The Blind Canyon and Bear Canyon seams were measured and observed at various points in the study area by the author, however, these seams were traceable only locally in Bear Canyon. Limited traceability of these two seams is attributed to the lenticular nature of the seams, the extent of slope debris acting as cover and/or depositional irregularities.[2] H.H. doelling indicates the Bear Canyon seam is present in Left Fork of Fish Creek Canyon (east of Bear Creek Canyon) with a thickness of 6.5 feet, however, this measurement was not verified.[1] Doelling also has a 17.3 foot measurement in the Bear Canyon seam in Bear Canyon that was not verified in the field possibly because this particular exposure has since been covered by slope debris.

A small adit approximately 50 feet in length and interpreted as penetrating the Bear Canyon seam (measurement M-5), and a longer adit approximately 300 feet in length and interpreted as penetrating the Blind Canyon seam (measurement M-7), were discovered in Bear Creek Canyon, Section 24, Township 16 South, Range 7 East. The full extent and history of these workings is not known. The fact that these two seams

---

[2] 1931, The Wasatch Plateau Coal Field, Utah, U.S.G.S. Bulletin 819, E.M. Spieker.

are not traceable for any significant area beyond these old workings indicates the subordinate nature of the Bear and Blind Canyon seams.

In the SW¼, SW¼ of Section 24, Township 16 South, Range 7 East the Bear Canyon Mine is located. Two seams were worked there, the upper of which is the Bear Canyon seam (elevation 7,420 feet) and the lower of which is the Hiawatha seam (elevation 7,340 feet). This interpretation is based on the seams stratigraphic position above the Star Point Sandstone. The Blind Canyon seam apparently has pinched out or been replaced in this locality. The mine lies on the west side of the Bear Canyon fault. The presence of the Hiawatha and Bear Canyon seams at the mine lend credence to the author's opinion that these seams are probably present across canyon to the east where they were not traceable nor measurable due to slope cover.

The Hiawatha seam was identified throughout the majority of the study area based on its stratigraphic relationship with the underlying Star Point Sandstone. The Star Point Sandstone is continuous and conspicuous within the area covered by this report. While the Hiawatha seam was not measured in Left Fork of Fish

Creek Canyon by this author or previous investigators (i.e. E.M. Spieker, H.H. Doelling), the presence of the Reichert Mine (Hiawatha seam - after Doelling) in Section 20, Township 16 South, Range 8 East suggests the interstitial presence of the Hiawatha seam in Left Fork. Where identified and measured, the Hiawatha seam achieved mineable thickness in all but one instance (3.3 feet - measurement M-2). However, coal thickness at outcrop is invariably thinner than the subsurface thickness. The Hiawatha seam averages 5.96 feet in thickness in the area inspected. Specific work accomplished is shown on the geologic map (Enclosure 1) and columnar outcrop sections (Figure 2 - following pages).

Well consolidated sandstone forms the roof and floor of the Hiawatha seam in the majority of locations inspected along outcrop. This situation provides excellent mining conditions and high coal recovery percentages as is demonstrated by 90 to 96 percent recovery of the Hiawatha seam at the King Mine approximately five miles NNE of the study area.(1)

Doelling states that "extensive mining under Gentry Mountain (a short distance due north of Bear Creek Canyon) reveals that the Hiawatha is continuous in the anticipated thickness".(1)

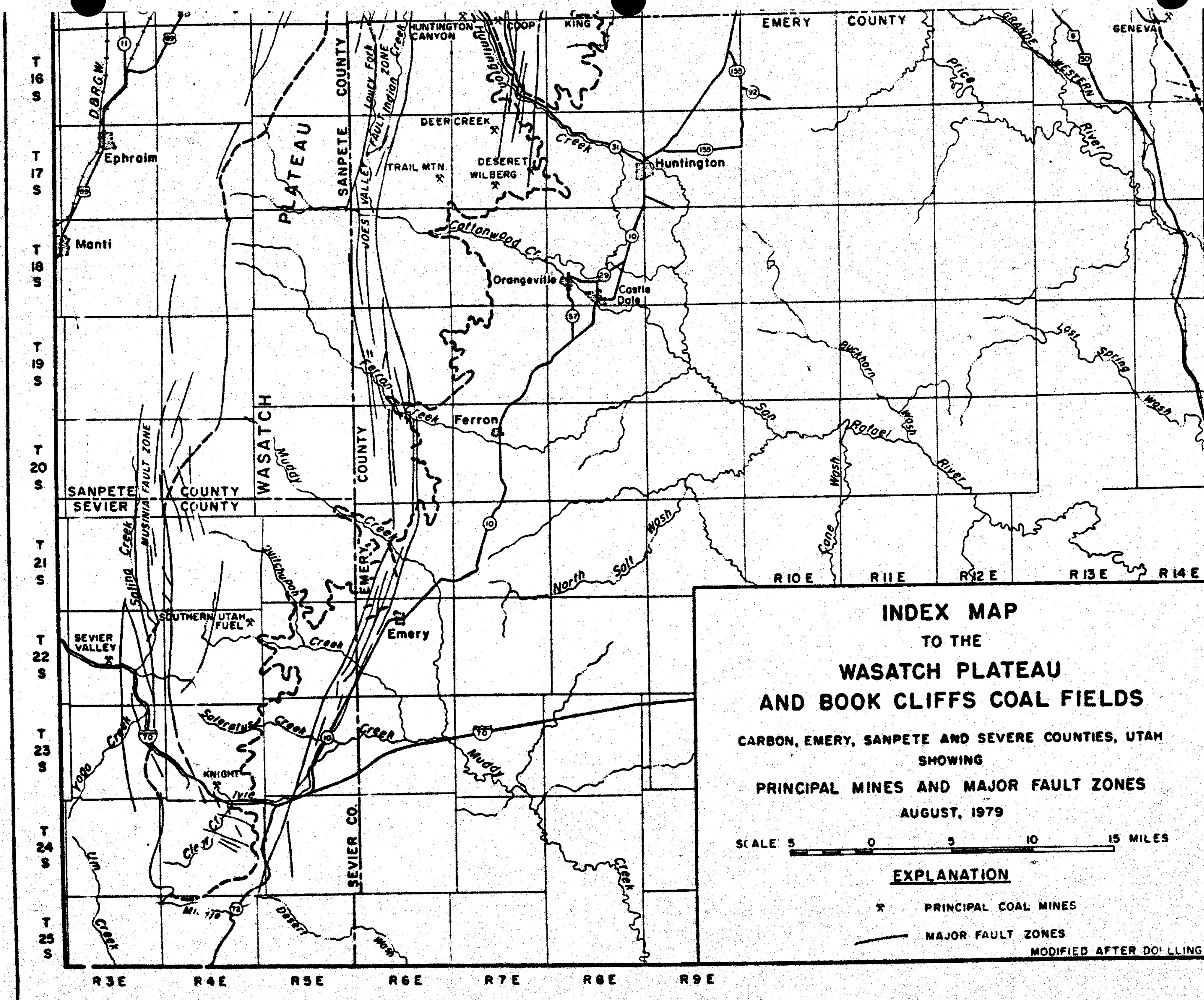
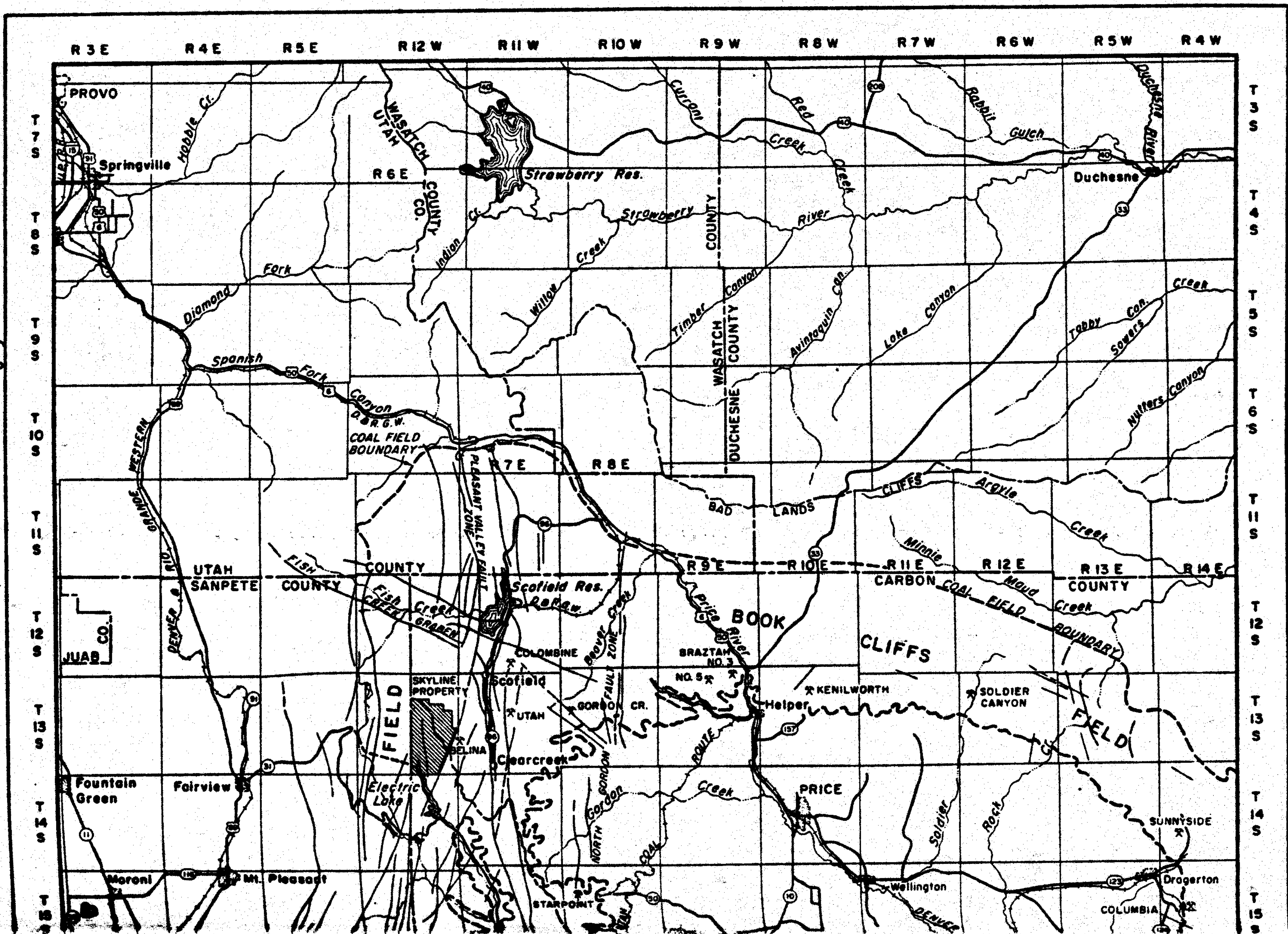
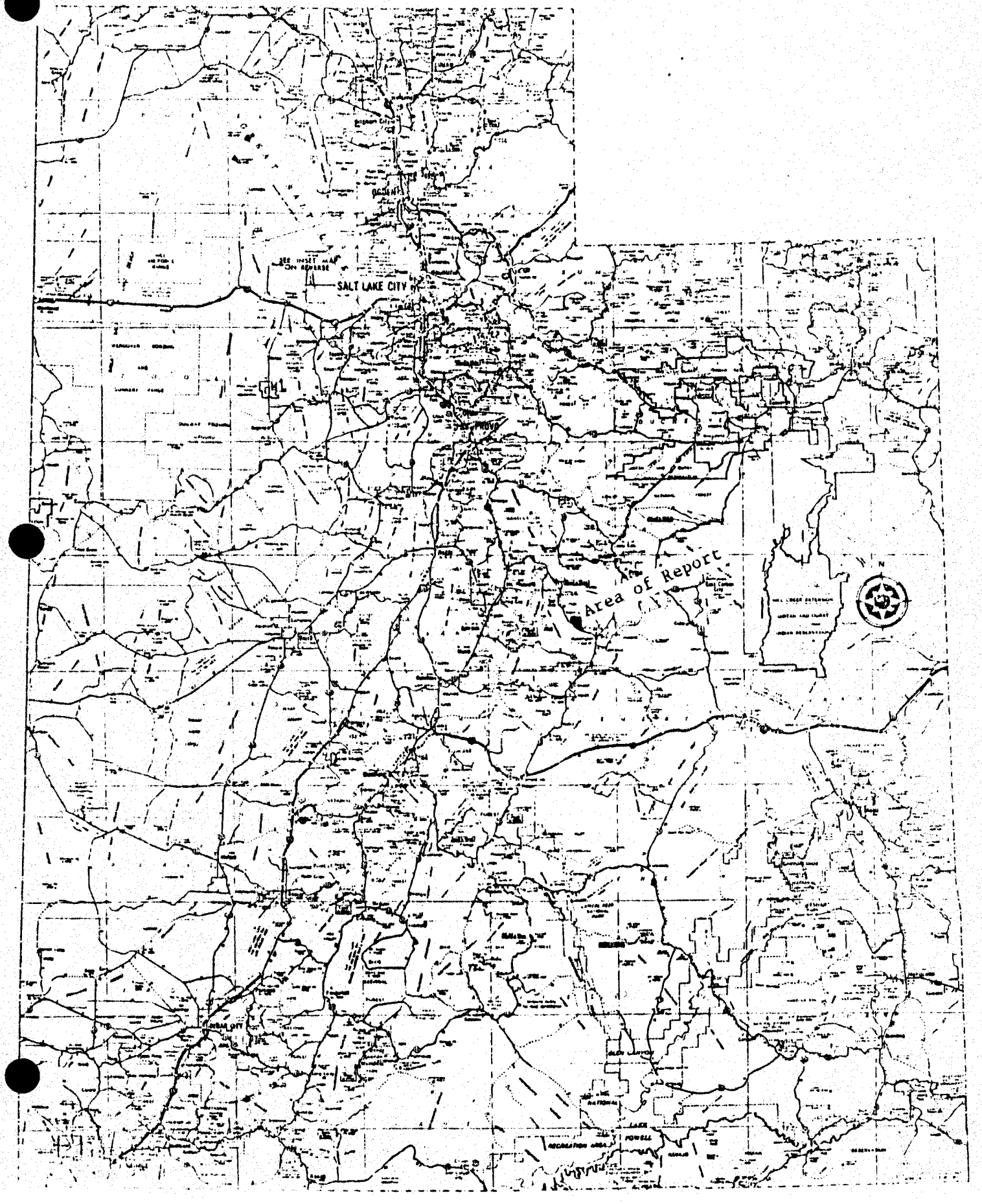

INDEX MAP
TO THE
WASATCH PLATEAU
AND BOOK CLIFFS COAL FIELDS
CARBON, EMERY, SANPETE AND SEVERE COUNTIES, UTAH
SHOWING
PRINCIPAL MINES AND MAJOR FAULT ZONES
AUGUST, 1979
SCALE 5 0 5 10 15 MILES
EXPLANATION
PRINCIPAL COAL MINES
MAJOR FAULT ZONES
MODIFIED AFTER DOELLING
EMERY COUNTY
SANPETE COUNTY
SEVIER COUNTY
WASATCH PLATEAU
SANPETE COUNTY
EMERY COUNTY
SEVIER CO.
JOES VALLEY FAULT ZONE
MUSINIA FAULT ZONE
HUNTINGTON CANYON
COOP
KING
GENEVA
DEER CREEK
TRAIL MTN.
DESERET
WILBERG
SOUTHERN UTAH FUEL
SEVIER VALLEY
KNIGHT
Ephraim
Manti
Huntington
Orangeville
Castle Dale
Ferron
Emery
D.&R.G.W.
GRANDE WESTERN
Price River
Huntington Creek
Cottonwood Cr.
Ferron Creek
Muddy Creek
Lost Spring Wash
Buckhorn Wash
San Rafael River
Cane Wash
North Salt Wash
Salina Creek
Saleratus Creek
Ivie Creek
Yogo Creek
R3E
R4E
R5E
R6E
R7E
R8E
R9E
R10E
R11E
R12E
R13E
R14E
T16S
T17S
T18S
T19S
T20S
T21S
T22S
T23S
T24S
T25S

FIGURE 6-1


R3E
R4E
R5E
R12W
R11W
R10W
R9W
R8W
R7W
R6W
R5W
R4W
T 3 S
T 4 S
T 5 S
T 6 S
T 11 S
T 12 S
T 13 S
T 14 S
T 15 S
T 7 S
T 8 S
T 9 S
T 10 S
PROVO
Springville
Hobble Cr.
WASATCH
UTAH
COUNTY
CO.
R6E
Strawberry Res.
Current
Red
Creek
Rabbit
Gulch
Duchesne River
Duchesne
Indian Cr.
Strawberry
River
Willow
Creek
Diamond
Fork
Timber
Canyon
WASATCH COUNTY
DUCHESNE COUNTY
Avintaquin Can.
Lake Canyon
Tabby Can.
Sowers
Creek
Nutters Canyon
Spanish
Fork
Canyon
D.& R.G.W.
COAL FIELD BOUNDARY
PLEASANT VALLEY FAULT ZONE
R7E
R8E
BAD
LANDS
CLIFFS
Argyle
Creek
Minnie
Maud
Creek
R9E
R10E
R11E
R12E
R13E
R14E
UTAH
SANPETE
COUNTY
CARBON
COAL FIELD BOUNDARY
COUNTY
DENVER & RIO GRANDE WESTERN
FISH CREEK GRABEN
Fish Creek
Scofield Res.
D.& R.G.W.
Beaver Creek
FAULT ZONE
Price River
BOOK
CLIFFS
JUAB
CO.
COLOMBINE
BRAZTAH NO. 3
NO. 5
KENILWORTH
SOLDIER CANYON
FIELD
SKYLINE PROPERTY
Scofield
UTAH
GORDON CR.
Helper
FIELD
BELINA
Clearcreek
ROUTE
Fountain Green
Fairview
Electric Lake
Creek
PRICE
NORTH GORDON
Gordon
COAL
Soldier
Rock
SUNNYSIDE
Moroni
Mt. Pleasant
STARPOINT
Wellington
DENVER
Dragerton
COLUMBIA

6-3


SALT LAKE CITY
Area of Report
N

6.5.4 Columns and Cross-Sections (Appendix 6-A)

6.5.5 Coal Reserves (See page 1-3)

6.5.5.2 Coal characteristics (App. 6-B)

6.5.6 Coal and rock sample sites (See Plate 2-2)

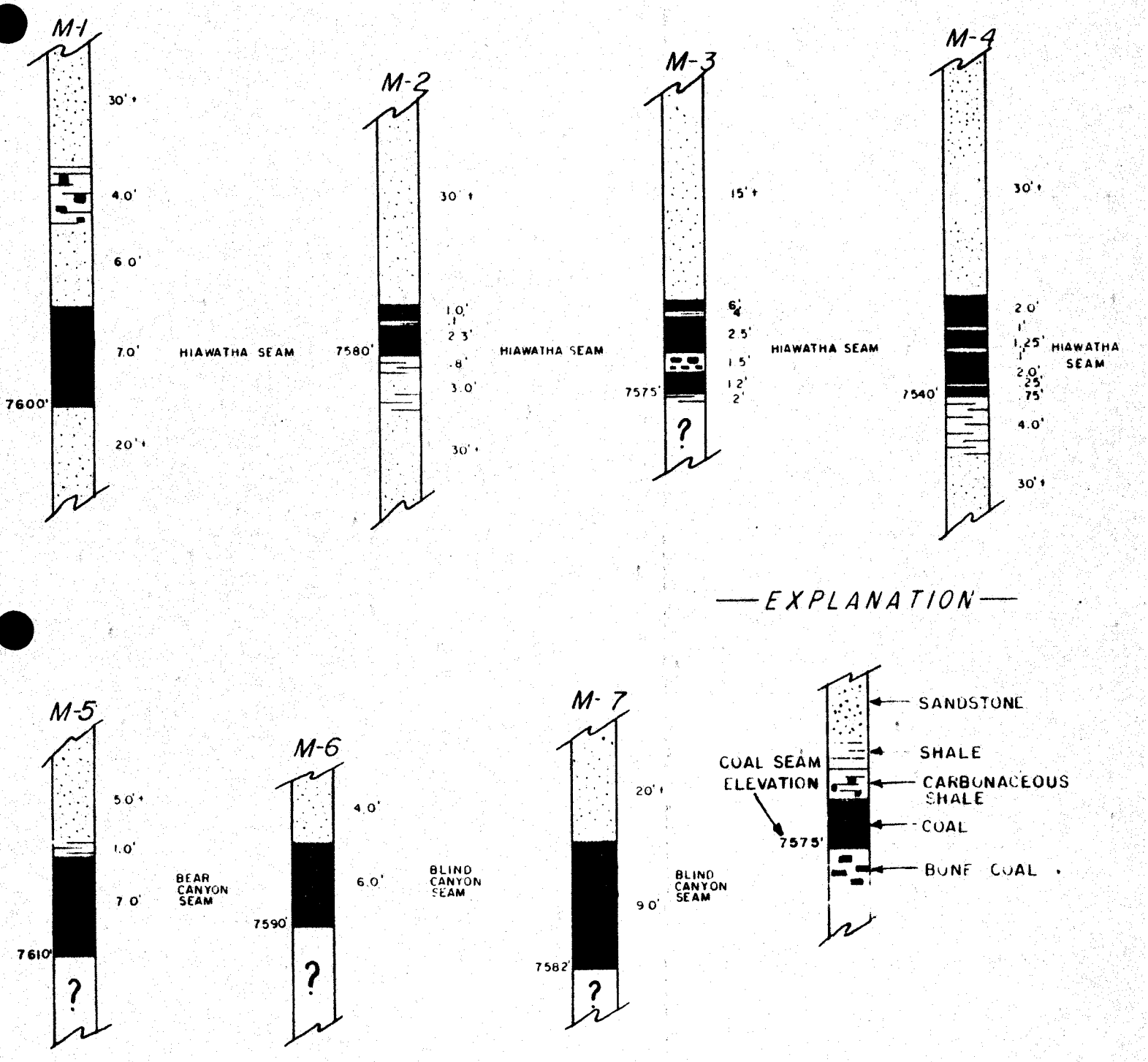
6.5.6.1 Rock characteristics (App. 6.C)

6.6.1 Mining hazards (See Appendix 3-B)

6.6.2 Surface hazards (See Sec. 3.5.8)

6.6.3 Impacts of mining (See Sec. 3.5)

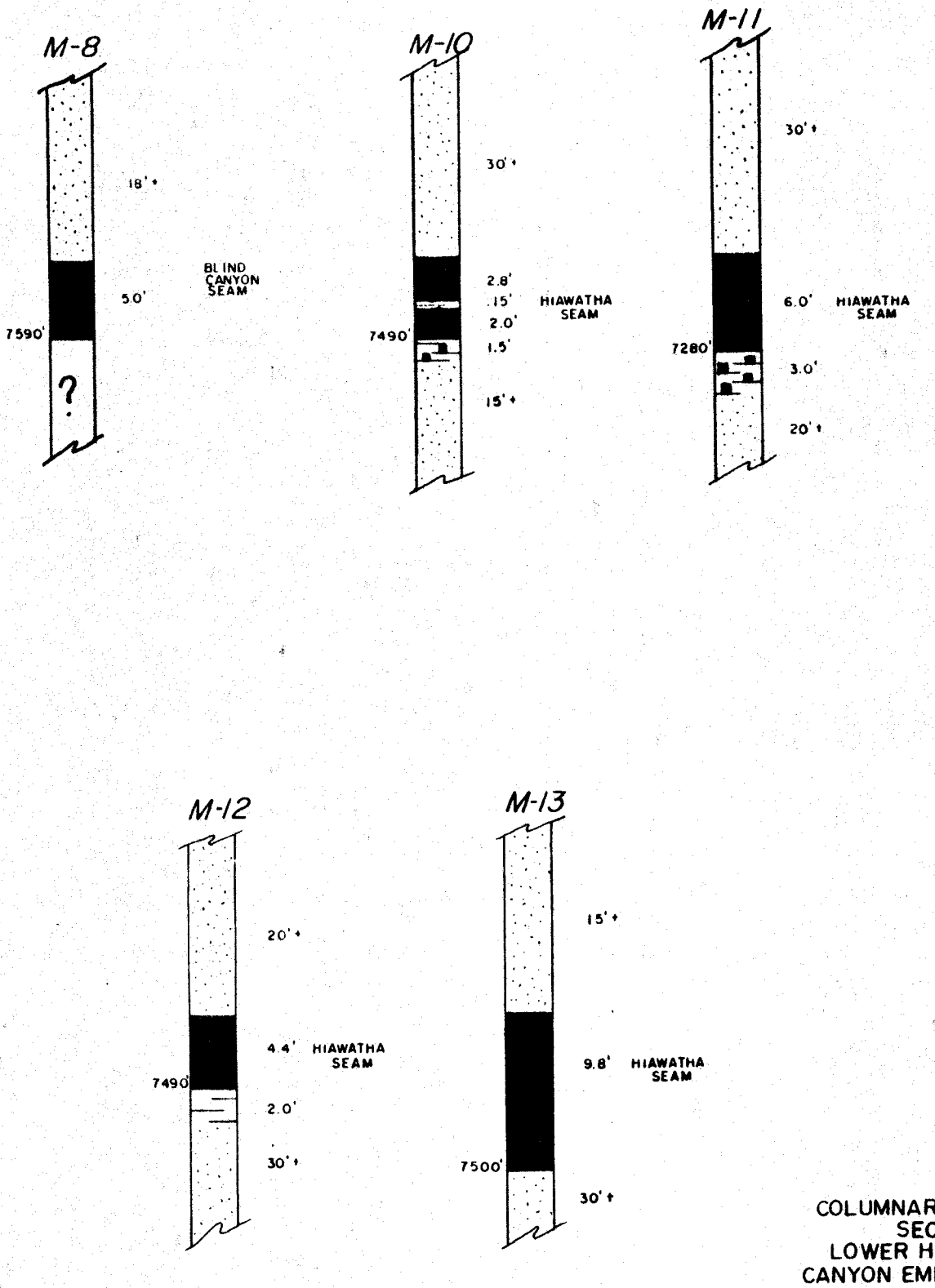
APPENDIX 6-A



COLUMNAR OUTCROP SECTIONS LOWER HUNTINGTON CANYON EMERY COUNTY, UTAH

Figure 2

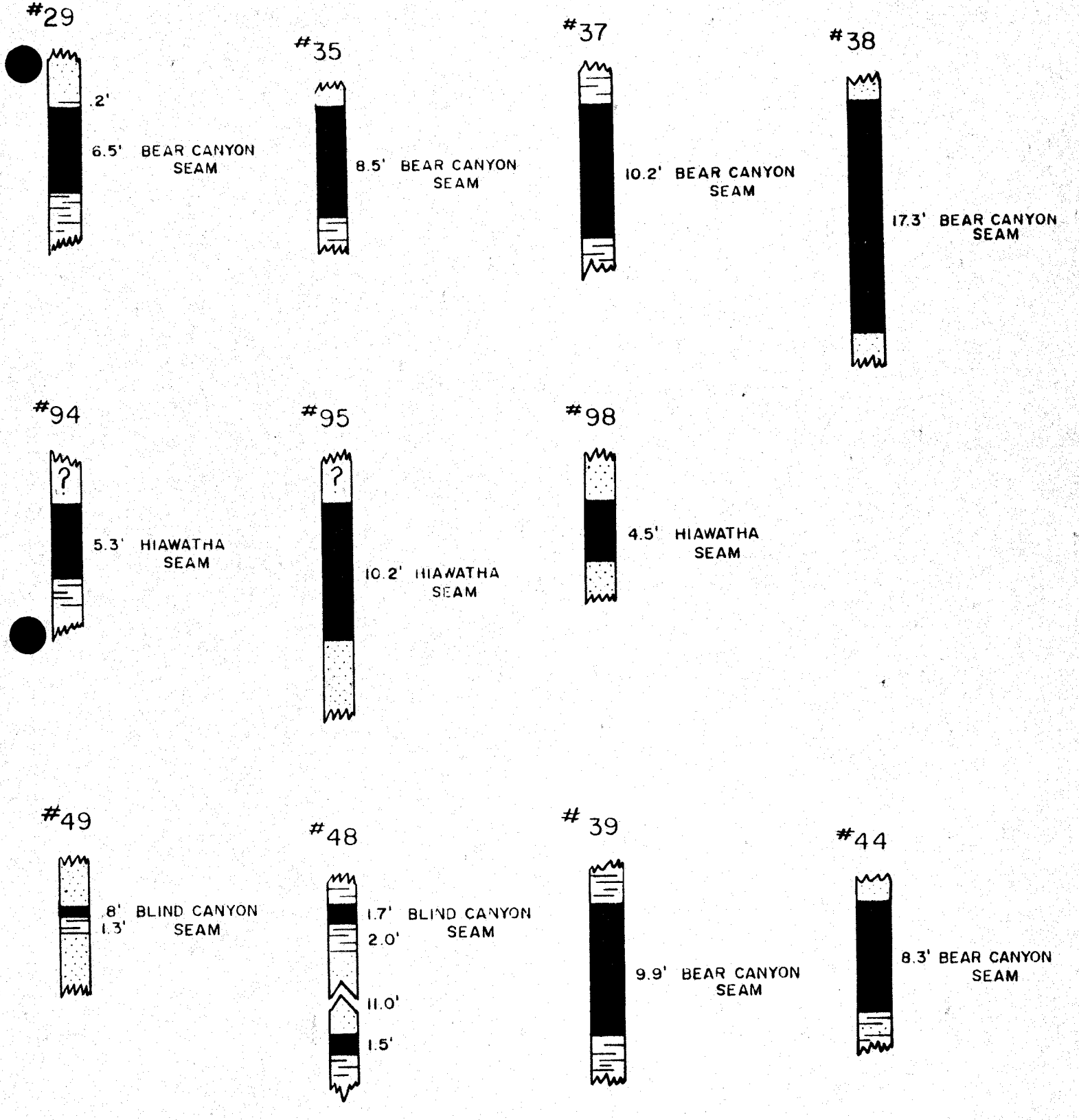
Vertical Scale 1"=10'



COLUMNAR OUTCROP SECTIONS LOWER HUNTINGTON CANYON EMERY COUNTY, UTAH

Figure 2

Vertical Scale 1"=10'



Vertical Scale 1" = 10'

COLUMNAR OUTCROP SECTIONS
(after Doelling, 1972)
LOWER HUNTINGTON CANYON
EMERY COUNTY, UTAH

Figure 2

System	Series	Stratigraphic Unit		Thickness (feet)	Description
TERTIARY	Eocene	Green River Formation		–	Chiefly greenish lacustrine shale and siltstone.
		Wasatch Group	Colton Formation	300-1,500	Varicolored shale with sandstone and limestone lenses, thickest to the north.
	Paleocene		Flagstaff Limestone	200-1,500	Dark yellow-gray to cream limestone, evenly bedded with minor amounts of sandstone, shale and volcanic ash, ledge former.
			North Horn Formation (Lower Wasatch)	500-2,500	Variegated shales with subordinate sandstone, conglomerate and freshwater limestone, thickens to north, slope former.
CRETACEOUS	?	Mesaverde Group			
	Maestrichthian		Price River Formation	600-1,000	Gray to white gritty sandstone interbedded with subordinate shale and conglomerate, ledge and slope former.
			Castlegate Sandstone	150- 500	White to gray, coarse-grained often conglomeratic sandstone, cliff former, weathers to shades of brown.
	Campanian		Blackhawk Formation *MAJOR COAL SEAMS*	700-1,000	Yellow to gray, fine- to medium-grained sandstone, interbedded with subordinate gray and carbonaceous shale, several thick *coal* seams.
			Star Point Sandstone	90-1,000	Yellow-gray massive cliff-forming sandstone, often in several tongues separated by Masuk Shale, thickens westward.
	Santonian	Mancos Shale	Masuk Shale	300-1,300	Yellow to blue-gray sandy shale, slope former, thick in north and central plateau area, thins southward.
			Emery Sandstone *COAL (?)*	50- 800	Yellow-gray friable sandstone tongue or tongues, cliff former, may contain *coal* (?) in south part of plateau if mapping is correct, thickens to west and south. *Coal* may be present in subsurface to west.
	Coniacian		Blue Gate Member	1,500-2,400	Pale blue-gray, nodular and irregularly bedded marine mudstone and siltstone with several arenaceous beds, weathers into low rolling hills and badlands, thickens northerly.
	Turonian		Ferron Sandstone Member *MAJOR COAL SEAMS*	50- 950	Alternating yellow-gray sandstone, sandy shale and gray shale with important *coal* beds of Emery coal field, resistant cliff former, thickens to the south.
	Cenomanian		Tununk Shale Member	400- 650	Blue-gray to black sandy marine slope forming mudstone.
	Albian	Dakota Sandstone *MINOR COAL*		0- 60	Variable assemblages of yellow-gray sandstone, conglomerate shale and *coal*. Beds lenticular and discontinuous.

Figure 5. Generalized section of rock formations, Wasatch Plateau coal field.

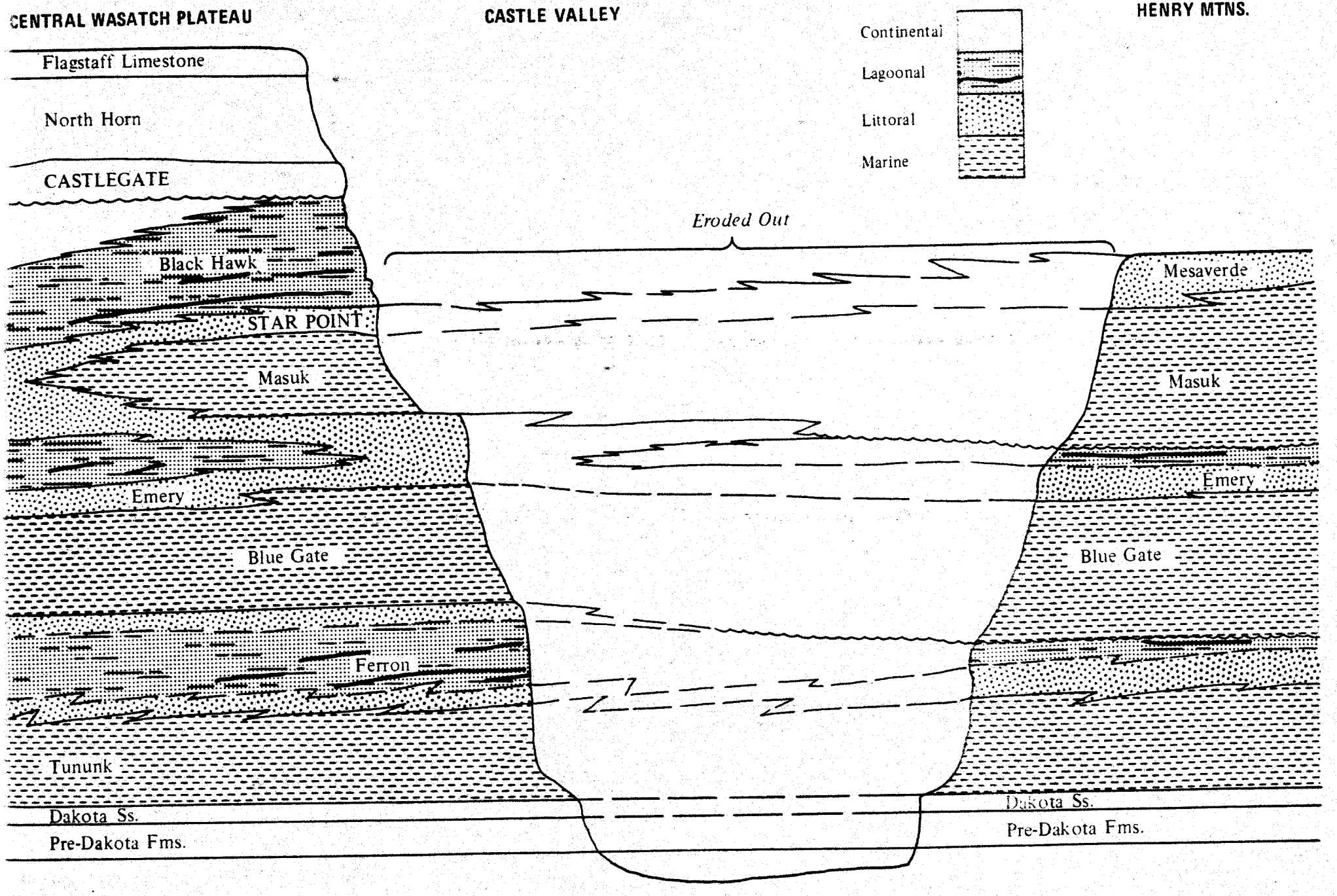


Figure 13. Stratigraphic correlation diagram from ntral Wasatch Plateau to the Henry Mountains.

Blackhawk Formation

The Blackhawk in the Mesaverde Group of the Wasatch Plateau contains important coal seams in the lower half of the formation. The 700- to 1,000-foot unit, less resistant than the units that contain it, consists of alternating slope- and cliff-forming units (figure 6). The cliff-forming sandstones are generally yellow-gray or white-gray on fresh surfaces and weather to shades of tan, yellow or brown. In places they are reddened by the natural burning of nearby coal seams. Sands are fine- to medium-grained and cemented by either calcite or silica. In a few places they are argillaceous. Iron colors the cement. Occasionally the iron has been leached by organic acids from covering swamps and the sandstone is white.

Slopes of the formation are made of various types of shale and coal. The shales, continental in origin, consist of three kinds: clay shale–soft, granular, gray to green in color and the most common; carbonaceous shale in various shades of brown and black; and smoke gray shale usually associated with the coal.

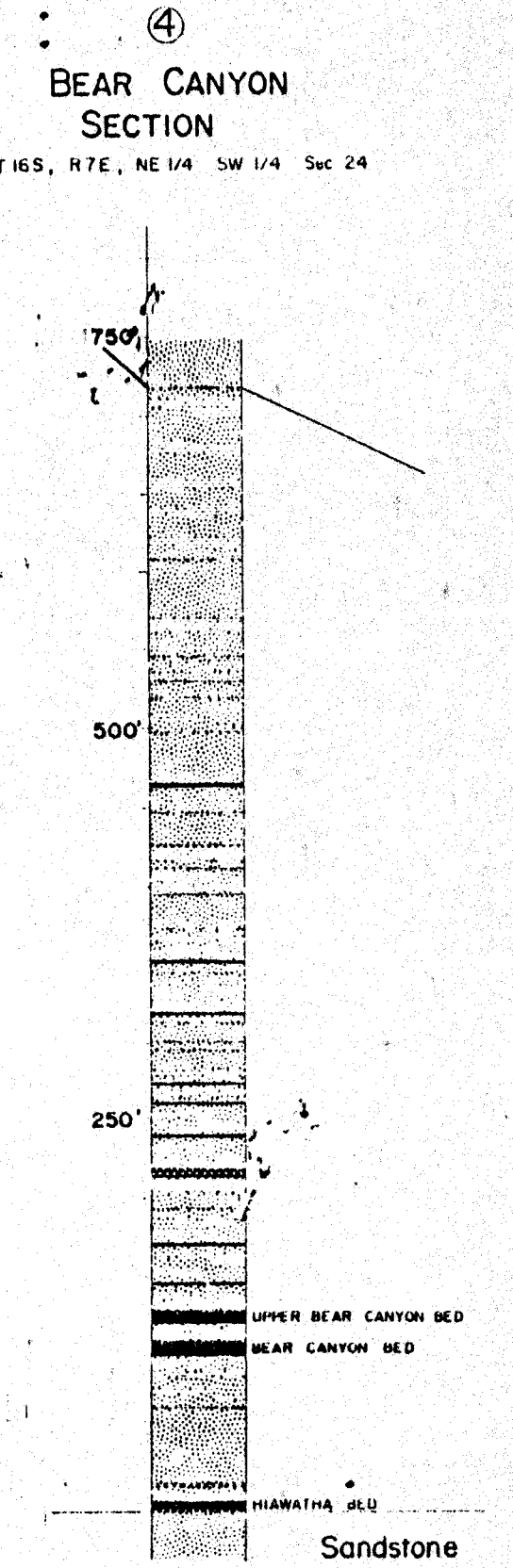
Other strata include friable shaley sandstones, usually thin and platy, that are cemented loosely by calcium carbonate. In some places the rock grades into an impure limestone.

The proportion of shale to sandstone is greater in the north part of the field as compared to the south, but total change in character of the formation is slight. In a section measured by Spieker (1931, p. 30-33) the unit consists of one-third shale and two-thirds sandstone. Key beds are local in extent and each area has its own grouping. An exception is the Aberdeen Sandstone Member. It underlies the Castlegate "A" coal bed and can be traced from the Gordon Creek area southward to Gentry Ridge near Wattis.

The lower contact of the Blackhawk was defined by Spieker (1931, p. 35) as "the clear-cut upper surface of the Star Point Sandstone," but Young (1955, p. 183) redefined the base as the bottom of the Spring Canyon Tongue. Young's work concentrated on the Book Cliffs coal field to the east, but his reports add to the understanding of the Blackhawk in the Wasatch Plateau field. Excerpts from his report follow:

> The redefined Blackhawk formation consists of some prominent littoral marine sandstone tongues and many lesser ones, all projecting eastward into the Mancos, where they lose their identity by grading into shale. Above each of them and below the next succeeding littoral marine sandstone, lagoonal deposits of sandstone, shale and coal were developed behind barrier bars, and where these deposits occur the underlying sandstone is almost everywhere white-capped. . .Division (of six members) is possible only where the basal littoral marine sandstones are developed at the extreme western end of the Book Cliffs at Storrs, Utah (simultaneously the northern end of the Wasatch Plateau field); only the basal sandstones of the Spring Canyon and Aberdeen members are present and between them is about 60 feet of coal-bearing rocks of the Spring Canyon Member. Above the basal sandstone of the Aberdeen Member are about 800 feet of undifferentiated coal measures of the Blackhawk, which are largely lagoonal but may include some inland floodplain deposits in the upper portion.

The commercial coal beds lie in the lower 250 to 350 feet of the formation; some thin units are in the upper part. Two of the more important coal beds are the Hiawatha and Castlegate "A" bed.



APPENDIX 6-B

COMMERCIAL TESTING & ENGINEERING CO.

GENERAL OFFICES: 228 NORTH LA SALLE STREET, CHICAGO, ILLINOIS 60601 · AREA CODE 312 726-8434

WESTERN DIVISION MANAGER
GAIL D. PALMER

SINCE 1908

PLEASE ADDRESS ALL CORRESPONDENCE TO
224 South Carbon Avenue
Price, Utah 84501
Phone: (801) 637-7540

March 2, 1982

CO-OP MINING CO
P.O. Box 300
Huntington, Utah 84528

Sample identification by
Co-op Mining Co.
#2

Kind of sample reported to us	Coal
Sample taken at	xxxx
Sample taken by	Co-op Mining Co.
Date sampled	xxxx
Date received	2-26-82

Analysis report no. 57-8990

SHORT PROXIMATE ANALYSIS

	As Received	Dry Basis
% Moisture	4.70	xxxxx
% Ash	7.49	7.86
Btu/lb	12937	13575
% Sulfur	0.41	0.43

% Air Dry Loss =	3.07
Moisture, Ash-free Btu =	14733
Pounds of SO2 per 10^6 Btu =	0.63
Moist, Mineral matter free Btu * =	14088
(Based on as rec'd moisture)*	
Pounds of Sulfur per 10^6 Btu =	0.32

JB/dt

Respectfully submitted,
COMMERCIAL TESTING & ENGINEERING CO.

JACK D. BLAIR, Manager, Price Laboratory

Original Copy Watermarked
For Your Protection

Charter Member

Sample No. WP-8-75 U.S.G.S. Serial No. D174679

Location Co-op Mine Face channel Sample

Sec. 22, T. 16 S., R. 7 E.

Seam Bear Canyon Seam Formation Blackhawk

Thickness Sampled 7' Date Sampled May 8, 1975

Proximate Analysis

	AD	AR	Dry	MAF
M	4.4	6.1		
VM	45.6	44.8	47.7	50.8
FC	44.1	43.3	46.2	49.2
Ash	5.9	5.8	6.1	
Btu/lb.	13140	12910	13740	14640

Ultimate Analysis

	AD	AR	Dry	MAF
H	5.9	5.9	5.6	6.0
C	72.6	71.4	76.0	80.9
N	1.3	1.3	1.4	1.5
O	13.8	15.1	10.4	11.1
S	0.5	0.5	0.5	0.5

FORMS OF SULFUR:

	Sulfate	Pyritic	Organic
As-received	0.02	0.16	0.30
Moist.-free	0.02	0.17	0.32
M. and ash-free	0.02	0.18	0.35

Free-swelling index No. 2 1/2

TRACE ELEMENTS BY VARIOUS DETERMINATIONS (Coal as received)

As (ppm) 1 F (ppm) <20 Hg (ppm) 0.03 Sb (ppm) 0.1 Se (ppm) 1.3

TRACE ELEMENTS, MOSTLY ATOMIC ABSORPTION ON ASH

MgO % 2.33 Cu (ppm) 97 Zn (ppm) 19

Na_2O % 2.96 Li (ppm) 84 Mn (ppm) 200

[illegible] (ppm) <1 Pb (ppm) 25

DELAYED NEUTRON DETERMINATION OF URANIUM AND THORIUM

ppm Th 5.0247 ppm U

SEMIQUANTITATIVE 6-STEP SPECTROGRAPHIC ANALYSIS OF THE ASH

G=Greater than 10%; N=Not detected; L=Detected, but below limit of determination

Fe %	5.0	Be (ppm)	N	Pb (ppm)	30	W (ppm)	N	Ag	N
Mg %	1.5	Bi	N	Pd	N	Y	30	La	N
Ca %	G	Cd	N	Pt	N	Zn	N	Th	N
Ti %	0.3	Co	10	Sb	N	Zr	200	U	N
Si %	---	Cr	70	Sc	15	Ce	N	V	3
Mn (ppm)	150	Cu	70	Sn	N	Ga	20	Yb	N

As (ppm)	N	La (ppm)	N	Sr (ppm)	500	Ge (ppm)	20	Al %	7.0
Au	N	Mo	15	Te	N	Hf	N	Na %	---
B	1500	Nb	L20	U	N	In	N	K %	N
Ba	1500	Ni	20	V	70	Li	N	P %	N

LOOKED FOR ONLY WHEN La OR Ce FOUND:

Pr		Fusibility of ash temp. °F.
Nd		Initial Deform. ------2190
Sm		Softening ----------2250
Eu	N	Fliud ----------2300

Ash Composition

AL203 -------11.0%
SO3 ---------~~1.9%~~ 8.4%
CL ----------0.10%
CAO ---------24.0%
SIO2 --------~~25.0%~~ 24.0%
P205 --------0.74%
TIO2 --------0.71%
MnO ---------0.020%
FE203 -------7.6%
K20 ---------0.17%

% Ash determined gravimetrically ashed at 525° C. -6.8%

AVERAGE COAL ANALYSES, HIAWATHA NE QUADRANGLE

	No. Analyses	As-received (percent)	
		Average	Range
BEAR CANYON BED			
Moisture	6	6.8	4.5-10.9
Volatile matter	6	43.8	37.4-46.0
Fixed carbon	6	45.7	44.9-46.0
Ash	6	4.5	3.8- 5.8
Sulfur	6	0.53	0.5- 0.6
Btu/lb	6	13,014	10,840-13,530
BLIND CANYON BED			
Moisture	10	4.8	3.8- 5.3
Volatile matter	9	41.7	40.2-44.7
Fixed carbon	9	44.3	39.2-48.3
Ash	10	8.9	5.8-12.4
Sulfur	8	0.58	0.5- 0.6
Btu/lb	9	12,492	11,700-13,080
HIAWATHA BED			
Moisture	370	5.6	0.7 -11.0
Volatile matter	357	42.3	36.3 -46.4
Fixed carbon	357	45.7	38.3 -52.7
Ash	359	6.2	3.3 -11.2
Sulfur	330	0.61	0.29- 1.1
Btu/lb	365	12,719	11,521-13,600

TABLE 2 (AFTER DOELLING, 1972)

APPENDIX 6-C

COMMERCIAL TESTING & ENGINEERING CO.

GENERAL OFFICES: 228 NORTH LA SALLE STREET, CHICAGO, ILLINOIS 60601 · AREA CODE 312 726-8434

WESTERN DIVISION MANAGER
LLOYD W. TAYLOR, JR.

SINCE 1908

PLEASE ADDRESS ALL CORRESPONDENCE TO:
10775 EAST 51st AVE., DENVER, COLO. 80239
OFFICE TEL. (303) 373-4772

June 25, 1979

CO-OP MINING COMPANY
Box No. 300
Huntington, Utah 84528

Sample identification by

CO-OP Mining Co.

Kind of sample reported to us	Floor Rock
Sample taken at	xxxxx
Sample taken by	CO-OP Mining Co.
Date sampled	xxxxx
Date received	5-24-79

Sample No. 57-2162 (CT&E Helper)
CO-OP Mine No. 2
Huntington Canyon

Analysis report no. 72-82660

SOIL ANALYSIS

pH	8.4
Sodium	5.4
Calcium	.61
Mangesium	4.4
Sodium Adsorption Ratio	6.4
Pyrite (as S-$CaCO_3$ eq t/1000T	0.0
Sand %	65
Silt %	26
Clay %	9

Respectfully submitted,
COMMERCIAL TESTING & ENGINEERING CO.

Gail D Palmer

G. D. PALMER, Manager, Denver Laboratory

GDP/vt

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AMERICAN COUNCIL OF INDEPENDENT LABORATORIES, INC. 1964

Charter Member

F-404

COMMERCIAL TESTING & ENGINEERING CO.

GENERAL OFFICES: 228 NORTH LA SALLE STREET, CHICAGO, ILLINOIS 60601 · AREA CODE 312 726-8434

WESTERN DIVISION MANAGER
LLOYD W. TAYLOR, JR.

PLEASE ADDRESS ALL CORRESPONDENCE TO
10775 EAST 51st AVE., DENVER, COLO. 80239
OFFICE TEL. (303) 373-4772

CO-OP MINING COMPANY
Box No. 300
Huntington, Utah

June 25, 1979

		Sample identification by
Kind of sample reported to us	Roof Rock	CO-OP Mining Co.
Sample taken at	xxxxx	Sample No. 57-2163 (CT&E Helper)
Sample taken by	CO-OP Mining Co.	CO-OP Mine No. 2
Date sampled	xxxxx	Huntington Canyon
Date received	5-24-79	

Analysis report no. 72-82661

SOIL ANALYSIS

pH	8.7
Sodium	12.5
Calcium	.34
Magnesium	.76
Sodium Adsorption Ratio	16.9
Pyrite (as S-$CaCO_3$ eq t/1000T)	0.0
Sand %	
Silt %	
Clay %	

Respectfully submitted,
COMMERCIAL TESTING & ENGINEERING CO.

Gail D Palmer

G. D. PALMER, Manager, Denver Laboratory

GDP/vt

COMMERCIAL TESTING & ENGINEERING CO.

GENERAL OFFICES: 1919 SOUTH HIGHLAND AVE., SUITE 210-B, LOMBARD, ILLINOIS 60148 • (312) 953-9300

DAVE SELDON
MANAGER
SOUTHWEST DIVISION

PLEASE ADDRESS ALL CORRESPONDENCE TO:
224 S. CARBON AVE., PRICE, UT 84501
OFFICE TEL. (801) 637-7540

CO-OP MINING COMPANY
P.O.Box 300
Huntington, Utah 84528

November 10, 1983

Sample identification by

CO-OP Mining

Bear Canyon
Hiawatha Seam

Kind of sample reported to us	Coal
Sample taken at	Bear Canyon
Sample taken by	Co-op Mining Co.
Date sampled	xxxx
Date received	11-4-83

Analysis report no.57-14270

SHORT PROXIMATE ANALYSIS

	As Received	Dry Basis
% Moisture	7.95	xxxxx
% Ash	9.55	10.37
Btu/lb	11641	12646
% Sulfur	0.50	0.54

% Air Dry Loss =	5.03
Moisture, Ash-free Btu =	14109
Pounds of SO2 per 10^6 Btu =	0.85
Moist, Mineral matter free Btu * =	12992
(Based on as rec'd moisture)*	
Pounds of Sulfur per 10^6 Btu =	0.43
% Residual moisture =	3.07

JB/cj

RECEIVED
NOV 18 1983
DIVISION OF
OIL, GAS & MINING

Respectfully submitted,
COMMERCIAL TESTING & ENGINEERING CO.

Jack Blair

Manager, Price Laboratory

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Charter Member