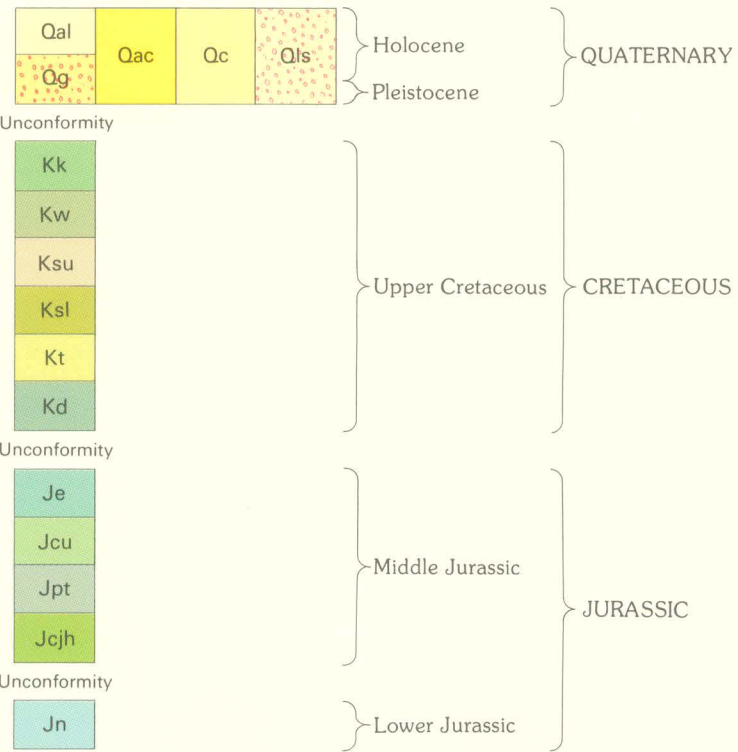


CORRELATION OF MAP UNITS



DESCRIPTION OF MAP UNITS

Qal Alluvium (Holocene)—Poorly consolidated, tan to brownish-gray clay, silt, sand, and gravel, includes some colluvium and slopewash and coarse-grained flood deposits in narrow canyons. Includes remnants of terrace gravel along Cottonwood Creek. Thickness 3-25 ft.

Qac Alluvium and colluvium (Holocene and Pleistocene)—Poorly to moderately consolidated, tan to brownish-gray clay, silt, sand, and gravel, includes slopewash and some windblown sand deposits on Horse Flat. Thickness 3-20 ft.

Qc Colluvium (Holocene and Pleistocene)—Mass-wasting debris and slopewash of sand and silt derived mostly from adjacent bedrock, may include windblown sand. Thickness 2-10 ft.

Qd Landslide (Holocene and Pleistocene)—Mostly older slide, slump, and rockfall debris derived from cliffs of Wahweap Formation. Thickness 5-40 ft.

Kk Gravel (Holocene and Pleistocene)—Patches of light-tan to brownish-gray sand and gravel, mostly remnants of pediment deposits along east side of The Cockscomb; may include lag gravel derived from the capping conglomeratic sandstone of the Wahweap Formation. Thickness 3-20 ft.

Kw Kaiparowits Formation (Upper Cretaceous)—Only lower part of formation present in quadrangle. Consists of brownish- to greenish-gray, friable sandstone, silt, and pepper coloration; contains subordinate gray to tan lenticular mudstone and brownish-gray, fine- to medium-grained, ledge-forming sandstone interbeds. May contain reptile bones and freshwater mollusks locally. Unconformably overlain by Quaternary surficial deposits. Kaiparowits is about 1,600 ft thick northeast of quadrangle. Lower part is 200 ft thick in quadrangle.

Ks Wahweap Formation (Upper Cretaceous)—Upper 200 ft is light-gray to white, fine- to coarse-grained, locally conglomeratic, massive, cliff-forming sandstone. Middle 500-600 ft is tan to light-brown, fine- to medium-grained, ledge-forming sandstone containing subordinate brownish-gray, lenticular mudstone interbeds. Lower 500-600 ft is gray to tan, slope-forming mudstone containing subordinate tan to light-brown, fine- to medium-grained, ledge-forming sandstone interbeds. About 1,200-1,400 ft thick.

Kt Straight Cliffs Formation (Upper Cretaceous)—Upper part—Upper 150-200 ft is light-gray to white, fine- to coarse-grained, crossbedded, cliff-forming sandstone; contains pebble-conglomerate lenses, mostly in upper half. Lower 800-900 ft is tan to brownish-gray, fine-grained sandstone and interbedded mudstone and carbonaceous mudstone; contains lenticular 1- to 3-ft-thick coal beds in lower 100 ft. Equivalent to the Drop Tank and underlying John Henry Members of the Straight Cliffs Formation in eastern Kaiparowits Plateau. Thickness 950-1,100 ft.

Kd Lower part—Upper 30-40 ft is white to light gray, medium- to coarse-grained, crossbedded, locally conglomeratic sandstone, probably equivalent to Calico bed of Peterson (1969). Middle part is interbedded fine-grained sandstone, mudstone, carbonaceous mudstone, and thin (<3 ft) coal beds, 130-210 ft thick. Basal part is buff to light-brown, very fine grained, marginal marine sandstone; 40-50 ft thick. Unit is probably equivalent to the Smoky Hollow and underlying Tibet Canyon Members of the Straight Cliffs Formation in eastern Kaiparowits Plateau. Thickness generally 200-300 ft.

Je Tropice Shale (Upper Cretaceous)—Light-gray to olive-gray, marine shale; upper part contains thin, very fine grained sandstone interbeds. Thickness 600-700 ft.

Jpt Dakota Formation (Upper Cretaceous)—Interbedded sandstone, mudstone, carbonaceous mudstone, and thin (<1.5 ft) coal beds. Sandstone is buff to light brown, fine to medium grained, and locally medium to coarse grained; mudstone is tan to brownish gray and is interbedded with carbonaceous mudstone and thin, impure coal beds. Unit unconformably overlies the Entrada Sandstone. Thickness 100-200 ft.

Jph Entrada Sandstone (Middle Jurassic)—Sandstone divisible in three parts: upper part is white to yellowish gray, medium to coarse grained, massive, and crossbedded; middle part is fine grained and thin bedded and contains red silty bands; lower part is gray to reddish brown, fine grained, and crossbedded. Unit is poorly exposed and partly cut out by faulting along Cottonwood Creek. Thickness probably 600-700 ft.

Jn Carnel Formation, upper part (Middle Jurassic)—Upper 50-60 ft is red to greenish-gray siltstone and mudstone and interbeds of yellowish-gray to white gypsum. Middle 290-350 ft is mostly white, pink, or red, fine-grained sandstone and interbeds of shale or mudstone. Lower 100-150 ft is red, pale-orange, or white, fine-grained sandstone, red to greenish-gray mudstone, and gray to tan limestone. Unit is poorly exposed and partly cut out by faulting along Cottonwood Creek. Thickness about 500 ft.

Jk Thousand Pockets Tongue of Page Sandstone (Middle Jurassic)—(Peterson and Phipps, 1979). White to light-gray, fine- to medium-grained, massive sandstone; light-angle crossbedding. Thickness about 100-150 ft.

Jl Judd Hollow Tongue of Carnel Formation (Middle Jurassic)—Grayish-green to reddish-brown mudstone and gray limestone. Unconformably overlies the Navajo Sandstone. Thickness about 50-120 ft.

Jm Navajo Sandstone (Lower Jurassic)—Only upper part of formation exposed in quadrangle. White to pale-orange-gray, massive sandstone; large-scale, high-angle crossbedding. Navajo is about 1,600 ft thick where exposed in adjacent quadrangles. Exposed thickness is about 400 ft in quadrangle.

— Contact—Dashed where approximately located or inferred (all contacts around or between Quaternary surficial deposits are inferred)

— Fault—Dashed where approximately located; dotted where concealed. Bar and ball on downthrown side

— Lineament—Direction or amount of displacement unknown

— Anticline—Showing crest line and direction of plunge. Approximately located

— Syncline—Showing trough line and direction of plunge. Approximately located

— Synclinal bend of monocline—Arrow on steep limb. Approximately located

— Strike and dip of beds

— Component of dip of beds

— Structure contour—Drawn on top of Wahweap Formation. Approximately located, dashed where projected above land surface. Contour interval 100 ft

— Location of measured coal section

INTRODUCTION

The Horse Flat quadrangle was mapped as part of a U.S. Geological Survey program for classifying and evaluating mineral lands of the Public Domain. Coal is the principal resource of economic interest, although the area lies outside the established Kaiparowits Plateau Known Recoverable Coal Resource Area (KRCRA), an area that by definition contains coal beds 4 ft or more thick under less than 3,000 ft of overburden. The quadrangle is on the western edge of the Kaiparowits Plateau, about 25 mi southeast of the town of Cannonville, Utah.

Access to the quadrangle from the north is from Cannonville via the Cottonwood Creek road, a county-maintained, fair-weather dirt road. From the south, Cottonwood Creek can be reached from U.S. 89 between Page, Ariz., and Kanab, Utah. Much of the quadrangle is accessible only by four-wheel drive vehicle, on foot, or on horseback.

The northwestern corner of the quadrangle is drained by Cottonwood Creek, which flows southward into the Pata River a few miles south of the quadrangle. The rest of the area is drained by Wahweap Creek and a major tributary, Coyote Creek, which flow southward into Lake Powell. Horse Flat is an area of subdued topography between the Cottonwood drainage and Wahweap Creek. The margins of Horse Flat are cut by deep canyons of the Wahweap drainage. The area is administered by the U.S. Bureau of Land Management and parts of the quadrangle are used seasonally for the grazing of livestock.

Earliest geologic work in the Kaiparowits region was done by Gregory and Moore (1931). Doelling and Graham (1972) produced a comprehensive report on the coal fields of southern Utah, including the Kaiparowits Plateau. Peterson (1969) described and named four members of the Upper Cretaceous Straight Cliffs Formation. Several quadrangles north and east of the Horse Flat quadrangle have been mapped by Bowers (1983, 1991a, b), Zeller (1973, 1990), and Zeller and Vaninetti (1990).

STRUCTURE

The major structural feature in the quadrangle is the faulted north-northeast-striking East Kaibab monocline in the northwest corner of the map area. The monocline is cut by a major reverse fault along Cottonwood Creek that parallels the trend of the fold and cuts out part of the Middle Jurassic Carnel and Entrada Formations. A complex of southeast-striking oblique faults extends from the fault along Cottonwood Creek, usually dying out in the Upper Cretaceous Straight Cliffs Formation. Evidence from the East Kaibab monocline and from faults in the Grand Canyon region (Huntson, 1971) indicates that the monocline lies along westward-dipping Precambrian normal faults that were reactivated as reverse faults when the monocline was formed.

COAL DEPOSITS

The coal-bearing rocks of the Upper Cretaceous Straight Cliffs Formation crop out only in the extreme northwest corner of the quadrangle along Cottonwood Creek. The coal beds are relatively thin, generally less than 3 ft thick, and occur only in the lower 100 ft of the upper part of the Straight Cliffs Formation (Ks). This interval contains the Henderson coal zone in quadrangles to the north where coals are thicker (Bowers, 1981, 1983). In this quadrangle most of the coal occurs within 40 ft of the Calico bed of Peterson (1969), which marks the top of the lower part of the Straight Cliffs Formation (Kd).

In addition to being relatively thin the coal beds exposed in the quadrangle lie along the highly faulted, steeply eastward dipping limb of the monocline and are therefore in an area of low potential for development of the coal resources. No subsurface data are available for evaluating coal deposits in the remainder of the quadrangle. Extensive drilling by private energy companies 10 mi east of the quadrangle indicates large amounts of coal at depth in the Straight Cliffs Formation (Bowers, 1991a; Zeller, 1990; Zeller and Vaninetti, 1990). An expected decrease in total coal to the west of this drilling makes the Horse Flat quadrangle less promising for coal resource development.

The Upper Cretaceous Dakota Formation, which also crops out along Cottonwood Creek, locally contains some very thin, lenticular, impure coal beds that grade laterally to carbonaceous shale. These coals are usually less than 1.5 ft thick although some coal has been mined from a 5-ft-thick bed in the Dakota Formation at the Bryce Canyon Coal and Coke Company mine about 8 mi south of the quadrangle near the Pata River (Doelling and Davis, 1989, p. 107). Total production there was probably less than 1,000 short tons.

OIL AND GAS

Prior to 1991, the only oil and gas test hole drilled near the quadrangle was the Tenneco Oil Co. Tibet Canyon #1 in sec. 19, T. 40 S., R. 2 E., which was drilled in 1969 in the adjacent Fournille Bench quadrangle to the east. Oil shows were obtained from the Permian Kaibab and Torowee Formations (Doelling and Davis, 1989, p. 116).

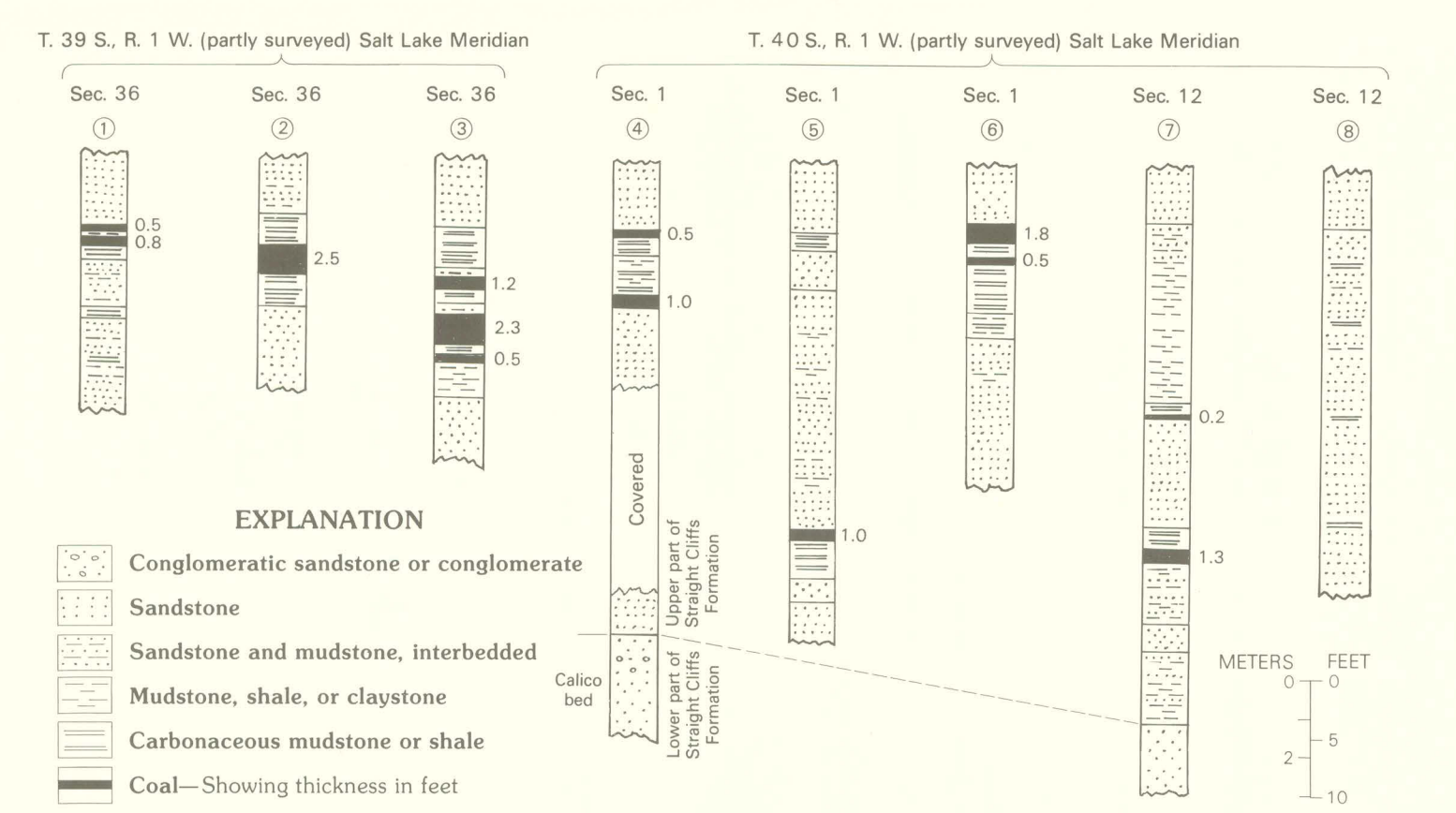
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CONVERSION FACTORS

Multiply	By	To obtain
inches (in)	2.54	centimeters (cm)
feet (ft)	0.3048	meters (m)
miles (mi)	1.609	kilometers (km)

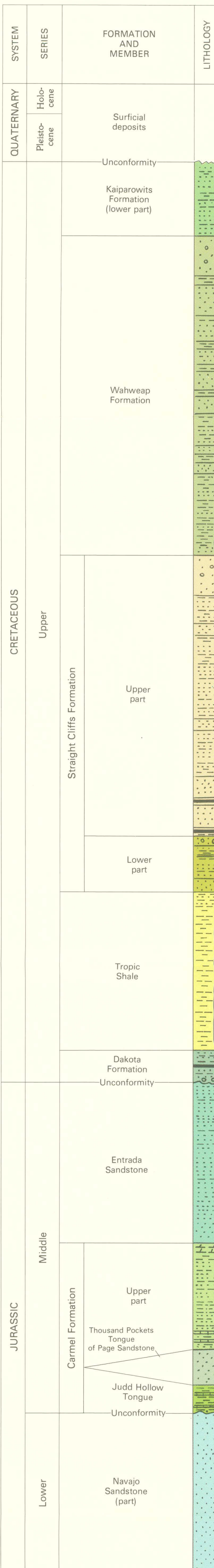
MEASURED COAL SECTIONS



EXPLANATION

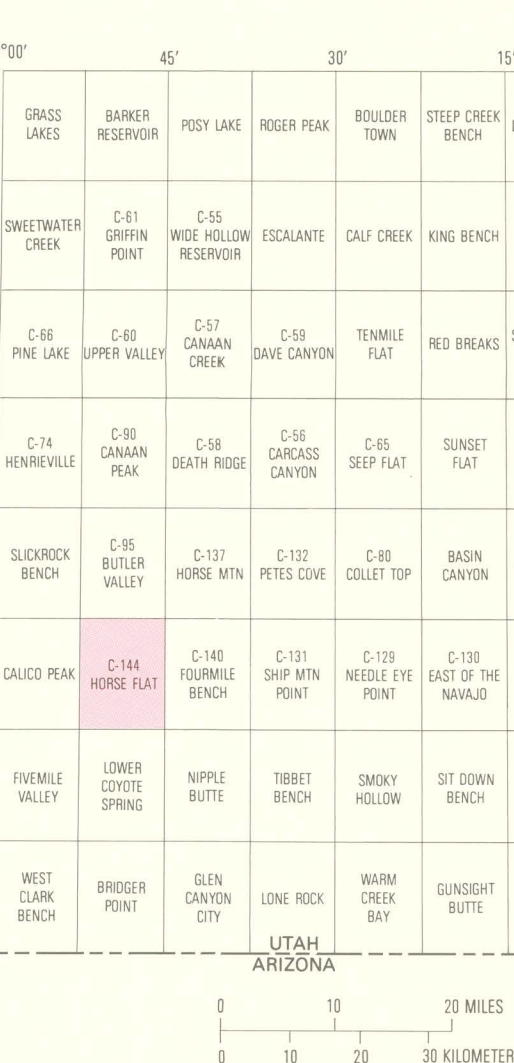
- Conglomeratic sandstone or conglomerate
- Sandstone
- Sandstone and mudstone, interbedded
- Mudstone, shale, or claystone
- Carbonaceous mudstone or shale
- Coal—Showing thickness in feet

GENERALIZED COLUMNAR SECTION



EXPLANATION

- Conglomeratic sandstone or conglomerate
- Sandstone
- Sandstone and mudstone, interbedded
- Mudstone, shale, or claystone
- Carbonaceous mudstone or shale
- Coal
- Limestone
- Gypsum



INDEX OF SOUTH-CENTRAL UTAH SHOWING LOCATION OF HORSE FLAT QUADRANGLE, 1:24,000-SCALE QUADRANGLE NAMES, AND NUMBERS OF PUBLISHED U.S. GEOLOGICAL SURVEY COAL INVESTIGATIONS (C) MAPS

GEOLOGIC MAP OF THE HORSE FLAT QUADRANGLE, KANE COUNTY, UTAH

By
William E. Bowers
1993