	1/2/03 20:19	1:21:23	1:12:45	1.164641099
5	45	1089	0.00017657	505	14.135	0.000174627	4.95054	0.002307324	65.3359	2.815369578	4.280484094	1/2/03 21:45	2:47:23	2:38:45	1.670246156
117	68	1087	0.00413183	528	14.109	0.003905572	110.593	0.006212896	175.929	7.580957511	9.046052027	1/3/03 12:23	17:24:53	17:16:15	4.173095041
68	69	1077	0.00240141	529	13.979	0.002244772	63.5646	0.008457668	239.494	10.32002117	11.76511566	1/4/03 14:56	43:57:53	43:49:15	6.630589885
5	68	1085	0.00017657	528	14.083	0.000166598	4.7175	0.008624265	244.211	10.5233032	11.98839772	1/5/03 15:12	68:13:53	66:05:15	8.260229348
22	69	1089	0.00077693	529	14.135	0.000734342	20.7942	0.009358607	265.005	11.41934459	12.88443911	1/7/03 13:35	114:36:53	114:28:15	10.70582655
7	66	1082	0.0002472	526	14.044	0.000233476	6.61129	0.009592083	271.617	11.70423166	13.16932618	1/9/03 13:25	162:26:53	162:18:15	12.74551119
-4	67	1095	-0.0001413	527	14.213	-0.00013476	-3.816	0.009457321	267.601	11.53979575	13.00489026	1/11/03 18:02	215:03:53	214:55:15	14.66508514
5	67	1088	0.00017657	527	14.122	0.000167375	4.73952	0.009624697	272.54	11.74402665	13.20912117	1/13/03 16:04	261:05:53	260:57:15	16.15852888
8	69	1089	0.00028252	529	14.135	0.000267033	7.56151	0.00989173	280.102	12.06965989	13.5349544	1/15/03 15:28	306:29:53	308:21:15	17.56411272
-6	68	1098	-0.0002119	526	14.252	-0.00020231	-5.7288	0.009689417	274.373	11.82299868	13.28809319	1/17/03 14:17	355:18:53	355:10:15	18.84979369
17	67	1082	0.00060035	527	14.044	0.000565938	16.0255	0.010255355	290.398	12.51355443	13.97864895	1/19/03 12:27	401:28:53	401:20:15	20.0370005
6	67	1092	0.00021189	527	14.174	0.000201589	5.70634	0.010456944	296.107	12.75953254	14.22462706	1/21/03 22:12	459:13:53	459:05:15	21.42968476
-11	67	1106	-0.0003865	527	14.355	-0.00037432	-10.599	0.010082626	285.507	12.30279114	13.76768566	1/23/03 13:56	496:57:53	496:49:15	22.33751826
29	69	1092	0.00102413	529	14.174	0.000970662	27.486	0.011053269	312.993	13.48719045	14.95228497	1/25/03 21:55	554:56:53	554:48:15	23.55733549
25	68	1083	0.00088287	528	14.057	0.000831453	23.544	0.011884742	336.537	14.50172708	15.96682158	1/27/03 17:43	598:44:53	596:36:15	24.46932887
-10	66	1095	-0.0003531	528	14.213	-0.00033627	-9.522	0.011548475	327.015	14.09141586	15.55651037	1/29/03 13:55	642:56:53	642:46:15	25.3564204
16	66	1085	0.00056504	528	14.083	0.000533113	15.096	0.012081586	342.111	14.74191837	16.20701289	1/31/03 15:05	692:06:53	691:58:15	26.30807333
18	66	1075	0.00063567	526	13.953	0.000596483	16.8905	0.012678072	359.002	15.46974578	16.9348403	2/3/03 15:54	764:55:53	764:47:15	27.65739302
-15	68	1090	-0.0005297	528	14.148	-0.0005021	-14.218	0.012175975	344.784	14.85708932	16.32216384	2/4/03 18:43	791:44:53	791:36:15	28.13801797

DECANISTERED 2/05/03

SAMPLE: 1113' to 1115' (Riverton sieved sample -- <0.090"; >0.0661") in canister 5

DRY WEIGHT	lbs.	grams	est. lost gas (cc) =	TIME 0F: off bottom	at surface in canister	elapsed time (off bottom to canistering)
sample weight:	0.1708	77.472	7	1/2/03 18:58	1/2/03 18:59 (at surface); 1/2/03 19:10 (in canister)	12.4 minutes; 0.206 hours

CONVERSION OF VOLUMES TO STP

RIG MEASUREMENTS			CONVERSION OF RIG MEASUREMENTS TO STP (cubic ft; @60 degrees; @14.7 psi)					CUMULATIVE VOLUMES		SCF/TON	SCF/TON			TIME SINCE		0.454300439 SQRT (hrs)
measured cc	measured T (F)	measured P	cubic ft (@rig)	ABSOLUTE T (F) (@rig)	psia (@rig)	cubic ft (@STP)	cc (@STP)	cubic ft (@STP)	cc (@STP)	without lost gas	with lost gas	TIME OF MEASURE		off bottom	in canister	SQRT hrs. (since off bottom)
2	69	1067	7.063E-05	529	14.109	6.66357E-05	1.66691	6.66357E-05	1.66691	0.76029364	3.675008453	1/2/03	19:15	0:16:53	0:04:30	0.530461016
0	69	1067	0	529	14.109	0	0	6.66357E-05	1.66691	0.76029364	3.675008453	1/2/03	19:21	0:23:08	0:10:45	0.6209312
0.5	69	1067	1.7657E-05	529	14.109	1.66589E-05	0.47173	8.32946E-05	2.35663	0.97536705	3.870061662	1/2/03	19:28	0:29:53	0:17:30	0.705730512
3	69	1067	0.00010594	529	14.109	9.99536E-05	2.83036	0.000183248	5.16899	2.145807509	5.040522322	1/2/03	19:35	0:37:23	0:25:00	0.769338682
2	69	1067	7.063E-05	529	14.109	6.66357E-05	1.66691	0.000249684	7.0759	2.926101149	5.820615962	1/2/03	19:49	0:51:23	0:39:00	0.925412621
0.5	69	1067	1.7657E-05	529	14.109	1.66589E-05	0.47173	0.000266543	7.54763	3.121174556	6.015689371	1/2/03	20:02	1:03:53	0:51:30	1.03165378
2	69	1066	7.063E-05	529	14.122	6.6697E-05	1.66864	0.00033324	9.43627	3.90216604	6.796900652	1/2/03	20:20	1:21:53	1:09:30	1.168213261
39	66	1067	0.00137728	526	14.109	0.001301857	36.6644	0.001635097	46.3006	19.14672966	22.04144449	1/3/03	12:24	17:25:53	17:13:30	4.175091463
21	69	1077	0.00074161	529	13.979	0.000693236	19.6302	0.002328336	65.9309	27.26443954	30.15915435	1/4/03	14:57	43:56:53	43:46:30	6.631646567
-7	66	1065	-0.0002472	526	14.083	-0.00023324	-6.6045	0.002095099	59.3264	24.53327361	27.42798662	1/5/03	15:13	66:14:53	66:02:30	8.261236137

DECANISTERED 1/09/03

SAMPLE: 1120' to 1122' (Riverton "B" coal) in canister A

					at surface		
DRY WEIGHT	lbs.	grams	est. lost gas (cc) =	TIME OF:	1/2/03 19:17	elapsed time (off bottom to canistering)	
sample weight:	0.4360	198.665	14	off bottom	in canister	2.9	minutes
				1/2/03 19:16	1/2/03 19:19	0.049	hours

CONVERSION OF VOLUMES TO STP

RIG MEASUREMENTS			CONVERSION OF RIG MEASUREMENTS TO STP (cubic ft; @60 degrees; @14.7 psi)					CUMULATIVE VOLUMES		SCF/TON	SCF/TON			TIME SINCE		0.220479276 SQRT (hrs)
measured cc	measured T (F)	measured P	cubic ft (@rig)	ABSOLUTE T (F) (@rig)	psia (@rig)	cubic ft (@STP)	cc (@STP)	cubic ft (@STP)	cc (@STP)	without lost gas	with lost gas	TIME OF MEASURE		off bottom	in canister	SQRT hrs. (since off bottom)
5	69	1067	0.00017657	529	14.109	0.000166589	4.71727	0.000166589	4.71727	0.760714127	3.01637749	1/2/03	19:21	0:05:10	0:02:15	0.293446948
5	69	1067	0.00017657	529	14.109	0.000166589	4.71727	0.000333179	9.43453	1.521428255	3.779091616	1/2/03	19:24	0:07:25	0:04:30	0.351583719
3	69	1067	0.00010594	529	14.109	9.99536E-05	2.83036	0.000433132	12.2649	1.977658731	4.235520094	1/2/03	19:26	0:09:40	0:06:45	0.401366486
2	69	1067	7.063E-05	529	14.109	6.66357E-05	1.66691	0.000499768	14.1516	2.262142382	4.539605745	1/2/03	19:26	0:12:10	0:09:15	0.450306536
5	69	1067	0.00017657	529	14.109	0.000166589	4.71727	0.000666357	18.6691	3.04265651	5.300519672	1/2/03	19:34	0:18:10	0:15:15	0.550252467
3	69	1067	0.00010594	529	14.109	9.99536E-05	2.63036	0.000766311	21.6994	3.499264966	5.756946349	1/2/03	19:42	0:26:10	0:23:15	0.660367092
1	69	1067	3.5315E-05	529	14.109	3.33179E-05	0.94345	0.000799629	22.6429	3.651427612	5.909091174	1/2/03	19:50	0:33:40	0:30:45	0.749073502
2	69	1067	7.063E-05	529	14.109	6.66357E-05	1.66691	0.000666264	24.5298	3.955713463	6.213376625	1/2/03	20:01	0:44:55	0:42:00	0.865223157
1	69	1067	3.5315E-05	529	14.109	3.33179E-05	0.94345	0.000699582	25.4732	4.107656288	6.365519651	1/2/03	20:11	0:54:55	0:52:00	0.956701509
1	69	1068	3.5315E-05	529	14.122	3.33485E-05	0.94432	0.000932931	26.4176	4.260139079	6.517602442	1/2/03	20:20	1:04:10	1:01:15	1.034139471
23	66	1067	0.00081224	526	14.109	0.000767762	21.7405	0.001700693	46.1561	7.766051499	10.02371466	1/3/03	12:25	17:06:25	17:05:30	4.140061656
2	69	1077	7.063E-05	529	13.979	6.60227E-05	1.66955	0.001766715	50.0276	8.067537634	10.3252012	1/4/03	14:59	43:42:25	43:39:30	6.611122762
-15	66	1065	-0.0005297	526	14.063	-0.00049979	-14.153	0.001266922	35.8751	5.785260139	8.042943502	1/5/03	15:14	67:57:25	67:54:30	8.243600211

DECANISTERED 1/09/03

673' to 676' (Mulberry Coal) in canister Brady 27

Meritage KCM Garrison #26-13 SWD; NE SW sec. 26-T.19S.-R.19E., Anderson County, KS

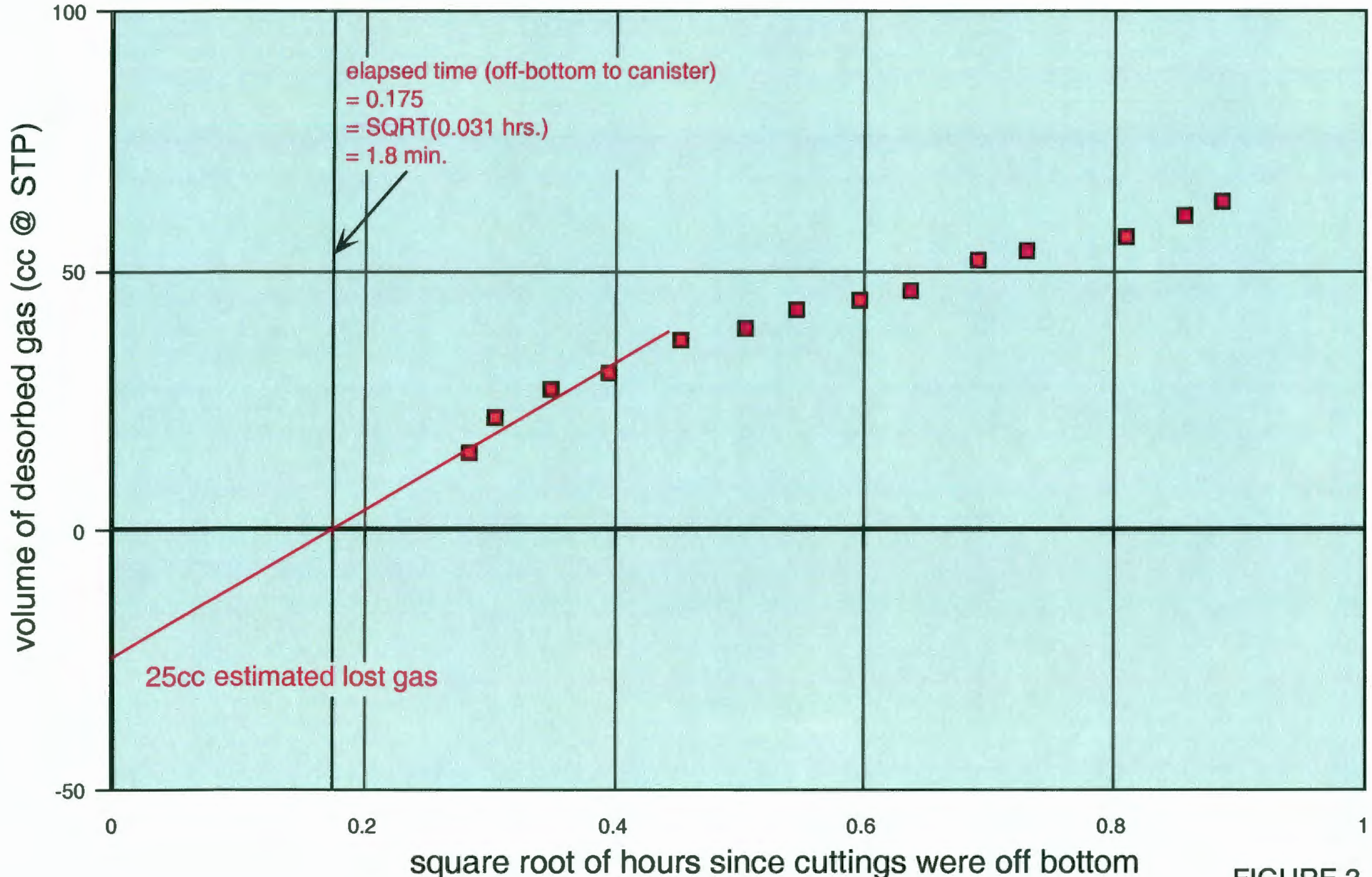


FIGURE 3.

755' to 758' (shale above Summit "coal") in canister Maggy 1

Meritage KCM Garrison #26-13 SWD; NE SW sec. 26-T.19S.-R.19E., Anderson County, KS

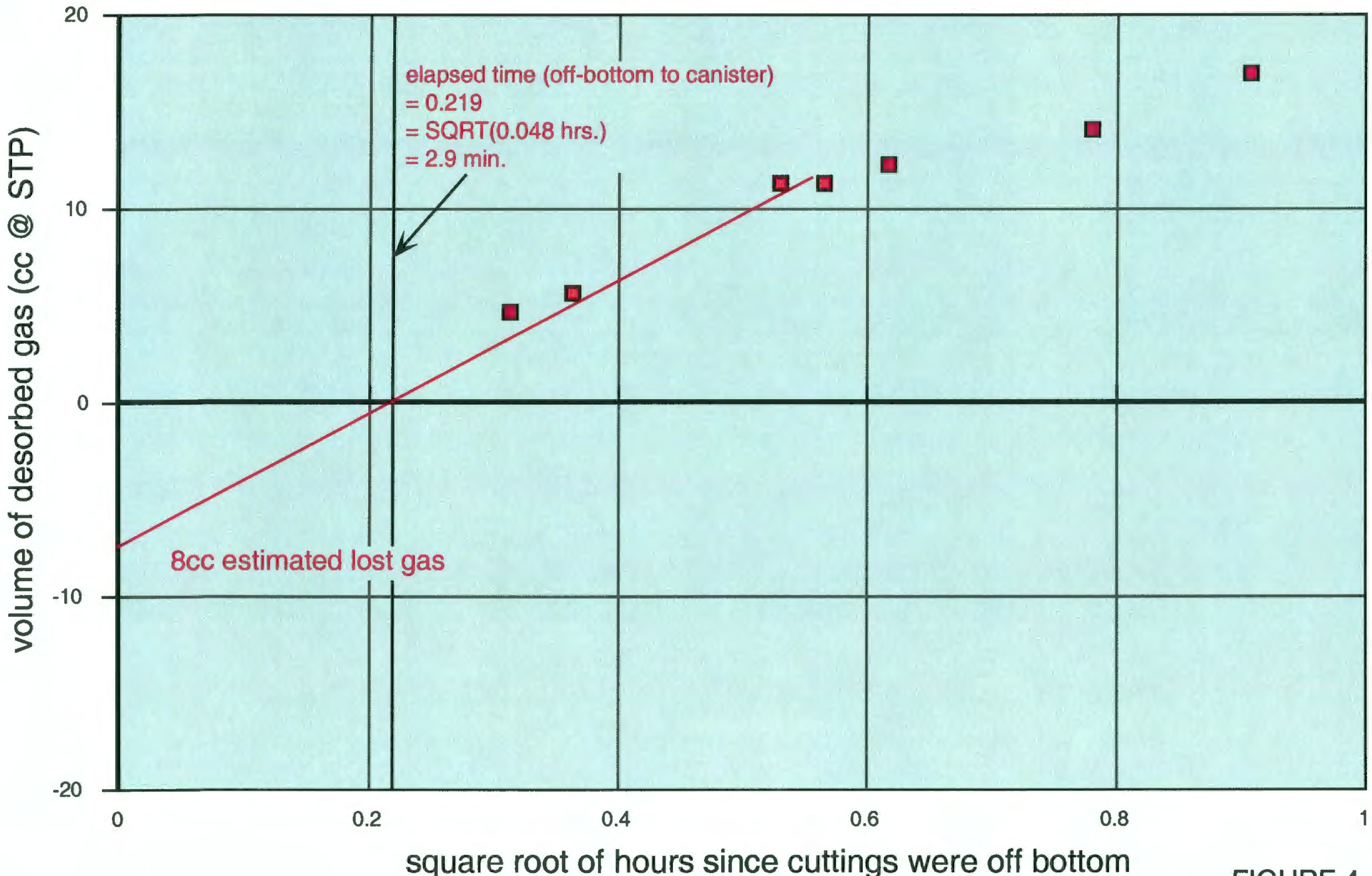


FIGURE 4.

760' to 762' (Summit "coal") in canister Maggy 2

Meritage KCM Garrison #26-13 SWD; NE SW sec. 26-T.19S.-R.19E., Anderson County, KS

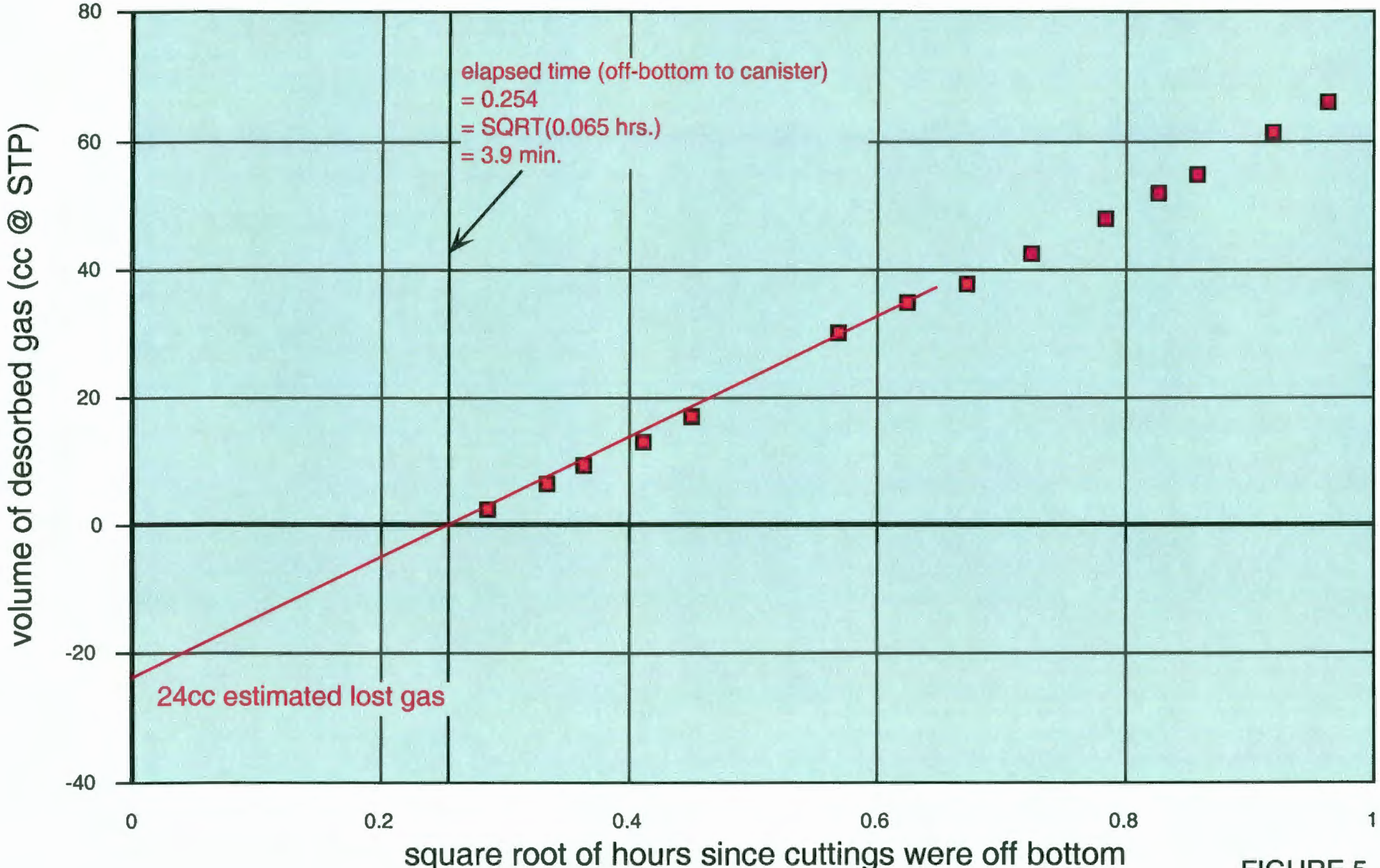


FIGURE 5.

853' to 855' (Bevier coal) in canister Maggy 3

Meritage KCM Garrison #26-13 SWD; NE SW sec. 26-T.19S.-R.19E., Anderson County, KS

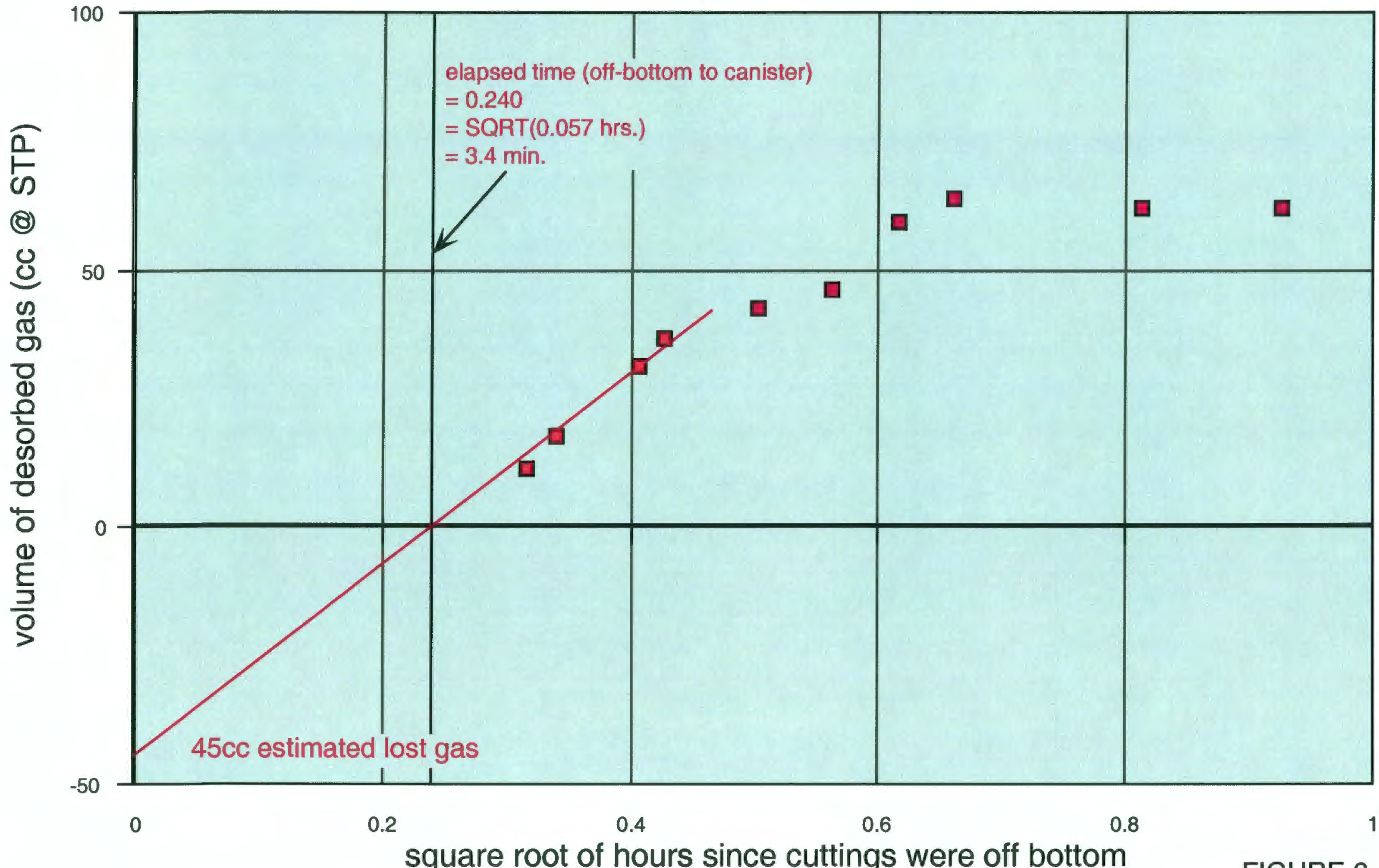


FIGURE 6.

898' to 900' (Mineral coal) in canister Maggy 4

Meritage KCM Garrison #26-13 SWD; NE SW sec. 26-T.19S.-R.19E., Anderson County, KS

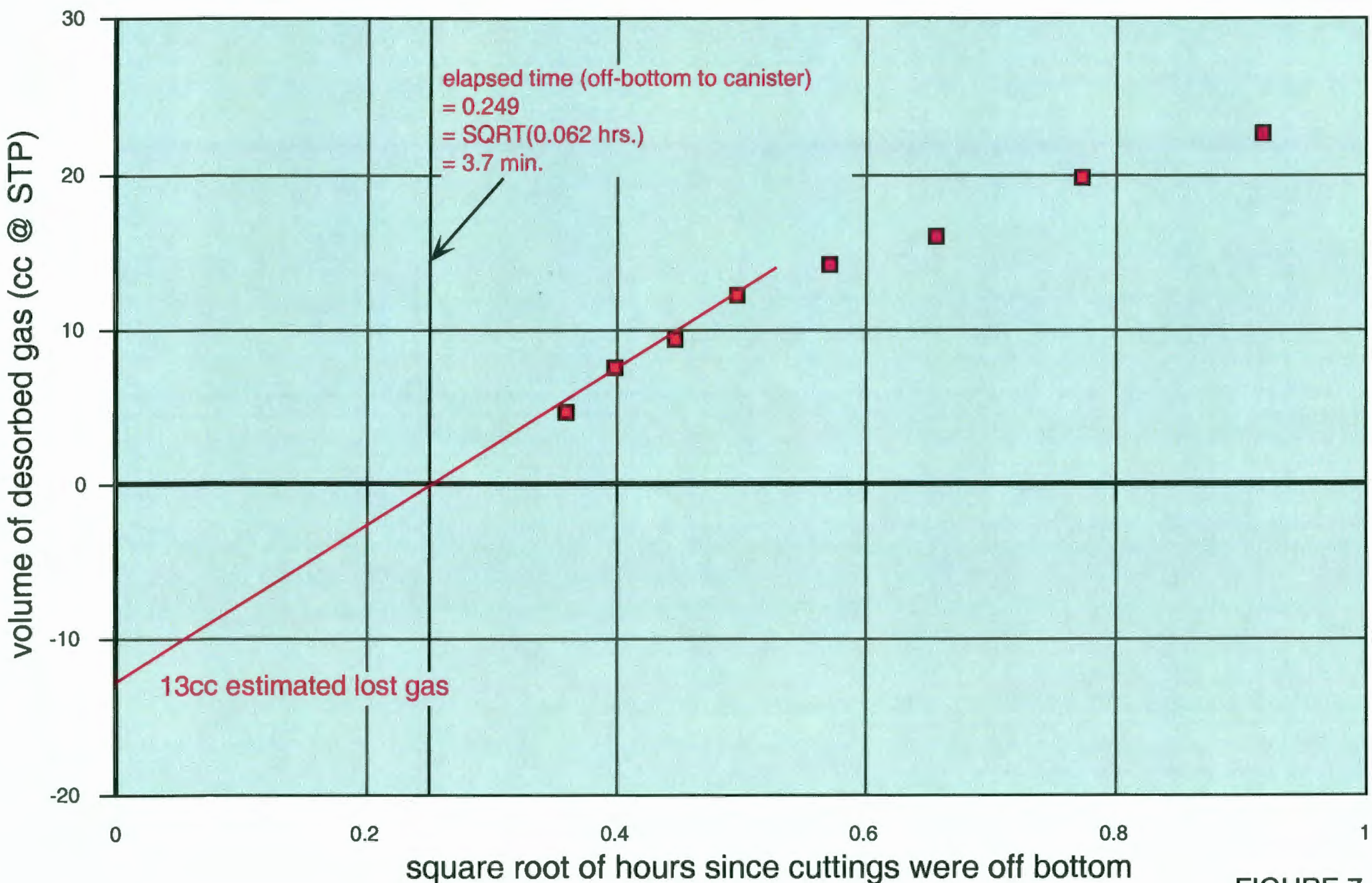


FIGURE 7.

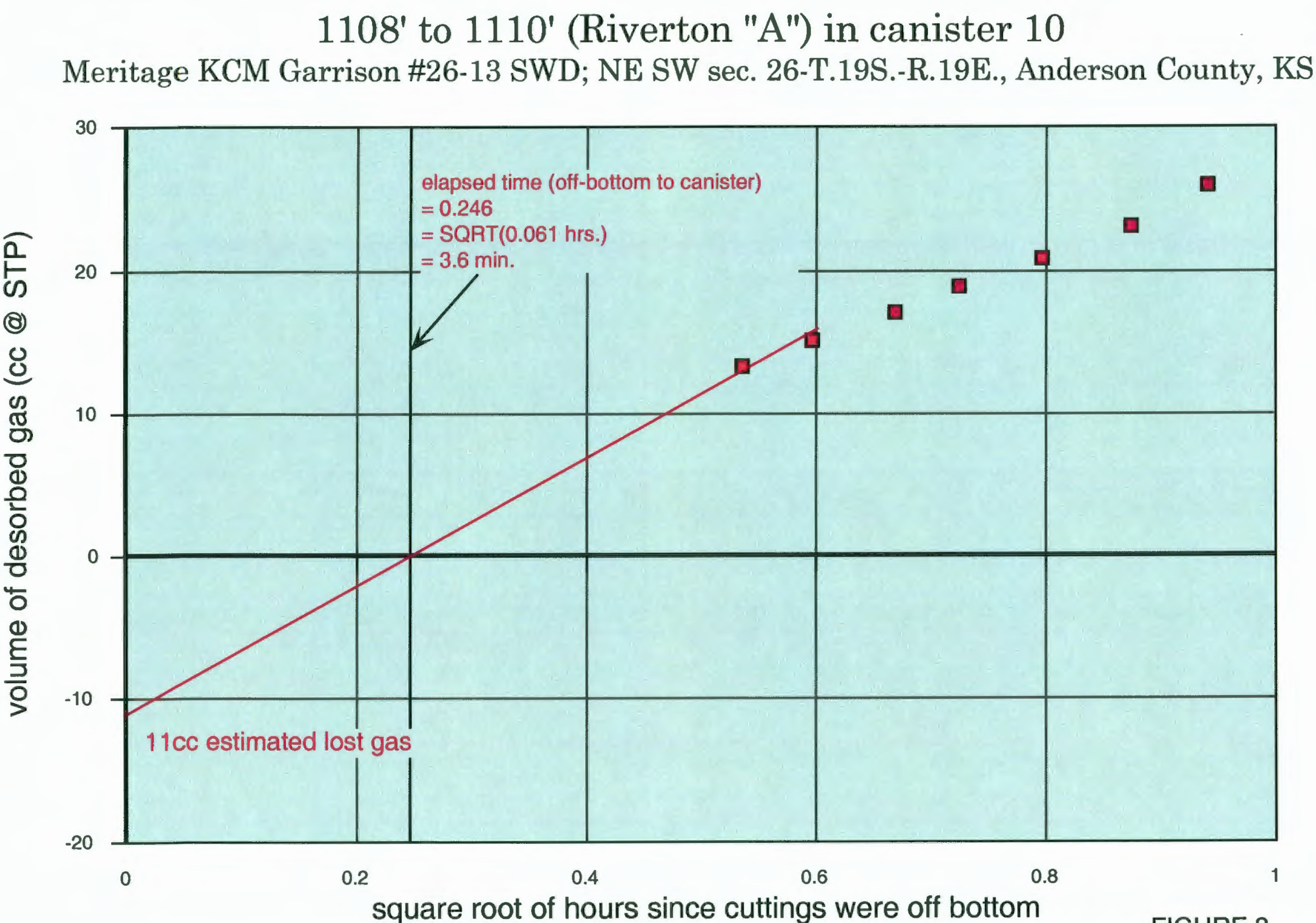

1108' to 1110' (Riverton "A") in canister 10
Meritage KCM Garrison #26-13 SWD; NE SW sec. 26-T.19S.-R.19E., Anderson County, KS
elapsed time (off-bottom to canister)
= 0.246
= SQRT(0.061 hrs.)
= 3.6 min.
11cc estimated lost gas
volume of desorbed gas (cc @ STP)
30
20
10
0
-10
-20
0
0.2
0.4
0.6
0.8
1
square root of hours since cuttings were off bottom

FIGURE 8.

1113' to 1115' (Riverton "A" sieved sample -- >0.090") in canister 9

Meritage KCM Garrison #26-13 SWD; NE SW sec. 26-T.19S.-R.19E., Anderson County, KS`

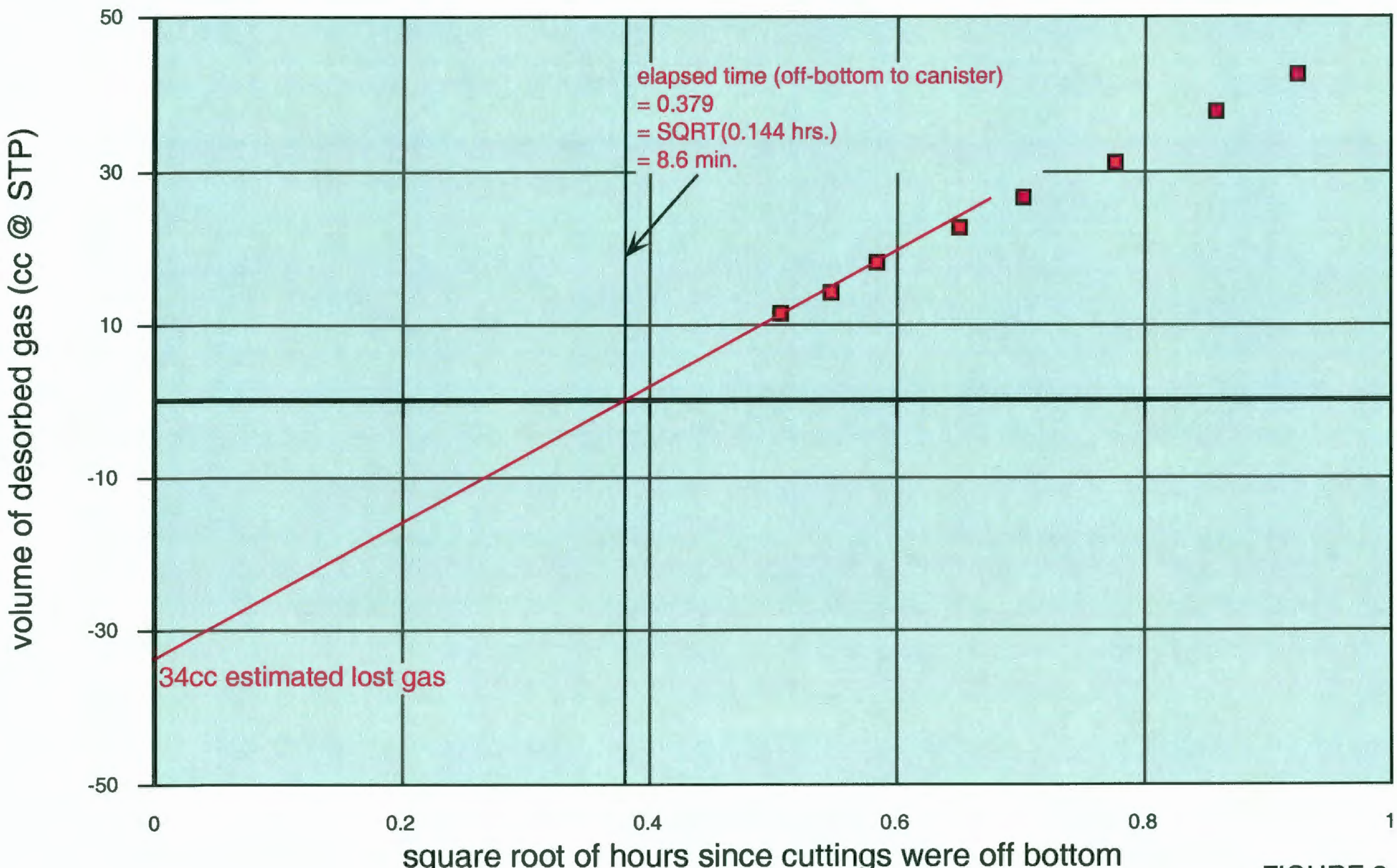


FIGURE 9.

1113' to 1115' (Riverton "A" sieved sample -- <0.090"; >0.0661") in canister 5

Meritage KCM Garrison #26-13 SWD; NE SW sec. 26-T.19S.-R.19E., Anderson County, KS

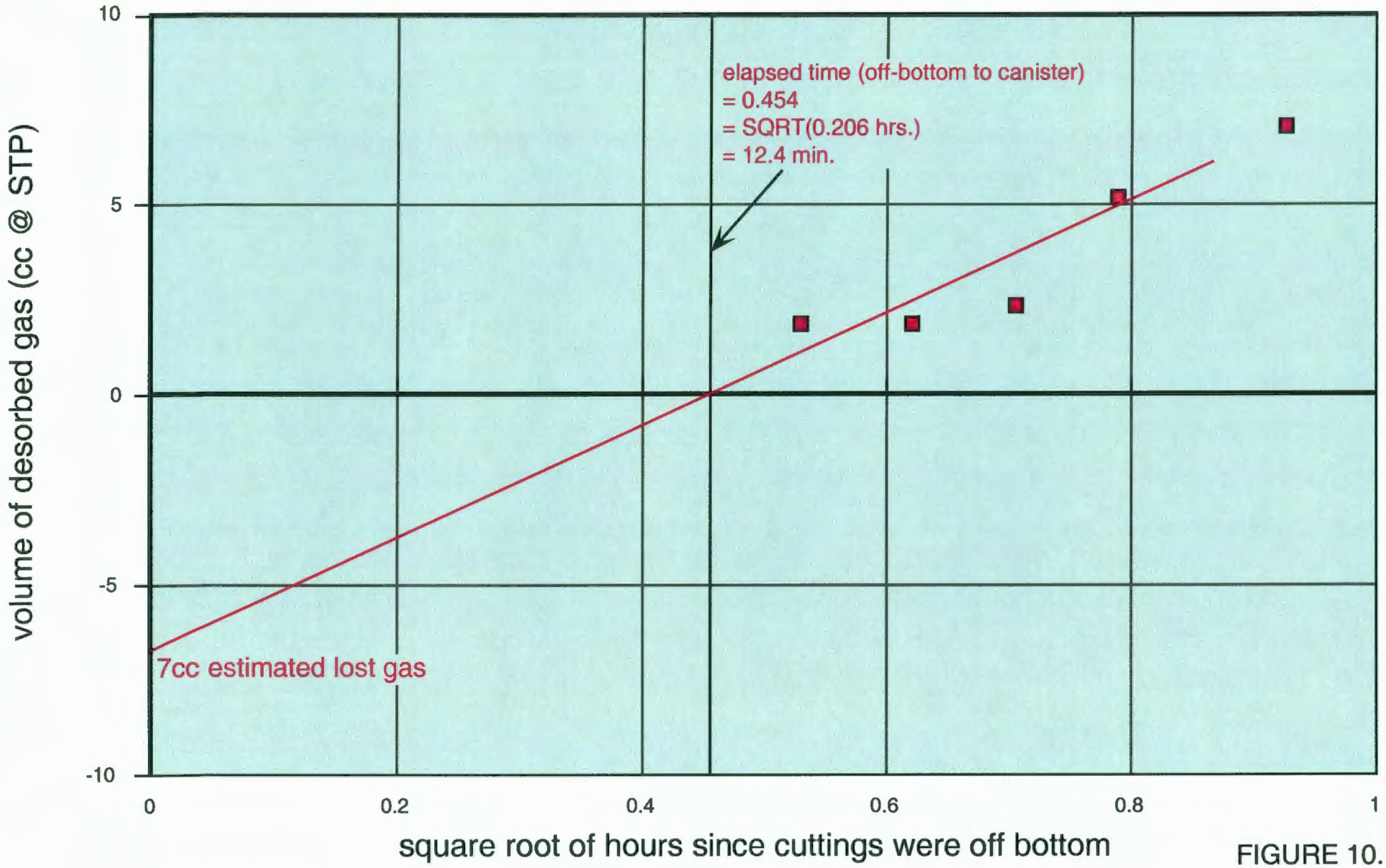


FIGURE 10.

1120' to 1122' (Riverton "B" coal) in canister A

Meritage KCM Garrison #26-13 SWD; NE SW sec. 26-T.19S.-R.19E., Anderson County, KS

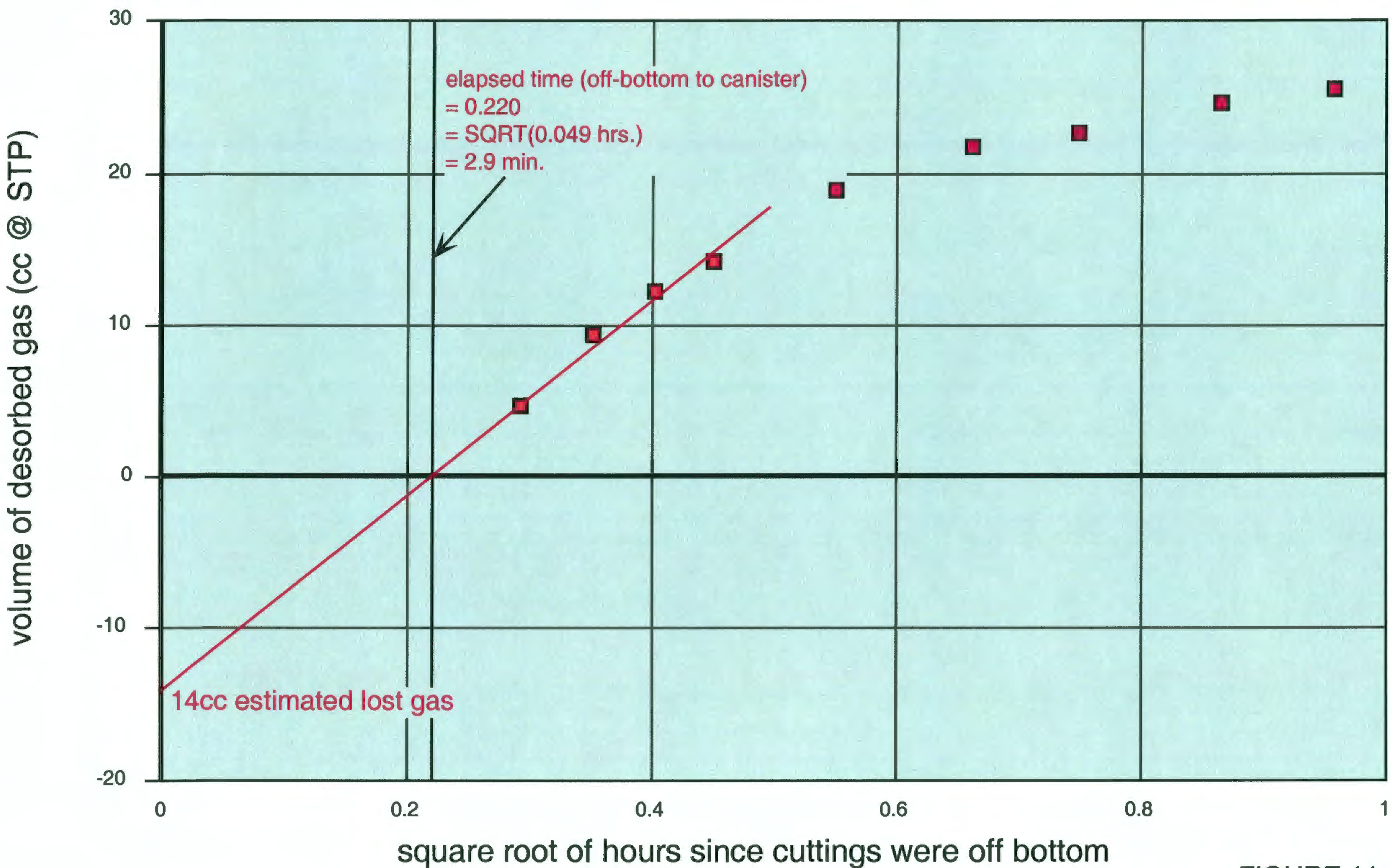


FIGURE 11.

Desorption Characteristics of Cuttings Samples

Meritage KCM #26-13 Garrison SWD; sec. NE NW 26-T.19S.-R.19E.; Anderson Co., KS

LITHOLOGIC COMPONENT SENSITIVITY ANALYSIS for calculation of gas content of Mulberry coal from 673-676'

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

total gas desorbed = 181 ccs

TOTAL DRY WEIGHT OF SAMPLE = 275.08 grams

$\text{weight}_{light\text{-}colored\ lithologies}$ = 96.68 grams (35.2%)

$\text{weight}_{dark\ shale}$ = 14.37 grams (5.2%)

weight_{coal} = 164.03 grams (59.6%)

sieve size	*grams*	*% coal / % dark shale / % light-colored liths*
>0.0930"	182.66	58.97% / 4.86% / 36.17%
>0.0661"	63.21	63.01% / 6.51% / 30.48%
>0.0460"	25.86	58.45% / 4.73% / 36.82%
>0.0331"	2.68	37.65% / 4.71% / 57.65%
<0.0331"	0.68	54.52% / 5.20% / 40.28%
	275.08 TOTAL	

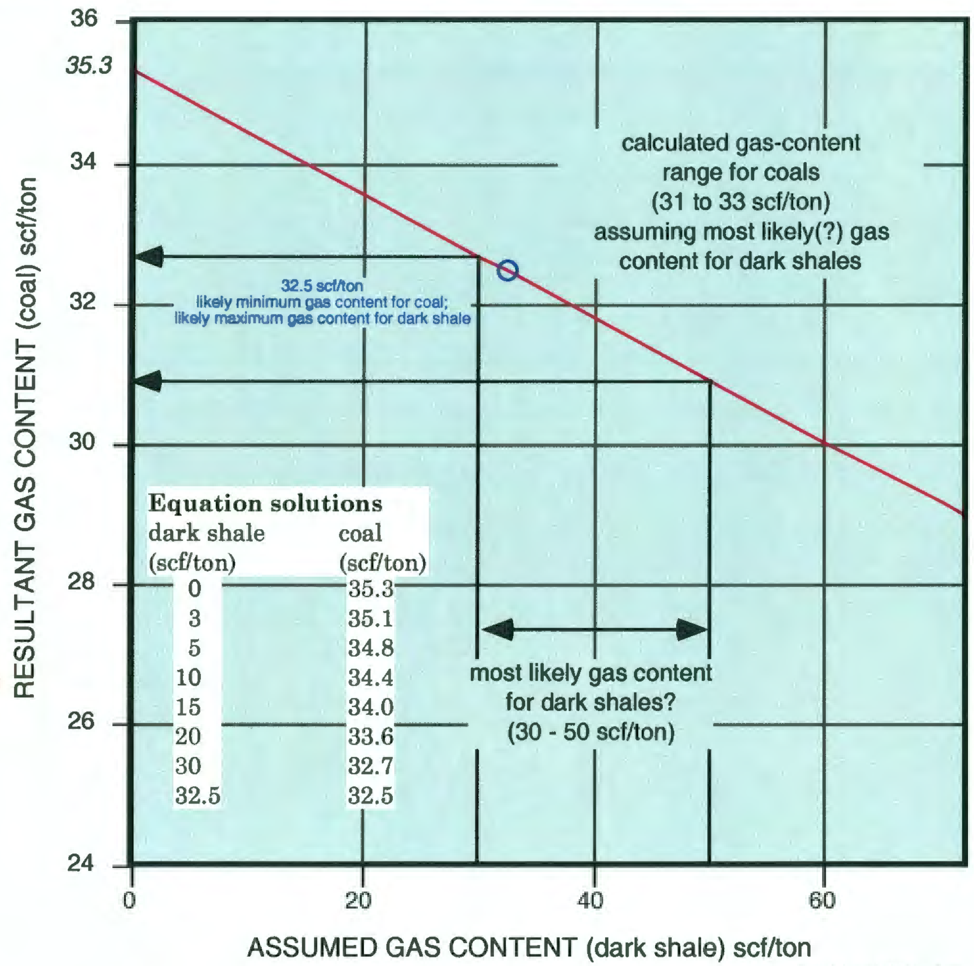


FIGURE 12.

Desorption Characteristics of Cuttings Samples

Meritage KCM #26-13 Garrison SWD; sec. NE NW 26-T.19S.-R.19E.; Anderson Co., KS

LITHOLOGIC COMPONENT SENSITIVITY ANALYSIS for calculation of gas content of shale above Summit "coal" at 755-758'

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

total gas desorbed = 32 ccs

TOTAL DRY WEIGHT OF SAMPLE = 459.87 grams
$\text{weight}_{\text{light-colored lithologies}}$ = 143.90 grams (31.3%)
$\text{weight}_{\text{dark shale}}$ = 315.97 grams (68.7%)
weight_{coal} = 0.00 grams (0.0%)

sieve size	*grams*	*% coal / % dark shale / % light-colored liths*
>0.0930"	334.12	0.00% / 74.28% / 25.72%
>0.0661"	72.43	0.00% / 48.84% / 51.16%
>0.0460"	26.60	0.00% / 58.27% / 41.73%
>0.0331"	8.36	0.00% / 66.22% / 33.78%
<0.0331"	18.36	0.00% / 61.90% / 38.10%
	459.87 TOTAL	

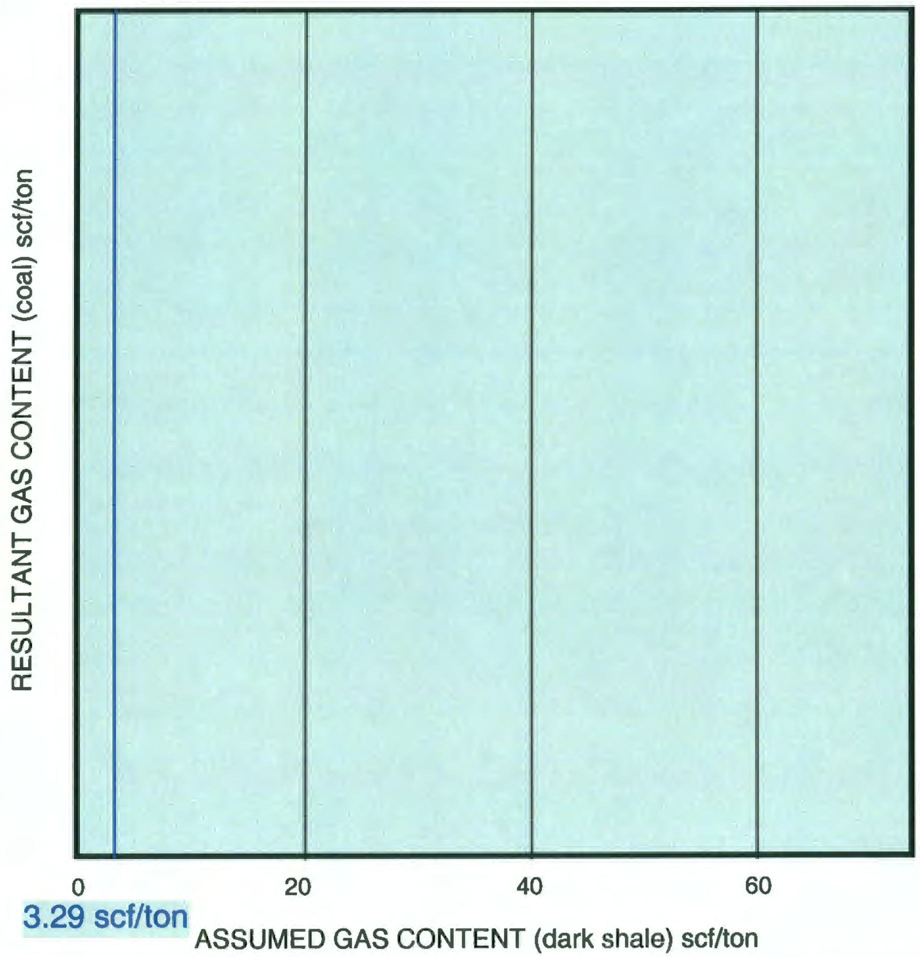


FIGURE 13.

Desorption Characteristics of Cuttings Samples

Meritage KCM #26-13 Garrison SWD; sec. NE NW 26-T.19S.-R.19E.; Anderson Co., KS

LITHOLOGIC COMPONENT SENSITIVITY ANALYSIS for calculation of gas content of Summit "coal" at 760-762'

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

total gas desorbed = 233 ccs

TOTAL DRY WEIGHT OF SAMPLE = 2420.65 grams
$\text{weight}_{\text{light-colored lithologies}}$ = 992.17 grams (41.0%)
$\text{weight}_{\text{dark shale}}$ = 1428.48 grams (59.0%)
$\text{weight}_{\text{coal}}$ = 0.00 grams (0.0%)

sieve size	*grams*	*% coal / % dark shale / % light-colored liths*
>0.0930"	1741.00	0.00% / 66.44% / 33.56%
>0.0661"	498.45	0.00% / 43.80% / 56.20%
>0.0460"	146.45	0.00% / 28.72% / 71.28%
>0.0331"	15.45	0.00% / 23.08% / 76.92%
<0.0331"	19.31	0.00% / 40.51% / 59.49%
	2420.65 TOTAL	

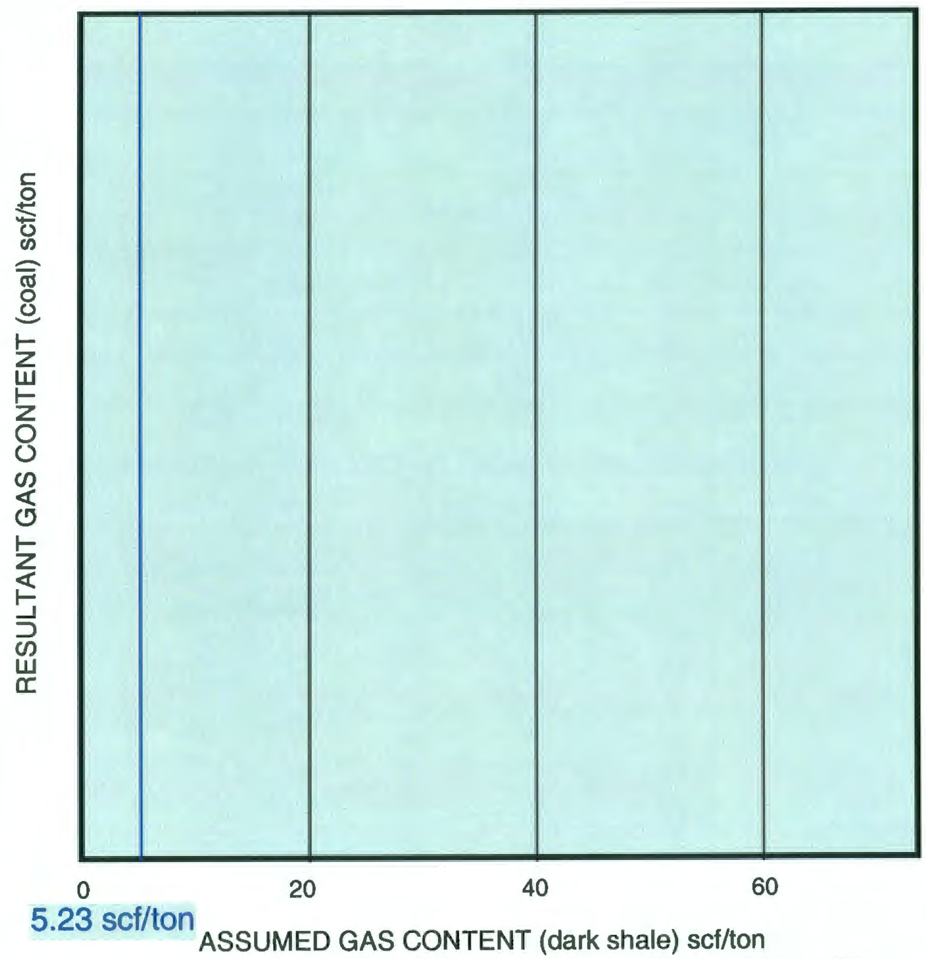


FIGURE 14.

Desorption Characteristics of Cuttings Samples

Meritage KCM #26-13 Garrison SWD; sec. NE NW 26-T.19S.-R.19E.; Anderson Co., KS

LITHOLOGIC COMPONENT SENSITIVITY ANALYSIS for calculation of gas content of Bevier coal from 853-855'

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

total gas desorbed = 109 ccs

TOTAL DRY WEIGHT OF SAMPLE = 1356.35 grams

$\text{weight}_{light\text{-}colored\ lithologies}$ = 808.80 grams (59.6%)

$\text{weight}_{dark\ shale}$ = 421.78 grams (31.1%)

weight_{coal} = 125.77 grams (9.3%)

sieve size	*grams*	*% coal / % dark shale / % light-colored liths*
>0.0930"	1018.83	8.97% / 31.84% / 59.18%
>0.0661"	178.93	13.07% / 34.24% / 52.68%
>0.0460"	74.43	7.53% / 24.00% / 68.47%
>0.0331"	26.43	2.68% / 12.75% / 84.56%
<0.0331"	38.23	8.06% / 25.71% / 66.23%
	1356.35 TOTAL	

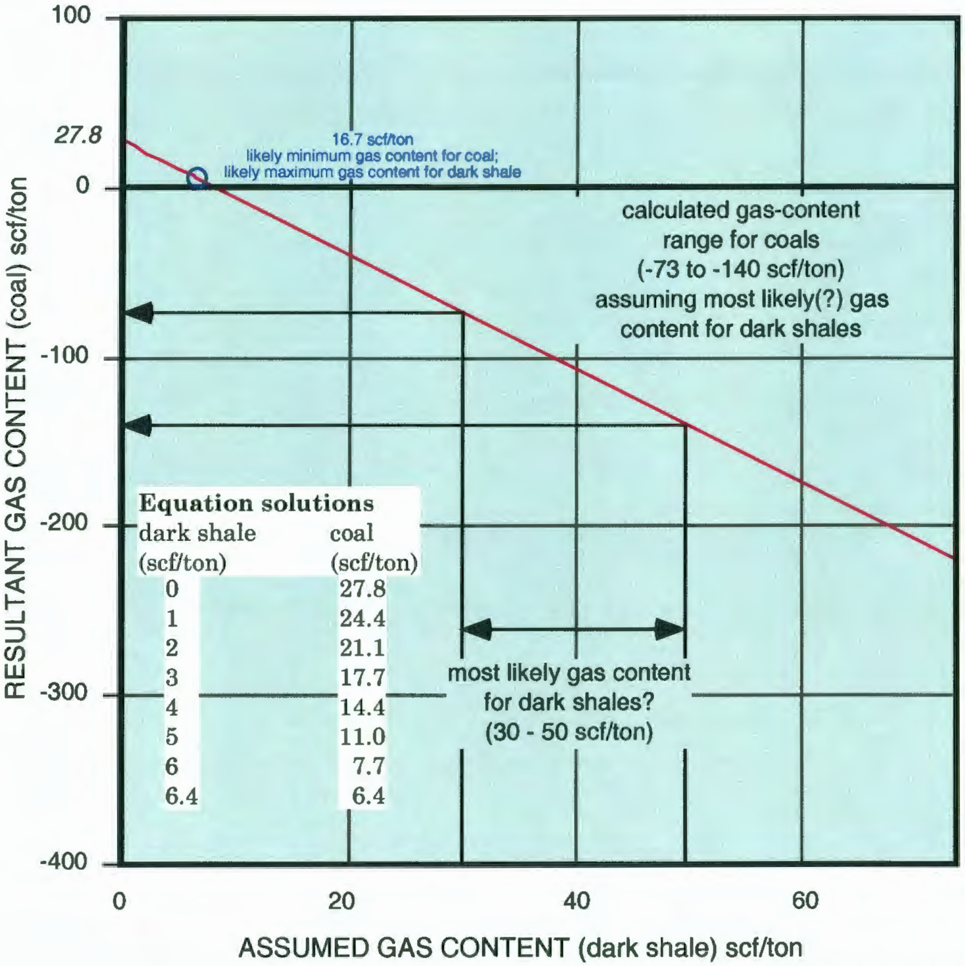


FIGURE 15.

Desorption Characteristics of Cuttings Samples

Meritage KCM #26-13 Garrison SWD; sec. NE NW 26-T.19S.-R.19E.; Anderson Co., KS

LITHOLOGIC COMPONENT SENSITIVITY ANALYSIS for calculation of gas content of Mineral coal from 898-900'

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

total gas desorbed = 40 ccs

TOTAL DRY WEIGHT OF SAMPLE = 924.47 grams
$\text{weight}_{light\text{-}colored\ lithologies}$ = 620.57 grams (67.1%)
$\text{weight}_{dark\ shale}$ = 262.61 grams (28.4%)
weight_{coal} = 41.29 grams (4.5%)

sieve size	*grams*	*% coal / % dark shale / % light-colored liths*
>0.0930"	543.28	4.60% / 33.65% / 61.76%
>0.0661"	237.99	4.58% / 21.23% / 74.19%
>0.0460"	107.79	3.76% / 20.45% / 75.79%
>0.0331"	16.31	3.64% / 17.27% / 79.09%
<0.0331"	19.10	4.14% / 23.15% / 72.71%
	924.47 TOTAL	

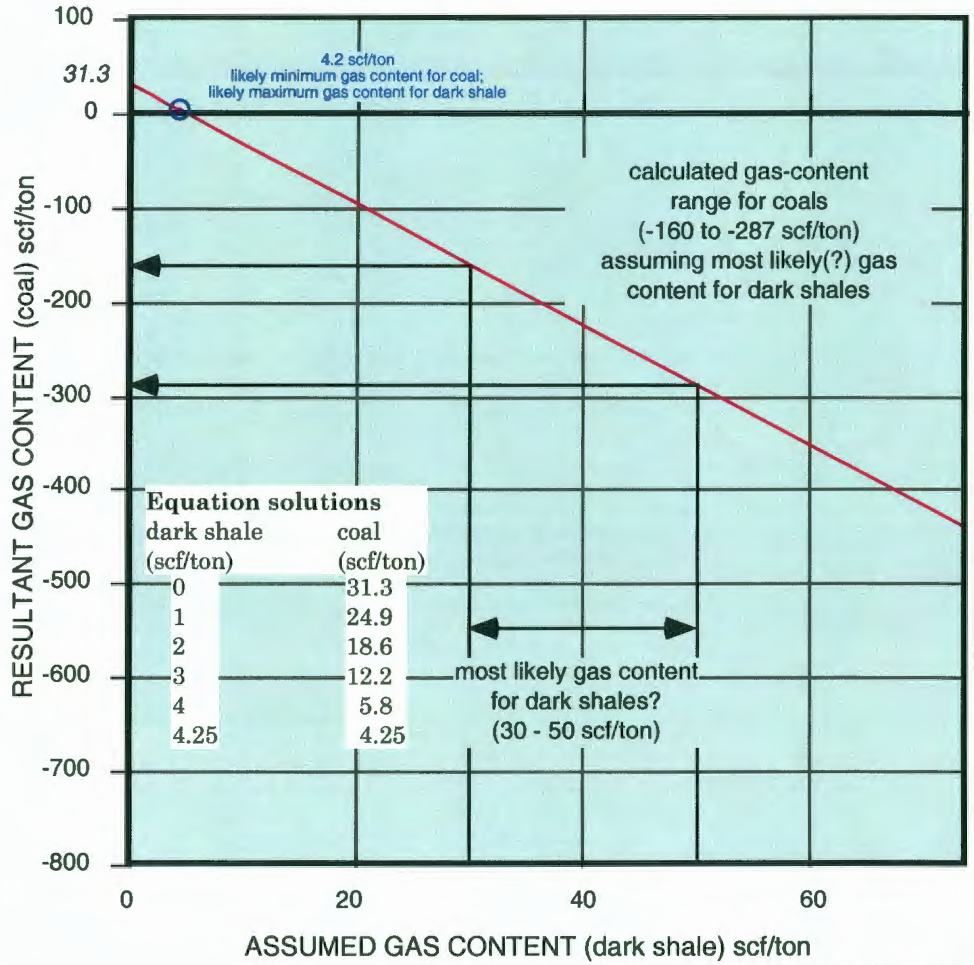


FIGURE 16.

Desorption Characteristics of Cuttings Samples

Meritage KCM #26-13 Garrison SWD; sec. NE NW 26-T.19S.-R.19E.; Anderson Co., KS

LITHOLOGIC COMPONENT SENSITIVITY ANALYSIS for calculation of gas content of Riverton "A" coal from 1108-1110'

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

total gas desorbed = 141 ccs

TOTAL DRY WEIGHT OF SAMPLE = 622.35 grams
$\text{weight}_{light\text{-}colored\ lithologies}$ = 352.41 grams (56.6%)
$\text{weight}_{dark\ shale}$ = 223.22 grams (35.9%)
weight_{coal} = 46.73 grams (7.5%)

sieve size	*grams*	*% coal / % dark shale / % light-colored liths*
>0.0930"	425.50	4.85% / 36.37% / 58.78%
>0.0661"	135.67	13.79% / 36.08% / 50.13%
>0.0460"	51.11	12.24% / 32.05% / 55.72%
>0.0331"	8.84	11.21% / 30.84% / 57.94%
<0.0331"	1.24	10.52% / 33.83% / 55.64%
	622.35 TOTAL	

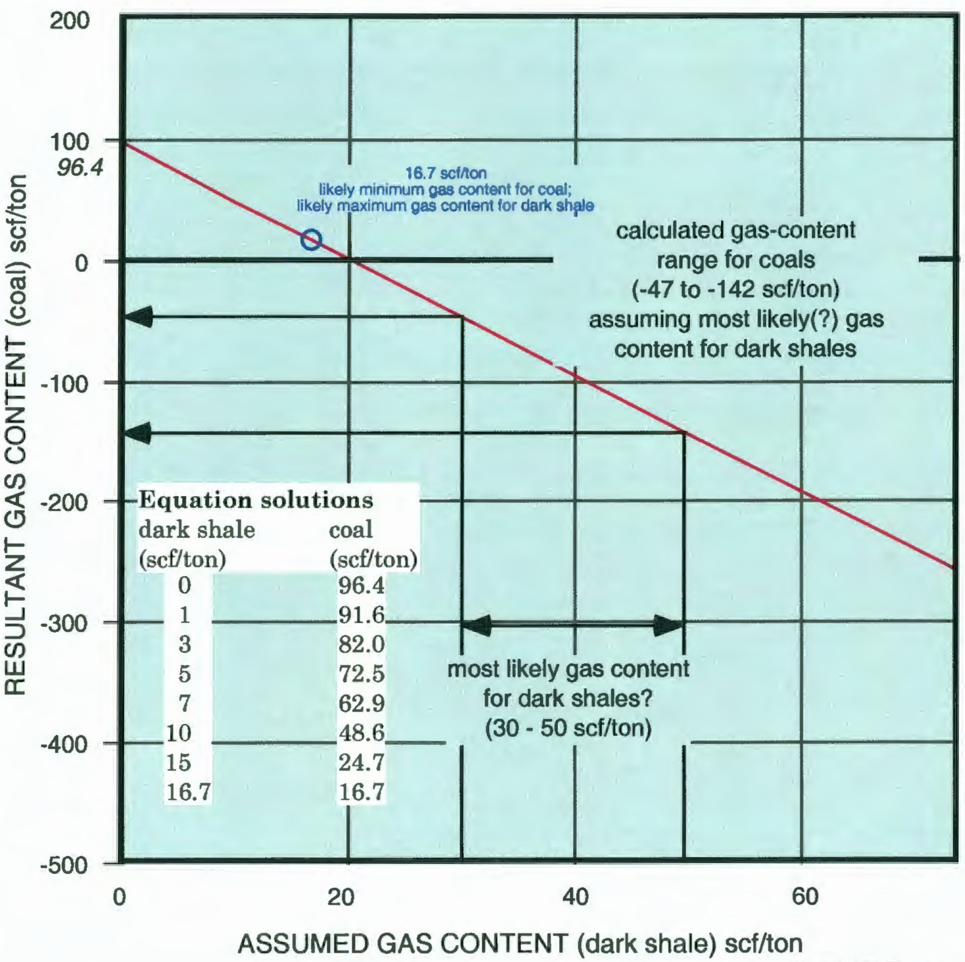


FIGURE 17.

Desorption Characteristics of Cuttings Samples

Meritage KCM #26-13 Garrison SWD; sec. NE NW 26-T.19S.-R.19E.; Anderson Co., KS

LITHOLOGIC COMPONENT SENSITIVITY ANALYSIS for calculation of gas content of sieved Riverton coal from 1113-1115'

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

SIEVED CUTTINGS (COARSE FRACTION) >0.0930"

total gas desorbed = 393 ccs

TOTAL DRY WEIGHT OF SAMPLE = 1011.36 grams

$\text{weight}_{light\text{-}colored\ lithologies}$ = 267.89 grams (26.5%)

$\text{weight}_{dark\ shale}$ = 628.67 grams (62.2%)

weight_{coal} = 114.81 grams (11.4%)

SIEVED CUTTINGS (FINE FRACTION) <0.0930" and >0.0661"

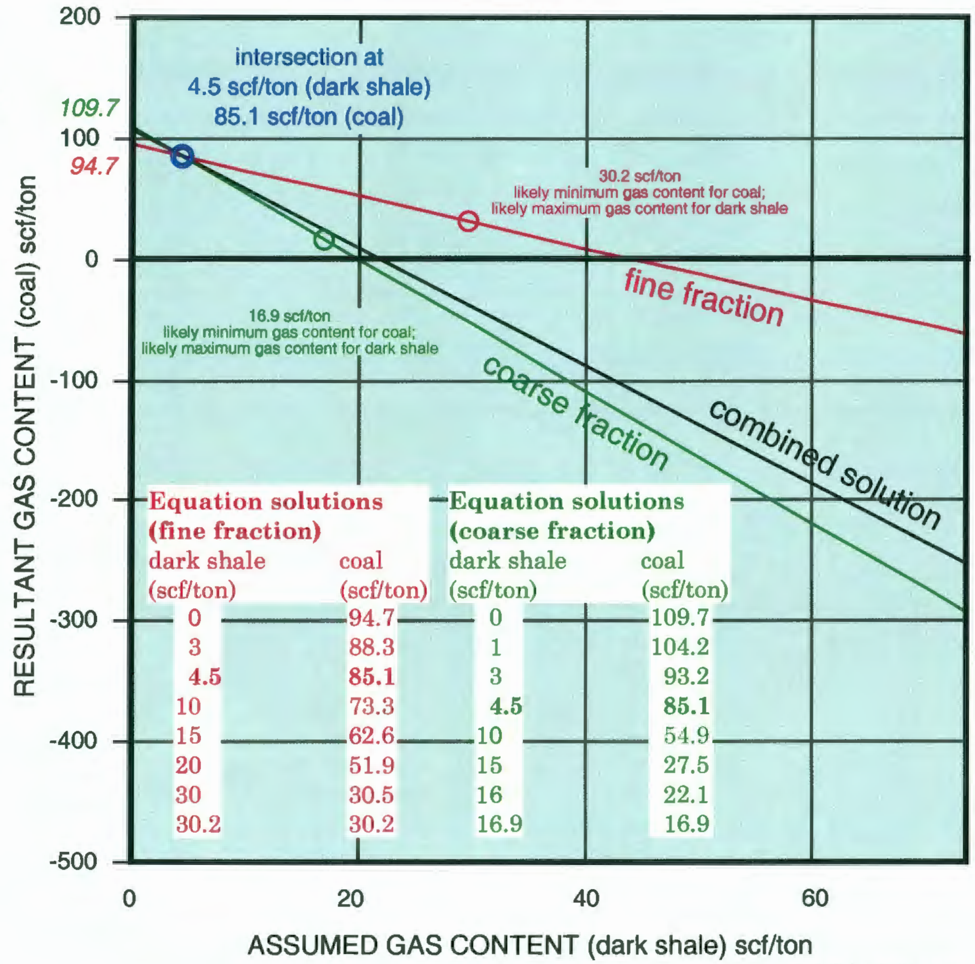
total gas desorbed = 73 ccs

TOTAL DRY WEIGHT OF SAMPLE = 126.07 grams

$\text{weight}_{light\text{-}colored\ lithologies}$ = 48.60 grams (38.6%)

$\text{weight}_{dark\ shale}$ = 52.80 grams (41.9%)

weight_{coal} = 24.67 grams (19.6%)



Equation solutions (fine fraction)

dark shale (scf/ton)	coal (scf/ton)
0	94.7
3	88.3
4.5	**85.1**
10	73.3
15	62.6
20	51.9
30	30.5
30.2	30.2

Equation solutions (coarse fraction)

dark shale (scf/ton)	coal (scf/ton)
0	109.7
1	104.2
3	93.2
4.5	**85.1**
10	54.9
15	27.5
16	22.1
16.9	16.9

FIGURE 18.

Desorption Characteristics of Cuttings Samples

Meritage KCM #26-13 Garrison SWD; sec. NE NW 26-T.19S.-R.19E.; Anderson Co., KS

LITHOLOGIC COMPONENT SENSITIVITY ANALYSIS for calculation of gas content of Riverton coal from 1120-1122'

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

total gas desorbed = 64 ccs

TOTAL DRY WEIGHT OF SAMPLE = 456.21 grams

$\text{weight}_{light\text{-}colored\ lithologies}$ = 257.54 grams (56.5%)

$\text{weight}_{dark\ shale}$ = 192.87 grams (42.3%)

weight_{coal} = 5.80 grams (1.3%)

sieve size	*grams*	*% coal / % dark shale / % light-colored liths*
>0.0930"	322.58	0.78% / 41.04% / 58.18%
>0.0661"	93.30	1.68% / 45.31% / 53.02%
>0.0460"	33.27	3.49% / 46.51% / 50.00%
>0.0331"	5.34	7.35% / 38.24% / 54.41%
<0.0331"	1.73	10.00% / 40.00% / 50.00%
	456.21 TOTAL	

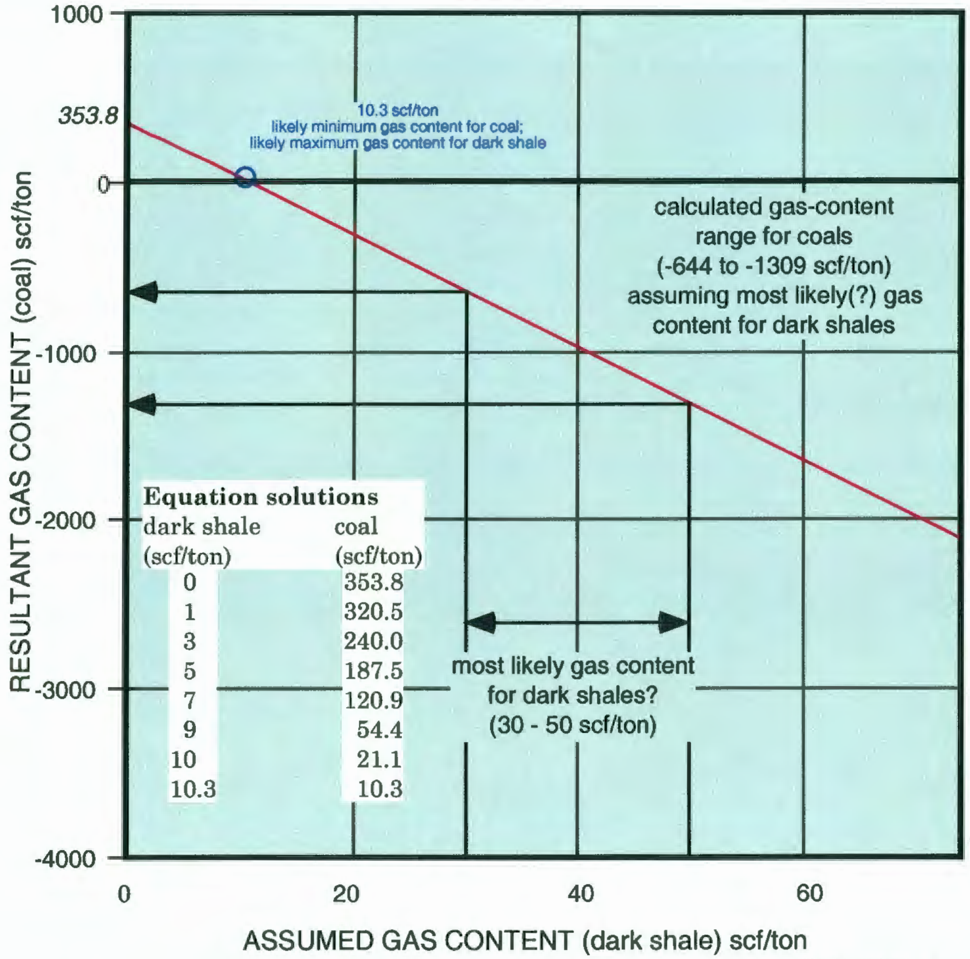


FIGURE 19.

Desorption Characteristics of Cuttings Samples

Meritage KCM #26-13 Garrison SWD; sec. NE NW 26-T.19S.-R.19E.; Anderson Co., KS

LITHOLOGIC COMPONENT SENSITIVITY ANALYSIS for gas content of Riverton cuttings samples at 1108-1110', 1113-1150', & 1120-1122'

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

1108-1110' Riverton cuttings sample

total gas desorbed = 141 ccs

TOTAL DRY WEIGHT OF SAMPLE = 622.35 grams

$\text{weight}_{\text{light-colored lithologies}}$ = 352.41 grams (56.6%)

$\text{weight}_{\text{dark shale}}$ = 223.22 grams (35.9%)

weight_{coal} = 46.73 grams (7.5%)

1113-1115' Riverton cuttings samples

total gas desorbed = 466 ccs

TOTAL DRY WEIGHT OF SAMPLE = 456.21 grams

$\text{weight}_{\text{light-colored lithologies}}$ = 316.49 grams (27.8%)

$\text{weight}_{\text{dark shale}}$ = 681.47 grams (59.9%)

weight_{coal} = 139.48 grams (12.3%)

1120-1122' Riverton cuttings sample

total gas desorbed = 64 ccs

TOTAL DRY WEIGHT OF SAMPLE = 456.21 grams

$\text{weight}_{\text{light-colored lithologies}}$ = 257.80 grams (56.5%)

$\text{weight}_{\text{dark shale}}$ = 192.87 grams (42.3%)

weight_{coal} = 5.80 grams (1.3%)

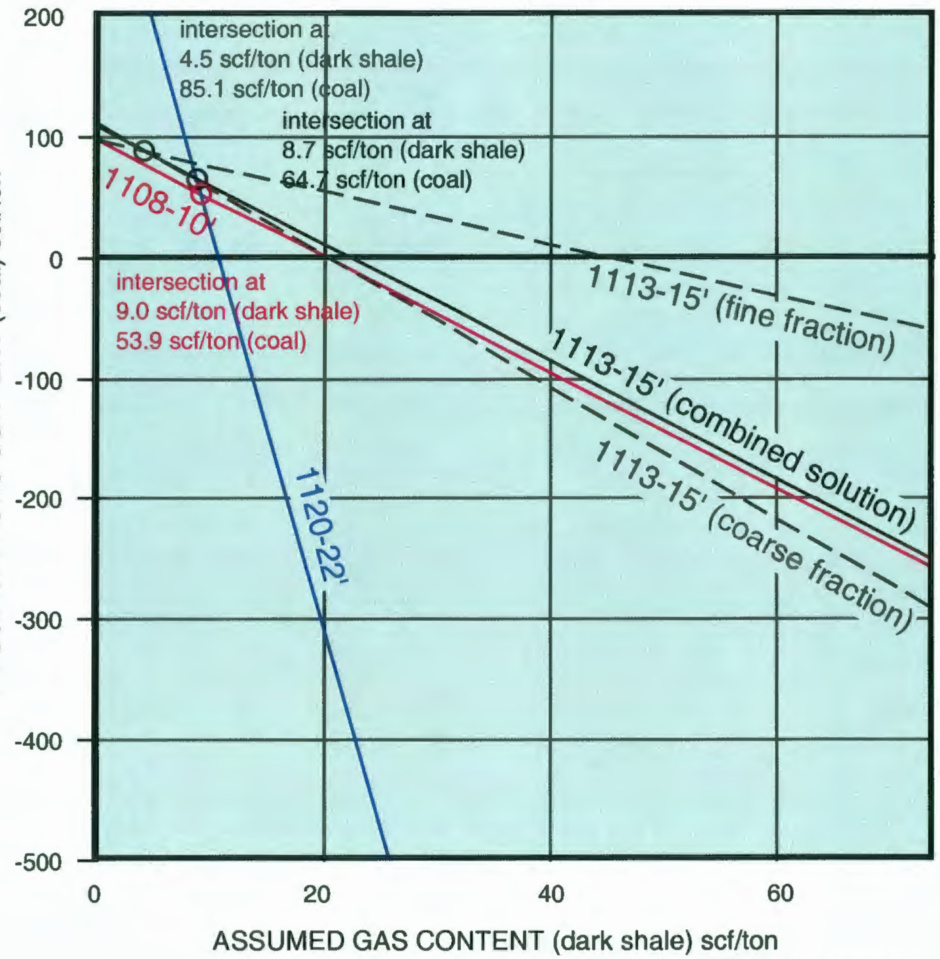


FIGURE 20.

Desorption Characteristics of Cuttings Samples

Meritage KCM #26-13 Garrison SWD; sec. NE NW 26-T.19S.-R.19E.; Anderson Co., KS

surface

100'

200'

300'

400'

500'

600'

673'-676' Mulberry

755'-758' shale above Summit
760'-762' Summit

800'

853'-855' Bevier

898'-900' Mineral

1000'

1100'

1108'-1110' Riverton "A"
1113'-1115' Riverton "A" (fine, coarse)
1120'-1122' Riverton "B"

1200'

LITHOLOGIC COMPONENT SENSITIVITY ANALYSIS for all samples

UNIT	coal in sample	scf/ton w/ shale @ 3 scf/ton	maximum scf/ton	minimum scf/ton
Mulberry	60%	35.1	35.3	32.5
shale	0%	------	3.3	3.3
Summit	0%	------	5.2	5.2
Bevier	9%	17.7	27.8	16.7
Mineral	5%	12.2	31.3	4.2
Riverton "A"	8%	82.0	96.4	16.7
Riverton "A" (cs)	20%	88.3	94.7	30.2
Riverton "A" (fn)	11%	93.2	109.7	16.9
Riverton "B"	1%	240.0	353.8	10.3

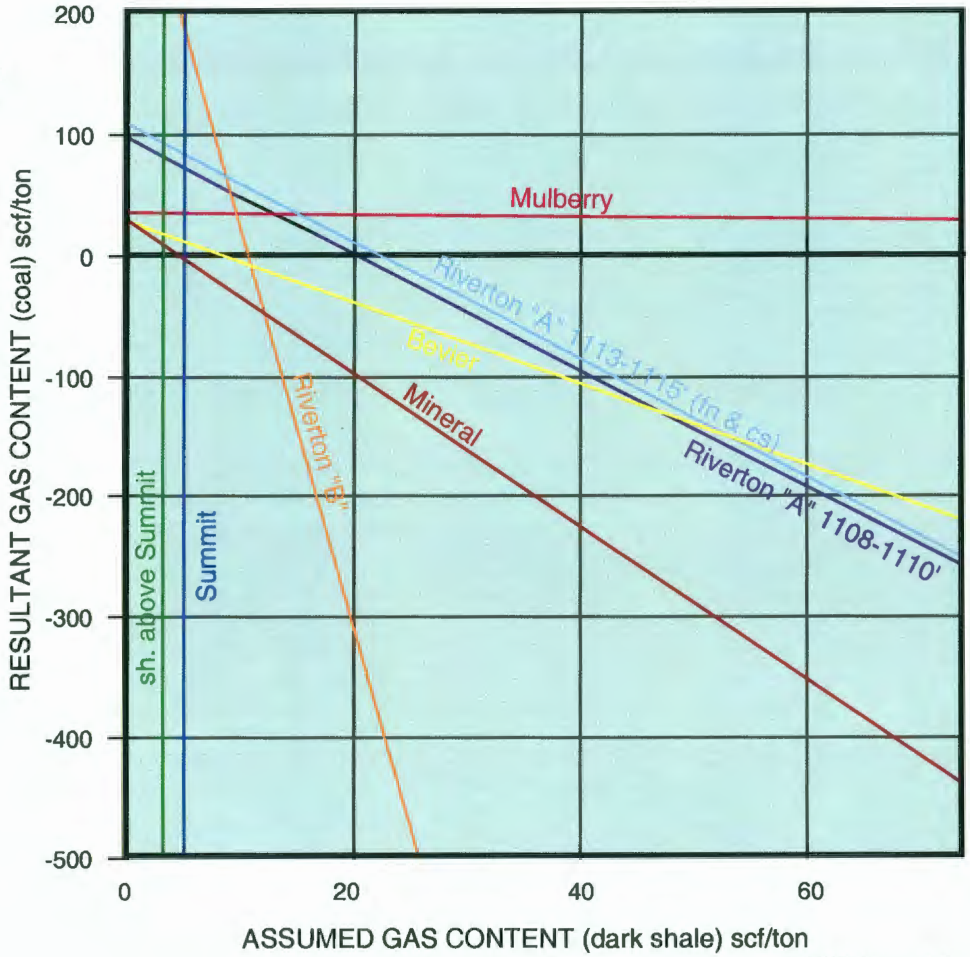


FIGURE 21.

Desorption Characteristics of Cuttings Samples (ie., coal & dark shale)

Meritage KCM #26-13 Garrison SWD; NE SW sec. 26-T.19S.-R.19E., Anderson County, KS

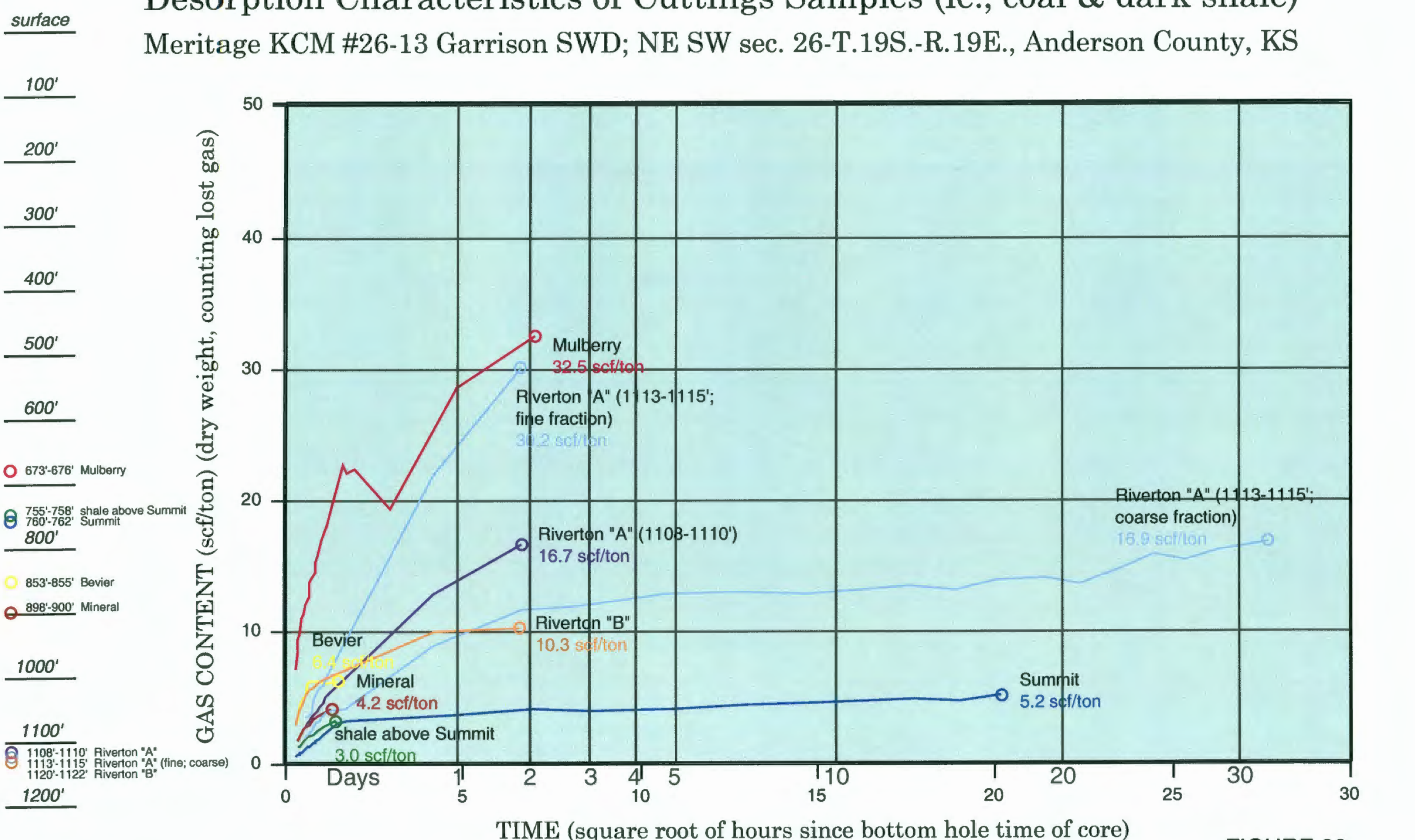


FIGURE 22.