

Drawn on top of Ksdj (Smoky Hollow and Tibet Canyon Members of the Straight Cliffs Formation). Dashed where control less accurate; short dashed where projected over land surface.

ECONOMIC GEOLOGY
The quadrangle was mapped as part of the U.S. Geological Survey program of classifying and evaluating mineral lands in the public domain. Resources of economic interest are coal and oil and gas.

COAL
A summary of data pertaining to the coal deposits of the entire Kaiparowits coal field is given by Doelling (1970). Coal beds in the Canaan Creek quadrangle occur mainly in the John Henry Member of the Straight Cliffs Formation; minor beds occur at the base and the top of the Smoky Hollow Member. The Christensen and Alvey coal zones, which are 680-780 and 1,100-1,250 feet, respectively, above the base of the Straight Cliffs Formation, are the most persistent throughout the region. Locally, intervals below the Christensen and between the Christensen and the Alvey contain beds of coal 6-8 feet thick.

Outcrops in the quadrangle are poorly exposed, and coal beds are generally concealed by slope wash and overhanging blocks of sandstone and talus. Because of this, coal beds and zones probably extend farther than shown on the geologic map. Individual coal beds are generally lenticular, grade laterally into carbonaceous shale, and in a few places interfinger with sandstone that was deposited along a beach. Marine oyster beds occur both below and above coal beds, indicating many fluctuations of the shoreline. The strand line during deposition of the Alvey coal zone trended about N. 20°W, and field observations indicate that both coal zones are more persistent in a northwesterly direction. The coal was deposited in a lagoonal-type environment, and coal beds are less continuous perpendicular to the strand line.

Coal beds have been burned over large areas of the quadrangle, resulting in areas of pink and red baked rocks. Near the actual site of burning, the rock in places became molten and moved like lava in small areas. Coal ash and clinker occur near the actual burn site but are generally obscured by talus consisting of baked shale, which is hard and platy and covers most of the slope area.

Coal beds are indicated on the map and shown in the coal sections (sheet 2) where observed; however, because of the lenticular nature of the coal, only the thicker coal beds were extended any distance from an outcrop. In general, the symbol or line showing a coal bed on the geologic map represents a single bed; however, on steep slopes and cliff faces it may represent an interval of four or five coal beds.

The lowest coal zones in the Straight Cliffs Formation occur at the base and the top of the Smoky Hollow Member. The coal is in thin beds, is of poor quality, and grades laterally into carbonaceous shale. Local coal beds occur about 160 feet above the Smoky Hollow Member, and in coal sections 62-87

a bed 5-7 feet thick is continuous over at least a 1-square-mile area. The Christensen coal zone is the most persistent in the region, and along Coal Bed Canyon in the northeast corner of the quadrangle at least five mines (coal sections 2-6) produced coal from it. The coal here is more than 10 feet thick, and to the west and south the thickness increases until at coal section 14 (sec. 32, T. 36 S., R. 2 E.) one bed is more than 22 feet thick. One of the local coal beds between the Christensen and the Alvey (coal sections 74-78) is persistent for more than 1 mile. The uppermost coal zone, the Alvey, has the thickest coal in the central and western part of the quadrangle; coal sections 34-37, 37B, and 32 average more than 15 feet of coal. A good minable bed also crops out in the eastern part of the quadrangle (coal sections 19-24).

Quality.—Analyses of coal from the Straight Cliffs Formation in this quadrangle were reported by Gregory and Moore (1931, p. 153). An analysis of coal in the Christensen zone at the Shurtz mine (coal section 6) on an air-dried basis indicated that the coal contains 12.20 percent moisture, 39.35 percent volatile matter, 44.20 percent fixed carbon, 4.25 percent ash, and 0.82 percent sulfur and has a heat value of 11,108 British thermal units. The Alvey coal zone was sampled at the Alvey mine by D. H. Hileman of the U.S. Bureau of Mines. This coal on an as-received basis contains 12 percent moisture, 38.1 percent volatile matter, 42.8 percent fixed carbon, 7.1 percent ash, and 0.6 percent sulfur and has a heat value of 10,730 British thermal units. More detailed information on the quality of coal in the area is given by Robison (1963, 1964) and Grose, Hileman, and Ward (1967).

Mines and prospects.—Gregory and Moore (1931, p. 152) reported eight coal mines and prospects excavations within 5 miles of Escalante, Utah. Seven of these are located in the mapped area, and measurements at five are included in the coal sections. Evidence of several other adits is in the nearby area, but the portals have long since caved in. The following mines are described in more detail by Gregory and Moore (1931, p. 152): Christensen mine, Richards mine, Schow mine, and Winkler mine (near Alvey mine).

Resources.—Reserves of coal were not calculated for individual beds within a coal zone because of the limited exposures and the lenticular nature of the coal. Total resources were estimated by adding the average thicknesses of coal in each zone in beds more than 4 feet thick and multiplying by the average weight of 1,770 tons per acre-foot for subbituminous coal; beds below 2,000 feet of overburden were not considered. The Canaan Creek quadrangle contains about 600 million tons of total coal resources.

OIL AND GAS
The main producing part of the Upper Valley oil field is in the southwestern part of the quadrangle. The doubly plunging anticlinal structure trends in a northwesterly to southeasterly direction. The west edge of the anticline becomes a steeply dipping monocline in less than 1 mile. There is evidence that a strong hydrodynamic force from the northeast has tilted the oil-water contact to the southwest of the field operated by Tennessee Oil Co. is producing oil (1970) mainly from the Kaibab Limestone. Fourteen producing oil wells and three dry holes have been drilled in the quadrangle, and details of these are given in table 2. Ritzma (1970, p. 1) reported that production in October 1969 for the entire field was 142,263 barrels from 16 wells, an average of 4,500 barrels per day. The Oil and Gas Journal (1970, p. 139) gave the 1969 production as 1,511,000 barrels, the cumulative production 1963-69 as 3,115,000 barrels, and the reserves as 15,651,000 barrels.

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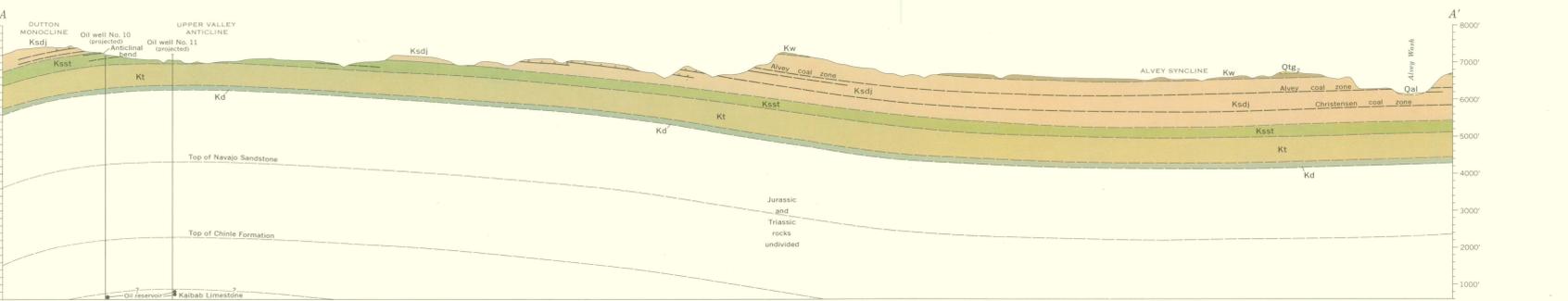
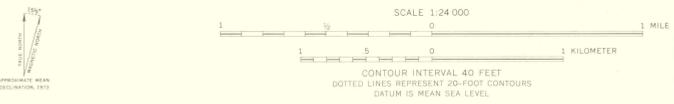
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TABLE 1.—FOSSIL COLLECTIONS FROM THE CANAAN CREEK QUADRANGLE
(Multiple identification and some segments by W. A. Cobban, U.S. Geological Survey, and verification/identification by G. E. Lewis, U.S. Geological Survey. Locations of fossil collections are shown on the geologic map, and the stratigraphic positions are given in the generalized columnar section of rocks.)

USGS locality or field No.	Collector	Fossils	Remarks
D585	W. M. Christensen and H. D. Zeller	Tooth of <i>Elasmobranchium</i> , <i>Selachian Chondrichthys</i> (shark) of the Suborder Galeoidae; <i>Goniatites</i> , <i>Conia</i> , <i>Trochilites</i> , <i>Lemna</i> , <i>Oolitepis</i> , and <i>Strophomena</i> .	All are found in matrix or brackish-water formations of the Upper Cretaceous.
D5179	H. D. Zeller	<i>Ostrac</i> sp.	
D5180	do	<i>Caligoneurus woolgari</i> (Mantell) <i>Isosaurus medialis</i> Sowerby	This collied insectarium is a guide to rocks of middle Neotera age. It is most abundant in the zone of <i>Sophia</i> specimens.
D5181	do	<i>Crasostrea ocellifera</i> (Meek)	
D5182	do	<i>Crasostrea ocellifera</i> (Meek)	
D5183	do	<i>Crasostrea</i> cf. <i>C. solitaria</i> (Meek)	
D5184	do	<i>Isosaurus</i> sp.	
D5185	do	<i>Crasostrea solitaria</i> (Meek)	
D5186	do	<i>Crasostrea solitaria</i> (Meek)	
D5187	do	<i>Phyllopora gregaria</i> (Meek)	A shallow-water marine assemblage.
D5188	do	<i>Glyptothorax</i> sp.	
D5189	do	<i>Crasostrea ocellifera</i> (Meek)	
D5190	do	<i>Brachidontes</i> sp.	All brackish-water species.
D5191	do	<i>Caridids</i> sp.	
D5192	do	<i>Caridids</i> sp.	
D5426	W. E. Bowers, W. A. Cobban, G. H. Horn, E. V. Stephens, and H. D. Zeller	<i>Isosaurus</i> sp.	
D5428	H. D. Zeller, W. A. Cobban, G. H. Horn, and E. V. Stephens	<i>Isosaurus howelli</i> White	"Probably was originally a piece of wood bored by 'shipworms.'" Suggests a marine environment! (W. A. Cobban, written comm., Jan. 15, 1966).
D666	H. D. Zeller	Crustacean of a plesiosaur, probably referable to the family Elasmobranchiidae.	

Base by U.S. Geological Survey, 1964
10,000-foot grid based on Utah coordinate system, south zone
1000-meter Universal Transverse Mercator grid, zone 12



GEOLOGIC MAP AND COAL AND OIL RESOURCES OF THE CANAAN CREEK QUADRANGLE, GARFIELD COUNTY, UTAH

By
Howard D. Zeller
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