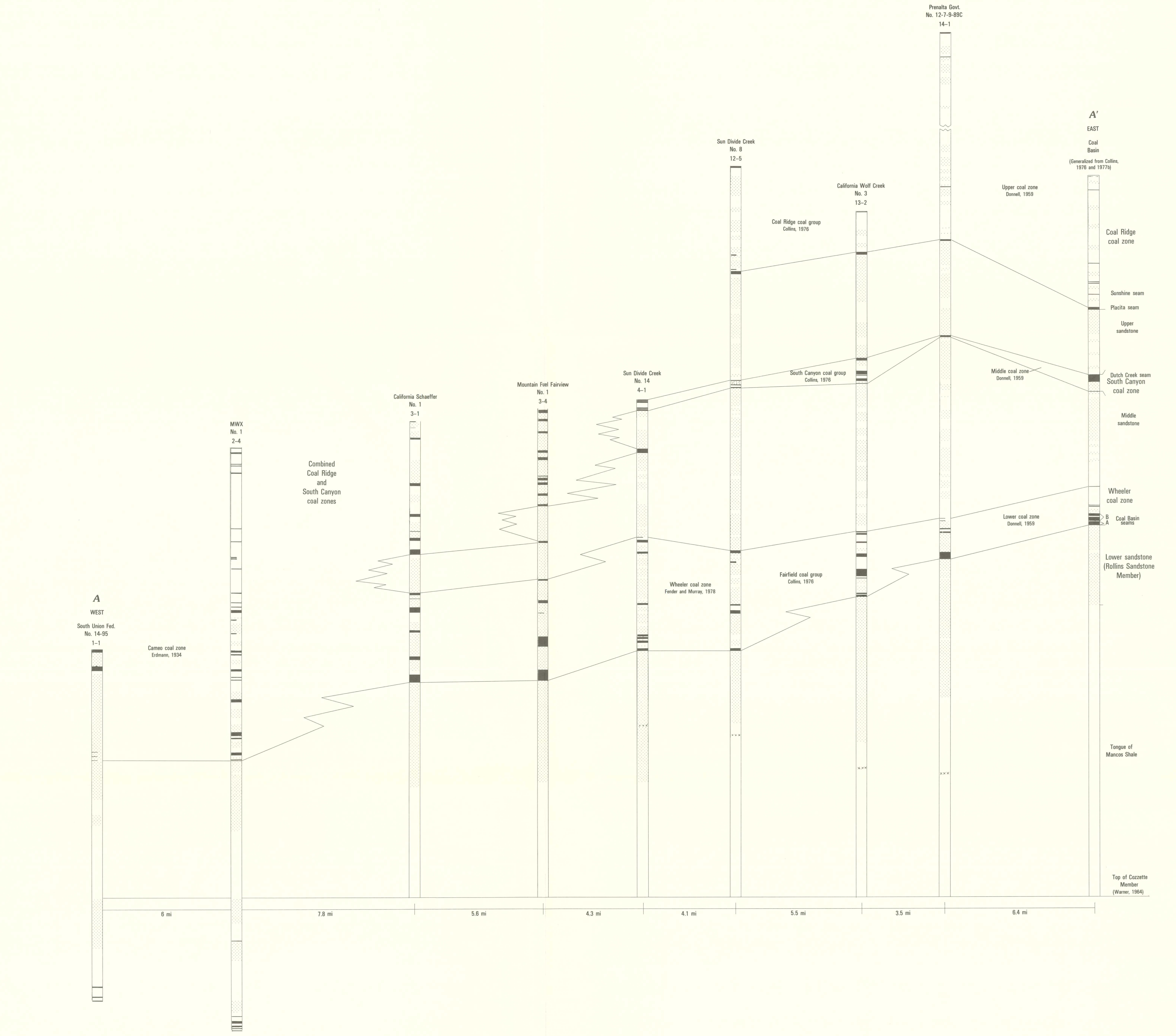
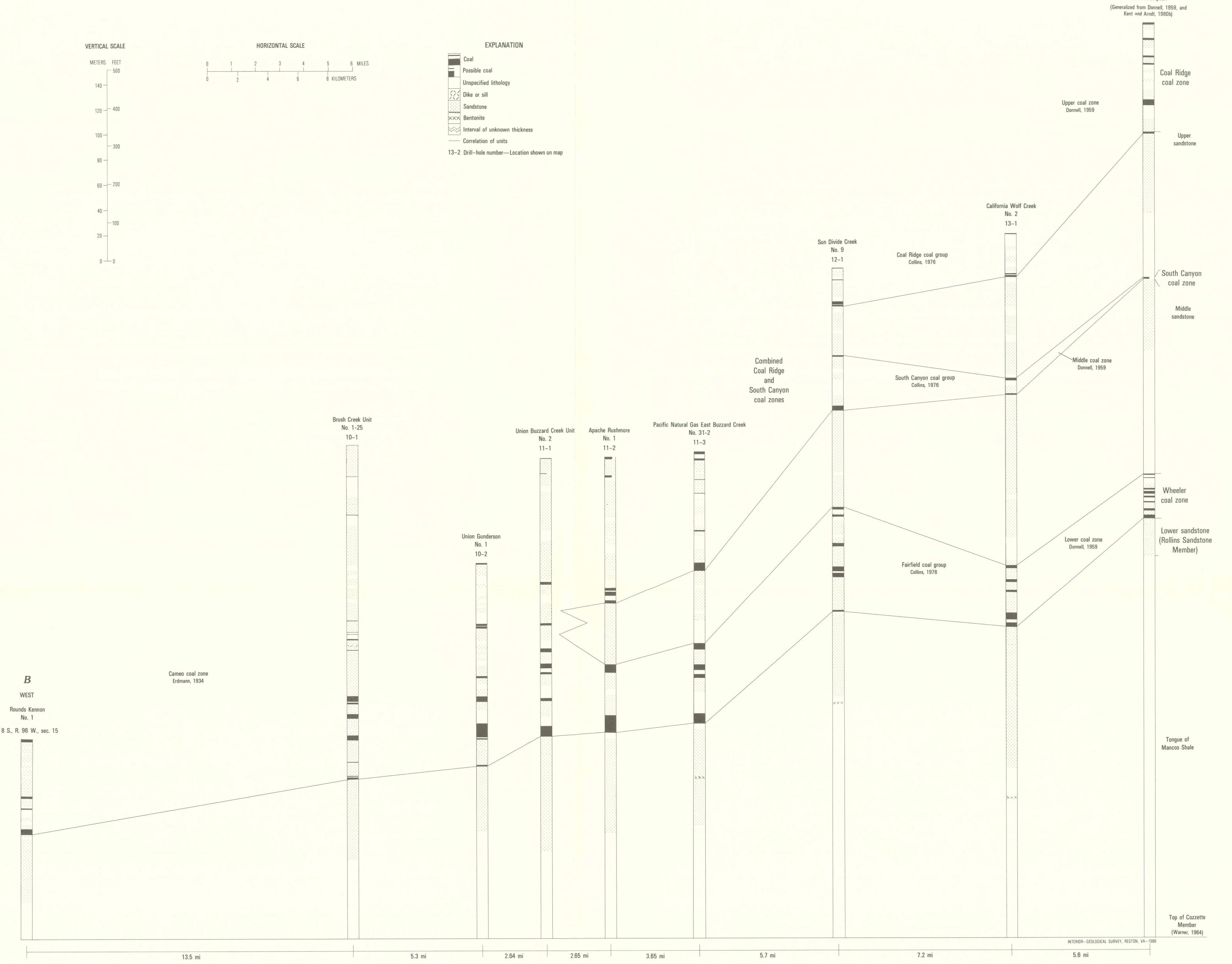
DEPARTMENT OF THE INTERIOR
U.S. GEOLOGICAL SURVEY

COAL INVESTIGATIONS
MAP C–97–B (SHEET 1 OF 2)

LOCATIONS OF CROSS SECTIONS IN THE CARBONDALE 30′ × 60′ QUADRANGLE, COLORADO





CROSS SECTIONS *A–A′* AND *B–B′* SHOWING CORRELATIONS OF COAL ZONES IN THE MESAVERDE FORMATION

EXPLANATION

- ▼ **Measured section**
- ○ **Drill hole**
- **Drill hole**—Approximately located
- ⊗ **Drill hole**—U.S. Steel Corporation
- ○—— 6 mi **Distance of drill hole from map edge**
- —— **Line of cross section**

DISCUSSION

INTRODUCTION

The Carbondale quadrangle of Colorado overlaps the southeastern part of the Piceance Basin (fig. 1) and includes parts of Delta, Eagle, Garfield, Gunnison, Mesa, and Pitkin Counties. Within the quadrangle, the Carbondale coal field contains coal that ranges in rank from high-volatile C bituminous to anthracite. Most of the bituminous coal in Pitkin and Gunnison Counties is moderately to strongly coking, and some has been naturally coked by heat from adjacent sills, dikes, and laccoliths. Coal in the Coal Basin area of southwestern Pitkin County is the highest quality metallurgical grade coal in the Rocky Mountain region (Collins, 1976).

GEOLOGY

The geology of the Carbondale quadrangle is shown by Ellis and Freeman (1984). Coal beds in the study area occur in the Upper Cretaceous Mesaverde Formation above each of three major sandstone units (fig. 2). The Mesaverde Formation is predominantly nonmarine, but has some marine rock in the lower part. It is overlain by the nonmarine Tertiary Wasatch Formation and underlain by the marine Cretaceous Mancos Shale. The top of the Mancos Shale intertongues with the Cozzette and Corcoran Members (Warner, 1964) of the Mesaverde Formation. The Mesaverde thins from north to south and from east to west in the study area. The thickness is about 5,000 ft (1,524 m) near New Castle (fig. 1), just north of the map, and about 3,400 ft (1,036 m) in the area of Coal Basin (Lavington, 1938, and Godwin, 1968).

The Mesaverde Formation crops out along the Grand Hogback, a steeply dipping monocline (fig. 1), and related structures. Mined coal beds along the outcrop dip from about 30° at Thompson Creek south of Carbondale to an average of 13° in Coal Basin (Collins, 1977a).

Extensive Tertiary igneous activity and related faulting have occurred in the southern part of the quadrangle. Heat from large intrusive masses is thought to have been a major factor in the genesis of coking coal and in the increased coal rank adjacent to Mount Sopris, Coal Basin, Chair Mountain, and Ragged Mountain (Murray and others, 1977). Anthracite is only present in the southern part of the quadrangle adjacent to Tertiary stocks. Dikes and sills that cut coal seams have affected the coal locally and changed it to natural coke. The thickness of the coke is directly related to the thickness and temperature of the igneous mass at the time of emplacement (Collins, 1977b).

COAL CORRELATIONS

Coal correlations are presented in two forms in this publication: one set of cross sections gives the correlations by coal beds and coal zones, and the other set of cross sections gives the coal correlations by coal zones only. Coal correlations were made using measured sections, electric logs, and generalized coal sections from both published and unpublished sources.

The set of cross sections having section numbers 1 through 129 was compiled using unpublished U.S. Geological Survey data, including sections measured in the early 1950's by John R. Donnell, Edwin R. Landis, and Walter E. Hallgarth, and unpublished drill-hole data supplied by the U.S. Steel Corporation. All of the U.S. Steel drill holes are located along the eastern edge of the Piceance Basin within 2 mi (3.2 km) of the Mesaverde outcrop. Information given in these cross sections includes the correlation of coal beds and coal zones, as well as lithology, Data bases are the tops of the upper, middle and lower (Rollins Sandstone Member) sandstones in the Mesaverde Formation. Correlations of individual coal beds were possible because of the close spacing of data points in these cross sections.

In addition, cross sections ***A–A′*** through ***E–E′*** were compiled using drill-hole data from oil and gas wells and coal exploratory wells located throughout the Carbondale quadrangle. Information in these cross sections includes coal correlations given by coal zones, major sandstone units, and bentonite beds. The data base is the top of the Cozzette Sandstone Member of the Mesaverde Formation. Lithology given on the cross sections was determined using natural gamma, gamma-gamma density, caliper, spontaneous potential, interval transit time, and resistivity logs. This suite of logs usually provides enough information for the positive identification of coal beds and related lithology. Where logs were not adequate and coal could not be positively identified, it is shown in the cross sections as possible coal. Individual coal beds could not be correlated in this set of cross sections due to the wide spacing of data points.

Generalized sections were used in areas where several coal sections were available at specific locations. The generalized coal sections are SK (Storm King) 6 and 7, North Thompson, and Coal Basin.

Three coal zones of economic interest are present in the eastern part of the Carbondale quadrangle. These zones are the Wheeler coal zone of Fender and Murray (1978), the South Canyon coal group of Collins (1976), and the Coal Ridge coal group of Collins (1976). For consistency all three are referred to as coal zones in this publication and are labeled on the right in cross sections ***A–A′*** through ***E–E′***.

The Wheeler coal zone is located above the lower sandstone (Rollins Sandstone Member) in the Mesaverde Formation. It is named for the Wheeler coal seam of Gale (1907), which has been identified in the northern part of the quadrangle. The Wheeler coal zone is the most easily correlated, most persistent, and most economic of the three coal zones. Coal beds in the Wheeler coal zone include the Wheeler, Coal Basin A and B, Diamond, Sommerset, Pocahontas, Black Diamond, Bear, and A, B, C, and D. As indicated in the cross sections, other workers in the study area have referred to the Wheeler coal zone as the lower coal zone (Donnell, 1959) and the Fairfield coal group (Hancock and Eby, 1930, and Collins, 1976).

The South Canyon coal zone is located above the middle sandstone in the Mesaverde Formation. It is named for South Canyon Creek, southeast of New Castle, where the thickest coal in the unit, 10–20 ft (3.1–6.1 m), is located (Collins, 1976). The South Canyon coal zone thins from east to west in the quadrangle and is less persistent than the Wheeler coal zone. Coal beds in the South Canyon include the Dutch Creek, Allen, Anderson (Gale, 1910, p. 130, and Collins, 1976, p. 28), Huntsman, and Hawksnest. Minable coal beds in this zone appear to be absent at Thompson Creek, and at Coal Basin only the Dutch Creek seam, which ranges in thickness from 3 ft to over 20 ft (0.9 m to over 6.1 m), is of economic importance (Collins, 1976). The South Canyon coal zone of Collins (1976) is the same as the upper part of Hancock and Eby's (1930) Fairfield group and Donnell's (1959) middle coal zone.

The Coal Ridge coal zone is located above the upper sandstone in the Mesaverde Formation and is the least consistent of the three coal zones. It is named for Coal Ridge (fig. 1), southeast of New Castle, where the thickest coal beds in the zone are located. Coal beds in the Coal Ridge coal zone include the Placita, Sunshine, Anderson (Gale, 1910, p. 134), North Rim, Lake Ridge, A, B, and C (Gale, 1910, p. 14), and Thompson. The Anderson coal bed identified in this coal zone is not the same as the Anderson coal bed in the South Canyon coal group and, according to Collins (1976, p. 29), has been misidentified. Donnell (1959) refers to the Coal Ridge as the upper coal zone.

The three major coal zones are distinct in the eastern part of the quadrangle but merge to the west. From east to west in cross sections ***A–A′***, ***B–B′***, and ***C–C′***, the Coal Ridge coal zone thins, becoming indistinguishable from the South Canyon coal zone, and the transgressive interval of shale and sandstone thins between the South Canyon and Wheeler coal zones. West of the limit of transgression, as shown by Zapp and Cobban (1960), only one zone can be recognized in the quadrangle. This zone is referred to as the Cameo coal zone (Erdmann, 1934), named for the mining town of Cameo, Colo. (fig. 1). Erdmann (1934) recognized another coal zone about 60 ft (18.3 m) above the Cameo coal zone, and he named it the Carbonera coal zone after the small, abandoned mining town of Carbonera, Colo. Because the Carbonera coal zone cannot be distinguished in the study area, all coal beds in the western part of the quadrangle are included in the Cameo coal zone. As seen in cross section ***D–D′***, coal beds equivalent to those in the Cameo coal zone are included in the Bowie Shale Member of the Mesaverde Formation. The Bowie Shale Member, named for the mining town of Bowie, Colo., occurs in the southern part of the Carbondale quadrangle.

A fourth coal zone, the Keystone coal zone, has been described in the study area north of drill hole 72. The Keystone coal zone was named for the Keystone mine near New Castle (fig. 1), where the zone consists of four coal beds in a 320-ft (97.5-m) interval about 700 ft (213.4 m) above the correlative of the Coal Ridge coal group of Gale (1910, p. 115) in the Carbondale quadrangle. Near New Castle the coal is high-grade bituminous and minable; however, in the study area these coal exposures are poor and coals present are thin and unminable. Therefore, the Keystone coal zone is not of economic interest in the Carbondale quadrangle and was not included in the coal correlations.

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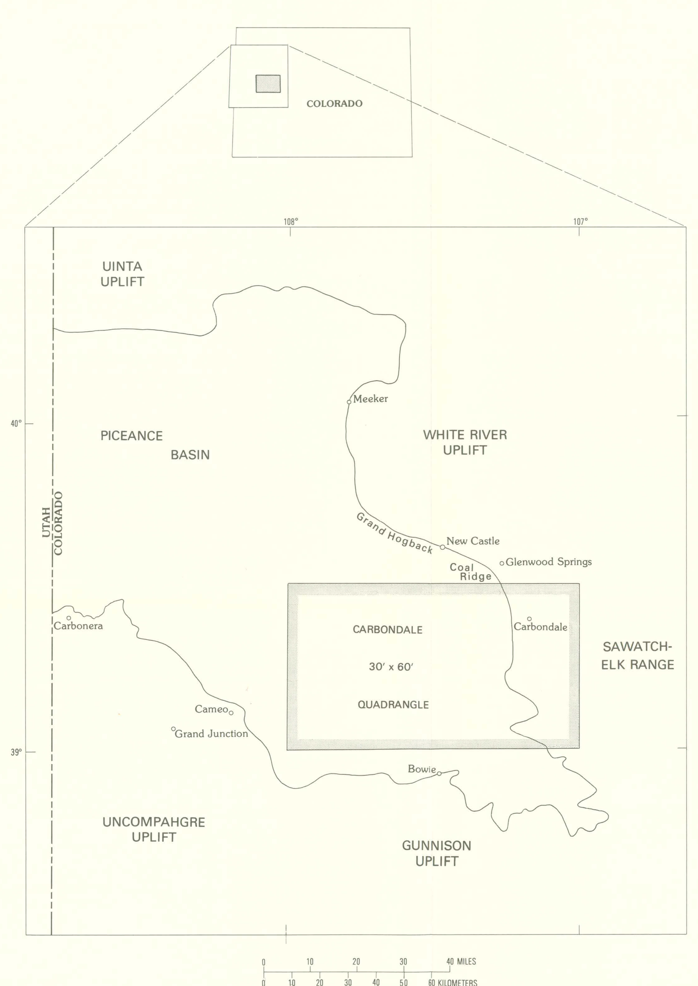

Figure 1.—Index map showing the Piceance Creek Basin in Colorado and tectonic features in the area. Adapted from Collins (1976, p. 2).

Figure 2.—Stratigraphic nomenclature used by various authors for Upper Cretaceous and lower Tertiary rocks in the Carbondale quadrangle. Adapted from Kent and Arndt (1980a).

CROSS SECTIONS SHOWING CORRELATION OF COAL BEDS AND COAL ZONES IN THE MESAVERDE FORMATION IN THE CARBONDALE 30′ × 60′ QUADRANGLE, WEST-CENTRAL COLORADO

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