Core Description, Stratigraphic Correlation, and Mapping of Pennsylvanian Strata in the Appalachians

The remaining laboratory sessions for the semester will be collected into a series of exercises designed to demonstrate the process by which you can use data from a single point (core hole, oil well, outcrop) to build an extended picture of a region using publicly available data.

This project will develop over several labs each lab will expand upon the complexity of the project until you have constructed lithostratigraphic cross sections and made isopach maps of specific stratigraphic units. Each student, working independently, will produce each of these materials.

At each stage in the project, students will be provided with the necessary data to complete the exercise.

Part I: Core Description

A typical practice for understanding the geological framework for an area is to take geological cores. Cores are taken with a drilling rig and represent a vertical section of rock in a specific locality. This is a useful way to assess local geology in regions with either limited rock exposure, or to assess conditions below the depth of the local erosion.

Rock doesn't always look the same in drill core as it looks on outcrop. Drill core provides a very detailed, but very localized picture of geologic conditions.

Your task is to provide a description of the drill core that has been provided by the Consolidated Coal Company of Pittsburgh, PA.

Your description should include:

1. detailed lithologic descriptions (keeping in mind that there might not be much to say about some sections) for all depths.
2. depth and thickness for specific lithologic units
3. sedimentary structures that are present (i.e. bedding details, lamination, crossbeds, fossils, bioturbation, etc.), these can often be difficult to describe in core. NOTE: the angle that crossbeds deviate from horizontal can be measured. This can often be used to distinguish between terrestrial and marine deposits.
4. A graphic log similar to Figure 2.1 in Tucker.
5. A grain-size profile - used as a quick reference guide to lithology.

You should start with a written description very similar to the descriptions that you make on outcrops. I have provided an example from some of my own work, and some blank pages that will get you started.

Some rules about working with the core:

1. this is our only core so far, treat it gently, you have to work with it and your fellow students also have to work with this data.

2. For core to be useful it has to remain in sequence – DO NOT REMOVE IT FROM THE BOX – you should be able to produce a description without disturbing it.

3. A damp cloth or rag can be used to highlight features that are not obvious when the core is dry.

Part II: Correlation and Mapping

Introduction: once a geologist has an idea about the lithologies present in a region (acquired from core holes, oil wells, outcrops, etc.), the next step is to extend that knowledge away from that point. This can be accomplished by either doing more fieldwork if the rock is available at Earth's surface. If the rock is below local drainage, then subsurface data must be employed.

Subsurface data is generally available from publicly available sources represented by state geologic surveys or similar agencies. In our case, we have obtained 25 drill records from the region around Morgantown, West Virginia. The records have been submitted to the state by drill crews or provided by geologists. The records are often of great variability in terms of detail and content. The lithologies described are all very similar to those you described in core.

You will have several tasks to be completed over the next couple of weeks.

You will have to:

1) Create Strip Logs from the available data
2) Correlate the strip logs, identifying specific stratigraphic units or horizons
3) Make maps of the specific horizons (isopach, structure)

Materials: all available on CD

Location Map
Strip Log Template – you can get many copies of these
Core records/descriptions

Things you might need at some point:

Scissors
Tape
Colored Pencils

1) Creating Strip Logs

Enter ID, Elevation at the top of the log.

Decide on a suitable scale, its best to decide this after reviewing all the data to determine the deepest core hole, this will allow you to decide upon a scale. This needs to balance your ability to get the project finished against the amount of detail necessary to complete the exercise.

There are typical colors to be used for specific lithologies.

These are:

Blue = Limestone
Green = Mudstone/Shale (marine)
Red = Mudstone/Shale (nonmarine)
Yellow= Sandstone
Orange= Siltstone
Black = Coal

A box with an X indicates missing section or surface materials.

You can modify these basic colors to indicate lithologies such as: “sandy shale”, “shaly lime”, “limey shale”, “silty sand”.
You can include any extra symbols that may highlight specific features you think are important. You can use your own discretion when determining what is important.

2) Correlation

Construct a lithostratigraphic cross section across your map area.

Lithostratigraphic cross sections can get rather large, so you may need more than one large sheet of sketch paper.

Your cross section should display the salient stratigraphic units of your map area – in this case coals, sandstones, and limestones.

To define a cross section, choose 4-6 core holes that extend N-S across the map area. The core holes should be arranged in geographic order depending upon the orientation that you choose (i.e. the easternmost [or northernmost] core hole will be farthest right on your cross section). The position of the core holes should be scaled, so you need to establish a horizontal scale for the cross section. Your vertical scale should already be established by the scale of your strip logs.

The next step is to define a correlation datum. This datum should be a “marker bed”, recall that a marker bed is a distinct stratigraphic unit that can be traced throughout your field area. In this case, it seems that most of you have been using the Pittsburgh Coal as a marker; you should continue to use that stratigraphic unit as your marker.

You should also construct an E-W cross section using topographic elevation as your datum. Using surface elevation as a datum will allow you to delineate some geological structure that may not be evident if you only look use stratigraphic markers for you datum.

Once you have picked the logs, established a scale, and defined your datum you are ready to construct your cross section.

Draw a line across your paper representing your correlation datum. If your datum is high in the section, this line should be near the top of your paper, if your datum is low in the section, this line should be near the bottom of your paper.

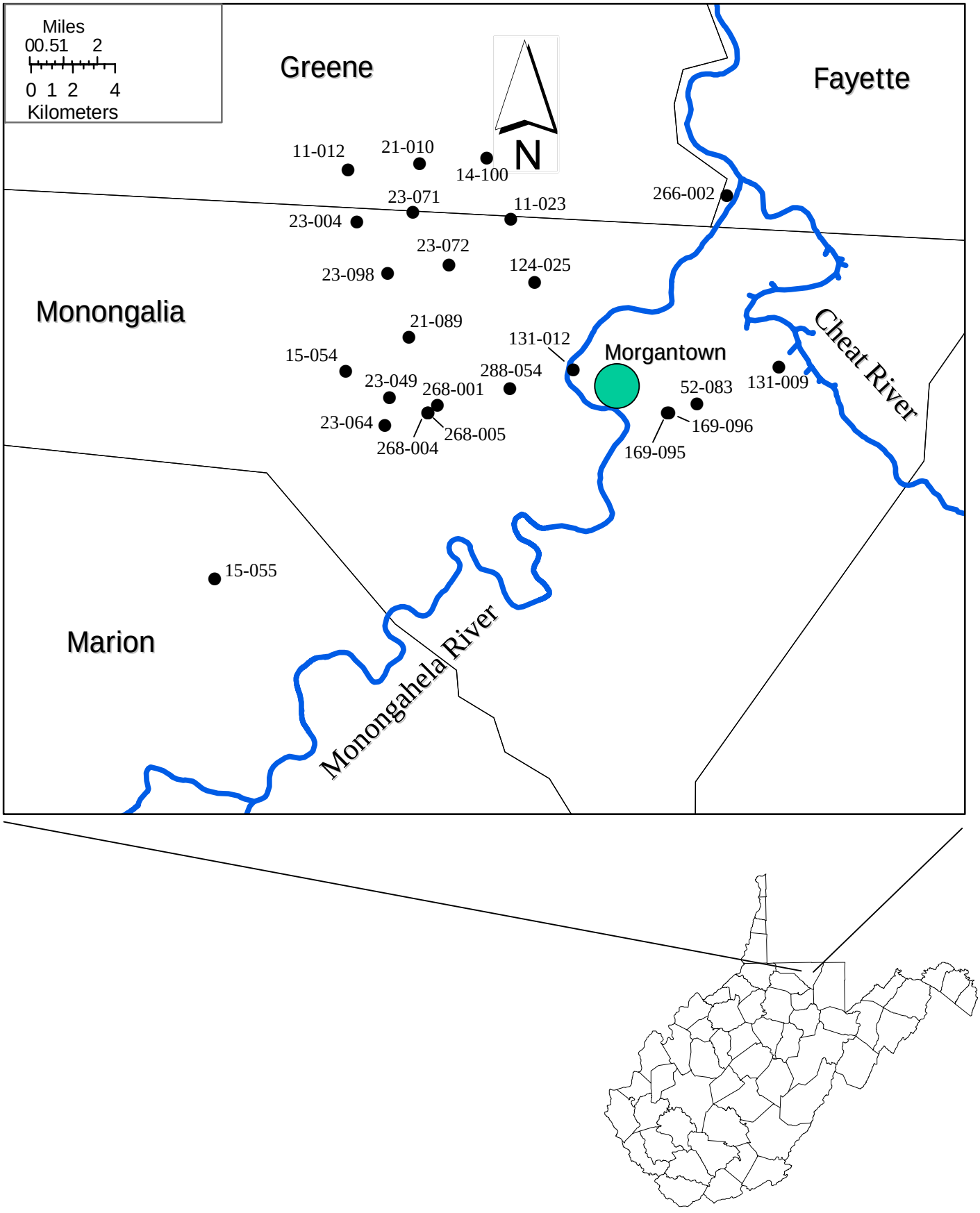
Establish the position of each log along your datum (measured as indicated by your scale). Tape each log to the paper in proper position, hanging the log on your correlation datum (i.e. the Pittsburgh Coal must be lined up with your correlation datum).

Now you are ready to sketch in the lithostratigraphic relationships for the region. You should then connect up stratigraphically equivalent rock units. The best way to start this is to connect the coal beds. These are the most recognizable units in the area. As with contour maps, your stratigraphic contacts cannot cross each other. Your coal beds establish distinct timelines, use these as guidelines for correlating the rest of the cross section.

3) Making maps: after you have defined lithostratigraphic units on your cross sections you need to identify the same units in the strip logs that were not used for the cross section. You should record the stratigraphic thickness of each unit in each well.

There are several complications in this step. For each location you will have either a stratigraphic thickness, this thickness may be zero. Additionally, the core hole may not reach the unit in question, in which case you should ignore the data point as there is no available data.

Plot the thickness for the stratigraphic unit at each location and contour using an appropriate contour interval. You should map the Pittsburgh Coal and at least one other stratigraphic unit, either limestone or sandstone. I recommend mapping a sandstone as the sandstones tend to be discrete, contacts for the limestone tends to be gradational and difficult to identify precisely.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21-010
14-100
23-071
11-023
23-004
266-002
23-072
23-098
124-025
21-089
131-012
15-054
288-054
23-049
268-001
52-083
131-009
23-064
268-005
268-004
169-096
169-095
15-055

CORE/SECTION #_____ **DATE**_____

LOCALITY_____ **DESCRIBED BY**_____

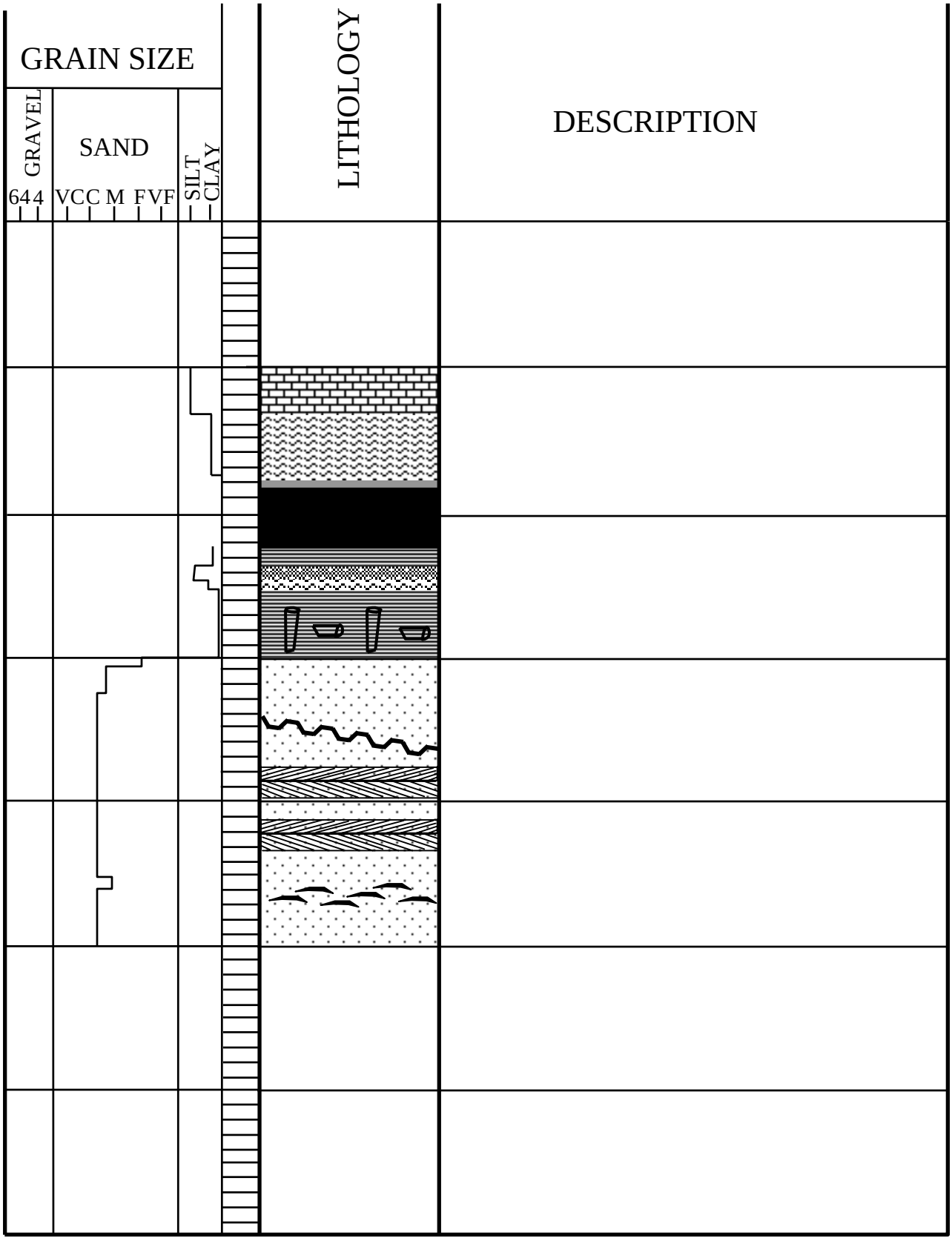
FORMATION_____

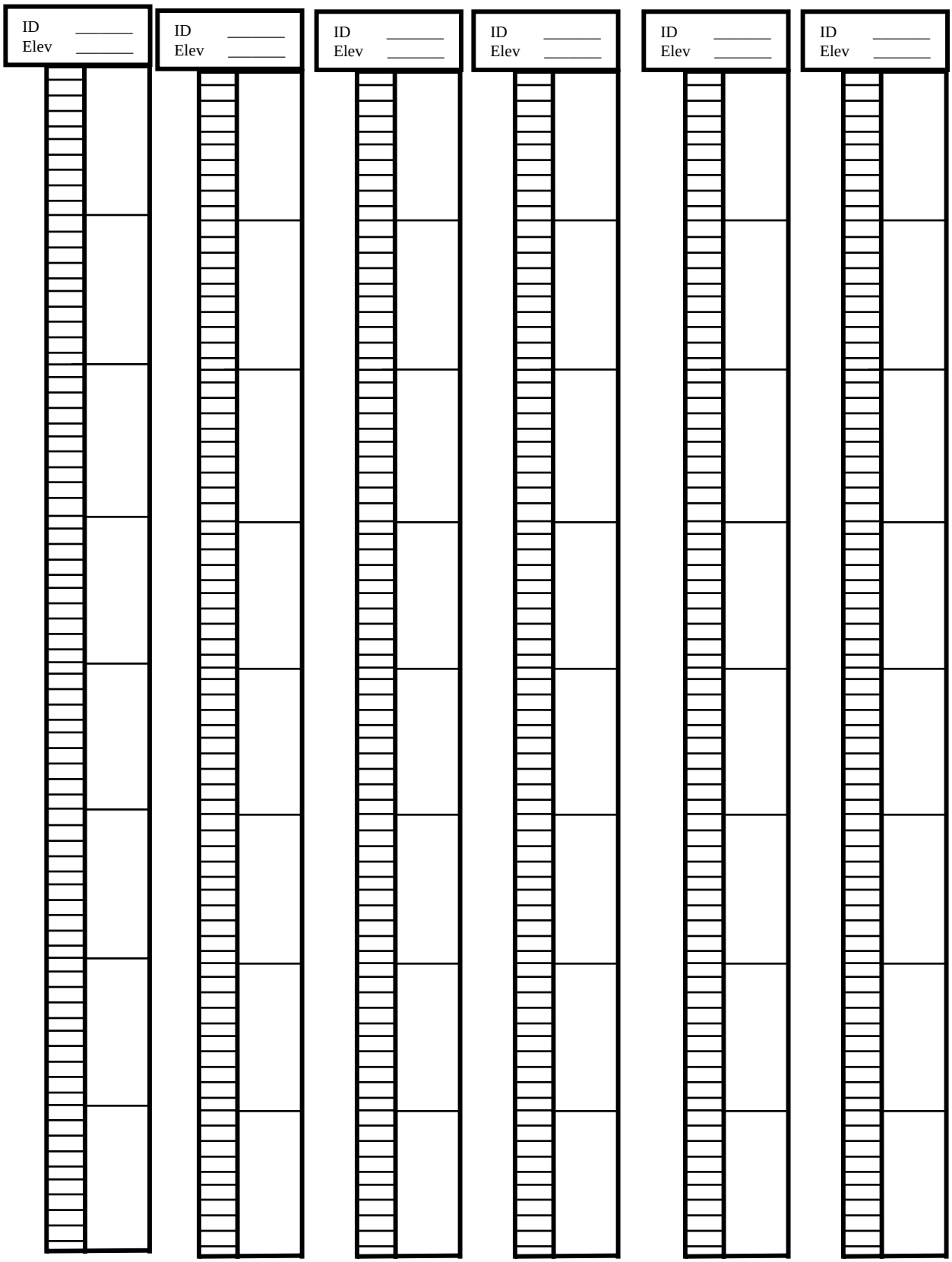
GRAIN SIZE				LITHOLOGY	DESCRIPTION
GRAVEL 64 4	SAND VC C M F VF	SILT CLAY			

CORE/SECTION # CONSOL AX-05-05 **DATE** 11/05/2005

LOCALITY **DESCRIBED BY** Matchen

FORMATION

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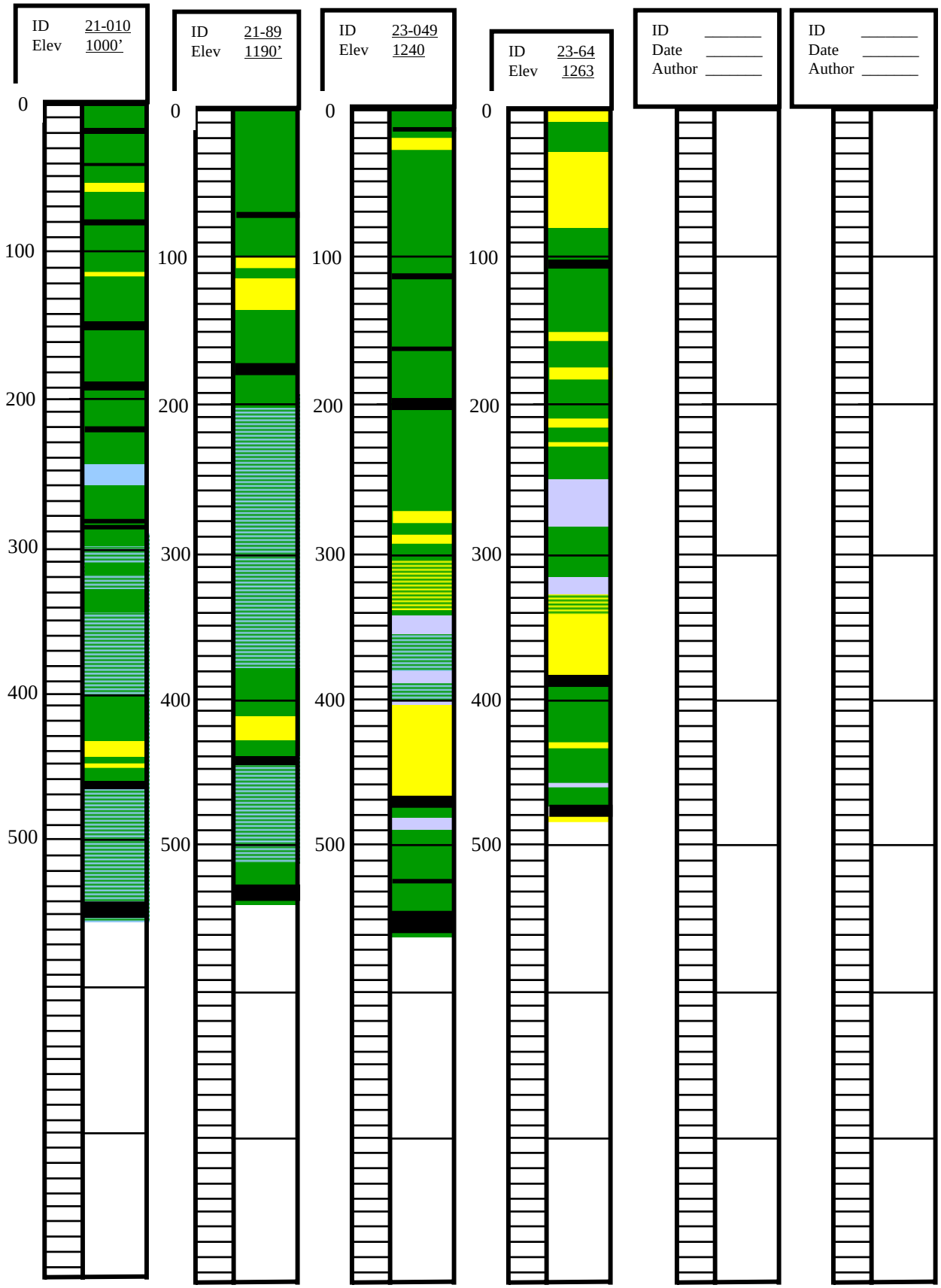
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400
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11-12

COORDINATES ~~1827900 EAST 451750 NORTH~~

NORTH 451300 *
East 1827500 *
elev 1078 *
~~Estimated El. 1000'~~

MOTT CORE DRILLING COMPANY

MAIN OFFICE
HUNTINGTON, W. VA.

DIAMOND CORE DRILL HOLE RECORD

OSAGE QUAD

FOR Christopher Coal Co. ADDRESS Pureglove, W. Va. DATE February 17, 1955

ON Little Big Shannon Creek NEAR ~~Deerlick Twp~~ Mt. Morris Perry Twp. COUNTY Greene (46) STATE Penn.

HOLE No. 201 EL. DRILLER James Kitchen DRILL NO.

80°05' 1.64 mile
39°45' .8

CLASSIFICATION	THICKNESS OF STRATA FEET	THICKNESS OF STRATA INS.	DEPTH FROM SURFACE FEET	DEPTH FROM SURFACE INS.	
Surface	5	0	5	0	
Brown clay	6	0	11	0	
Gray shale	12	0	23	0	
Gray sandy shale	40	6	63	6	
Dark shale	17	6	81	0	
Sandy shale	3	5	84	5	
Gray shale	6	6	90	11	
Coal Washington Coal El. 908'	1	5	92	4	Washington
Dark shale	20	0	112	4	
Coal Little Washington Coal El. 887'	1	1	113	5	Little Wash
Sandy shale	12	7	126	0	
Dark shale	3	6	129	6	
Sandy lime	52	6	182	0	
Sandstone Mannington ss	7	2	189	2	
Gray lime	10	4	199	6	
Sandy lime	2	6	202	0	
Gray lime	7	1	209	1	
Bony coal Waynesburg "A" Coal El. 788'	3	8	212	9	Waynesburg A
Green lime	4	7	217	4	
Green soft lime	10	0	227	4	
Sandstone Waynesburg ss	33	8	261	0	
Dark shale	20	0	281	0	
Coal	2	5	283	5	Waynesburg
Gray shale	0	8-1/2	285	11-1/2	
Coal	1	10-1/2	285	10	
Bony coal	0	7	286	5	
Coal Waynesburg Coal	0	8-1/2	287	1-1/2	
Soft shale El. 712'	0	4	287	5-1/2	
Bone	0	8	288	1-1/2	
Sandy shale	10	0	298	1-1/2	
Sandstone. Gilboy ss	3	1	301	2-1/2	
Dark shale Lit. Waynesburg Coal Horizon	5	0	306	2-1/2	
Gray lime	15	6	321	9-1/2	
Green lime	10	3	332	0-1/2	
White lime	5	6	337	6-1/2	
Green lime	15	5	352	11-1/2	
White lime	10	4	363	3-1/2	
Gray lime	14	3	377	6-1/2	
White lime	36	0	413	6-1/2	
Sandy lime	25	5-1/2	439	0	
White lime	7	4	446	4	
Lime shale streaks	32	8	479	0	
White lime	3	0	482	0	

STARTED 19

COMPLETED 19

FORM 1

* coordinates/elev changed due to data from

PAGE [illegible]

MOTT CORE DRILLING COMPANY

MAIN OFFICE

HUNTINGTON, W. VA.

DIAMOND CORE DRILL HOLE RECORD

FOR Christopher Coal Co. ADDRESS DATE Feb. 17, 1955

ON NEAR COUNTY STATE

HOLE NO. 201 EL. DRILLER James Kitchen DRILL NO.

CLASSIFICATION	Notes	THICKNESS OF STRATA FEET	THICKNESS OF STRATA INS.	DEPTH FROM SURFACE FEET	DEPTH FROM SURFACE INS.	
Dark shale		4	6	486	6	
Gray lime		10	5	496	11	
Green lime		9	2	506	1	
Gray lime		11	0	517	1	
Sandy shale		18	0	535	1	
Dark shale		4	5	539	6	
Coal sulphur streaks	Sewickly Coal (Coal sulphur streaks to Coal)	0	1	539	7	
Coal		2	8	542	3	
Bony coal		0	2	542	5	
Coal		1	3-1/2	543	8-1/2	SEW
Sulphur		0	1	543	9-1/2	
Coal sulphur streaks		0	2-1/2	544	0	6'-2"
Bone		1	1	545	1	
Sandy shale		0	2-1/2	545	3-1/2	
Coal	El. 454'	0	4-1/2	545	8	
Dark shale		17	0	562	8	
Sandy shale		24	6	587	2	
Dark shale		3	0	590	2	
Soft clay		2	0	592	2	
Coal	Redstone Coal El. 406'	1	9	593	11	REDSTONE
Dark shale		2	1	596	0	
Gray lime		6	6	602	6	
Dark shale		14	8	617	2	
Bone coal streaks	Pittsburgh Coal El. 368' (Bone coal streaks and Coal)	7	7	624	9	
Coal		7	8	632	5	PGH.
Dark shale		0	9	633	0	

STARTED February 17, 1955

COMPLETED March 22, 1955

Total 633 0

131-012

January 20, 1928.

One. near Masontown. Bethlehem Mines Corp.
146 (Key-C). Union District.
W.I.Vandevort Farm Monongalia. C.N.White.
up Right Fork of Whites Run. West Virginia.

0 Surface	6	4	6	4
1 Sand Stone	-	8	7	-
2 Soft Shale & Fire Clay	14	6	21	6
3 Red Shale	3	6	25	-
4 Light Shale	2	-	27	-
5 Lime Stone	-	10	27	10
6 Soft Shale	2	2	30	-
7 Lime Stone	1	4	31	4
8 Light Shale	5	2	36	6
9 Coal----(Elk Lick Seam--------	1	6	38	-
10 Soft Shale & Fire Clay	12	6	50	6
11 Light Shale	28	-	78	6
12 Red Shale	5	6	84	-
13 Light Shale	9	6	93	6
14 Red & Green Shale	6	6	100	-
15 Light Shale	20	6	120	6
16 Fossiliferous Shale	8	10	129	4
17 Coal----(Harlem Seam)---------	-	3	129	7
18 Soft Shale & Fire Clay	12	5	142	-
19 Red Shale	11	6	153	6
20 Light Shale	6	6	160	-
21 Red Shale	5	6	165	6
22 Light Shale	22	-	187	6
23 Lime Stone	2	6	190	-
24 Soft Shale	2	-	192	-
25 Lime Stone	2	10	194	10
26 Light Shale	3	2	198	-
27 Lime Stone	1	8	199	8
28 Light Shale	15	4	215	-
29 Soft Shale & Clay	8	6	223	6
30 Sand Stone	-	10	224	4
31 Light Shale	8	8	233	-
32 Sand Stone	28	5	261	5
33 Sand Stone with Coal Spars Bakerstown Seam	-	1	261	6
34 Soft Shale & Clay	5	6	267	-
35 Light Shale	7	-	274	-
36 Sand Stone	36	6	310	6
37 Dark Shale	3	-	313	6
38 Sand Stone	28	-	341	6
BRUSH CREEK SEAM.				
39 Coal--(Bone Streaked with Pyrite)----------	-	6	342	-
40 Binder (Fire Clay)	-	3	342	3
41 Coal--(Bone Streaked with Pyrite)----------	-	9	343	-
42 Fire Clay	7	-	350	-
43 Light Shale	3	6	353	6
44 Red Shale	6	6	360	-

Diamond Drill Hole #146 (Key-C) on W. I. Vandevort Farm, up Right Fork of Whites Run, near Masontown, Union District, Monongalia County, West Virginia, for the Bethlehem Mines Corporation.

NO.	CLASSIFICATION	THICKNESS OF STRATA Feet	Inches	DEPTH FROM SURFACE. Feet	Inches.
				360	-
45	Light Sandy Shale	12	-	372	-
		CONTINUED DRILLING.		Finished April 2, 1928	
45	Light Sandy Shale	19	-	391	-
46	Dark Shale	11	6	402	6
47	Black Slate	-	1	402	7
48	Bone Coal----(Upper Freeport Seam)----------	2	3 1/2	404	10 1/2
	UPPER FREEPORT WORKING SEAM.				
49	Coal----------	2	6	407	4 1/2
50	Binder	-	1 1/2	407	6
51	Coal----------	-	9 1/2	408	3 1/2
52	Sticker	-	- 1/2	408	4
53	Coal----------	-	1 3/4	408	5 3/4
54	Fire Clay	3	- 1/4	411	6
	Total Depth			411	6

21-89

MOTT CORE DRILLING COMPANY

MAIN OFFICE

HUNTINGTON, W. VA.

DIAMOND CORE DRILL HOLE RECORD

FOR Christopher Coal Co., ADDRESS Osage, W.Va., DATE July 5, 19 55

ON Henderson-Tennant NEAR Cass District COUNTY Monongalia 93 STATE W.Va.,

Farm 277.295 acres

HOLE NO. 236 ~~236~~ EL. 1190± DRILLER Ray Cooper DRILL NO.

80°05' -09 mile
39°45' 5.67

CLASSIFICATION		THICKNESS OF STRATA FEET	THICKNESS OF STRATA INS.	DEPTH FROM SURFACE FEET	DEPTH FROM SURFACE INS.	
Surface		6	0	6	0	
Sandy shale		4	0	10	0	
Blue shale		11	9	21	9	
Gray shale		1	10	23	7	
Sandy shale		7	6	31	1	
Blue shale		20	7	51	8	
Soft gray shale		3	3	54	11	
Blue shale		6	10	61	9	
Sandy shale		4	10	66	7	
Blue shale		5	6	71	1	
Dark shale		1	11	73	0	
Coney Coal	1114	3	0	76	0	Way. "A"
Blue shale		8	0	84	0	
Gray shale		10	2	94	2	
Sandy shale		6	6	100	8	
Sandstone		6	10	107	6	
Sandy shale		7	3	114	9	
Sandstone		22	6	137	3	
Coney coal	1051	1	6	138	9	Way. rider
Dark shale		10	4	149	1	
Sandy shale		9	9	158	10	
Gray shale		13	2	172	0	
Coal		1	10	173	10	
Binder		1	3	175	1	
Coal		3	0	178	1	WAY
Binder		0	2	178	3	
Coal	1011	1	1	179	4	
Dark shale		1	10	181	2	
Sandy shale		9	4	190	6	
Blue shale		11	8	202	2	
Limestone		15	7	217	9	
Blue shale		3	8	221	5	
Limestone		2	10	224	3	
Blue shale		4	8	228	11	
Sandy shale		4	1	233	0	
Blue shale		7	11	240	11	
Dark shale		1	5	242	4	
Limestone		1	1	243	5	
Blue shale		3	4	246	9	
Sandy shale		9	3	256	0	
Dark shale		2	9	258	9	
Limestone		7	4	266	1	
Blue shale		11	7	277	8	

STARTED 19

COMPLETED 19

FORM 1

HUNTINGTON, W. VA.

DIAMOND CORE DRILL HOLE RECORD

Christopher Coal Co., ADDRESS DATE 19

ON NEAR COUNTY STATE

HOLE NO. 236 EL. DRILLER Ray Cooper DRILL NO.

Page - 2

CLASSIFICATION	THICKNESS OF STRATA FEET	THICKNESS OF STRATA INS.	DEPTH FROM SURFACE FEET	DEPTH FROM SURFACE INS.	
Sandy shale	8	7	395	8	
Blue shale	8	7	403	10	
Limeshale	5	0	407	10	
Blue shale	22	1	430	11	
Limestone	10	6	440	5	
Blue shale	8	11	448	4	
Limestone	4	7	452	11	
Sandy shale	7	10	460	9	
Blue shale	5	6	466	3	
Limestone	9	5	474	8	
Sandy shale	8	11	483	7	
Limestone	4	3	487	10	
Blue shale	14	4	502	2	
Dark shale	2	1	504	3	
Blue shale	10	3	514	6	
Sandstone	15	8	530	2	
Sandy shale	5	9	535	11	
Dark shale	4	1	540	0	
Coal	5	4	545	4	Sew 6'-1"
Binder	0	1½	545	5½	
Coal 744	0	7½	546	1	
Dark shale	5	0	551	1	
Limeshale	5	6	556	7	
Limestone	7	0	563	7	
Soft gray shale	3	6	567	1	
Lime shale	6	0	573	1	
Limestone	12	0	585	1	
Gray shale	1	10	586	11	
Limestone	1	7	588	6	
Sandy shale	4	1	592	7	
Soft gray shale REDSTONE COAL HORIZON: EL 694	3	10	596	5	
Limeshale	14	8	611	1	
Gray shale	11	8	622	9	
Dark shale	4	4	626	7	
Coal	0	5	627	0	
Dark shale	1	9	628	9	
Coal	4	5½	633	2-½	Pitt
Binder	0	0-½	633	3	
Coal 653	3	7	636	10	8'-1"
Gray shale	3	2	640	0	

1200
527
673

STARTED June 22, 1955 19

COMPLETED July 6, 1955 19

FORM 1