Base from U.S. Geological Survey, 1968

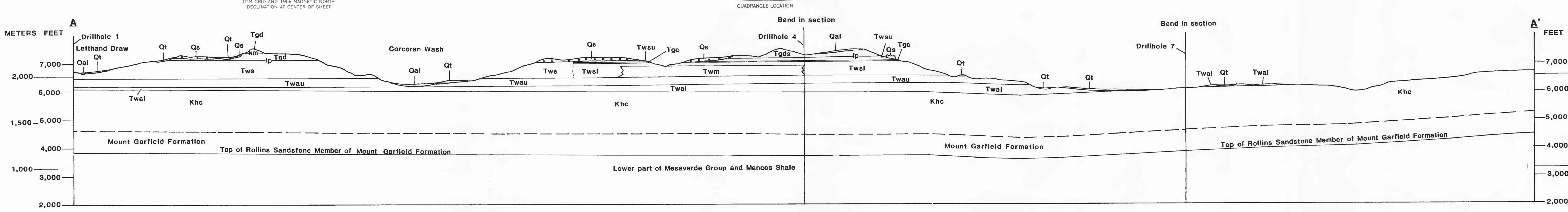
SCALE 1:24 000

CONTOUR INTERVAL 40 FEET
DATUM IS MEAN SEA LEVEL

UTM GRID AND 1968 MAGNETIC NORTH DECLINATION AT CENTER OF SHEET

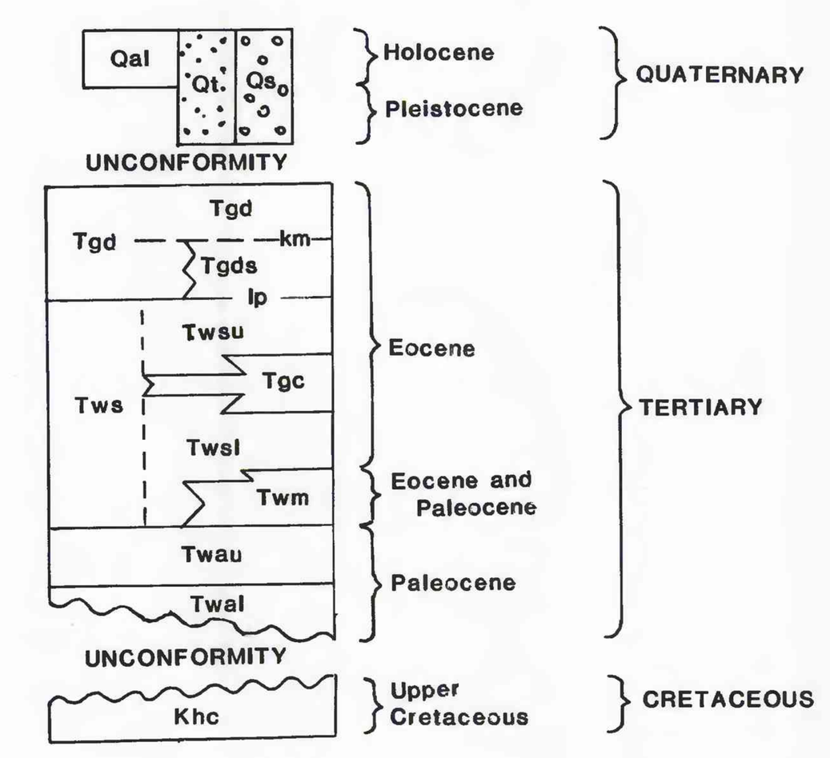
QUADRANGLE LOCATION

Geology mapped in 1975, 1977, 1979, 1980, and 1982 by R. C. Johnson; assisted in 1975 by J. Twyman, in 1977 by B. J. Douglas, in 1979 by M. P. Granica, in 1980 by V. F. Nuccio



NO VERTICAL EXAGGERATION

CORRELATION OF MAP UNITS



DESCRIPTION OF MAP UNITS

Qal ALLUVIUM (HOLOCENE)--Derived from local bedrock outcrops

Qt TERRACE AND PEDIMENT DEPOSITS (HOLOCENE AND PLEISTOCENE)--Alluvial-fan, talus, and slope-wash deposits that dip away from ridges. At least two levels present. Lowest level may be post-Pleistocene and, in some areas, seems to merge with level of recent alluvial deposition

Qs SLUMP DEPOSITS (HOLOCENE AND PLEISTOCENE)

GREEN RIVER FORMATION (EOCENE)

Douglas Creek Member

Tgd Main part--Carbonate-rich rocks such as laminated muddy carbonates, and ostracodal, oolitic, and algal limestones interlayered with olive-green mudstone, medium- to dark-gray shale, gray siltstone, and gray sandstone. Sandstone units are fairly persistent, are 16 ft (5 m) or less thick, and constitute less than 20 percent of unit. Sandstone is fine to medium grained, moderately to well sorted, showing parallel horizontal lamination and ripple lamination. Ostracodal, oolitic, and algal limestones are as much as 6 ft (2 m) thick and constitute about 10 percent of the unit. North of South Dry Fork, lower 33-130 ft (10-40 m) of Douglas Creek Member is mostly fissile shale. This unit was mapped as Garden Gulch Member in The Saddle quadrangle, to the north (Johnson, 1977), but is included in Douglas Creek Member here. Member is middle to early Eocene in age (Johnson and May, 1978). Only lower 1,100 ft (335 m) of Douglas Creek Member is exposed in quadrangle

—km— — Kimball Mountain Tuff Bed--Planar top and base, about 2 in. (5 cm) thick; consists of analcime that is partially replaced by large sparry calcite crystals; crystals are conspicuous on fresh surface. Purple and gray on fresh surface, and rust brown where weathered. Mapped as base of main part of Douglas Creek Member in east-central part of quadrangle although may be as much as 50 ft (15 m) above true lithologic base. Becomes discontinuous in west-central two-thirds of quadrangle (dashed line on map), and was not found on the west end of South Shale Ridge

Tgds Sandy part--Gray sandstone, gray siltstone, and gray to olive-gray mudstone; contains minor oolitic, ostracodal, and algal limestone and a few thin oil-shale beds. Sandstone units are fairly persistent, are as much as 100 ft (30 m) thick, and constitute about half of the facies. Sandstone is fine to coarse grained, moderately well sorted, and shows parallel horizontal lamination, trough cross lamination, and ripple lamination. Mudstone is nonlaminated to indistinctly laminated and locally contains ostracods. Equivalent to Anvil Points Member of Green River Formation as mapped in Long Point quadrangle (Johnson, 1975). Grades into main part of Douglas Creek Member in central part of quadrangle. Middle to early Eocene in age (Johnson and May, 1978). Thickness 230-315 ft (70-96 m)

—lp— — Long Point bed--Composed of varying amounts of fine- to medium-grained quartz sandstone, ostracods, and oolites; contains locally abundant *Goniobasis* and *Vivaparus* gastropods. Basal bed of Douglas Creek Member. A widespread transgressive unit found throughout southwestern Piceance Creek basin. Thickness about 3-23 ft (1-7 m)

Tgc Cow Ridge Member--Gray ostracodal clay shale and brown carbonaceous shale; contains some sandstone, siltstone, and maroon and gray mudstone. Sandstone is fine grained and well sorted; contains abundant ostracods and some gastropods, pelecypods, and fish remains. Sandstone units are persistent, show parallel horizontal lamination and ripple lamination, and are 15 ft (5 m) or less thick. Grades into Shire Member of Wasatch Formation in southwestern part of quadrangle. Middle to early Eocene in age (Johnson and May, 1978). Thickness 40-200 ft (12-61 m); thins toward west

WASATCH FORMATION (EOCENE AND PALEOCENE)

Tws Shire Member (Eocene and Paleocene)--Mostly nonlaminated gray, purple, and maroon mudstone; contains a few thin, lenticular sandstone units. Sandstone units are fine to coarse grained and moderately to poorly sorted; show parallel horizontal lamination, trough cross lamination, and drift-ripple lamination; and are 35 ft (10 m) or less thick. Mapped in southwestern half of quadrangle. Equivalent to upper and lower parts of Shire Member of Wasatch Formation (units Twsu, Twsl), Molina Member of Wasatch Formation (unit Twm), and Cow Ridge Member of Green River Formation (unit Tgc). Thickness 475-675 ft (145-205 m); thins toward southwest

Twsu Upper part (Eocene)--Mostly nonlaminated gray, purple, and maroon mudstone; contains a few thin, lenticular sandstone units. The sandstone units are fine to coarse grained and moderately to poorly sorted; show parallel horizontal lamination, trough cross lamination, and drift-ripple lamination, and are 35 ft (10 m) or less thick. Mapped in northeastern half of quadrangle where Cow Ridge Member of Green River Formation is present. Thickness 70-300 ft (21-92 m); thins toward southwest

Twsl Lower part (Eocene and Paleocene)--Mostly nonlaminated gray, purple, and maroon mudstone; contains lenticular sandstone units. Mapped in northeastern half of quadrangle where Cow Ridge Member of Green River Formation is present. Locally includes equivalent of Molina Member of Wasatch Formation. Thickness where Molina equivalent is not included 100-220 ft (30-67 m). Thickness where Molina equivalent is included 425-625 ft (130-191 m)

Twm Molina Member (Eocene and Paleocene)--Mostly gray and brown sandstone, interlayered with nonlaminated gray mudstone. Sandstone units are 3-50 ft (1-15 m) thick, fairly persistent, and constitute 25-70 percent of member. Sandstone is fine to medium grained and well sorted to moderately well sorted; shows parallel horizontal lamination, trough cross lamination, and drift-ripple lamination. Sandstone units become more lenticular and less abundant to southwest. Grades to southwest into purple and maroon mudstone containing a few lenticular sandstone units. Where sandstone constitutes less than about 25 percent of rock, unit is mapped with lower part of Shire Member. Basal sandstone unit of Molina Member persists throughout quadrangle, and becomes base of the Shire Member where Molina Member is not mapped. Middle to early Eocene and late Paleocene in age (Johnson and May, 1978). Thickness 220-450 ft (67-137 m)

Atwell Gulch Member (Late Paleocene)

Twau Upper part--Mostly gray and maroon claystone and mudstone; contains a few thin, persistent, ripple laminated and small-scale trough cross laminated sandstone units. Generally lacks purple claystone and mudstone common in Shire Member. Thickness 230-330 ft (70-100 m); thins toward southwest

Twal Lower part--Mostly black and gray claystone and mudstone; contains a few thin coal beds. Thickness 80-430 ft (25-130 m); thins mainly by onlap on underlying unconformity toward both west and southwest

Khc HUNTER CANYON FORMATION (UPPER CRETACEOUS)--Mostly gray to white sandstone, interlayered with nonlaminated gray mudstone and gray carbonaceous claystone. Sandstone units are as much as 130 ft (40 m) thick, are lenticular, and constitute about 60-70 percent of formation. Sandstone is fine to coarse grained; contains a few lenses of small gray chert pebbles and gray silicified limestone pebbles, mainly in the upper 330 ft (100 m). Sandstone shows parallel horizontal lamination, trough cross lamination, and some large-scale lateral-accretion bedding. White sandstone is confined to upper 165-330 ft (50-100 m) of section. The white color is caused by a breakdown of feldspar to kaolinite and is interpreted to be an ancient weathering profile developed during time gap represented by overlying unconformity (Johnson and May, 1980). This white zone has been called Ohio Creek Formation but was recently redefined as a member of Hunter Canyon Formation (Johnson and May, 1980). In Winter Flats quadrangle, lower contact of Ohio Creek Member is gradational in outcrop and, consequently, the member was not mapped. Early Maestrichtian to late Campanian in age (Johnson and May, 1978). Only upper 865 ft (264 m) is exposed.

Beneath Hunter Canyon Formation, two units in Mesaverde Group are shown in subsurface on cross section A-A'. These are Mount Garfield Formation and lower part of Mesaverde Group. Lower part of Mesaverde Group intertongues with Mancos Shale, and these units are shown together on cross section. Mount Garfield Formation is mostly fine-grained sandstone, carbonaceous shale, and coal. Rollins Sandstone Member of Mount Garfield Formation, top of which is shown on cross section, is mostly fine-grained sandstone

CONTACT--Dashed where approximately located

FAULT--Bar and ball on downthrown side

—6700— STRUCTURE CONTOURS--Datum is base of Molina Member of Wasatch Formation. Dashed where datum is absent. Contour interval 100 ft (30.5 m)

ANTICLINE--Arrow shows direction of plunge

● 8 DRILL HOLE--Queried where approximately located. Locations given in table of drill-hole data

3 MEASURED SECTION--Numbers on map are keyed to measured section and show where each segment of the section was measured

REFERENCES CITED

Johnson, R. C., 1975, Preliminary geologic map, oil-shale yield histograms, and stratigraphic sections, Long Point quadrangle, Garfield County, Colorado: U.S. Geological Survey Miscellaneous Field Studies Map MF-688, scale 1:24,000.

_____ 1977, Preliminary geologic map and cross section of The Saddle quadrangle, Garfield County, Colorado: U.S. Geological Survey Miscellaneous Field Studies Map MF-829, scale 1:24,000.

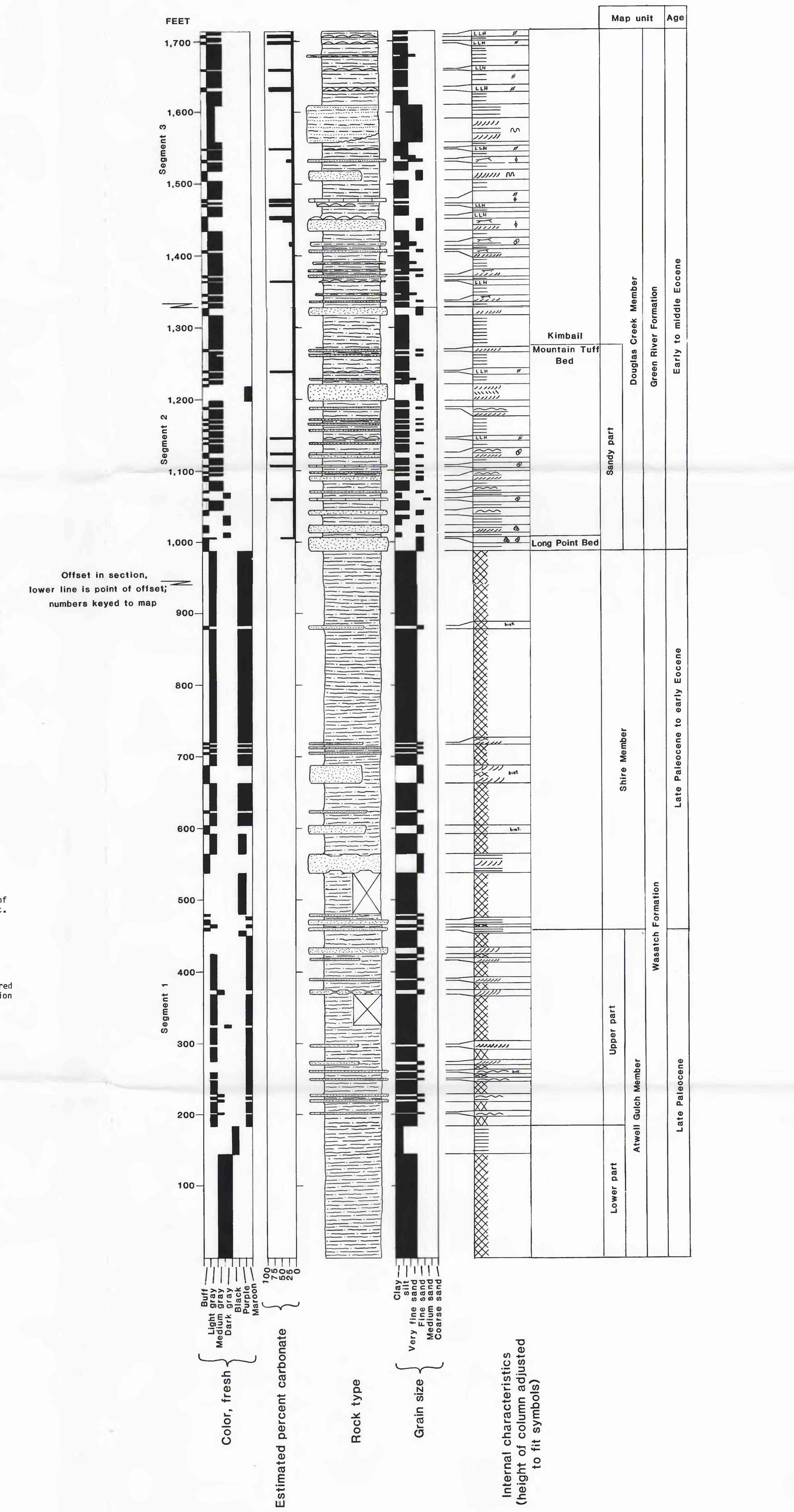
Johnson, R. C., and May, Fred, 1978, Preliminary stratigraphic studies of the Mesaverde Group, the Wasatch Formation, and the lower part of the Green River Formation, DeBeque area, Colorado, including environments of deposition and investigation of palynomorph assemblages: U.S. Geological Survey Miscellaneous Field Studies Map MF-1050.

_____ 1980, A study of the Cretaceous-Tertiary unconformity in the Piceance Creek basin, Colorado--The underlying Ohio Creek Formation (Upper Cretaceous) redefined as a member of the Hunter Canyon or Mesaverde Formation: U.S. Geological Survey Bulletin 1482-B , 27 p.

Table of drill-hole data

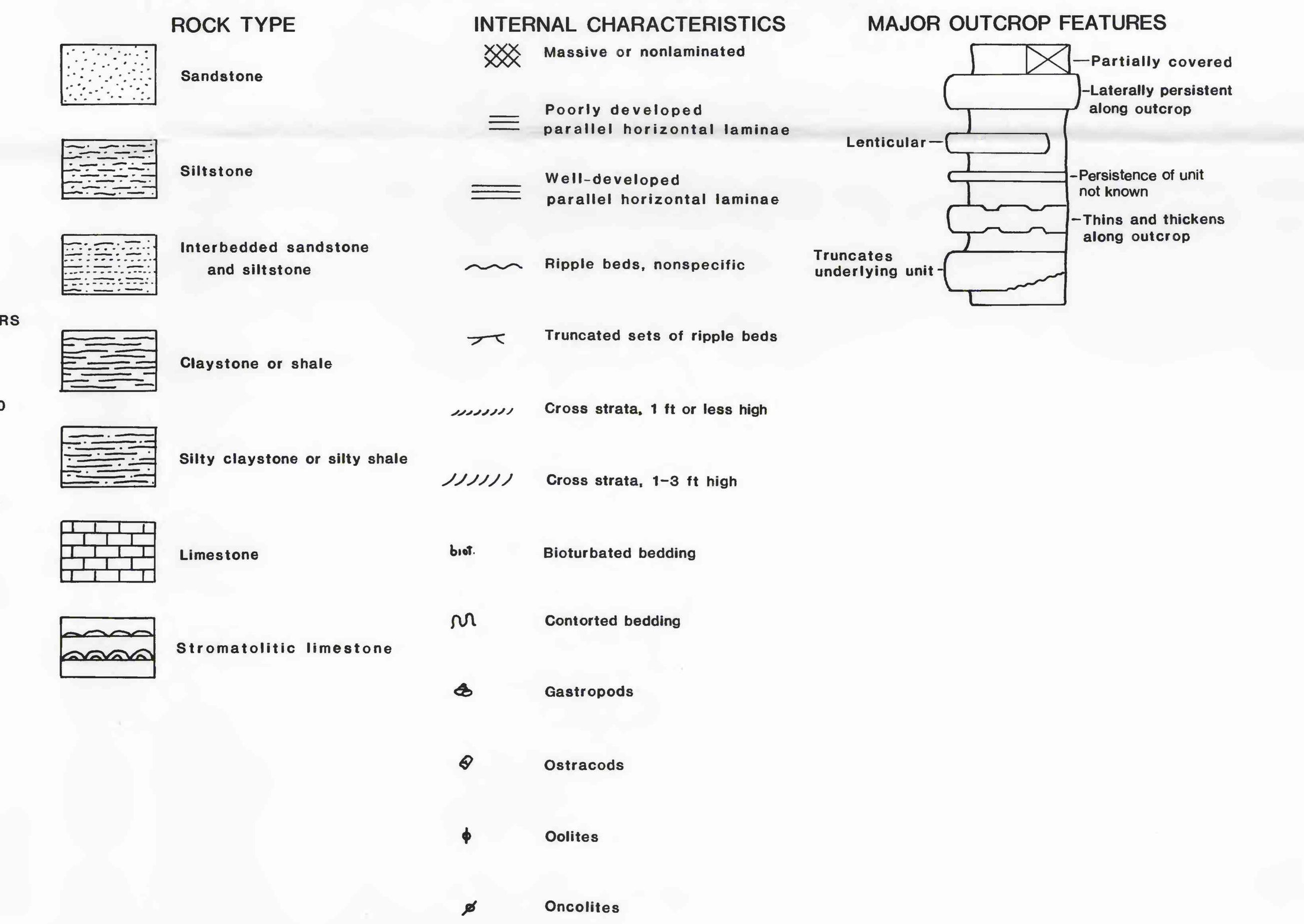
[Leaders (---) indicate that formation was not penetrated; T. S., township south; R. W., range west]

No. on map	Name and operator	Location Sec.	Location T.S.	Location R.W.	Total depth (ft)	Elevation of Kelly Bushing (ft)	Depth to top Rollins Ss Mbr. (ft)	Depth to top Dakota (ft)
1	Dyco Petroleum No. 13-1 Federal Mesager	13	8	100	7,820	6,709	2,860	7,550
2	Dyco Petroleum No. 18-1 Latham Mesager	18	8	99	8,345	6,495	2,905	7,590
3	Adolph Coors 1-26 U.S.A. H.G.	26	8	99	8,891	7,024.5	3,545	8,285
4	Marathon Oil No. 2 DeBeque Unit	34	8	99	4,207	7,276	3,545	---
5	Sunray-Midcontinent No. 1 Red Rock Point	8	9	99	2,898	Approx. 6,240	1,980	---
6	Koch Exploration No. 1-10-99 Winter Flats	10	9	99	7,120	6,187	2,150	6,855
7	Koch Exploration No. 1-11-99 Winter Flats	11	9	99	7,200	6,105	2,230	6,900
8	Koch Exploration No. 1 Winter Flats	15	9	99	7,450	6,294	Cased over	6,830
9	Koch Exploration No. 1-16-99 Winter Flats	16	9	99	6,710	6,070	1,740	6,470
10	Koch Exploration No. 1-13-100 Winter Flats	13	9	100	6,648	6,488	1,680	6,360



VERTICAL SCALE 1 in. =100 ft.
MEASURED SECTION

EXPLANATION FOR MEASURED SECTION



PRELIMINARY GEOLOGIC MAP OF THE WINTER FLATS QUADRANGLE, GARFIELD AND MESA COUNTIES, COLORADO

By
Ronald C. Johnson
1985

For sale by Branch of Distribution, U.S. Geological Survey, Box 25286, Federal Center, Denver, CO 80225