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COAL RESOURCE OCCURRENCE MAPS

OF THE

TAYFOYA CANYON QUADRANGLE,

RIO ARRIBA COUNTY, NEW MEXICO

[Report includes 6 plates]

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TAYFOYA CANYON 7 1/2-MINUTE QUADRANGLE

INTRODUCTION

Purpose

This text is to be used in conjunction with the Coal Resource Occurrence (CRO) Maps of the Tayfoya Canyon quadrangle, Rio Arriba County, New Mexico. These maps were compiled to provide a systematic coal resource inventory of Federal coal lands in Known Recoverable Coal Resource Areas (KRCRA's) of the western United States. The work was performed under contract with the Conservation Division of the U.S. Geological Survey (Contract No. 14-08-0001-17172).

The resource information gathered in this program is in response to the Federal Coal Leasing Amendments Act of 1976 and is part of the U.S. Geological Survey's coal program. The information provides basic data on coal resources for land-use planning purposes by the Bureau of Land Management, state and local governments, and the public.

Location

The Tayfoya Canyon 7 1/2-minute quadrangle is located in southwestern Rio Arriba County, New Mexico. The area is bounded on the east by the Jicarilla Apache Indian Reservation and is located approximately 50 miles (80 km) southeast of Farmington and 88 miles (142 km) northeast of Gallup, New Mexico.

Accessibility

The Tayfoya Canyon quadrangle is accessible from State Route 403 which extends north to south across the center of the area. A light-duty road and numerous unimproved dirt roads throughout the area provide access to remote parts. The Atchison, Topeka, and Santa Fe Railway operates a route approximately 88 miles (142 km) to the southwest which passes through Gallup, New Mexico, and extends southeast and southwest.

Physiography

The quadrangle is in the Central Basin area (Kelley, 1950) of the structural depression, the San Juan Basin. The area is part of the Largo Plains physiographic sector as described by Baltz (1967), and is characterized by mesas and intermittent streams which have dissected the former broad plains. Elevations range from 6,320 ft (1,926 m) in the stream channel of Canon Largo to 7,100 ft (2,164 m) at the extreme southwest corner of the quadrangle.

Canon Largo and its tributaries are the dominant physiographic features in this quadrangle. These intermittent streams exhibit a dendritic drainage pattern, and the general direction of drainage is to the north. The topography to the south and to the west of Canon Largo is characterized by steep-walled canyons, broad valleys with intermittent streams, and mesas. The topography to the north and to the east of Canon Largo is typified by more gentle slopes and narrow stream valleys, with the exception of Canada Larga.

Climate

The climate of the San Juan Basin is arid to semi-arid. Annual precipitation is usually less than about 10 inches (25 cm), but varies across the basin due to elevational differences. Rainfall is rare in the early summer and winter; most precipitation occurs in July and August as intense afternoon thundershowers. Annual temperatures range from below 0°F (-18°C) to over 100°F (38°C) in the basin. Snowfall may occur from November to April with an average of 18 inches (46 cm) in the southern part of the basin.

Land Status

Approximately 71 percent of the quadrangle is in the eastern portion of the San Juan Basin Known Recoverable Coal Resource Area. The Federal Government owns the coal rights for approximately 82 percent of the KRCRA land as shown on Plate 2 of the Coal Resource Occurrence Maps. No Federal coal leases occur within the quadrangle.

GENERAL GEOLOGY

Previous Work

Fassett and Hinds (1971) have published subsurface interpretations of Fruitland Formation coal deposits throughout the San Juan Basin.

Geologic History

The San Juan Basin, an area of classic transgressive and regressive sedimentation, provided the ideal environment for formation of coals during Late Cretaceous time. At that time a shallow epeiric sea which trended northwest-southeast was northeast of the basin. The sea transgressed southwesterly into the basin area and regressed northeasterly numerous times; consequently, sediments from varying environments were deposited across the basin. Noncarbonaceous terrestrial deposition predominated during Paleocene and Eocene time.

Depositional evidence of the final retreat of the Late Cretaceous sea are the nearshore regressive Pictured Cliffs Sandstone and the overlying paludal Fruitland Formation which were deposited in successively higher stratigraphic positions to the northeast. Southwest (shoreward) of the beach deposits, swamps, which were dissected by streams, accumulated organic matter which later became coals in the Fruitland. Deposition of organic material was influenced by the strandline as shown by greater continuity of the coal beds parallel to the northwest-southeast strandline and discontinuity perpendicular to it to the northeast.

The brackish-water swamp environment of the Fruitland moved farther to the northeast as the regression continued in that direction. Terrestrial sediments covered the quadrangle, with deposition of lacustrine, channel, and floodplain sediments of the Kirtland Shale. This sequence of events is evidenced by both an upward decrease in occurrence and thickness of Fruitland coals and a gradational change to noncarbonaceous deposits of the Kirtland. Continuous deposition during Late Cretaceous time ended with the

Kirtland. The sea then retreated beyond the limits of the quadrangle area, and modern basin structure began to develop. An erosional unconformity developed in a relatively short time as part of the Cretaceous Kirtland Shale was removed.

Terrestrial deposition resumed in the Paleocene as represented by the Ojo Alamo Sandstone and the overlying Nacimiento Formation. Alluvial plain and floodplain deposits of the Ojo Alamo were followed by the thick, lithologically varied deposits of the Nacimiento during continuous nonmarine deposition. The Nacimiento was later exposed to erosion.

The Eocene San Jose Formation was subsequently deposited over the Nacimiento erosional surface, reflecting various nonmarine environments which developed across the basin. Deposition and structural deformation of the basin then ceased, and the warped strata of the San Juan Basin have been exposed to the present time.

Stratigraphy

The formations studied within this quadrangle range from Late Cretaceous to Eocene in age. They are, in order from oldest to youngest: the Pictured Cliffs Sandstone, Fruitland Formation, Kirtland Shale, Ojo Alamo Sandstone, Nacimiento Formation, and San Jose Formation. A composite columnar section on CRO Plate 3 illustrates the stratigraphic relationships of these formations and is accompanied by lithologic descriptions of the individual formations.

The Pictured Cliffs Sandstone is approximately 75 ft (23 m) thick in this quadrangle. Because the unit is present throughout most of the San

Juan Basin and displays a distinctive character on geophysical logs, the top was picked as the datum (CRO Plate 3) for Fruitland coal correlations. The formation consists of light gray, slightly calcareous, kaolinitic sandstone with interbedded gray to brown, sandy shale near the base.

The major coal-bearing unit in the quadrangle is the Fruitland Formation. Wide variations in reported thickness are common due to an indistinct upper contact of the Fruitland Formation with the Kirtland Shale, but the average is about 180 ft (55 m) in this quadrangle. Several authors have utilized various criteria for establishing the upper contact, but, in general, for this study the uppermost coal was chosen (after Fassett and Hinds, 1971). The formation consists primarily of gray-green to brown, carbonaceous, clayey shale with plant fossils, interbedded sandstone to siltstone, and lenticular coal beds.

The Upper Cretaceous Kirtland Shale in this area averages 230 ft (70 m) in thickness. It is predominantly a gray-green to gray-brown, locally sandy, freshwater shale. The formation has previously been divided into several members by various authors; however, for the purposes of this report it was not necessary to distinguish between the individual members.

The Paleocene Ojo Alamo Sandstone, which unconformably overlies the Kirtland Shale, is a light gray, locally conglomeratic, slightly calcareous sandstone with traces of pyrite, and interbedded shale. It averages 90 ft (27 m) in thickness.

Approximately 1,260 ft (384 m) of the Paleocene Nacimiento Formation overlie the Ojo Alamo Sandstone. These rocks consist of gray-green to dark red to brown claystone and interbedded light gray, slightly calcareous and micaceous sandstone with traces of pyrite, and interbedded gray shale.

The San Jose Formation of Eocene age unconformably overlies the Nacimiento Formation and crops out over the entire quadrangle area. It is predominantly gray to gray-green shale, interbedded white to buff, locally conglomeratic sandstone, and interbedded gray to brown siltstone and claystone.

Structure

The axis of the San Juan Basin is about 14 miles (23 km) northeast of the Tayfoya Canyon quadrangle area and trends in an arcuate pattern across the northern portion of the Central Basin area (Baltz, 1967). Regional dip within the quadrangle is 1° to 2° to the northeast.

COAL GEOLOGY

One coal zone (Fruitland) was identified in the subsurface of this quadrangle. The coal beds of the Fruitland Formation were designated as the Fruitland coal zone (Fr zone) because they are generally discontinuous, noncorrelative, and less than reserve base thickness (5 ft [1.5 m]) as set by the U.S. Geological Survey; exceptions are a 5-ft (1.5-m) coal bed in drill holes 1 and 28 (CRO Plate 3).

Fruitland Formation coals in the southern part of the San Juan Basin are considered high volatile A to B bituminous. The rank of the coal has been determined on a moist, mineral-matter-free basis with calorific values ranging from 13,494 to 14,227 Btu's per pound (31,387-33,092 kj/kg) (Amer. Soc. for Testing and Materials, 1977). The coal is hard, brittle, and black with a bright luster. The coal readily slakes with exposure to weather; however, it stocks fairly well when protected. The "as received" analyses indicate moisture content varying from 3.6 to 5.7 percent, sulfur content less than one percent, ash content ranging from 13.5 to 24.5 percent, and heating values on the order of 11,370 Btu's per pound (11,372 kj/kg). Analyses of several Fruitland Formation coal beds are given in Table 1 (Bauer and Reeside, 1921; Dane, 1936; Fassett and Hinds, 1971).

Fruitland Coal Zone

The Fruitland coal zone extends from the top of the Fruitland Formation to the base of the lowermost coal designated on CRO Plate 3 as a Fruitland zone coal bed. The structure contour map (CRO Plate 5) was, therefore, constructed using the top of the Fruitland Formation. The coal zone dips approximately 1° to the northeast. As a result of topography and dip, overburden (CRO Plate 6) ranges from less than 1,800 ft (549 m) in the south in portions of Escrito Canyon, Venou Canyon, and Rincon Largo to greater than 2,400 ft (732 m) in the north. Also shown on CRO Plate 6 is the the total amount of interburden, which is the noncoal-bearing portion of the coal zone. The interburden thickness ranges from zero to greater than 190 ft (46 m). This variation in thickness is the result of the number of coal beds and their stratigraphic position within the Fruitland zone. For example, a single Fruitland zone coal bed which is located at the top of the Fruitland Formation has no interburden; but, several beds which have a large stratigraphic spread will have a large interburden value. The isopach map (CRO Plate 4) illustrates the total thickness of the individual coal beds of the

TABLE 1

Analyses of coal samples from the Fruitland Formation

(Form of analysis: A, as received; B, moisture free; C, moisture and ash free)

U.S. Bureau Mines Lab No.	Well or Other Source	Location Section	T.N.	R.W.	Approx. Depth Interval of Sample (ft.)	Form of Analysis	Proximate, percent Moisture	Volatile matter	Fixed Carbon	Ash	Sulfur	Heating Value (Btu)	Remarks
H-16309	Val Reese & Assoc. Betty "B" No. 1-15.	NW¼ 15	23	7	2,180-2,195	A	5.7	39.3	40.8	14.2	0.6	11,410	
						B	----	41.7	43.3	15.0	0.7	12,100	
						C	----	49.1	50.9	----	0.8	14,240	
H-22075	Val Reese & Assoc. Bobby "B" No. 2-31.	NE¼ 31	24	6	2,070-2,090	A	3.6	41.1	40.6	14.7	0.7	11,840	
						B	----	42.6	42.2	15.2	0.7	12,280	
						C	----	50.2	49.8	----	0.9	14,480	
H-31101	Val Reese & Assoc. Lybrook No. 7-27.	NE¼ 27	24	7	2,140-2,150	A	4.4	40.9	41.2	13.5	0.6	11,790	
						B	----	42.8	43.1	14.1	0.6	12,340	
						C	----	49.9	50.1	----	0.7	14,370	
H-37832	Merrion & Assoc. Federal No. 3-35.	SW¼ 35	25	6	2,455-2,465	A	3.6	36.3	35.6	24.5	0.8	10,440	
						B	----	37.7	36.9	25.4	0.8	10,830	
						C	----	50.5	49.5	----	1.1	14,510	

To convert Btu's/lb to kj/kg, multiply Btu's/lb by 2.326.
To convert feet to meters, multiply feet by 0.3048.

Fruitland zone. The combined thickness is greater than 30 ft (9.1 m) in the southeast. The coal is absent in several areas in the northern part of the quadrangle.

Chemical analyses of the Fruitland zone coal beds - Analyses of several coal beds of the Fruitland Formation from this quadrangle and the surrounding area were published by Fassett and Hinds (1971). The results of these analyses are given in Table 1.

COAL RESOURCES

Coal resource data from oil and gas wells (El Paso Natural Gas Co., 1978, unpublished data in well log library in Farmington, New Mexico) were used in the construction of the isopach and structure contour maps of the coal in this quadrangle. Coal resources were not calculated for the Fruitland zone coals because the coals are discontinuous, noncorrelative, and generally less than the reserve base thickness of 5 ft (1.5 m).

COAL DEVELOPMENT POTENTIAL

Coal development potential maps were not constructed for this quadrangle because the coal beds are generally less than the reserve base thickness (5 ft [1.5 m]) and, therefore, have unknown coal development potential.

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