

UNITED STATES DEPARTMENT OF THE INTERIOR
GEOLOGICAL SURVEY

TEXT TO ACCOMPANY:

COAL RESOURCE OCCURRENCE

AND

COAL DEVELOPMENT POTENTIAL

MAPS

OF THE

FIDDLEBACK RANCH QUADRANGLE,

CAMPBELL, CONVERSE AND WESTON COUNTIES, WYOMING

BY

INTRASEARCH INC.

DENVER, COLORADO

OPEN FILE REPORT 79-321
1979

This report is preliminary, and has not been
edited or reviewed for conformity with
United States Geological Survey standards or
stratigraphic nomenclature.

TABLE OF CONTENTS

	<u>PAGE</u>
I. INTRODUCTION	1
II. GEOLOGY	3
III. DATA SOURCES	7
IV. COAL BED OCCURRENCE	8
V. COAL DEVELOPMENT POTENTIAL	8
SELECTED REFERENCES	9

MAPS

	<u>PLATES</u>
1. Coal Data Map	1
2. Boundary and Coal Data Map	2
3. Coal Data Sheet	3

CONVERSION TABLE

<u>TO CONVERT</u>	<u>MULTIPLY BY</u>	<u>TO OBTAIN</u>
inches	2.54	centimeters (cm)
feet	0.3048	meters (m)
miles	1.609	kilometers (km)
acres	0.40469	hectares (ha)
tons (short)	0.9072	metric tons (t)
cubic yards/ton	0.8428	cubic meters per metric ton
acre feet	0.12335	hectare-meters
Btu/lb	2.326	kilojoules/kilogram (kJ/kg)
Btu/lb	0.55556	kilocalories/kilogram (kcal/kg)
Fahrenheit	$5/9 (F-32)$	Celsius

I. Introduction

This report and accompanying maps set forth the Coal Resource Occurrence (CRO) and Coal Development Potential (CDP) of coal beds within the Fiddleback Ranch Quadrangle, Campbell, Converse and Weston Counties, Wyoming. This CRO and CDP map series includes 3 plates (U. S. Geological Survey Open-File Report 79-321). The project is compiled by IntraSearch, Inc., 1600 Ogden Street, Denver, Colorado, under KRCRA Northeastern Powder River Basin, Wyoming Contract Number 14-08-0001-17180. This contract is a part of a program to provide an inventory of unleased federal coal in Known Recoverable Coal Resource Areas (KRCRA) in the western United States.

The Fiddleback Ranch Quadrangle is located in Campbell, Weston, and Converse Counties in northeastern Wyoming. It encompasses all or parts of Townships 39, 40, and 41 North, Ranges 68 and 69 West, and covers the area: 43° 22' 30" to 43° 30' north latitude; 105° 00' to 105° 07' 30" west longitude.

Access to the Fiddleback Ranch Quadrangle is provided by the Dull Center road which angles northeast-southwest across the southern portion of the study area. The Rochelle Hills road branches from the Dull Center road and extends north through the northern portion of the quadrangle. Numerous minor roads and trails that branch from these maintained roads provide additional access to the area. The closest railroad is the Burlington Northern trackage under construction near the proposed Rochelle coal mine, approximately 10 miles (16 km) to the West.

The major drainage is provided by the Cheyenne River and Antelope Creek which flow eastward through the central portion of the quadrangle. Wildcat, Horse, Lake, and Meadow Creeks are tributary to the

Cheyenne River and Antelope Creek, and drain fairly rugged terrain that attains a maximum elevation of 4701 feet (1433 m) above sea level in the extreme southern portion of the study area. Minimum elevations of 4280 feet (1305 m) above sea level are located in the valley floor of the Cheyenne River at the eastern quadrangle boundary. The somber grays, yellows, and browns of outcropping shales and siltstones contrast strikingly with the brilliant reds, oranges, and purples of "clinker", and deep greens of the juniper and pine tree growth.

The ten to twelve inches (25 to 30 cm) of annual precipitation that falls in this semi-arid region accrues principally in the springtime. Summer and fall precipitation usually originates from thunderstorms, and infrequent snowfalls of six inches (15 cm) or less generally characterize winter precipitation. Although temperatures ranging from less than -25°F (-32°C) to more than 100°F (38°C) have been recorded near Gillette, Wyoming, average wintertime minimums and summertime maximums approach +5° to +15°F (-15° to -9°C) and 75° to 90°F (24° to 32°C), respectively.

Surface ownership is divided among fee, state, and federal categories with the state and federal surface generally leased to ranchers for grazing purposes. Details of surface ownership are available at the Campbell, Weston, and Converse County Courthouses in Gillette, Newcastle, and Douglas, Wyoming, respectively. Details of mineral ownership on federal lands are available from the U. S. Bureau of Land Management in Cheyenne, Wyoming. Federal coal ownership is shown on Plate 2 of the Coal Resource Occurrence maps. The non-federal coal ownership comprises both fee and state coal resources.

The Coal Resource Occurrence and Coal Development Potential program pertains to unleased federal coal and focuses upon: 1) the delineation of lignite, subbituminous, bituminous and anthracite coal at the sur-

face and in the subsurface on federal land; 2) the identification of total tons in place as well as recoverable tons; 3) categorization of these tonnages into measured, indicated, and inferred reserves and resources, and hypothetical resources; and 4) recommendations regarding the potential for surface mining, underground mining, and in-situ gasification of the coal beds. This report evaluates the coal resources of all unleased federal coal beds in the quadrangle which are 5 feet (1.5 m) or greater in thickness and occur at depths down to 3000 feet (914 m). No resources or reserves are computed for leased federal coal, state coal, fee coal, or lands encompassed by coal prospecting permits and preference right lease applications.

II. Geology

Regional. The thick, economic coal deposits of the Powder River Basin in northeastern Wyoming occur mostly in the Tongue River Member of the Fort Union Formation, and in the lower part of the Wasatch Formation. Approximately 3000 feet (914 m) of the Fort Union Formation, that includes the Tongue River, Lebo, and Tullock Members of Paleocene age, are unconformably overlain by approximately 700 feet (213 m) of the Wasatch Formation of Eocene age. These Tertiary formations lie in a structural basin flanked on the east by the Black Hills uplift, on the south by the Hartville and Casper Mountain uplifts, and on the west by the Casper Arch and the Big Horn Mountain uplift. The structural configuration of the Powder River Basin originated in Late Cretaceous time, with episodic uplift thereafter. The Cretaceous Cordillera was the dominant positive land form throughout the Rocky Mountain area at the close of Mesozoic time.

Outcrops of the Wasatch Formation and the Tongue River Member of the Fort Union Formation cover most of the areas of major coal resource occurrence in the Powder River Basin. The Lebo Member of the Fort Union Formation is mapped at the surface northeast of Recluse, Wyoming, east of the principal coal outcrops and associated clinkers (McKay, 1974), and presumably projects into the subsurface beneath much of the basin. One of the principal characteristics for separating the Lebo and Tullock Members (collectively referred to as the Ludlow Member east of Miles City, Montana) from the overlying Tongue River Member is the color differential between the lighter-colored upper portion and the somewhat darker lower portion (Brown, 1958). Although geologists working with subsurface data, principally geophysical logs, in the basin are trying to develop criteria for subsurface recognition of the Lebo-Tullock and Tongue River-Lebo contacts, no definitive guidelines are known to have been published. Hence, for subsurface mapping purposes, the Fort Union Formation is not divided into its member subdivisions for this study.

During the Paleocene epoch, the Powder River Basin tropic to subtropic depositional environment included broad, inland flood basins with extensive swamps, marshes, freshwater lakes, and a sluggish but active northeastward discharging drainage system, superimposed on a near base level, emerging sea floor. Much of the vast areas where organic debris collected was within a reducing depositional environment. Localized uplifts began to disturb the near sea level terrain of northeastern Wyoming, following retreat of the Cretaceous seas. However, the extremely fine-grained characteristics of the Tongue River Member clastics suggest that areas of recurring uplift peripheral to the Powder River Basin were

subdued during major coal deposit formation.

The uplift of areas surrounding the Powder River Basin created a structural basin of asymmetric characteristic, with the steep west flank located on the eastern edge of the Big Horn Mountains. The axis of the Powder River Basin is difficult to specifically define, but is thought to be located in the western part of the Basin, and to display a north-south configuration some 15 to 20 miles (24 to 32 km) east of Sheridan, Wyoming. Thus, the sedimentary section described in this report lies on the east flank of the Powder River Basin, with gentle dips of two degrees or less disrupted by surface structure thought to relate to tectonic adjustment and differential compaction.

Some coal beds in the Powder River Basin exceed 200 feet (61 m) in thickness. Deposition of these thick, in-situ coal beds requires a discrete balance between subsidence of the earth's crust and in-filling by tremendous volumes of organic debris. These conditions in concert with a favorable ground water table, non-oxidizing clear water, and a climate amenable to the luxuriant growth of vegetation produce a stabilized swamp critical to the deposition of coal beds.

Deposition of the unusually thick coal beds of the Powder River Basin may be partially attributable to short distance water transportation of organic detritus into areas of crustal subsidence. Variations in coal bed thickness throughout the basin relate to changes in the depositional environment. Drill hole data that indicate either the complete absence or extreme attenuation of a thick coal bed probably relate to location of the drill holes within the ancient stream channel system draining this low land area in Early Cenozoic time. Where thick coal beds thin rapidly from the depocenter of a favorable depositional environment, it is not unusual

to encounter a synclinal structure over the maximum coal thickness due to the differential compaction between organic debris in the coal depositor and fine-grained clastics in the adjacent areas.

The Wasatch Formation of Eocene age crops out over most of the central part of the Powder River Basin and exhibits a disconformable contact with the underlying Fort Union Formation. The contact has been placed at various horizons by different workers; however, for the purpose of this report, in northwestern Campbell County, Wyoming, the contact is positioned near the top of the Roland coal bed as mapped by Olive (1957 and is considered to disconformably descend in the stratigraphic column to the top of the Wyodak-Anderson coal bed (Roland coal bed of Taff, 1909) along the eastern boundary of the coal measures. No attempt is made to differentiate the Wasatch and Fort Union Formations on geophysical logs or in the subsurface mapping program that is a part of this CRO-CDP project.

Although Wasatch and Fort Union lithologies are too similar to allow differentiation in some areas, most of the thicker coal beds occur in the Fort Union section on the east flank of the Powder River Basin. Furthermore, orogenic movements peripheral to the basin apparently increased in magnitude during Wasatch time causing the deposition of friable, coarse-grained to gritty arkosic sandstones, fine-to very fine-grained sandstones, siltstones, mudstones, claystones, brown-to-black carbonaceous shales and coal beds. These sediments are noticeably to imperceptibly coarser than the underlying Fort Union clastics.

The Fiddleback Ranch Quadrangle is located in an area where surface rocks are classified into the Tongue River Member of the Fort Union Formation. Although the Tongue River Member is reportedly 1200 to 1300

feet (366 to 396 m) thick (Olive, 1957), only 300 to 400 feet (91 to 122 m) are exposed in this area. Olive (1957) correlated coal beds in the Spotted Horse coal field with coal beds in the Sheridan coal field (Baker, 1929) and Gillette coal field (Dobbin and Barnett, 1927), Wyoming, and with coal beds in the Ashland coal field (Bass, 1932) in southeastern Montana. This report utilizes, where possible, the coal bed nomenclature used in previous reports. The Wildcat coal bed was informally named by IntraSearch (1978).

III. Data Sources

Publications regarding the areal geology of coal outcrops and associated clinker at a scale appropriate for the CRO-CDP mapping program are unknown at the time of this publication.

The major source of subsurface control is the geophysical logs from oil and gas test bores and producing wells. Some geophysical logs are not applicable to this study, for the logs relate only to the deep potentially productive oil and gas zones. More than eighty percent of the logs include resistivity, conductivity, and self-potential curves. Occasionally the logs include gamma, density, and sonic curves. These logs are available from several commercial sources.

All geophysical logs available in the quadrangle are scanned to select those with data applicable to Coal Resource Occurrence mapping. Paper copies of the logs are obtained, interpreted, and coal intervals identified where they exist.

The topographic map of the Fiddleback Ranch Quadrangle is published by the U. S. Geological Survey, compilation date, 1971. Land ownership data are compiled from land plats available from the U. S. Bureau of Land Management in Cheyenne, Wyoming. This information is current to October 13, 1977.

IV. Coal Bed Occurrence

The Fiddleback Ranch Quadrangle is located east of the principal coal deposits of the Powder River Basin. No coal bed outcrops are known in this area.

The Coal Data Sheet, Plate 3, shows by columnar sections the interpretations of geophysical well logs. The coal bed that is identified in the subsurface is thin and has limited lateral extent, as a result, coal bed reserve base estimates are not made for this quadrangle. Inasmuch as the Lower Wildcat coal bed is the only coal bed identified, it is designated as datum for the correlation diagram.

V. Coal Development Potential

The current data base indicates that there are no significant coal resources within the Fiddleback Ranch Quadrangle of importance to surface and underground mining or in-situ gasification. The entire quadrangle is considered to have no coal development potential. Therefore, no coal development potential map was compiled.

SELECTED REFERENCES

- Baker, A. A., 1929, The northward extension of the Sheridan coal field, Big Horn and Rosebud Counties, Montana: U. S. Geol. Survey Bull. 806-B, p. 15-67.
- Bass, N. W., 1932, The Ashland coal field, Rosebud, Powder River, and Custer Counties, Montana: U. S. Geol. Survey Bull. 831-B, p. 19-105.
- Brown, R. W., 1958, Fort Union Formation in the Powder River Basin, Wyoming: Wyo. Geol. Soc. Guidebook, Thirteenth Annual Field Conf., p. 111-113.
- Dobbin, C. E., and Barnett, V. H., 1927, The Gillette coal field, northeastern Wyoming, with a chapter on the Minturn district and northwestern part of the Gillette field by W. T. Thom, Jr.: U. S. Geol. Survey Bull. 796-A, p. 1-50.
- Glass, G. B., 1975, Review of Wyoming coal field, 1975: Wyoming Geol. Survey Public Information circ. 4, p. 10.
- IntraSearch Inc., 1978, Coal resource occurrence and coal development potential of the Cabin Creek Northeast Quadrangle, Sheridan and Campbell Counties, Wyoming and Powder River County, Montana: U.S. Geol. Survey Open-File Report 78-064, 21 p.
- Jacob, A. F., 1973, Depositional environments of Paleocene Tongue River Formation: Am. Assoc. of Petroleum Geologists Bull., vol. 56, no. 6, p. 1038-1052.
- McKay, E. J., 1974, Preliminary geologic map of the Bertha 2 NW (Rocky Butte) Quadrangle, Campbell County, Wyoming: U. S. Geol. Survey Open-File Report 74-173, scale 1:24,000.
- Olive, W. W., 1957, The Spotted Horse coal field, Sheridan and Campbell Counties, Wyoming: U. S. Geol. Survey Bull. 1050, 83 p.

- Schell, E. M., and Mowat, G. D., 1972, Reconnaissance map showing some coal and clinker beds in the Fort Union and Wasatch Formations in the eastern Powder River Basin, Campbell and Converse Counties, Wyoming: U. S. Geol. Survey Open-File Report, scale 1:63,360.
- Taff, J. A., 1909, The Sheridan coal field, Wyoming: U. S. Geol. Survey Bull. 341-B, p. 123-150.
- U. S. Bureau of Mines and U. S. Geological Survey, 1976, coal resource classification system of the U. S. Bureau of Mines and U. S. Geological Survey: U. S. Geol. Survey Bull. 1450-B, 7 p.
- U. S. Geological Survey and Montana Bureau of Mines and Geology, 1973, Preliminary report of coal drill hole data and chemical analyses of coal beds in Sheridan and Campbell Counties, Wyoming, and Big Horn County, Montana: U. S. Geol. Survey Open-File Report 73-351, 51 p.
- U. S. Geological Survey and Montana Bureau of Mines and GEology, 1974, Preliminary report of coal drill hole data and chemical analyses of coal beds in Campbell County, Wyoming: U. S. Geol. Survey Open-File Report 74-97, 241 p.
- U. S. Geological Survey and Montana Bureau of Mines and Geology, 1976, Preliminary report of coal drill hole data and chemical analyses of coal beds in Campbell and Sheridan Counties, Wyoming; Custer, Prairie, and Garfield Counties, Montana; and Mercer County, North Dakota: U. S. Geol. Survey Open-File Report 76-319, 377p.
- U. S. Geological Survey and Montana Bureau of Mines and Geology, 1976, Preliminary report of coal drill hole data and chemical analyses of coal beds in Campbell, Converse, and Sheridan Counties of Wyoming; and Big Horn, Richland, and Dawson Counties, Montana: U. S. Geol. Survey Open-File Report 76-450, 382 p.

- U. S. Geological Survey and Montana Bureau of Mines and Geology, 1977, Preliminary report on 1976 drilling of coal in Campbell and Sheridan Counties, Wyoming; and Big Horn, Dawson, McCone, Richland, Roosevelt, Rosebud, Sheridan, and Wibaux Counties, Montana: U. S. Geol. Survey Open-File Report 77-283, 403 p.
- U. S. Geological Survey and Montana Bureau of Mines and Geology, 1978, Preliminary report of 1977 coal drilling in eastern Montana and northeastern Wyoming; Geophysical logs for Campbell and Converse Counties, Wyoming: U. S. Geol. Survey Open-File Report 77-721 E, 202 p.
- Warren, W. C., 1959, Reconnaissance geology of the Birney-Broadus coal field, Rosebud and Powder River Counties, Montana: U. S. Geol. Survey Bull. 1072-J, p. 561-585.
- Weimer, R. J., 1977, Stratigraphy and tectonics of western coals, in Geology of Rocky Mountain Coal, A Symposium, 1976: Colorado Geol. Survey Resource Series 1, p. 9-27.