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COAL RESOURCE OCCURRENCE MAPS AND COAL DEVELOPMENT POTENTIAL OF THE SAWMILL MOUNTAIN QUADRANGLE, RIO BLANCO COUNTY, COLORADO

[Report includes 2 plates]

Prepared for

UNITED STATES DEPARTMENT OF THE INTERIOR

GEOLOGICAL SURVEY

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INTRODUCTION

Purpose

This text is to be used in conjunction with Coal Resource Occurrence Maps of the Sawmill Mountain quadrangle, Rio Blanco County, Colorado. This report was compiled to support the land-planning work of the Bureau of Land Management (BLM) and to provide a systematic coal resource inventory of Federal coal lands in Known Recoverable Coal Resource Areas (KRCRA's) in the western United States. This investigation was undertaken by Dames & Moore, Denver, Colorado, at the request of the United States Geological Survey under contract number 14-08-0001-15789. The resource information gathered for this report is in response to the Federal Coal Leasing Amendments Act of 1976 (P.L. 94-377). Published and unpublished public information available through April, 1978, was used as the data base for this study. No new drilling or field mapping was done as part of this study, nor was any confidential data used.

Location

The Sawmill Mountain quadrangle is located in northeastern Rio Blanco County in northwestern Colorado, approximately 28 airline miles (45 km) south-southwest of the town of Craig and 9 miles (14 km) east of the town of Meeker, Colorado, via an improved light-duty road, Colorado Highway 132, and Colorado Highway 13 (also known as Colorado Highway 789). With the exception of a few ranches, the quadrangle is unpopulated. The northeast quarter and the eastern edge of the quadrangle lie within the White River National Forest.

Accessibility

An improved light-duty road crossing east-west through the southern part of the quadrangle connects with Meeker to the west via Colorado Highway 132 and Colorado Highway 13. The remainder of the quadrangle is accessible by several other improved light-duty roads, unimproved dirt roads and trails.

Railway service for the Sawmill Mountain quadrangle area is provided by the Denver and Rio Grande Western Railroad from Denver to the railhead

at Craig or at the town of Rifle, approximately 34 airline miles (55 km) to the south. These railroads are the major transportation routes for coal shipped east from northwestern Colorado (U.S. Bureau of Land Management, 1977).

Physiography

The Sawmill Mountain quadrangle lies in the western part of the Southern Rocky Mountain physiographic province as defined by Howard and Williams (1972). The quadrangle is approximately 58 miles (93 km) southwest of the Continental Divide.

The landscape within the Sawmill Mountain quadrangle is characterized by moderate to steep slopes cut by numerous creeks and gulches in the northern and eastern parts of the quadrangle. Moderate slopes and wide stream valleys are characteristic of the southwestern quarter of the quadrangle. Altitudes range from 9,462 feet (2,884 m) on Sawmill Mountain in the northeast corner of the quadrangle to less than 6,600 feet (2,012 m) along Little Beaver Creek on the southwestern edge of the quadrangle.

Coal Creek and Little Beaver Creek drain the western part of the quadrangle, flowing west into the White River. Big Beaver Creek drains the eastern part of the quadrangle and flow south into the White River. Tributaries of these major creeks are generally intermittent and flow mainly in response to snowmelt in the spring.

Climate and Vegetation

The climate of northwestern Colorado is semiarid. Clear, sunny days prevail in the Sawmill Mountain quadrangle, with daily temperatures typically varying from 7° to 34° F (-14° to 1° C) in January and from 39° to 82° F (4° to 28° C) in July. Annual precipitation in the area averages 20 inches (51 cm). Snowfall during the winter months accounts for the major part of the precipitation in the area, although rainfall from thundershowers during the summer months also contributes to the total.

Winds, averaging approximately 3 miles per hour (5 km per hour), are generally from the west, but wind directions and velocities vary greatly depending on the local terrain (U.S. Bureau of Land Management, 1977).

The dominant vegetation in the central part of the Sawmill Mountain quadrangle is mountain shrub, which includes serviceberry, Gambel oak and rabbitbrush. Aspen grow at higher altitudes in the east-central and northeastern parts of the quadrangle. Sagebrush is the dominant vegetation along the Little Beaver Creek valley in the southwestern part of the quadrangle. A small area in the southwestern quarter of the quadrangle is used as cropland (U.S. Bureau of Land Management, 1977).

Land Status

The Sawmill Mountain quadrangle lies at the southwestern edge of the Danforth Hills Known Recoverable Coal Resource Area (KRCRA). Approximately 1 percent of the quadrangle, in the northwest corner, lies within the KRCRA boundary and the Federal government owns the coal rights for all of that area. There are no active coal leases in the quadrangle, but a Preference Right Lease Application (PRLA) area comprising approximately one half of the land within the KRCRA is present in secs. 31 and 32, T. 2 N., R. 92 W., as shown in figure 1.

GENERAL GEOLOGY

Previous Work

The first geologic description of the general area in which the Sawmill Mountain quadrangle is located was reported by Emmons (1877) as part of a survey of the Fortieth Parallel. The decision to build a railroad into the region stimulated several investigations of coal between 1886 and 1930, including papers by Hewett (1889), Hills (1893), Storrs (1902), Gale (1907), Hancock (1925), and Hancock and Eby (1930). Tweto (1976) compiled a generalized regional geologic map that included this quadrangle. The most comprehensive work in the quadrangle is a preliminary geologic map by Reheis (no date).

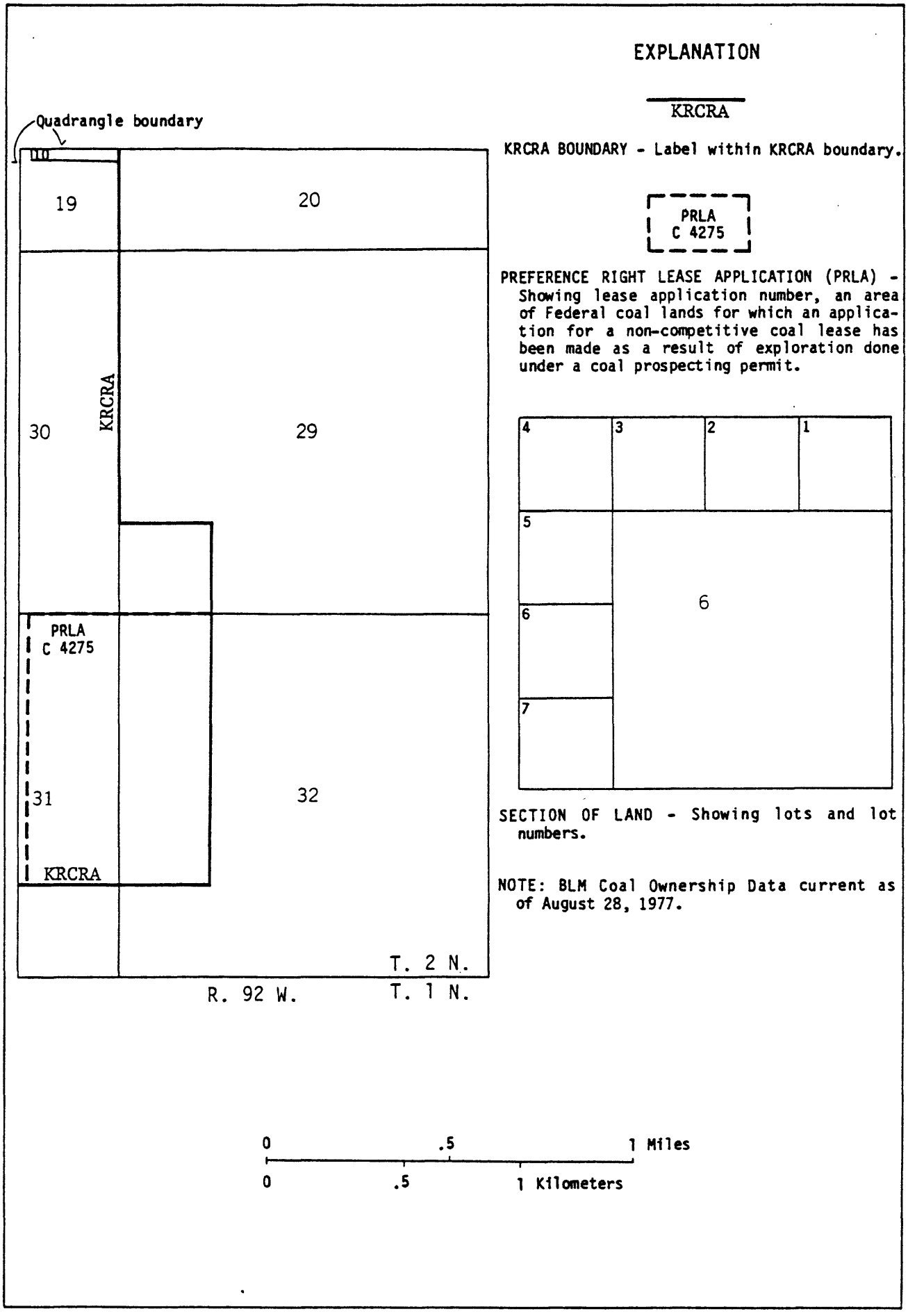

FIGURE 1. — Boundary data map.

Stratigraphy

The rock formations that crop out in the Sawmill Mountain quadrangle range from Pennsylvanian to Miocene in age and include the coal-bearing Iles and Williams Formations of the Mesaverde Group. Formations older than the Mancos Shale crop out over most of the north-central and eastern half of the quadrangle (Tweto, 1976). Although shown in the composite columnar section on plate 3, none of these older formations are coal-bearing in this quadrangle and their lithologic character is not discussed in this report.

The Mancos Shale of Late Cretaceous age crops out over most of the western half of the quadrangle (Tweto, 1976; Reheis, no date). It consists of gray to dark-gray marine shale with ledge-forming thin-bedded sandstone occurring locally in the upper part of the formation (Hancock and Eby, 1930). The Mancos Shale is estimated to range from approximately 5,100 to 5,300 feet (1,554 to 1,615 m) thick (Reheis, no date).

The Mesaverde Group of Late Cretaceous age conformably overlies the Mancos Shale and contains two formations, the Iles and Williams Fork.

The Iles Formation crops out in the northwest corner of the quadrangle (Tweto, 1976; Reheis, no date). It consists of tan to light-gray fine-grained sandstone interbedded with shaly sandstone, gray mudstone, brown carbonaceous shale, and coal. It ranges in thickness from approximately 1,300 to 1,475 feet (396 to 450 m) in this quadrangle (Reheis, no date). The basal "rim rock" sandstone (Hancock and Eby, 1930; Konishi, 1959) is a light brown to white massive sandstone, approximately 85 feet (26 m) thick. The Trout Creek Sandstone Member caps the formation and consists of approximately 70 to 160 feet (21 to 49 m) of tan to white massive cross-bedded fine-grained sandstone (Reheis, no date). Two coal-bearing sequences, the "lower" coal group and Black Diamond coal group (Hancock and Eby, 1930), occur in the Iles Formation below the Trout Creek Sandstone in this quadrangle.

The Williams Fork Formation conformably overlies the Iles Formation and crops out only in a small area in the northwest corner of the quadrangle (Tweto, 1976; Reheis, no date). The thickness of the formation ranges from approximately 4,500 to 5,000 feet (1,372 to 1,524 m) in the Meeker area (Hancock and Eby, 1930); however, the maximum thickness preserved in this quadrangle is only about 150 feet (46 m) (Reheis, no date). The formation consists of interbedded tan to light-gray sandstone, shaly sandstone, gray mudstone, brown carbonaceous shale and numerous coal beds (Reheis, no date). Coal beds in the lower part of this formation have been designated the Fairfield Coal Group by Hancock and Eby (1930).

Holocene and Pleistocene deposits of alluvium cover the stream valleys in this quadrangle.

The Late Cretaceous sedimentary rocks cropping out in the quadrangle accumulated close to the western edge of a Late Cretaceous epeirogenic seaway which covered part of the western interior of North America. Several transgressive-regressive cycles caused the deposition of a series of marine, nearshore-marine, and non-marine sediments in the Sawmill Mountain quadrangle area (Ryer, 1977).

The Mancos Shale was deposited in an offshore marine environment which existed east of the shifting strand line. Deposition of the Mancos Shale in the quadrangle area ended with the eastward migration of the shoreline, and the subsequent deposition of the Iles Formation (Konishi, 1959; Kucera, 1959).

The interbedded sandstone, shale, and coal of the Iles and Williams Fork Formations were deposited as a result of minor changes in the position of the shoreline. Near-shore marine, littoral, brackish-tidal, brackish and fresh-water supratidal, and fluvial environments existed during the deposition of the Iles and Williams Fork Formations. The major sandstone beds in the Iles Formation were deposited in shallow-marine and near-shore marine environments as the shoreline fluctuated.

Coal beds of limited areal extent were generally deposited in environments associated with fluvial systems, such as back-levee and coastal-plain swamps, interchannel basin areas, and abandoned channels (Konishi, 1959; Kucera, 1959).

Structure

The Danforth Hills KRCRA lies in the northern part of the Piceance structural basin of west-central Colorado (Howard and Williams, 1972). The Danforth Hills area is bordered on the northeast by the Axial Basin anticline, approximately 10 miles (16 km) north of the Sawmill Mountain quadrangle, and on the west by the Yampa Plateau, approximately 42 miles (68 km) northwest of the quadrangle (Grose, 1972).

The Sawmill Mountain quadrangle lies on a series of northwest-trending folds. The Sulfur Creek syncline is an asymmetric fold which crosses from the southeast to the northwest corner of the quadrangle and plunges to the northwest. The Yellowjacket anticline is parallel to and approximately 2 to 3 miles (3 to 5 km) northeast of the Sulfur Creek syncline. Several small east-west-trending faults and a northwest-trending fault have been mapped in the north-central part of the quadrangle (Tweto, 1976; Reheis, no date); however, none of these faults are known to cut the coal beds within the KRCRA.

The structure contour maps of the isopached coal beds are based on a regional structure map of the base of the Iles Formation (Reheis, no date) and it is assumed that the structure of the coal beds nearly duplicates that of the base of the Iles Formation. Minor modifications were made where necessary in accordance with outcrop data.

COAL GEOLOGY

Coal beds in the Iles and Williams Fork Formations have been identified in outcrops and drill holes in the Sawmill Mountain quadrangle. Coal beds in the Iles Formation are usually confined in two groups: the "lower" coal group contains thin coal beds between 100 and 250 feet (30 and 76 m) above the base of the formation, and the Black Diamond coal

group includes all coal beds within the interval from 150 to 350 feet (46 to 107 m) below the top of the Trout Creek Sandstone Member (Hancock and Eby, 1930). According to Hancock and Eby (1930), coal beds in the basal 1,300 feet (396 m) of the Williams Fork Formation are included in the Fairfield coal group.

None of the coal beds in the "lower", Black Diamond, and Fairfield coal groups are formally named, but coal beds exceeding Reserve Base thickness (5.0 feet or 1.5 meters) have been given bracketed numbers for identification purposes.

Chemical analyses of coals.--Analyses of the coals in this area are listed in table 1. Chemical analyses were not available for coals in the Black Diamond and Fairfield coal groups in this quadrangle. Representative analyses from nearby quadrangles are listed in table 1. In general, chemical analyses indicate that the coals in the Black Diamond and Fairfield Coal Groups are high-volatile C bituminous in rank on a moist, mineral-matter-free basis according to ASTM Standard Specification D 388-77 (American Society for Testing and Materials, 1977).

Black Diamond Coal Group

Coal beds in the Black Diamond coal group have been identified in several measured sections (Reheis, no date) in the northwestern part of the quadrangle. One of the beds, the Black Diamond [1], exceeds Reserve Base thickness at one location outside of the KRCRA boundary and cannot be inferred to exceed Reserve Base thickness within the boundary.

Fairfield Coal Group

Coal beds in the Fairfield coal group have also been identified in measured sections (Reheis, no date) in the northwestern part of the quadrangle. Only one of these coal beds, the Fairfield [2], is known to exceed Reserve Base thickness in this quadrangle.

The Fairfield [2] coal bed ranges from 3.9 to 5.9 feet (1.2 to 1.8 m) in thickness where measured at two locations in the northwestern

part of the quadrangle. The coal bed attains its maximum measured thickness in sec. 31, T. 2 N., R. 92 W., and exceeds Reserve Base thickness over a small area in secs. 31 and 32, T. 2 N., R. 92 W., as shown on figure 2. However, Reserve Base and Reserve tonnages were not calculated for the area because it lies totally within an active coal lease. Overburden thickness increases to the west as shown in figure 3.

COAL RESOURCES

Information from outcrop measurements (Reheis, no date) were used to construct outcrop, isopach, and structure contour maps of the Fairfield [2] coal bed in this quadrangle. The source of each indexed data point shown on plate 1 is listed in table 2.

Coal resources were not calculated for the Sawmill Mountain quadrangle because the area in which the Fairfield [2] coal bed is known to exceed Reserve Base thickness cannot be inferred to extend onto non-leased Federal land within the KRCRA boundary.

COAL DEVELOPMENT POTENTIAL

Areas where coal beds greater than Reserve Base thickness occur within 3,000 feet (914 m) of the ground surface are considered to have development potential for surface and subsurface mining methods. These areas are generally assigned a high, moderate, or low development potential rating. An unknown development potential rating is assigned to an area if knowledge pertaining to the areal distribution, thickness, depth, and attitude of the coal beds in that area is limited, or absent, and prevents accurate evaluation of the development potential in the high, moderate, or low categories. All of the non-leased Federal lands within the KRCRA boundary in this quadrangle are classified as having unknown development potential for both surface and subsurface mining methods.

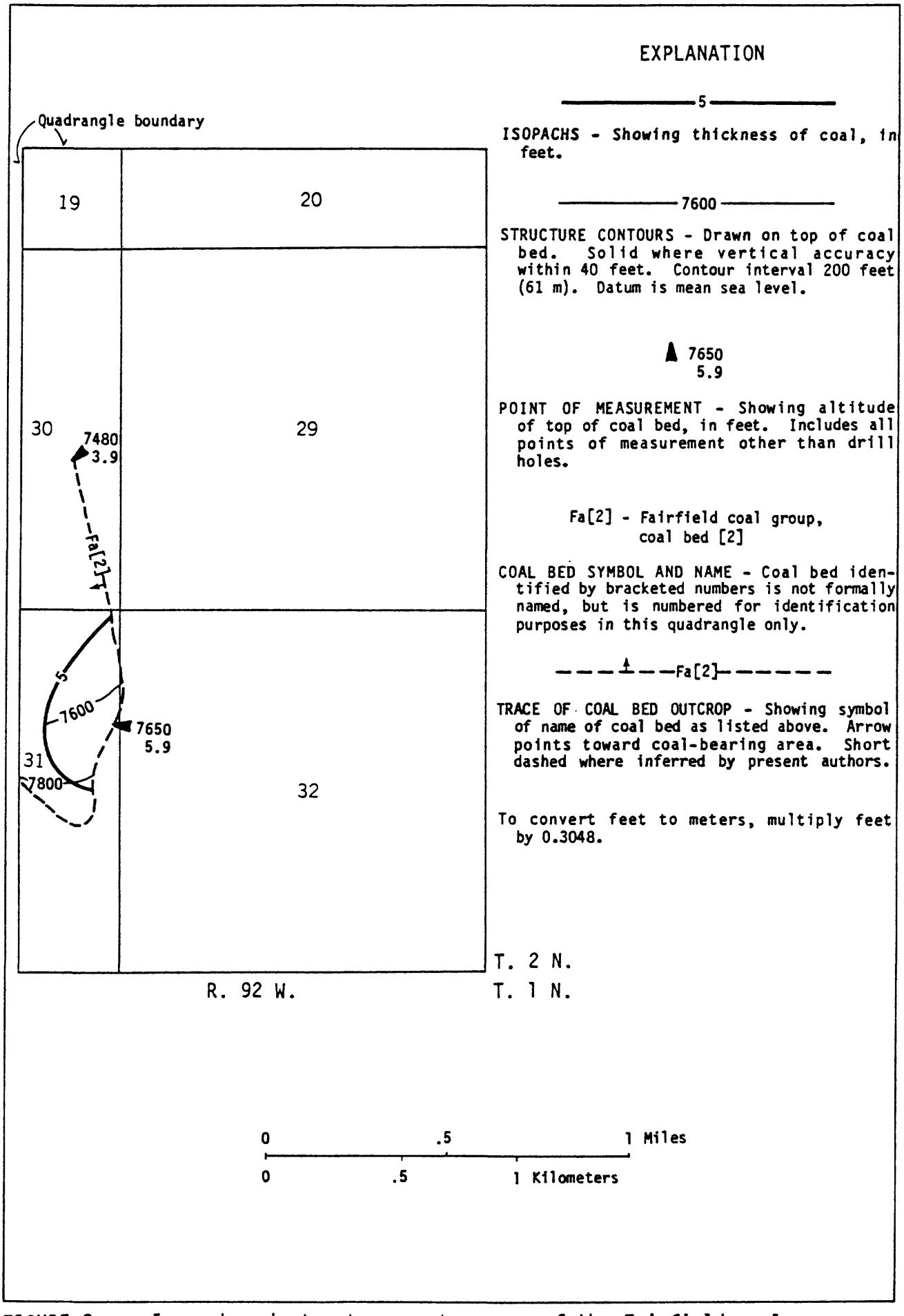

FIGURE 2. — Isopach and structure contour map of the Fairfield coal group, coal bed [2].

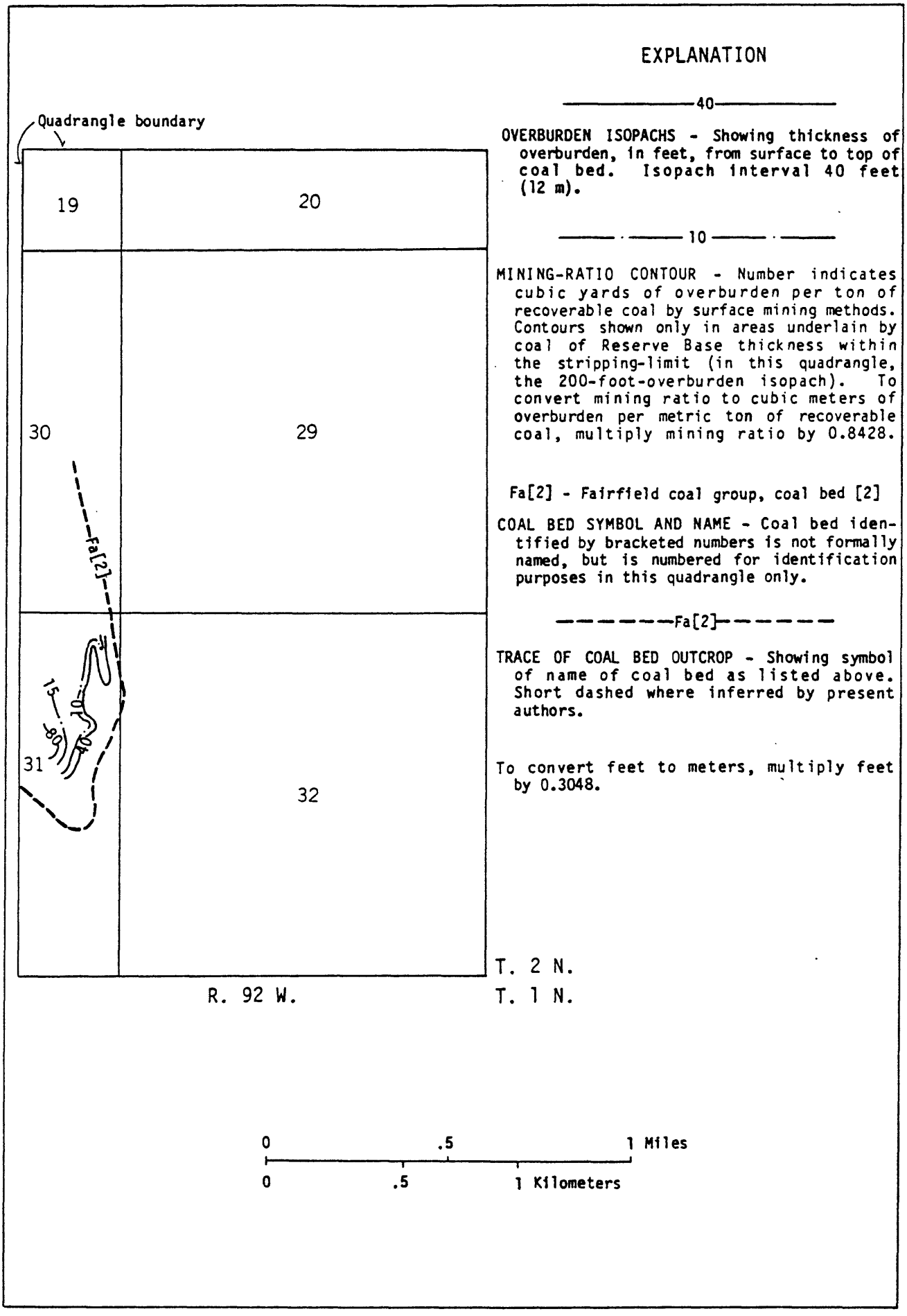

FIGURE 3. — Overburden isopach and mining ratio map of the Fairfield coal group, coal bed [2].

Table 1. -- Chemical analyses of coals in the Sawmill Mountain quadrangle, Rio Blanco County, Colorado.

Location	COAL BED NAME	Form of Analysis	Proximate				Ultimate					Heating Value	
			Moisture	Volatile Matter	Fixed Carbon	Ash	Sulfur	Hydrogen	Carbon	Nitrogen	Oxygen	Calories	Btu/Lb
SW¼ sec. 15, T. 1 N., R. 94 W., Black Diamond Mine (Hancock, 1925) from Meeker quadrangle	Black Diamond coal group	A	10.8	37.2	44.0	7.98	0.49	-	-	-	-	-	11,220
		B	8.5	38.2	45.1	8.18	0.50	-	-	-	-	-	11,510
		C	-	41.8	49.3	8.95	0.55	-	-	-	-	-	12,580
NE¼ sec. 30, T. 2 N., R. 92 W., Wesson Mine (Gale, 1907) from Rattlesnake Mesa quadrangle	Fairfield coal group	A	13.60	36.17	45.57	4.66	0.45	-	-	-	-	-	10,931

Form of Analysis: A, as received
B, air dried
C, moisture free

Note: To convert Btu/pound to kilojoules/kilogram, multiply by 2.326

Table 2. -- Sources of data used on plate 1.

Plate 1 Index Number	Source	Data Base
1	Reheis, (no date), U.S. Geological Survey, in preparation	Measured Section No. 1
2		Measured Section No. 2
3		Measured Section
4		Measured Section
5		Measured Section
6		Measured Section No. 3
7		Measured Section No. 4

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