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Gary B. Glass, State Geologist

# THE JACKSON HOLE COAL FIELD

by Richard W. Jones

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# THE JACKSON HOLE COAL FIELD

RICHARD W. JONES[1]

## INTRODUCTION

The Jackson Hole Coal Field is located in the eastern and northern parts of Teton County, northwestern Wyoming, approximately 23 miles northeast of the town of Jackson. The field is an elongate, north-northwest-trending basinal area approximately 60 miles long and nine to 18 miles wide and is underlain by coal-bearing rocks over an area of about 672 square miles (Figure 1). The field lies almost entirely within the boundaries of the Teton National Forest, with the exception of the extreme northern part in Yellowstone National Park, and the western part in Grand Teton National Park.

## FIELD BOUNDARIES

The field is bounded by the Yellowstone Volcanic Plateau to the north, the Washakie Range to the northeast, the Wind River Basin and Wind River Range to the east and southeast, the Gros Ventre Range to the southwest, and the Teton Range to the west. The actual field boundaries (Figure 1) are defined by formation contracts, faults, and the inferred extent of coal-bearing rocks in the subsurface. The boundaries were compiled from published U.S. Geological Survey maps (Love, 1947, 1956, 1973a & b, 1975a & b; Love and Keefer, 1975; Rohrer, 1969) and unpublished mapping by J. D. Love (written communication, 1982).

The eastern boundary of the field is the Buffalo Fork thrust fault on the southwest side of the Washakie Range. This fault places older noncoal-bearing rocks in fault contact with coal-bearing and younger rocks. Several small outcrops of steeply dipping coal-bearing rocks are found to the east of this fault; the field boundary here is based on these outcrops. The southeastern boundary of the coal field east of Purdy Basin is based on the inferred extent of a coal-bearing unit in Eocene rocks (Rohrer, 1969). The southern, southwestern, and northern boundaries of the field are defined by the base of the coal-bearing Bacon Ridge Sandstone. The western boundary is inferred below younger noncoal-bearing rocks and is based on the westward projection of discontinuous, isolated outcrops of known coal-bearing rocks. The northwest part of the coal field is defined by the Heart River and West Sheridan faults (Love and Keefer, 1975) and the Pilgrim Creek and Rodent Creek faults (Love, 1974).

[1]Staff coal geologist, Wyoming Geological Survey

## STRUCTURE

The Jackson Hole Coal Field is one of the more structurally complex coal fields in the state. Many structural features are present in the field, including normal and reverse faults, thrust faults, steeply dipping to overturned coal-bearing rocks, and unconformities of various magnitudes of age and angular discordance. These structural features have great effect on the coal field, in that erosion and faulting can drastically alter the thickness of coal-bearing rocks or even remove the coal-bearing units, coal-bearing facies in the rocks may change to noncoal facies through structural influences at the time of deposition, and coal-bearing rocks are often overlain by younger rocks (including volcanic rocks) of great or highly variable thickness.

From a structural standpoint, the least complicated areas in the coal field are located along the southwestern part of the field northeast of the Gros Ventre River, where coal-bearing rocks are well exposed and dip from about 10 to 25 degrees to the northeast, and in the southeast part of the field, where coal-bearing rocks in the Wind River Formation dip from about 10 to 30 degrees to the northeast. Coal-bearing rocks in the southern and northern parts of the field occur on the flanks of the following anticlines: the Bacon Ridge anticline in the south, the Hancock and Wolverine anticlines to the north, and the Wildcat and Kitten anticlines to the northwest. Coal-bearing rocks also occur on the Spread Creek and Whetstone anticlines in the central part of the field. The dip of the coal-bearing rocks on all the above anticlines is quite variable, ranging from less than 10 degrees to vertical or overturned.

## COAL-BEARING ROCKS

The coal-bearing rocks in this coal field (Figure 2) are the Bacon Ridge Sandstone, the Sohare sequence (Love and Christiansen, 1980), and the Mesaverde Formation of

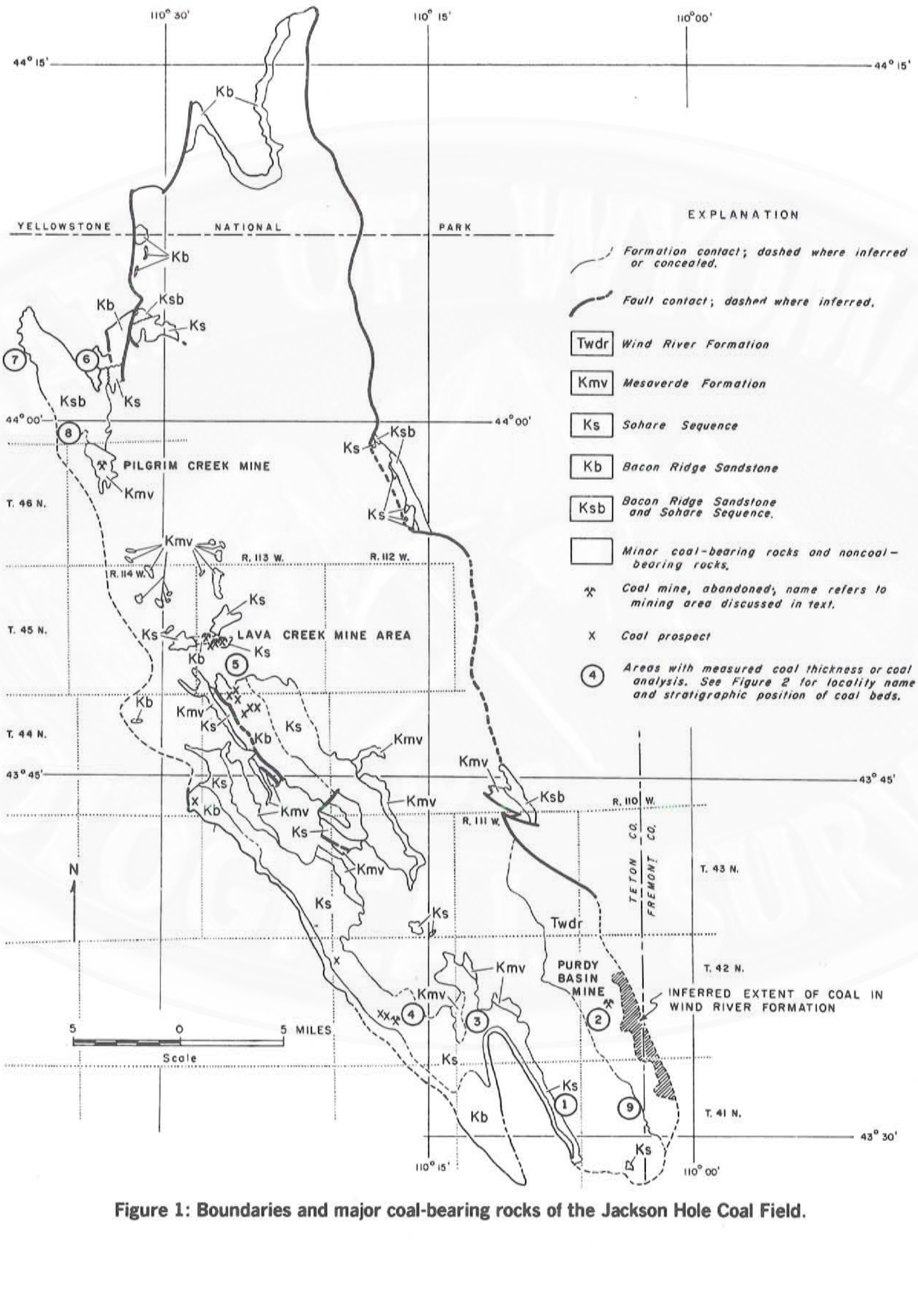


Figure 1: Boundaries and major coal-bearing rocks of the Jackson Hole Coal Field.

Upper Cretaceous age, the coal member of the Pinyon Conglomerate of Upper Cretaceous and Paleocene age (Love, 1973), the Devils Basin Formation" (proposed new name) of Paleocene age (Love, oral communication, 1982) and the Wind River Formation (lower and upper variegated sequence (Love and Christiansen, 1980)) of Eocene age. The Upper Cretaceous Frontier Formation contains an impure coal bed two feet thick near the northern part of the field (Love, Antweiler, and Williams, 1975); other thin, impure coal beds may also be present near the field. However, the coals in this formation are not considered minable and are not included in the coal field.

The Bacon Ridge Sandstone is the oldest, most important, and most extensive coal-bearing formation in the Jackson Hole Coal Field. The Bacon Ridge Sandstone overlies the Cody Shale and includes a lower unit 500 to 1,250 feet thick and an upper unit of about 1,000 feet in thickness. The upper unit, known as the coaly sequence in Love, et al. (1948), is now mapped with the lower unit because both units are coal-bearing, have similar lithologies, and a reliable or meaningful contact between the two units cannot be determined (J. D. Love, oral communication, 1982). The lower unit of this formation contains several zones that have coal beds of minable thickness. A coal zone between the base of the Bacon Ridge and an overlying pearl-gray marker zone contains coal beds up to seven feet thick (Figure 2). This coal zone is best developed in the Lava Creek-Spread Creek area (locality 5, Figue 1), extends northward from this area to Arizona Creek (locality 7), and is absent to the northeast, east, and southeast of locality 5 (Love, et al., 1951). Coal in this zone was mined at Lava Creek and possibly Spread Creek to the south (see Coal Production section below). According to Berryhill, et al. (1950), 11.2 feet of coal in several closely spaced beds occurs near the base of the Bacon Ridge Sandstone at an unspecified location in the field. However, the original references for this coal field cited by Berryhill, et al., as well as other reports published later, make no mention of this coal occurrence. Above the pearl-gray marker zone in the northern part of the field are several coal beds between two and 3.7 feet thick (Love, Antweiler, and Williams, 1975). A coal bed at locality 4 is over four feet thick. In general, coal beds above the pearl-gray marker zone and below the "coaly sequence" are thickest and most numerous in the south-central part of the Jackson Hole Coal Field (Love, et al., 1951).

The upper 1,000 feet of the Bacon Ridge Sandstone contains most of the coal beds of minable thickness in the coal field. Because the information available on these coal beds is so widely spaced and because the coal beds that occur have not been mapped in detail, individual coal beds cannot be correlated. The coal beds shown in Figure 2 for the "coaly sequence" are "equivalent" only in the sense that they occur in approximately the same stratigraphic position; actual physical equivalency determined by tracing and mapping individual coal beds in the field has not been done.

On the basis of four measured sections in the southwestern part of the field (Love, et al., 1948), Berryhill, et al. (1950), reported 13 coal beds 2.5-5 feet thick and five coal beds 5-10 feet thick in this interval, with the thickest coal (8.3 feet) a short distance south of locality 3 (Fish Creek). It seems peculiar that only one mine on one coal bed in the "coaly sequence" is reported in the literature (Love, et al., 1948). The lower half of the "coaly sequence" appears to contain thicker and more abundant coals than the upper half (Love, et al., 1951).

The Sohare sequence, a new name for the lecticular sandstone and shale sequence, lies above the Bacon Ridge Sandstone. The Sohare and the Bacon Ridge are equivalent to the upper part of the Cody Shale in the Wind River and Bighorn Basins to the east and the Hilliard Shale and Adaville Formation in the Thrust Belt to the south (Love and Christiansen, 1980). Coals in the Sohare are relatively thin and widely spaced throughout the section. The thickest coal bed reported is only three feet thick at locality 3; only four other coal beds are over two feet thick (Love, et al., 1948).

The Mesaverde Formation overlies the Sohare sequence. The thickness of the Mesaverde is highly variable; part of all of the formation has been removed by erosion. Where the Mesaverde is present, it is usually composed of a lower white sandstone sequence which is coal-bearing and an upper conglomeratic sandstone. It is believed that these two units are separated by an unconformity (Love, et al., 1951). Coal beds are reported by Love, et al., (1948) at locality 3 (maximum thickness 1.5 feet) and locality 5. In addition, coal was mined from a bed in the Mesaverde at Pilgrim Creek. The stratigraphic position and thickness of this bed are not known, but analyses of two samples of coal from this bed are reported in Love, Antweiler, and Williams (1975).

The Meeteetse and Harebell Formations overlie the Mesaverde Formation in the coal field, but, apparently, do not contain coal beds of minable thickness. Thin, impure coal beds are reported from an outcrop of the Meeteetse Formation near locality 5, but their thicknesses have not been documented and the extent of the Meeteetse is quite limited. The Harebell Formation does not contain minable coal, although Love (1973b) reports several coal beds less than one foot thick near the base of the Harebell and a coal bed 1.5 feet thick 2,240 feet above the base.

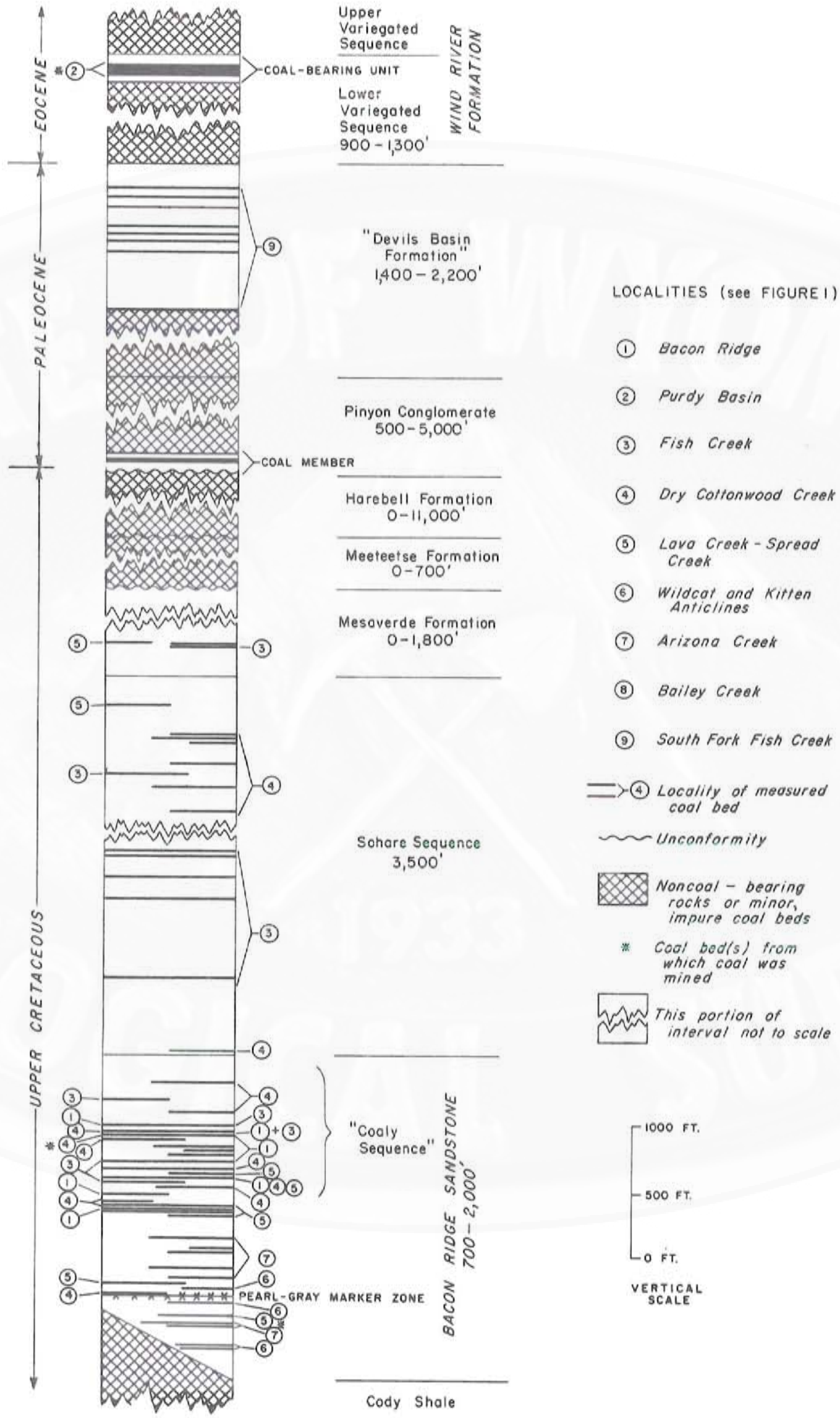


**Figure 2: Approximate Stratigraphic Position of Major Coal Beds in the Jackson Hole Coal Field.**

The Pinyon Conglomerate overlies the Harebell and/or older formations either disconformably or unconformably in the Jackson Hole Coal Field. A lenticular coal-bearing sequence called the coal member occurs only in the southwestern part of the field at the base of the Pinyon at locality 4 and north of Mount Leidy in T.44N., R.113W. (Love, 1937b). It ranges in thickness from 50 to 140 feet, contains fossils of early Paleocene age, and is equivalent in part to the Fort Union Formation in the Wind River Basin, the Hoback Formation in the northern Green River Basin, and the Evanston Formation in the Thrust Belt (Love, 1973b; Love and Christiansen, 1980). Farther north, at the principal reference section on Pinyon Peak, the lower part of the formation is considered to be Cretaceous in age (Love, 1973b). At locality 4, the coal member contains up to 12.2 feet of coal; the thickest coal beds are 2.5, 2.8 and 4.0 feet thick, but are separated by shale or siltstone partings 1.5 to 2.0 feet thick. Although these coals are major coal beds in the Jackson Hole Coal Field, the coal member is only a localized coal occurrence within the Pinyon; therefore, the Pinyon Conglomerate as a whole is considered a minor coal-bearing unit and is not shown on Figure 1.

Overlying the Pinyon Conglomerate in the southeastern part of the field is the "Devils Basin Formation," a proposed new name (Love, oral communication, 1982) for a coal-bearing unit of Paleocene age in the southeastern part of the coal field. The formation was mapped in detail by Rohrer (1969) as the Fort Union (?) Formation. The upper half of the formation contains eight to ten relatively thin coal beds at locality 9 (Love, 1947). In the same area, Rohrer (1969) has mapped up to eight coal beds ranging in thickness from 0.8 to 2.6 feet. Because this unit is limited in extent and contains few, if any, minable coal beds, it is, overall, a minor coal-bearing unit and is not shown on Figure 1.

Overlying the "Devils Basin Formation" in the southeastern part of the coal field is the Wind River Formation of early Eocene age. At various times, this formation has been called the lower variegated sequence (Indian Meadows), the coal-bearing sequence, and the upper variegated sequence (Wind River) by Love (1947); the Wind River Formation (Love, et al., 1955); the "Member at Purdy Basin" (Rohrer, 1969); the lower and upper variegated sequence (Love and Christiansen, 1980); and, finally, the Wind River Formation (Love, oral communication, 1982). The coal-bearing unit, which is from 40 to 330 feet in thickness (Rohrer, 1969), occurs in about the middle of the Wind River Formation and separates the noncoal-bearing upper and lower variegated sequences. The coal-bearing unit contains the thickest coal bed(s) in the Jackson Hole Coal Field. A 63-foot coal bed with numerous shale partings is reported in the Purdy Basin at locality 2, Figure 1 (Love, 1947; Berryhill, et al., 1950). Detailed mapping of the coal-bearing unit has shown that the thickest coal section occurs at an old coal mine adit along Purdy Creek and contains a total of 46.1 feet of coal in a 51-foot-thick interval (Rohrer, 1969). The thickest individual coal bed within this interval is 27.5 feet thick. The coal beds in this area occur in an elongate, northwest-trending lentil about eight miles long and one to two miles wide. The coal sequence wedges out to the southeast, where it is replaced by arkose; to the northwest, the coals are replaced by carbonaceous shales and the sequence intertongues or merges with variegated rocks; and to the northeast, the coal sequence gradually merges with arkosic rocks (Rohrer, written communication, 1982).

## COAL QUALITY

The quality and rank of the coal in the Jackson Hole Coal Field are unknown. Based on the appearance and weathering properties of the coal in the field, Berryhill, et al. (1950) assumed the coal to be subbituminous. The little analytical data that exists on the coals is not sufficient to characterize the coal field, a particular formation, or a particular coal bed. From the Bacon Ridge Sandstone, Love, Antweiler, and Williams (1975) sampled two coal beds less than one foot thick and one coal bed two feet thick at locality 8 (Figure 1), and three coal beds of 5.5 feet, one foot, and less than one foot in thickness, respectively, from the vicinity of locality 6 (Figure 1). Evidently, complete standard proximate or ultimate analyses were not run on these samples, as only ash, total sulfur, and total carbon are reported. An average of seven samples from the above localities yielded 13.20% ash, 0.78% total sulfur, and 56.7% total carbon (presumably on an as-received basis). The heat value, (Btu content) of coal in the Bacon Ridge is not known, but a U.S. Bureau of Reclamation (1916) report states that coal from the Lava Creek area was "about 30" thick and is of good quality bituminous coal."

A single coal sample from a coal bed less than one foot thick in the Sohare sequence, 2½ miles north of the Pilgrim Creek locality, was reported by Love, Antweiler, and Williams (1975) to contain 27.80% ash, 1.02% total sulfur, and 51.3% total carbon. At an old coal mine on Pilgrim Creek, an average of two samples taken from a coal bed of unknown thickness in the Mesaverde Formation by Love, Antweiler, and Williams (1975) yielded 40.67% ash, 0.25% total sulfur, and 35.2% total carbon.

The only other published analyses of coal in the Jackson Hole Coal Field are for coals in the coal-bearing sequence in the Wind River Formation at Purdy Basin. A sample of unweathered, but perhaps abnormally dry, coal from a coal mine adit at locality 2 (Figure 1), which was analyzed over 40 years ago by the U.S. Bureau of Mines, yielded the following values on an as-received basis: moisture 10.3%, volatile matter 18.2%, fixed carbon 60.2%, ash 11.3%, sulfur 2.82%, and a heating value of 9,828 Btu/lb. (U.S. Minerals Management Service, unpublished file data; Rohrer, 1969). Unfortunately, four additional samples that were taken from outcrops in this same vicinity were weathered and had as-received heat values of 4,350, 5,170, 6,190, and 8,160 Btu/lb., respectively (Rohrer, 1969).

## COAL RESOURCES

The only estimate of coal resources in the Jackson Hole Coal Field was made by Berryhill, et al., (1950): a total of 121,49 million short tons of subbituminous coal, all in the inferred category, was estimated for this coal field. This estimate, however, is far too conservative. At locality 2, using Figure 2 of Rohrer (1969) and an average total cost thickness of about 15 feet, there is over 220 million tons of coal in place in the Wind River Formation alone. Although some of this tonnage may be included in Berryhill, et al.'s estimate, it is obvious that their published estimate was far from inclusive. In short, there must be more coal than has been estimated, but, to date, no better estimate has been made.

## COAL PRODUCTION

The Jackson Hole Coal Field has only produced a total of 11,382 tons of coal that can be documented since 1910. The following table summarizes coal production from the field:

The mining at Pilgrim Creek and Lava Creek between 1910 and 1916 was conducted by the U.S. Bureau of Reclamation to power construction equipment used in the building of the original Jackson Lake Dam (1910-1911) and its later reconstruction (1913-1916).

The mine at Lava Creek was at peak production during 1914 and 1915: over 3,000 tons were produced in 1914 and over 5,000 tons in 1915. Sixteen coal miners, 14 coal haulers, and three foremen were employed at this mine during 1915. The coal miners were paid at the rate of one dollar per ton of coal loaded on the cars in the mine; the cost of the coal used on the project was calculated at $7.105/ton delivered to the project site (U.S. Bureau of Reclamation, 1913-1916). A brief description of the coal mining operation in 1915 at the Lava Creek mine is given in the U.S. Bureau of Reclamation (1913-1916) report for 1915 (Chapter IV, p. 29-30):

> "In order to prevent encroachment on private property, it was necessary to establish a portion of the main entry on a steep grade against the direction of haul and branch off rooms about forty feet wide from that on practically a level grade. Coal cars were pushed by hand out of the rooms to the main entry and then hauled to the tipple by two burros working in tandem. By November 5 the incline had become so long that the burros could no longer handle the output of the mine and a twelve Horse Power hoisting engine was installed."

The report for 1916 (U.S. Bureau of Reclamation, 1913, 1916) describes the last mining that occurred in this mine and the deposition of the coal:

> "The fault that was encountered in December, 1914 was found to shut off progress in all directions and to obtain the required amount of coal, it was found necessary to go into the old workings and remove coal that had been previously abandoned on account of its inaccesibility. At the works, bins were constructed near where the coal was to be used and a portion of the coal deposited therein and the balance stored in discarded bunkhouses."

| *Locality (see Figure 1)* | *Mine Name (Mine Method)* | *Years of Production* | *Production (tons)* | *Formation Produced From* |
|---|---|---|---|---|
| Pilgrim Creek | Pilgrim Creek (underground) | 1910-1911 | 661 | Mesaverde |
| Lava Creek | Lava Creek (underground) | 1913-1916 | 9,447 | Bacon Ridge Sandstone |
| 5? | Buffalo (unknown) | 1939 | 100 | Bacon Ridge Sandstone |
| Lava Creek | Johnson (underground) | 1939-1942 | 1,174 | Bacon Ridge Sandstone |
| | | TOTAL | 11,382 | |

The Johnson and Buffalo coal mines were also located in the Lava Creek mine area. The exact location and mining method of the Buffalo mine is not known at the present time. The Johnson mine was an underground mine with two entries along the outcrop of a 2.2- to 2.5-feet-thick coal bed. The coal bed in the mine had a 20° dip to the northeast; the mine encountered two north-trending faults that displaced the coal from two to six feet and appeared to limit the extent of mining. The mining at these two mines was by private individuals and, evidently, the coal was sold for local consumption.

Two other underground coal mines in the Jackson Hole Coal Field have been reported: the Iter Gros Ventre mine at locality 4 (Figure 1), at which part of a total coal section 4.6 feet thick was mined (Love, et al., 1948) and the mine at Purdy Basin (locality 2, Figure 1), in the coal-bearing unit of the Wind River Formation. Coal production has not been documented for these two coal mines or any other coal prospects in the field.

The coal production from the Johnson and Buffalo mines is the only production in the coal field reported by the Wyoming State Inspector of Mines (annual, 1902-1981). An additional 10,138 tons of coal produced by the Bureau of Reclamation should be added to the total production for this field and for Teton County.

## SUMMARY

Although much of the basic framework for the coal deposits in this field has been assembled, the continuity and correlation of coal beds has not been established, there is no adequate coal analysis for any coal bed in the field, and the coal resource estimate is not only over 30 years old, but it is also inadequate. Clearly, the Jackson Hole Coal Field remains one of the least known and least understood coal fields in Wyoming.

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