UNITED STATES DEPARTMENT OF THE INTERIOR

GEOLOGICAL SURVEY

Text to accompany:

OPEN-FILE REPORT 80-027

1985

FEDERAL COAL RESOURCE OCCURRENCE AND COAL DEVELOPMENT POTENTIAL MAPS OF THE OAK SPRING 7 1/2-MINUTE QUADRANGLE, McKINLEY COUNTY, NEW MEXICO

[Report includes 4 plates]

Prepared by Berge Exploration, Inc.

CONTENTS (OAK SPRING QUADRANGLE)

ILLUSTRATIONS

INTRODUCTION

Purpose

This text complements the Coal Resource Occurrence (CRO) and Coal Development Potential(CDP) maps of the Oak Spring 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 desposits, and the potential for developing commercial quantities of coal at minable depths.

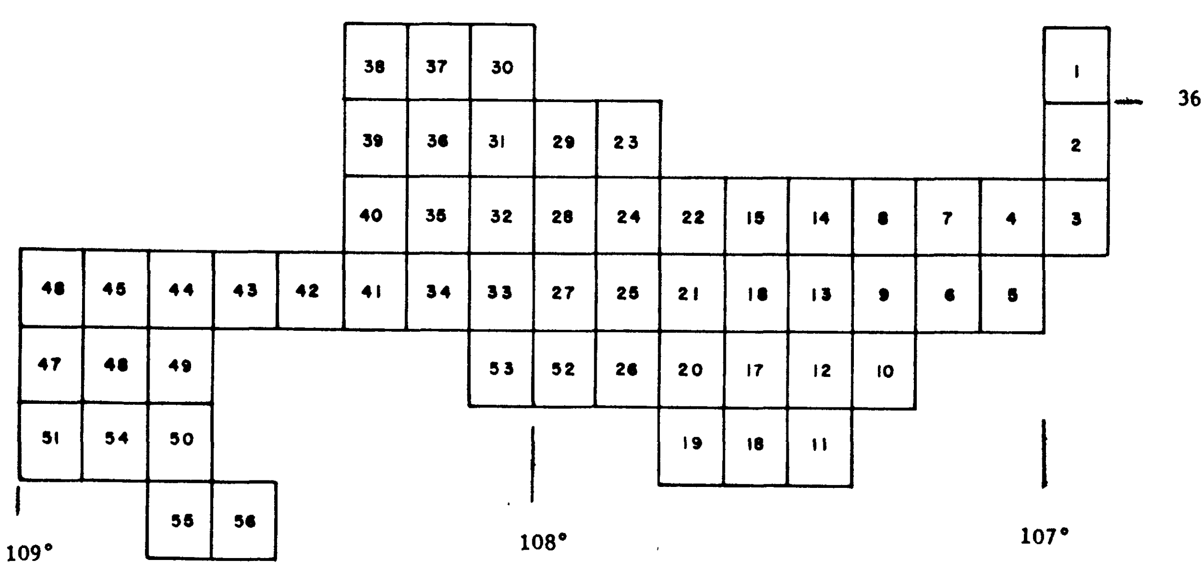
This report is limited to coal resources which are 3,000 ft (914 m) or less below ground surface. Published and unpublished public information was used as the data base for this study. No new drilling or field mapping was performed as part of this study, nor were any confidential data used.

LOCATION OF PROJECT AREA
PROJECT AREA
AREA OF THIS REPORT
COLORADO
ARIZONA
FARMINGTON
ALBUQUERQUE
Grants
Bernalillo
Bloomfield
Aztec
Shiprock
Window Rock
St. Michaels
SAN JUAN
INDIAN RESERVATION

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 Oak Spring 7 1/2 minute quadrangle includes acreage in Tps. 16, 17, and 18 N., Rs. 14, 15, and 16 W. of the New Mexico Principal Meridian, McKinley County, northwestern New Mexico (see figs. 1 and 2).

Accessibility

No paved roads pass through the Oak Spring quadrangle. Unimproved dirt roads and jeep trails traverse most parts of the area. An unimproved dirt road in the southern part of the quadrangle provides access to the town of Pinedale, 1.6 mi (2.6 km) south of the quadrangle. The Atchison, Topeka, and Santa Fe Railroad line parallels Interstate Highway 40 about 8 mi (13 km) south of the Oak Spring quadrangle (see fig. 1).

Physiography

The Oak Spring quadrangle is in the Navajo section of the southernmost part of the Colorado Plateau physiographic province (U. S. Geological Survey, 1965). The area is characterized by mesa-and-canyon topography.

No perennial streams are present in the quadrangle. The Puerco River and several intermittent arroyos provide local drainage. Elevations within the quadrangle range from less than 6,320 ft (1,926 m) along Black Mesa Canyon in the northwest to 7,764 ft (2,366 m) on a mesa in the southeast.

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 Gallup 5 E Station. The Oak Spring quadrangle is about 12 mi (19 km) NE of the Gallup 5 E Station. Average total annual precipitation for eleven of the previous fifteen years is 9.53 in. (24.21 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 seven of the previous fifteen years is 48.8^{0} F (9.3^{0} C). The average daily temperatures in January and July are 29.0^{0} F (-1.7^{0} C) and 71.3^{0} F (21.8^{0} C), respectively.

Land status

The Federal Government holds the coal mineral rights to approximately 5 percent of the Oak Spring 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. The Oak Spring quadrangle is not within any Known Recoverable Coal Resource Area. The Navajo Indians own the coal mineral rights to the northern three-fourths of the quadrangle. As of October 26, 1978, there were no Federal coal leases, coal preference right lease applications or coal exploration licenses within the Oak Spring quadrangle.

GENERAL GEOLOGY

Previous work

Early reports on the area include reconnaissance mapping by Gardner (1909), who measured two coal sections of the Gibson and Dilco Coal Members of the Crevasse Canyon Formation in this quadrangle. He notes that at the measured section in sec. 34, T. 17 N., R. 15 W. "The three workable beds in the upper part of this section, with an average thickness of 6 feet, apparently contain a good grade of subbituminous coal, free from partings." Sears (1934) mapped and measured coals within the Gallup Sandstone, Dilco and Gibson Coal Members of the Crevasse Canyon Formation, and Cleary Coal Member of the Menefee Formation in the Oak Spring quadrangle. Shomaker, Beaumont, and Kottlowski (1971) discussed the coals of the area and noted a few coal beds greater than 3.0 ft (0.9 m) thick. They did not estimate any strippable reserves. Kirk and Zech (1976) mapped the surface geology and compiled a structure contour map of the Oak Spring quadrangle.

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 Oak Spring quadrangle include some of the sedimentary units of Upper Cretaceous age. There is Quaternary alluvium along drainages in the area.

The "main body" of the Mancos Shale is stratigraphically the lowest exposed unit in the quadrangle and represents transgressive marine deposits. Light to dark gray, silty shales with interbedded brown, calcareous sandstones comprise the lithologies of the Mancos Shale. Thickness of the unit is up to 660 ft (201 m) in the area, although only the upper 100 ft (30 m) of the unit is exposed locally.

A major northeastward regression of the Cretaceous seaways followed, and 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 coal beds which averages 170 ft (52 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 ranges from 110 to 160 ft (34 to 49 m) thick in the area.

Increased rates of trough subsidence caused the regessive 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 and is composed of light gray to tan, silty shale with interbedded reddish-tan, very fine-grained sandstone. Thickness of the unit ranges from 100 to 155 ft (30 to 47 m) locally. 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 condition

The Dalton Sandstone Member is composed of yellowish-gray, very fine-grained, quartzose sandstone which formed in a nearshore environment and averages 60 ft (18 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 Member. Medium gray, carbonaceous siltstone with interbedded gray to tan sandstone, and coal beds comprise the lithologies of the Gibson Coal Member, which ranges from 240 to 400 ft (73 to 122 m) thick in the area. The Bartlett Barren Member divides the Gibson Coal Member into upper and lower portions in this quadrangle. Yellowish-brown to olive-gray siltstone with interbedded gray shales, white to brown, locally calcareous sandstones, and local coal beds comprise the lithologies of the Bartlett Barren Member, which ranges from 60 to 140 ft (18 to 43 m) thick locally.

Increased rates of trough subsidence resulted in the gradual reversal from regressive to transgressive depositional conditions, and the Hosta Tongue of the Point Lookout Sandstone was deposited over the Gibson Coal Member during the advancing shoreline sequence. Light gray to reddish-brown, fine-to medium-grained sandstone with interbedded gray shales comprise the lithologies of the Hosta Tongue, which ranges from 0 to 50 ft (0 to 15 m) thick locally.

As the transgression proceeded and the Cretaceous seaways deepened, the Satan Tongue of the Mancos Shale was desposited over the Hosta Tongue, and is composed of light to dark gray, silty shales with interbedded tan to buff sandstones. Thickness of the Satan Tongue ranges from 0 to 60 ft (0 to 18 m) locally. The Satan Tongue pinches out in the eastern part of the Oak Spring quadrangle, and is not recognized further west.

With the pinch out of the Satan Tongue, the Hosta Tongue and overlying Point Lookout Sandstone combine to form 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 similar to the Hosta Tongue. Thickness of the unit ranges from 100 to 312 ft (30 to 95 m) locally. The continental deposits which formed inland from the beach area during 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. Erosion has reduced the thickness of the Cleary Coal Member to about 200 ft (61 m) locally. The Allison Member is probably absent in the Oak Spring quadrangle.

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 Oak Spring 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 rock units dip from 2° to 5° NE to NW. No faults have been mapped by previous workers in the quadrangle. Sears (1934) mapped locallized folding in the area. Kirk and Zech (1976) mapped anticlinal and synclinal structural features in the quadrangle.

COAL GEOLOGY

In this quadrangle, the authors identified eleven coal beds and four coal zones from Sears' (1934) surface mapping. These coal beds and zones are here informally called the Gallup No. 1 coal bed, Gallup coal zone, Crevasse Canyon Dilco No. 2 coal bed, Crevasse Canyon Dilco coal zone, Crevasse Canyon Dilco No. 3 and No. 4 coal beds, Crevasse Canyon Gibson Lower coal zone, Crevasse Canyon Gibson Upper coal zone, Crevasse Canyon Gibson coal zone, Crevasse Canyon Gibson No. 6, No. 7, and No. 8 coal beds, Menefee Cleary No. 1, No. 2, No. 2A, and No. 3 coal beds, and the Menefee Cleary coal zone.

The Gallup No. 1 coal bed crops out in the southeast part of the quadrangle and occurs about 65 ft (20 m) below the top of the Gallup Sandstone. Thickness of the bed ranges from 1.4 to 2.8 ft (0.4 to 0.8 m). Two thin coals which occur from 27 ft (8 m) above and 15 ft (5 m) below the Gallup No. 1 bed comprise the Gallup coal zone.

The Crevasse Canyon Dilco No. 2 coal bed was identified in two surface outcrops by Sears (1934) and occurs from 18 to 20 ft (5 to 6 m) above the Gallup Sandstone. A 1.0 ft (0.3 m) bed which occurs about 27 ft (8 m) above the Crevasse Canyon Dilco No. 2 bed comprises the Crevasse Canyon Dilco coal zone. The Crevasse Canyon Dilco No. 3 and No. 4 coal beds occur from 90 to 110 ft (27 to 34 m) and 140 to 160 ft (43 to 49 m), respectively, above the Gallup Sandstone. These coal beds are inferred to be continuous, although they may be several individual coal beds that are stratigraphically equivalent.

The Crevasse Canyon Gibson coal zone contains up to eight individual beds which occur from 10 to 313 ft (3 to 95 m) below the base of the Point Lookout Sandstone. The Crevasse Canyon Gibson coal zone is divided into Upper ("CGU") and Lower ("CGL") parts by the intervening Bartlett Barren Member. The Lower zone pinches out in the western part of the quadrangle, and the Bartlett Barren Member directly overlies the Dalton Sandstone Member.

Other Gibson Coal Member beds include the Crevasse Canyon Gibson No. 6, No. 7, and No. 8 coal beds, which occur from 59 to 83 ft (18 to 25 m), 24 to 67 ft (7 to 20 m), and 0 to 23 ft (0 to 7 m), respectively, below the base of the Point Lookout Sandstone. The Crevasse Canyon Gibson No. 6 and No. 7 coal beds possess significant lateral extents and important thicknesses in this quadrangle.

Stratigraphically, the Cleary Coal Member of the Menefee Formation contains the highest identified coal beds in the Oak Spring quadrangle. The Menefee Cleary No. 1 coal bed directly overlies the Point Lookout Sandstone in this area, although the bed is known to occur up to 15 ft (5 m) above the Point Lookout Sandstone in nearby areas. The Menefee

Cleary No. 2, No. 2A, and No. 3 coal beds occur from 18 to 20 ft (5 to 6 m), 40 ft (12 m), and 76 to 78 ft (23 to 24 m), respectively, above the Point Lookout Sandstone. Individual coals which range from 53 to 118 ft (16 to 36 m) above the Point Lookout Sandstone comprise the Menefee Cleary coal zone. These zone coals, as with other zone coals in this quadrangle, 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.

COAL RESOURCES

No resource evaluations were made for any of the coal beds identified in the Oak Spring quadrangle because all beds where present underlying Federal coal lands were less than 3.0 ft (0.9 m) thick. The U. S. Geological Survey specified that only coal beds 3.0 ft (0.9 m) or greater in thickness be 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.

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 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 stripping 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 underlain by a potentially coal-bearing formation within 200 ft (61 m) of the surface which contain no correlative coal bed or a correlative coal bed less than 3.0 ft (0.9 m) thick have unknown surface mining potential.

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.

The no and unknown development potential boundaries for surface mining methods (plate 4) are defined at the contacts of the coal-bearing Gallup Sandstone and Dilco Coal Member of the Crevasse Canyon Formation with the underlying noncoal-bearing "main body" of the Mancos Shale and overlying noncoal-bearing Mulatto Tongue of the Mancos Shale. The contact of the coal-bearing Gibson Coal Member of the Crevasse Canyon Formation with the underlying noncoal-bearing Dalton Sandstone Member and Bartlett Barren Member of the Cevasse Canyon Formation, and the overlying noncoal-bearing Point Lookout Sandstone also defines a no and unknown development potential boundary. These contacts are approximated due to the inaccuracies of adjusting old geologic maps to modern topographic bases.

The coal development potential of this quadrangle is subject to revision. As further coal information becomes available, it is possible that correlative coal beds with sufficient thicknesses may be identified. These coal data will likely define areas of Federal coal lands with development potentials other than no or unknown.

Development potential for surface mining methods

The coal development potential for surface mining methods in the Oak Spring quadrangle is shown on plate 4. Based on coal development potential criteria, all Federal coal lands in the Oak Spring quadrangle where data are sufficient to determine development potentials, have either no or unknown development potential for surface mining methods.

Development potential for subsurface mining methods and in situ gasification

The coal development potential for subsurface mining methods was not mapped in the Oak Spring quadrangle because based on coal development potential criteria, all Federal coal lands in the quadrangle have unknown development potential for subsurface mining methods.

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.

SELECTED REFERENCES
(OAK SPRING QUADRANGLE)

#42

American Society for Testing and Materials, 1973, Standard specification for classification of coals by rank, in American Society for Testing and Materials Standards for coal and coke: Designation D388-66, p. 54-57.

Baltz, E. H., 1967, Stratigraphy and regional tectonic implications of part of Upper Cretaceous and Tertiary rocks, east-central San Juan Basin, New Mexico: U.S. Geological Survey Professional Paper 552, 101 p.

Chapman, Wood, and Griswold, Inc., 1977, Geologic map of the Grants uranium region: New Mexico Bureau of Mines and Mineral Resources Geologic Map 31.

Gardner, J. H., 1909, The coal field between Gallup and San Mateo, New Mexico, in Coal fields of Colorado, New Mexico, Utah, Oregon, and Virginia: U.S. Geological Survey Bulletin 341-C, p. 364-378.

Hackman, R. J., and Olson, A. B., 1977, Geology, structure, and uranium deposits of the Gallup 1°x2° quadrangle, New Mexico and Arizona: U.S. Geological Survey Miscellaneous Geologic Investigations Map I-981, scale 1:250,000.

Kelley, V. C., 1950, Regional structure of the San Juan Basin, in New Mexico Geological Society Guidebook of the San Juan Basin, New Mexico and Colorado, 1st Field Conference, 1950: p. 101-108.

Keroher, G. C., and others, 1966, Lexicon of geologic names of the United States for 1936-60: U.S. Geological Survey Bulletin 1200, 4341 p.

Kirk, A. R., and Zech, R. S., 1976, Preliminary geologic and structure contour maps of the Oak Spring quadrangle, New Mexico: U.S. Geological Survey Open-File Report 76-347.

National Oceanic and Atmospheric Administration, 1964-78, Climatological data, New Mexico: National Climatic Center, Asheville, N.C., v. 68-82.

Petroleum Information Well Log Library: Denver, Colo.

Rocky Mountain Well Log Service, 1974, Catalog of electrical, radioactivity and hydrocarbon surveys: Electrical Log Services, 1974, 819 p.

Sears, J. D., 1925, Geology and coal resources of the Gallup-Zuni Basin, New Mexico: U.S. Geological Survey Bulletin 767, 54 p.

Sears, J. D., 1934, The coal field from Gallup eastward toward Mount Taylor, part 1 of Geology and fuel resources of the southern part of the San Juan Basin, New Mexico: U.S. Geological Survey Bulletin 860-A, p. 1-30.

Sears, J. D., Hunt, C. B., and Hendricks, T. A., 1941, Transgressive and regressive Cretaceous deposits in southern San Juan Basin, New Mexico: U.S. Geological Survey Professional Paper 193-F, p. 101-121.

Shomaker, J. W., Beaumont, E. C., and Kottlowski, F. E., 1971, Strippable low-sulfur coal resources of the San Juan Basin in New Mexico and Colorado: New Mexico Bureau of Mines and Mineral Resources Memoir 25, 189 p.

Shomaker, J. W., and Whyte, M. R., 1977, Geologic appraisal of deep coals, San Juan Basin, New Mexico: New Mexico Bureau of Mines and Mineral Resources Circular 155, 39 p.

U.S. Bureau of Mines, 1936, Analyses of New Mexico coals: U.S. Bureau of Mines Technical Paper 569, 112 p.

U.S. Bureau of Mines and U.S. Geological Survey, 1976, Coal resource classification system of the U.S. Bureau of Mines and U.S. Geological Survey: U.S. Geological Survey Bulletin 1450-B, 7 p.

U.S. Geological Survey, 1965, Mineral and water resources of New Mexico: New Mexico Bureau of Mines and Mineral Resources Bulletin 87, 437 p.

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 forseeable 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.