

UNITED STATES DEPARTMENT OF THE INTERIOR
GEOLOGICAL SURVEY

Text to accompany:

OPEN-FILE REPORT 79-1122

1985

FEDERAL COAL RESOURCE OCCURRENCE AND COAL DEVELOPMENT POTENTIAL MAPS
OF THE MESA DE LOS TOROS 7 1/2-MINUTE QUADRANGLE,
McKINLEY COUNTY, NEW MEXICO

[Report includes 12 plates]

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MESA DE LOS TOROS QUADRANGLE
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INTRODUCTION

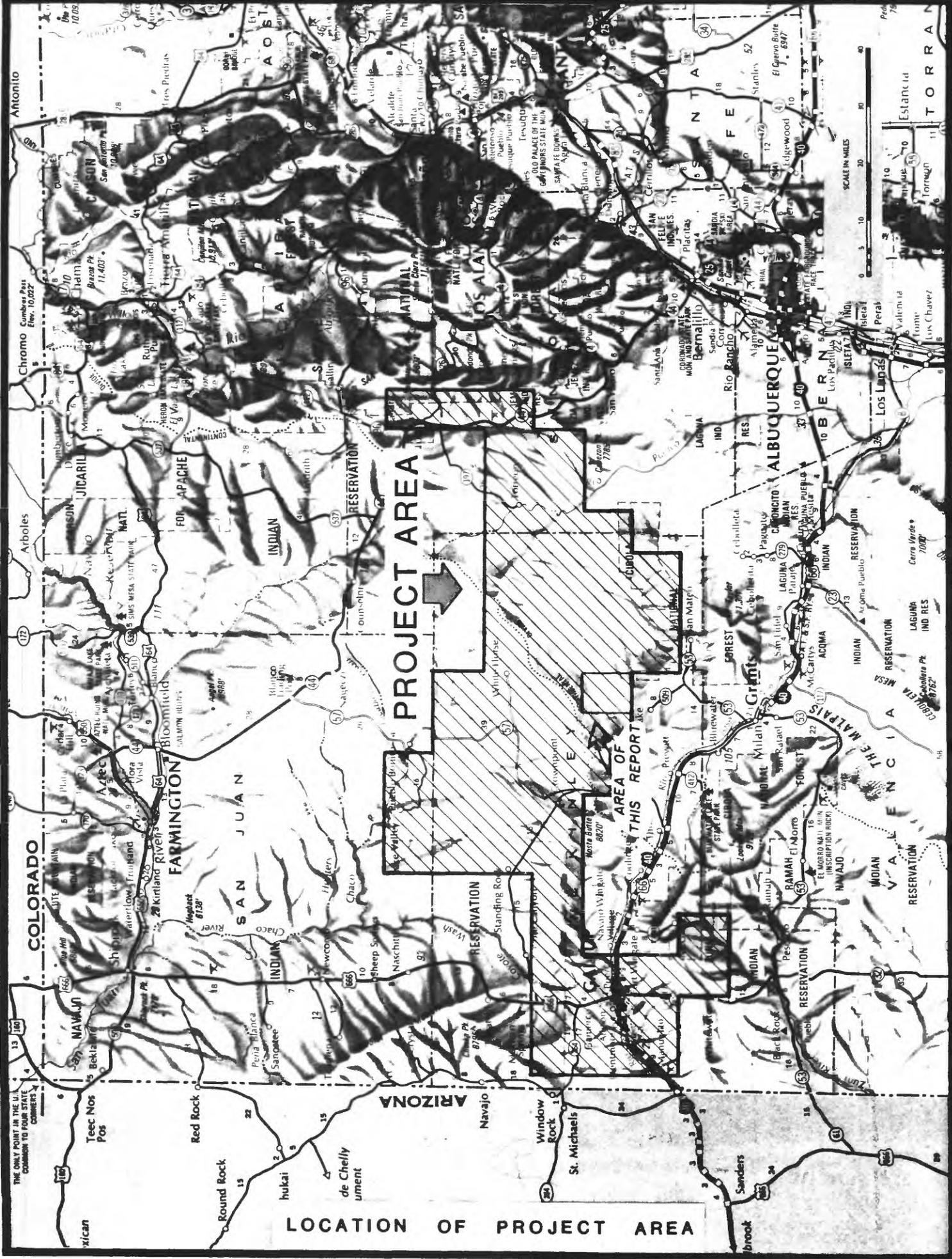
Purpose

This text complements the Coal Resource Occurrence (CRO) and Coal Development Potential (CDP) maps of the Mesa de los Toros 7 1/2 minute quadrangle, McKinley County, New Mexico. These maps and report are part of an evaluation of fifty-six 7 1/2 minute quadrangles in northwestern New Mexico, which were completed under U. S. Geological Survey Contract No. 14-08-0001-17459 (see figs. 1 and 2).

The purpose of this Coal Resource Occurrence-Coal Development Potential program, which was conceived by Congress as part of its Federal Coal Leasing Amendments Act of 1976, is to obtain coal resource information and to determine the geographical extent of Federal coal deposits. In addition, the program is intended to provide information on the amount of coal recoverable by various mining methods and to serve as a guide for land-use planning.

The U. S. Geological Survey initiated the program by identifying areas underlain by coal resources. These areas were designated Known Recoverable Coal Resource Areas based on the presence of minable coal thicknesses, adequate areal extent of these coal deposits, and the potential for developing commercial quantities of coal at minable depths.

This report is limited to coal resources which are 3,000 ft (914 m) or less below ground surface. Published and unpublished public information was used as the data base for this study. No new drilling or field mapping was performed as part of this study, nor were any confidential data used.

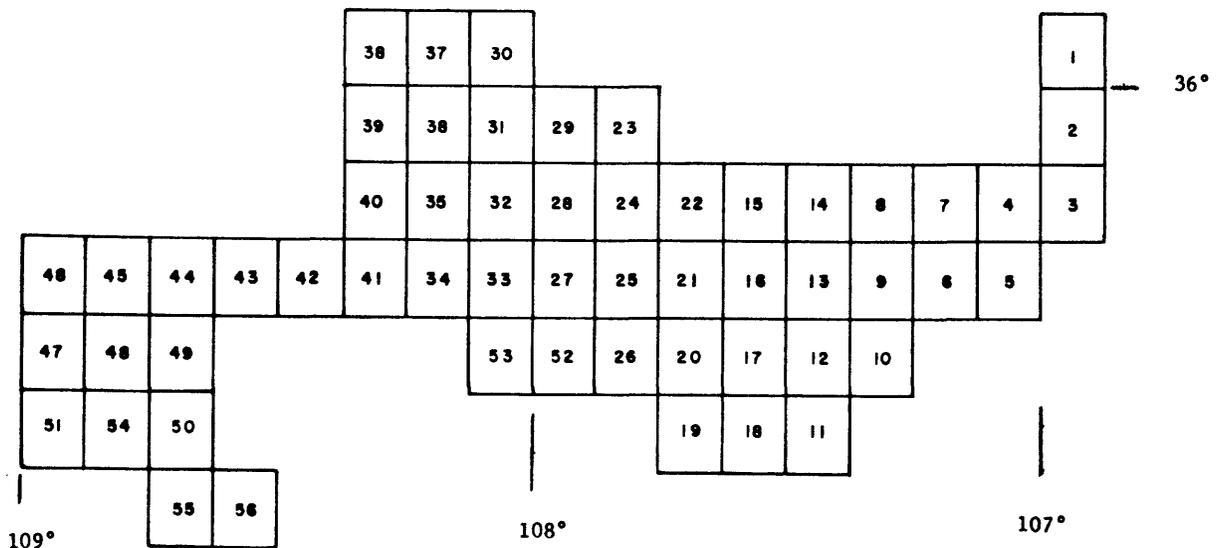


LOCATION OF PROJECT AREA

FIGURE 1

FIGURE 2.--Index to USGS 7 1/2-minute quadrangles and coal resource occurrence/
coal development potential maps for the southern San Juan Basin area, New Mexico

Map No.	Quadrangle	Open-file report	Map No.	Quadrangle	Open-file report
1	Cuba	79- 623	31	Nose Rock	79- 641
2	San Pablo	79- 624	32	Becenti Lake	79-1124
3	La Ventana	79-1038	33	Heart Rock	79- 642
4	Headcut Reservoir	79-1043	34	Crownpoint	79-1125
5	San Luis	79-1044	35	Antelope Lookout Mesa	79-1376
6	Arroyo Empedrado	79-1045	36	Milk Lake	79-1377
7	Wolf Stand	79-1046	37	La Vida Mission	79-1378
8	Tinian	79- 625	38	The Pillar 3 SE	79-1379
9	Canada Calladita	79- 626	39	Red Lake Well	79-1380
10	Cerro Parido	79- 627	40	Standing Rock	79-1381
11	El Dado Mesa	79- 628	41	Dalton Pass	80- 026
12	Mesa Cortada	79- 629	42	Oak Spring	80- 027
13	Mesita del Gavilan	79- 630	43	Hard Ground Flats	80- 028
14	Rincon Marquez	79- 631	44	Big Rock Hill	80- 029
15	Whitehorse Rincon	79- 632	45	Twin Lakes	80- 030
16	Mesita Americana	79- 633	46	Tse Bonita School	80- 031
17	El Dado	79- 634	47	Samson Lake	80- 032
18	Cerro Alesna	79- 635	48	Gallup West	80- 033
19	San Lucas Dam	79- 636	49	Gallup East	80- 034
20	Piedra de la Aguila	79-1039	50	Bread Springs	80- 035
21	Hospah	79- 637	51	Manuelito	80- 036
22	Whitehorse	79-1040	52	Borrego Pass	80- 037
23	Seven Lakes NE	79- 638	53	Casamero Lake	80- 038
24	Kin Nahzin Ruins	79- 639	54	Twin Buttes	80- 039
25	Orphan Annie Rock	79-1041	55	Pinehaven	80- 040
26	Mesa de los Toros	79-1122	56	Upper Nutria	80- 041
27	Laguna Castillo	79- 640			
28	Seven Lakes	79-1042			
29	Seven Lakes NW	79-1123			
30	Kin Klizhin Ruins	79-1047			



Location

The Mesa de los Toros 7 1/2 minute quadrangle includes acreage in Tps. 15 and 16 N., Rs. 9 and 10 W. of the New Mexico Principal Meridian, McKinley County, northwestern New Mexico (see figs. 1 and 2).

Accessibility

No paved roads pass through the Mesa de los Toros quadrangle. A light-duty, maintained road in the northwest corner of the quadrangle provides access to the town of Prewitt, 26 mi (42 km) SW of the area, and to the towns of Hospah and Whitehorse, 10 and 17 mi (16 and 27 km), respectively, NE of the area. Unimproved dirt roads traverse most parts of the quadrangle. The Atchison, Topeka, and Santa Fe Railroad line passes through Prewitt (see fig. 1).

Physiography

The Mesa de los Toros quadrangle is in the Navajo section of the southernmost part of the Colorado Plateau physiographic province (U. S. Geological Survey, 1965). The quadrangle is characterized by mesa-and-canyon topography. The Continental Divide crosses the northwest corner of the Mesa de los Toros quadrangle.

No perennial streams are present in the quadrangle. Local drainage is provided by several intermittent arroyos including Cañada Marcelina, Cañada Milpitas, and Cañada del Camino. Elevations within the quadrangle range from less than 6,780 ft (2,067 m) in the northeast corner to over 8,020 ft (2,444 m) at the southern boundary.

Climate

The climate of this area is semiarid to arid. The following temperature and precipitation data were reported by the National Oceanic and Atmospheric Administration for the San Mateo Station. The Mesa de los Toros quadrangle is about 12.5 mi (20.1 km) northwest of the San Mateo Station. Average total annual precipitation for ten of the previous fifteen years is 8.37 in. (21.26 cm). Intense thunderstorms in July, August, and September account for the majority of precipitation. The area is susceptible to flash flooding associated with these thunderstorms. Mean annual temperature for four of the previous fifteen years is 48.8⁰ F (9.3⁰ C). The average daily temperatures in January and July are 28.3⁰ F (-2.1⁰ C) and 69.0⁰ F (20.5⁰ C), respectively.

Land status

The Federal Government holds the coal mineral rights to approximately 30 percent of the Mesa de los Toros quadrangle. For the specific coal ownership boundaries, see plate 2. It is not within the scope of this report to provide detailed land-surface ownership. About 450 acres (182 ha) in the northwest part of the quadrangle are within the Hospah Known Recoverable Coal Resource

Area. Most of the remainder of the quadrangle is within the Crownpoint Known Recoverable Coal Resource Area. As of October 26, 1978, there were no Federal coal leases, coal preference right lease applications or coal exploration licenses within the Mesa de los Toros quadrangle.

GENERAL GEOLOGY

Previous work

Early reports on the area include that of Gardner (1909) who identified coal outcrops of the Gibson Coal Member in the the southern part of the Mesa de los Toros quadrangle. Hunt (1936) measured several coal beds from the Gibson Coal Member in the area. Shomaker, Beaumont, and Kottlowski (1971) estimated strippable Gibson Coal Member beds in Secs. 15, 16, 21, and 22, T. 15 N., R. 9 W. as 9.5 million short tons (8.6 million t). They noted that very little, if any, of these coal reserves could be recovered at a stripping ratio of 10:1. The sandstone overburden is between 150 and 250 ft (46 and 76 m) thick on these beds. They suggest that additional field work and one or two drill holes would refine these reserve estimates.

Stratigraphy

Within the San Juan Basin, the shoreline positions of the Cretaceous seaways changed innumerable times. The overall regional alignment of the shorelines trended N. 60° W.-S. 60° E. (Sears, Hunt, and Hendricks, 1941). The transgressive and regressive shoreline migrations are evidenced by the intertonguing relationships of continental and marine facies. Rates of trough (geosynclinal) subsidence and the availability of sediment supplies

are the major factors that controlled the transgressive-regressive shoreline sequences.

Exposed rock units in the Mesa de los Toros quadrangle include some of the sedimentary units of Upper Cretaceous age. There is Quaternary alluvium along drainages in the area. Coal beds have been identified only in the Gibson Coal Member of the Crevasse Canyon Formation in this quadrangle. The Gallup Sandstone is a prominent sandstone marker in most of the southern San Juan Basin and is the oldest Upper Cretaceous unit which crops out in the area.

A major northeastward regression of the Cretaceous seaways resulted in deposition of the Gallup Sandstone in a beach or littoral environment. The Gallup Sandstone is composed of pink to gray, fine to medium grained massive sandstone with interbedded gray shales, and averages 150 ft (46 m) thick locally. The Dilco Coal Member of the Crevasse Canyon Formation overlies the Gallup Sandstone and represents the continental deposits which formed inland from the beach area during deposition of the Gallup Sandstone. Medium to dark gray siltstone with interbedded medium grained, tan sandstones and coal beds comprise the lithologies of the Dilco Coal Member, which averages 80 ft (24 m) thick in the area.

Increased rates of trough subsidence caused the regressive sequence to gradually slow, and finally stop. The seaways deepened and the shorelines advanced southwestward during the succeeding transgressive phase. The Mulatto Tongue of the Mancos Shale overlies the Dilco Coal Member which formed from the marine sands, silts, and muds, and is composed of light gray to tan, silty shale with interbedded reddish-tan, very fine grained sandstone,

and averages 350 ft (107 m) thick in this area. A transitional contact of the Mulatto Tongue with the overlying Dalton Sandstone Member of the Crevasse Canyon Formation indicates the gradual reversal from transgressive to regressive depositional conditions.

The Dalton Sandstone Member is composed of yellowish-gray, very fine grained quartzose sandstone which formed in a nearshore environment and ranges from 80 to 150 ft (24 to 46 m) thick locally. The Gibson Coal Member of the Crevasse Canyon Formation overlies the Dalton Sandstone Member and represents the continental deposits which formed inland from the beach area during deposition of the Dalton Sandstone. Medium gray, carbonaceous siltstone with interbedded gray to tan sandstone and coal beds comprise the lithologies of the Gibson Coal Member, which ranges from 160 to 200 ft (49 to 61 m) thick in the area.

Increased rates of trough subsidence resulted in the gradual reversal from regressive to transgressive conditions, and the Hosta Tongue of the Point Lookout Sandstone was deposited during the advancing shoreline sequence. The Hosta Tongue overlies the Gibson Coal Member and is composed of light gray to reddish-brown, fine to medium grained sandstone with interbedded shales and ranges from 60 to 100 ft (18 to 30 m) thick locally.

As the transgression proceeded and the Cretaceous seaways deepened, the Satan Tongue of the Mancos Shale was deposited over the Hosta Tongue. The Satan Tongue is composed of light to dark gray, silty shale with interbedded tan to buff sandstone, and ranges from 0 to 230 ft (0 to 70 m) thick locally. The Satan Tongue pinches out near the southern quadrangle boundary, and the Hosta Tongue and overlying Point Lookout Sandstone merge into an undivided sandstone unit. The Point Lookout Sandstone represents nearshore or littoral deposits which formed during the most extensive northeastward

retreat prior to the final withdrawal of the Cretaceous seaways in the San Juan Basin (Sears, Hunt, and Hendricks, 1941). Lithology of the Point Lookout Sandstone is identical to the Hosta Tongue. It is about 120 ft (37 m) thick locally. The continental sediments deposited inland from the beach area during the deposition of the Point Lookout Sandstone compose the overlying Menefee Formation.

The Menefee Formation consists of dark gray to brown carbonaceous to noncarbonaceous shales, light gray sandstones, and coal beds, and is divisible into the basal Cleary Coal Member and upper Allison Member. A massive channel sandstone sequence defines the boundary between the two members. The Cleary Coal Member has been severely eroded in this quadrangle, and only the lowermost 50 ft (15 m) of the unit is exposed. The Allison Member is absent in this area.

Depositional environments

The Cretaceous System sedimentary units in the quadrangle represent transgressive and regressive depositional conditions. There were innumerable minor cycles of widely varying duration and extent within the major sedimentary sequences. The paucity of data in this quadrangle and the intended scope of this report permit only general interpretations of the depositional environments.

The Cretaceous coal deposits of the San Juan Basin are products of former coastal swamps and marshes. These swamps and marshes were supported by heavy precipitation and a climate conducive to rapid vegetal growth in moderately fresh water. Due to the relatively low sulfur contents of the

San Juan Basin coals, Shomaker and Whyte (1977) suggest the coals formed in fresh water environments.

Most of the coal-bearing units were deposited in coastal plain environments. The majority of the peat deposits formed in a transition zone between lower and upper deltaic sediments during periods of relative shoreline stability. Coals also formed in lake margin swamps inland from the coastal area. Shoreline oscillations and the subsequent influx of continental or marine debris upon the peat accumulations produced the vertical buildup or "stacking" of peat deposits. This sediment debris is represented by variable ash contents, rock partings, and splits within the coal seams.

The peat accumulated in lenses or pods which were generally parallel to the ancient shorelines. The coals in the lower portions of the coal-bearing units represent regressive depositional conditions (Sears, Hunt, and Hendricks, 1941). The coals in the upper portions of these units are relatively sporadic in occurrence.

Structure

The Mesa de los Toros quadrangle is in the Chaco Slope structural division in the southern portion of the structural depression known as the San Juan Basin (Kelley, 1950). The Walker Dome which is a prominent structural feature in the southwest corner of the quadrangle greatly influences the strike and dip of rock units. The dips generally vary from 1° to 5° N to NE. Numerous low to moderate displacement faults have been mapped in the quadrangle by Hunt (1936).

COAL GEOLOGY

In this quadrangle, the authors identified one coal bed and one coal zone in oil and gas well logs and Hunt's (1936) surface mapping. The bed and zone are here informally called the Crevasse Canyon Gibson No. 3 coal bed and the Crevasse Canyon Gibson coal zone.

The Crevasse Canyon Gibson No. 3 coal bed ranges from 35 to 115 ft (11 to 35 m) below the Hosta Tongue of the Point Lookout Sandstone. The bed is inferred to be continuous, although it may be several individual beds that are stratigraphically equivalent. The Crevasse Canyon Gibson coal zone contains up to seven beds which occur from 16 to 175 ft (5 to 53 m) below the Hosta Tongue. These beds may be correlated for limited distances in portions of the area but they lack sufficient continuity with poorly defined stratigraphic position and cannot be designated as persistent coal beds.

There are no published coal quality analyses for coal beds from the Mesa de los Toros quadrangle. An analysis of Gibson Coal Member beds taken from the abandoned Crownpoint mine, 15 mi (24 km) northwest of the quadrangle, has been reported by the U. S. Bureau of Mines (1936) and is shown in table 1. The Gibson Coal Member beds analyzed are probably similar in quality to the Gibson Coal Member beds in this quadrangle. Rank of the Gibson Coal Member seams is probably high volatile C bituminous in this area.

Table 1. - Analysis of a coal sample from the Gibson Coal Member of the Crevasse Canyon Formation.

(Crownpoint mine sample from sec. 30, T. 17 N., R. 12 W.)

[Form of analysis: A, as received; B, moisture free; C, moisture and ash free]

from U. S. Bureau of Mines, 1936

Form of analysis	Proximate analysis (percent)				Sulfur	Heating value (Btu/lb)
	Moisture	Volatiles matter	Fixed carbon	Ash		
A	15.4	36.1	39.0	9.5	1.3	10,520
B	-----	42.7	46.1	11.2	1.5	12,440
C	-----	48.0	52.0	-----	1.7	14,010

Remarks:

A moist, mineral-matter-free (MMMF) calculation using the Parr formula (American Society for Testing and Materials, 1973) yields a heating value of 11,744 Btu/lb (27,317 kJ/kg). No agglomerating characteristics were included with the analysis.

Crevasse Canyon Gibson coal zone

The Crevasse Canyon Gibson coal zone was identified in two drill hole logs and in several outcrop measurements. The zone crops out over the southern and western parts of the area and contains from 0 to 16 ft (0 to 5 m) of total coal. Many of the isopach values (plate 4) are considered to be partial data points because the entire Gibson coal zone thickness is not present. The structural datum used to map the zone is the top of the Gibson Coal Member. Interburden values (plate 6) were calculated from the top of the member to the lowest identified zone coal, less intervening coal thicknesses.

Crevasse Canyon Gibson No. 3 coal bed

The Crevasse Canyon Gibson No. 3 coal bed was identified in one drill hole log and in several outcrop measurements. Thickness of the bed ranges from 0 to 7.5 ft (0 to 2.3 m) and commonly contains rock partings in several of the outcrop measurements. The procedure prescribed by the U. S. Geological Survey regarding rock partings in coal beds at outcrop are that coal benches less than 1.0 ft (0.3 m) thick should not be included in the isopached thickness unless the rock parting is 0.2 ft (0.1 m) thick or less. These less than 1.0 ft (0.3 m) thick benches are included in the isopached thickness, however, if they occur between two other benches of the same bed which are each greater than 1.0 ft (0.3 m) thick. Following these guidelines, the upper 0.4 ft (0.1 m) Crevasse Canyon Gibson No. 3 bench was deleted from the isopached thickness of data point #11 (see plate 3).

COAL RESOURCES

The U. S. Geological Survey requested a resource evaluation of the Crevasse Canyon Gibson No. 3 coal bed, where the bed is 3.0 ft (0.9 m) or more thick. The evaluation is restricted to Federal coal lands.

The following procedures were prescribed by the U. S. Geological Survey for the calculation of reserve base. Criteria established in U. S. Geological Survey Bulletin 1450-B were used to areally divide the bed into measured, indicated, and inferred reserve base categories. Reserve base was calculated for each category by section, using data from the isopach and overburden maps (plates 7 and 9). The acreage in each category (measured by planimeter) multiplied by the average coal bed thickness and a bituminous coal conversion factor (1,800 tons of coal per acre-ft) yields the reserve base for that category. Coal beds with 3.0 ft (0.9 m) minimum thickness are included in reserve base and reserve data rather than the 28 in. (71 cm) minimum thickness prescribed in U. S. Geological Survey Bulletin 1450-B. Reserve figures are derived from reserve base totals by applying recovery factors of 85 percent and 50 percent for coal beds 0 to 200 ft (0 to 61 m) and 200 to 3,000 ft (61 to 914 m) deep, respectively. All reserve base and reserve values are rounded to the nearest 10,000 short tons (9,072 t).

Total reserve base data, which include all reserve base categories, are shown by section on plate 2. Reserve base and reserve data in the various categories are shown on plate 10.

The U. S. Geological Survey also requested a resource evaluation of the Crevasse Canyon Gibson coal zone, where the total coal thickness is 5.0 ft (1.5 m) or greater. Total identified resources for the coal zone in this quadrangle are 17.57 million short tons (15.94 million t).

COAL DEVELOPMENT POTENTIAL

The factors used to determine the development potential are the presence of a potentially coal-bearing formation, and thickness and overburden of correlative coal beds. The U. S. Geological Survey supplied the criteria to evaluate the coal development potential for Federal lands in this quadrangle. These criteria are based on current industry practice, U. S. Geological Survey Bulletin 1450-B, and anticipated technological advances. All available data were utilized for the surface and subsurface coal development potential evaluations.

Any area underlain by a potentially coal-bearing formation with 200 ft (61 m) or less of overburden has potential for surface mining. The U. S. Geological Survey designated the 200 ft (61 m) maximum depth as the strip-ping limit. Areas where a potentially coal-bearing formation is overlain by more than 200 ft (61 m) of overburden have no potential for surface mining. Areas with no correlative coal bed or a correlative coal bed less than 3.0 ft (0.9 m) in thickness and overlain by 200 ft (61 m) or less of overburden have unknown surface mining potential. Areas which have a correlative coal bed 3.0 ft (0.9 m) or more thick with surface mining potential are assigned a high, moderate, or low development potential based on the mining ratio (cubic yards of overburden per short ton of recoverable coal). The formula used to calculate mining ratios is:

$$MR = \frac{t_o (C)}{t_c (Rf)}$$

Where MR = Mining ratio

t_o = Thickness of overburden in feet

t_c = Thickness of coal in feet

Rf = Recovery factor

C = Volume-weight conversion factor

(.896 yd³/short ton for bituminous coal)

(.911 yd³/short ton for subbituminous coal)

High, moderate, and low development potential areas are underlain by a coal bed 3.0 ft (0.9 m) or more thick and have respective surface mining ratio values of 0 to 10, 10 to 15, and greater than 15.

Any area underlain by a potentially coal-bearing formation with 200 to 3,000 ft (61 to 914 m) of overburden has potential for subsurface mining. Areas where a potentially coal-bearing formation is overlain by more than 3,000 ft (914 m) of overburden have no subsurface mining potential. Development potential for subsurface mining is unknown where a potentially coal-bearing formation within 200 to 3,000 ft (61 to 914 m) of the surface contains no identified correlative coal bed or a correlative coal bed less than 3.0 ft (0.9 m) thick. High, moderate, and low development potential areas have respective overburden values of 200 to 1,000 ft (61 to 305 m), 1,000 to 2,000 ft (305 to 610 m), and 2,000 to 3,000 ft (610 to 914 m).

The no and unknown development potential boundaries for surface mining methods (plate 11) are defined at the formation contacts of the coal-bearing Gibson Coal Member of the Crevasse Canyon Formation with the overlying noncoal-bearing Hosta Tongue of the Point Lookout Sandstone.

Additional no and unknown development potential boundaries are defined at the contact of the coal-bearing Gibson Coal Member with the underlying non-coal-bearing Dalton Sandstone Member of the Crevasse Canyon Formation. These contacts are approximated due to the inaccuracies of adjusting old geologic maps to modern topographic bases.

Boundaries of coal development potential areas coincide with the boundaries of the smallest legal land subdivision (40 acre or lot). When a land subdivision contains areas with different development potentials, the potential shown on the map is that of the areally largest component area. Where an area is underlain by more than one bed, the potential shown on the map is that of the bed with the highest potential.

Reserve base (in short tons) in the various development potential categories for surface and subsurface mining methods are shown in tables 2 and 3, respectively.

The coal development potential maps are subject to revision. Map boundary lines and reserve base values are based on coal resource occurrence map isopachs, overburden isopachs, and coal bed correlations that are interpretive and subject to change as additional coal information becomes available.

Development potential for surface mining methods

The coal development potential for surface mining methods in the Mesa de los Toros quadrangle is shown on plate 11. Based on coal development criteria, all Federal coal lands have high, moderate, low, unknown or no surface mining potentials. Refer to table 4 for reserves and planimetered acreage, by section, for Federal coal lands with surface mining potential.

Development potential for subsurface mining
methods and in situ gasification

The coal development potential for subsurface mining methods in the Mesa de los Toros quadrangle is shown on plate 12. Based on coal development criteria, all Federal coal lands have high, unknown or no subsurface mining potentials. Refer to table 5 for reserves and planimetered acreage, by section, for Federal coal lands with subsurface mining potential.

In situ gasification of coal has not been done on a commercial scale in the United States and criteria for rating the development potential of this method are unknown.

Table 2. - Reserve base data (in short tons) for surface mining methods for Federal coal lands in the Mesa de los Toros quadrangle, McKinley County, New Mexico.

[Development potentials are based on mining ratios (cubic yards of overburden/ton of underlying coal). To convert short tons to metric tonnes, multiply by 0.9072; to convert mining ratios in yds³/ton coal to m³/t, multiply by 0.842].

Coal Bed	High Development Potential (0-10 Mining Ratio)	Moderate Development Potential (10-15 Mining Ratio)	Low Development Potential (greater than 15 Mining Ratio)	Total
Crevasse Canyon Gibson No. 3	960,000	370,000	5,480,000	6,810,000
Total	960,000	370,000	5,480,000	6,810,000

Table 3. - Reserve base data (in short tons) for subsurface mining methods for Federal coal lands in the Mesa de los Toros quadrangle, McKinley County, New Mexico.

[Development potentials are based on thickness of overburden. To convert short tons to metric tonnes, multiply by 0.9072].

Coal Bed	High Development Potential	Moderate Development Potential	Low Development Potential	Total
	(200' -1,000' overburden)	(1,000' -2,000' overburden)	(2,000' -3,000' overburden)	
Crevasse Canyon Gibson No. 3	2,800,000	-----	-----	2,800,000
Total	2,800,000	---	---	2,800,000

Table 4. - Reserves and planimetered acreage, by section, for Federal coal lands in the Mesa de los Toros quadrangle with surface mining potential.

[To convert acres to hectares, divide acres by 2.471; to convert short tons to metric tonnes (t), multiply short tons by 0.90723.]

Potential category	Coal bed	Sec.	T. N.	R. W.	Acres (planimetered)	Reserves (in short tons)
High	Crevasse Canyon Gibson No. 3	4	15	9	1.0	less than 10,000
		8			23.1	130,000
		10			1.5	less than 10,000
		20			3.5	less than 10,000
		22			14.5	110,000
		28			13.0	110,000
Moderate	Crevasse Canyon Gibson No. 3	8	16	9	41.0	460,000
		4	15	9	1.0	less than 10,000
		8			13.1	90,000
		10			1.5	less than 10,000
		20			2.5	10,000
		22			8.3	60,000
Low	Crevasse Canyon Gibson No. 3	28			11.7	110,000
		4	15	9	4.0	20,000
		8			198.9	1,460,000
		10			9.4	50,000
		20			17.5	130,000
		22			211.6	1,600,000
		26			13.2	70,000
		28			60.3	590,000
		8	16	9	22.7	250,000
		10			19.7	100,000
		22			60.6	320,000

Table 5. - Reserves and planimetered acreage, by section, for Federal coal lands in the Mesa de los Toros quadrangle with subsurface mining potential.

[To convert acres to hectares, divide acres by 2.471; to convert short tons to metric tonnes, multiply short tons by 0.9072].

Potential category	Coal bed	Sec. T. N. R. W.	Acres (planimetered)	Reserves (in short tons)
High	Crevasse Canyon Gibson No. 3	28 15 9	98.0	420,000
		26	157.6	700,000
		22 16 9	83.5	260,000

SELECTED REFERENCES
(MESA DE LOS TOROS QUADRANGLE)

#26

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GLOSSARY

- coal bed--A stratified sequence of coal, composed of relatively homogeneous material, exhibiting some degree of lithologic unity and separated from the rocks above and below by physically rather well defined boundary planes.
- coal bed separation line--A line on a map plate separating areas where different coal beds or zones are mapped.
- coal bench--One of two or more divisions of a coal bed separated by rock.
- coal conversion factor--A factor used to convert acre-feet of coal into short tons of coal; bituminous coal is 1800 tons/acre-ft; subbituminous coal is 1770 tons/acre-ft.
- coal development potential--A subjective determination of the comparative potential of Federal coal lands for development of a commercially viable coal mining operation.
- coal exploration license--An area of Federal coal lands in which the licensee is granted the right, after outlining the area and the probable methods of exploration, to investigate the coal resources. An exploration license has a term not to exceed 2 years and does not confer rights to a lease.
- coal lease--An area of Federal coal lands in which the Federal Government has entered into a contractual agreement for development of the coal deposits.
- coal split--A coal bed resulting from the occurrence of a noncoal parting within the parent coal bed which divides the single coal bed into two or more coal beds.
- coal zone--A distinctive stratigraphic interval containing a sequence of alternating coal and noncoal layers in which the coal beds may so lack lateral persistence that correlating individual beds in the zone is not feasible.
- Federal coal land--Land for which the Federal Government holds title to the coal mineral rights, without regard to surface ownership.
- hypothetical resources--Undiscovered coal resources in beds that may reasonably be expected to exist in known mining districts under known geologic conditions. In general, hypothetical resources are in broad areas of coal fields where points of observation are absent and evidence is from distant outcrops, drill holes or wells. Exploration that confirms their presence and reveals quantity and quality will permit their reclassification as a Reserve or Identified Subeconomic Resource.
- identified resources--Specific bodies of coal whose location, rank, quality, and quantity are known from geologic evidence supported by engineering measurements.
- indicated--Coal for which estimates for the rank, quality, and quantity have been computed partly from sample analyses and measurements and partly from reasonable geologic projections.
- inferred--Coal in unexplored extensions of demonstrated resources for which estimates of the quality and quantity are based on geologic evidence and projections.
- isopach--A line joining points of equal bed thickness.
- Known Recoverable Coal Resource Area (KRCRA)--Formerly called Known Coal Leasing Area (KCLA). Area in which the Federal coal land is classified (1) as subject to the coal leasing provisions of the Mineral Leasing Act of 1920, as amended, and (2) by virtue of the available data being sufficient to permit evaluation as to extent, location, and potential for developing commercial quantities of coal.
- measured--Coal for which estimates for rank, quality, and quantity can be computed, within a margin of error of less than 20 percent, from sample analyses and measurements from closely spaced and geologically well known sample sites.
- mining ratio--A numerical ratio equating the in-place volumes, in cubic yards, of rocks that must be removed in order to recover 1 short ton of coal by surface mining.
- overburden--A stratigraphic interval (composed of noncoal beds and coal beds) lying between the ground surface and the top of a coal bed. For coal zones, overburden is the stratigraphic interval lying between the ground surface and the structural datum used to map the zone.
- parting--A noncoal layer occurring along a bedding plane within a coal bed.
- 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. PRLA's are no longer obtainable.
- quality or grade--Refers to measurements such as heat value; fixed carbon; moisture; ash; sulfur; phosphorus; major, minor, and trace elements; coking properties; petrologic properties; and particular organic constituents.
- rank--The classification of coal relative to other coals, according to degree of metamorphism, or progressive alteration, in the natural series from lignite to anthracite (Classification of coals by rank, 1973, American Society for Testing and Materials, ASTM Designation D-388-66).
- recovery factor--The percentage of total tons of coal estimated to be recoverable from a given area in relation to the total tonnage estimated to be in the Reserve Base in the ground.
- reserve--That part of identified coal resource that can be economically mined at the time of determination. The reserve is derived by applying a recovery factor to that component of the identified coal resource designated as the reserve base.
- reserve base--That part of identified coal resource from which Reserves are calculated.
- stripping limit--A vertical depth, in feet, measured from the surface, reflecting the probable maximum, practical depth to which surface mining may be technologically feasible in the foreseeable future. The rock interval, expressed in feet, above the stripping limit is the "strippable interval."
- structure contour--A line joining points of equal elevation on a stratum or bed.