Text to Accompany:

Open-File Report 79-1399

1979

COAL RESOURCE OCCURRENCE AND COAL DEVELOPMENT POTENTIAL MAPS OF THE SOUTHWEST QUARTER OF THE CITADEL PLATEAU 15-MINUTE QUADRANGLE, MOFFAT COUNTY, COLORADO

[Report includes 9 plates]

Prepared for

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GEOLOGICAL SURVEY

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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 southwest quarter of the Citadel Plateau 15-minute quadrangle, Moffat 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 14-08-0001-15789. 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 Published and unpublished public information available through February, 1979, was used as the data base for this study.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

In this report, the term "quadrangle" refers only to the southwest quarter of the Citadel Plateau 15-minute quadrangle which is located in south-central Moffat County in northwestern Colorado, approximately 32 airline miles (51 km) east-northeast of the town of Rangely and approximately 19 airline miles (31 km) northwest of the town of Meeker. With the exception of several ranches, the area within the quadrangle is unpopulated.

Accessibility

The southwest quarter of the Citadel Plateau 15-minute quadrangle is approximately 8 miles (13 km) southeast of U.S. Highway 40, and approximately 23 miles (37 km) northwest of Colorado Highway 64 via an improved light-duty road across the north-central and northeastern parts of the quadrangle. Several other improved light-duty roads cross the northeast corner of the quadrangle, connecting with U.S. Highway 40 east of the town of Maybell. The remainder of the quadrangle is accessible by numerous unimproved dirt roads and trails.

Railway service for the quadrangle is provided by the Denver and Rio Grande Western Railroad from Denver to the railhead at Craig. The railroad follows U.S. Highway 40, terminating approximately 30 miles (48 km) northeast of this quadrangle and is the major transportation route for coal shipped east from northwestern Colorado (U.S. Bureau of Land Management, 1977).

Physiography

The southwest quarter of the Citadel Plateau 15-minute quadrangle lies at the western edge of the southern Rocky Mountains physiographic province, as defined by Howard and Williams (1972). The central part of the quadrangle is located in the Danforth Hills. The quadrangle is approximately 80 miles (129 km) southwest of the Continental Divide.

The landscape within the Danforth Hills in the southern half of the quadrangle and on Wolf Mountain in the northeast corner of the quadrangle is characterized by moderate to steep slopes cut by numerous gulches. Gentle to moderate slopes are present along the foot of the Citadel Plateau on the western edge of the quadrangle, along Deep Channel Creek in the southeast corner, and in a wide northwest-trending band between the Citadel Plateau and Wolf Mountain in the northeastern part of the quadrangle. Altitudes range from approximately 8,014 feet (2,443 m) on Escarpment Peak in the east-central part of the quadrangle to less than 6,000 feet (1,829 m) in the southwest corner.

Streams and gulches in the northern half of the quadrangle are tributaries of the Yampa River approximately 11 miles (18 km) north-northeast of the quadrangle. Freeman Gulch, Swan Draw, Bob Hughes Creek, and Pine Tree Gulch join Deception Creek, a tributary of the Yampa River, northeast of the quadrangle. Deep Channel Creek and its tributaries drain the southern half of the quadrangle, flowing into the White River approximately 12 miles (19 km) southwest of the quadrangle. With the exception of Deep Channel Creek, all of the creeks in the quadrangle are intermittent, flowing mainly in response to snowmelt in the spring.

Climate and Vegetation

The climate of northwestern Colorado is semiarid. Clear, sunny days prevail in the Citadel Plateau quadrangle area, with daily temperatures typically varying from 3° to 32° F (-16° to 0°C) in January and from 48° to 88°F (9° to 31°C) in July. Annual precipitation averages about 12 inches (30 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).

Vegetation is varied in the quadrangle. The western and northwestern parts of the quadrangle are dominated by sagebrush. Pinyon, Utah juniper, and Rocky Mountain juniper are characteristic of the Citadel Plateau in the southeastern half of the quadrangle. Mountain shrub, including serviceberry, Gambel oak, and rabbitbrush, is the predominant vegetation in the east-central and northeastern parts of the quadrangle, while grasslands cover the flatter areas in the northeastern corner and west-central part of the quadrangle (U.S. Bureau of Land Management, 1977).

Land Status

The southwest quarter of the Citadel Plateau 15-minute quadrangle lies in the northwestern part of the Danforth Hills Known Recoverable Coal Resource Area (KRCRA). The KRCRA crosses the northeast quarter of the quadrangle in a northwest-trending band about 2 miles (3.2 km) wide, and the Federal government owns the coal rights for approximately 85 percent of that area as shown on plate 2. There are no active coal leases within the quadrangle.

GENERAL GEOLOGY

Previous Work

The first geologic description of the general area in which this 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 (1899), Hills (1893), and Storrs (1902). Gale (1910) reported on the coal fields and geology of northwestern Colorado and Sears (1924) also described the geology of this area. Relatively little recent work has been done in this quadrangle and surrounding areas. Reheis (1975) compiled a generalized geologic map of the Danforth Hills KRCRA, which includes only the area within and immediately adjacent to the KRCRA boundary. Pipiringos and Rosenlund (1977) prepared a preliminary geologic map of the White Rock quadrangle to the southeast, and Rowley and others (1978) compiled a preliminary geologic map of the Vernal 1° x 2° quadrangle that includes the Citadel Plateau area.

Stratigraphy

The rock formations that crop out in the southwest quarter of the Citadel Plateau quadrangle range in age from Late Cretaceous to Eocene and include the Mancos Shale, the Mesaverde Group, and the Fort Union and Wasatch Formations. Only the Williams Fork Formation of the Mesaverde Group is known to contain coal in this quadrangle.

The Mancos Shale of Late Cretaceous age crops out in the northeast corner of the quadrangle (Rowley and others, 1978) and is composed of gray shale interbedded with thin layers of sandstone and sandy shale near the top (Tweto, 1976). According to Tweto, the Mancos Shale is approximately 5,000 feet (1,524 m) thick in northwestern Colorado; however, its total thickness in this quadrangle is unknown.

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 a northeast-trending band across the northeastern part of the quadrangle. It consists of massive sandstone interbedded with shaly sandstone, sandy shale, and black carbonaceous shale. In the Meeker quadrangle to the southeast, Hancock and Eby (1930) report that the Iles Formation ranges in thickness from

approximately 1,350 to 1,600 feet (411 to 488 m), and it is believed that the formation is probably within that range in this quadrangle. The basal unit of the Iles Formation, the Tow Creek Sandstone Member (Bass and others, 1955), is a light-brown to white massive sandstone approximately 90 feet (27 m) thick where measured in the Tennessee Gas Transmission No. 1 USA Chorney well drilled in sec. 11, T. 3 N., R. 95 W., in the White Rock quadrangle. The Trout Creek Sandstone Member caps the formation and consists of about 110 to 120 feet (34 to 37 m) of massive white sandstone. Two coal-bearing sequences, the "lower" coal group and Black Diamond coal group (Hancock and Eby, 1930), occur in the Iles below the Trout Creek Sandstone Member in the Meeker area, but these coal groups have not been identified in this quadrangle.

The Williams Fork Formation also crops out in a northwest-trending band across the northeastern part of the quadrangle. It is approximately 3,400 feet (1,036 m) thick (Sears, 1924) where measured in Freeman and Bob Hughes (Swan Draw) Gulches, and it appears that the formation thickens to the south. The formation is generally divided into three units: a lower coal-bearing unit, the Lion Canyon Sandstone Member, and an upper unit that also contains coal. Individual thicknesses of these three units are not known in this quadrangle, but they have been estimated based on geologic data projected from the White Rock quadrangle (Pipiringos and Rosenlund, 1977), the Devils Hole Gulch area (Hancock and Eby, 1930), and the preliminary geologic map by Rowley and others (1978).

The lower unit extends upward from the base of the formation to the base of the Lion Canyon Sandstone Member and may possibly be from 1,700 to 2,100 feet (518 to 640 m) thick in this quadrangle. It consists of interbedded sandstone, siltstone, sandy shale, carbonaceous shale and coal beds. The sandstone is white to tan, light gray to brown, and fine to medium grained. Two coal groups, the Fairfield coal group and the Goff coal group, occur in the lower unit of the Williams Fork Formation (Hancock and Eby, 1930).

The Lion Canyon Sandstone Member is a thick-bedded light-yellow-brown sandstone, and may contain locally thin beds of shale and siltstone. It is estimated to be about 150 feet (46 m) thick in this quadrangle.

The upper unit of the Williams Fork Formation, which may be a Lance equivalent (Pipiringos and Rosenlund, 1977), is probably between 1,200 and 1,600 feet (366 and 488 m) thick, consisting of a series of yellow to brown massive and shaly sandstone, brown to black sandy and carbonaceous shale, and coal beds. Coal beds in this unit that crop out above the Lion Canyon Sandstone Member have been designated the Lion Canyon coal group by Hancock and Eby (1930).

Unconformably overlying the Williams Fork Formation, the Fort Union Formation of Paleocene age crops out in the northeast corner of the quadrangle and parallel to the Williams Fork outcrop (Rowley and others, 1978). In the White Rock quadrangle to the southeast, the formation is composed predominantly of light-gray to brown sandstone with minor amounts of interbedded siltstone, claystone, carbonaceous shale, and thin coal beds. Several conglomerate beds occur in the basal 40 to 70 feet (12 to 21 m) of the formation (Pipiringos and Rosenlund, 1977). The formation ranges in thickness from about 1,200 to 1,400 feet (366 to 427 m) on the surface in the White Rock quadrangle and may be even thicker in this quadrangle.

The Wasatch Formation of Eocene-Paleocene age crops out in the western and southern parts of the quadrangle and in a northeast-trending band across the northeastern part of the quadrangle (Rowley and others, 1978). The contact between the Wasatch and the underlying Fort Union strata is probably unconformable (Gale, 1907) in this area. In general, the Wasatch is composed of variegated shale, light-gray to tan sandstone with minor amounts of conglomerate, and it is estimated that its thickness may be about 1,200 feet (366 m) where exposed.

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

The Cretaceous sedimentary rocks 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. A major regressive cycle caused the deposition of a series of marine, near-shore marine, and non-marine sediments in the Citadel Plateau area (Masters, 1959; 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 (Kucera, 1959).

The interbedded sandstone, shale, and coal of the Mesaverde Group 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 members of the Iles and Williams Fork Formations, including the Trout Creek and Lion Canyon Sandstone Members, were deposited in shallow marine and near-shore marine environments as the shoreline fluctuated. Coal beds of limited areal extent, such as those in the Lion Canyon coal group, were generally deposited in environments associated with fluvial systems, such as back-levee and coastal plain swamps, interchannel basin areas, and abandoned channels (O'Boyle, 1955; Konishi, 1959).

After the final withdrawal of the Cretaceous sea, thick sections of detrital material, eroded from older deposits, were deposited as the Fort Union Formation. The conglomerates, sandstones, shales, and coals were deposited in braided-stream, flood-plain and backswamp deposits (Beaumont, 1979).

The coarse sediments at the base of the Wasatch Formation were deposited in a fluvial environment and the upper sediments were deposited in alternating swamp, lake and stream environments (Beaumont, 1979).

Structure

The Danforth Hills KRCRA lies in the northern part of the Piceance structural basin of west-central Colorado. The Danforth Hills area is bordered on the northeast by the Axial Basin anticline, approximately 5 miles (8 km) east of the southwest quarter of the Citadel Plateau 15-minute quadrangle, and on the west by the Yampa Plateau, approximately 14 miles (23 km) west of the quadrangle.

Reheis (1975) indicates that the coal beds within this quadrangle are situated on the southwestern flank of the northwest-trending Danforth Hills anticline and dip approximately 25° to 60° to the southwest.

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 Reheis (1975) and it is assumed that the structure of the coal beds nearly duplicates that of the Trout Creek Sandstone Member.

COAL GEOLOGY

Only coal beds in the Lion Canyon coal group of the Williams Fork Formation have been identified in the southwest quarter of the Citadel Plateau 15-minute quadrangle. This coal group includes all coal beds in the upper Williams Fork Formation above the Lion Canyon Sandstone Member (Hancock and Eby, 1930). Coal beds in the Lion Canyon coal group are not formally named, but where they exceed Reserve Base thickness they have been given bracketed numbers for identification purposes.

Chemical analyses of coal.--Chemical analyses were not available for coals from the Lion Canyon coal group in this quadrangle. However, it is believed that these coals are similar in rank to the Lion Canyon coal mined at the Montgomery Mine in the Meeker quadrangle to the southeast. Analyses for this coal are listed in table 1, and these analyses indicate that the coal is 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).

Lion Canyon Coal Group

Coal beds in the Lion Canyon coal group have been identified in several measured sections (Reheis, 1975) in the northeastern part of the quadrangle. Four of these coal beds are known to exceed Reserve Base thickness (5 feet or 1.5 meters), and only two coal beds, the Lion Canyon [1] and Lion Canyon [3], were identified at more than one location and have been isopached. The remaining two beds, the Lion Canyon [2] and Lion Canyon [4], were each identified at one location only and have been treated as isolated data points (see Isolated Data Points section of this report).

Lion Canyon [1] Coal Bed

The Lion Canyon [1] coal bed (plate 4) ranges in thickness from 5.0 to 5.5 feet (1.5 to 1.7 m) where measured at three locations along the outcrop in secs. 26 and 27, T. 5 N., R. 96 W.

Lion Canyon [3] Coal Bed

The Lion Canyon [3] coal bed (plate 4) has been identified at the north-central edge of the quadrangle where it is 6.0 feet (1.8 m) thick in sec. 21, T. 5 N., R. 96 W. This coal bed extends to the north into the northwest quarter of the Citadel Plateau 15-minute quadrangle where it has a measured thickness of 5.0 feet (1.5 m) in sec. 20, T. 5 N., R. 96 W.

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. For this reason, isolated data points are included on a separate plate for non-isopached coal beds (plate 7).

COAL RESOURCES

Data from outcrop measurements (Reheis, 1975) were used to construct outcrop, isopach, and structure contour maps of the coal beds in the southwest quarter of the Citadel Plateau 15-minute quadrangle.

Coal resources for Federal land were calculated using data obtained from the coal isopach maps (plate 4), the areal distribution and identified resources maps (plate 6), and the isolated data point maps (plate 7). The coal bed acreage (measured by planimeter), multiplied by the average isopached 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 used in calculating Reserve and Reserve Base tonnages as 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 Lion Canyon [1] and Lion Canyon [3] coal beds are shown on plate 6, 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 the areas influenced by the isolated data points (Lion Canyon [2] and Lion Canyon [4] coal beds, plate 7).

Coal Reserve Base tonnages per Federal section are shown on plate 2 and total approximately 3.28 million short tons (2.98 million metric tons) for the entire quadrangle, including the tonnages from 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. The source of each indexed data point shown on plate 1 is listed in table 4.

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 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.

Unknown development potentials have been assigned to those areas where coal data is absent or extremely limited, including areas influenced by isolated data points. Even though these areas may contain coal thicker than 5 feet (1.5 m), limited knowledge of 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 the isolated data points in this quadrangle contain approximately 0.55 million short tons (0.50 millon metric tons) of coal available for surface mining.

The coal development potential for surface mining methods is shown on plate 8. Of the Federal land areas having a known development potential for surface mining, all are rated as 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 where the coal beds of Reserve Base thickness lie between 200 feet (61 m) and 3,000 feet (914 m) below the ground surface, having dips of 15° or less, are usually considered to have development potential for conventional subsurface mining methods. In this quadrangle, all known coal beds of Reserve Base thickness have dips greater than 15°. Therefore, all Federal lands have been rated as having unknown development potential for conventional subsurface mining methods.

Unfaulted coal beds lying between 200 feet (61 m) and 3,000 feet (914 m) below the ground surface, dipping greater than 15°, are considered to have a development potential for in-situ mining methods.

Based on criteria provided by the U.S. Geological Survey, coal beds of Reserve Base thickness dipping between 35° and 90° with a minimum Reserve Base of 70 million short tons (63.5 million metric tons) of subbituminous coal or 50 million short tons (45.4 million metric tons) of bituminous coal have a moderate potential for in-situ development. Coal beds dipping from 15° to 35°, regardless of tonnage, and coal beds dipping from 35° to 90° with less than 50 million short tons (45.4 million metric tons) of coal have a low development potential for in-situ mining methods. Coal lying between the 200-foot (61-m) overburden line and the outcrop are not included in the total coal tonnages available for in-situ mining because they are needed for cover and containment in the in-situ process.

Areas classified as having development potential for in-situ mining methods are shown on plate 9. Since the dips of the coal beds in these areas exceed 15° and the total Reserve Base tonnage is only 2.47 million short tons (2.24 million metric tons), all of the Federal land areas having a known development potential have been rated low for in-situ mining methods. The remaining Federal land areas within the KRCRA boundary have been classified as having an unknown development potential for in-situ mining methods.

Table 1. -- Chemical analyses of coals in the southwest quarter of the Citadel Plateau 15-minute quadrangle, Moffat County, Colorado.

Location	Coal Group Name	Form of Analysis	Proximate				Ultimate					Heating Value	
			Moisture	Volatile Matter	Fixed Carbon	Ash	Sulfur	Hydrogen	Carbon	Nitrogen	Oxygen	Calories	Btu/Lb
NW¼, sec. 29, T. 1 N., R. 94 W., Montgomery Mine (Hancock and Eby, 1930) from Meeker quadrangle	Lion Canyon	A	12.4	38.6	42.9	6.1	0.71	5.38	62.61	1.33	23.84	5,995	10,790
		B	10.6	39.4	43.7	6.3	0.72	5.27	63.89	1.36	22.50	6,115	11,010
		C	-	44.1	48.9	7.0	0.81	4.58	71.45	1.52	14.64	6,840	12,320
		D	-	47.4	52.6	-	0.87	4.92	76.83	1.63	15.75	7,355	13,240

Form of Analysis: A, as received
B, air dried
C, moisture free
D, moisture and ash 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 southwest quarter of the Citadel Plateau 15-minute quadrangle, Moffat County, Colorado.

Coal Bed or Zone	High Development Potential	Moderate Development Potential	Low Development Potential	Unknown Development Potential	Total
Lion Canyon {3}	30,000	40,000	110,000	-	180,000
Lion Canyon {1}	10,000	20,000	50,000	-	80,000
Isolated Data Points	-	-	-	550,000	550,000
Totals	40,000	60,000	160,000	550,000	810,000

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

Table 3. -- Coal Reserve Base data for in-situ mining methods for Federal coal lands (in short tons) in the southwest quarter of the Citadel Plateau 15-minute quadrangle, Moffat County, Colorado.

Coal Bed	Moderate Development Potential	Low Development Potential	Unknown Development Potential	Total
Lion Canyon {3}	-	370,000	-	370,000
Lion Canyon {1}	-	30,000	-	30,000
Isolated Data Points	-	-	2,070,000	2,070,000
Totals	-	400,000	2,070,000	2,470,000

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	Reheis, compiler, 1975, U.S. Geological Survey, unpublished map	Measured Section
2		Measured Section
3		Measured Section
4		Measured Section
5		Measured Section
6		Measured Section
7		Measured Section
8		Measured Section

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