ANALYSIS OF MARMATON AND CHEROKEE GROUP CORE SAMPLES FOR GAS CONTENT
-- DART CHEROKEE BASIN OPERATING COMPANY
BUTLER #A3-35; sec. 35-T.33S.-R.14E.; MONTGOMERY COUNTY, KANSAS

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SUMMARY

Three three-inch diameter core samples from the Pennsylvanian Marmaton and Cherokee Groups were collected from the Dart Cherokee Basin Butler #A3-35; sec. 35-T.33S.-R.14E.; in Montgomery County, KS over November 10th and 11th, 2002. The following gas contents have been measured, based on the dry weight of the sample:

- 952.2' to 953.6' (Summit coal) (21.5 scf/ton)
- 1033.3' to 1034.0' (Croweburg coal) (62.3 scf/ton)
- 1124.3' to 1125.3' (Tebo coal) (19.9 scf/ton)

Proximate analyses indicate the moisture/ash-free BTU/lb. of the Tebo sample (1124.3' to 1125.3') is 12,228, which makes this coal a high-volatile C bituminous coal. Conversely, the shallower Croweburg sample (1033.3' to 1034.0') assays at 14,364 BTU/lb., making it a high-volatile A bituminous coal.

Isotopic and compositional analysis of the gas obtained from the Croweburg coal (1033.3' to 1034.0') indicates it has mixed biogenic and thermogenic characteristics, with a heating value of 878 BTU/scf.

BACKGROUND

The Dart Cherokee Basin Butler #A3-35 in sec. 35-T.33S.-R.14E (Montgomery County, KS) was selected for desorption tests in association with an on-going coalbed gas research project at the Kansas Geological Survey. The samples (3-inch-diameter core) were gathered November 10th and 11th, 2002 by K. David Newell of the Kansas Geological Survey. Samples were obtained during wireline coring. The well was drilled by a rig owned by Layne Christensen, Canada. Tichora, Inc., was charged with the responsibility to collect most of the coals from this well, but results for shale and minor coals collected separately by the Kansas Geological Survey are reported in this document.

Bottom-hole times (i.e., the time the core sample was lifted from the bottom of the hole) and canistering times (i.e., the time the sample was placed in the desorption canister) were noted in order to determine lost gas and start of desorption. Approximate wet weight of the sample was determined by subtraction of the weight of the empty canister from the weight of the canister with the sample in it. After the sample was removed from the canister, it was weighed again before air- or oven-drying, then weighed after drying. The weight loss is noted in the desorption table (Table 1).

Temperature baths for the desorption canisters were on site, with temperatures at 85 degrees F. The canistered samples were later transported to the laboratory at the Kansas Geological Survey in Lawrence, KS and desorption measurements were continued at this temperature. Desorption measurements were periodically made until the canisters produced no more gas upon testing for at least two successive measurements.

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 commercially 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).

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.

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 core sample is lifted from the bottom of the hole. 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 two hours for core samples.

One desorption-gas sample was collected from the Croweburg coal. The gas was collected November 21, 2003 in two 120-cc glass bottles. Each of these bottles were water-filled and inverted in a larger bucket of water. Gas was channeled to the sample bottle directly from the desorption canister through a capillary tube. To minimize dilution of the desorption gas by the atmosphere, the capillary tube was initially filled with water. Once the valve to the desorption canister was open, the gas from the desorption canister forced the water out of the capillary tube and then the inverted bottle. The bottle was then sealed under water and subsequently sent to Isotech Laboratories in Champaign, IL for analysis.

LITHOLOGIC ANALYSIS

Upon removal from the canisters, the cores were washed of drilling mud, and air-dried for 7 days. After drying, the cores were weighed again to obtain a dry-weight based gas content. Selected samples were sent for proximate analysis at Luman's Laboratories in Chetopa, KS, in addition to being subjected to ashing experiments at the Kansas Geological Survey.

DATA PRESENTATION

Data and analyses accompanying this report are presented in the following order: 1) data tables for the desorption analyses, 2) lost-gas graphs, 3) desorption graphs for individual samples, and 4) desorption graph for all samples at a common scale.

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 core 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 2-4)
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 two hours after canistering, thus data are presented in the lost-gas graphs for only up to 9 hours after canistering. Lost-gas volumes derived from this analysis are incorporated in the data tables described above.

Desorption Graphs (Figures 5-8)
These are desorption graph (gas content per weight vs. square root of time) for all the samples. The last graph in the series has all the desorption curves on it at a common scale.

Isotopic Analysis (Figure 9)
This figure compares the results of the isotopic and compositional analyses to other conventionally-produced gases in eastern Kansas.

Appendix 1
These are photocopies of the results of the Luman's Laboratories proximate analyses.

Appendix 2
This is a photocopy of the results of the Isotech Laboratories compositional and isotopic analysis.

RESULTS and DISCUSSION

The following gas contents are calculated, based on dry weight of the sample:

- 952.2' to 953.6' (Summit coal) (21.5 scf/ton)
- 1033.3' to 1034.0' (Croweburg coal) (62.3 scf/ton)
- 1124.3' to 1125.3' (Tebo coal) (19.9 scf/ton)

Proximate analyses were performed on the Croweburg and Tebo coal samples at Luman's Laboratories in Chetopa, KS. The core was cut down its vertical axis. The proximate analysis was performed on one half of the sample and the other half was preserved for future analyses.

Croweburg (1033.3' to 1034.0')
As Received

moisture	*ash*	*volatile matter*	*fixed carbon*	*BTU/lb.*	*sulfur*
2.59%	20.50%	35.59%	41.32%	11047	3.01%

Moisture Free

ash	*volatile matter*	*fixed carbon*	*BTU/lb.*	*sulfur*
21.04%	36.53%	42.43%	11342	3.09%

Moisture/ash free

BTU/lb.
14364

Tebo (1124.3' to 1125.3')
As Received

moisture	*ash*	*volatile matter*	*fixed carbon*	*BTU/lb.*	*sulfur*
3.82%	62.23%	17.46%	16.19%	4172	1.30%

Moisture Free

ash	*volatile matter*	*fixed carbon*	*BTU/lb.*	*sulfur*
64.70%	18.46%	16.84%	4338	1.35%

Moisture/ash free

BTU/lb.
12228

Proximate analyses indicate the moisture/ash-free BTU/lb. of the Tebo sample (1124.3' to 1125.3') is 12,228, which makes this coal a high-volatile C bituminous coal. Conversely, the shallower Croweburg sample (1033.3' to 1034.0') assays at 14,364 BTU/lb., making it a high-volatile A bituminous coal.

Using the equation from McLennan and others (1995):

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

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

the gas content of the samples converts to:

unit	*depth*	*moisture-free ash*	G_c	G_{pc}
Croweburg	1033.3'	21.04%	62.3 scf/ton	78.9 scf/ton
Tebo	1124.3'	64.70%	19.9 scf/ton	56.4 scf/ton

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

unit	*depth*	*moisture*	*ash*	*moisture-free ash*
Summit	952.2'	2.22%	79.94%	81.75%
Croweburg	1033.3'	1.53%	19.56%	19.87%
Tebo	1124.3'	2.00%	76.44%	78.00%

Using the equation from McLennan and others (1995) (see above), the gas content of the samples converts to:

unit	*depth*	*moisture-free ash*	G_c	G_{pc}
Summit	952.2'	81.75%	21.5 scf/ton	117.8 scf/ton
Croweburg	1033.3'	19.87%	62.3 scf/ton	77.7 scf/ton
Tebo	1124.3'	78.00%	19.9 scf/ton	90.5 scf/ton

The compositional and isotopic analysis of the Croweburg coal desorption gas indicates that this gas has both microbial and thermogenic components (Figure 9). The conventional gases in the region of the Dart Cherokee Basin Butler #A3-35 well also have mixed origin, according to the map of isotopic compositions in Figure 9. Heating value for the Croweburg desorption gas is 878 BTU/scf.

REFERENCES

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FIGURES, TABLES, and APPENDICES

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

TABLE 1. Desorption measurements for samples.

FIGURE 2. Lost-gas graph for 952.2' to 953.6' (Summit coal).
FIGURE 3. Lost-gas graph for 1033.3' to 1034.0' (Croweburg coal).
FIGURE 4. Lost-gas graph for 1124.3' to 1125.3' (Tebo coal).

FIGURE 5. Desorption graph for 952.2' to 953.6' (Summit coal).
FIGURE 6. Desorption graph for 1033.3' to 1034.0' (Croweburg coal).
FIGURE 7. Desorption graph for 1124.3' to 1125.3' (Tebo coal).

FIGURE 8. Desorption graph for all samples.

FIGURE 9. Compositional and isotopic analyses for Croweburg sample compared to conventional gases from eastern Kansas.

APPENDIX 1. Proximate analyses performed by Luman's Laboratories.

APPENDIX 2. Compositional and isotopic analysis performed by Isotech Laboratories.

TABLE 1 -- Desorption data for Dart Butler #A3-35; sec. 35-T.33S.-R.14E.; Montgomery Co., KS

SAMPLE: 952.2' to 953.6' (Summit Coal) in canister 3

sample air dried 7 Days

	lbs.	grams		lbs.	grams	moisture weight		est. lost gas (cc) =		TIME OF:		elapsed time (off bottom to canistering)
dry sample weight:	5.0268	2280.13345	wet sample weight:	5.1190	2321.93	1.8%		82		off bottom	in canister	13.1 minutes
CONVERSION OF VOLUMES TO STP										11/10/02 16:14	11/10/02 16:27	0.219 hours

RIG MEASUREMENTS			CONVERSION OF RIG MEASUREMENTS TO STP (cubic ft; @60 degrees; @14.7 psi)					CUMULATIVE VOLUMES		SCF/TON (approx)	SCF/TON (approx)			TIME SINCE		0.467855628 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)
6	85	1076	0.000211889	545	13.966	0.000192075	5.43893	0.000192075	5.43893	0.076419769	1.228562006	11/10/02	16:29	0:14:56	0:01:48	0.498887652
6	85	1076	0.000211889	545	13.966	0.000192075	5.43893	0.000384149	10.87786	0.152839538	1.304981775	11/10/02	16:31	0:16:45	0:03:37	0.52836225
4	85	1076	0.000141259	545	13.966	0.00012805	3.625953	0.000512199	14.50381	0.203786051	1.355928288	11/10/02	16:32	0:18:00	0:04:52	0.547722558
4	85	1076	0.000141259	545	13.966	0.00012805	3.625953	0.000640249	18.12977	0.254732563	1.4068748	11/10/02	16:33	0:19:30	0:06:22	0.570087713
6	85	1076	0.000211889	545	13.966	0.000192075	5.43893	0.000832324	23.5687	0.331152332	1.483294569	11/10/02	16:35	0:21:15	0:08:07	0.595119036
4	85	1076	0.000141259	545	13.966	0.00012805	3.625953	0.000960374	27.19465	0.382098845	1.534241082	11/10/02	16:37	0:22:45	0:09:37	0.615765107
8	85	1076	0.000282518	545	13.966	0.0002561	7.251907	0.001216473	34.44656	0.48399187	1.636134107	11/10/02	16:40	0:26:00	0:12:52	0.658280589
8	85	1076	0.000282518	545	13.966	0.0002561	7.251907	0.001472573	41.69846	0.585884896	1.738027133	11/10/02	16:43	0:29:15	0:16:07	0.698212002
5	85	1076	0.000176574	545	13.966	0.000160062	4.532442	0.001632635	46.23091	0.649568037	1.801710273	11/10/02	16:46	0:31:45	0:18:37	0.727438428
4	85	1076	0.000141259	545	13.966	0.00012805	3.625953	0.001760685	49.85686	0.700514549	1.852656786	11/10/02	16:47	0:33:30	0:20:22	0.747217059
3	85	1076	0.000105944	545	13.966	9.60374E-05	2.719465	0.001856722	52.57632	0.738724434	1.890866671	11/10/02	16:49	0:35:30	0:22:22	0.769198717
8	85	1076	0.000282518	545	13.966	0.0002561	7.251907	0.002112822	59.82823	0.840617459	1.992759696	11/10/02	16:54	0:40:00	0:26:52	0.816496581
6	85	1076	0.000211889	545	13.966	0.000192075	5.43893	0.002304897	65.26716	0.917037228	2.069179465	11/10/02	16:57	0:42:45	0:29:37	0.844097151
7	85	1076	0.000247204	545	13.966	0.000224087	6.345418	0.002528984	71.61258	1.006193625	2.158335862	11/10/02	17:00	0:46:15	0:33:07	0.877971146
5	85	1076	0.000176574	545	13.966	0.000160062	4.532442	0.002689046	76.14502	1.069876766	2.222019003	11/10/02	17:04	0:50:00	0:36:52	0.912870929
6	85	1076	0.000211889	545	13.966	0.000192075	5.43893	0.002881121	81.58395	1.146296535	2.298438772	11/10/02	17:08	0:53:45	0:40:37	0.946484724
5	85	1076	0.000176574	545	13.966	0.000160062	4.532442	0.003041183	86.11639	1.209979676	2.362121913	11/10/02	17:11	0:57:15	0:44:07	0.976814551
13	85	1076	0.000459092	545	13.966	0.000416162	11.78435	0.003457345	97.90074	1.375555842	2.527698079	11/10/02	17:22	1:08:15	0:55:07	1.06653645
7	85	1076	0.000247204	545	13.966	0.000224087	6.345418	0.003681432	104.2462	1.464712239	2.616854476	11/10/02	17:29	1:14:56	1:01:48	1.117536974
13	85	1077	0.000459092	545	13.979	0.000416549	11.7953	0.004097981	116.0415	1.630442287	2.782584524	11/10/02	17:41	1:27:15	1:14:07	1.205888331
7	85	1077	0.000247204	545	13.979	0.000224295	6.351316	0.004322276	122.3928	1.719681543	2.87182378	11/10/02	17:48	1:33:45	1:20:37	1.25
17	85	1077	0.000600352	545	13.979	0.000544718	15.42462	0.004866994	137.8174	1.936405451	3.088547688	11/10/02	18:07	1:52:45	1:39:37	1.370827001
25	85	1078	0.00088287	545	13.992	0.000801799	22.70433	0.005668793	160.5217	2.255413006	3.407555243	11/10/02	18:41	2:26:45	2:13:37	1.563916025
23	85	1078	0.00081224	545	13.992	0.000737655	20.88799	0.006406448	181.4097	2.548899957	3.701042194	11/10/02	19:22	3:07:45	2:54:37	1.768945072
48	85	1079	0.00169511	545	14.005	0.001540882	43.63275	0.00794733	225.0425	3.161962639	4.314104876	11/10/02	20:51	4:36:45	4:23:37	2.14767316
28	85	1080	0.000988814	545	14.018	0.000899681	25.47603	0.008847011	250.5185	3.519913973	4.67205621	11/10/02	21:55	5:40:45	5:27:37	2.383100222
3	85	1080	0.000105944	545	14.018	9.63944E-05	2.729575	0.008943405	253.2481	3.558265902	4.710408139	11/10/02	22:01	5:46:45	5:33:37	2.403989739 estimate
9	85	1080	0.000317833	545	14.018	0.000289183	8.188724	0.009232588	261.4368	3.673321688	4.825463925	11/10/02	22:23	6:08:45	5:55:37	2.47907913
30	85	1081	0.001059444	545	14.031	0.000964836	27.32102	0.010197425	288.7578	4.057196085	5.209338322	11/10/02	22:49	6:34:45	6:21:37	2.564988629
25	85	1082	0.00088287	545	14.044	0.000804774	22.78858	0.011002199	311.5464	4.377387342	5.529529579	11/11/02	1:06	8:51:45	8:38:37	2.976995129
20	85	1083	0.000706296	545	14.057	0.000644414	18.24771	0.011646613	329.7941	4.633777087	5.785919324	11/11/02	2:35	10:20:45	10:07:37	3.21649395
60	85	1089	0.002118888	545	14.135	0.001943953	55.04642	0.013590566	384.8405	5.407207649	6.559349886	11/11/02	7:16	15:01:45	14:48:37	3.876746918
39	85	1091	0.001377277	545	14.161	0.00126589	35.84589	0.014856457	420.6864	5.910860801	7.063003038	11/11/02	9:58	17:43:45	17:30:37	4.210601699
23	80	1087	0.00081224	540	14.109	0.000750701	21.2574	0.015607157	441.9438	6.209538174	7.36168041	11/11/02	16:14	23:59:45	23:46:37	4.898554208
100	85	1094	0.00353148	545	14.200	0.003254798	92.16526	0.018861955	534.1091	7.504507617	8.656649854	11/12/02	9:26	41:11:45	40:58:37	6.418398035
58	85	1091	0.002048258	545	14.161	0.001882606	53.30927	0.020744561	587.4183	8.253530254	9.405672491	11/12/02	19:11	50:56:45	50:43:37	7.137634996
95	85	1080	0.003354906	545	14.018	0.003052489	86.43653	0.02379705	673.8549	9.468007996	10.62015023	11/13/02	18:53	74:38:45	74:25:37	8.639782019
64	85	1081	0.002260147	545	14.031	0.002058318	58.28484	0.025855367	732.1397	10.28694004	11.43908228	11/14/02	18:19	98:04:45	97:51:37	9.90349265
92	85	1086	0.003248962	545	14.096	0.002972517	84.17199	0.028827885	816.3117	11.46959989	12.62174213	11/16/02	22:40	150:25:45	150:12:37	12.26495686
160	85	1085	0.005650368	545	14.083	0.005164835	146.2513	0.033992719	962.563	13.5245057	14.67664793	11/22/02	17:39	289:24:45	289:11:37	17.01212803
50	85	1092	0.00176574	545	14.174	0.001624424	45.99839	0.035617143	1008.561	14.17080672	15.32294895	11/24/02	17:30	337:15:45	337:02:37	18.364708
26	85	1093	0.000918185	545	14.187	0.000845474	23.94106	0.036462617	1032.502	14.50719101	15.65933325	11/25/02	18:50	362:35:45	362:22:37	19.0419493
35	85	1092	0.001236018	545	14.174	0.001137097	32.19887	0.037599714	1064.701	14.95960173	16.11174396	11/27/02	18:43	410:28:45	410:15:37	20.26028545
44	85	1096	0.001553851	545	14.226	0.001434729	40.62685	0.039034443	1105.328	15.53042994	16.68257217	12/3/02	18:57	554:42:45	554:29:37	23.55233534
42	85	1088	0.001483222	545	14.122	0.001359518	38.49711	0.040393961	1143.825	16.07133418	17.22347641	12/6/02	14:26	622:11:45	621:58:37	24.94385362
40	85	1087	0.001412592	545	14.109	0.001293589	36.63022	0.041687549	1180.455	16.58600759	17.73814983	12/10/02	10:41	714:26:45	714:13:37	26.72911958
28	85	1082	0.000988814	545	14.044	0.000901347	25.52321	0.042588896	1205.979	16.9446218	18.09676403	12/12/02	18:04	769:49:45	769:36:37	27.74579548
34	85	1074	0.001200703	545	13.940	0.0010864	30.76332	0.043675297	1236.742	17.37686224	18.52900447	12/16/02	15:49	863:34:45	863:21:37	29.38671752
24	85	1078	0.000847555	545	13.992	0.000769727	21.79616	0.044445024	1258.538	17.68310949	18.83525173	12/19/02	20:48	940:33:45	940:20:37	30.66859143
13	85	1075	0.000459092	545	13.953	0.000415775	11.7734	0.044860799	1270.312	17.84853178	19.00067401	12/21/02	18:04	985:49:45	985:36:37	31.3979166
9	85	1088	0.000317833	545	14.122	0.000291325	8.249381	0.045152124	1278.561	17.96443983	19.11658206	12/23/02	19:24	1035:09:45	1034:56:37	32.17394132
45	85	1067	0.001589166	545	13.849	0.001428511	40.45078	0.046580635	1319.012	18.5327941	19.68493634	12/29/02	21:45	1181:30:45	1181:17:37	34.37313631
8	85	1082	0.000282518	545	14.044	0.000257528	7.292345	0.046838163	1326.304	18.63525531	19.78739754	12/31/02	21:08	1228:53:45	1228:40:37	35.05561058
12	85	1087	0.000423778	545	14.109	0.000388077	10.98907	0.04722624	1337.293	18.78965733	19.94179957	1/3/03	12:28	1292:13:45	1292:00:37	35.94758916
20	85	1088	0.000706296	545	14.122	0.000647389	18.33196	0.047873629	1355.625	19.04723078	20.19937301	1/7/03	13:41	1389:26:45	1389:13:37	37.27527107
28	85	1088	0.000988814	545	14.122	0.000906345	25.66474	0.048779974	1381.29	19.4078336	20.55997584	1/13/03	16:21	1536:06:45	1535:53:37	39.19327111
37	85	1100	0.001306648	545	14.278	0.00121088	34.28817	0.049990854	1415.578	19.88960011	21.04174235	1/22/03	15:35	1751:20:45	1751:07:37	41.84908402
45	85	1095	0.001589166	545	14.213	0.001465998	41.51228	0.051456852	1457.09	20.47286903	21.62501127	1/29/03	13:52	1917:37:45	1917:24:37	43.79074293

43	85	1075	0.001518536	545	13.953	0.001375256	38.94277	0.052832108	1496.033	21.02003505	22.17217729	2/3/03	16:06	2039:51:45	2039:38:37	45.16483699
29	85	1083	0.001024129	545	14.057	0.000934401	26.45918	0.053766509	1522.492	21.39180018	22.54394242	2/10/03	14:24	2206:09:45	2205:56:37	46.96980413
21	85	1083	0.000741611	545	14.057	0.000676635	19.1601	0.054443144	1541.652	21.66100941	22.81315165	2/17/03	14:09	2373:54:45	2373:41:37	48.72281293
10	85	1100	0.000353148	545	14.278	0.000327265	9.267074	0.054770409	1550.919	21.79121658	22.94335881	2/24/03	14:23	2542:08:45	2541:55:37	50.41969688
27	85	1095	0.0009535	545	14.213	0.000879599	24.90737	0.055650008	1575.827	22.14117793	23.29332016	3/3/03	14:04	2709:49:45	2709:36:37	52.0560195
18	85	1089	0.000635666	545	14.135	0.000583186	16.51393	0.056233194	1592.341	22.3732071	23.52534933	3/10/03	14:08	2877:53:45	2877:40:37	53.64602346
31	85	1072	0.001094759	545	13.914	0.000988697	27.99667	0.05722189	1620.337	22.76657478	23.91871702	3/20/03	11:54	3115:39:45	3115:26:37	55.81811982
11	85	1073	0.000388463	545	13.927	0.000351155	9.943571	0.057573046	1630.281	22.90628707	24.0584293	3/24/03	14:03	3213:48:45	3213:35:37	56.69049744
4	85	1077	0.000141259	545	13.979	0.000128169	3.629323	0.057701214	1633.91	22.95728093	24.10942316	3/31/03	17:22	3385:07:45	3384:54:37	58.18186287
7	85	1090	0.000247204	545	14.148	0.000227003	6.42798	0.057928217	1640.338	23.04759735	24.19973959	4/9/03	18:25	3602:10:45	3601:57:37	60.01815697
2	85	1078	7.06296E-05	545	13.992	6.41439E-05	1.816347	0.057992361	1642.155	23.07311796	24.22526019	4/14/03	15:17	3719:02:45	3718:49:37	60.98398014

DECANISTERED 4/14/03

SAMPLE: 1033.3' to 1034.0' (Croweburg Coal) in canister C

sample air dried 7 Days

	lbs.	grams		lbs.	grams	moisture weight		est. lost gas (cc) =		TIME OF:		elapsed time (off bottom to canistering)	
dry sample weight:	2.7858	1263.61	wet sample weight:	2.8122	1275.58	0.9%		180		off bottom	in canister	14.2	minutes
CONVERSION OF VOLUMES TO STP										11/10/02 21:02	11/10/02 21:17	0.236	hours
RIG MEASUREMENTS		CONVERSION OF RIG MEASUREMENTS TO STP (cubic ft; @60 degrees; @14.7 psi)				CUMULATIVE VOLUMES		SCF/TON (approx)	SCF/TON (approx)	TIME SINCE		0.485912658	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)
21	85	1079	0.000741611	545	14.005	0.000674136	19.08933	0.000674136	19.08933	0.483983048	5.047629186	11/10/02 21:20	0:17:40	0:03:30	0.542627353
8	85	1079	0.000282518	545	14.005	0.000256814	7.272126	0.00093095	26.36146	0.668357542	5.23200368	11/10/02 21:21	0:19:00	0:04:50	0.562731434
7	85	1079	0.000247204	545	14.005	0.000224712	6.36311	0.001155662	32.72457	0.829685224	5.393331363	11/10/02 21:23	0:20:10	0:06:00	0.579750904
8	85	1079	0.000282518	545	14.005	0.000256814	7.272126	0.001412475	39.99669	1.014059719	5.577705857	11/10/02 21:24	0:21:25	0:07:15	0.597448278
6	85	1079	0.000211889	545	14.005	0.00019261	5.454094	0.001605085	45.45079	1.152340589	5.715986728	11/10/02 21:25	0:22:25	0:08:15	0.611237361
6	85	1079	0.000211889	545	14.005	0.00019261	5.454094	0.001797696	50.90488	1.29062146	5.854267598	11/10/02 21:26	0:23:25	0:09:15	0.62472216
6	85	1080	0.000211889	545	14.018	0.000192789	5.459149	0.001990484	56.36403	1.429030487	5.992676626	11/10/02 21:27	0:24:25	0:10:15	0.637921974
8	85	1080	0.000282518	545	14.018	0.000257052	7.278866	0.002247536	63.6429	1.613575857	6.177221995	11/10/02 21:28	0:25:55	0:11:45	0.657224805
5	85	1080	0.000176574	545	14.018	0.000160657	4.549291	0.002408193	68.19219	1.728916713	6.292562851	11/10/02 21:29	0:26:55	0:12:45	0.669784377
16	85	1080	0.000565037	545	14.018	0.000514103	14.55773	0.002922297	82.74992	2.098007452	6.661653591	11/10/02 21:33	0:30:10	0:16:00	0.709068246
9	85	1080	0.000317833	545	14.018	0.000289183	8.188724	0.00321148	90.93864	2.305620993	6.869267131	11/10/02 21:35	0:32:10	0:18:00	0.732196088
8	85	1080	0.000282518	545	14.018	0.000257052	7.278866	0.003468532	98.21751	2.490166363	7.053812501	11/10/02 21:36	0:33:40	0:19:30	0.749073502
32	85	1080	0.001130074	545	14.018	0.001028207	29.11546	0.004496738	127.333	3.228347841	7.79199398	11/10/02 21:44	0:41:40	0:27:30	0.833333333
5	85	1080	0.000176574	545	14.018	0.000160657	4.549291	0.004657396	131.8823	3.343688697	7.907334836	11/10/02 21:45	0:42:40	0:28:30	0.843274043
28	85	1080	0.000988814	545	14.018	0.000899681	25.47603	0.005557077	157.3583	3.989597491	8.553243629	11/10/02 21:54	0:51:21	0:37:11	0.925112606
47	85	1080	0.001659796	545	14.018	0.001510179	42.76333	0.007067255	200.1216	5.073801538	9.637447676	11/10/02 22:11	1:08:10	0:54:00	1.06588513
6	85	1080	0.000211889	545	14.018	0.000192789	5.459149	0.007260044	205.5808	5.212210565	9.775856703	11/10/02 22:13	1:10:10	0:56:00	1.081408546
61	85	1081	0.002154203	545	14.031	0.001961834	55.55274	0.009221878	261.1335	6.620671933	11.18431807	11/10/02 22:41	1:38:10	1:24:00	1.27910559
96	85	1081	0.003390221	545	14.031	0.003087476	87.42726	0.012309354	348.5608	8.837266873	13.40091301	11/10/02 23:45	2:42:10	2:28:00	1.644012706
85	85	1082	0.003001758	545	14.044	0.002736232	77.48116	0.015045586	426.0419	10.80169253	15.36533866	11/11/02 1:09	4:06:10	3:52:00	2.02553148
65	85	1083	0.002295462	545	14.057	0.002094346	59.30506	0.017139932	485.347	12.30528874	16.86893488	11/11/02 2:36	5:33:10	5:19:00	2.356433275
162	85	1089	0.005720998	545	14.135	0.005248674	148.6253	0.022388606	633.9723	16.07347451	20.63712065	11/11/02 7:13	10:10:10	9:56:00	3.188956639
91	85	1091	0.003213647	545	14.161	0.002953744	83.6404	0.02534235	717.6127	18.19405886	22.757705	11/11/02 10:01	12:58:10	12:44:00	3.601311489
73	85	1087	0.00257798	545	14.109	0.0023608	66.85015	0.02770315	784.4629	19.88895002	24.45259616	11/11/02 16:15	19:12:10	18:58:00	4.382097418
231	85	1094	0.008157719	545	14.200	0.007518583	212.9018	0.035221733	997.3646	25.28677393	29.85042007	11/12/02 9:21	36:18:10	36:04:00	6.025178651
135	85	1091	0.004767498	545	14.161	0.004381928	124.0819	0.039603661	1121.447	28.43269578	32.99634192	11/12/02 19:12	46:09:10	45:55:00	6.793583574
203	85	1081	0.007168904	545	14.031	0.006528726	184.8722	0.046132387	1306.319	33.11987049	37.68351663	11/13/02 18:54	69:51:10	69:37:00	8.357797424
158	85	1081	0.005579738	545	14.031	0.005081471	143.8907	0.051213858	1450.209	36.76801633	41.33166247	11/14/02 18:16	93:13:10	92:59:00	9.655021722
205	85	1086	0.007239534	545	14.096	0.006623543	187.5572	0.057837402	1637.767	41.52326351	46.08690965	11/16/02 22:42	145:39:10	145:25:00	12.06866926
240	85	1086	0.008475552	545	14.096	0.007754392	219.5791	0.065591794	1857.346	47.09038217	51.6540283	11/21/02 14:00	256:57:10	256:43:00	16.02974665
94	85	1085	0.003319591	545	14.083	0.00303434	85.92263	0.068626134	1943.268	49.26882918	53.83247532	11/22/02 17:41	284:38:10	284:24:00	16.87116212
84	85	1092	0.002966443	545	14.174	0.002729032	77.27729	0.071355166	2020.546	51.22808586	55.791732	11/24/02 17:32	332:29:10	332:15:00	18.23420169
52	85	1093	0.00183637	545	14.187	0.001690948	47.88213	0.073046114	2068.428	52.44206973	57.00571587	11/25/02 18:50	357:47:10	357:33:00	18.91523489
52	85	1092	0.00183637	545	14.174	0.001689401	47.83832	0.074735515	2116.266	53.65494291	58.21858905	11/27/02 18:45	405:42:10	405:28:00	20.14206488
90	85	1096	0.003178332	545	14.226	0.002934673	83.10038	0.077670188	2199.367	55.76183588	60.32548202	12/3/02 18:59	549:56:10	549:42:00	23.45071664
57	85	1088	0.002012944	545	14.122	0.00184506	52.24608	0.079515248	2251.613	57.08646153	61.65010767	12/6/02 14:26	617:23:10	617:09:00	24.84725561
9	85	1087	0.000317833	545	14.109	0.000291057	8.241799	0.079806306	2259.854	57.29542072	61.85906685	12/10/02 10:42	709:39:10	709:25:00	26.63930888
7	85	1082	0.000247204	545	14.044	0.000225337	6.380802	0.080031642	2266.235	57.45719695	62.02084308	12/12/02 18:04	765:01:10	764:47:00	27.65898488
4	85	1074	0.000141259	545	13.940	0.000127812	3.619214	0.080159454	2269.854	57.548957	62.11260314	12/16/02 15:50	858:47:10	858:33:00	29.30505265
3	85	1078	0.000105944	545	13.992	9.62159E-05	2.72452	0.08025567	2272.579	57.61803336	62.1816795	12/19/02 20:49	935:46:10	935:32:00	30.59034888
1	85	1075	3.53148E-05	545	13.953	3.19827E-05	0.905646	0.080287653	2273.485	57.64099474	62.20464087	12/21/02 18:06	981:03:10	980:49:00	31.32176205
2	85	1088	7.06296E-05	545	14.122	6.47389E-05	1.833196	0.080352392	2275.318	57.68747283	62.25111897	12/23/02 19:23	1030:20:10	1030:06:00	32.09884906
7	85	1067	0.000247204	545	13.849	0.000222213	6.292343	0.080574604	2281.61	57.84700632	62.41065246	12/29/02 21:45	1176:42:10	1176:28:00	34.30310158
10	85	1082	0.000353148	545	14.044	0.00032191	9.115431	0.080896514	2290.726	58.07811522	62.64176136	12/31/02 21:09	1224:06:10	1223:52:00	34.98718019
22	85	1087	0.000776926	545	14.109	0.000711474	20.14662	0.081607988	2310.872	58.58890434	63.15255048	1/3/03 12:29	1287:26:10	1287:12:00	35.88085996
32	85	1088	0.001130074	545	14.122	0.001035823	29.33113	0.082643811	2340.203	59.33255383	63.89619997	1/7/03 13:42	1384:39:10	1384:25:00	37.21092283
45	85	1088	0.001589166	545	14.122	0.001456626	41.2469	0.084100437	2381.45	60.37831092	64.94195706	1/13/03 16:22	1531:19:10	1531:05:00	39.13207692

48	85	1100	0.00169511	545	14.278	0.001570871	44.48196	0.085671309	2425.932	61.50608818	66.06973432	1/22/03	15:37	1746:34:10	1746:20:00	41.79197823	
42	85	1095	0.001483222	545	14.213	0.001368265	38.74479	0.087039573	2464.677	62.4884078	67.05205394	1/29/03	13:53	1912:50:10	1912:36:00	43.73598188	
33	85	1075	0.001165388	545	13.953	0.001055429	29.88631	0.088095002	2494.563	63.24613315	67.80977929	2/3/03	16:07	2035:04:10	2034:50:00	45.11174397	
36	85	1083	0.001271333	545	14.057	0.001159946	32.84588	0.089254948	2527.409	64.07889413	68.64254027	2/10/03	14:25	2201:22:10	2201:08:00	46.91875365	
32	85	1083	0.001130074	545	14.057	0.001031063	29.19634	0.090286011	2556.605	64.81912611	69.38277225	2/17/03	14:25	2369:22:10	2369:08:00	48.67616916	
23	85	1100	0.00081224	545	14.278	0.000752709	21.31427	0.09103872	2577.92	65.35951938	69.92316552	2/24/03	14:34	2537:31:10	2537:17:00	50.3737972	
9	85	1075	0.000317833	545	13.953	0.000287844	8.150813	0.091326565	2586.071	65.56617175	70.12981789	3/3/03	14:05	2705:02:10	2704:48:00	52.00996165	
30	85	1089	0.001059444	545	14.135	0.000971977	27.52321	0.092298541	2613.594	66.26398393	70.82763007	3/10/03	14:08	2873:05:10	2872:51:00	53.6011764	
62	85	1072	0.002189518	545	13.914	0.001977394	55.99335	0.094275935	2669.587	67.68361627	72.24726241	3/20/03	11:55	3110:52:10	3110:38:00	55.77516871	
10	85	1073	0.000353148	545	13.927	0.000319232	9.03961	0.094595167	2678.627	67.91280283	72.47644896	3/24/03	14:04	3209:01:10	3208:47:00	56.64820778	estimate
3	85	1077	0.000105944	545	13.979	9.61266E-05	2.721992	0.094691294	2681.349	67.9818151	72.54546124	3/31/03	17:24	3380:21:10	3380:07:00	58.14080132	
3	85	1090	0.000105944	545	14.148	9.72869E-05	2.754848	0.094788581	2684.104	68.0516604	72.61530654	4/9/03	18:27	3597:24:10	3597:10:00	59.97835258	
7	85	1078	0.000247204	545	13.992	0.000224504	6.357213	0.095013084	2690.461	68.21283857	72.77648471	4/14/03	15:19	3714:16:10	3714:02:00	60.94480654	

DECANISTERED 4/14/03

SAMPLE: 1124.3' to 1125.3' (Tebo Coal) in canister 7

sample air dried 7 Days

	lbs.	grams		lbs.	grams	moisture weight		est. lost gas (cc) =		TIME 0F:		elapsed time (off bottom to canistering)
dry sample weight:	5.5338	2510.09	wet sample weight:	6.3926	2899.62	13.4%		53		off bottom	in canister	13.2 minutes
CONVERSION OF VOLUMES TO STP										11/11/02 1:21	11/11/02 1:34	0.221 hours

RIG MEASUREMENTS			CONVERSION OF RIG MEASUREMENTS TO STP (cubic ft; @60 degrees; @14.7 psi)					CUMULATIVE VOLUMES		SCF/TON (approx)	SCF/TON (approx)		TIME SINCE		0.469929073 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)
4	85	1083	0.000141259	545	14.057	0.000128883	3.649542	0.000128883	3.649542	0.046580229	0.723035503	11/11/02 1:36	0:15:50	0:02:35	0.513701167
2	85	1083	7.06296E-05	545	14.057	6.44414E-05	1.824771	0.000193324	5.474313	0.069870343	0.746325618	11/11/02 1:39	0:18:00	0:04:45	0.547722557
8	85	1083	0.000282518	545	14.057	0.000257766	7.299085	0.00045109	12.7734	0.163030801	0.839486076	11/11/02 1:43	0:22:00	0:08:45	0.605530071
5	85	1083	0.000176574	545	14.057	0.000161104	4.561928	0.000612194	17.33533	0.221256088	0.897711362	11/11/02 1:46	0:25:00	0:11:45	0.645497224
4	85	1083	0.000141259	545	14.057	0.000128883	3.649542	0.000741076	20.98487	0.267836317	0.944291591	11/11/02 1:48	0:27:45	0:14:30	0.680073525
9	85	1083	0.000317833	545	14.057	0.000289986	8.21147	0.001031063	29.19634	0.372641832	1.049097106	11/11/02 1:58	0:37:00	0:23:45	0.785281266
10	85	1083	0.000353148	545	14.057	0.000322207	9.123856	0.00135327	38.32019	0.489092404	1.165547679	11/11/02 2:03	0:42:00	0:28:45	0.836660027
3	85	1083	0.000105944	545	14.057	9.66621E-05	2.737157	0.001449932	41.05735	0.524027576	1.20048285	11/11/02 2:05	0:44:45	0:31:30	0.863616427
5	85	1083	0.000176574	545	14.057	0.000161104	4.561928	0.001611036	45.61928	0.582252862	1.258708137	11/11/02 2:09	0:48:00	0:34:45	0.894427191
4	85	1083	0.000141259	545	14.057	0.000128883	3.649542	0.001739919	49.26882	0.628833091	1.305288366	11/11/02 2:14	0:53:00	0:39:45	0.939858145
8	85	1083	0.000282518	545	14.057	0.000257766	7.299085	0.001997684	56.56791	0.721993549	1.398448824	11/11/02 2:17	0:56:00	0:42:45	0.966091783
7	85	1083	0.000247204	545	14.057	0.000225545	6.386699	0.002223229	62.9546	0.80350895	1.479964224	11/11/02 2:22	1:01:00	0:47:45	1.008298897
3	85	1083	0.000105944	545	14.057	9.66621E-05	2.737157	0.002319891	65.69176	0.838444122	1.514899396	11/11/02 2:26	1:05:00	0:51:45	1.040833
9	85	1083	0.000317833	545	14.057	0.000289986	8.21147	0.002609878	73.90323	0.943249637	1.619704911	11/11/02 2:34	1:13:15	1:00:00	1.10491327
130	85	1089	0.004590924	545	14.135	0.004211899	119.2672	0.006821777	193.1705	2.4654941	3.141949375	11/11/02 7:11	5:50:00	5:36:45	2.415229458
60	85	1091	0.002118888	545	14.161	0.001947523	55.14752	0.0087693	248.318	3.169358779	3.845814054	11/11/02 10:03	8:42:00	8:28:45	2.949576241
46	80	1087	0.001624481	540	14.109	0.001501401	42.51479	0.010270702	290.8328	3.71198814	4.388443415	11/11/02 16:17	14:56:00	14:42:45	3.864367132
123	85	1094	0.00434372	545	14.200	0.004003401	113.3633	0.014274103	404.1961	5.158878439	5.835333713	11/12/02 9:23	32:02:00	31:48:45	5.659799761
71	85	1091	0.002507351	545	14.161	0.002304569	65.25789	0.016578673	469.454	5.991784975	6.66824025	11/12/02 19:14	41:53:00	41:39:45	6.47173341
99	85	1081	0.003496165	545	14.031	0.00318396	90.15936	0.019762632	559.6133	7.142516629	7.818971904	11/13/02 18:57	65:36:00	65:22:45	8.099382693
75	85	1081	0.00264861	545	14.031	0.002412091	68.30255	0.022174723	627.9159	8.014283034	8.690738308	11/14/02 18:15	88:54:00	88:40:45	9.428679653
98	85	1086	0.00346085	545	14.096	0.003166377	89.66147	0.0253411	717.5773	9.158659906	9.83511518	11/16/02 22:44	141:23:00	141:09:45	11.89047238
96	85	1085	0.003390221	545	14.083	0.003098901	87.75077	0.028440001	805.3281	10.2786499	10.95510517	11/17/02 18:00	160:39:00	160:25:45	12.6747781
81	85	1085	0.002860499	545	14.083	0.002614698	74.03971	0.031054699	879.3678	11.22364146	11.90009673	11/22/02 17:43	280:22:00	280:08:45	16.74415321
45	85	1092	0.001589166	545	14.174	0.001461981	41.39855	0.03251668	920.7664	11.75202383	12.42847911	11/24/02 17:53	328:32:00	328:18:45	18.1254885
27	85	1093	0.0009535	545	14.187	0.000877992	24.86188	0.033394672	945.6282	12.06934358	12.74579885	11/25/02 18:51	353:30:00	353:16:45	18.80159568
34	85	1092	0.001200703	545	14.174	0.001104608	31.2789	0.03449928	976.9071	12.46856582	13.14502109	11/27/02 18:46	401:25:00	401:11:45	20.03538536
43	85	1096	0.001518536	545	14.226	0.001402122	39.70352	0.035901402	1016.611	12.97531398	13.65176925	12/3/02 19:01	545:40:00	545:26:45	23.35950913
48	85	1088	0.00169511	545	14.122	0.001553735	43.9967	0.037455137	1060.607	13.53685735	14.21331262	12/6/02 14:42	613:21:00	613:07:45	24.76590398
39	85	1087	0.001377277	545	14.109	0.001261249	35.71446	0.038716386	1096.322	13.99269198	14.66914726	12/10/02 10:45	705:24:00	705:10:45	26.55936746
27	85	1082	0.0009535	545	14.044	0.000869156	24.61166	0.039585542	1120.933	14.30681821	14.98327348	12/12/02 18:06	760:45:00	760:31:45	27.58169683
32	85	1074	0.001130074	545	13.940	0.001022494	28.95371	0.040608036	1149.887	14.67636329	15.35281857	12/16/02 15:51	854:30:00	854:16:45	29.23183196
24	85	1078	0.000847555	545	13.992	0.000769727	21.79616	0.041377763	1171.683	14.95455436	15.63100963	12/19/02 20:49	931:28:00	931:14:45	30.51993884
15	85	1075	0.000529722	545	13.953	0.000479741	13.58469	0.041857504	1185.268	15.1279399	15.80439518	12/21/02 18:07	976:46:00	976:32:45	31.2532665
12	85	1088	0.000423778	545	14.122	0.000388434	10.99917	0.042245937	1196.267	15.26832575	15.94478102	12/23/02 19:24	1026:03:00	1025:49:45	32.03201523
35	85	1067	0.001236018	545	13.849	0.001111064	31.46172	0.043357002	1227.729	15.6698813	16.34633657	12/29/02 21:46	1172:25:00	1172:11:45	34.24057048
12	85	1082	0.000423778	545	14.044	0.000386292	10.93852	0.043743293	1238.667	15.80949296	16.48594823	12/31/02 21:10	1219:49:00	1219:35:45	34.92587389
14	85	1087	0.000494407	545	14.109	0.000452756	12.82058	0.044196049	1251.488	15.9731259	16.64958118	1/3/03 12:30	1283:09:00	1282:55:45	35.82108318
17	85	1088	0.000600352	545	14.122	0.000550281	15.58216	0.04474633	1267.07	16.17200585	16.84846112	1/7/03 13:42	1380:21:00	1380:07:45	37.15306178
23	85	1088	0.00081224	545	14.122	0.000744498	21.08175	0.045490828	1288.152	16.44107871	17.11753398	1/13/03 16:23	1527:02:00	1526:48:45	39.07727387
28	85	1100	0.000988814	545	14.278	0.000916342	25.94781	0.04640717	1314.1	16.77225855	17.44871382	1/22/03 15:38	1742:17:00	1742:03:45	41.74066762
28	85	1095	0.000988814	545	14.213	0.000912176	25.82986	0.047319346	1339.93	17.10193302	17.77838829	1/29/03 13:54	1908:33:00	1908:19:45	43.68695457
33	85	1075	0.001165388	545	13.953	0.001055429	29.88631	0.048374775	1369.816	17.48338123	18.1598365	2/3/03 16:08	2030:47:00	2030:33:45	45.06421344
29	85	1083	0.001024129	545	14.057	0.000934401	26.45918	0.049309176	1396.275	17.82108789	18.49754316	2/10/03 14:25	2197:04:00	2196:50:45	46.87287773
24	85	1083	0.000847555	545	14.057	0.000773297	21.89725	0.050082473	1418.172	18.10056926	18.77702453	2/17/03 14:26	2365:05:00	2364:51:45	48.63212244

15	85	1100	0.000529722	545	14.278	0.000490897	13.90061	0.05057337	1432.073	18.27798703	18.9544423	2/24/03	14:34	2533:13:00	2532:59:45	50.33107059
21	85	1075	0.000741611	545	13.953	0.000671637	19.01856	0.051245007	1451.092	18.5207268	19.19718207	3/3/03	14:06	2700:45:00	2700:31:45	51.9687406
15	85	1089	0.000529722	545	14.135	0.000485988	13.76161	0.051730996	1464.853	18.69637039	19.37282566	3/10/03	14:09	2868:48:00	2868:34:45	53.56117997
21	85	1072	0.000741611	545	13.914	0.000669762	18.96549	0.052400758	1483.819	18.93843274	19.61488802	3/20/03	11:56	3106:35:00	3106:21:45	55.73673235
11	85	1073	0.000388463	545	13.927	0.000351155	9.943571	0.052751913	1493.762	19.06534559	19.74180086	3/24/03	14:05	3204:44:00	3204:30:45	56.61036419
7	85	1077	0.000247204	545	13.979	0.000224295	6.351316	0.052976209	1500.114	19.14640938	19.82286465	3/31/03	17:25	3376:04:00	3375:50:45	58.10392987
6	85	1090	0.000211889	545	14.148	0.000194574	5.509697	0.053170782	1505.623	19.21673133	19.8931866	4/9/03	18:28	3593:07:00	3592:53:45	59.94261144
4	85	1078	0.000141259	545	13.992	0.000128288	3.632693	0.05329907	1509.256	19.26309651	19.93955178	4/14/03	15:18	3709:57:00	3709:43:45	60.90935889

DECANISTERED 4/14/03

Correlation of Field Barometer to KGS Petrophysics Lab Barometer

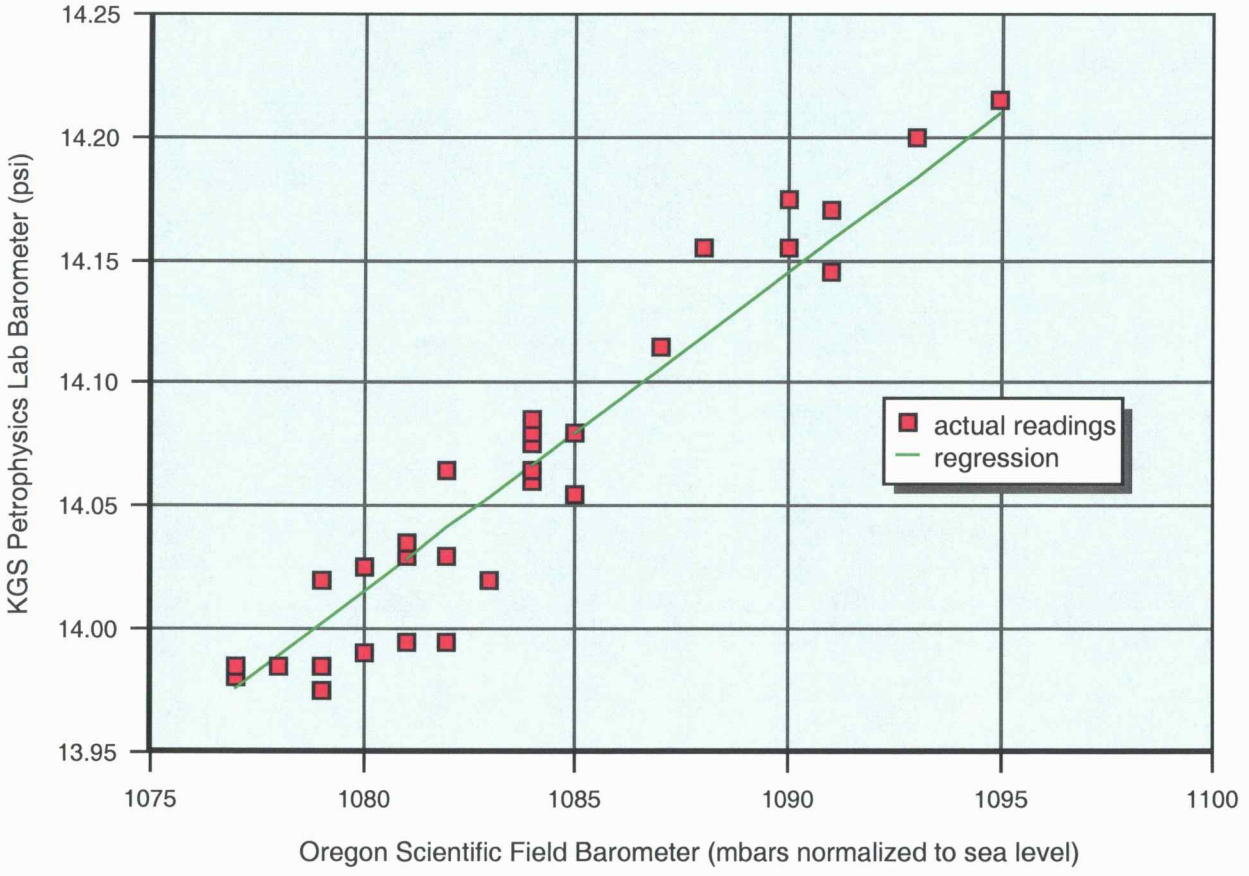


FIGURE 1.

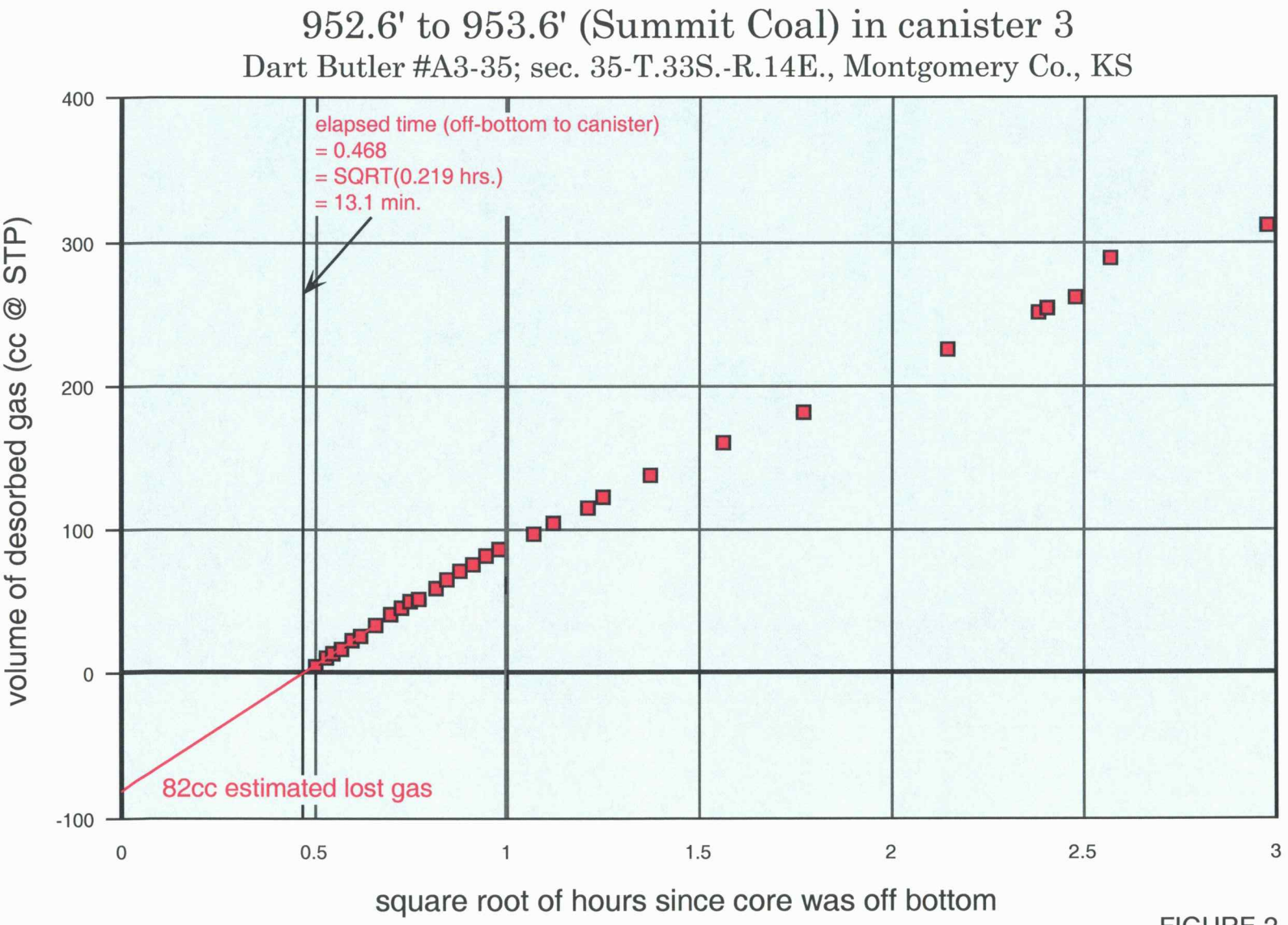

952.6' to 953.6' (Summit Coal) in canister 3
Dart Butler #A3-35; sec. 35-T.33S.-R.14E., Montgomery Co., KS
elapsed time (off-bottom to canister)
= 0.468
= SQRT(0.219 hrs.)
= 13.1 min.
82cc estimated lost gas
volume of desorbed gas (cc @ STP)
400
300
200
100
0
-100
0
0.5
1
1.5
2
2.5
3
square root of hours since core was off bottom

FIGURE 2.

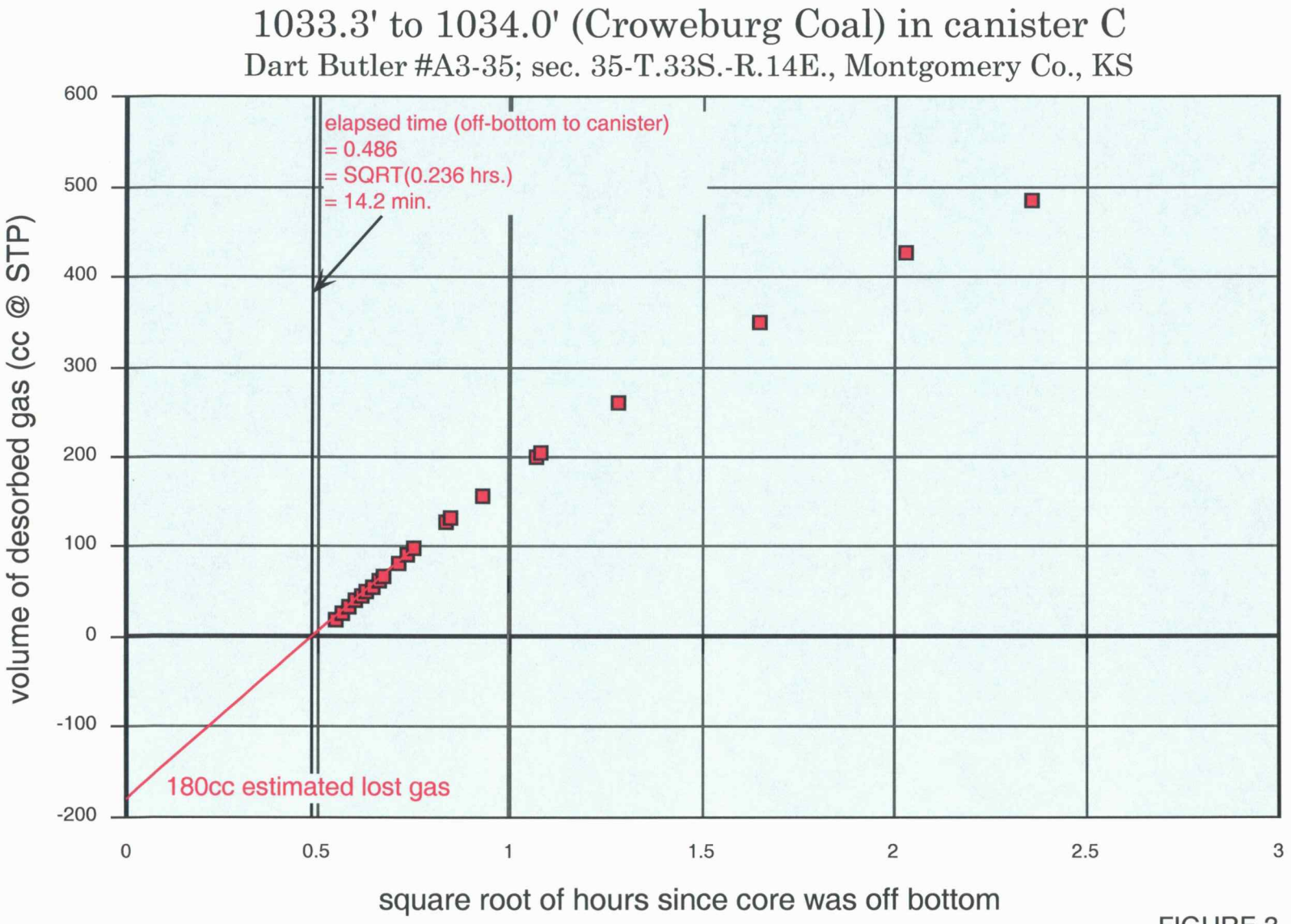

1033.3' to 1034.0' (Croweburg Coal) in canister C
Dart Butler #A3-35; sec. 35-T.33S.-R.14E., Montgomery Co., KS
elapsed time (off-bottom to canister)
= 0.486
= SQRT(0.236 hrs.)
= 14.2 min.
180cc estimated lost gas
volume of desorbed gas (cc @ STP)
600
500
400
300
200
100
0
-100
-200
0
0.5
1
1.5
2
2.5
3
square root of hours since core was off bottom

FIGURE 3.

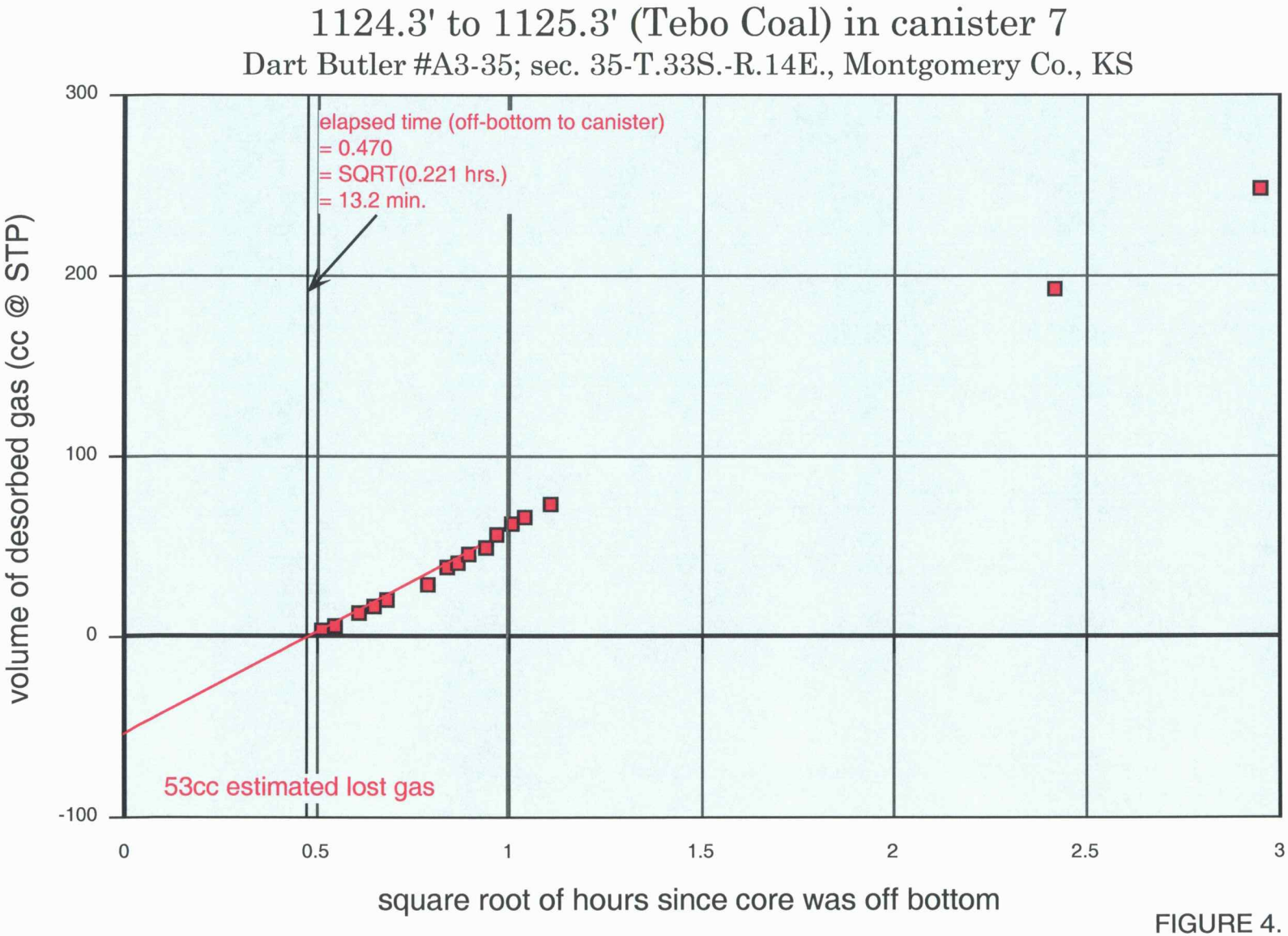

1124.3' to 1125.3' (Tebo Coal) in canister 7
Dart Butler #A3-35; sec. 35-T.33S.-R.14E., Montgomery Co., KS
elapsed time (off-bottom to canister)
= 0.470
= SQRT(0.221 hrs.)
= 13.2 min.
53cc estimated lost gas
volume of desorbed gas (cc @ STP)
300
200
100
0
-100
0
0.5
1
1.5
2
2.5
3
square root of hours since core was off bottom

FIGURE 4.

surface

100'

200'

300'

400'

500'

600'

700'

800'

900'

◆ 952'-965' Summit

1000'

◇ 1033'-1034' Croweburg

▽ 1124'-1125' Tebo

1200'

Desorption Characteristics of Dart Butler #A3-35; Summit coal at 952.2' to 953.6';

sec. 35-T.33S.-R.14E.; Montgomery Co., KS

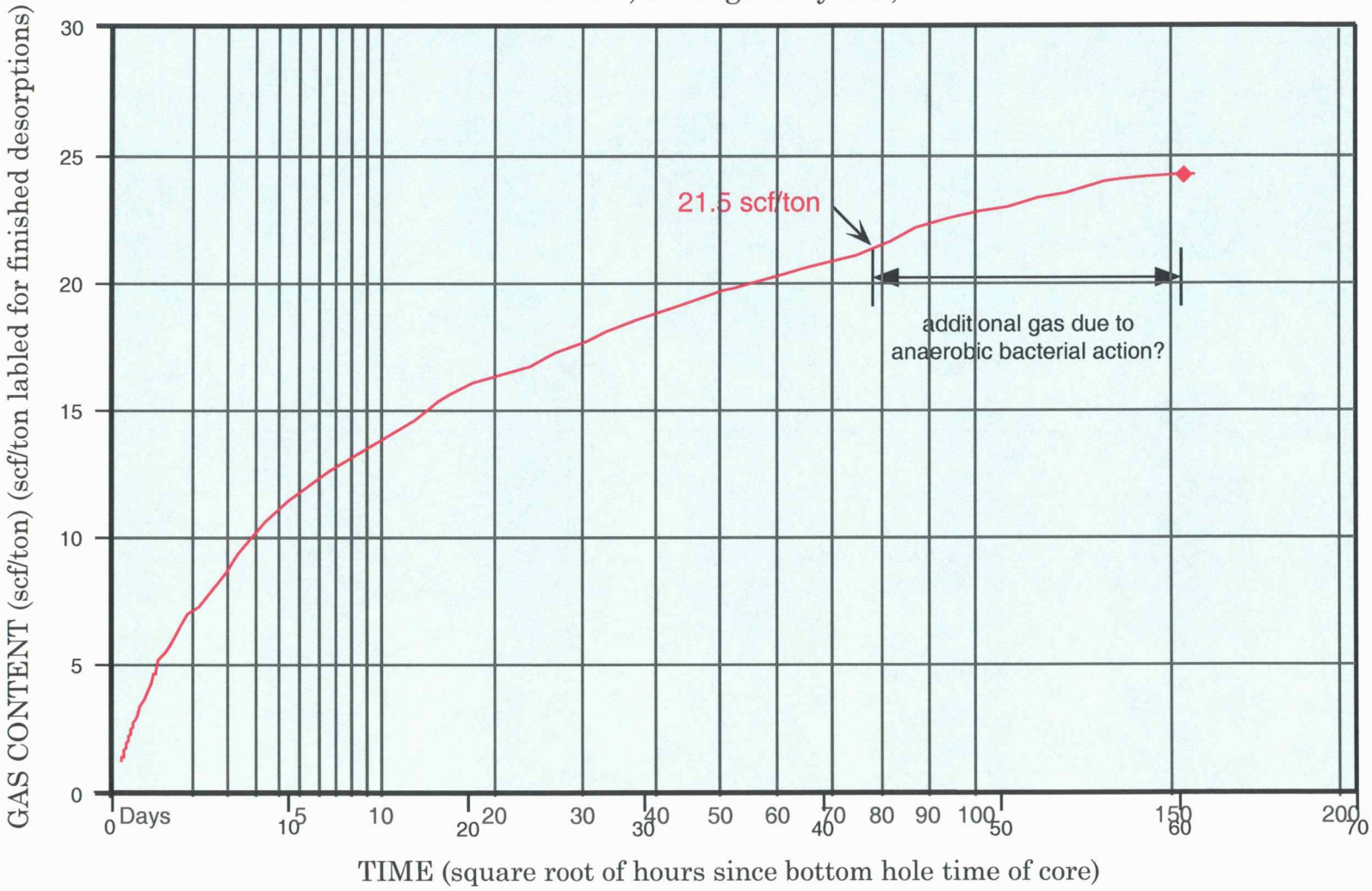


FIGURE 5.

Desorption Characteristics of Dart Butler #A3-35; Croweburg coal at 1033.3' to 1034.0';

sec. 35-T.33S.-R.14E.; Montgomery Co., KS

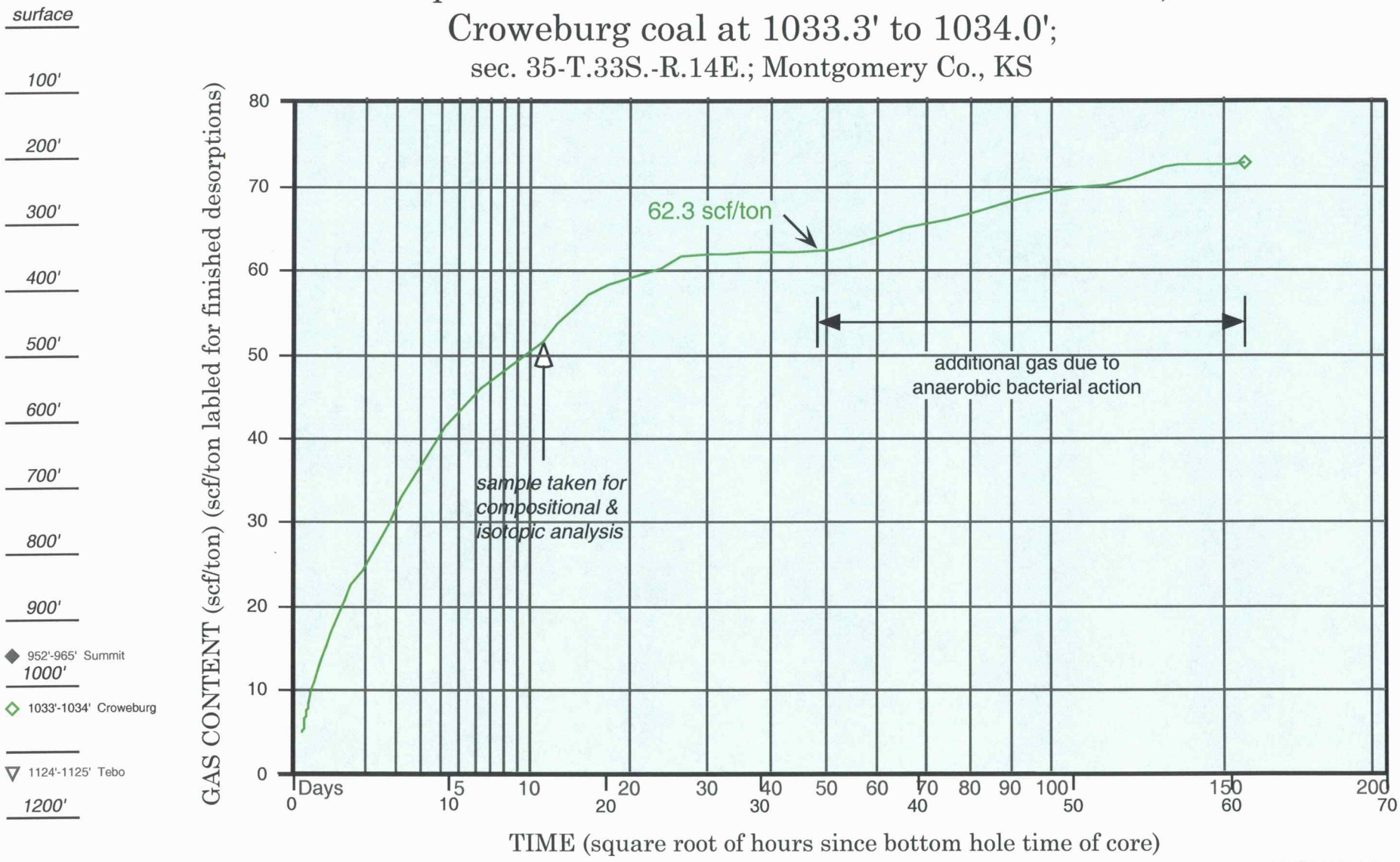


FIGURE 6.

surface

100'

200'

300'

400'

500'

600'

700'

800'

900'

◆ 952'-965' Summit

1000'

◇ 1033'-1034' Croweburg

▽ 1124'-1125' Tebo

1200'

Desorption Characteristics of Dart Butler #A3-35; Tebo coal at 1124.3' to 1125.3';

sec. 35-T.33S.-R.14E.; Montgomery Co., KS

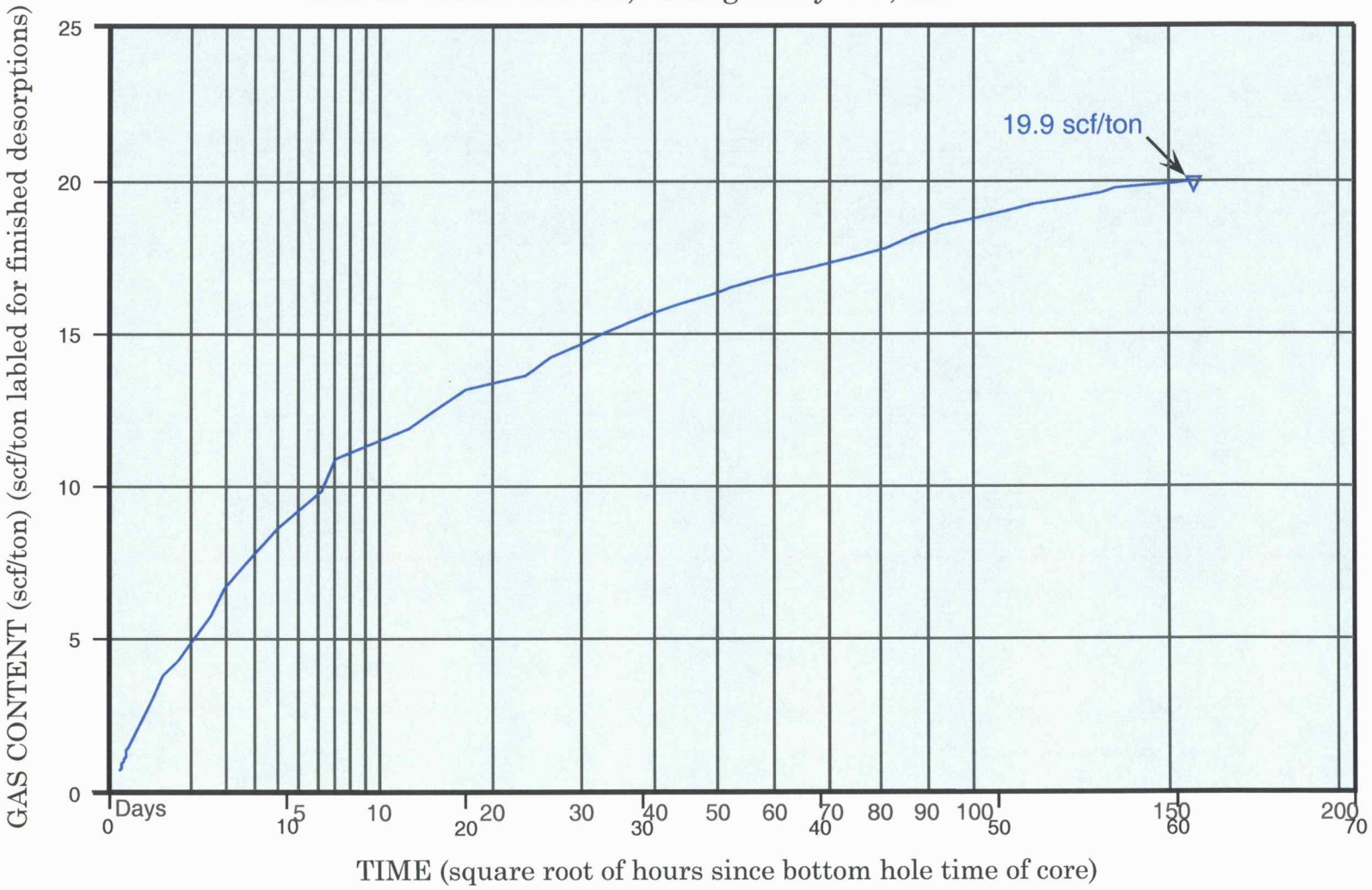


FIGURE 7.

Desorption Characteristics of Dart Butler #A3-35;

sec. 35-T.33S.-R.14E.; Montgomery Co., KS

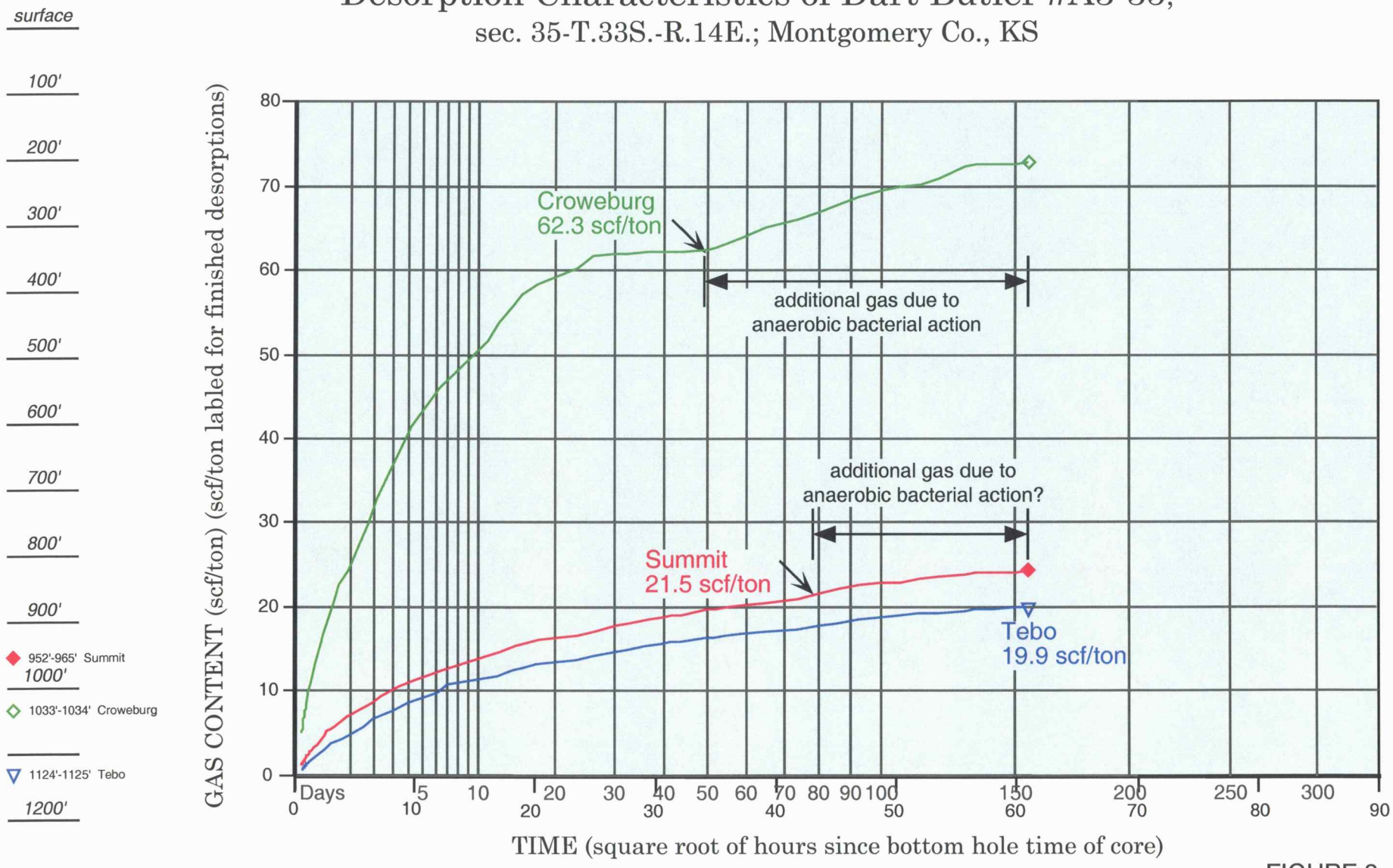
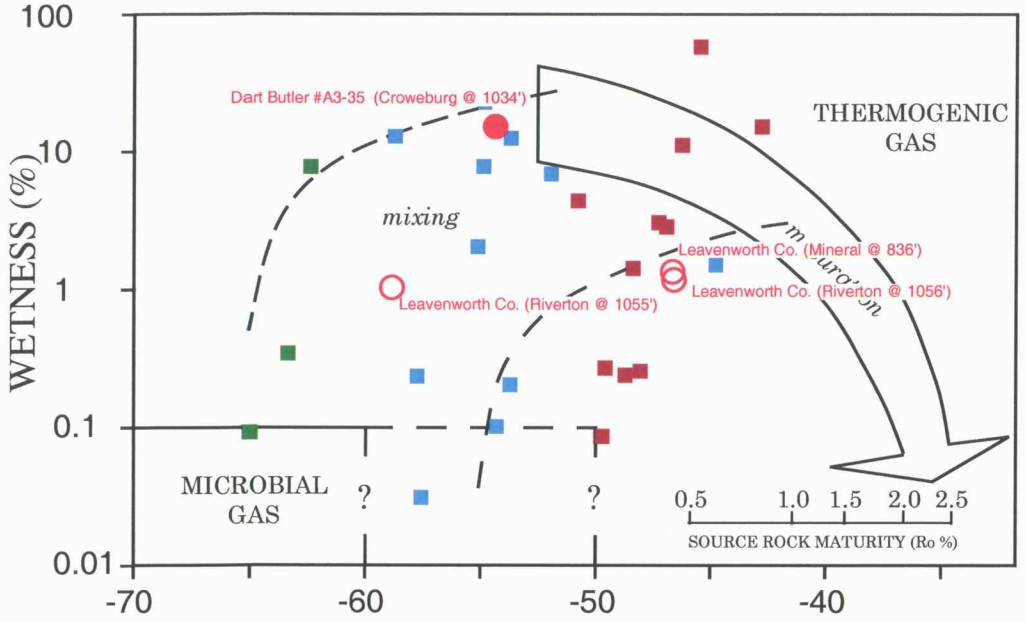
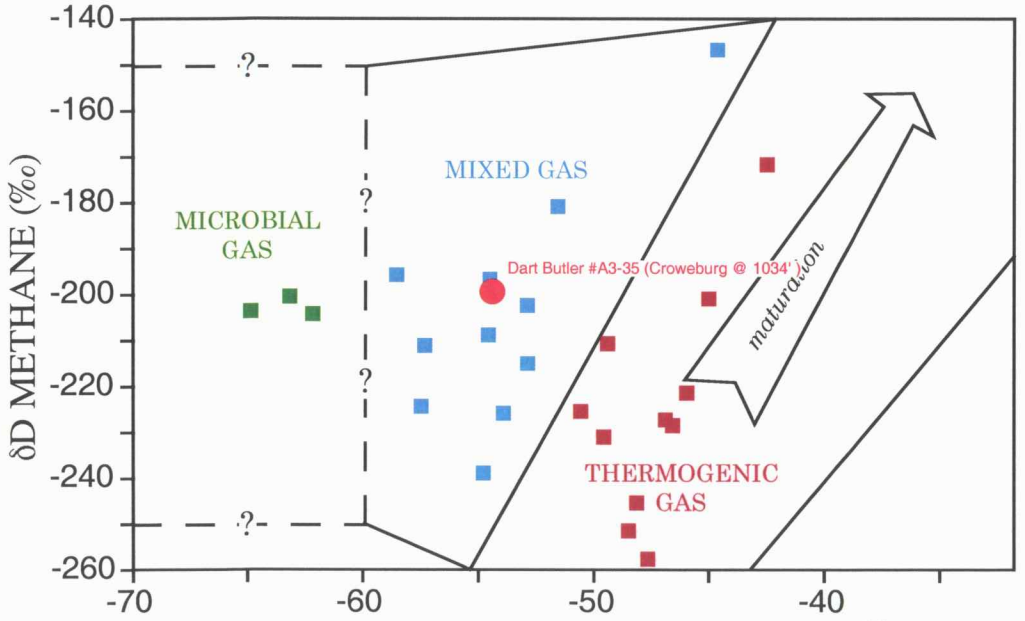
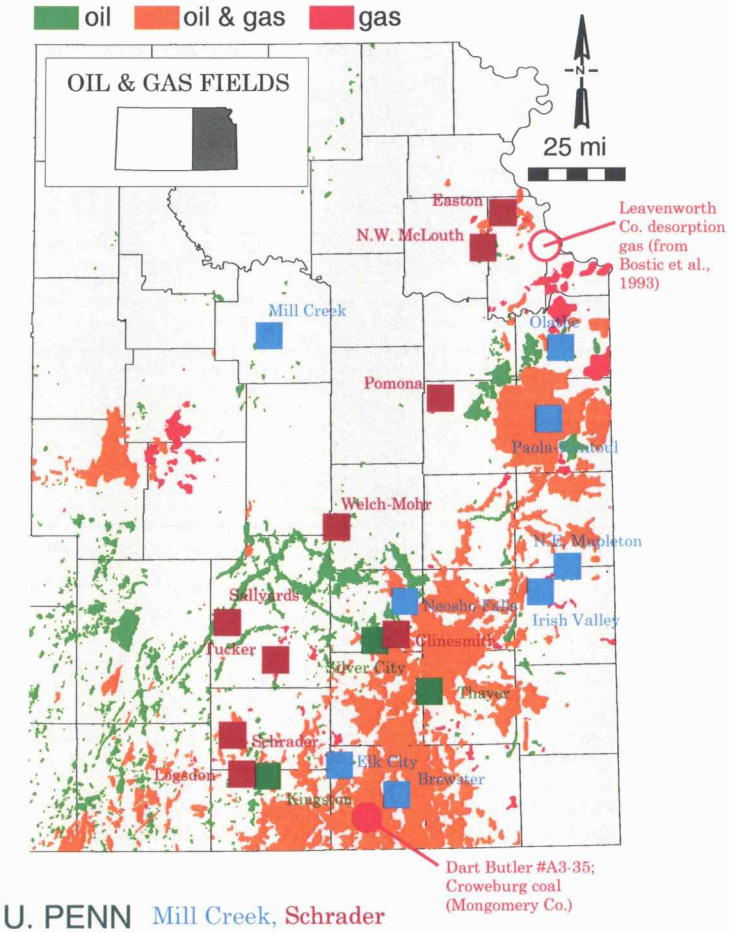


FIGURE 8.







U. PENN Mill Creek, Schrader

M. PENN Silver City, Thayer, Brewster, Elk City, Mapleton NE, Neosho Falls, Olathe, Clinesmith, Easton, McLouth NW, Pomona, Sallyards, Welch-Mohr

MSSP Kingston, Brewster, Irish Valley, Neosho Falls, Paola-Rantoul, Tucker

L. ORD Logsden

■ eastern Kansas conventional gas (from Jenden et al., 1988)

● analysis of coalbed desorption gas; Croweburg coal (1034'); Dart Cherokee Basin Butler #A3-35

FIGURE 9.

LUMAN'S LABORATORIES

P.O. Box 326 • Chetopa, KS 67336
(620) 236-7874

ANALYTICAL AND PHYSICAL TESTING

June 20, 2003

Kansas Geological Survey
1930 Constant Ave.
Lawrence Ks 66047-3724

Dart Cherokee Basin
Butler #A3-35
(35-T.33S.-R.14E.)
Crowberg coal
(1033.3' to 1034.0')

Attn: Jonathan Lange

Please find listed below analysis on the following sample.

Lab ID. 61804 Sample ID. Kansas Geological Survey Sample 3J-607.48g.

	As Received	Moisture Free	MAF
Moisture	2.59%		
Ash	20.50%	21.04%	
Volatile Matter	35.59%	36.53%	
Fixed Carbon	41.32%	42.43%	
BTU/lb	11,047	11,341	14,364
Sulfur	3.01%	3.09%	

Hi-Vol bit A

Respectfully,

Carrol Luman

CGL:pdl

APPENDIX I

LUMAN'S LABORATORIES

P.O. Box 326 • Chetopa, KS 67336
(620) 236-7874

ANALYTICAL
AND
PHYSICAL
TESTING

June 20, 2003

Kansas Geological Survey
1930 Constant Ave.
Lawrence Ks 66047-3724

Dart Cherokee Basin
Butler #A3-35
(35-T33S-R14E)
Tebo coal
(1124.3' to 1125.3')

Attn: Jonathan Lange

Please find listed below analysis on the following sample.

Lab ID. 61805 Sample ID. Kansas Geological Survey Sample 3K-326.28g.

	As Received	Moisture Free	MAF
Moisture	3.82%		
Ash	62.23%	64.70%	
Volatile Matter	17.46%	18.46%	
Fixed Carbon	16.19%	16.84%	
BTU/lb	4,172	4,338	12,228
Sulfur	1.30%	1.35%	

Respectfully,

Carrol Luman

CGL:pdl

APPENDIX 1

ANALYSIS REPORT

Lab #:	49459	Job #:	3869
Sample Name/Number:	Croweburg Coal coalbed gas		
Company:	Kansas Geological Survey		
Date Sampled:	/ /		
Container:	Glass Bottle		
Field/Site Name:	Montgomery Co, KS		
Location:	API # 15-125-30195		
Formation/Depth:	Dart Cherokee Basin Operating Co. #A3-35 Butler		
Sampling Point:	1033' - 1034' depth		
Date Received:	1/15/2003	Date Reported:	2/18/2003

Component	Chemical mol. %	Delta 13C per mil	Delta D per mil	Delta 15N per mil
Carbon Monoxide	nd			
Hydrogen Sulfide	nd			
Helium	nd			
Hydrogen	nd			
Argon	0.068			
Oxygen	0.021			
Nitrogen	21.14			
Carbon Dioxide	1.22	-10.73		
Methane	68.93	-54.44	-199.6	
Ethane	5.71			
Ethylene	nd			
Propane	2.45			
Iso-butane	0.083			
N-butane	0.31			
Iso-pentane	0.020			
N-pentane	0.025			
Hexanes +	0.020			

Total BTU/cu.ft. dry @ 60deg F & 14.7psia, calculated: 878

Specific gravity, calculated: 0.712

nd = not detected. na = not analyzed. Isotopic composition of carbon is relative to VPDB. Isotopic composition of hydrogen is relative to VSMOW. Calculations for BTU and specific gravity per ASTM D3588. Chemical compositions are normalized to 100 percent. Mol. % is approximately equal to vol. %

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APPENDIX 2