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GEOLOGY OF THE RIFLE GAP COAL DISTRICT, GARFIELD COUNTY, COLORADO

by

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and

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INTRODUCTION

The geology of the Rifle Gap coal district of the Grand Hogback coal field, Garfield County, Colorado was examined in August 1954 at the request of the regional geologist, Mineral Classification Branch, and the Mining Branch, Conservation Division of the U. S. Geological Survey. The request was for an examination of sec. 7, T. 5 S., R. 92 W., and sec. 12, T. 5 S., R. 93 W., sixth principal meridian. Since many of the coal beds are burned on the surface or not exposed in the requested area, the area was expanded to include secs. 7, 8, 17, and 18, T. 5 S., R. 92 W., and secs. 12 and 13, T. 5 S., R. 93 W. The results of this survey are to be used as an aid in the supervision of coal mining on Federal lands.

Acknowledgements are due K. V. Cammack of the Mining Branch, who assisted in underground mine examinations and who furnished mine inspection records.

A reconnaissance investigation of this area was published by H. S. Gale in U. S. Geological Survey Bulletin 415 (1910).

GEOGRAPHY

The Rifle Gap coal district is part of the Grand Hogback, which is a rugged, prominent physiographic feature caused by the steeply dipping outcrops of resistant massive sandstones rising above lower areas of less resistant shale on each side.

Rifle Creek has cut through the hogback, forming a physiographic feature known as Rifle Gap. Within the area there is over 2000 feet of relief. The area is 6 miles north of the town of Rifle, which is the market for the coal mined.

STRATIGRAPHY

Sedimentary rocks exposed in the Rifle Gap district range in age from Cretaceous to Recent and are over 7000 feet thick.

Cretaceous System

Upper Cretaceous Series

Mancos shale

The Mancos shale consists of about 5000 feet of dark gray marine shale, with only the upper part exposed in this area.

Iles formation

The Iles formation forms the lower part of the Mesaverde group. It lies conformably above the Mancos shale and below the Williams Fork formation. It is 1090 feet in thickness and consists of interbedded sandstones, sandy shales, shales, carbonaceous shales, and coals. The Trout Creek sandstone member, a white massive sandstone about 115 feet thick, composes the upper part of this formation. A massive sandstone (Horizon A), the top of which is 420 feet below the top of the formation, is persistent through the area. This formation contains several coal beds, one of which has been mined extensively. Invertebrate fossils collected from this formation in the Meeker

quadrangle were mostly of marine types, and the plants collected were of the type found in the lower part of the Mesaverde formation.

Section of the Iles formation as exposed in Rifle Gap:

	Feet
Trout Creek sandstone member (top).....	115
Shale with a few thin-interbedded sandstones.....	320
Sandstone, massive (top is horizon A).....	50
Shale.....	40
Coal (Bed C).....	3
Sandstone and shale interbedded.....	60
Sandstone, massive.....	30
Concealed - probably shale and sandstone.....	100
Coal (Bed B).....	7
Shale and sandstone.....	55
Coal (Bed A).....	3
Carbonaceous shale and thin coals.....	5
Sandstones.....	45
Sandstones.....	17
Shale and sandstone (base).....	120
	1090

Williams Fork formation

The Williams Fork formation[19a] forms the upper part of the Mesaverde group. It lies conformably on the Iles formation and unconformably below the Wastach formation. It is 3700 feet thick and consists of an alternating series of massive sandstones, sandy shales, carbonaceous shales, shales and coals, all of which are very lenticular, with the coal beds being the most persistent. Brackish and fresh water invertebrate fossils occur in this formation in the Meeker area.

The age of the lower portion of the Williams Fork formation at Rifle Gap is unquestionably the same age as the Williams Fork formation at its type locality near Craig, Colorado. The upper portion of this formation at Rifle Gap could be equivalent

to beds of Lewis and Lance age in the Craig area, because south of Craig the Lewis shale changes in lithology from shale to interbedded sandstones and shales and, therefore, makes the Lance formation, Lewis shale, and Williams Fork formation one lithologic unit in this area.

This formation contains many coal beds, many of which have burned and formed huge thicknesses of clinker.

Section of part of the Williams Fork formation as exposed in the North Canon Mine:

	Feet
(Top) section starts 45 feet south of mine portal	
Coal (Bed S)	1.5
Sandstone and shale interbedded	42.0
Mine Portal	
Talus	20.0
Carbonaceous shale and coal	.5
Carbonaceous shale and massive to thin-bedded sandstone	68.0
Coal (Bed R)	8.1
Carbonaceous shale	8.0
Bone	.6
Coal (Bed Q)	3.6
Carbonaceous shale with coal partings	4.8
Carbonaceous shale	2.0
Sandstone	10.9
Carbonaceous shale and coal	.4
Coal (Bed P)	2.4
Carbonaceous shale with coal partings	1.9
Coal	.6
Carbonaceous shale with coal partings	.4
Shale	6.2
Carbonaceous shale and coal	1.0
Sandstone and shale interbedded	11.0
Coal (Bed O) strike S. 68° E., dip 76° S.	1.0
Shale	4.2
Sandstone	11.2
Shale	16.2
Sandstone	4.8
Carbonaceous shale	1.3
Sandstone	3.5
Shale	6.6
Sandstone	7.8
Shale	28.8
Carbonaceous shale	.4

	Feet
Coal (Bed N)	7.7
Carbonaceous shale	1.0
Coal	1.5
Sandstone and shale interbedded	6.5
Carbonaceous shale	.3
Coal (Bed M)	8.5
Carbonaceous shale	3.9
Sandstone	6.1
Carbonaceous shale	.2
Coal (Bed L)	6.0
Bone	.5
Sandstone	7.2
Carbonaceous shale	1.0
Sandstone and shale interbedded	28.8
Sandstone	2.0
Coal	.1
Carbonaceous shale	1.4
Coal (Bed K) strike N. 74° W., dip 68° S	6.3
Carbonaceous shale	1.1
Sandstone, some thin shale	76.0
Slickenside - shale	2.2
Coal (Bed J)	2.3
Sandstone and carbonaceous shale	6.5
Sandstone	12.7
Carbonaceous shale	.8
Sandstone	2.2
Sandy shale	3.7
Sandstone (face of tunnel)	13.9
Shale? drilled (base)	23.5

Section of part of the Williams Fork formation as exposed on the surface by the Dutton-Hanley Mine and the Haas Mine:

Coal (Bed H) (top)	1.5
Sandstone and shale interbedded	8.0
Coal)	2.5
Shale) (Bed G)	1.5
Coal)	3.7
Shale	20.0
Coal (Bed F)	9.1
Bone	.9
Concealed - shale?	8.6
Sandstone	9.3
Shale	13.4
Sandstone	5.0
Shale	27.0
Sandstone	33.0
Coal (Bed E)	9.0
Shale	20.0
Sandstone, massive	3.0

	Feet
Sandstone, thin-bedded	6.0
Shale with some thin sandstones	5.0
Sandstone	1.0
Coal (Bed D)	4.1
Bone	.1
Shaly sandstone, Trout Creek sandstone (base)	5.5

Section of the Williams Fork formation as exposed in Rifle Gap:

Conglomerate of the Wasatch formation (top)	
Sandstone, massive	68.0
Shale	45.0
Sandstone	40.0
Shale with a few thin sandstones	80.0
Sandstone	70.0
Sandstone with several 5' shale beds	270.0
Shale with several thin sandstone beds	80.0
Sandstone, massive	40.0
Sandstone, some thin shale beds	140.0
Sandstone	35.0
Shale	40.0
Coal (Bed T)	2.5
Shale some thin sandstone beds	135.0
Sandstone and shale interbedded - two 15' sandstone beds	160.0
Sandstone, massive	24.0
Sandstone with few thin shale beds	150.0
Shale	50.0
Sandstone	103.0
Shale	26.0
Sandstone	20.0
Sandstone with few thin shale beds	160.0
Shale with few sandstone beds	165.0
Sandstone	10.0
Shale	12.0
Sandstone	25.0
Sandstone with few thin shale beds	70.0
Sandstone, massive	25.0
Shale with several 1' sandstone beds	85.0
Sandstone, massive	30.0
Sandstone with several thin shale beds	88.0
Shale with several thin sandstone beds	92.0
Sandstone, massive, white	25.0
Shale with two 5' sandstone beds	72.0
Sandstone	54.0
Shale	40.0
Sandstone	12.0
Shale	12.0
Sandstone	10.0
Shale	25.0

	Feet
Sandstone, massive with a few thin shale beds	100.0
Clinker and talus	940.0
Coal	4.5
Shale and sandstone, interbedded	6.0
Coal	.5
Shale	.5
Coal	1.0
Shale	.5
Coal	.5
Shale (base)	1.5
Trout Creek sandstone of the Iles formation	3700.5

Tertiary System

Eocene Series

Wasatch formation

The Wasatch formation lies unconformably on the Williams Fork formation, with only the basal portion exposed in this area. The formation consists of a basal conglomerate with superjacent interbedded sandstones and shales and varicolored shales. Fossils from this formation in other adjacent areas have been identified as Fort Union age (Paleocene).

Section of part of the Wasatch formation in Rifle Gap:

	Feet
Red shales and sandstones interbedded	-
Sandstone and gray shales interbedded	200
Varicolored shale	200
Gray shale with four 5' sandstones	150
Conglomerate (base)	10+

Quaternary System

Recent Series

Alluvium

Rifle Creek has deposited a thin sheet of alluvium contiguous to its present course. Several gravel terrace levels were observed but not mapped.

STRUCTURE

The main structural feature of the Rifle Gap area is the Grand Hogback, which is part of a monocline dipping steeply southwestward into the Piceance Creek Basin. The date of the orogeny is placed in the Eocene, as beds of early Wasatch age have been folded. The strike and dip in the area averages N. 65° E., 70° SW.

No major faults were observed although several minor faults were seen (7 foot displacement). Difficulty is encountered in finding faults on the surface because of the lenticular beds and the talus cover. These minor faults have been of great concern and hindrance to mining operations and their surface location would be important in future mine development.

North Canon Mine

Two minor faults first encountered in mining operations were observed on the surface. They occurred in incompetent shales and could only be traced a short distance. They did not persist through competent sandstones.

Some of the faults encountered in mining operations which are an oblique horizontal type were not observed on the surface. Apparently these are a series of horizontal en echelon faults which offset the coal beds and have caused abandonment of mining operations.

Rauman Mine

In the mine inspection reports reference is made to a fault at the face of the main entry. No other description was given. This mine is now caved and abandoned. No offset

was observed in the Trout Creek sandstone on the surface.

Estes Mine

In mine inspection reports reference is made to a 7 foot normal fault ~~that~~ was intersected 310 feet from the rock tunnel. This mine is now caved and abandoned.

Dutton and Hasley Mine

In U. S. Geological Survey Bulletin 415, page 119, it states that a sandstone dike transverse to the bedding is exposed in the entry 100 feet from the mouth.

COAL

The Rifle Gap Coal district is in the Grand Hogback coal field. The coal is of sub-bituminous quality and of Cretaceous age. It occurs in formations of the Mesaverde group.

Most of the coal in this area has been burned near the surface and has formed huge clinkers. Coal bed F, located on patented land just south of the Dutton and Hasley mine is burning.

Coal Bed A

This is the lowest coal in the Iles formation. A section was measured in the Riesenees mine as follows:

	Feet	Inches
Sandy carbonaceous shale (top)	4	3
Coal	2	6
Carbonaceous shale and dirty coal		5
Sandy clay		3
Dirty coal		2
Carbonaceous shale, some coal inclusions	3	6
Coal	1	7
Carbonaceous shale and dirty coal		4
Coal	1	11
Carbonaceous shale (base)	1	6

Coal Bed B

This coal bed has been mined in the Ziesenss, McLearn, and Estes mines and in thickness varies from 5 feet 8 inches to 7 feet. Apparently this bed develops a split west of the Ziesenss mine as several beds close together are reported in the mine inspection reports of the McLearn mine. The McLearn mine and the Estes mine are both caved and abandoned, therefore, the sections in these mines were not checked.

Coal Bed C

This coal bed was intersected in the development tunnel of Big Three Mine (same as the McLearn Mine). It is 3 feet in thickness and an entry was driven in this bed for 104 feet. This coal is of good quality but has a soft bottom that tears up with the coal and was, therefore, not worked at this time.

Coal Bed D

This bed ranges in thickness from 4 feet 2 inches to 10 feet 11 inches, and has been mined in the Dutton and Hasley, Rauman, Senger, and Big Three mines.

A sample of this coal (Big Three mine) was taken March 5, 1945, by the U. S. Bureau of Mines and gave the following analysis:

Moisture.....	5.8 per cent
Volatile matter.....	36.9 per cent
Fixed carbon.....	47.3 per cent
Ash.....	10.0 per cent
Sulphur.....	1.8 per cent
BTU.....	11,150
Soft. temp.....	2,850

Coal Bed E

This coal bed was mined in the Dutton and Hasley mine and was reported as 10 feet 11 inches thick in U. S. Geological Survey Bulletin 415. At the Dutton and Hasley mine this bed is 35 feet above coal Bed D. In the Hauman mine they prospected for this bed and drove a tunnel 65 feet from Bed D before they intersected an ash and clinker. In the Big Three Mine they prospected for this bed and drove a tunnel 92 feet from Bed D before they intersected an ash and clinker. Apparently the interval between Bed D and Bed E is thinning to the east. This bed is burned in Rifle Gap.

Coal Bed F

This bed is being mined at the Haas mine and is about 9 feet thick. This bed is burning just west of the Haas mine and is burned in Rifle Gap and above the North Cannon mine.

Coal Beds G and H

These beds are not mined but are well exposed in a cut above the Haas mine. The thickness of Bed G is 3 feet 8 inches and for Bed H it is 1 foot 6 inches. These horizons are in clinker in Rifle Gap.

Coal Bed I

This bed was only found as a clinker above the North Cannon mine. Its thickness is unknown as it has not been prospected.

Coal Bed J

This bed was found in the development tunnel of the North Cannon mine and measured 2 feet 4 inches in thickness. This bed is burned on the surface east of the North Cannon mine

and is not being mined.

Coal Bed K

This bed is being mined in the North Cannon mine and measured 6 feet 4 inches in thickness. In the mine this bed intersected a fault which stopped the mining of this bed. This bed is burned east of the North Cannon mine and in the western portion of section 12. This horizon is clinkered in Rifle Gap and on the eastern boundary of this map.

Coal Bed L

This bed is being mined in the North Cannon mine and measures 6 feet in thickness. This bed is burned on the west and east boundaries of the map and in Rifle Gap.

Coal Bed M

This bed was mined in the North Cannon mine and measures 8 feet 6 inches in thickness. Mining operations stopped because it was burned to the west. This bed is also burned east of North Cannon mine, in Rifle Gap, and on the east boundary of the map.

Coal Bed N

This bed was mined in the North Cannon mine and measures 7 feet 9 inches in thickness. Mining operations stopped because it was burned to the west. This bed is also burned east of the North Cannon mine, in Rifle Gap, and on the east boundary of the map.

Coal Bed O

This bed is exposed in the North Cannon mine and is 1 foot thick. This horizon is clinkered east and west of the North Cannon mine, in Rifle Gap, and on the east boundary of the map.

Coal Bed P

This bed is exposed in the North Cannon mine and is 2 feet 5 inches thick. This horizon is clinkered in Rifle Gap.

Coal Bed Q

This bed is exposed in the North Cannon mine and is 3 feet 7 inches thick. In the mine this bed is offset by a 15 foot fault. This horizon is clinkered on the west and east part of the area and in Rifle Gap.

Coal Bed R

This bed is mined in the North Cannon mine and is 8 feet 1 inch in thickness. In the mine it is offset by a 15 foot fault. This horizon is clinkered on the surface except for a distance of about ¼ of a mile west of the mine.

Coal Bed S

This bed is exposed 45 feet south of the North Cannon mine portal and is 1 foot 6 inches thick. This horizon is clinkered in Rifle Gap.

Coal Bed T

This bed was mined years ago in the Maxfield mines and is 2 feet 6 inches thick. This bed was only observed in Rifle Gap and, therefore, may not be a persistent bed. This is the highest coal bed in the Mesaverde group.