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Hypothetical coal resources of the Almond Formation in the Rock Springs coal field, Wyoming

By

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This report is preliminary and has not been edited or reviewed for conformity with U.S. Geological Survey standards.

Introduction

This report updates coal resource information in the Almond Formation of the Rock Springs coal field, which is located in the central part of Sweetwater County, Wyoming. Recent outcrop and most of the available well log data have been used to calculate hypothetical coal resources by township. These resources are categorized as hypothetical resources which are defined in U.S. Geological Survey Bulletin 1460-B to be "undiscovered coal resources in beds that may reasonably be expected to exist in known mining districts under known geologic conditions. In general, Hypothetical Resources are in broad areas of coal fields where points of observation are absent or evidence is from distant outcrops, drill holes, or wells." Coal resources, by township are subdivided into categories based on coal thickness and depth of overburden.

The Rock Springs coal field covers about 3,000 square miles in the central part of the Green River region. Nearly all points in the field are readily accessible from the main line of the Union Pacific Railroad. Most of the coal in the field is exposed around Baxter Basin, the eroded central part of the Rock Springs uplift. The coal-bearing rocks include the Rock Springs and Almond Formations of the Mesaverde Group and the Lance, Fort Union, and Wasatch Formations. From a commercial standpoint, the most important coal is that in the Rock Springs Formation and coal in the Almond Formation is of second importance. Mines were opened in the Almond coal beds just east of Point of Rocks, Wyoming in T. 20 N., R. 10 W. when the Union Pacific Railroad was first built. At Rock Springs, a mine was opened in 1882 and abandoned within four years as the coal was found to be inferior to that obtained from the Rock Springs Formation (Schultz, 1908).

Previous Investigations

Previous investigations of the coal resources of the Rock Springs coal field include works by Schultz (1909 and 1910), Berryhill and others (1950), Root, Glass, and Lane (1973), and Roehler (1973a, 1973b, 1975, 1976b, 1976c, and 1977).

Schultz mapped the geology and evaluated coal resources in the northern part of the field at a scale of 1:62,500 and in the southern part of the field at a scale of 1:250,000 (1909; 1910). In the 1910 publication, Schultz mapped coal along several miles of outcrop in the vicinity of Rock Springs at the scale of 1:62,500. His resource assessment of coal in the Almond Formation is a result of extrapolation of information from surface mapping. Coal beds greater than 2.5 feet were projected downdip to a depth of 1500 feet.

Berryhill and others (1950) is a compilation of the coal resources of Wyoming. Coal tonnages, listed by township within counties are divided into categories on the basis of coal bed thickness (2.5-5, 5-10, and >10 feet) and overburden thickness (<1,000, 1,000-2,000 and 2,000-3,000 feet). However, coal resources were not estimated for the individual formations.

Root, Glass and Lane prepared a "Geologic Map Atlas and Summary of Economic Mineral Resources" for Sweetwater County, Wyoming (1973). Included in the atlas is a map of coal rank and distribution and a coal resource map showing original resources (0-3,000 feet and 0-1,000 feet below the surface) by township for subbituminous coals greater than 2.5 feet thick. Again, no estimates were determined for the individual formations. Average values for analyses of coal samples taken from the Almond Formation is included in the atlas and is reproduced in Table 3.

H.W. Roehler mapped seven 7½-minute quadrangles in the southeastern part of the Rock Springs coal field. These quadrangles include Titsworth Gap (1973a, Potter Mountain (1973b), Burley Draw (1975), Sand Butte Rim NW (1976b), Cooper Ridge NE (1976c), Mud Springs Ranch (1977), and Camel Rock (in press). He is currently reinvestigating the geology and coal resources in this part of the field utilizing detailed stratigraphic correlations and drill hole data, and is computing coal resources of the Almond and other coal-bearing formations by section and township.

Structural and Stratigraphic Setting

The Rock Springs uplift is a north trending, double plunging, asymmetric anticline of Laramide age. It lies between two structural basins: the Green River Basin to the west and the Great Divide and Washakie Basins to the east. The beds on the west flank dip 4^{o} to 35^{o} west and the beds on the east flank dip 5^{o} to 8^{o} east.

The Baxter Basin at the core of the uplift results from weathering of the Baxter Shale and the Blair Formation; the oldest rocks exposed in the uplift. The basin is surrounded on the outer edges by inward facing white sandstone cliffs including parts of the Almond Formation that rise several hundred feet above Baxter Basin. Other coal bearing formations of Late Cretaceous age are exposed on the flanks of the uplift (Table 2). High-angle normal and reverse faults of Tertiary age interrupt the continuity of outcrops along the flanks of the uplift.

Almond Formation

The Almond Formation is a part of the Mesaverde Group of Late Cretaceous age. It is composed mostly of gray sandstone interbedded with gray shale, gray and brown carbonaceous shale, coal and minor beds of gray siltstone, and dolomite.

Along the east side of the Rock Springs uplift the Almond Formation has an average thickness of 725 feet. At the northern edge of the uplift, the formation is approximately 600 feet thick. Along the western flank it thins and may be missing due to Late Cretaceous erosion. On the southwest flank of the uplift, the unit is conformably overlain by rocks of Late Cretaceous and Tertiary age.

Depositional environments in which the Almond Formation accumulated include coastal swamps, lagoons, and shorelines, that were interpreted from the lithologies and fossil occurrences. These environments occurred during general westward transgression of the north trending Lewis sea in Late Cretaceous time. The Ericson - Almond contact is clearly defined throughout the Rock Springs uplift; it is characterized by a sharp lithologic change from sandstone and conglomerate to dark carbonaceous shale. This boundary may represent a change from inland fluvial deposition to swampy, lowland sedimentation. The change is probably due to progressive westward migration of stream activity (Jacka, 1965).

The lower part of the formation which consists of 200 feet of non coal-bearing rocks was deposited in a fresh-water coastal swamp environment; the middle 150 foot-thick coal-bearing zone in brackish-water lagoons to the west of a series of north-trending barrier bars. The intertonguing and juxtaposition of coal beds with barrier bars and the presence of oyster beds within coal-bearing zones are evidence for the lagoonal origin of the coal. The upper part of the Almond was deposited as barrier bars and in shallow sea environments.

Beds of coal range in thickness from less than 1 foot to 10 feet. In the southeast part of the coal field, 18 coal beds have been mapped and named by Roehler (1976). Precise correlation of these beds along outcrops is difficult due to the characteristic splitting and wedging out. Coal beds in the Almond Formation in the northern part of the Rock Springs coal field have not yet been mapped in adequate detail to permit correlation with coal beds in other parts of the uplift.

The coal of the Almond Formation is subbituminous and has the apparent rank of subbituminous C to subbituminous A (Table 3).

Method for Estimating Resources

Drill hole and outcrop data, as well as the distribution of the outcropping Almond Formation were plotted on 1:125,000 scale base maps of the Rock Springs coal field (Plates 1 and 2). An overburden map was prepared with thickness categories of 0-1,000 feet, 1,000-2,000 feet, 2,000-3,000 feet, and 3,000-6,000 feet to the top of the uppermost identified coal bed in the Almond Formation. Isopach lines were then drawn on separate maps for coal beds of thickness 2.5-5 feet (Plate 1) and 5-10 feet (Plate 2). An electronic planimeter was used to measure the acreage underlain by coal in each of the overburden categories. The tonnages were calculated by multiplying the acreage by the weighted average thickness by 1,770 (weight of subbituminous B coal in tons per acre foot). The tonnages were rounded to two significant figures, tabulated by township, and placed in categories according to coal bed thickness and overburden thickness (Table 1).

Summary of Resources

The estimated coal resources of the Almond Formation in the Rock Springs coal field total 27,000 million short tons of which 20,000 million short tons occur in coal beds 2.5-5 feet thick and 6,600 million short tons in coal beds 5-10 feet thick. The estimated resources are listed in Table 1. Also listed in Table 1 are the total coal tonnages in the 2.5-5 feet and 5-10 feet thickness categories with their weighted average thicknesses.

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Table 2.--Generalized stratigraphic section of Upper Cretaceous rocks in the Rock Springs coal field

<table>
<tr><th colspan="3">Age</th><th>Formation</th></tr>
<tr><td rowspan="6">Late Cretaceous</td><td rowspan="6">Montana age</td><td colspan="2">Lance Formation</td></tr>
<tr><td colspan="2">Lewis Shale</td></tr>
<tr><td rowspan="4">Mesaverde Group</td><td>Almond Formation</td></tr>
<tr><td>Ericson Sandstone</td></tr>
<tr><td>Rock Springs Formation</td></tr>
<tr><td>Blair Formation</td></tr>
</table>

Table 3.--Average analyses of coal in the Almond Formation (Root, Glass and Lane, 1973)

Average as-received Analysis (%)		Almond Fm. coals
proximate	moisture	16.4
	volatile matter	31.0
	fixed carbon	47.7
	ash	5.0
ultimate	sulphur	0.6
	hydrogen	5.4
	carbon	58.1
	nitrogen	1.2
	oxygen	29.7
heat value (Btu/lb)		9727

Based on analyses published by the U.S. Geological Survey and U.S. Bureau of Mines, as well as company records