UNITED STATES DEPARTMENT OF THE INTERIOR

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Selected references on the geology of the Danforth Hills coal field, Moffat and Rio Blanco Counties, Colorado

By

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INTRODUCTION

The selected references contained in this report cover most geologic subjects relevant to areas in or adjacent to the Danforth Hills coal field of northwest Colorado (fig. 1). Approximately 220 references are listed ranging from 1876 to 1984. While no such list should ever be considered complete, it is hoped that this report contains the basic sources of interest to those earth scientists studying the area. Most of the reference material can be found in larger public libraries and those of major colleges and universities.

Physiography

The Danforth Hills coal field is situated in northwest Colorado in Moffat and Rio Blanco Counties. The coal field lies north of the White River, west of the White River Plateau, south and west of the Axial Basin, and east of the valley of Strawberry Creek which flows southward along the northward extension of the Grand Hogback. The Flat Tops highlands of the White River Plateau to the southeast ranges in elevation from 8,500 to 12,000 ft.

The Danforth Hills area is characterized by northward-sloping ridges separated by steep canyons on the north and to the south and west by steeply dipping, long and narrow hogbacks. Elevations range from 6,200 to 8,700 ft. Northward drainage is to the Yampa River and southward drainage is to the White River.

Regional Stratigraphy

There are approximately 30 named stratigraphic formations or groups in the study region. Distribution of most of these formations is shown on various regional geologic maps, particularly those compiled by Tweto (1975, 1976), Miller (1977), and Rowley and others (1979).

Coal beds of economic interest are present only in strata of Late Cretaceous and Tertiary age. These will be more fully described in the following part of this report.

Formations of Late Mesozoic age (Cretaceous) are the oldest strata that contain coal beds of economic interest in northwestern Colorado. The Dakota, Mowry, Frontier, Niobrara, and Mancos Formations, which underlie the coal-bearing rocks, were deposited under marine and marginal-marine conditions. The coal-bearing Iles and Williams Fork Formations were deposited mostly in terrestrial environments that contained swamps where organic

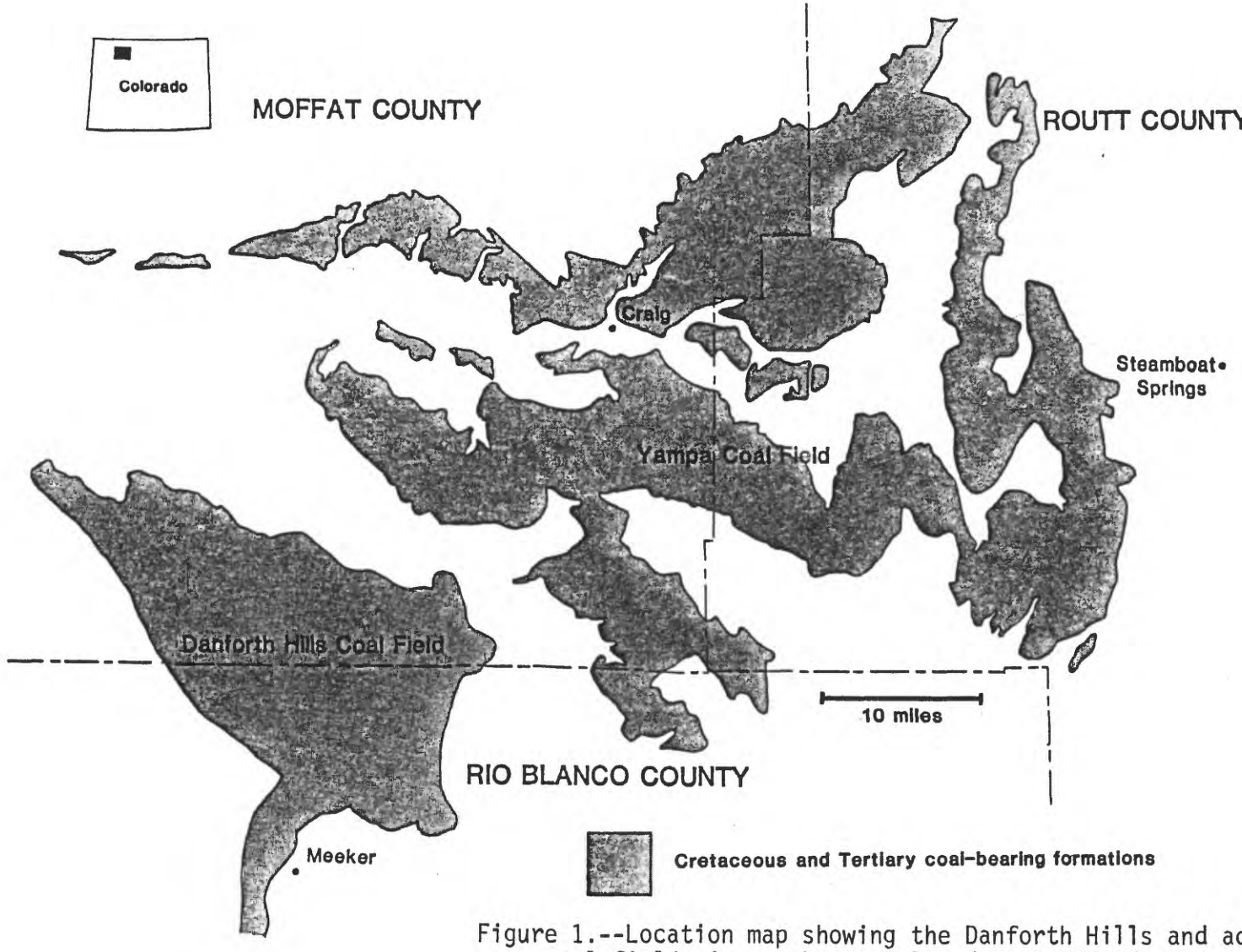

Figure 1.--Location map showing the Danforth Hills and adjacent coal fields in northwest Colorado. Outlined area contains Cretaceous and Tertiary coal-bearing sediments.

materials accumulated to form the present coal beds. Fluctuations of sea level occurred so that sediments of marine or near-marine origin are interbedded with the nonmarine coal-bearing beds. To the north and east of the Danforth Hills, the upper part of the coal-bearing Williams Fork Formation grades upward into and interfingers with the marine beds of the Lewis Shale. Ritzma (1955) provides a brief history of the end of the Cretaceous and early Cenozoic time in this region.

During earliest Tertiary time, in the Paleocene Epoch, swamps associated with fluvial conditions 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, the Denver Basin, and some of the Powder River Basin coal beds.

Coal Stratigraphy

Coal beds of economic interest in the Danforth Hills coal field occur in the Iles and Williams Fork Formations of the Mesaverde Group of Late Cretaceous age and the Fort Union Formation of Paleocene age. The stratigraphic sequence of these coal-bearing rocks is shown in figure 2.

The Mesaverde Group crops out throughout most of the Danforth Hills coal field. To the southwest, the Mesaverde plunges too deep to be of economic interest at the present time. This group of coal-bearing sediments in the Danforth Hills coal field has been described by several geologists. Among these are Hancock (1925) for the Axial area in the northeast portion of the field, and Hancock and Eby (1930) for the Meeker region. Gale (1907 and 1910) described the regional stratigraphic variations. The following descriptions of the Iles and Williams Fork Formations are modified from Hancock and Eby (1930).

The Iles Formation, which makes up the lower part of the Mesaverde Group, consists of a sequence of rocks 1,350-1,600 ft thick. The formation contains massive ledge-forming beds of sandstone interbedded with sandy shale and shale with minor coals occurring throughout. The uppermost ledge-forming sandstone in the Iles Formation is the Trout Creek Sandstone Member. This conspicuous white marine sandstone was named by Fenneman and Gale (1906) for its outcrop in Twentymile Park southwest of Steamboat Springs, Colo. The coal beds assigned to the lower coal group and Black Diamond coal group are in the Iles Formation. The lower coal group consists of thin coal beds from 100 to 250 ft

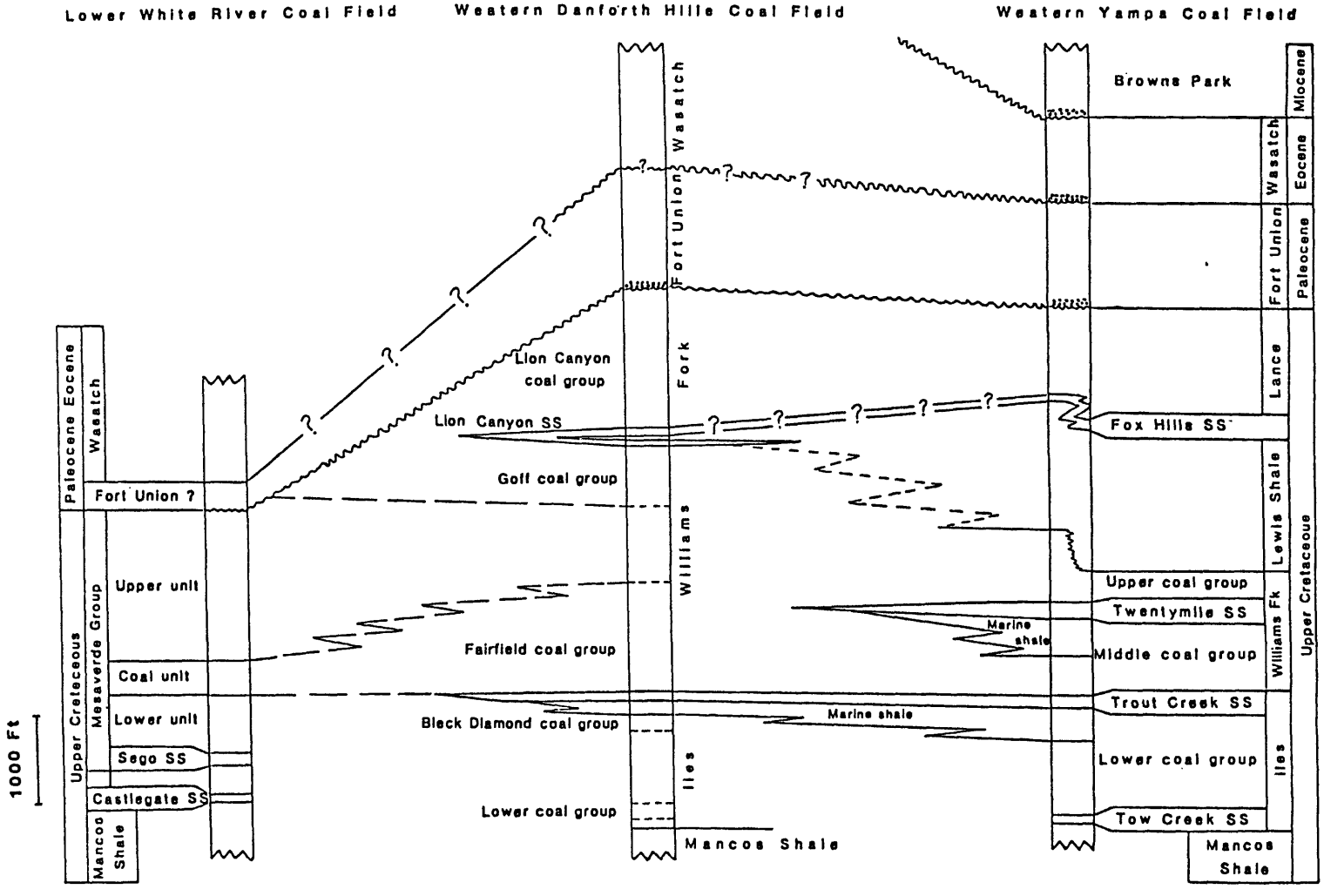

Figure 2.--Generalized stratigraphic sections of the coal-bearing formations of northwest Colorado.

above the base of the Iles and the Black Diamond coal group lies 150-350 ft below the Trout Creek Sandstone.

The Williams Fork Formation, which makes up the upper part of the Mesaverde Group, includes all beds between the top of the Trout Creek Sandstone Member of the Iles Formation and the base of the overlying unconformable Fort Union Formation. Its thickness ranges from 4,500 to 5,000 ft and the formation consists of thin to thick sandstone beds, sandy shale, shale, and coal. About 3,000 ft above the Trout Creek Sandstone is another white marine sandstone named the Lion Canyon Sandstone Member by Hancock and Eby (1930). The coal beds of the Fairfield, Goff, and Lion Canyon coal groups occur in the Williams Fork Formation. The Fairfield coal group contains numerous coal beds throughout an interval 1,300 ft thick above the Trout Creek Sandstone. The Goff coal group is an interval of 700 ft of coal-bearing sediments that directly underlie the Lion Canyon Sandstone. This coal group is separated from the Fairfield group by about 1,000 ft of Williams Fork sediments that are mostly barren of coal. The Lion Canyon coal group inlcudes all the coal bearing sediments above the Lion Canyon Sandstone and is about 1,000 ft thick.

Along the western margin of the Yampa coal field the thickness of the Williams Fork Formation is only about 2,000 ft compared to the 4,500-5,000 ft exposed along the southwest margin of the Danforth Hills. This great difference in thickness is due to regional facies changes within the Williams Fork, Lewis, and Lance Formations (fig. 2). The upper part of the Williams Fork in the Meeker area contains sediments equivalent in age to the Lewis and Lance Formations of the western Yampa coal field. The entire Mesaverde Group thins to 2,400 ft about 50 miles west near the town of Rangley, Colo. This thinning is do in part to the truncating of the Cretaceous sedimentary rocks by the overlying Tertiary sedimentary units.

The coal-bearing Fort Union Formation unconformably overlies the Williams Fork Formation along the western margin of the Danforth Hills. The Fort Union consists of interbedded sandstone, shale, and coal. The lower sandstone member ranges in thickness from 1,200 to 1,400 ft (Pipiringos and Rosenlund, 1977) and is conglomeratic at the base. The Fort Union may exceed 2,000 ft in thickness if Paleocene shale beds included in the overlying Wasatch Formation by Pipiringos and Rosenlund (1977) are included in the Fort Union. Coal beds found within the Fort Union Formation are typically thin and lenticular.

Coal Resources

The Danforth Hills coal field contains the major coal deposits on the northeast flank of the Piceance Creek Basin. In general, the individual coal beds within the coal groups are discontinuous and difficult to correlate laterally. The coal is mainly high-volatile C-bituminous in rank, though some of the upper coal beds in the northern part of the field may be subbituminous. The Iles and Williams Fork Formations, from which most future production will come, contain coals with Btu values ranging from 10,600 to 11,800 per pound on an as-received basis and with sulfur content ranging from 0.2 to 0.9 percent. In these same formations the range of percentage value of moisture is 9.4-14.8; volatile matter is 33.1-42.0; fixed carbon is 41.2-49.2; and ash is 2.2-9.5 (Hancock and Eby, 1930).

In Landis' (1959) report the reserves were estimated by bed, except in the northern part of the field where inferred coal reserves were estimated on a group basis, and in the part of the field west of long 108° W., where reserves were estimated on a coal zone basis by Spencer and Erwin (1953). A total of about 7,854 million tons of bituminous coal is estimated to have been originally present in 252 mi^2 of the field. An additional area of 18 mi^2 may contain minable reserves of coal with less than 3,000 ft of overburden.

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