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COAL RESOURCE OCCURRENCE MAP AND COAL DEVELOPMENT POTENTIAL OF THE PADLOCK RANCH QUADRANGLE, BIG HORN COUNTY, MONTANA

[Report includes 3 plates]

By

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This report has not been edited for conformity with U. S. Geological Survey editorial standards or stratigraphic nomenclature.

CONTENTS

ILLUSTRATIONS

[Plates are in pocket]

Conversion table

To convert	Multiply by	To obtain
feet	0.3048	meters (m)
miles	1.609	kilometers (km)
acres	0.40469	hectares (ha)
tons (short)	0.907	metric tons (t)
short tons/acre-ft	7.36	metric tons/hectare-meter (t/ha-m)
Btu/lb	2.326	kilojoules/kilogram (kJ/kg)

INTRODUCTION

Purpose

This text is to be used in conjunction with the Coal Resource Occurrence (CRO) maps of the Padlock Ranch quadrangle, Big Horn County, Montana, (3 plates; U.S. Geological Survey Open-File Report 78-633). This report was compiled to support the land planning work of the Bureau of Land Management in response to the Federal Coal Leasing Amendments Act of 1975, and to provide a systematic resource inventory of Federal coal lands in Known Recoverable Coal Resource Areas (KRCRAs) in the western United States.

Location

The Padlock Ranch 7 1/2-minute quadrangle is in northeastern Big Horn County, Montana, about 12 miles (19 km) northeast of the town of Hardin and 20 miles (32 km) southeast of Bighorn, Montana.

Accessibility

The Padlock Ranch quadrangle area is accessible from Hardin by going 2 miles (3.2 km) east on Interstate Highway 90, then east-northeast on local route 384 (Sarpy Road) 11 miles (18 km). The improved Sarpy Road runs northeastward across the southern part of the quadrangle and intersects a few unimproved roads.

Physiography

The Padlock Ranch quadrangle is in the western part of the Great Plains physiographic province. The rolling hills and wide, flat valleys are drained by northward flowing Tullock Creek, a perennial tributary of the

Big Horn River. Tullock Creek flows through the central portion of the quadrangle from the southern to the northern border. Tributary creeks, all intermittent streams, join the Tullock almost at right angles. The flat flood plain of Tullock Creek is 0.5 to 1 mile (0.8 to 1.6 km) wide, and the flood plains of the tributaries are smaller. The intertributary land areas are gently sloping hills, 1 to 2 miles (1.6 to 3.2 km) wide, which rise only 100 to 200 feet (30 to 60 m) above the streams.

Only in the northwest and northeast extremities of the quadrangle is the terrain more rugged. In the northwest, north of Big Meadow Creek, a dissected escarpment etched in the Tullock Member of the Fort Union Formation rises 200 feet (60 m) above the rolling plain eroded on the less-resistant Hell Creek Formation. In the northeast, the steep-sided, flat-topped Red Hills are capped by resistant clinkered rock produced by burning of coal beds in the Fort Union Formation.

The lowest elevation in the quadrangle, 3,060 feet (924 m) above sea level, is on Tullock Creek at the north quadrangle boundary, and the highest, 3,778 feet (1,152 m) is in the Red Hills. Relief is 748 feet (228 m).

Climate

The Padlock Ranch quadrangle has a semiarid climate. Annual mean total precipitation over most of eastern Montana ranges from 12 to 16 inches (30 to 41 cm). Colstrip, 25 miles (40 km) to the east and at an elevation of 3,232 feet (985 m), receives an average of about 15 inches (38.1 cm) annually. May and June have the two highest monthly precipitation averages, with 2.22

inches (5.6 cm) and 2.83 inches (7.2 cm), respectively. December, January, and February have the least, with less than 0.6 inch (1.5 cm) each.

Temperatures at Colstrip over a 28-year period ranged from as low as -50 °F (-46 °C) to as high as 110 °F (43 °C). July and August are the warmest months, and December, January, and February are the coldest.

Land status

The quadrangle is located in the northwestern part of the Northern Powder River Basin KRCRA. The Federal Government does not own any coal rights in this quadrangle, because all Federal land and minerals were ceded to the Crow Indians in 1958.

GENERAL GEOLOGY

Previous work

Rogers and Lee (1923) mapped most of the Padlock Ranch quadrangle as part of the much larger Tullock Creek coal field. Thom, Jr. and others (1935) also covered the quadrangle in mapping the geology of Big Horn County and the Crow Indian Reservation. Tudor (1975) mapped a small area in the northeastern part of the quadrangle.

Stratigraphy

A generalized columnar section of the coal-bearing rocks is shown on the Coal Data Sheet (pl. 3) of the CRO maps. The exposed bedrock units belong to the Hell Creek Formation (Upper Cretaceous) and the overlying Fort Union Formation (Paleocene).

The Hell Creek Formation crops out in the central, western, and southern parts of the Padlock Ranch quadrangle. It is made up of sandstone

and shale having a general yellowish to greenish-yellow color, and contains no coal (Rogers and Lee, 1923, p. 19). A full section is about 800 feet (244 m) thick, but only about the upper half is exposed in the quadrangle.

The Fort Union Formation is composed of three members: the upper Tongue River Member, the middle Lebo Shale Member, and the lower Tullock Member. Rogers and Lee (1923, p. 29) represented the Tullock to be a member of the Lance Formation, but since 1949 the U.S. Geological Survey has considered the Tullock in Montana to be the lowermost member of the Fort Union Formation.

The Tullock Member crops out along a belt extending southeastward from the center of the north boundary to the southeast corner of the quadrangle. It consists of yellowish-gray sandstone and shale, carbonaceous shale, and several lenticular, unimportant coal beds less than 3 feet (0.9 m) thick. The Tullock Member is about 290 feet (88 m) thick.

The Lebo Shale Member is about 140 feet (43 m) thick and crops out along a 1-mile wide (1.6-km wide) belt adjacent to and east of the Tullock Member. It consists of dark-gray to olive-gray shale interbedded with a few beds of carbonaceous shale, and may contain, in places, as many as two beds of coal, each of which is less than 2 feet (0.6 m) thick.

The Tongue River Member, the principal coal-bearing unit, crops out only in the northeast corner of the quadrangle. Here the member consists of arkosic sandstone, sandy shale, carbonaceous shale, and coal. Its color is normally yellowish-gray, but in most of the outcrops the coal beds have been burned and the overlying strata have been baked and altered to a brick-red

or reddish-brown colored clinker. The member is at least 1,275 feet (389 m) thick where more completely exposed in the Little Wolf Mountains about 18 miles (29 km) to the east of the Padlock Ranch quadrangle, but most of the member in this quadrangle has been removed by erosion so that a maximum of only about 300 feet (91 m) remains.

Structure

Strata in the quadrangle dip eastward or northeastward at a rate of 100 to 150 feet (30 to 46 m) per mile (about 1 to 1.5 degrees). No folds and only two small faults have been noted.

COAL GEOLOGY

Two coal beds, both in the Tongue River Member, were mapped on the surface in this quadrangle (pl. 1) and are shown in section on plate 3. The stratigraphically lowest is the Robinson coal bed, which occurs about 100 feet (30.5 m) above the base of the Tongue River Member. The Robinson is overlain by a noncoal interval of about 100 feet (30.5 m), and the Rosebud coal bed.

The Robinson coal bed is present in only a small area near the northeast corner of the quadrangle. Its known thickness ranges from about 2 feet (0.6 m) to a little over 5 feet (1.5 m).

The Rosebud coal bed is so completely burned that only its clinker bed, capping the tops of hills, remains to indicate its former presence.

The entire quadrangle lies within the area where Federal coal lands were ceded to the Crow Indians in 1958, or the Crow Indian Reservation. There are no Federal coal lands left in the quadrangle. Most of the lands

belong to the Crow Indian Tribe or to individual Indians. For this reason Coal Resource Occurrence maps were not made of the individual coal beds, coal resource tonnages were not estimated, and Coal Development Potential maps were not made.

REFERENCES

Rogers, G. S., and Lee, Wallace, 1923, Geology of the Tullock Creek coal field, Rosebud and Big Horn Counties, Montana: U.S. Geological Survey Bulletin 749, 181 p.

Thom, W. T., Jr., Hall, G. M., Wegemann, C. H., and Moulton, G. F., 1935, Geology of Big Horn County and the Crow Indian Reservation, Montana, with specific reference to the water, coal, oil, and gas resources: U.S. Geological Survey Bulletin 856, 200 p.

Tudor, M. S., 1975, Geological exploration and development of coal in the Sarpy Creek area, Big Horn County, Montana: Montana Geological Society 22nd Annual Publication, Energy Resources of Montana, p. 159-164.