MANDRONES COAL MINE
Report
by

State Department of Geology and Mineral Industries

SUMMARY

1. The mine is situated favorably relative to transportation to Portland and other northern Willamette Valley centers of population.

2. As shown by present development, the coal bed at the Mandrones mine is relatively thick (7-10 feet) and the clean coal in the bed is good grade, but the large proportion of waste in the bed reduces the amount of commercial coal to a figure of 2 to 3 feet. Even under favorable conditions this thickness of this rank of coal would be considered marginal economically. In a large proportion of the bed the coal is in knife-edge seams. Thus the problem of recovering the coal economically by washing is difficult. As shown by sink and float tests on two bulk samples of the coal bed (each about 200 pounds) the recovery of coal is poor and the concentrate of coal made is not clean, that is, it is high ash. Whether or not some economical method of concentrating the coal could be evolved is problematical - probably doubtful under present economic conditions. Therefore, the competitive position of the Mandrones coal appears poor.

3. The extent of the coal bed laterally is unknown outside of the boundaries represented by the small amount of development work done. The bed is probably persistent, but this is unproved. The chances for material improvement in the proportion of coal contained with further development do not appear good, but estimate of the chances is theoretical in the absence of extensive exploration.

4. Sink and float is a method of separating valuable from waste material of

a product by means of the difference in specific gravities. Sink and float tests on large bulk samples of coal indicate fairly reliably what may be expected in practice. Crushing is usually done to an economical maximum size which will free the waste from the coal. Separate products are then separated according to their specific gravities. In the case of coal-testing the lightest products are the valuable constituents; the heavier the product the more waste it has.

5. The test on the sample collected by Libbey and Mason in April 1948 was made by A. D. Centenero, Chemical Engineer at the University of Washington. As a result of his tests it is estimated that by crushing to a 1-inch size, about 32 percent of washed coal could be recovered having about 9 or 10 percent ash. The cost of producing the coal would depend on several factors including quantity produced and efficiency of management, but in any event, judging from this test, only about 32 tons of commercial coal with relatively high ash would be produced from each 100 tons mined. Of course by discarding more of the high gravity fractions a lower ash product could be obtained, but this lowers the amount of coal recovered from the bed and increases the unit cost. It will be noted that this test gave results which showed some improvement over that conducted by Dr. H. F. Yancey of the U. S. Bureau of Mines on the bulk sample of Mandrones coal obtained by Libbey and Allen - October, 1946. This improvement may have been due to crushing to a different size. In the earlier sample the bed contained slightly more waste. The low-temperature carbonization assay on the float 1.70 gravity cumulative fraction presents nothing unexpected. The analysis shows a lower percentage amount of volatiles than the average for Coos Bay coals, and the total amount which could be obtained from Coos Bay coal is considerably greater because of less waste in the bed. The 1.70 float was selected for the test because it

would produce the maximum amount of volatiles. The char is high ash - about 25 percent. Following is a tabulation showing a comparison of the yields of Mandrones and Coos Bay coals based on the low temperature carbonation assays of Mandrones coal by Mr. Centenero of the University of Washington and on Coos Bay coal by Yancey and Geer of the U. S. Bureau of Mines Station at Seattle as reported in State Department of Geology and Mineral Industries Bulletin No. 27:

	Mandrones (1.70 float gravity - fraction of Sink and Float test - represents approximately 47% of coal bed)	Coos Bay (Average of coal samples from 6 mines - would represent high percentage of coal bed)
Yield on "as received" basis		
Char	62.1 percent	57.7 percent
Gas	6.1 "	9.9 "
Tar and Oil	8.2 "	8.8 "
Water	23.6 "	23.3 "
Yield per net ton of product tested		
Gas (at 60°F and 29.92 inches mercury) wet	2626 cu. ft.	3109 cu. ft.
Tar and Oil	19.7 gallons	21.1 gallons

Gas Analysis, volume percent

	Mandrones	Coos Bay
CO_2	13.2	26.9
Illuminants	1.9	2.1
CO	11.9	8.7
H_2	29.1	16.8
CH_4	40.3	34.8
C_2H_6	3.5	8.1
N_2	.1	1.7
Calorific value, gross Btu	632	617

6. The sample of the coal bed taken in Tunnel No. 2 by Libbey and Mason, April, 1948 for the purpose of determining the heating value and ash of a thick section of the mixed bone and coal in the bed was not encouraging. On an "as received" basis, the sample returned 5,410 Btu and 41.4% ash. This does not mean that a better grade of sample could not have been obtained here by shortening up the width of the coal section. This however would have meant only about 2 feet of coal, and considerable coal left in the section unsampled in the form of very thin seams.

7. Because of the current power shortage and the need for finding additional sources of power as soon as possible, comment should be made on the feasibility of building a steam-electric power plant at the mine using pulverized coal as fuel. Since the efficiency of such a plant would depend upon supplying it with cheap fuel, and since the low percentage of coal in the bed would mean a high unit cost of usable coal, the proposal for such a plant appears

uneconomic under present conditions.

8. Mention has been made in the press in recent years of gasification of coal in place. Where conditions are favorable this type of operation may some day be commercial in this country. However, such a method of obtaining energy from coal without mining it is as yet highly experimental.

9. The landslides on the hillside in the mine area would affect the coal bed near the surface, but it is not believed that any crushing and faulting resulting from slumping would extend into the bed far enough to interfere with mining. The present slopes were driven in two places where there was little or no slumping in evidence on the surface.

RIKER-MANDRONES COAL MINE CORPORATION (Also known as Wilhoit Springs Coal Mine) — Clackamas County

Operator: Ted G. Mandrones, Wilhoit.

Lessee: Riker-Mandrones Coal Mine Corp., an Oregon corporation.

Owner: Mine located on U. S. government land, O and C Railroad-revested Lands Administration from which agency operator leases 240 acres in sec. 15, T. 6 S., R. 2 E. Also 320 acres are leased from J. J. Tobin in secs. 15 and 16.

Location: The main mine workings are situated a few hundred feet east of the ¼ corner between secs. 15 and 16. The mine is located about half a mile east of the Wilhoit Springs resort, which at present is the end of a power line. The property is served by a partially paved county road from Wilhoit Springs to Molalla which is about 8 miles to the north. Molalla is roughly 30 miles south of Portland.

History: A small amount of coal has been mined during the past few years. Most of it has been produced as a result of the development work in digging the two slopes.

Topography: The topography of the immediate area surrounding the mine is shown on the accompanying map. The terrain is fairly rugged and has suffered extensive slumping on the steeper gradients. The timber was logged off several years ago and the surface is now littered with the usual tangle of vine maple, blackberry vines and other underbrush.

Geology:

Areal Geology

General: The coal bed occurs within a series of marine and terrestrial sediments which are underlain and overlain by lavas. Both lavas and sediments are part of the Western Cascade Series

described by Callaghan (1).

Near the outcrop of the coal bed these sediments are fine-grained, cream-to buff-colored tuffs often containing small amounts of charred vegetable matter. About three quarters of a mile west of the mine portal on the Rock Creek road near the contact with the basalts at the base of the section, the sediments are coarser--conglomerates and grits predominating. Interbedded with the sediments at this point are thin lava flows or sills. The upper portion of the sediments is blanketed by soil and vegetation and cannot be seen. From the pieces of float observed in the drainage lines it is thought that a large part is fine-grained tuff similar to the outcrop near the portal.

Harper (2) describes the sediments of the series in which the coal bed occurs as follows:

> "The beds are composed mainly of rather well-bedded tuffaceous marine sandstones which appear to interfinger with, or grade upward into terrestrial sediments which range from conglomerates to fine-grained tuffs and ash. Small patches of impure shell limestone are present and thin coal beds and carbonaceous shales are numerous. The medium-grained sandstones are bluish or greenish gray in fresh exposures and weather to various shades of brown. Blocky jointing is developed in the massive sandstones and spheroidal weathering is common in some of the more resistant beds."

Numerous boulders and blocks of black vesicular lava are found as float in the area of the mine. Quantities of these blocks are found on the hillside just above the two portals and in the drainage channels. The accumulations on the hillside are thought to represent relatively recent concentrations due to slumping of the lava-capped sediments. The quantities in the drainages represent accumulations from earlier landslides and occur as residual debris.

The hill rising behind (east of) the mine is capped with lava. Although the contact between sediments and the overlying lava was not seen, indications from the float are that the summit is from 200 to 250 feet vertically above the portals. The lava is black, fine-grained, and sometimes quite vesicular. Because of the occasional phenocrysts of olivine seen in hand specimens, this lava was called basalt.

Within the map area the base of the sediments was not seen. To the northwest, down Rock Creek about two miles, there is a quarry in lava which is thought to represent the underlying material. The lower part of the quarry is a greenish-black, somewhat porphyritic lava with phenocrysts of feldspar up to 3 millimeters. It was called basalt. The rock is badly altered - the green cast of the rock being due to the alteration of the mafic minerals to chlorite. Chunks of this rock used as road metal on the road to the mine often disintegrate to an incoherent greenish mass. Overlying the greenish-black basalt is a dense, gray, platy lava. This is either an andesite or a basalt. There is a 2 to 5 foot thick soil layer at the contact between the two lavas. It was developed on the underlying basalt and marks a time interval, the extent of which is unknown, between the flows.

Age of beds: The age of the sediments which include the coal bed is considered to be middle Oligocene. Harper (2) named these sediments the Butte Creek beds. He states that they "...can be traced into the Stayton quadrangle to the southwest where they have been mapped by O'Neill (3) and Thayer (4) as the Illahe formation. Thayer considers the Illahe formation to be the equivalent of the Eugene or Pittsburg Bluff formations of middle Oligocene age."

The overlying lavas are younger than the Butte Creek beds. However, it could not be determined within the map area whether they were equivalent to the Columbia River basalts of Miocene age or to the Boring lavas of late Pliocene or early Pleistocene age.

On the basis of fossils found in interfingering marine conglomerates in the lavas underlying the Butte Creek beds, Harper (2) stated that "...the lower part of the series is tentatively considered Eocene in age, and the upper andesitic portion may in part be Oligocene." In his report Harper called them the "Pre-Butte Creek Lavas." He further stated that the contact between the Pre-Butte Creek Lavas and the Butte Creek Beds is unconformable.

Structure: Harper (2) gives the structure of the area as follows:

"Dips observed in the southern half of the Molalla quadrangle indicate an anticline or elongate domal fold lying between these two structures (Willamette syncline and Mehama anticline) with a northeasterly trend parallel to the trend N 45° E) of the Mehama anticline. Westerly dips which average about 6 degrees were observed in the Butte Creek marine sandstones in the vicinity of Beaver Creek school, along Butte Creek west of Scotts Mills, and along Abiqua Creek near the southern edge of the area. Dips vary from 1 to 8 degrees east in a coal seam about a mile east of Wilhoit, and southeasterly dips of from 3 to 11 degrees were observed in the terrestrial sediments and fossiliferous sandstones on Coal Creek, and on Butte Creek 4 miles southeast of Scotts Mills. On the basis of these dips, the axis of the fold would cross Butte Creek 2 or 3 miles east of Scotts Mills and extend northeasterly to Wilhoit."

The strike of the coal bed as computed from the outcrops is N 1°0 E with a dip of 6 degrees to the east. This would mean that the sediments of this area occupy the eastern limb of the anticline or dome.

The general topography indicates that in this area Rock Creek has breeched the lavas near the crest of the fold and is cutting deep into the soft sediments. Because the sediments erode more easily than the lavas, steep hillsides result. This coupled with other factors, such as the dip of the beds into the hill and consequent poor drainage, and the presence of clay layers, is favorable for

landslides. These conditions are quite noticeably reflected on the hillside behind the mine as practically the whole area is made up of small slumps. They range in degree of freshness from small blocks with undrained spots on the hillward side to small terraces covered with blocks of lava. The numerous landslides are the most distinctive topographic feature of the mine area.

The outcrops at the two main adits are on small ridges which have been relatively unaffected by slumping. The area between the portals and to the north of entry no. 1 is practically all covered with slump material. This is thought to be the main factor in being unable to trace the outcrop.

Coal Bed

General: Coal is exposed by entries at three different locations within the map area. The strike and dips, thicknesses, and attitudes indicate that all are at the same stratigraphic level. Therefore, all entries are considered to be on the same bed.

The thickness of the coal bed exposed varies from ? feet in the no. 3 adit to around 10 feet in the no. 2 adit. Present development, and the adit on which the most work has been done, is in no. 1 where the thickness exposed is between 5 feet plus to around 7 feet. Auger holes drilled in the roof and floor near the point where the bulk sample was taken (see map) showed small (less than one inch) seams of coal occurring through a distance of 21 inches in the roof and 26 inches in the floor. At this spot, then, various thicknesses of coal occur through a vertical distance of approximately 10 feet. The total amount of measurable coal, however, is less than ? feet, the remainder being a mixture of bone and minute seams of coal and clay partings. The thickest sections of coal at this point are found near the floor. Here, two beds of bright coal 1 foot 2⅝ inches and 1 foot 0 inches thick, respectively, are separated by a 4 inch clay parting (see sections). Although there is considerable lensing and pinching and swelling of individual layers (coal,

bone and clay) in the slope it is thought that this section is representative of the bed in this slope.

The thicker sections of coal in slope no. 1 are usually found near the floor; an exception to this is the lens of coal exposed at the roof in the room off transit station no. 24.

In slope no. 2 there appears to be more bone and tuff partings in relation to coal than there is in slope no. 1 (see sections). Also the horizontal length of the various seams appears to be less; in other words lensing is more pronounced. Most of the slope, however, was filled with water and not open for inspection, consequently only the first 60 feet was examined.

Very little work, and none of a recent nature, has been done on slope no. 3. It is approximately 20 feet in length and not more than 3 feet wide and 3 feet high. Whether or not the total thickness of the coal bed is exposed by this slope is not known. That which is exposed shows bright coal from knife edge seams to bands not over 5 inches thick. The tuff and bone partings are numerous and do not exceed 4 to 5 inches in thickness. All bands appear to be quite lenticular and, in comparison to slope no. 1, short along the long axis.

A "blossom" or coal outcrop was reported in the creek 675 feet west and 120 feet lower than entry no. 1. The outcrop showed some carbonaceous material in badly altered tuff or "fire clay", but it could not be determined whether or not this was an actual exposure of a coal bed. If it is, it would be an altogether different bed than that exposed by the three entries. More work will be necessary at this spot before any information will be available.

Petrology: The coal is bright and slacks but slightly on exposure. It is poorly indurated and breaks easily into particles down to granule size.

The bone is dull black in color, fairly well indurated and often contains minute seams of bright coal. Occasional plant fragments and particles of volcanic ash often give it a speckled or mottled appearance. The bone appears to be a highly carbonaceous, well indurated volcanic tuff.

Partings of volcanic tuff occur as lenses in the coal bed. The tuff is brownish yellow in color, fine-grained, and contains fragmentary plant remains. Widths vary from a knife edge to several inches. Some partings can be traced over distances of around 100 feet.

Structure: As noted previously the strike of the beds as computed from the outcrops is N 13° E with a dip of 6 degrees to the east. In the no. 1 slope three other attitudes were computed from measurements on tuff partings. These were at stations 21, 24 and 26 (see map). The strikes obtained were N 20° E, N 25° E, and N 63° E respectively. The dips were all to the southeast and were low - 4 degrees, 5 degrees, and 3 degrees respectively. The strikes indicatethat the coal bed is swinging around to the east and that the general structure is tending to close to the south. This fits in with Harper's (2) idea of an elongate domal fold in this area. Many apparent attitudes were taken and indicated minor swells and dips in the bed. Generally, the bed appeared to be flatter toward the face from station 24, than between station 24 and the portal. The slope, as it is now being driven, is not going directly down the dip but quartering off to the east. This might account for the apparent flattening.

Minor faulting was noted in slope no. 1 for the first 140-150 feet from the portal. On most of the faults the offset was vertical and was never greater than 0.2 feet. The up side of the fault was always on the portal or outward side. The slope was making water in two zones. The first zone was from the portal to station 20 and the second was a zone 10 to 15 feet on either side of station 25.

It is believed that the minor faulting and the water seeps are due to the slumping at the surface.

Slope no. 2 trends N 52° E up the west limb to the crest of a small southeastward plunging anticlinal fold whose axis is 45 feet in. The slope then trends N 88° E down the east limb of this fold. Apparently there has been some thickening of beds at the crest of the anticline as the coal bed exposed at this point by the slope is approximately 10 feet thick. This is at least 1 foot thicker than exposed by the entry farther down either limb of the fold.

Slope no. 3 appears to be driven at an angle to the true dip of the coal bed. Insufficient development work has been done on this outcrop, however, to warrant any more than the above suggestion.

Condition of sedimentation: Coal is usually considered to mark the site of an ancient peat bog or an accumulation of vegetation that has drifted into a bay or estuary. It is thought that this deposit conforms to the accepted theory in that it marks a swamp area near an ancient coast line. Reasons for so believing are the fineness of the sediments, the presence of charred wood found in the sediments, and the interfingering of marine and terrestrial beds.

This occurrence of coal was considered by Lowry (5) to be equivalent in age to the coal beds found at Scotts Mills, east of Pratum (Waldo Hills Coal Mine), and west of Scappoose and St. Helens. Lowry considered the coal as representing near-shore conditions and thought these occurrences indicative of the Oligocene shoreline in their respective areas.

Development: Present development work is being done by the operator and one helper and is confined to deepening the No. 1 slope and extending a gangway turned off to the south a short distance from the present face. A minor amount of lump coal has been sold locally after hand sorting. Some stoker coal is reportedly being trucked to Portland. The No. 2 slope located 650 feet

south of the No. 1 slope, said to be 215 feet long, is now largely filled with water.

Mining: The mining practice employed is similar to that at many other small unmechanized coal mines. A rebuilt hoist powered by a second-hand automobile motor is used to haul the cars up the slope to the portal from which point they are hand-trammed out on the trestle and dumped over a screen. A small gasoline-driven piston pump is used to dewater the mine. Augering in preparation for blasting is done by hand after the face has been undercut. Buildings at the mine include a house occupied by the operator and sheds covering the blacksmith shop and a hammer mill. The hammer mill which was being set up at the time of the inspection is powered by an eight cylinder Marmon automobile motor. The 8 inch mill is set up to discharge through a 1/8-inch perforated screen. The plan for utilising this mill is not known to the writers.

Sampling: The coal bed has been sampled and analyzed several times in the past few years. Channel samples taken by the U. S. Bureau of Mines and the State Department of Geology and Mineral Industries, and analyzed by the U. S. Bureau of Mines have shown the coal to be high volatile class C bituminous grade. The clean coal has a Btu content of about 11,600 on an as received basis. It will be seen from the accompanying sections of the bed, that the coal is intermixed with many bony layers, especially in the upper portion of the bed. The analyses show that the coal is diluted by waste in sampling even though the intent is to sample only clean coal.

Results of analyses of channel samples taken at both the No. 1 and No. 2 slopes by the State Department of Geology and Mineral Industries follow.

Measured sections of the coal bed, together with analyses of channel samples of coal both by the U. S. Bureau of Mines and the State Department of

Geology and Mineral Industries are attached as exhibits in the following order:

I. Measured sections of coal bed where samples were taken by Libbey and Mason, April, 1948. The sample from No. 2 slope was analyzed by U. S. Bureau of Mines, Seattle. The bulk sample from No. 1 slope was tested for sink and float and low-temperature carbonization characteristics by A. D. Centenero, Chemical Engineer, University of Washington.

II. Proximate analysis of sample from No. 2 slope.

III. Report of sink and float test, by A. D. Centenero.

IV. Report of low-temperature carbonization assay by A. D. Centenero.

V. Topographic and geologic map of Mandrones Mine area.

VI. Cross section on No. 1 slope of mine and graphic representation of coal bed sampled April, 1948 by Libbey and Mason.

VII. Appendix containing records of previous sampling by State Department of Geology and Mineral Industries and U. S. Bureau of Mines as follows:

a. Sections of Mandrones coal bed measured by J. E. Allen of State Department, August, 1944.

b. Results of analyses by State Department of (2) picked samples taken by C. C. Ralph, August, 1944.

c. Measured section of Mandrones coal bed at point sampled 5/28/43 by H. Fowler of U. S. Bureau of Mines, sample No. C-1417.

d. Report of analyses of sample C-1417.

e. Measured section of Mandrones coal bed sampled 12/2?/43 by Yancey and Coughlin of U. S. Bureau of Mines, sample No. C-12927.

f. Report of analyses of sample C-12927.

g. Measured sections of coal bed at opposite sides of entry 325 feet from portal sampled by Libbey and Allen, October 1926.

h. Sink and float tests on bulk sample taken October 1926 by Libbey and Allen. Testing work by Dr. H. F. Yancey of U. S. Bureau of Mines.

i. Letter from H. F. Yancey in explanation of results of sink and float tests.

VIII. Bibliography.

Tunnel No. 1

Bulk Sample

Section measured 463 feet from portal.

	Ft.	in.
Roof, sandstone		
Bone with coal seams		4
Coal, bright		2½
Bone and coal		5
Coal, bright		3/4
Bone and coal	1	5
Clay parting		1
Bone and coal		8½
Coal, bright		3
Bone and coal		3
Coal, bright	1	2½
Clay parting		4
Coal, bright	1	0
Floor		
Thickness of bed	6	3¼
Thickness of sample	6	3¼
Thickness of bright coal	2	8 3/4

Sample placed in large carbide cans.

Sampled by F. W. Libbey
R. S. Mason
April 23, 1948

Tunnel No. 2

Section measured 67 feet from portal

	Ft.	in.
Roof, sandstone		
Bone and coal, mostly coal	1	2
Bone with thin coal seams		10*
Bone and coal, mostly coal	1	11
Bone		2*
Coal some bone		7
Bone		5*
Coal and bone	2	
Floor, not stated		
Thickness of bed	7	1
Thickness of sample	5	8

Sample placed in USBM sample can #2358.

Sampled by F. W. Libbey
R. S. Mason
April 23, 1948

* not included in sample.

UNITED STATES
DEPARTMENT OF THE INTERIOR
Bureau of Mines

G- Coal-Analysis Report

Sample of Coal — NAa. Can No. 2358

Operator T. G. Mandrones Mine Mandrones

State Oregon County Clackamas Bed (Unnamed)

Town Wilhoit Springs

Location in mine Working face

Net weight, grams 1137

Date of sampling 4/27/48 Date of Lab. sampling 5/7/48

Collector F. W. Libbey and Ralph Mason

		COAL (Air Dried)	COAL (As rec'd)	COAL (Moisture free)	COAL (Moisture and ash free)
Air-Dry Loss	9.6%				
PROXIMATE ANALYSIS					
Moisture		6.8	15.7		
Volatile Matter		20.3	18.4	21.8	42.8
Fixed carbon		27.1	24.5	29.1	57.2
Ash		45.8	41.4	49.1	
		100.0	100.0	100.0	100.0
ULTIMATE ANALYSIS					
Hydrogen					
Carbon					
Nitrogen					
Oxygen					
Sulphur		.4	.4	.4	.8
Ash					
British thermal units		5,980	5,410	6,420	12,620
Softening temperature of ash					

Date May 24, 1948 Signed K. A. Johnson
Chemist

Specific-gravity analysis of coal from Mandrones mine, Wilhoit Springs, Clackamas, Oregon. Face sample collected April, 1948 by F. W. Libbey and Ralph Mason, Oregon State Department of Geology and Mineral Industries.

Size [1]	Specific gravity			Weight, percent	Ash, [2] percent	Cumulative Weight, percent	Cumulative Ash, [2] percent
1 inch to 20 mesh	Under		1.30	14.6	2.8	14.6	2.8
Weight, 94.7 percent	1.30	to	1.40	11.1	7.6	25.7	4.9
	1.40	to	1.50	8.6	19.3	34.3	8.5
	1.50	to	1.60	7.2	30.8	41.5	12.4
	1.60	to	1.70	5.3	40.7	46.8	15.6
	Over		1.70	53.2	76.3	100.0	47.9
Under 20 mesh	Under		1.30	9.6	5.1	9.6	5.1
Weight, 5.3 percent	1.30	to	1.40	15.6	7.1	25.2	6.3
Ash, 37.6 percent [2]	1.40	to	1.50	23.6	14.6	48.8	10.3
	1.50	to	1.60	5.3	24.4	54.1	11.7
	1.60	to	1.70	5.5	32.8	59.6	13.7
	Over		1.70	40.4	71.6	100.0	37.1
Composite	Under		1.30	14.4	2.9	14.4	2.9
Weight, 100.0 percent	1.30	to	1.40	11.3	7.6	25.7	5.0
	1.40	to	1.50	9.4	18.7	35.1	8.6
	1.50	to	1.60	7.1	30.5	42.2	12.3
	1.60	to	1.70	5.3	40.3	47.5	15.4
	Over		1.70	52.5	76.1	100.0	47.3

1/ Total sample was crushed to pass 1 inch square hole.

2/ Moisture-free basis.

A. D. Centenero
Chemical Engineer

Low-temperature assay at 550°C. of float 1.70 fraction of coal from Manganese mine, Wilhoit Springs, Clackamas County, Oregon. Face sample collected April, 1948 by F. W. Libbey and Ralph Mason, Oregon State Department of Geology and Mineral Industries.

Analysis of sample, air-dry basis:	
Moisture, percent	4.8
Ash, percent	14.7
Air-dry loss, percent	11.4

Yield, percent, air-dry basis:	
Char	70.0
Gas	6.9
Tar and oil	9.3
Water	13.8
Total	100.0

Yield, percent, calculated as received:	
Char	62.1
Gas	6.1
Tar and oil	8.2
Water	23.6

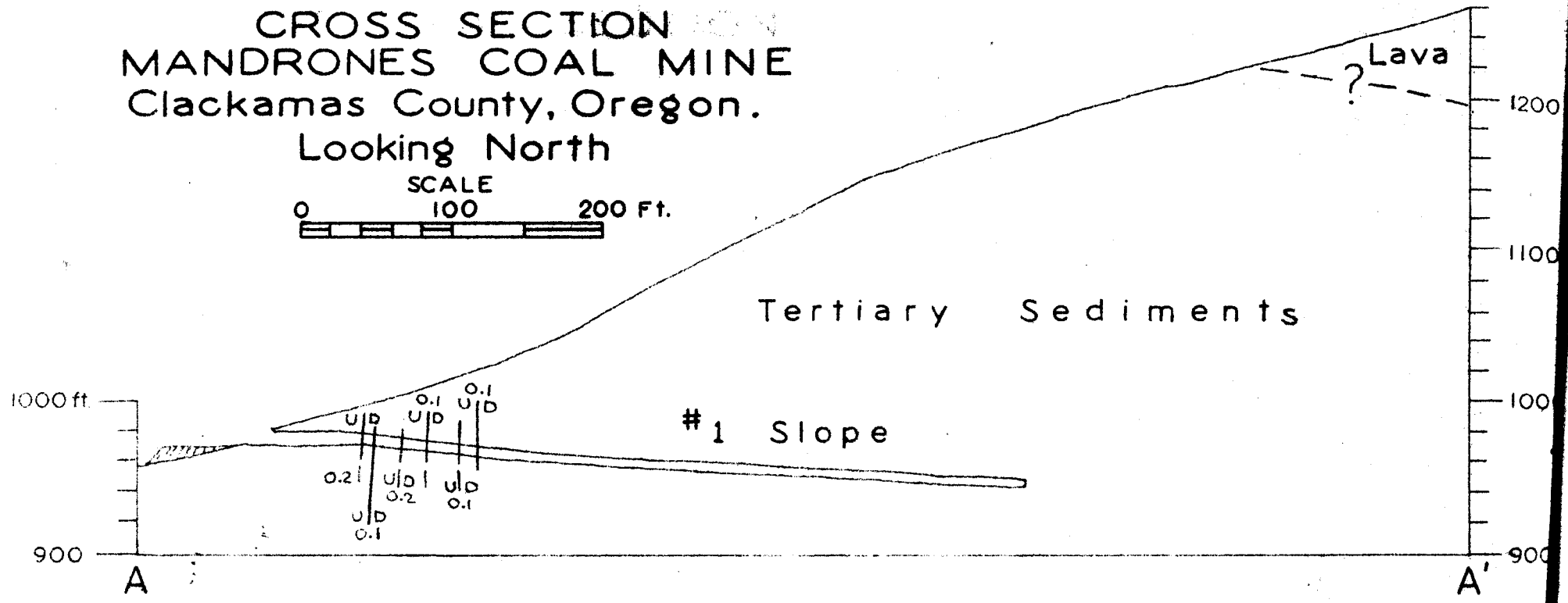
Yield, per net ton, calculated as received:	
Gas at 60°F. and 29.92 inches of Hg, cu. ft. wet	2626
Tar and oil, gallons	19.7

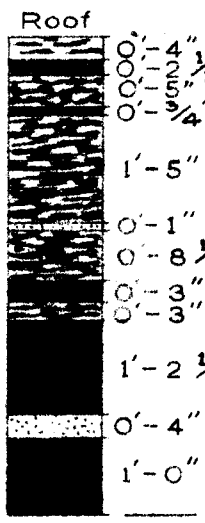
Gas analysis, volume percent	
CO_2	13.2
Illuminants	1.9
O_2	.0
CO	11.9
H_2	29.1
CH_4	40.3
C_2H_6	3.5
N_2	.1
Calorific value of gas at 60°F. and 29.92 inches of Hg, gross B.t.u.	632

A. D. Centenero
Chemical Engineer

CROSS SECTION
MANDRONES COAL MINE
Clackamas County, Oregon.
Looking North

SCALE
0 100 200 Ft.

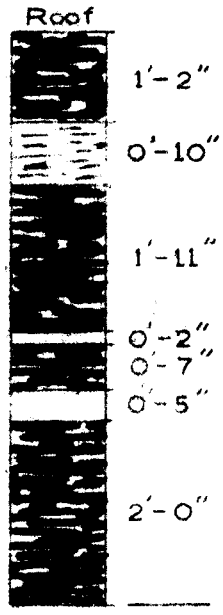




Roof	Sandstone.
0'-4"	Bone with coal seams.
0'-2½"	Coal, bright.
0'-5"	Bone and coal.
0'-¾"	Coal, bright.
1'-5"	Bone and coal.
0'-1"	Clay parting.
0'-8½"	Bone and coal.
0'-3"	Coal, bright.
0'-3"	Bone and coal.
1'-2½"	Coal, bright.
0'-4"	Clay parting.
1'-0"	Coal, bright.
Floor	

Thickness of bed 6'-3¼"

SECTION OF COAL BED
#1 Slope 28 ft. inby Sta. 26



Roof	Sandstone
1'-2"	Coal and bone, mostly coal.
0'-10"	Bone with thin coal seams.
1'-11"	Coal and bone, mostly coal.
0'-2"	Bone.
0'-7"	Coal, some bone.
0'-5"	Bone.
2'-0"	Coal and bone.
Floor	

Thickness of bed 7'-1"

SECTION OF COAL BED
#2 Slope 7 ft. inby Sta. 19

MANDRONES COAL MINE

Sections of Coal Bed

Tunnel No. 1

Section taken at face on left or north side, 325 feet from portal.

Roof, shale, carbonaceous	Ft.	in.
Bone and coal in thin seams	3	0
Clay		1
Coal		4
Clay		2½
Coal		8
Clay, hard, yellow		2
Bone		2
Coal, bright	1	1
Clay		3
Coal, bright		4
Clay		5
Coal		6
Floor (not seen)		
Total thickness of coal	2 Ft.	11 in.
Total thickness of bed	7 Ft.	2½ in.

Measured August 1944 by J. E. Allen

Tunnel No. 2

Section taken 60 feet from portal at turn, on right or south side.

Roof, shale, carbonaceous	Ft.	in.
Tuff, yellow, with plants		3
Shale, carbonaceous, with thin coal seams up to 40%	1	5
Shale		4
Shale, carbonaceous, as above	2	0
Coal		4
Shale, carbonaceous		5
Coal, bony		3
Tuff, yellow, hard		3
Coal, in part bony		9
Shale, gray		3
Coal, bright	1	0
Coal, bony		8
Shale		4
Coal, bony		5
Floor, shale, or tuff, yellow		
Total thickness of coal	2 Ft.	1 in.
Total thickness of bed	8 Ft.	8 in.

Measured August 1944 by J. E. ALLEN

Analyses of Coal

A. Sample of bright coal only by C. C. Ralph

	As Rec'd	Dry
Moisture	12.55	—
Ash	1.95	2.23
B.t.u.	11,616	13,283

B. Sample of carbonaceous shale with coal seams by C. C. Ralph

	As Rec'd	Dry
Moisture	5.65	—
Ash	32.95	34.9
B.t.u.	7,799	8,266

August, 1944
By State Department of Geology
and Mineral Industries.

UNITED STATES
DEPARTMENT OF THE INTERIOR
Bureau of Mines

F — Sampling Report

Can No. 6820 Lab. No. C-1417

(1) State Oregon (2) County Clackamas (3) Town Wilhoit (4) Mine Prospect

(5) Sample of Coal (6) Analysis desired

(7) Method of sampling Standard

(8) Location in mine On rib, 60' NE of drift mouth (9) Date 5/28/43

(10) Coal, dry or moist slightly moist (11) Gross wt., lbs. 30 (12) Net wt. 1 can

(13) Sample from fresh or weathered coal fresh (14) Roof uncertain

(15) Draw slate or roof coal roof coal (16) Floor Fire clay

(17) Vertical depth from surface to point of sampling, feet 20'

No.	Section of Bed	Ft.	Ins.
x 1	Roof coal streaked with shale, uncertain thickness		
x 2	Coal		2 1/2
x 3	Shale		2 3/4
4	Coal		4 1/2
x 5	Shale		2
6	Coal		1 1/4
x 7	Coal with shale mixed	1	3
8	Coal		2
x 9	Shale & coal mixture		3 3/4
10	Coal		1 1/2
x 11	Shale & coal mixture		7
12	Coal		3
x 13	Shale & coal mixture		4
14	Coal		2 1/2
x 15	Shale & coal mixture		1 1/2
16	Coal		2
x 17	Shale & coal mixture		2
x 18	Clay		4
x 19	Shale & coal mixture		3
20	Coal		11
	TOTAL THICKNESS OF BED	6	3 1/4
	THICKNESS IN SAMPLE	2	6 1/4

(18) Excluded from sample, marked x, section Nos. 1,3,5,7,9,11,13,15,17,18, and 19.

(19) Send analysis to Washington, D. C. (20) Collector H. Fowler (21) Office Fuel Insp.

Above information copied from B card by FEH on June 16, 1943

UNITED STATES
DEPARTMENT OF THE INTERIOR
Bureau of Mines

G — Coal-Analysis Report Lab. No. C-1417

Sample of Coal. If non-weathering, HighVolatile C Bit.; if weathering, Subbituminous A. (62.-113)-NAa. Can No. 6820

Operator T. G. Mandrones Mine (prospect) Unnamed State Oregon

County Clackamas Bed Unknown Town Wilhoit Springs

Location in Mine On rib, 60' NE of drift mouth Method of sampling Standard

Gross weight, lbs. 30 Net weight, grams 1219.0 Date of sampling 5/28/43

Date of Lab. sampling 6/8/43 Date of Analysis 6/8/43 B. of M. or USGS B. of M.

Collector N. Fowler

	COAL (Air Dried)	COAL (As rec'd)	COAL (moisture free)	COAL (moisture & ash free)
Air-Dry Loss	6.0			
PROXIMATE ANALYSIS				
Moisture	9.7	15.2		
Volatile Matter	28.0	26.3	31.0	39.2
Fixed carbon	43.4	40.7	48.0	60.8
Ash	18.9	17.8	21.0	
	100.0	100.0	100.0	100.0
ULTIMATE ANALYSIS				
Hydrogen	5.0	5.4	4.3	5.5
Carbon	55.0	51.7	60.9	77.0
Nitrogen	.9	.9	1.0	1.3
Oxygen	19.7	23.7	12.2	15.4
Sulphur	.5	.5	.6	.8
Ash	18.9	17.8	21.0	
	100.0	100.0	100.0	100.0
British thermal units	9670	9080	10700	13540
Initial deformation	2730° F.			
Softening temperature of ash	2850° F.			
Fluid temperature	2910 ± 0F.			

Date June 16, 1943 Signed H. M. Cooper

Y

X

UNITED STATES
DEPARTMENT OF THE INTERIOR
Bureau of Mines

Can No. 66 F - SAMPLING REPORT Lab. No. C-12927

(1) State: Oregon (2) County: Clackamas (3) Town: Wilhoit Springs

(4) Mine: Madrona No. 2 (5) Sample of: Coal (6) Analysis desired: Prox.S.Btu-S.T.

(7) Method of sampling (if other than standard):

(8) Location in mine: Face of drift (9) Date: 12/20/43 (10) Coal, dry or moist: moist

(11) Gross wt., lbs. (12) Net Wt., lbs. 4

(13) Sample from fresh or weathered coal: Fresh (14) Roof Shale

(15) Draw slate or roof coal: Shale (16) Floor: Coal, 6"

(17) Vertical depth from surface to point of sampling, feet: 35

No.	Section of Bed	Ft.	Ins.
1	Coal		5
x 2	Shale and boney		6
x 3	Bone	2	0
4	Coal		6 3/4
x 5	Sandstone		1
6	Coal		7 1/2
x 7	Bone and boney		5
8	Coal	1	0
x 9	Shale		1/2
10	Coal		11
	TOTAL THICKNESS OF BED	6	6 3/4
	THICKNESS IN SAMPLE	3	6 1/4

(18) Excluded from sample, marked x, section Nos. 2, 3, 5, 7, and 9

(19) Send analysis to B. of M. (20) Collector: H. F. Yancey and G. P. Coughlin

(21) Office: Seattle, Washington

Above information copied from B card by FEH on January 19, 1944

UNITED STATES
DEPARTMENT OF THE INTERIOR
Bureau of Mines

Test No._____ G- COAL-ANALYSIS REPORT Lab. No. C-12927

Sample of: Coal--MAs. Can No. 66 Operator: T. G. Mandrones

Mine: Madrona No. 2 State: Oregon County: Clackam. Bed: (Unnamed)

Town: Wilhoit Springs Location in mine: Face of drift

Method of sampling:_____ Gross weight, lbs.____ Net weight, grams: 1250.5

Date of sampling: 12/20/43 Date of Lab. sampling: 1/10/44 Date of analysis:____

B. of M. or U.S.G.S. section: B. of M. Sta. Collector: H. F. Yancey & C. P. Coughlin

Air-dry loss 11.3	COAL (Air dried)	COAL (As Rec'd)	COAL (moist. free)	COAL (moist & ash free)
PROXIMATE ANALYSIS				
Moisture	5.1	15.9		
Volatile matter	26.9	23.9	28.4	41.9
Fixed carbon	37.4	33.1	39.4	58.1
Ash	30.6	27.1	32.2	
	100.0	100.0	100.0	100.0
ULTIMATE ANALYSIS				
Hydrogen				
Carbon				
Nitrogen				
Oxygen				
Sulphur	.5	.4	.5	.7
Ash				
British thermal units	8470	7510	8930	13170

FUSIBILITY OF ASH, °F.

Initial deformation temperature 2780

Softening temperature 2850

Fluid temperature 2910 +

Total thickness of bed: 6' 6-3/4"

Total thickness in sample: 3' 6-1/4"

Date: January 19, 1944

(Signed) H. M. Cooper
Chemist

MANDRONES COAL MINE

Section of Coal Bed

Tunnel No. 1

Section taken at point 325 feet from portal on east side of north entry 15 feet from center of slope.

	Ft.	in.
Shale, carbonaceous		
Coal seams and shale half and half		3½
White clay		½
Coal seams and shale half and half		2½
White clay lens		1 3/4
Coal seams (½" carbonaceous shale)		8½
Bright coal		2½
Coal and shale		3½
Bright coal		4½
Coarse tuff		2½
Bright coal		2½
Clay, light colored		1½
Coal seams in carbonaceous shale		3½
Gray clay		6
Coal seams in carbonaceous shale		2½
Bright coal		10 3/4
Gray and white clay		3½
Iron stained good coal		4 3/4
Gray clay		4 3/4
Coal seams in carbonaceous shale		6
Carbonaceous shale		
Total thickness of coal	2	3/4
Total thickness of bed	6	3

Sampled October, 1946.

Section taken at point 325 feet from portal on west side of north entry 25 feet from center of slope.

	Ft.	in.
Shale, carbonaceous		
Coal seam up to 1" and carbonaceous shale		3½
Carbonaceous shale within coal seams (¼")	1	3½
Bright coal		3½
Gray tuff		2½
Bright coal		1½
Gray clay with 3 coal seams ½"		8½
Bony coal		6
Bright coal		8½
Gray and white clay, a few seams		6
Bright coal		3½
Gray clay		2½
Bony coal		7
Carbonaceous shale		
Total thickness of coal	1	4 3/4
Total thickness of bed	6	1½

Sampled October, 1946.

Specific-gravity analysis of coal from Mandrones mine, Wilhoit Springs, Oregon. Face sample collected October, 1946, by F. W. Libbey and John Eliot Allen, Oregon State Department of Geology and Mineral Industries.

Size [1]	Specific gravity		Weight, percent	Ash, [2] percent	Cumulative Weight, percent	Cumulative Ash, [2] percent
3 inches to 20 mesh	Under	1.30	4.0	3.3	4.0	3.3
Weight, 95.9 percent	1.30 to	1.40	16.4	9.0	20.4	7.9
	1.40 to	1.50	8.4	26.1	28.8	13.2
	1.50 to	1.60	6.4	38.7	35.2	17.8
	1.60 to	1.70	7.4	49.9	42.6	23.4
	Over	1.70	57.4	75.7	100.0	53.4
Under 20 mesh	Under	1.30	6.3	5.5	6.3	5.5
Weight, 4.1 percent	1.30 to	1.40	18.1	6.7	24.4	6.4
Ash, 42.6 percent [2]	1.40 to	1.50	17.5	14.5	41.9	9.8
	1.50 to	1.60	6.3	26.7	48.2	12.0
	1.60 to	1.70	7.2	36.1	55.4	15.1
	Over	1.70	44.6	75.2	100.0	41.9
Composite	Under	1.30	4.1	3.4	4.1	3.4
Weight, 100.0 percent	1.30 to	1.40	16.4	8.9	20.5	7.8
Ash, 53.6 percent [2]	1.40 to	1.50	8.8	25.1	29.3	13.0
	1.50 to	1.60	6.4	38.2	35.7	17.5
	1.60 to	1.70	7.4	49.3	43.1	23.0
	Over	1.70	56.9	75.7	100.0	53.0
Portion of total sample crushed to pass 3 mesh	Under	1.30	6.8	2.7	6.8	2.7
	1.30 to	1.50	29.0	12.2	29.8	10.0
	1.50 to	1.70	11.1	40.7	40.9	18.4
	Over	1.70	59.1	78.1	100.0	53.7

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[1] Top size of sample as received approximately 3 inches. A portion of the sample was crushed to pass 3 mesh and then tested to determine how much coal would be liberated by fine crushing.

[2] Moisture-free basis.

Northwest Experiment Station
Bureau of Mines
Seattle, Washington
October 15, 1946

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Report by

F. W. Libbey
R. S. Mason
Hollis M. Dole

June 3, 1948