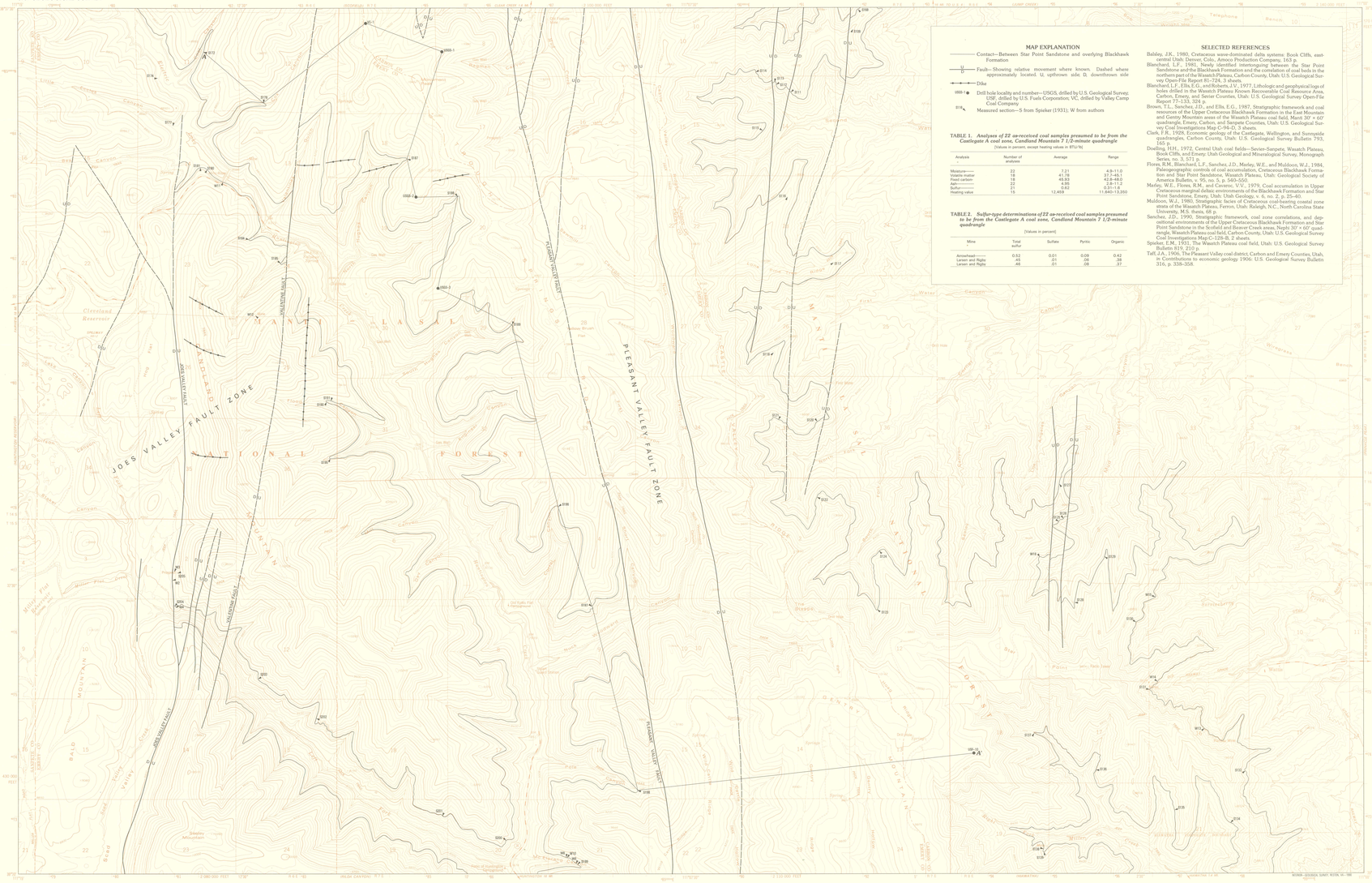

MAP EXPLANATION

- Contact—Between Star Point Sandstone and overlying Blackhawk Formation
- Fault—Showing relative movement where known. Dashed where approximately located. U, upthrown side; D, downthrown side
- Dike
- USGS-1 ● Drill hole locality and number—USGS, drilled by U.S. Geological Survey; USF, drilled by U.S. Fuels Corporation; VC, drilled by Valley Camp Coal Company
- S116 Measured section—S from Spieker (1931); W from authors

TABLE 1. *Analyses of 22 as-received coal samples presumed to be from the Castlegate A coal zone, Candland Mountain 7 1/2-minute quadrangle*

(Values in percent, except heating values in BTU/lb)

Analysis	Number of analyses	Average	Range
Moisture	22	7.21	4.9–11.0
Volatile matter	18	41.78	37.3–45.1
Fixed carbon	18	46.93	42.8–49.0
Ash	22	4.66	2.9–11.2
Sulfur	22	0.01	0.01–0.09
Heating value	15	12,459	11,640–13,350

TABLE 2. *Sulfur-type determinations of 22 as-received coal samples presumed to be from the Castlegate A coal zone, Candland Mountain 7 1/2-minute quadrangle*

(Values in percent)

Mine	Total sulfur	Sulfate	Pyritic	Organic
Annished	0.52	0.01	0.09	0.42
Larsen and Rigby	.45	.01	.06	.38
Larsen and Rigby	.66	.01	.08	.57

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INTRODUCTION

This report is one of a series of reports whose main purpose is to show the stratigraphic framework and coal zone correlations for the Blackhawk Formation in the Wasatch Plateau coal field, which approximates the area of the Wasatch Plateau itself. Figure 1 shows the study area of this report as well as that of the other reports in this series. This study, as well as the other studies in this series, was part of the U.S. Geological Survey's coal folio mapping program of 30′ × 60′ quadrangles. From these 30′ × 60′ quadrangles, selected areas were mapped at a scale of 1:24,000 and reports were prepared detailing the stratigraphy and coal occurrences. The area investigated is adjacent to the western edge of the Book Cliffs and on the northern part of the Wasatch Plateau (fig. 2). The Wasatch Plateau has been uplifted and eroded and is now marked by steep, highly dissected escarpments with some heavily vegetated areas.

GENERALIZED GEOLOGY

In the study area the Upper Cretaceous Star Point Sandstone and Blackhawk Formation dip 2°–6° W. into the subsurface. The Star Point comprises three prominent sandstone beds, in ascending order: Panther, Storrs, and Spring Canyon Tongues. These sandstone beds are separated by tongues of the Blackhawk Formation. The sandstone beds wedge out in the subsurface, eastward they merge with each other and then pinch out into the Mancos Shale. The Star Point underlies and intertongues with the continental coal-bearing Blackhawk. The Blackhawk consists of sandstone, siltstone, shale, coal, carbonaceous shale, and limestone.

DEPOSITIONAL ENVIRONMENT AND INTERTONGUING

The depositional environment of the Star Point Sandstone and Blackhawk Formation in the Wasatch Plateau was a northwest-trending barrier island–delta plain adjacent to the eastern Late Cretaceous seaway. Each eastward progradation of the shoreline and adjacent environments resulted in sedimentation characteristic of barrier island and delta plain facies.

A series of delta front–barrier island deposits have been mapped south of the study area of this report in the Convulsion Canyon, Muddy Canyon, and Rock Canyon areas of the Wasatch Plateau. Several of these deposits have been interpreted by Flores and others (1984), Marley and others (1979), and Muldoon (1980) to be accretion ridges (barrier islands and recurved spits). These authors postulated that many contemporaneous shoreline-trend delta-front point sources discharged sediment into the Late Cretaceous seaway, which was then reworked into these accretion ridges in a process similar to that described by Bailey (1980) for modern deposits as a tongue of the Star Point Sandstone and "consist of 15- to 30-m-thick, fine- to medium-grained sandstone underlain by distal bar–prodelta deposits of interbedded silty shale, siltstone, and silty sandstone" (Flores and others, 1984, p. 542).

North and east of the study area, in the Book Cliffs area, Bailey (1980) described a wave-dominated delta system. This system is represented by fluvial coastal plain, deltaic, and barrier island facies. The Aberdeen Sandstone Member of the Blackhawk Formation and the Spring Canyon Tongue of the Star Point Sandstone were described by him as being "composed of a basinward-stepping succession of shoreface deposits that are 15–30 m thick and commonly 5–10 km wide" (Bailey, 1980, p. 1). These shoreface bodies reflecting a single uninterrupted regressive episode and containing fluvial channel and river mouth bar facies are similar to the deposits of modern and ancient wave-dominated delta systems. " * * On the basis of the similarities between the major features of the Blackhawk regressive sandstone and the deposits of wave-dominated deltas, the Blackhawk units are interpreted to be deltaic in origin" (Bailey, 1982, p. 9–13). Although he recognized barrier island environments and other related facies, he contended that the major deposit in the Book Cliffs area was a wave-dominated delta system.

The intertonguing in the central and southern parts of the Wasatch Plateau has aided in the interpretation of paleoshorelines and their associated environments of deposition. The sedimentary rocks that constitute the coal-bearing Blackhawk Formation were deposited in a barrier island–delta plain setting that trended northwest to southeast. Each eastward progradation of the shoreline and adjacent environments of the shoreline and adjacent environments prograded to the east. Newly delineated intertonguing north of this study area has been identified by Blanchard (1981). His detailed cross sections demonstrated that the Aberdeen Sandstone Member of the Blackhawk Formation is a genetically related facies (tongue) of the Star Point Sandstone. The Aberdeen Sandstone Member pinches out to a feather edge in the Jump Creek–Beaver Creek areas and merges with the Spring Canyon Tongue of the Star Point Sandstone to the east.

Spieker (1931) and Clark (1928) assumed that the Aberdeen Member was a persistent stratigraphic horizon throughout the study area. Consequently, the Aberdeen was mapped as a continuous horizontal sandstone datum on which correlations of coal beds were made. These authors' assumption contributed to the miscorrelation of coal beds west of the intertongue zone.

The major difference in depositional setting between the intertonguing in the northern part of the Wasatch Plateau–Book Cliffs area and that in the central and southern parts of the Wasatch Plateau is the lateral and vertical extent of the regressively deposited sandstone tongues. The tongues in the central and southern parts of the Wasatch Plateau represent barrier island–deltaic facies, are thin (30 ft thick), and pinch out within several miles. Yet the Aberdeen Member in the northern part of the Wasatch Plateau probably reflects a general westward transgression for 5–25 mi and then subsequent progradation seaward, with these sandstones being deposited during the regressive phase. This type of deposition could possibly reflect a change in the depositional environment from prograding short-headed stream deltas and barrier islands to a large wave-dominated deltaic facies in the study area. These large deltaic lobes of sediment (sand, shale, coal, and so on) were deposited and then abandoned. After abandonment came subsidence and transgression of the seaway. Deposition of the large sheets of sandstone such as the Aberdeen represent a regressively deposited sand reworked after delta lobe abandonment and subsequent progradation of the shoreline.

Flores and others (1984) also pointed out the difference in the depositional environments of the Blackhawk Formation in the Book Cliffs and Wasatch Plateau areas. They concluded that the Blackhawk Formation in the Book Cliffs probably represents a wave-dominated deltaic system, whereas the Blackhawk in the central and southern parts of the Wasatch Plateau represents a delta plain–barrier island deposit (fig. 3).

The model presented in figure 3 attempts to diagrammatically depict and integrate the work of Bakley (1980), Flores and others (1984), Marley and others (1979), and Muldoon (1980). Note that the model depicts deposition of the Blackhawk Formation and Star Point Sandstone during two different chronologic periods.

COAL ZONES

There are five coal zones in the Blackhawk Formation in the study area. From bottom to top they are the Cottonwood, Blind Canyon, Bear Canyon, Castlegate A, and Bob Wright coal zones. Figure 4 diagrammatically depicts the coal zones and their stratigraphic position in named coal beds and the Aberdeen Sandstone Member of the Blackhawk Formation.

The Cottonwood coal zone of this report and of Brown and others (1987) is stratigraphically equivalent to the Hiawatha coal bed of Spieker (1931). The coal zone is laterally continuous throughout the study area. Throughout most of the study area, the coal zone either rests conformably on the Star Point Sandstone or a short distance above it. The coal beds in the zone range in thickness from 12 in. in measured section S189, sec. 29, T. 14 S., R. 7 E. to 11 ft 9 in. in measured section S185, sec. 24, T. 14 S., R. 6 E. Currently the Cottonwood coal zone is being mined in the Gentry Mountain area by the Getty Oil Company and U.S. Fuels Corporation.

The Blind Canyon coal bed of Spieker (1931) is here referred to as the Blind Canyon coal zone because the coal occurs in several beds that are laterally discontinuous and (or) bifurcate. The zone only occurs locally. This zone is from 5 to 15 ft above the Cottonwood coal zone. The coal beds in the zone range in thickness from 2 ft in measured section S188, sec. 20, T. 14 S., R. 7 E. to 16 ft 8 in. in measured section W42, sec. 24, T. 14 S., R. 6 E. This coal zone is currently being mined in Miller Canyon by the U.S. Fuels Corporation.

The Bear Canyon coal bed of Spieker (1931) is here referred to as the Bear Canyon coal zone because of discontinuities and bifurcations of the coal beds. The coal zone is not laterally continuous. The zone is 10–20 ft stratigraphically above the Blind Canyon coal zone. The thickness of the coal beds in the zone vary from 10 in. in measured section S174, sec. 11, T. 14 S., R. 6 E. to 9 ft in measured section S123, sec. 12, T. 15 S., R. 7 E.

The Castlegate A coal bed of Spieker (1931) is here referred to as the Castlegate A coal zone because the coal is discontinuous and (or) bifurcates. Throughout the eastern part of the study area this coal zone either rests conformably on the Aberdeen Sandstone Member or a short distance above it. Westward, in the central part of the study area it is 140–180 ft above the Spring Canyon Tongue of the Star Point Sandstone. The coal beds in the zone range in thickness from 1 in. in drill hole USF–10, sec. 18, T. 15 S., R. 8 E. to 15 ft in measured section S113, sec. 14, T. 14 S., R. 7 E. The coal zone is currently being mined in the Miller Canyon area by the U.S. Fuels Corporation.

The Bob Wright coal group of Spelker (1931) or Bob Wright coal zone is present in the northern part of Trough Springs and Castle Valley and is approximately 260–320 ft above the Spring Canyon Tongue of the Star Point Sandstone. The coal beds in the group range in thickness from 3 ft 6 in. in measured section S188, sec. 20, T. 14 S., R. 7 E. to as much as 10 ft in measured section S113, sec. 14, T. 14 S., R. 7 E.

COAL QUALITY

Tables 1 and 2 show analyses of 22 coal samples in the Candland Mountain 7 1/2-minute quadrangle. All are presumed to be from the Castlegate A coal zone (Doelling, 1972). The rank of the coal samples is high-volatile B bituminous.

ACKNOWLEDGMENTS

Appreciation is extended to the U.S. Fuels Corporation and Valley Camp Coal Company for allowing the authors to access and publish selected drill hole information. Terrence L. Brown assisted with part of the field work and we thank him for his logistical support and companionship.

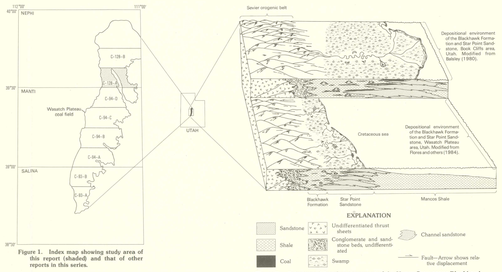

Figure 1. Index map showing study area of this report (shaded) and that of other reports in this series.

Figure 3. Paleodepositional environment of the Upper Cretaceous Blackhawk Formation and Star Point Sandstone, Wasatch Plateau, Utah.

Figure 2. Index map showing study area with respect to the Wasatch Plateau and Book Cliffs.

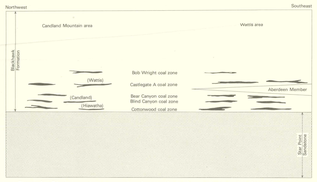

Figure 4. Diagrammatic cross section showing the coal zone stratigraphy of the Blackhawk Formation. Coal bed names in parentheses are used locally.

EXPLANATION OF COAL SECTIONS

[1 ft = 0.3048 m, 1 in. = 2.54 cm]

- Sandstone—Curved line at base indicates an erosional base
- Sandstone, crossbedded
- Sandstone, laminated to massive
- Siltstone
- Shale
- Carbonaceous shale
- Coal
- Unidscribed rock
- Covered interval
- Projected interval—Lithology not described and (or) measured
- Rooted
- Burrowed
- Convoluted bedding
- Rock altered by natural burning of coal
- Channel sandstone
- S116 Measured section identification number—S from Spieker (1931); W from authors
- 11′ Thickness of coal—Shown in feet and inches
- USGS-2 Drill hole identification number—USGS, drilled by U.S. Geological Survey; USF, drilled by U.S. Fuels Corporation; VC, drilled by Valley Camp Coal Company

VERTICAL SCALE
1 METER EQUALS 40
10
5
0

Map showing location of drill holes and measured sections

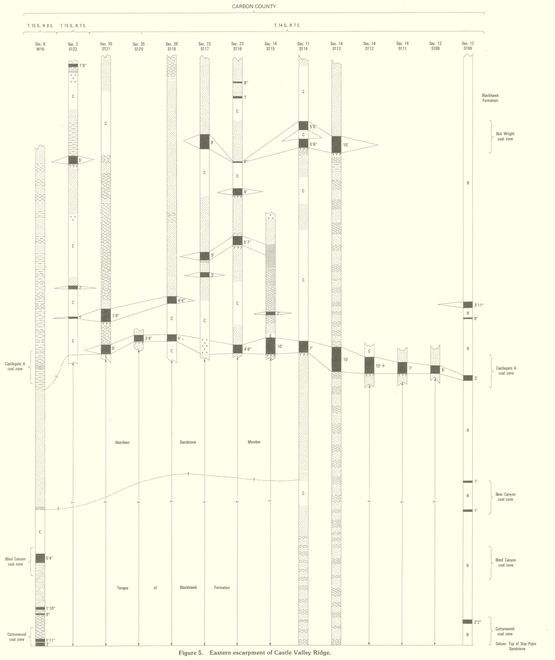

Figure 5. Eastern escarpment of Castle Valley Ridge.

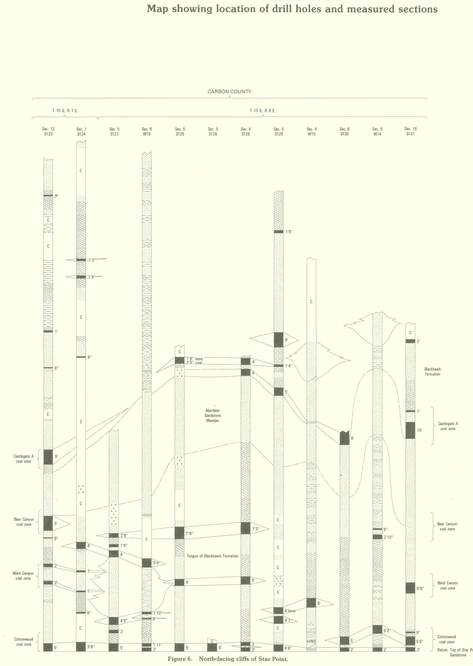

Figure 6. North-facing cliffs of Star Point.

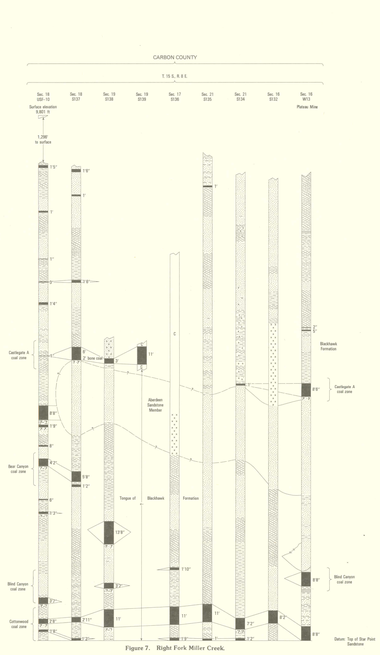

Figure 7. Right Fork Miller Creek.

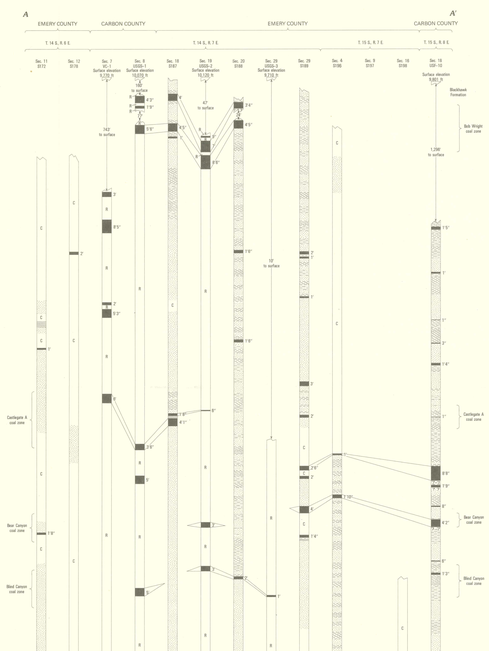

Figure 8. Trough Springs Ridge to Gentry Mountain.

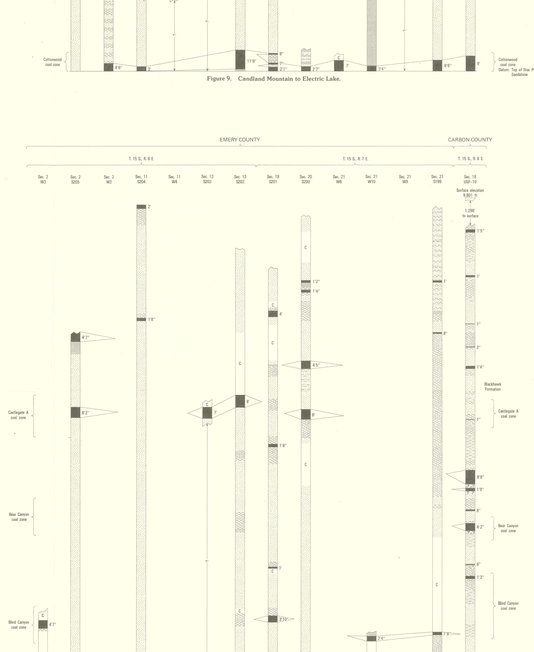

Figure 10. Left Fork Huntington Creek and east-facing cliffs on east side of Huntington Creek.

Figure 9. Candland Mountain to Electric Lake.

STRATIGRAPHIC FRAMEWORK, COAL ZONE CORRELATIONS, AND DEPOSITIONAL ENVIRONMENT OF THE UPPER CRETACEOUS BLACKHAWK FORMATION AND STAR POINT SANDSTONE IN THE CANDLAND MOUNTAIN AND WATTIS AREAS, NEPHI 30′ × 60′ QUADRANGLE, WASATCH PLATEAU COAL FIELD, CARBON AND EMERY COUNTIES, UTAH

By
J. David Sanchez and Eugene G. Ellis
1990

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