UNITED STATES DEPARTMENT OF THE INTERIOR

GEOLOGICAL SURVEY

Selected References on the Geology of the Yampa Coal Field and Sand Wash Basin, Moffat, Routt, and Rio Blanco Counties, Colorado

By

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This report is preliminary and has not been reviewed for conformity with U.S. Geological Survey editorial standards and stratigraphic nomenclauture.

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INTRODUCTION

The selected references contained in this report cover most geologic subjects relevant to areas in or adjacent to the Yampa coal field of northwestern Colorado (fig. 1). Also included are listings for the southeastern part of the Sand Wash Basin which is known to contain coal at depths of less than 3,000 ft. Approximately 385 references are listed ranging from 1874 to 1984. While no such list should ever be considered complete, it is hoped that this work contains the basic sources necessary to those earth scientists studying the area. Most of the references can be found in larger public libraries and those of major colleges and universities.

Physiography

The Yampa coal field is an area characterized by rolling hills, broad river valleys, and low mountain ranges. Elevations within the coal field typically range between 6,000 and 8,000 ft. This area is partly bordered by higher, mountainous terrain where elevations locally exceed 12,000 ft. The coal field is drained by the Yampa River.

Regional Coal Stratigraphy

There are approximately 30 named stratigraphic formations or groups in the general region of the Yampa coal field. Distribution of most of these units is shown on various regional geologic maps, particularly those complied by Miller (1975, 1977) and Tweto (1976).

Formations of late Mesozoic age (Cretaceous) are the oldest strata that contain coal beds of economic interest in northwestern Colorado (fig. 2). In ascending order, the Dakota Sandstone, Mowry Shale, Frontier Sandstone, Niobrara Formation, and Mancos Shale were deposited under marine or marginal-marine conditions and do not contain coal in this area.

The Iles and Williams Fork Formations, which comprise the Mesaverde Group, were deposited primarily in terrestrial environments which included swamps where the organic materials accumulated that later formed the present coal beds of these units. Fluctuations of sea level did occur so that some rocks of marine or marginal-marine origin are interbedded with the nonmarine coal-bearing rocks.

The Iles Formation, which is the lower part of the Mesaverde Group, consists of a sequence of rocks about 1,500 ft thick containing massive ledge-forming beds of sandstone interbedded with sandy shale, shale, and

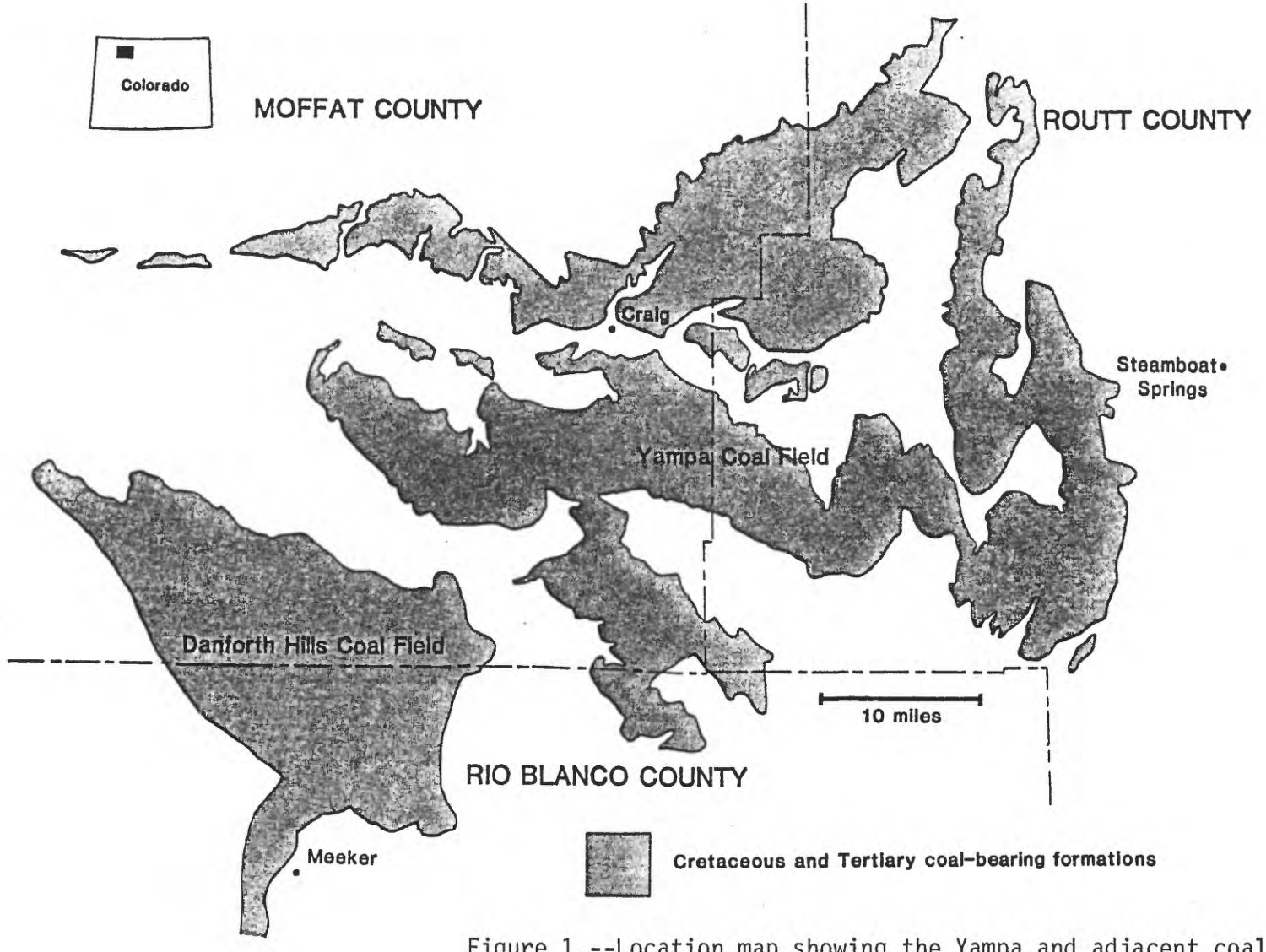

Figure 1.--Location map showing the Yampa and adjacent coal field in northwest Colorado.

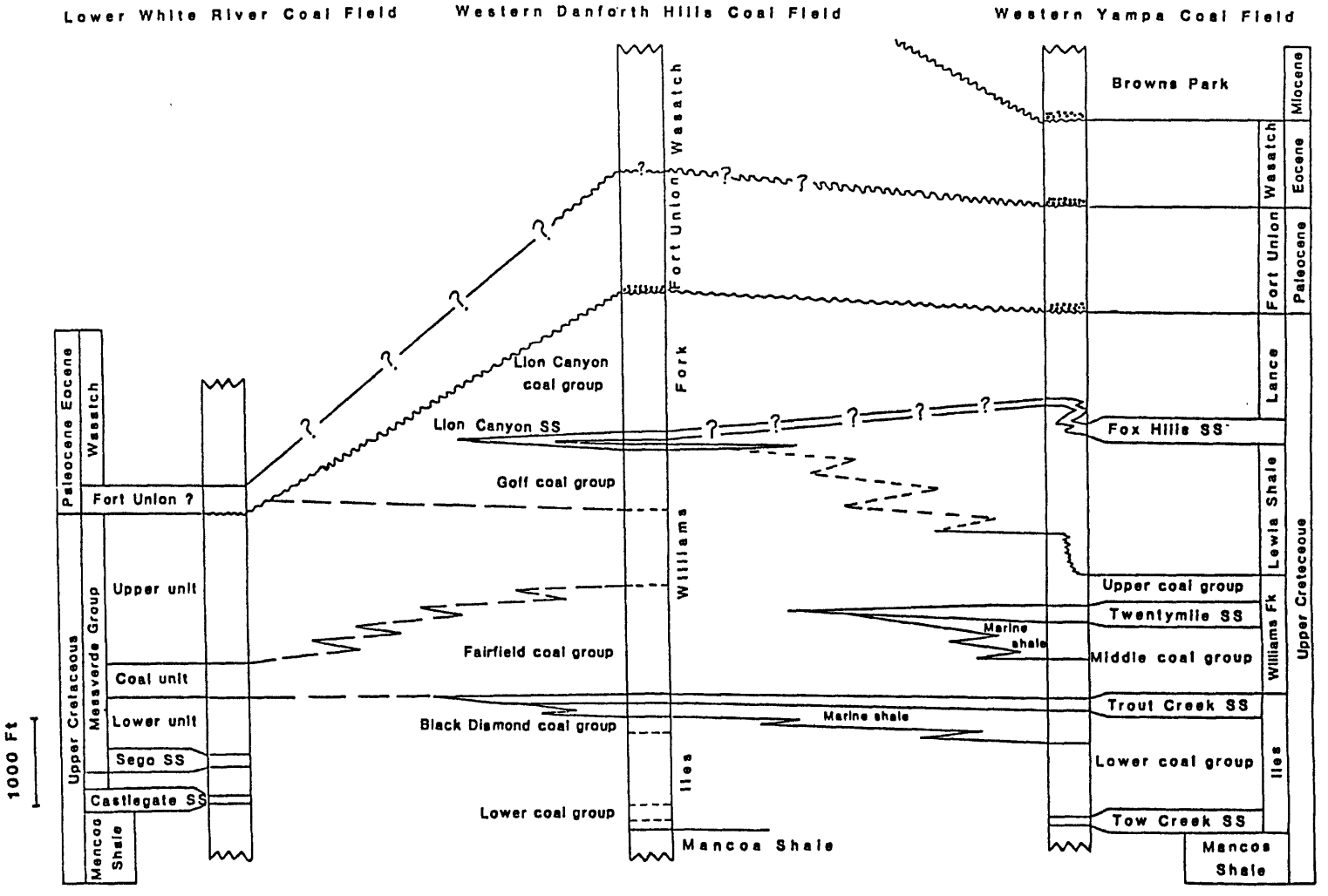

Figure 2.--Generalized stratigraphic sections of the coal-bearing formations of northwest Colorado.

widely distributed coal. The coal beds in this formation are assigned to the lower coal group of the Mesaverde Group. The thicknesses of individual beds of sandstone vary greatly, but some sandstone units, or zones, persist throughout the area and deserve special mention as guides to correlation within the coal field. They are: (1) the Tow Creek Sandstone Member at the base in the eastern part of the coal field, (2) a double ledge-forming sandstone sequence about 400 ft above the base also located in the eastern part of the field, and (3) the Trout Creek Sandstone Member occurring throughout the coal field at the top of the formation.

The Williams Fork Formation, which overlies the Iles Formation and comprises the upper part of the Mesaverde Group, ranges in thickness from 1,100 ft near Mount Harris to nearly 2,000 ft at the west margin of the Yampa coal field. The formation continues to increase in thickness southwestward toward Meeker, where Hancock and Eby (1930) measured as much as 5,050 ft. The formation includes thin to thick sandstone beds, sandy shale, shale, and coal. A massive cliff-forming sandstone about 100 ft thick named the Twentymile Sandstone Member divides the formation into two parts: a lower part containing the so-called middle coal group and an upper part containing the so-called upper coal group of the Mesaverde Group. In the eastern part of the coal field the middle coal group contains several thick coal beds. These beds are named in ascending order: the Wolf Creek, Wadge, and Lennox, and are found in the Mount Harris and Oak Creek areas. To the west in the Williams Fork Mountains these names are not used but many economical beds occur in the middle group. The upper coal group of the Williams Fork Formation lies above the Twentymile Sandstone Member. In the vicinity of Mount Harris, Twentymile Park, and Fish Creek the thickness of the unit is about 200 ft and consists of beds of sandstone, sandy shale, shale, and one coal bed about 3 ft thick. In the Williams Fork Mountains the upper coal group is about 800 ft thick and contains up to nine coal zones (Bass, Eby, and Campbell, 1955).

The Mesaverde Group crops out across much of the southern part of the coal field, including a large area southeast of Hamilton. In addition, a narrow band of outcrops extend north from just east of the Hayden area to the Elkhead Mountains. To the northwest, the Mesaverde Group plunges to several thousand feet under the Sand Wash Basin where it is probably too deep to be of economic interest at the present time. This Group of coal-bearing rocks has been described in various parts of the region by Bass, Eby, and Campbell

(1955) for the eastern Yampa coal field, and Hancock (1925) for the western part. The upper part of the Mesaverde Group grades upward into, and interfingers eastward with, marine beds of the Lewis Shale. This unit ranges in thickness from 1,000 to 1,900 ft.

The uppermost Cretaceous rocks of the Lance Formation were deposited under terrestrial conditions which included swamps in which organic debris accumulated and later formed coal beds. Very little study has been done on the Lance Formation in this area but the thickness of the formation is thought to be about 1,050-1,500 ft and it is known to be composed of interbedded sandstone, sandy shale, shale, and thin coal. Ritzma (1955) provides a brief history of the end of the Cretaceous and beginning of early Cenozoic time in this region.

During parts of earliest Tertiary time, in the Paleocene Epoch, fluvial swamps were present and the accumulated organic material became the coal beds of the Fort Union Formation. These coal beds are approximately the same age as the lignites of Montana, North and South Dakota, and of the Denver Basin. The Fort Union Formation overlies the Lance Formation and a regional unconformity marked by a widespread conglomerate seperates the two units. The Fort Union Formation consists of interbedded sandstone, shale, and coal. Northeast of Craig, the formation is about 1,500 ft thick (Bass, Eby, and Campbell, 1955), and contains one thick coal bed named the Seymour. West of Craig the thickness of the formation ranges from 800 to 1,100 ft thick in the Lay Creek area (Brownfield and Anderson, 1979) where it contains three coal zones. The lower zone contains several coal beds up to 10 ft in thickness; the middle zone contains one thick coal bed called the Emerson which pinches out towards the western margin of the area; and the upper coal zone contains only the Blevins bed.

Coal Resources

Landis (1959) describes the coal resources of the Yampa coal field as being in the Colorado part of the Green River region which is the southern extension of the Wyoming Basin Province of Wyoming and Colorado. Structurally, the region is a broad northwestward-plunging syncline. The coal ranges in rank from subbituminous to anthracite. Most of the coal is of high-volatile C-bituminous rank, but coal along the eastern edge of the field is locally of higher rank due to the close proximity of small intrusions.

The Williams Fork and Iles Formations, from which much of the expected future production will come, contain coals with Btu values that range from 10,000 to 12,000 per pound as-received with a sulfur content that ranges from 0.3 to 1.9 percent. In these same coal beds the range of percentage value of moisture is 8.4-17.6; volatile matter is 37.6-44.0; fixed carbon is 47.9-55.9; and ash is 4.4-11.0. Coal found in the Fort Union Formation is considered to be subbituminous in rank (Bass, Eby, and Campbell, 1955). Coal quality has been determined from several core holes which were drilled through the middle and upper coal zones by the Bureau of Reclamation and Utah International, Inc. Analyses from these Fort Union coals indicate the following average results on an as-received basis:

Moisture (percent)	Ash (percent)	Sulfur (percent)	Volatile matter (percent)	Fixed carbon (percent)	Btu/lb
13	8	0.49	33.47	45.50	10,300

Estimates of reserves in the eastern part of the region were made by F. D. Spencer (Bass, Eby, and Campbell, 1955). Landis (1959) estimated the reserves in the western part of the field based on information contained in reports by Gale (1909, 1910), Hancock (1925), and the U.S. Bureau of Mines (1937). Reserves were estimated by individual bed except for the inferred coal west of long 107°30' W. and south of lat 40°30' N. and for a small area in northern Routt County where reserves were estimated on a coal-zone basis. For the Yampa coal field a total of about 23,607 million tons of coal (76 percent bituminous, 24 percent subbituminous) were estimated by Hornbaker, Holt, and Murray (1976) to have been originally present in an area of 828 mi^2 and an additional area of 852 mi^2 may contain 21,300 tons of coal within 3,000 ft of the surface.

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