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COAL RESOURCES OF SOCORRO COUNTY NEW MEXICO

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INTRODUCTION

Coal-bearing strata crop out in the northwest corner of Socorro County in the Datil Mountains coal field and in the east-central part of the county in the Jornada del Muerto and Carthage coal fields (fig. 1). In addition, small isolated coal outcrops occur in northeastern Socorro County on the Sevilleta Wildlife Refuge near the village of La Joya (fig. 1). In all areas in the county, potential coal resources are present in the Crevasse Canyon Formation with the thickest coal beds occurring in the lower part of the formation.

DEPOSITIONAL SETTING

Coals are found in two Upper Cretaceous formations in central New Mexico: the Tres Hermanos Formation and the Crevasse Canyon Formation. Both formations provide a record of sedimentation shoreward of a regressing seaway. Coals present in the Tres Hermanos Formation seldom exceed 60 cm in thickness and are more commonly 15 to 30 cm thick with limited areal extent. Tres Hermanos coals, therefore, have very limited resource potential.

Coals in the Crevasse Canyon Formation in central New Mexico represent a modest resource. The coals are concentrated, though not confined to, the lowest 125 m of the formation. The Crevasse Canyon Formation comprises a sequence of predominantly fine-grained sedimentary rocks, associated coals, and thin fluvial sandstones. The formation can be effectively divided into three parts: a lower coastal swamp sequence about 125 m thick, a middle coastal plain sequence about 90 m thick, and an upper fresh-water swamp sequence that may be as much as 125 m thick in Socorro County. Thin channel sandstones occur in the lowest part of the formation and sandstones as much as 12 m thick occur in the highest portion of the formation exposed in the eastern part of the Datil Mountains coal field.

The coal beds in the Crevasse Canyon Formation in Socorro County are typical of coals deposited in environments with strong fluvial influence. They are thin and discontinuous with strike lengths generally less than a kilometer, but of excellent quality.

The majority of coal beds encountered in the eastern part of the Datil Mountains coal field are around 70 cm thick. This estimate of thickness is based on 20 holes drilled on 1.8-km centers on the Crevasse Canyon outcrop belt and on detailed surface mapping throughout the area. Coal beds as much as 1.3 m thick have been observed during both surface and subsurface mapping; however, coal beds this thick appear to be uncommon in the eastern part of the Datil Mountains coal field. More closely spaced drilling could better define areas of thicker coals. Resources for the eastern part of the Datil Mountains coal field based largely on a recent open-file report (Osbum, 1982) are presented in Table 1.

Maximum thickness of coal beds exposed at the surface in the Jornada del Muerto coal field is 70 cm. However, two holes drilled in the field and the coal bed worked in the Law mine show that coals as much as 1.2 m thick are present in the subsurface (Tabet, 1979). More exploratory drilling must be done, especially in the southern part of the field, before a resource estimate can be made.

The minable coal bed in the Carthage coal field ranges from 1.5 to 1.8 m in thickness. Little is known about the total amount of coal already mined in eastern Socorro County. Upper Cretaceous rocks present in the Carthage area have not been mapped in detail. It would, therefore, be meaningless to present a resource estimate for any of the coal-bearing areas in eastern Socorro County.

MINING HISTORY

Coal mining activity in Socorro County has been recorded intermittently from 1856 to 1980. Production reported by state and federal inspectors has been concentrated in the Carthage coal field (fig. 2). There are, however, a number of small mines and prospects scattered

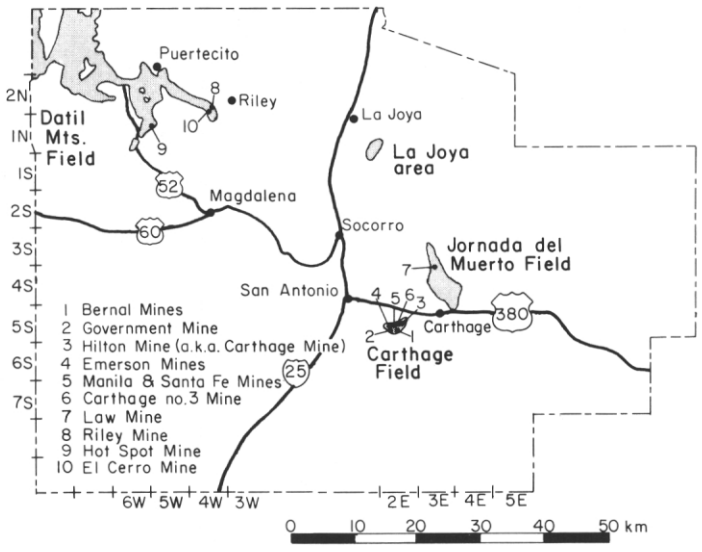

Figure 1. Coal-bearing areas in Socorro County (gray). Locations of historic coal mines indicated by number and then listed at lower left.

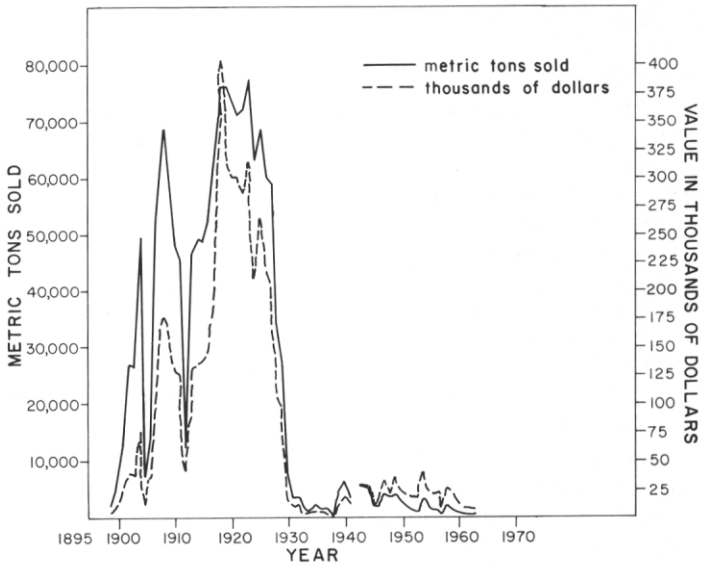

Figure 2. Coal production in Socorro County shown in metric tons and dollar value.

Table 1. Demonstrated coal resources in the eastern part of the Datil Mountains coal field, Socorro County, New Mexico (in millions of metric tons, all values rounded, 1800 short tons/acre-foot used in calculations then converted to metric tons, maximum depth = 107 m).

Location Twp.	Rge.	Measured Resources Thickness of coal bed, in cm 37-70	70-107	>107	Indicated Resources Thickness of coal bed, in cm 37-70	70-107	>107	Demonstrated Resources measured & indicated
1N.	3W.	0.23	-	-	-	-	-	0.23
1N.	4W.	0.54	-	-	-	-	-	0.54
1N.	5W.	0.74	-	-	-	-	-	0.74
1N.	6W.	1.71	-	-	-	-	-	1.71
2N.	4W.	2.08	-	-	-	-	-	2.08
2N.	5W.	0.66	0.40	-	-	-	-	1.06
2N.	6W.	3.12	0.52	0.47	9.73	1.59	-	15.43
2N.	7W.	2.19	0.87	1.16	8.85	3.62	6.77	23.46
3N.	7W.	1.77	0.16	0.24	7.30	-	-	9.47
4N.	7W.	2.56	1.07	1.36	5.19	1.76	4.91	16.85
4N.	8W.	1.39	1.48	-	0.55	1.13	-	4.55
Totals		16.99	4.50	3.23	31.62	8.10	11.68	76.12
		measured - 24.72			indicated - 51.40			

throughout the county on which no production records are known. Most of the data presented here was gleaned from reports of the New Mexico State Mine Inspector and the New Mexico State Coal Mine Inspector from 1899 to the present, unless otherwise stated.

In the Carthage coal field, only one minable coal bed exists and it is known as the Carthage coal bed. There are no surviving production records prior to 1899. All of the mines were worked underground by the room and pillar method. The Carthage coal bed dips from 12° to 35° and was often difficult to follow due to faulting. These problems caused the demise of a number of very short-lived mining ventures and greatly modified the normal grid associated with room and pillar mining (fig. 3). The coal was sold throughout the Rio Grande valley, in El Paso, and in markets in Mexico (Gardner, 1910).

Carthage coals are of excellent quality and to this end the San Pedro Coal and Coke Company (an Atchison, Topeka, and Santa Fe subsidiary) operated coke ovens in San Antonio beginning in the early 1880's (Marshall, 1945). The Atchison, Topeka, and Santa Fe Company built the San Pedro Branch east from San Antonio to the coalfield in the spring of 1882. The San Pedro Branch was abandoned in February 1896 because of persistent rumors that the Carthage coal reserves were depleted. In 1902, Holm Bursum of the Carthage Coal Company wrote the management of the AT&SF requesting that the San Pedro Branch be rebuilt (Bursum papers). Bursum's request was denied as an unprofitable venture for the railroad. Hence, from 1896 to 1906, all coal produced in Carthage was shipped about 19 km by wagon to San Antonio to the main line of the Atchison, Topeka and Santa Fe. In 1906, the New Mexico Midland Railroad was built by the Carthage Fuel Company which operated the Hilton, Government, and Bernal mines, thus connecting selected Carthage mines with the Santa Fe main line (fig. 4). The New Mexico Midland Railroad operated until 1931 when mining declined drastically in the Carthage coalfield (Myrick, 1970).

From 1900 to 1918 the Hilton, Government, Bernal, and Emerson mines provided the reported production in the county. However, several other small mines are known to have been worked in the area during this time period although no production data has survived for them. These mines include the McIntyre mine that operated from 1904 to 1907 and the Gap mine that operated from 1909 through 1911. The

Figure 3. Mine map circa 1888 of the Manila (left) and Santa Fe mines, located at SW1/4 SW1/4 sec. 10, T5S, R2E, showing highly modified room and pillar pattern. All of the dotted and hachured lines are faults.

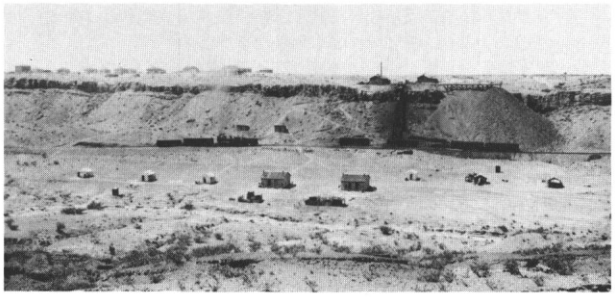

Figure 4. The New Mexico Midland Railroad loading at the Kinney Mines, Tokay, New Mexico, circa 1918. The Gallup Sandstone forms the prominent ledge below the townsite. Photo courtesy of Museum of New Mexico, Santa Fe, NM.

operators of the Emerson mine continued to haul their coal to Sat Antonio by wagon until 1915 when the mine intersected a major faul which cut out the coal bed causing the mine to cease operations.

In 1918, B. H. Kinney became the primary operator in the Carthage area producing more than 34,000 metric tons per year until 1929 whet production decreased dramatically. The Kinney mine continued pro. ducing on a small scale until 1950. In the early 1920's, the Carthage Fuel Company operated only the Government mine where pillars wen robbed in 1923 and the mine was closed in 1924. The Carthage No. mine was being developed during the same time period by the Carthage Fuel Company and reported 16,300 metric tons of production in 1925 This mine continued producing through 1967 supplying local market! such as the Albuquerque school system and Socorro public building! (Kiraly, 1983).

Coal production plunged during the 1930's and the Carthage mine never returned to pre-Depression production levels. The Kinney mine were the only producing mines from 1926 through 1935. The Stan Mine Inspector's Report stopped listing individual mine productior figures in 1936 when they began giving only county production figures Therefore, from 1936 on, accurate production figures are possible onl) when but one mine in the county was producing in a given year. Ir 1936 through 1939, both the Kinney mine and the Hart mine operate(in the Carthage area until the Hart mine was closed in 1939. Othei mines that operated in the Carthage area in the 1940's and 1950' included the San Antonio, Desoto, Cortez, and Aguilar mines, none 01 which operated for more than 3 consecutive years. By 1954, the on!) working mine in the Carthage field was the Carthage No. 3 mine operated by A. B. Baca of Socorro until 1967. Mining ceased primaril) because of a widespread switch to natural gas, not necessarily because of depleted coal reserves. The final venture known in the Carthage fielc was the Tres Hermanos mine which opened in 1980 but ceased oper- ations within the year because of an original overestimation of reserve (Martinez, 1981).

Tabet (1979) reports two small mines in the Jornada del Muerto coa field, north of Carthage. Federal records identify one mine as the Lam mine which operated in the late 1920's on a 1.2-m coal bed. No date was found on the other Jornada mine.

Much less is known about the coal mining activity in the eastern par of the Datil Mountains coal field. The three known mines probabl) supplied residents at Riley and Magdalena with domestic fuel and pos. sibly fueled the smelters in Magdalena as well. These are the Riley, E Cerro, and Hot Spot mines.

The Riley mine was located about 1.6 km southwest of the Rile) townsite and operated from 1939 intermittently until 1949. The coa bed is in the lower part of the Crevasse Canyon Formation and wae reported to be as much as 1.4 m thick (Frost and others, 1979). Pro- duction, estimated at a few hundred tons, was certainly hampered b) closely spaced faults and Tertiary intrusions common to the Riley area.

The El Cerro mine is located about 5 km southwest of Riley and was mined from 1917 to 1940. The mine produced 715 metric tons from an upper Crevasse Canyon coal bed ranging from 45 to 70 cm in thickness (Frost and others, 1979).

The Hot Spot mine, located west of Abbe Spring Canyon, produced 77 metric tons from a thin seam in the upper Crevasse Canyon Formation during the period from 1927 to 1931. Small-scale, closely spaced fault- ing probably forced the mine to close.

COAL QUALITY

The quality of coals in Socorro County is generally very good. Based on 41 published analyses, heating value ranges from 10,030 to 14,950 BTU/lb. (as received), the percentage of sulfur is consistently less than one percent, and the ash content is less than 14 percent (Table 2).

Coal analyses in the Carthage coal field are limited to 19 pre-1925 U.S. Bureau of Mines analyses (Ellis, 1936) and one recent channel sample from the Hart mine (Tabet, 1979). Seven of the early analyses consist of proximate and sulfur analyses only. Calculation of apparent coal ranks on Carthage samples yield a rank of high-volatile A bitu- minous coal according to ASTM standards (1980).

Samples analyzed from the eastern part of the Datil Mountains coal field consist of five samples analyzed by the by the U.S. Bureau of Mines prior to 1925 (Ellis, 1936) and 15 recent, commercially analyzed samples (Osburn, 1982). It should be emphasized that all of these samples fall in the range of high-volatile B bituminous coals. These recent analyses are significant because the Datil Mountains coals have previously been categorized as subbituminous rank coals (Read and others, 1950; Trumbull, 1960). There are *no* published analyses that support a subbituminous coal rank. It is presumed that this miscon- ception was based on unpublished analyses of grab samples of outcrop coals.

CONCLUSIONS

There are still more unknowns than facts about the coal resource potential of Socorro County. Additional exploratory drilling would be

Table 2. Average chemical analyses of Socorro County coals by field.

	Carthage coal field		Eastern Datil Mtns. coal field	
number of samples*	20		20	
	mean percent	Std. dev.	mean percent	std. dev.
Moisture	3.3	1.4	6.1	5.6
Volatile matter	37.7	3.4	38.0	3.5
Fixed Carbon	51.3	5.0	45.0	6.2
Ash	11.5	3.0	12.5	5.6
Sulfur	0.9	0.1	0.6	0.1
Hydrogen	5.3	0.4	5.0	0.5
Carbon	73.7	6.2	65.4	7.2
Nitrogen	1.4	0.2	1.1	0.2
Oxygen	10.8	3.2	12.4	6.5
BTU/lb.	13,069	1,004	11,602	1,426

* 35 percent of Carthage analyses comprise proximate analysis plus sulfur. In these cases, number of samples is 13.

valuable in both the Jornada del Muerto and the Datil Mountains coal fields. The most favorable factors about the coal in Socorro County are high heating values and low sulfur and ash values. This resource would probably be best utilized locally for municipal and domestic heating, or perhaps at a local smelter. The overall tonnages available are small when compared to coal resources in northwestern and northeastern New Mexico. Development will depend largely on local economic factors.

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Assay lab and sampling department, Billing smelter, ca 1885. The plant metallurgist was all-important to the financial success of any smelting works: the reputation of the business rested in large part on his honesty and expertise, while ores were purchased and furnace charges made up on the basis of his analyses. Pictured here is doubtless Mr. Furman, "knight of the crucible and tongs" who would later become a prominent metallurgist in his own right, and his laboratory assistant. Photo by Joseph E. Smith, courtesy Ed Smith; New Mexico Bureau of Mines and Mineral Resources collection.