Text to Accompany:

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COAL RESOURCE OCCURRENCE AND COAL DEVELOPMENT POTENTIAL MAPS OF THE RATTLESNAKE MESA QUADRANGLE RIO BLANCO COUNTY, COLORADO

[Report includes 4 plates]

Prepared for

UNITED STATES DEPARTMENT OF THE INTERIOR

GEOLOGICAL SURVEY

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This report has not been edited
for conformity with U.S. Geological
Survey editorial standards or
stratigraphic nomenclature.

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INTRODUCTION

Purpose

This text is to be used in conjunction with Coal Resource Occurrence and Coal Development Potential Maps of the Rattlesnake Mesa 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 U.S. Geological Survey under contract Number 14-08-001-15789. 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 Published and unpublished public information available through April, 1978, was used as the data base for this study.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 performed as part of this study, nor was any confidential data used.

Location

The Rattlesnake Mesa quadrangle is located in northeastern Rio Blanco County in northwestern Colorado, approximately 38 miles (61 km) southwest of the town of Craig via Colorado Highway 13 (also known as Colorado Highway 789) and 2.5 miles (4 km) northeast of the town of Meeker via Colorado Highway 13. There are numerous houses or farms located in the southern half of the quadrangle; the northern half of the quadrangle is unpopulated.

Accessibility

Colorado Highway 13 crosses the northwestern part of the quadrangle connecting Craig to the northeast and Meeker to the southwest. Colorado Highway 132 crosses the southwestern part of the quadrangle connecting Meeker with the town of Buford approximately 14 miles (23 km) to the southeast. An improved light-duty gravel road from Colorado Highway 13 crosses Rattlesnake Mesa in the central part of the quadrangle and follows Coal Creek to Yellowjacket pass approximately 1.9 miles (3.1 km) to the northeast of the quadrangle. The remainder of the quadrangle is accessible by several other medium-duty roads, improved light-duty roads and unimproved dirt roads and trails.

The nearest railway service for the quadrangle is provided by the Denver and Rio Grande Western Railroad at the town of Rifle or at Craig, Colorado. The railhead at Craig is approximately 30 airline miles (48 km) north-northeast of the quadrangle, while the railroad at Rifle is approximately 32 airline miles (51 km) south of the quadrangle. These are the major transportation routes for coal shipped east from northwestern Colorado (U.S. Bureau of Land Management, 1977).

Physiography

The Rattlesnake Mesa quadrangle lies at the western edge of the Southern Rocky Mountain physiographic province as defined by Howard and Williams (1972). The quadrangle lies on the northwestern edge of the White River Uplift, approximately 24 miles (39 km) southwest of the Williams Fork Mountains and 64 miles (103 km) southwest of the Continental Divide. The northern half of the quadrangle lies in the Danforth Hills.

The landscape in the northern half of the quadrangle is characterized by moderate to steep slopes cut by numerous gulches or draws. The landscape becomes relatively flat in the southern half of the quadrangle. The Meeker dome in the southwestern part of the quadrangle rises approximately 350 feet (107 m) above Agency Park and the White River.

Altitudes in the Rattlesnake Mesa quadrangle range from 8,568 feet (2,612 m) in the north-central part of the quadrangle to less than 6,280 feet (1,914 m) along the White River on the southwestern edge.

The White River, the major drainage system of the area, flows northwestward across the southwestern corner of the quadrangle. Coal Creek flows southwest across the eastern part of the quadrangle into the White River near the Meeker dome. Curtis Creek drains the northwestern part of the quadrangle and flows into the White River approximately 1 mile (1.6 km) west of the quadrangle. The Mc Hattan Reservoir is located on Rattlesnake Mesa near the center of the quadrangle.

Climate and Vegetation

The climate of northwestern Colorado is semiarid. Clear, sunny days prevail in the Rattlesnake Mesa quadrangle area, with daily temperatures typically varying from 9° to 36°F (-13° to 2°C) in January and from 45° to 84°F (7° to 29°C) in July. Annual precipitation averages approximately 18 inches (46 cm). Snowfall during the winter months accounts for the major part of the precipitation in the area, but 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 principle type of vegetation at the higher elevations in the northern part of the quadrangle is mountain shrub, which includes serviceberry, Gambel oak, and rabbitbrush. Sagebrush predominates across the central part of the quadrangle. Grassland occurs in the east-central part of the quadrangle and some of the flatter areas along the White River are utilized as cropland (U.S. Bureau of Land Management, 1977).

Land Status

The Rattlesnake Mesa quadrangle lies on the southeastern boundary of the Danforth Hills Known Recoverable Coal Resource Area (KRCRA). Approximately one fourth of the quadrangle lies within the KRCRA boundary and the Federal government owns the coal rights for approximately 98 percent of this area. Six coal leases and three Preference Right Lease Application (PRLA) areas cover about 80 percent of the remaining Federal lands as shown on plate 2.

GENERAL GEOLOGY

Previous Work

The first geologic description of the general area in which the Rattlesnake Mesa 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 1905, including papers by Hewett (1889), Hills (1893), and Storrs (1902). The quadrangle was included in a report on the coal fields of the Danforth Hills and Grand Hogback areas of northwestern Colorado by Gale (1907). Hancock and Eby (1930) included the Rattlesnake Mesa 7 1/2 minute quadrangle in their geologic report on the Meeker 15-minute quadrangle. The most recent geologic map of the region was compiled by Tweto (1976). Results from drilling by the U.S. Geological Survey in the quadrangle were reported by Reheis (1976).

Stratigraphy

The rock formations cropping out in the quadrangle range in age from Jurassic to Late Cretaceous and include the coal-bearing Iles and Williams Fork Formations of the Mesaverde Group. Formations older than the Mancos Shale crop out over a small area along the White River in Agency Park in the southwestern part of the quadrangle (Hancock and Eby, 1930; Tweto, 1976). Although shown in the composite columnar section on plate 3, the lithologic character of these older formations is not discussed in this report.

The Mancos Shale of Late Cretaceous age crops out in the Agency Park-Rattlesnake Mesa area which covers the southern two thirds of the quadrangle. The formation is composed of gray to dark-gray marine shale with interbedded ledge-forming thin-bedded sandstone and sandy shale occurring locally in the upper part (Hancock and Eby, 1930). In this quadrangle, the thickness of the Mancos Shale is unknown; however, in the adjacent Ninemile Gap quadrangle to the north the formation ranges in thickness from approximately 4,970 to 5,300 feet (1,515 to 1,615 m) where measured in the oil and gas wells drilled in that quadrangle.

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

The Iles Formation crops out in an east-west-trending belt across the northern part of the quadrangle (Hancock and Eby, 1930). It consists of approximately 1,600 feet (488 m) of fine-grained thick-bedded to massive sandstone interbedded with shaly sandstone, sandy shale, black carbonaceous shale, and coal (Hancock and Eby, 1930). The "rim rock" sandstone (Hancock and Eby, 1930; Konishi, 1959), the basal unit of the Iles Formation, consists of approximately 70 feet (21 m) of light-brown massive sandstone with thin seams of sandy shale. The Trout Creek Sandstone Member caps the formation and consists of about 110 feet (34 m) of massive white sandstone (Hancock and Eby, 1930). Two coal-bearing sequences, the "lower" coal group and the Black Diamond coal group (Hancock and Eby, 1930), occur in the Iles Formation below the Trout Creek Sandstone in the Meeker area. However, only coal beds belonging to the Black Diamond coal group have been identified in this quadrangle.

The Williams Fork Formation crops out in the northern part of the quadrangle. The formation ranges in thickness from approximately 4,500 to 5,000 feet (1,372 to 1,524 m) in adjacent quadrangles (Hancock and Eby, 1930) and is generally divided into three units: a lower coal-bearing unit, the Lion Canyon Sandstone Member, and an upper unit that also contains coal. The only unit of the Williams Fork Formation exposed within this quadrangle is the lower coal-bearing unit. Generally this unit extends from the top of the Trout Creek Sandstone Member to the base of the Lion Canyon Sandstone Member. It consists of approximately 2,900 feet (884 m) of interbedded sandstone, shale, sandy shale, carbonaceous shale, and coal beds. Two coal groups, the Fairfield and Goff coal groups, occur within the lower unit (Hancock and Eby, 1930).

The Lion Canyon Sandstone Member crops out in adjacent quadrangles to the north and west and consists of approximately 100 feet (30 m) of thick-bedded yellowish-brown sandstone (Hancock and Eby, 1930).

The upper unit of the Williams Fork Formation, exposed in the Meeker and Devils Hole Gulch quadrangles to the west and northwest, respectively, ranges in thickness from 1,500 to 2,050 feet (457 to 625 m). It consists of yellowish-brown to white sandstone interbedded with sandy carbonaceous shale, and coal beds.

Holocene and Pleistocene deposits of stream alluvium and colluvium cover the stream valleys and gulches 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, near-shore marine, and non-marine sediments in the Rattlesnake Mesa 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 and Williams Fork Formations 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 and on the west by the Yampa Plateau (Grose, 1972). The Rattlesnake Mesa quadrangle is approximately 14 miles (23 km) south of the Axial Basin anticline and approximately 36 miles (58 km) southeast of the Yampa Plateau.

The Rattlesnake Mesa quadrangle lies east of the Grand Hogback, a monocline separating the Piceance Creek Basin to the west and the White River Uplift to the east. The axis of the Sulphur Creek syncline crosses the northeastern part of the quadrangle. Dips along the southern limb range from 10° to 23°, decreasing to the east. The Meeker dome is located in the southwestern part of the quadrangle (Hancock and Eby, 1930).

The structure contour maps of the isopached coal beds are based on a regional structure map of the top of the Trout Creek Sandstone Member by Hancock and Eby (1930) and it is assumed that the structure of the coal beds duplicates that of the Trout Creek Sandstone Member. 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 Rattlesnake Mesa 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). However, coal beds in the lower coal group have not been identified in this quadrangle.

According to Hancock and Eby (1930), coal beds in the Williams Fork Formation that lie below the Lion Canyon Sandstone Member are placed in the Fairfield and Goff coal groups. The Fairfield coal group includes the coal beds that occur in the basal 1,300 feet (396 m) of the formation and the Goff coal group generally includes the coal beds in the 700 feet (213 m) of coal-bearing strata below the Lion Canyon Sandstone Member.

Coal beds exceeding Reserve Base thickness (5.0 feet or 1.5 m) in the Black Diamond and Fairfield coal groups that are not formally named have been given bracketed numbers for identification purposes. In instances where coal beds have been identified at one location only and cannot be correlated with other coal beds, they are treated as isolated data points (see Isolated Data Points section of this report).

Chemical analyses of coal.--Analyses of the coals in this area are listed in table 1. In general, chemical analyses indicate that the coals in the Black Diamond, Fairfield, and Goff 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

Two coal beds in the Black Diamond coal group exceed Reserve Base thickness in the Rattlesnake Mesa quadrangle. One bed, the Miller Mine coal bed, was isopached; the other coal bed, the Black Diamond [1], was identified at one location only and treated as an isolated data point.

The Miller Mine coal bed is named after the Miller mine located in the SE 1/4 SW 1/4 sec. 29, T. 2 N., R. 93 W. This coal bed has been identified in several locations along the outcrop and ranges in thickness from 2.3 to 7.6 feet (0.7 to 2.3 m) as shown in figure 1 (figures are shown on pages 14 through 18). It reaches its maximum thickness in sec. 29, T. 2 N., R. 93 W. Rock partings ranging from 0.1 to 0.9 feet (0.03 to 0.3 m) in thickness occur in this coal bed.

Fairfield Coal Group

Nine coal beds exceeding Reserve Base thickness in the Fairfield coal group have been identified in the quadrangle. All of these coal beds, except the Bloomfield, have been measured at one location only and treated as isolated data points. Three coal beds, the Fairfield [3], [4] and [5], were identified on non-Federal land.

The Bloomfield coal bed, named after the Bloomfield mine in the SE 1/4 NW 1/4 sec. 30, T. 2 N., R. 92 W., has been identified at five locations across the northern part of the quadrangle. The coal bed exceeds Reserve Base thickness at only one location, in the SE 1/4 SE 1/4 sec. 29, T. 2 N., R. 93 W., and this location is on non-Federal land.

Goff Coal Group

Coal beds in this group crop out in the northwest corner of the quadrangle, and the Goff [12] is the only coal bed known to exceed Reserve Base thickness in this quadrangle.

The Goff [12] coal bed (figure 1) ranges from 4.8 to 12.0 feet (1.5 to 3.7 m) in thickness where measured at two locations along the outcrop. A rock parting 2.0 feet (0.6 m) thick is included in the coal bed where the total coal thickness is 12.0 feet (3.7 m).

Isolated Data Points

In instances where single or isolated measurements of coal beds thicker than 5.0 feet (1.5 m) are encountered, the standard criteria for construction of isopach, structure contour, mining ratio, and overburden isopach maps are not available. The lack of data concerning these coal beds limits the extent to which they can be reasonably projected in any direction and usually precludes correlations with other, better known coal beds. Also, where the inferred limit of influence from the isolated data point is entirely within non-Federal land areas or lands already leased for coal mining, an isolated data point map is not constructed for the coal bed. Maps for isolated data points occurring in this quadrangle, and the influence from an isolated data point in the adjacent

Ninemile Gap quadrangle, are included on a separate plate for non-isopached coal beds (plate 4).

COAL RESOURCES

Data from outcrops and drill holes (Hancock and Eby, 1930; Reheis, 1976; Horn and Adair, no date) were used to construct outcrop, isopach and structure contour maps of the coal beds in the Rattlesnake Mesa quadrangle. The source of each indexed data points shown on plate 1 is listed in table 4.

Coal resources for Federal land were calculated using data obtained from the coal isopach map (figure 1), the areal distribution and identified resources map (figure 3), and the isolated data point maps (plate 4). The coal bed acreage (measured by planimeter), multiplied by the average thickness of the coal bed and by a conversion factor of 1,800 short tons of coal per acre-foot (13,238 metric tons per hectare-meter) for bituminous coal, yields the coal resources in short tons of coal for each coal bed. Coal beds thicker than 5 feet (1.5 m) that lie less than 3,000 feet (914 m) below the ground surface are included. These criteria differ somewhat from those stated in U.S. Geological Survey Bulletin 1450-B which call for a minimum thickness of 28 inches (70 cm) and a maximum depth of 1,000 feet (305 m) for bituminous coal.

Reserve Base and Reserve tonnages for the isopached Goff [12] coal bed are shown in figure 3 and are rounded to the nearest 10,000 short tons (9,072 metric tons). Only Reserve Base tonnages (designated as inferred resources) are calculated for areas influenced by the isolated data points. Coal Reserve Base tonnages per Federal section are shown on plate 2 and total approximately 8.92 million short tons (8.09 million metric tons) for the entire quadrangle, including the tonnages for the isolated data points. Reserve Base tonnages in the various development potential categories for surface and subsurface mining methods are shown in tables 2 and 3.

Dames & Moore has not made any determination of economic recoverability for any of the coal beds described in this report.

COAL DEVELOPMENT POTENTIAL

Coal development potential areas are drawn to coincide with the boundaries of the smallest legal land subdivisions shown on plate 2. In sections or parts of sections where no land subdivisions have been surveyed by the BLM, approximate 40-acre (16-ha) parcels have been used to show the limits of the high, moderate, or low development potentials. A constraint imposed by the BLM specifies that the highest development potential affecting any part of a 40-acre (16-ha) lot, tract, or parcel be applied to that entire lot, tract, or parcel. For example, if 5 acres (2 ha) within a parcel meet criteria for a high development potential; 25 acres (10 ha), a moderate development potential; and 10 acres (4 ha), a low development potential; then the entire 40 acres (16 ha) are assigned a high development potential.

Development Potential for Surface Mining Methods

Areas where the coal beds of Reserve Base thickness are overlain by 200 feet (61 m) or less of overburden are considered to have potential for surface mining and are assigned a high, moderate, or low development potential based on the mining ratio (cubic yards of overburden per ton of recoverable coal). The formula used to calculate mining ratios for surface mining of coal is shown on below:

$$MR = \frac{t_o\ (cf)}{t_c\ (rf)}$$

where MR = mining ratio

t_o = thickness of overburden in feet

t_c = thickness of coal in feet

rf = recovery factor (85 percent for this quadrangle)

cf = conversion factor to yield MR value in terms of cubic yards of overburden per short tons of recoverable coal:
0.911 for subbituminous coal
0.896 for bituminous coal

Note: To convert mining ratio to cubic meters of overburden per metric ton of recoverable coal, multiply MR by 0.8428.

Areas of high, moderate, and low development potential for surface mining methods are defined as areas underlain by coal beds having respective mining-ratio values of 0 to 10, 10 to 15, and greater than 15. These mining ratio values for each development potential category are based on economic and technological criteria and were provided by the U.S. Geological Survey.

Areas where the coal data is absent or extremely limited between the 200-foot (61-m) overburden line and the outcrop are assigned unknown development potential for surface mining methods. This applies to areas where coal beds 5 feet (1.5 m) or more thick are not known, but may occur, and to those areas influenced by isolated data points. Limited knowledge pertaining to the areal distribution, thickness, depth, and attitude of the coal beds prevents accurate evaluation of development potential in the high, moderate, and low categories. The areas influenced by isolated data points in this quadrangle total approximately 3.75 million short tons (3.40 million metric tons) of coal available for surface mining.

The coal development potential for surface mining methods is shown on figure 4. All of the Federal land areas having a known development potential for surface mining are rated high. The remaining Federal lands within the KRCRA boundary in this quadrangle are classified as having unknown development potential for surface mining methods.

Development Potential for Subsurface and In-Situ Mining Methods

Areas considered to have a development potential for conventional subsurface mining methods include those areas where coal beds of Reserve Base thickness are between 200 and 3,000 feet (61 and 914 m) below the ground surface and have dips of 15° or less. Unfaulted coal beds lying between 200 and 3,000 feet (61 and 914 m) below the ground surface, dipping greater than 15°, are considered to have development potential for in-situ mining methods.

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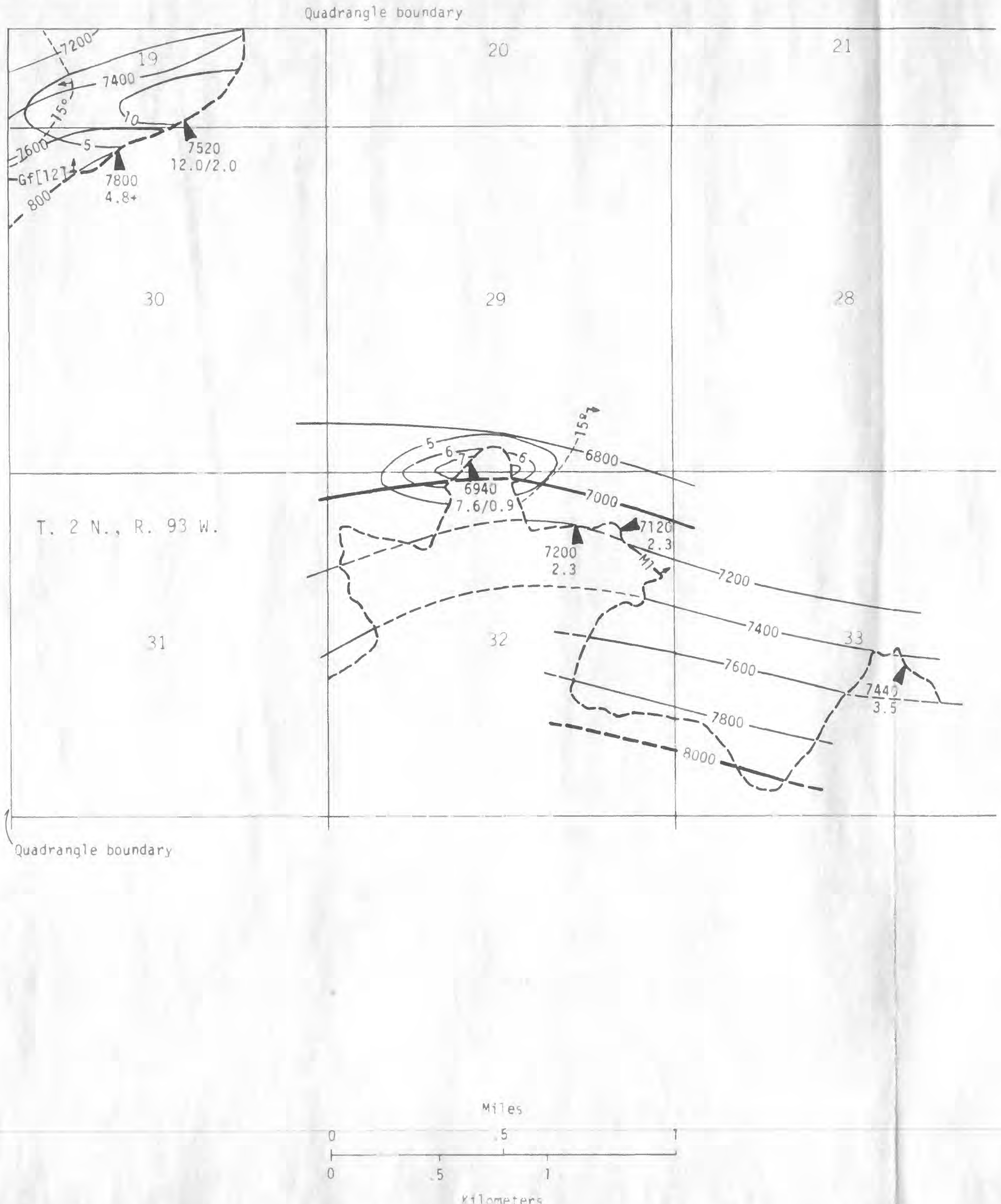

EXPLANATION

——5——

ISOPACHS - Showing thickness of coal, in feet. Long dashed where inferred. Isopach interval 5 feet for the Goff coal group, coal bed [13]; 1 foot for the Miller Mine coal bed.

——7000 — — — —
——6800 — — — —

STRUCTURE CONTOURS - Drawn on top of coal bed. Long dashed where vertical accuracy possibly not within 40 feet; short dashed where projected above ground surface. Contour interval 200 feet (61 m). Datum is mean sea level.

▲7120/2.3

POINT OF MEASUREMENT - Showing altitude of top of coal bed, in feet. Includes all points of measurement other than drill holes.

12.0/2.0

INTERBEDDED COAL AND ROCK - Showing total coal thickness/rock thickness.

Gf - Goff coal group
Ml - Miller Mine

COAL BED SYMBOLS AND NAMES - Coal beds identified by bracketed numbers are not formally named, but are numbered for identification purposes in this quadrangle only.

— — — — Ml — — — —

TRACE OF COAL BED OUTCROP - Showing symbol of name of coal bed as listed above. Arrow points toward coal-bearing area. Short dashed where projected by present authors.

- - - - - 15° - - - - -

SUBSURFACE MINING LIMIT - Showing areas where dips of coal beds are greater than 15° and subsurface mining by conventional methods is not considered feasible. Reserve Base tonnages are calculated beyond limit; Reserve tonnages are not. Arrow points toward area where dips are greater than 15°.

To convert feet to meters, multiply feet by 0.3048.

FIGURE 1. — Isopach and structure contour maps of the Miller Mine coal bed and the Goff coal group, coal bed [12].

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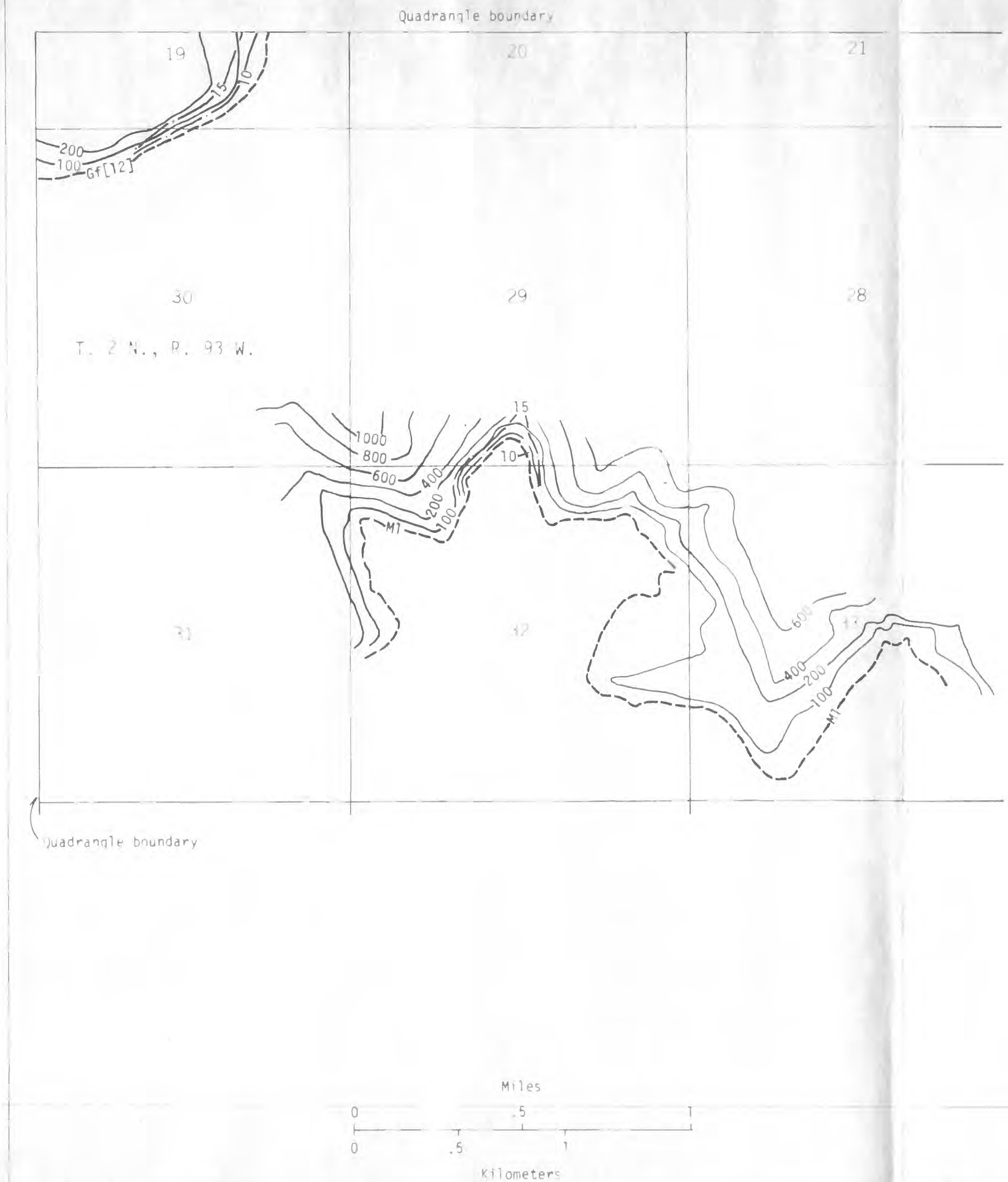

EXPLANATION

——400——

OVERBURDEN ISOPACHS - Showing thickness of overburden, in feet, from surface to top of coal bed. Dashed where vertical accuracy possibly not within 40 feet. Isopach interval 100 feet (31 m) over strippable coal and 200 feet (61 m) beyond the stripping-limit line.

——·——15——·——

MINING-RATIO CONTOUR - Number indicates cubic yards of overburden per ton of recoverable coal by surface mining methods. Contours shown only in areas underlain by coal of Reserve Base thickness within the stripping-limit (in this quadrangle, the 200-foot-overburden isopach). To convert mining ratio to cubic meters of overburden per metric ton of recoverable coal, multiply mining ratio by 0.8428.

Gf - Goff coal group
M1 - Miller Mine

COAL BED SYMBOLS AND NAMES - Coal beds identified by bracketed numbers are not formally named, but are numbered for identification purposes in this quadrangle only.

- - - - - - - - -M1- - - - - - - - -

TRACE OF COAL BED OUTCROP - Showing symbol of name of coal bed as listed above. Short dashed where projected by present authors.

To convert feet to meters, multiply feet by 0.3048.

FIGURE 2. — Overburden isopach and mining ratio maps of the Miller Mine coal bed and the Goff coal group, coal bed [12].

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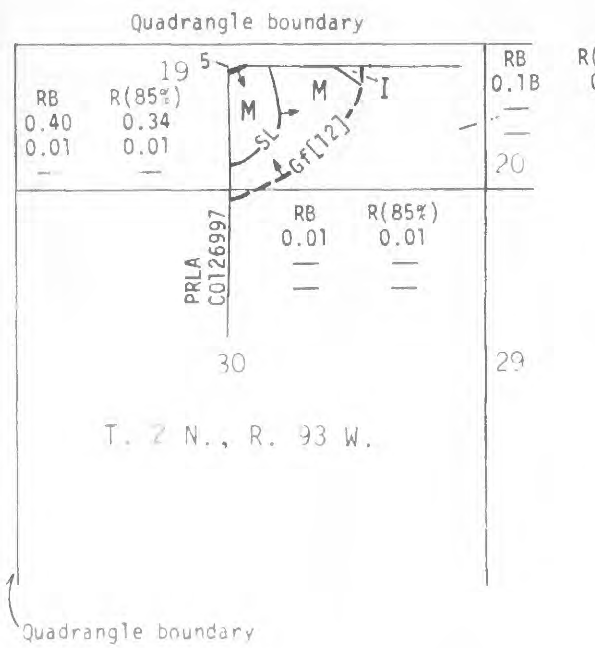
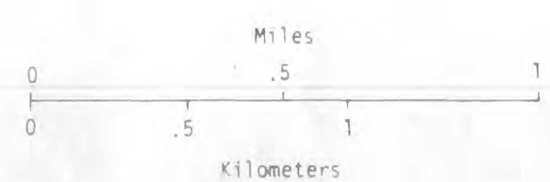




EXPLANATION

PRLA
C0126997

PREFERENCE RIGHT LEASE APPLICATION (PRLA) - An area of Federal coal lands for which an application for a noncompetitive coal lease has been made as a result of exploration done under a coal prospecting permit.

5

ISOPACH - Showing thickness of coal, in feet. Arrow points toward area where coal bed is 5 feet or more thick.

Gf - Goff coal group

COAL BED SYMBOL AND NAME - Coal bed identified by bracketed numbers is not formally named, but is numbered for identification purposes in this quadrangle only.

------Gf[12]------

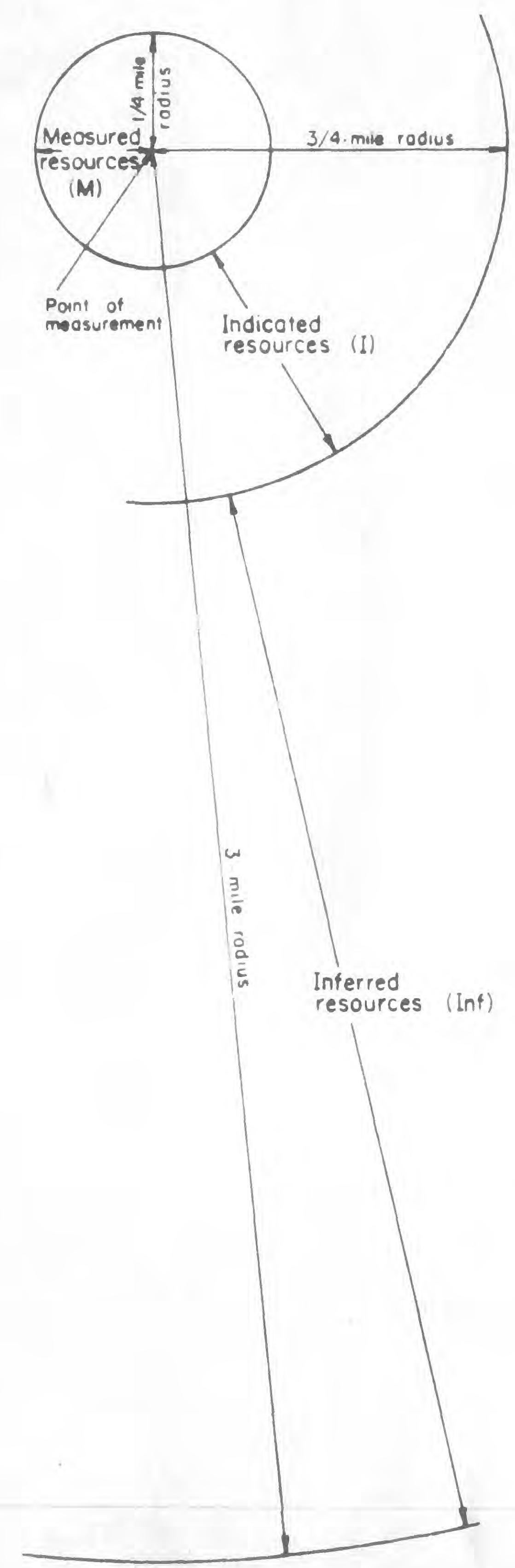
TRACE OF COAL BED OUTCROP - Showing symbol of name of coal bed as listed above. Arrow points toward coal-bearing area. Short dashed where projected by present authors.

SL

STRIPPING-LIMIT LINE - Boundary for surface mining (in this quadrangle, the 200-foot-overburden isopach). Arrow points toward the area suitable for surface mining where the recovery factor is 85 percent, and away from the area suitable for subsurface mining (down dip to the 3,000-foot-overburden isopach) where the recovery factor is 50 percent.

RB	R(85%)	RB	R(50%)	
0.40	0.34	0.18	0.09	(Measured)
0.01	0.01	—	—	(Indicated)
—	—	—	—	(Inferred)

IDENTIFIED COAL RESOURCES - Showing totals for Reserve Base (RB) and Reserves (R), in millions of short tons, for each section or part of section of non-leased Federal coal land, both within and beyond the stripping-limit line. Reserve (R) tonnage is calculated by multiplying the Reserve Base (RB) tonnage by the appropriate recovery factor. Dash indicates no resource in that category.



BOUNDARY LINES - Enclosing areas of measured (M), indicated (I), and inferred (Inf) coal resources.

To convert short tons to metric tons, multiply short tons by 0.9072.

To convert feet to meters, multiply feet by 0.3048.

To convert miles to kilometers, multiply miles by 1.6093.

FIGURE 3. - Areal distribution and identified resources maps of the Miller Mine coal bed and the Goff coal group, coal bed [12].

Areas of high, moderate, and low development potential for conventional subsurface mining methods are defined as areas underlain by coal beds at depths ranging from 200 to 1,000 feet (61 to 305 m), 1,000 to 2,000 feet (305 to 610 m), and 2,000 to 3,000 feet (610 to 914 m), respectively.

Areas where the coal data is absent or extremely limited between 200 and 3,000 feet (61 and 914 m) below the ground surface are assigned unknown development potentials. This applies to the areas where coal beds exceeding Reserve Base thickness are not known, but may occur, and to those areas influenced by isolated data points. The areas influenced by isolated data points in this quadrangle contain approximately 4.57 million short tons (4.15 million metric tons) of coal available for conventional subsurface mining.

The coal development potential for conventional subsurface mining methods is shown on figure 5. All of the Federal land areas having known development potential for conventional subsurface mining methods are rated high. The remaining Federal lands within the KRCRA boundary in this quadrangle are classified as having unknown development potentials for conventional subsurface mining methods.

Because the coal beds have dips less than 15° in the areas where they exceed Reserve Base thickness, the development potential for in-situ mining methods is rated unknown for all Federal lands within the KRCRA boundary in this quadrangle.

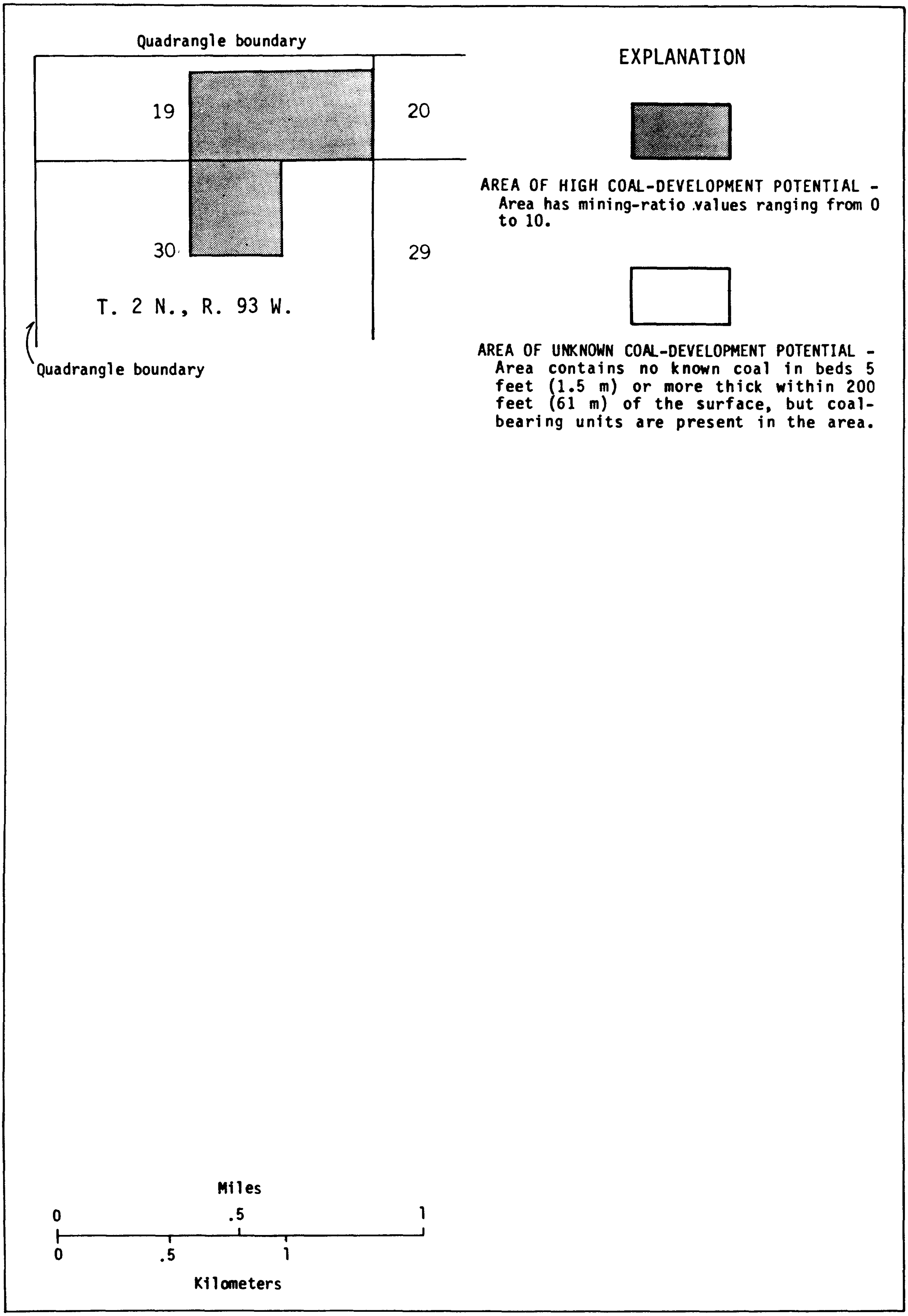


FIGURE 4. — Coal development potential map for surface mining methods.

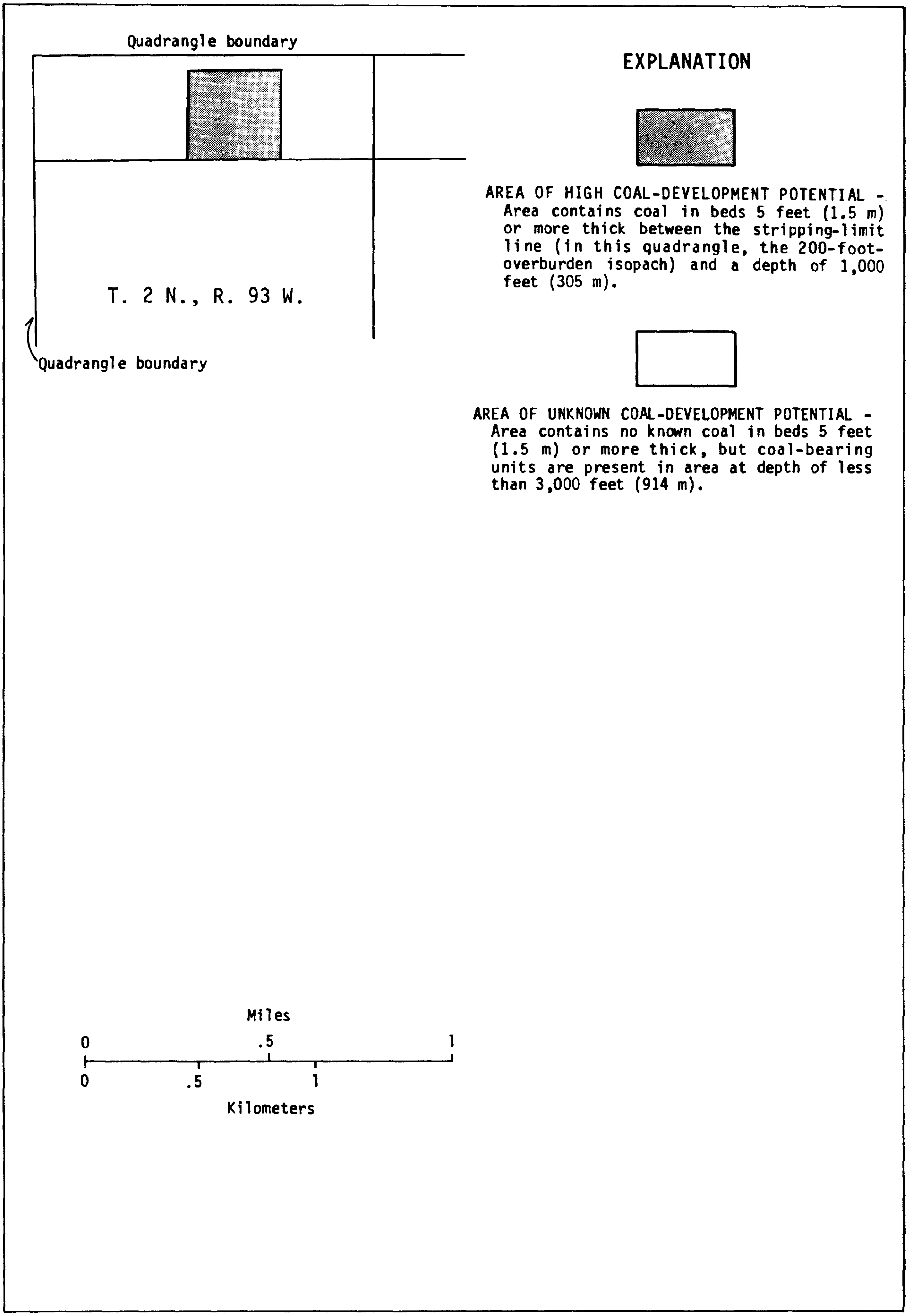


FIGURE 5. — Coal development potential map for subsurface mining methods.

Table 1. -- Chemical analyses of coals in the Rattlesnake Mesa 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
NE¼ sec. 15, T. 1 N., R. 94 W., Black Diamond Mine (Hancock and Eby, 1930) from Meeker quadrangle	Black Diamond coal group	A	10.8	37.2	44.0	8.0	0.49	-	-	-	-	-	11,220
		B	8.5	38.2	45.1	8.2	0.50	-	-	-	-	-	11,510
		C	-	41.8	49.3	8.9	0.55	-	-	-	-	-	12,580
Secs. 19 and 30, T. 2 N., R. 92 W., Wesson Mine (Hancock and Eby, 1930)	Wesson (Fairfield coal group)	A	13.6	36.2	45.6	4.7	0.45	-	-	-	-	-	10,930
		B	9.9	37.7	47.5	4.9	0.47	-	-	-	-	-	11,400
		C	-	41.9	52.7	5.4	0.52	-	-	-	-	-	12,650
SW¼ sec. 10, T. 2 N., R. 93 W., Cornrike Mine (Hancock and Eby, 1930) from Ninemile Gap quadrangle	Cornrike (Goff coal group)	A	13.9	42.0	41.9	2.2	0.28	-	-	-	-	-	11,270
		B	10.6	43.6	43.5	2.3	0.29	-	-	-	-	-	11,700
		C	-	48.8	48.6	2.6	0.33	-	-	-	-	-	13,000

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. -- Coal Reserve Base data for surface mining methods for Federal coal lands (in short tons) in the Rattlesnake Mesa quadrangle, Rio Blanco County, Colorado.

Coal Bed or Zone	High Development Potential	Moderate Development Potential	Low Development Potential	Unknown Development Potential	Total
Goff {12}	160,000	150,000	110,000	-	420,000
Isolated Data Points	-	-	-	3,750,000	3,750,000
Totals	160,000	150,000	110,000	3,750,000	4,170,000

NOTE: To convert short tons to metric tons, multiply by 0.9072.

Table 3. -- Coal Reserve Base data for subsurface mining methods for Federal coal lands (in short tons) in the Rattlesnake Mesa quadrangle, Rio Blanco County, Colorado.

Coal Bed or Zone	High Development Potential	Moderate Development Potential	Low Development Potential	Unknown Development Potential	Total
Goff {12}	180,000	-	-	-	180,000
Isolated Data Points	-	-	-	4,570,000	4,570,000
Totals	180,000	-	-	4,570,000	4,750,000

NOTE: To convert short tons to metric tons, multiply by 0.9072.

Table 4. -- Sources of data used on plate 1

Plate 1 Index Number	Source	Data Base
1	Hancock and Eby, 1930, U.S. Geological Survey Bulletin 812-C, pl. 30	Mine-Measured Section No. 457
2	Hancock and Eby, 1930, U.S. Geological Survey Bulletin 812-C, pl. 30	Composite Section Nos. 452-453
3	↓	Composite Section Nos. 450-451
4	Hancock and Eby, 1930, U.S. Geological Survey Bulletin 812-C, pl. 30	Measured Section No. 448
5	↓	Measured Section No. 449
6	Reheis, 1976, U.S. Geological Survey Open-File Report 76-870	Drill hole No. D-9-RM
7	Horn and Adair, no date, U.S. Geological Survey, unpublished map	Measured Section No. 2
8	Hancock and Eby, 1930, U.S. Geological Survey Bulletin 812-C, pl. 30	Measured Section No. 440
9	↓	Composite Section Nos. 432-435
10	Hancock and Eby, 1930, U.S. Geological Survey Bulletin 812-C, pl. 30	Measured Section No. 443
11	↓	Measured Section No. 442
12	↓	Measured Section No. 436
13	↓	Measured Section No. 446
14	Horn and Adair, no date, U.S. Geological Survey, unpublished map	Composite Measured Section. Nos. 3 and 4

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Table 4. -- Continued

Plate 1 Index Number	Source	Data Base
15	Hancock and Eby, 1930, U.S. Geological Survey Bulletin 812-C, pl. 30	Measured Section No. 431
16	↓	Measured Section No. 430
17	Horn and Adair, no date, U.S. Geological Survey, unpublished map	Measured Section No. 5
18	Hancock and Eby, 1930, U.S. Geological Survey Bulletin 812-C, pl. 30	Composite Section Nos. 482-483

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