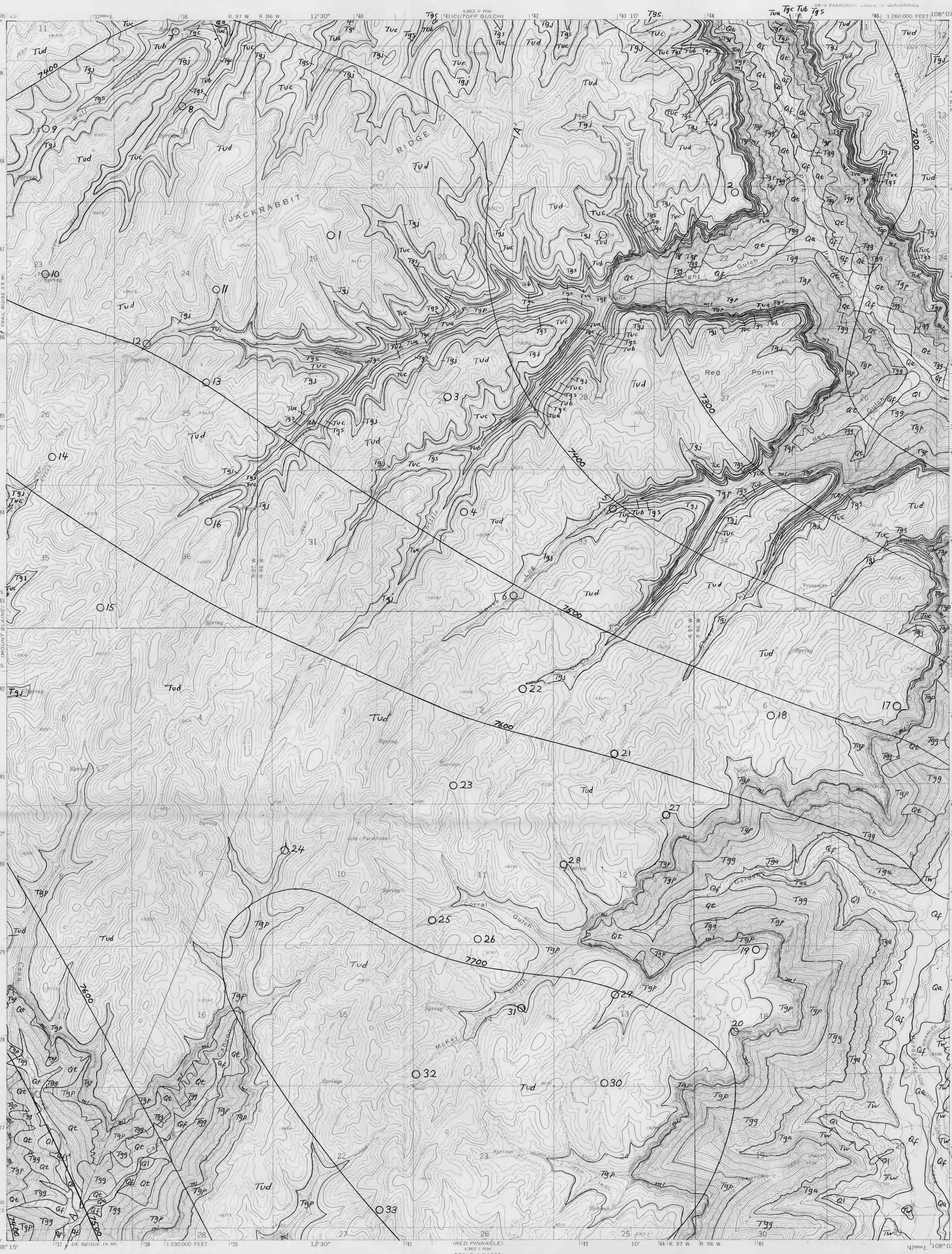
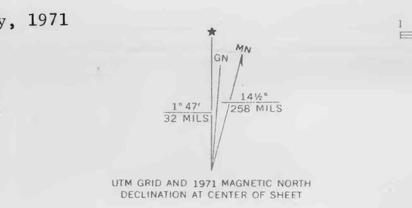


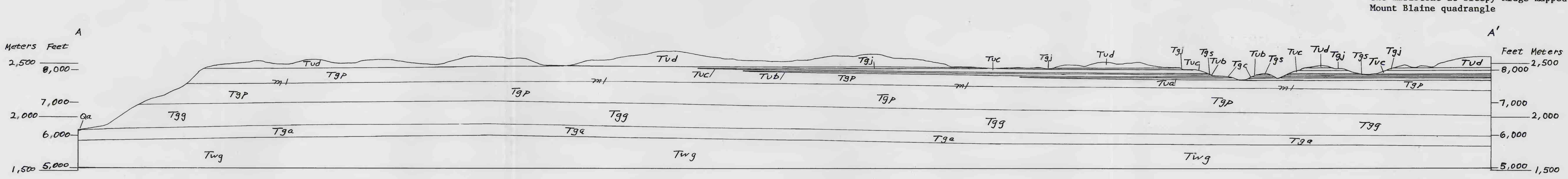
Base map from U.S. Geological Survey, 1971

SCALE 1:24 000

CONTOUR INTERVAL 40 FEET
DATUM IS MEAN SEA LEVEL

Geology mapped in 1976 and 1980



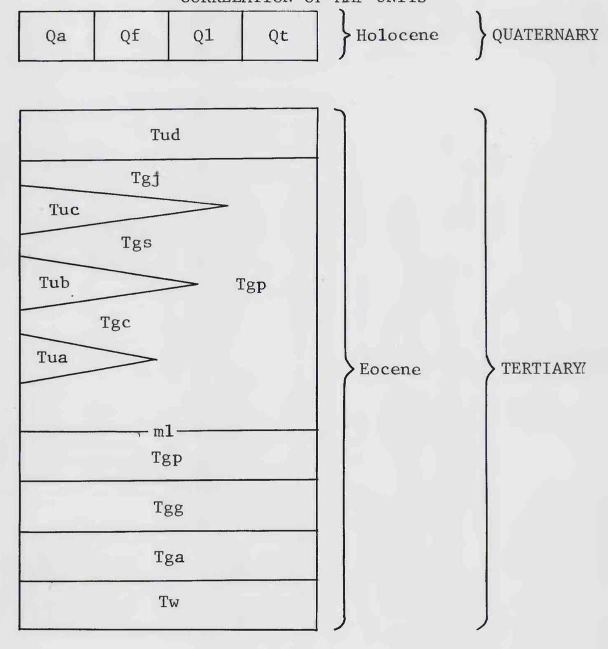


PRELIMINARY GEOLOGIC MAP OF THE CIRCLE DOT GULCH QUADRANGLE, GARFIELD COUNTY, COLORADO

By
William J. Hail, Jr.

1982

CORRELATION OF MAP UNITS



DESCRIPTION OF MAP UNITS

Qa ALLUVIUM (HOLOCENE)--Locally derived stream deposits along valley floors

Qf ALLUVIAL FAN DEPOSITS (HOLOCENE)--Flash-flood deposits at the mouths of steep drainages

Ql LANDSLIDE DEPOSITS (HOLOCENE)--Slide masses and slumped ground

Qt TALUS AND SLOPE WASH (HOLOCENE)--Gravity and sheetwash deposits on or at the base of steep cliffs. Only the larger or more extensive deposits are shown

UINTA FORMATION (EOCENE)--Units C, B, and A are southward-projecting tongues of the Uinta Formation which join the main body of the Uinta north of the Circle Dot Gulch Quadrangle

Tud Unit D--Brown-weathering siltstone and fine- to medium-grained sandstone; light-brown to light-gray-weathering marly siltstone and variably silty marlstone; subordinate oil shale; minor limestone and coarse-grained to conglomeratic channel sandstone. The siltstone and fine-grained sandstone beds are apparently tuffaceous and commonly contain carbonized plant trash. Discontinuous marlstone and oil-shale beds are fairly abundant. Oil-shale beds are locally rich and well developed but are lenticular. At many places, the basal contact of unit D is irregular and undulating, apparently as a result of moving or slumping of consolidated siltstone or sandstone masses of unit D into poorly consolidated marlstone of the underlying Green River Formation during or shortly after deposition. Similar paleo-slump structures are also present in stratigraphically higher beds of unit D. Unit D forms most of the upland surface of the quadrangle. Relatively nonresistant; weathers to rounded slopes. Maximum remaining thickness about 165 m (540 ft)

Tuc Unit C--Mostly light-brown-weathering siltstone with varying amounts of carbonized plant trash; lesser brown-weathering fine- to very fine-grained sandstone, and light-gray-weathering silty marlstone. Mostly nonresistant; forms slopes locally interrupted by ledges. Maximum thickness about 45 m (150 ft)

Tub Unit B--Mostly light-brown to light-gray-weathering siltstone and marly siltstone with varying amounts of carbonized plant trash; lesser brown-weathering very fine grained sandstone. Commonly contains a 40 to 48 liters-per-metric-ton (10 to 12 gallons-per-ton) oil-shale bed as much as 6 m (20 ft) thick near the middle of the unit. Mostly nonresistant; forms slopes. Maximum thickness about 30 m (100 ft)

Tua Unit A--Mostly light-brown-weathering variably marly siltstone with varying amounts of carbonized plant trash; lesser brown-weathering very fine-grained sandstone. Nonresistant; forms slopes. Maximum thickness about 18 m (60 ft)

GREEN RIVER FORMATION (EOCENE)

Tgj Marlstone at Jackrabbit Ridge--Informally named for exposures on Jackrabbit Ridge in the north-central part of the quadrangle. Mostly marlstone, oil shale, lesser siltstone, and very fine-grained sandstone. Channel sandstone present locally. The marlstone beds contain some lean oil shale, estimated at about 20 to 40 liters per metric ton (5 to 10 gallons per ton) in the extreme northern part of the quadrangle, but contain progressively increasing oil-shale values to the south toward the line of merger with the Parachute Creek Member where the marlstone at Jackrabbit Ridge is dominantly oil shale. The marlstone beds are variably silty, and weather light gray to light brown. The siltstone and sandstone beds are variably marly, tuffaceous, locally contain carbonized plant trash, and weather light to medium brown. Unit forms a series of benches and grooves on steep exposures. The thickness of the marlstone at Jackrabbit Ridge ranges from about 12 m (40 ft) near Sheep Kill and Gardner Gulches in the east, to about 45 m (150 ft) along Wolf Creek near the northwest corner of the quadrangle. In the northwestern part of the area, the marlstone at Jackrabbit Ridge consists of three beds of marlstone separated by two wedges of siltstone and sandstone which wedge out or grade out southward and eastward, so that the Jackrabbit Ridge merges with the Parachute Creek Member of the Green River Formation along an east-west line across the central part of the quadrangle. The lowermost marlstone bed is the equivalent of the marlstone at Barnes Ridge as mapped in the Cutoff Gulch quadrangle to the north (Hail, 1975). Higher beds of the Jackrabbit Ridge are equivalent to the lower part of a tongue of the Uinta Formation above the marlstone at Barnes Ridge as mapped in the Cutoff Gulch quadrangle. The lower marlstone was not mapped separately in the Mount Blaine quadrangle to the west, but there it is mapped with a tongue of the Uinta Formation (Hail, 1978) which also includes equivalents of the overlying siltstone bed. Higher beds of the Jackrabbit Ridge are equivalent to the marlstone at Sleepy Ridge mapped in the Mount Blaine quadrangle

Tgs Stewart Gulch Tongue--Light-gray-weathering marlstone and oil shale; dominantly oil shale everywhere in the quadrangle. Joins the Parachute Creek Member across the central part of the quadrangle. Commonly forms a single conspicuous and persistent steep-faced cliff on canyon walls. Thickness ranges from about 4 to 12 m (13 to 40 ft)

Tgc Coughs Creek Tongue--Light-gray-weathering marlstone and oil shale. Joins the Parachute Creek Member across the north-central part of the quadrangle. Commonly forms a steep-faced cliff with two or more resistant and prominent ledges on canyon walls. Thickness ranges from about 6 to 12 m (20 to 40 ft)

Tgp Parachute Creek Member--Light-gray to light-brown-weathering marlstone much of which is oil shale; lesser silty marlstone and marly siltstone; a few beds of siltstone and sandstone; numerous very thin beds of analcitized tuff throughout the member; a few sparse algal beds and some fissile shale and dolomitic claystone in the lower part. Contains most of the potentially valuable oil shale in the quadrangle. Resistant; forms high precipitous cliffs on canyon walls. The basal contact of the Parachute Creek Member as used herein is that defined by Bradley (1931, p. 11-14, pl. 7) at the type section of the member along Parachute Creek in or near the Circle Dot Gulch Quadrangle. The basal contact is placed at the base of the lowest sequence of oil-shale beds ("lower oil-shale group" of Bradley, 1931, p. 11-12, pl. 7) in the Green River Formation in this area. However, fissile oil shale is present below this zone near the top of the underlying Garden Gulch Member. The basal contact of the Parachute Creek, as thus defined, rises stratigraphically from north to south within the quadrangle. The upper contact is placed either at the base of the lowermost tongue or the main body of the overlying Uinta Formation. The upper contact of the Parachute Creek rises stratigraphically from north to south because of the southward pinchout of the three separately mapped tongues of the Uinta. The thickness of the Parachute Creek Member ranges from about 290 to 365 m (950 to 1,200 ft)

ml Mahogany ledge--A rich oil-shale zone in the Parachute Creek Member. Line on map drawn on the top of the Mahogany ledge. Thickness ranges from about 30 to 40 m (100 to 130 ft)

Tgg Garden Gulch Member--Gray- to grayish-brown-weathering variably silty dolomitic claystone, clay shale, dolomitic shale, shaly marlstone, and marlstone; a few thin brown-weathering siltstone and sandstone beds; a few beds of fissile oil shale, mostly in upper part; several thin algal beds. The tuff marker bed at Kimball Mountain (Johnson, 1975) lies about 20 m (65 ft) above the base of the member near the mouth of Garden Gulch. Carbonate marlstone in the upper part is transitional to the dominant carbonate marlstone lithology typical of the overlying Parachute Creek Member. Mostly nonresistant; forms smooth slopes. The upper and lower contacts follow those defined by Bradley (1931, p. 10-11, pl. 7) at the type section of the member presumably on the north side and near the mouth of Garden Gulch. The upper contact is discussed above. The lower contact is placed at the top of the highest prominent sandstone bed of the underlying Anvil Points Member of the Green River. Thickness of the Garden Gulch ranges from about 207 to 223 m (680 to 730 ft)

Tga Anvil Points Member--Mostly gray-to brown-weathering kerogen-rich fissile shale, with lesser but conspicuous brown-weathering fine- to medium-grained sandstone beds. The overall brown-weathering Anvil Points displays a pronounced color contrast with the dominantly gray weathering overlying Garden Gulch Member. The base of the member is the marker bed at Long Point, a fairly widespread transgressive lacustrine unit consisting mostly of ostracodal and oolitic sandstone (Johnson, 1975). The Anvil Points is generally a nonresistant unit but forms broken slopes because of several relatively resistant sandstone beds. Strata assigned here to the Anvil Points have previously been mapped as Douglas Creek Member of the Green River Formation because they were so designated by Bradley (1931, pl. 7) in his measured section on Parachute Creek. The usage of Anvil Points in this quadrangle follows that of Johnson (1975) in the Long Point quadrangle to the southwest. Thickness ranges from about 90 to 120 m (300 to 400 ft)

Tw WASATCH FORMATION (EOCENE)--Varicolored red and grayish-yellow claystone, and channel-sandstone beds. Only the upper part is exposed in the quadrangle. Nonresistant; forms gentle slopes; tends to slump. Maximum exposed thickness about 75 m (250 ft). Not shown separately on cross section

Twg INTERTONGUED WASATCH AND GREEN RIVER FORMATIONS (EOCENE)--Shown in cross section only. Although local subsurface information is lacking, regional relations suggest that a tongue of the Green River Formation is present within the Wasatch in the subsurface of the quadrangle. In the Long Point quadrangle to the southwest, this unit is 55 to 70 m (175 to 225 ft) thick and consists mostly of carbonaceous shale, silty claystone, siltstone, and sandstone, with minor coal and limestone (Johnson, 1975).

CONTACT--Approximately located where obscured by soil cover or vegetation

FAULT--Bar and ball on downthrown side

7400 STRUCTURE CONTOURS--Drawn on top of the Mahogany ledge oil-shale zone. Contour interval 100 ft (30.5 m)

○ 22 DRILL HOLE SHOWING MAP NUMBER

OIL SHALE

Rich oil shale is present in the Parachute Creek Member of the Green River Formation. Some low-grade oil shale and a few beds of rich oil shale are also present in the marlstone tongues of the Green River, in unit D of the uppermost Uinta Formation, and in the Garden Gulch Member of the Green River.

Information for evaluating oil-shale resources at present is mostly limited to the Mahogany zone and higher oil-shale zones, although some information is available for the R-6 zone just below the Mahogany. Rich oil-shale zones below the R-6 zone are present in the quadrangle but are largely unevaluated. The various rich-oil-shale zones in the Piceance Creek Basin are shown graphically by Cashion and Donnell (1972), Johnson (1975, 1977), and Hail (1975).

Pitman and Donnell (1973) evaluated oil-shale resources for beds from the top of the Mahogany zone upward to the top of the Big Three rich-oil-shale zone. Resources for this sequence range from about 93,000 m^3 per hm^2 (236,000 barrels per acre) in the southwestern part of the quadrangle, to about 130,000 m^3 per hm^2 (330,000 barrels per acre) in the northeastern part of the quadrangle. Based on these figures, the total oil-shale resource for this sequence in the quadrangle is about 1.38 billion m^3 (8.7 billion barrels). This sequence ranges in thickness from about 60 m (200 ft) in the southwestern part of the quadrangle, to about 80 m (260 ft) in the northeastern part of the quadrangle.

For the Mahogany zone, Pitman and Johnson (1978) estimated that oil-shale resources range from about 63,000 m^3 per hm^2 (160,000 barrels per acre) in the southwestern part of the quadrangle, to about 94,000 m^3 per hm^2 (240,000 barrels per acre) in the northeastern part of the quadrangle. Based on these figures, the total oil-shale resource for the Mahogany zone in the quadrangle is about 0.97 billion m^3 (6.1 billion barrels). The Mahogany zone averages about 34 m (110 ft) thick in the quadrangle.

For the R-6 rich-oil-shale zone, Pitman (1979) estimated that resources range from about 39,000 m^3 per hm^2 (100,000 barrels per acre) in the southwestern part of the quadrangle, to about 118,000 m^3 per hm^2 (300,000 barrels per acre) in the northeastern part of the quadrangle. Based on these figures, the total oil-shale resource for the R-6 zone in the quadrangle is about 0.83 billion m^3 (5.2 billion barrels). The R-6 zone ranges in thickness from about 45 m (150 ft) in the northwestern part of the quadrangle, to about 58 m (190 ft) in the northeastern part of the quadrangle.

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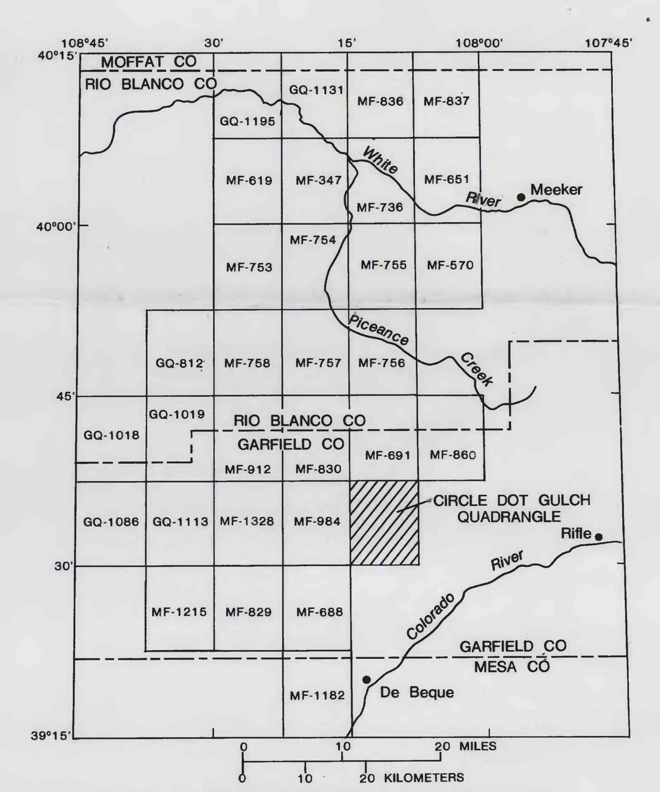
Oil-shale evaluation drill holes. Partial list
Approximately located.

Map no.	Drill hole	Section
	T. 5 S., R. 96 W.	
1	Chevron Shale Oil Co., C-1A	NE1/4 19
2	Pacific Oil Co., Burbank	NE1/4 22
3	Chevron Shale Oil Co., C-2	NE1/4 29
4	Chevron Shale Oil Co., PC-11	NE1/4 32
5	Union Oil Co., Jann	NE1/4 33
6	Chevron Shale Oil Co., PC-2	SW1/4 33
	T. 5 S., R. 97 W.	
7	Getty Oil Co., 15-12	SW1/4 12
8	Getty Oil Co., 21-13	NW1/4 13
9	Getty Oil Co., 19-14	NW1/4 14
10	Getty Oil Co., 22-23	SE1/4 23
11	Getty Oil Co., 23-24	SE1/4 24
12	Sun Oil Co., Bear Run 1	NW1/4 25
13	Getty Oil Co., 24-25	NE1/4 25
14	Getty Oil Co., 25-26	SE1/4 26
15	Cities Service Oil Co., 2	SE1/4 35
16	Getty Oil Co., 26	NE1/4 36
	T. 6 S., R. 96 W.	
17	Pacific Oil Co., Dragert 1	SW1/4 5
18	Chevron Shale Oil Co., C-3	SE1/4 6
19	Chevron Shale Oil Co., PC-8	NW1/4 18
20	Pacific Oil Co., Midland 1	SW1/4 18
	T. 6 S., R. 97 W.	
21	Chevron Shale Oil Co., PC-3	SE1/4 1
22	Chevron Shale Oil Co., PC-1	NW1/4 2
23	Chevron Shale Oil Co., PC-10	SW1/4 2
24	Cities Service Oil Co., Cascade 1	NW1/4 10
25	Chevron Shale Oil Co., PC-4	SW1/4 11
26	Chevron Shale Oil Co., C-4	SW1/4 11
27	Chevron Shale Oil Co., PC-12	NE1/4 12
28	Chevron Shale Oil Co., PC-9	NW1/4 12
29	Chevron Shale Oil Co., PC-6	NW1/4 13
30	Chevron Shale Oil Co., PC-7	SW1/4 13
31	Chevron Shale Oil Co., PC-5	NE1/4 14
32	Pacific Oil Co., Pratt 1	SW1/4 14
33	Cities Service Oil Co., CH-5	SE1/4 22



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