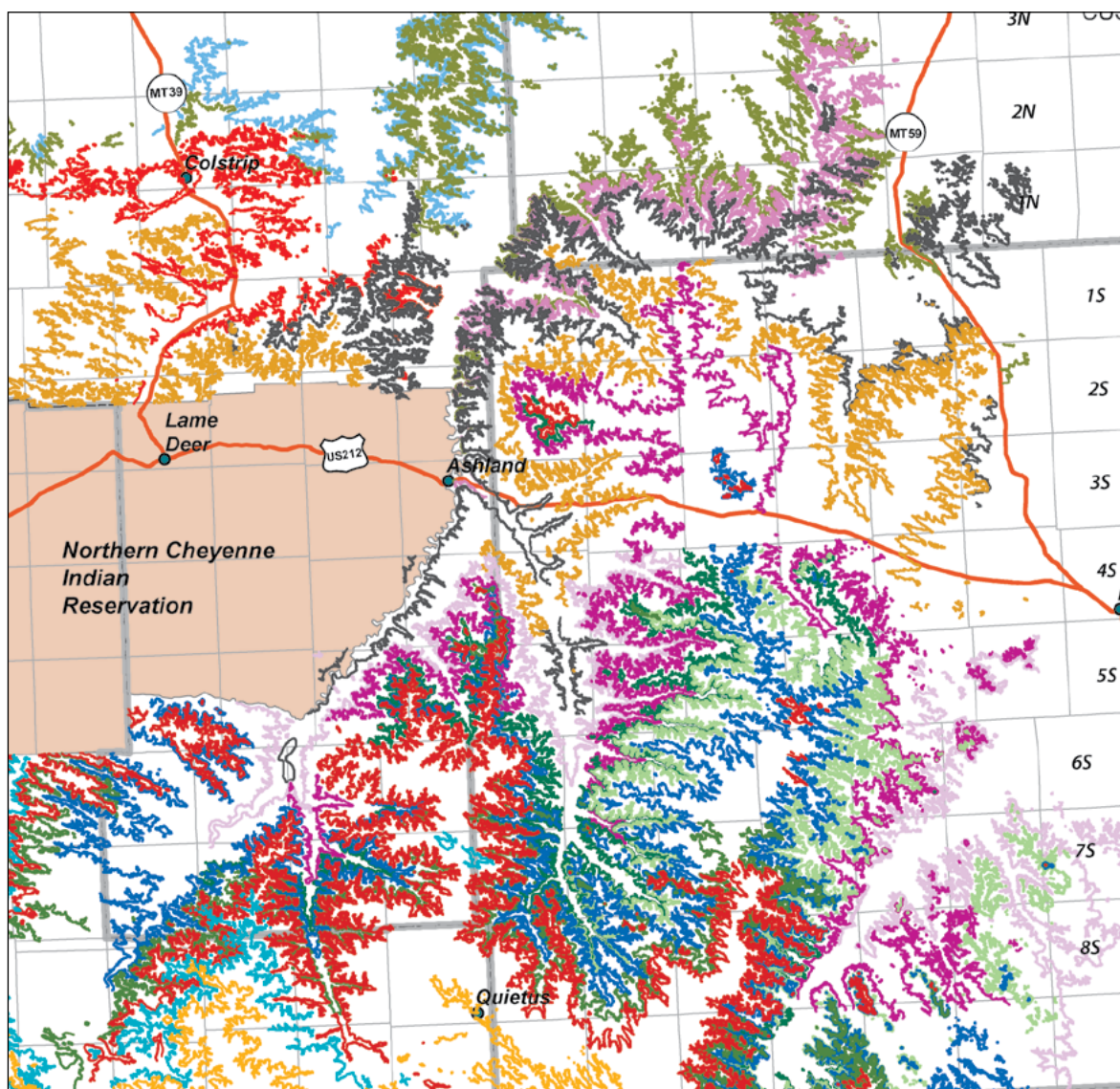


DIGITAL COAL OUTCROP PATTERNS FOR THE POWDER RIVER BASIN OF MONTANA

MBMG Open-File Report 667

by
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OBJECTIVE

The Federal Land Grant Amendments of 1975 required inventories of coal resources in the western United States to determine the resources available on Federal lands. In response, the U.S. Geological Survey (USGS) began the Coal Resource Occurrence and Coal Development Potential (CRO/CDP) program in 1977 to compile coal resource information for the Powder River Basin (PRB) of Wyoming and Montana. During a 5-year period, the USGS published coal data, coal outcrop maps, and coal resource estimates for 108 7.5-minute quadrangles in Montana (fig. 1). The CRO/CDP studies were based on prior field mapping by the USGS and the Montana Bureau of Mines and Geology (MBMG), and on drill-hole data acquired during the late 1960s and 1970s. The USGS published quadrangle-by-quadrangle results as Open-File Reports (appendix A) that are available online from the USGS Publications Warehouse (<http://pubs.er.usgs.gov/>).

Collectively, the CRO/CDP reports are one of the most comprehensive compilations of coal stratigraphic and coal outcrop data for the PRB. The reports are an invaluable source of information and a convenient starting point for further coal research and interpretation. Digital coal stratigraphic data are available from the MBMG coal database (<http://www.mbmgt.mtech.edu/datacenter/datacenter.asp>), but the outcrop data have been difficult to use because they are not in digital form and because the authors named coalbeds inconsistently.

Our purpose was to:

1. Combine correlatable coalbeds with different names into single outcrop patterns.
2. Make the mapped coal outcrops (i.e., outcrop patterns) digital and publicly available.

We did not add interpretation except to correct errors and we are not proposing these coalbed names as standard nomenclature for the PRB.

METHODS

Coal outcrop maps from 108 CRO/CDP reports were imported into ESRI's ArcMap software as tagged image format (*.tif) files and georeferenced to state plane coordinates. Coal outcrop traces and faults were digitized from the georeferenced images and output as shape files using Able Software's R2V. All coalbeds shown on the CRO/CDP maps were digitized, including minor beds that outcrop over limited areas and several unnamed "local" beds. No distinction between *mapped* vs. *inferred* outcrops was made during digitizing.

Outcrop segments were combined in ArcMap where:

- CRO/CDP authors used different abbreviations (or outcrop codes) to identify the same coalbed. For example, "S" and "Sm" each refer to the Smith Coal.
- Coal seams merge and/or split. As examples, the Anderson (An) was combined with the "merged" Anderson–Dietz (An-D) bed; where the Canyon Coal splits into upper and lower benches, the Canyon (Cy) was combined with the Upper Canyon (UCy). Generally, we used the bench or split that was thickest and/or had the greatest aerial distribution as the primary bed.
- Beds with different names clearly join across quadrangle boundaries and do not exist anywhere together in stratigraphic succession. In most cases, joining beds with different names was supported by the literature (appendix A).

Table 1 is a list of CRO/CDP outcrop codes from each quadrangle (rows) that were combined to form final coal outcrop patterns (columns). It documents, for example, the Roland outcrop (table 1, column 3) as the combination of coalbeds mapped as "Ro" in the Bar V Ranch quadrangle, "Ro" in the Bar V Ranch NE quadrangle, "RB" in the Bear Creek School quadrangle, and so on. Final shape files for coal outcrops and faults were combined as feature classes within a geodatabase. All outcrop feature classes in the geodatabase retain original CRO/CDP outcrop codes in the BEDNAME attribute.

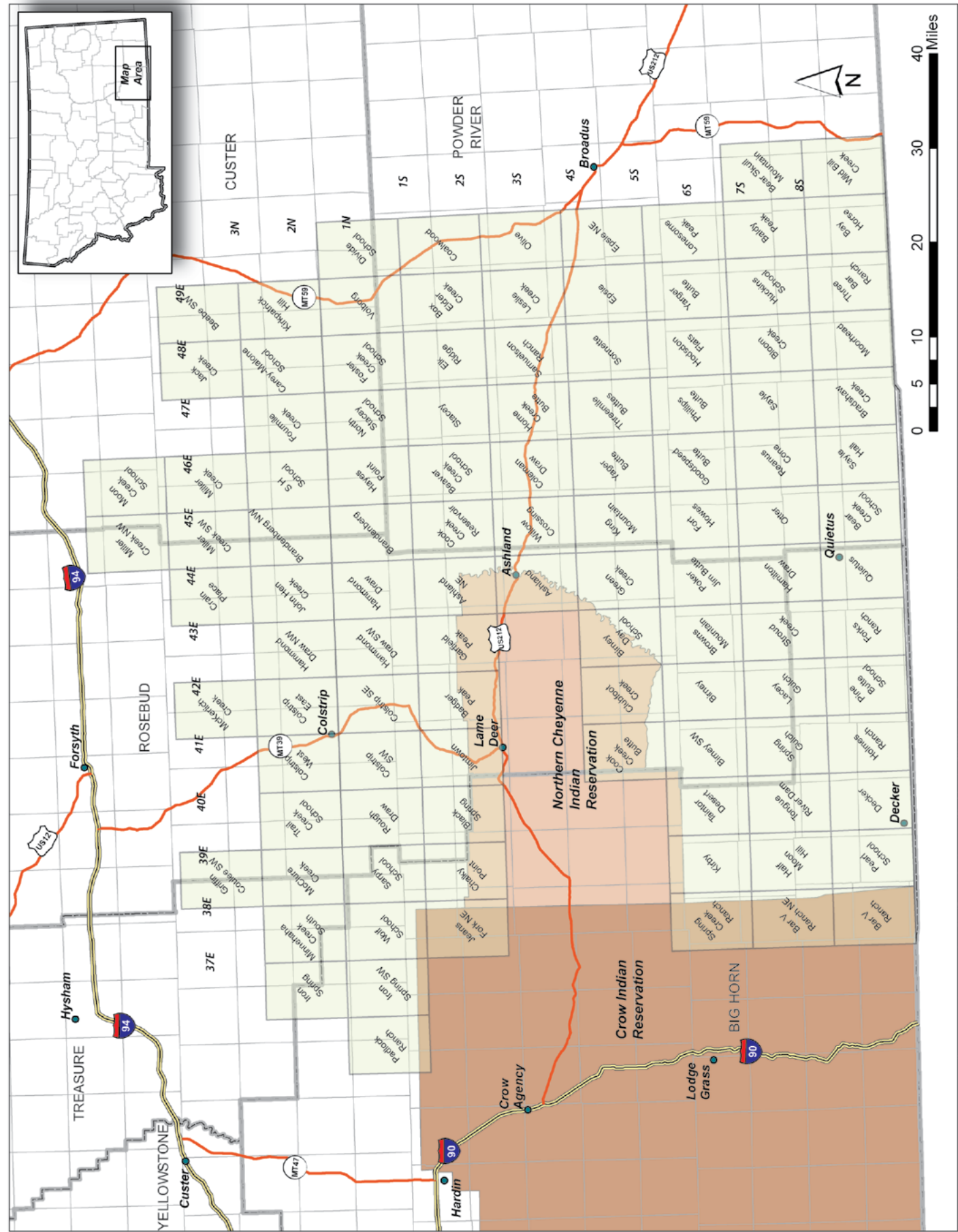


Figure 1. One hundred and eight 7.5-minute quadrangles mapped as part of the CRO/CDP project.

TABLE 1—Continued.

Outcrop Name		Badger	Arvada	Roland	- Lower Roland	Waddle	Smith	Squirrel Creek	Roland (Taft)	Anderson	Anderson1	Anderson2	Anderson3	Dietz1	Dietz	Dietz3	Canyon	- Lower Canyon	Ferry	- Upper Cook	Cook	Otter	Wall	- Lower Wall	Carlson	Elk	Pawnee	PokerJim	Cache-Odell	Xbed	CandD	Cbed	Richard	Proctor	Mackin-Walker	
HomeCreekButte									Ga								Cy		Fe	Ck1	Ck2	W			El	Pa, Pa-E	Pa	O								
HSSchool																				Ck1							Pa	Ca								
HuckinsSchool																																				
IronSpring																																				
IronSpringSW																																				
JackCreek																																				
JeansForkNE																																				
Jimtown																																				
JohnHenCreek																																				
KingMt										An				D	D2, D2-3	D3	Cy					W				Pa	Ca, D	Ca, D		Dbed	Cbed					
Kirby										An												W														
KirkpatrickHill										An							Cy					W														
LaceyGulch										An, AD				D			Cy						W													
LeslieCreek																																				
LonesomePeak																																				
McClureCreek																																				
McKerlichCreek																																				
MillerCreek																																				
MillerCreekNW																																				
MillerCreekSW																																				
MinnehahaCreekSouth																																				
Moorehead										An				D			Cy									Pa										
NorthStaceySchool																									E						CandD					
Olive										An				D			Cy																			
Otter																																				
PadlockRanch																																				
PearlSchool			Ro							An																										
PhillipsButte											An1	An2	An3	D1	D, D2		Cy, Cy1	Cy2	Fe	Ck1	Ck2															
PineButteSchool	B		RB							An							UCy	LCy																		
PokerJimButte										An, AD				D													P									
Quietus			RB, URB	LRB						An							Cy																			
ReanusCone										An				D												El	Du									
RoughDraw																																				
SamuelsonRanch																			Fe	Ck1	Ck2					Pa										
SarpySchool																																				
Sayle		Ar	Ro							An, An1	An1	An2	An3	D1	D, D2		Cy																			
SayleHall										An				D			Cy																			
Sonnette										Ga							Cy, Cy1	Cy2	Fe	Ck1	Ck2						Pa									
SpringCreekRanch										An				D2-3			Cy																			
SpringGulch		Ro								An				D2			Cy																			
Stacey										Ga									Fe																	
StroudCreek										An				D			UCy	LCy																		
TaintorDesert										An				D2, D2-3			Cy																			
ThreeBarRanch										An				D			Cy																			
ThreemileButtes										Ga							Cy, Cy1	Cy2	Fe	Ck1	Ck2															
TongueRiverDam										An				D2			Cy																			
TrailCreekSchool																																				
Volborg																																				
WildBillCreek																																				
WillowCrossing																			Fe		Ck2															
WillowCrossing																																				
WolfSchool																																				
WolfSchool																																				
YagerButte																																				
YagerButte																																				
YagerButte																																				

TABLE 1—Continued.

Outcrop Name		Sawyer	- Lower Sawyer	King	Knobloch	- Lower Knobloch	Popham	Lay Creek	Lee	Qbed	- Upper Rosebud	Rosebud	McKay	Flowers-Goodale	Stocker Creek	Haddow	Allen	Terret	Foster	Volberg	Contact	Burley	Trail Creek	Big Dirty	4a	4b	5	5a	7	8	8a	9a	9b	9c	11	Broadus	12a	12b	
Ashland	Sa1	Sa2	Kl	Kn, Kn1	Kn2									F-G			Te																						
Ashland NE				Kn								Rb	Mc	F-G			Te																						
Badger Peak	Sa			Kn							Rb1	Rb2	Mc														5	5a				9a	9b	9c					
Baldy Peak																																							
BarVRanch																																							
BarVRanchNE																																							
BayHorse																																							
BearCreekSchool																																							
BearSkullMt																																							
BeaverCreekSchool	Sa1	Sa2		Kn										F-G			Te										5	5a			9a				11	Br			
BeebeSW														F-G			Te																						
Birney				Kg	K																																		
BirneyDaySchool				Kl	Kn																																		
BirneySW																																							
BlackSpring	Sa					Po																																	
BloomCreek																																							
BoxElderCreek	Sa, Sa1	Sa2		Kn													Aln																						
BradshawCreek																																							
Brandenberg	Sa			Kn										F-G			Te																						
BrandenbergNW																	Te																						
BrandenbergNW																	Te																						
BrandenbergNW																	Te																						
BrandenbergNW																	Te																						
BrownMt																																							
BrownMt																																							
Carey-MalonesSchool																																							
Carey-MalonesSchool																																							
ChalkyPoint	Sa																																						
ChalkyPoint																																							
ClubfootCreek																																							
Coalwood	Sa			Kn	Kn2																																		
ColemanDraw	Sa, Sa1	Sa2		Kn																																			
ColemanDraw																																							
ColstripEast																																							
ColstripEast	Sa, Sa1	Sa2		Kn																																			
ColstripSE	Sa			Kn																																			
ColstripSW	Sa					Po																																	
ColstripSW																																							
ColstripWest																																							
CookCreekButte																																							
CookCreekButte	Sa, Sa1	Sa2		Kn																																			
CookCreekRes																																							
CrainPlace																																							
Decker																																							
DivideSchool				Kn, Kn1	Kn2																																		
ElkRidge	Sa, Sa1	Sa2		Kn																																			

TABLE 1—Continued.

[illegible]

RESULTS

The ***MTPRB Coal Outcrop*** map package contains outcrop patterns for 75 named coal seams. Roughly 30 percent are major coal seams with mineable thicknesses and broad spatial distribution (fig. 2). Primary bed combinations are:

Anderson + Anderson–Dietz + Garfield

Dietz + Dietz2 + Dietz2,3 + Alderson

Canyon + Upper Canyon

Cook + Lower Cook

Pawnee + Dunning + Ebed

Cache + Odell + Brewster–Arnold

Sawyer + Upper Sawyer

Rosebud + Rosebud–McKay + Lower Rosebud

Terret + Robinson

The outcrop patterns are intended to be used at a scale of no greater than 1:24,000. They are only as accurate as the combined errors from original mapping; the CRO/CDP compilation; and georeferencing and digitizing to create the shape files. Minor gaps and misalignment along quadrangle boundaries are common, but most are not significant at the 1:24,000 scale.

DISCUSSION

Combining outcrop patterns from the CRO/CDP maps was straightforward using the methods described above. However, there were several exceptions.

1. Otter Creek Problem—In some cases, two or more authors applied the same name to different coalbeds. In fact, entire coal fields were sometimes mapped using bed names “stratigraphically offset” from those used in an adjacent field. For example, several authors used inconsistent coalbed names to describe coal stratigraphy near Otter Creek in eastern Powder River County (table 2). A result is that the interval between the Canyon bed(s) and the Pawnee bed remains problematic in the central PRB near Otter Creek. Coalbeds mapped along the boundary between the Fort Howes and Goodspeed Butte quadrangles are clearly misaligned on the CRO/CDP maps (appendix A., nos. 75 and 76). These bed naming differences are mentioned in the CRO/CDP reports but have not been resolved.

2. Wall–Otter–Elk Problem—The stratigraphic positions of the Wall, Otter, and Elk beds are uncertain. In the northwest Poker Jim Butte and northeast Browns Mountain quadrangles, the Otter lies above the Wall. Further east, the Otter bed is equivalent to the Elk bed along the Fort Howes–Goodspeed Butte quadrangle boundary. Yet, to the northwest in the Threemile Buttes quadrangle, the Otter–Elk lies below the Wall. There is an obvious conflict in stratigraphic order—a consequence of the naming inconsistencies noted above in (1). We left the names of these coalbeds (Wall, Otter, and Elk) “as is” until the discrepancies can be rectified.

3. Poker Jim—The Poker Jim coalbed in the northern Browns Mountain quadrangle was named by Culbertson and Klett (1976) and appears equivalent with Warren’s (1959) Pawnee bed to the



Figure 2. Major coal outcrops of the PRB showing extent of CRO/CDP mapping. Not intended to show details of individual coalbeds.

north. Culbertson and Klett (1976) applied the Pawnee name to a stratigraphically higher bed in the Browns Mountain quadrangle. We did not combine the Poker Jim bed with the Pawnee bed because it would violate one of our rules for “joining patterns”—namely, that beds do not exist anywhere together.

4. Anderson1, 2, 3 / Dietz 1—In northern Sayle and southern Phillips Butte quadrangles (NE¼ of T. 7 S., R. 47 E.) the Anderson1, Anderson2, Anderson3, and Dietz1 beds are mapped on the north side of an east–west-trending fault. This is the only location in the Montana PRB where these bed names were used. None of these beds were combined with the primary Anderson or Dietz outcrop patterns.

Table 2. Coalbed names used by various authors in the vicinity of Otter Creek.

CRO/CDP (Fort Howes)	McKay (1976)	Warren (1959)	Bryson & Bass (1973)	CRO/CDP (Goodspeed Butte)
Upper Canyon	Canyon	Canyon	Canyon	Canyon
Lower Canyon	Cook	Ferry	—	Ferry
Local	Wall	Cook	Cook	Upper Cook
Cook	Lower Wall	Wall	Otter	Lower Cook
Otter	Pawnee	Elk	Elk	Elk
—	Local	Dunning	Dunning	Dunning
Brewster–Arnold	Cache	Odell		Odell

Our goal was to provide digital coal outcrop patterns representative of coal stratigraphy in the Montana PRB that could be easily accessed and used with other graphical datasets. The coal outcrops are available from the MBMG ftp site (ftp://sun2.mtech.edu/pub/geology/MTPRB_Coal_Outcrop.mpk) and subject to change without notice as more information and new interpretations become available.

REFERENCES

- Bryson, R.P., and Bass, N.W., 1973, Geology of the Moorhead coal field, Powder River, Big Horn, and Rosebud Counties, Montana: U.S. Geological Survey Bulletin 1338, 116 p.
- Culbertson, W.C., and Klett, M.C., 1976, Geologic map and coal sections of the Browns Mountain quadrangle, Rosebud County, Montana: U.S. Geological Survey Map MF-814, 2 sheets.
- McKay, E.J., 1976, Preliminary geologic map and coal sections of the Fort Howes quadrangle, Rosebud and Powder River Counties, Montana: U.S. Geological Survey Map MF-807, 1 sheet.
- Warren, W.C., 1959, Reconnaissance geology of the Birney-Broadus coal field, Rosebud and Powder River Counties, Montana: U.S. Geological Survey Bulletin 1072-J, p.561–585.

APPENDIX A

The following list provides references for 108 7.5-minute quadrangles located in Montana and mapped as part of the CRO/CDP program. The map scale for all reports is 1:24,000.

1. Colorado School of Mines Research Institute, 1979, Coal resource occurrence and coal development potential maps of the Miller Creek NW quadrangle, Rosebud and Custer Counties, Montana: U.S. Geological Survey Open-File Report 78-637, 17 p., 7 pls., 1 table.
2. Colorado School of Mines Research Institute, 1979, Coal resource occurrence and coal development potential maps of the Moon Creek School quadrangle, Custer County, Montana: U.S. Geological Survey Open-File Report 78-636, 14 p., 7 pls., 1 table.
3. Colorado School of Mines Research Institute, 1978, Coal resource occurrence and coal development potential maps of the Griffin Coulee SW quadrangle, Rosebud and Treasure Counties, Montana: U.S. Geological Survey Open-File Report 78-647, 17 p., 7 pls., 1 table.
4. Colorado School of Mines Research Institute, 1979, Coal resource occurrence and coal development potential maps of the McKerlich Creek quadrangle, Rosebud County, Montana: U.S. Geological Survey Open-File Report 78-641, 15 p., 10 pls., 1 table.
5. Colorado School of Mines Research Institute, 1979, Coal resource occurrence and coal development potential maps of the Crain Place quadrangle, Rosebud County, Montana: U.S. Geological Survey Open-File Report 78-644, 18 p., 11 pls., 1 table.
6. Colorado School of Mines Research Institute, 1979, Coal resource occurrence and coal development potential maps of the Miller Creek SW quadrangle, Custer and Rosebud Counties, Montana: U.S. Geological Survey Open-File Report 78-646, 18 p., 12 pls., 2 tables.
7. Colorado School of Mines Research Institute, 1979, Coal resource occurrence and coal development potential maps of the Miller Creek quadrangle, Custer County, Montana: U.S. Geological Survey Open-File Report 78-635, 16 p., 7 pls., 2 tables.
8. Colorado School of Mines Research Institute, 1978, Coal resource occurrence and coal development potential maps of the Jack Creek quadrangle, Custer County, Montana: U.S. Geological Survey Open-File Report 78-639, 16 p., 8 pls., 1 table.
9. Colorado School of Mines Research Institute, 1979, Coal resource occurrence and coal development potential maps of the Beebe SW quadrangle, Custer County, Montana: U.S. Geological Survey Open-File Report 78-634, 8 p., 3 pls.
10. Colorado School of Mines Research Institute, 1979, Coal resource occurrence and coal development potential maps of the Iron Spring quadrangle, Big Horn and Treasure Counties, Montana: U.S. Geological Survey Open-File Report 78-631, 8 p., 3 pls.
11. Colorado School of Mines Research Institute, 1979, Coal resource occurrence and coal development potential maps of the Minnehaha Creek South quadrangle, Treasure and Big Horn Counties, Montana: U.S. Geological Survey Open-File Report 78-833, 21 p., 16 pls., 1 table.
12. Colorado School of Mines Research Institute, 1979, Coal resource occurrence and coal development potential maps of the McClure Creek quadrangle, Rosebud and Treasure Counties, Montana: U.S. Geological Survey Open-File Report 78-834, 22 p., 15 pls., 2 tables.
13. Colorado School of Mines Research Institute, 1979, Coal resource occurrence and coal development potential maps of the Trail Creek School quadrangle, Rosebud County, Montana: U.S. Geological Survey Open-File Report 78-835, 20 p., 13 pls., 1 table.
14. Colorado School of Mines Research Institute, 1979, Coal resource occurrence and coal development potential maps of the Colstrip West quadrangle, Rosebud County, Montana: U.S. Geological Survey Open-File Report 78-648, 20 p., 13 pls., 1 table.

15. Colorado School of Mines Research Institute, 1978, Coal resource occurrence and coal development potential maps of the Colstrip East quadrangle, Rosebud County, Montana: U.S. Geological Survey Open-File Report 78-836, 18 p., 13 pls., 1 table.
16. Colorado School of Mines Research Institute, 1979, Coal resource occurrence and coal development potential maps of the Hammond Draw NW quadrangle, Rosebud County, Montana: U.S. Geological Survey Open-File Report 78-645, 18 p., 10 pls., 1 table.
17. Colorado School of Mines Research Institute, 1979, Coal resource occurrence and coal development potential maps of the John Hen Creek quadrangle, Rosebud County, Montana: U.S. Geological Survey Open-File Report 78-643, 18 p., 10 pls., 1 table.
18. Colorado School of Mines Research Institute, 1979, Coal resource occurrence and coal development potential maps of the Brandenburg NW quadrangle, Custer and Rosebud Counties, Montana: U.S. Geological Survey Open-File Report 78-642, 17 p., 7 pls., 1 table.
19. Colorado School of Mines Research Institute, 1979, Coal resource occurrence and coal development potential maps of the H S School quadrangle, Custer County, Montana: U.S. Geological Survey Open-File Report 78-638, 16 p., 7 pls., 1 table.
20. Colorado School of Mines Research Institute, 1979, Coal resource occurrence and coal development potential maps of the Fourmile Creek quadrangle, Custer County, Montana: U.S. Geological Survey Open-File Report 78-640, 16 p., 8 pls., 1 table.
21. Colorado School of Mines Research Institute, 1979, Coal resource occurrence and coal development potential maps of the Carey-Malone School quadrangle, Custer County, Montana: U.S. Geological Survey Open-File Report 78-837, 20 p., 11 pls., 2 tables.
22. Colorado School of Mines Research Institute, 1979, Coal resource occurrence and coal development potential maps of the Kirkpatrick Hill quadrangle, Custer County, Montana: U.S. Geological Survey Open-File Report 78-838, 20 p., 10 pls., 2 tables.
23. Colorado School of Mines Research Institute, 1979, Coal resource occurrence and coal development potential maps of the Padlock Ranch quadrangle, Big Horn County, Montana: U.S. Geological Survey Open-File Report 78-633, 9 p., 3 pls.
24. Colorado School of Mines Research Institute, 1979, Coal resource occurrence and coal development potential maps of the Iron Spring SW quadrangle, Big Horn County, Montana: U.S. Geological Survey Open-File Report 78-632, 9 p., 3 pls.
25. Colorado School of Mines Research Institute, 1979, Coal resource occurrence and coal development potential maps of the Wolf School quadrangle, Big Horn and Treasure Counties, Montana: U.S. Geological Survey Open-File Report 79-20, 25 p., 17 pls., 2 tables.
26. Colorado School of Mines Research Institute, 1979, Coal resource occurrence and coal development potential maps of the Sarpy School quadrangle, Big Horn, Rosebud, and Treasure Counties, Montana: U.S. Geological Survey Open-File Report 79-18, 22 p., 13 oversize sheets.
27. Colorado School of Mines Research Institute, 1979, Coal resource occurrence and coal development potential maps of the Rough Draw quadrangle, Rosebud County, Montana: U.S. Geological Survey Open-File Report 79-17, 28 p., 22 oversize sheets.
28. Colorado School of Mines Research Institute, 1979, Coal resource occurrence and coal development potential maps of the Colstrip SW quadrangle, Rosebud County, Montana: U.S. Geological Survey Open-File Report 79-7, 24 p., 17 oversize sheets.
29. Colorado School of Mines Research Institute, 1979, Coal resource occurrence and coal development potential maps of the Colstrip SE quadrangle, Rosebud County, Montana: U.S. Geological Survey Open-File Report 79-6, 23 p., 17 pls., 1 table.

30. Colorado School of Mines Research Institute, 1979, Coal resource occurrence and coal development potential maps of the Hammond Draw SW quadrangle, Rosebud County, Montana: U.S. Geological survey Open-File Report 79-12, 22 p., 16 pls., 1 table.
31. Colorado School of Mines Research Institute, 1979, Coal resource occurrence and coal development potential maps of the Hammond Draw quadrangle, Rosebud County, Montana: U.S. Geological Survey Open-File Report 79-11, 23 p., 16 oversize sheets.
32. Colorado School of Mines Research Institute, 1979, Coal resource occurrence and coal development potential maps of the Brandenburg quadrangle, Rosebud and Powder River Counties, Montana: U.S. Geological Survey Open-File Report 79-4, 20 p., 13 pls., 2 tables.
33. Colorado School of Mines Research Institute, 1979, Coal resource occurrence and coal development potential maps of the Hayes Point quadrangle, Custer and Powder River Counties, Montana: U.S. Geological Survey Open-File Report 79-13, 22 p., 16 oversize sheets.
34. Colorado School of Mines Research Institute, 1979, Coal resource occurrence and coal development potential maps of the North Stacey School quadrangle, Custer and Powder River Counties, Montana: U.S. Geological Survey Open-File Report 79-16, 27 p., 22 pls., 2 tables.
35. Colorado School of Mines Research Institute, 1979, Coal resource occurrence and coal development potential maps of the Foster Creek School quadrangle, Custer and Powder River Counties, Montana: U.S. Geological Survey Open-File Report 79-9, 23 p., 14 pls., 2 tables.
36. Colorado School of Mines Research Institute, 1979, Coal resource occurrence and coal development potential maps of the Volborg quadrangle, Custer and Powder River Counties, Montana: U.S. Geological Survey Open-File Report 79-19, 23 p., 13 pls., 2 tables.
37. Colorado School of Mines Research Institute, 1979, Coal resource occurrence and coal development potential maps of the Divide School quadrangle, Custer and Powder River Counties, Montana: U.S. Geological Survey Open-File Report 79-8, 19 p., 10 pls., 1 table.
38. Colorado School of Mines Research Institute, 1979, Coal resource occurrence and coal development potential maps of the Jeans Fork NE quadrangle, Big Horn County, Montana: U.S. Geological Survey Open-File Report 79-14, 19 p., 6 pls., 1 table.
39. Colorado School of Mines Research Institute, 1980, Coal resource occurrence and coal development potential maps of the Chalky Point quadrangle, Big Horn and Rosebud Counties, Montana: U.S. Geological Survey Open-File Report 79-5, 20 p., 9 oversize sheets.
40. Colorado School of Mines Research Institute, 1980, Coal resource occurrence and coal development potential maps of the Black Spring quadrangle, Rosebud and Big Horn Counties, Montana: U.S. Geological Survey Open-File Report 79-3, 21 p., 16 oversize sheets.
41. Colorado School of Mines Research Institute, 1980, Coal resource occurrence and coal development potential maps of the Jimtown quadrangle, Rosebud and Big Horn Counties, Montana: U.S. Geological Survey Open-File Report 79-15, 21 p., 10 oversize sheets.
42. Colorado School of Mines Research Institute, 1979, Coal resource occurrence and coal development potential maps of the Badger Peak quadrangle, Rosebud County, Montana: U.S. Geological Survey Open-File Report 79-2, 25 p., 16 pls., 2 tables.
43. Colorado School of Mines Research Institute, 1979, Coal resource occurrence and coal development potential maps of the Garfield Peak quadrangle, Rosebud County, Montana: U.S. Geological Survey Open-File Report 79-10, 23 p., 13 pls., 2 tables.
44. Colorado School of Mines Research Institute, 1979, Coal resource occurrence and coal development potential maps of the Ashland NE quadrangle, Rosebud County, Montana: U.S. Geological Survey Open-File Report 79-1, 22 p., 19 pls., 1 table.

45. Colorado School of Mines Research Institute, 1979, Coal resource occurrence and coal development potential maps of the Cook Creek Reservoir quadrangle, Powder River and Rosebud Counties, Montana: U.S. Geological Survey Open-File Report 79-84, 27 p., 35 pls., 2 tables.
46. Colorado School of Mines Research Institute, 1980, Coal resource occurrence and coal development potential maps of the Beaver Creek School quadrangle, Powder River County, Montana: U.S. Geological Survey Open-File Report 79-79, 31 p., 32 oversize sheets.
47. Colorado School of Mines Research Institute, 1979, Coal resource occurrence and coal development potential maps of the Stacey quadrangle, Powder River County, Montana: U.S. Geological Survey Open-File Report 79-99, 26 p., 25 pls., 2 tables.
48. Colorado School of Mines Research Institute, 1979, Coal resource occurrence and coal development potential maps of the Elk Ridge quadrangle, Powder River County, Montana: U.S. Geological Survey Open-File Report 79-85, 26 p., 19 oversize sheets.
49. Colorado School of Mines Research Institute, 1980, Coal resource occurrence and coal development potential maps of the Box Elder Creek quadrangle, Powder River County, Montana: U.S. Geological Survey Open-File Report 79-81, 26 p., 16 oversize sheets.
50. Colorado School of Mines Research Institute, 1980, Coal resource occurrence and coal development potential maps of the Coalwood quadrangle, Powder River County, Montana: U.S. Geological Survey Open-File Report 79-82, 22 p., 17 oversize sheets.
51. Colorado School of Mines Research Institute, 1979, Coal resource occurrence and coal development potential maps of the Ashland quadrangle, Rosebud County, Montana: U.S. Geological Survey Open-File Report 79-78, 23 p., 16 pls., 2 tables.
52. Colorado School of Mines Research Institute, 1980, Coal resource occurrence and coal development potential maps of the Willow Crossing quadrangle, Powder River and Rosebud Counties, Montana: U.S. Geological Survey Open-File Report 79-101, 26 p., 14 oversize sheets.
53. Colorado School of Mines Research Institute, 1980, Coal resource occurrence and coal development potential maps of the Coleman Draw quadrangle, Powder River County, Montana: U.S. Geological Survey Open-File Report 79-83, 28 p., 31 oversize sheets.
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