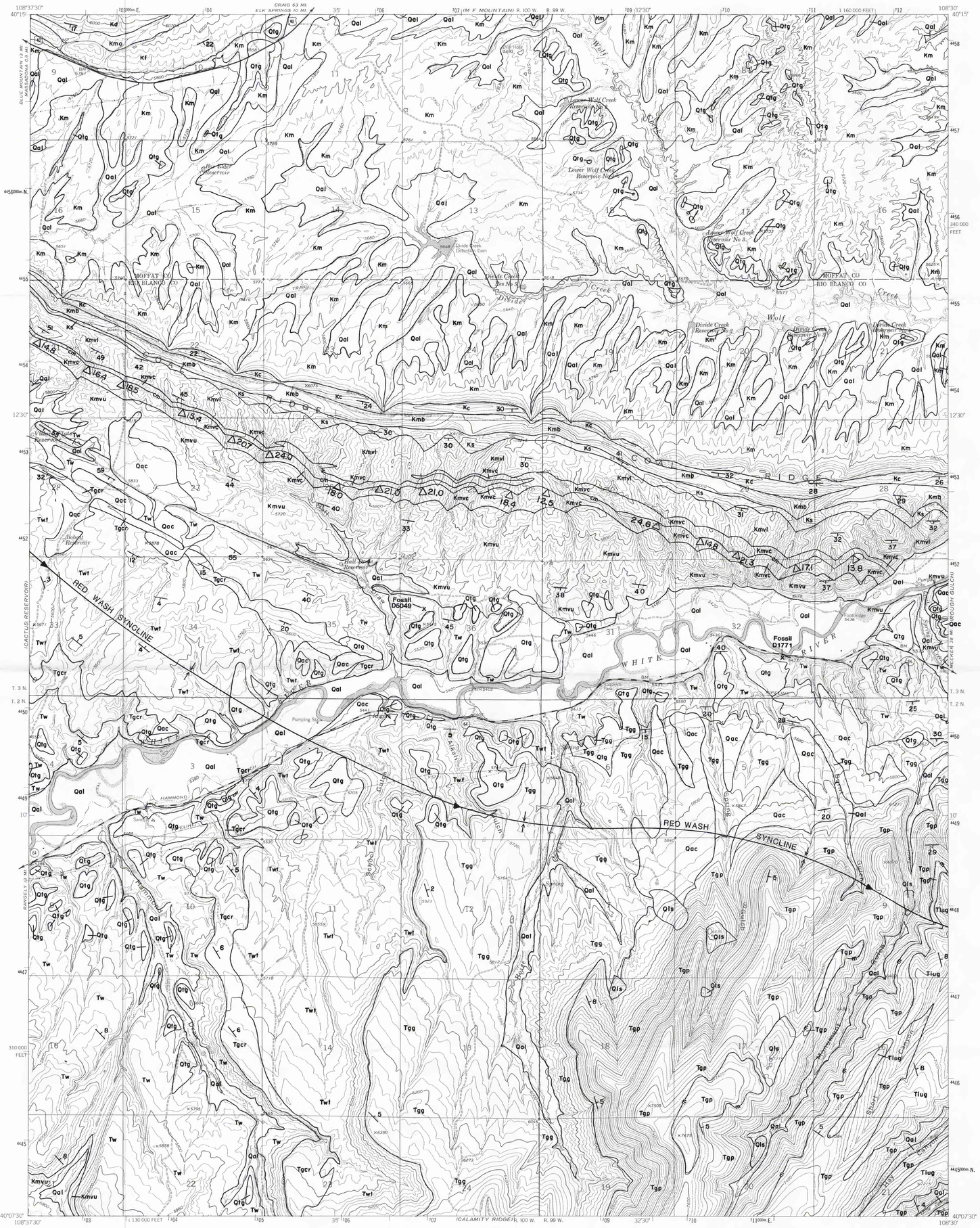
U.S. DEPARTMENT OF THE INTERIOR
U.S. GEOLOGICAL SURVEY

MISCELLANEOUS FIELD STUDIES
MAP MF–2232



Base from U.S. Geological Survey, 1962
Polyconic projection. 1927 North American datum
10,000-foot grid based on Colorado coordinate system, north zone
1,000-meter Universal Transverse Mercator ticks, zone 12

UTM GRID AND 1962 MAGNETIC NORTH DECLINATION AT CENTER OF SHEET

Geology mapped in 1972-73, 1975-76, 1982, 1988-89, 1991

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CORRELATION OF MAP UNITS

Qal / Qtg	Qac	Qls	Holocene / Pleistocene	QUATERNARY
Unconformity				
Tiug			Eocene	TERTIARY
Tgp				
Tgp		m		
Tgg				
Twt				
Tgcr		Tw		
Paleocene				
Unconformity				
Kmvu			Upper Cretaceous	CRETACEOUS
Kmvc				
Kmvc		cm		
Kmvl				
Ks				
Kmb				
Kc				
Km				
Kf				
Kmo				
Kd				

DESCRIPTION OF MAP UNITS

Qal **Alluvium (Holocene)**—Mud, silt, sand, and gravel. Mostly confined to major stream valleys. Includes lowermost terrace deposits along major drainages, some slopewash along valley walls, and alluvial fan deposits at mouths of minor tributary drainages. Mostly derived from nearby sources, but in valley of White River includes some rounded gravel from distant sources to the east. Maximum thickness about 50 ft (15 m)

Qac **Alluvial and colluvial deposits, undifferentiated (Holocene and Pleistocene)**—Sand, silt, and some gravel, all derived from nearby sources. Includes slopewash, isolated upland alluvial deposits, and fans and pediment deposits at bases of steep slopes. Locally covers Pleistocene terrace gravel deposits (Qtg)

Qls **Landslide deposits (Holocene and Pleistocene)**—Chaotic masses originating in the Parachute Creek Member of the Green River Formation (Tgp)

Qtg **Terrace gravel deposits (Pleistocene)**—Gravel in a sandy matrix, at several levels
Area south of Coal Ridge, mostly along White River: Terraces mostly represent former levels of White River. Levels range from 40 to 350 ft (12-106 m) above present valley bottom of White River. Larger gravel clasts, as much as 9 in. (22 cm) in longest dimension, are well-rounded pebbles and cobbles composed mostly of quartzite, quartzitic sandstone, and siltstone, lesser amounts of limestone, and sparse basalt and granite. Locally mantled by a thin veneer of younger alluvial and colluvial deposits, especially along upper margins. Maximum thickness probably not more than 50 ft (15 m)
Area north of Coal Ridge: Higher level terraces east of Wolf Creek, lying 120-360 ft (37-110 m) above present valley bottom of Wolf Creek, are capped by terrace gravels as much as 13 ft (4 m) thick. Gravel clasts are in a silty to sandy matrix and consist of well-rounded pebbles and cobbles of limestone, quartzite, chert, and sandstone; largest clasts are as much as 16 in. (40 cm) in longest dimension. Lower level terraces, mostly less than 50 ft (15 m) above present stream levels, are capped by terrace gravels mostly less than 10 ft (3 m) thick that are similar to higher terrace gravels but gravel clasts are generally smaller

Tiug **Intertongued Uinta and Green River Formations (Eocene)**—Includes one tongue each of Uinta and Green River Formations, not mapped separately. Upper part is a tongue of Green River Formation consisting mostly of light-gray variably silty marlstone, and some thin beds of fine-grained sandstone and marly siltstone; about 80-100 ft (24-30 m) thick. The tongue of Green River Formation is present to the east in the adjacent Rough Gulch 7 1/2-minute quadrangle but was included with the Uinta Formation and not mapped separately there (Hail, 1974). Lower part is a tongue of Uinta Formation consisting mostly of light-brown sandstone and siltstone, minor conglomerate, and some mudstone and silty marlstone beds; about 100-150 ft (30-46 m) thick. Usage here follows that in the 1:50,000-scale map of the lower Piceance Creek area (Hail and Pipiringos, 1990) to the east

Green River Formation (Eocene)—Sediments deposited in predominantly lacustrine environments

Tgp **Parachute Creek Member**—Mostly dolomitic marlstone, oil shale, several beds of marly siltstone, and sandstone, and numerous very thin beds of analcimized altered tuff. Brown to gray clay shale present in lower part. Marlstone is massive to platy and gray to light gray; weathers light gray. Oil shale is thin, even bedded, and medium to dark brown. Some of the sandstone beds may represent distal parts of tongues of Uinta Formation. Marlstone and oil-shale beds are resistant, and form the cliffs and high ground that dominate topography in southeastern part of quadrangle. Basal contact is drawn at or near probable base of R2 oil-shale zone, which coincides with the blue marker, a resistivity log marker widely recognized throughout much of the Piceance Creek basin. It marks the change upward from mostly clay shale of underlying Garden Gulch Member to mostly carbonate-rich rocks typical of the Parachute Creek Member. Thickness of Parachute Creek Member ranges from about 1,560 to 1,940 ft (460-590 m). Although Parachute Creek Member contains oil-shale zones R2 upward through Mahogany zone, oil-yield values are considerably lower in the Divide Creek quadrangle than elsewhere in the Piceance Creek basin. Definitive oil-shale resource information for the Parachute Creek Member is wholly lacking for this quadrangle but trends of isovalue and isoresource contours shown on basin-wide oil-shale resource maps by Pitman and Johnson (1978), Pitman (1979), and Pitman and others (1989) suggest that oil-shale values are greatly diminished for all oil-shale zones in the Parachute Creek Member

—m— **Probable top of Mahogany oil-shale zone**—Top of Mahogany is not firmly established in this area owing to presence of a probable tongue of Uinta Formation (not mapped separately) lying between Mahogany bed and true top of Mahogany zone

Tgg **Garden Gulch Member**—Mostly clay shale and low-grade clay-rich oil shale, lesser carbonate shale and shaly marlstone, and several persistent ostracodal limestone beds in lower part. Entire unit includes much low-grade oil shale. Clay shale and clay-rich oil shale, mostly of freshwater offshore lacustrine origin, are fissile to papery and gray to brown and weather dark gray. Carbonate shale and shale marlstone reflect deposition in more alkaline offshore lake environment; weather light gray. Ostracodal limestone beds are locally silty or sandy, weather light gray to grayish orange, and form thin resistant ledges. Most of unit is nonresistant; forms slopes and poorly exposed lowland areas. Thickness ranges from about 630 to 900 ft (190-275 m). Includes R1 and L1 oil-shale zones. An oil-shale test hole (USGS core hole No. 78-7) just south of quadrangle boundary (Smith and O'Sullivan, 1982, p. 127-136) penetrated about 190 ft (58 m) of low-grade clay-rich oil shale of the R1 zone, and about 50 ft (15 m) of low-grade clay-rich oil shale below the R1 zone to total depth of hole. This oil shale probably averages less than 10 gallons per ton

Tgcr **Cow Ridge Member**—Interbedded lacustrine and alluvial rocks. Mostly lacustrine rocks consisting of shale, sandstone, and minor limestone. Shale is gray to brown, mostly fissile, nonresistant, and variably ostracodal. Sandstone is very fine grained, mostly thin flat bedded, light brown to brownish gray, sparsely ostracodal, and ledge forming. Limestone is light gray, orange weathering, and abundantly ostracodal. Alluvial beds resemble those in Wasatch Formation: massive, locally crossbedded channel-type sandstone, and green, greenish-gray, locally red, nonbedded claystone. Unit wedges out eastward into Wasatch Formation beneath alluvium of White River. Thickness of exposed rocks about 70-100 ft (21-30 m)

Wasatch Formation (Eocene and Paleocene)—Rocks mostly of fluvial origin

Tw **Main body (Eocene and Paleocene)**—Claystone, shale, mudstone, and sandstone. Upper part of main body of Wasatch is Eocene and consists mostly of claystone, mudstone, and sandstone, and lesser shale. Claystone, mudstone, and shale are gray and varicolored greenish gray, red, purple, and yellow; mostly nonresistant. Sandstone units are mostly white, gray, and brown, fine to coarse grained, commonly crossbedded, lenticular, and locally resistant, forming ledges. Lesser amounts of light-gray to brown conglomerate and conglomeratic sandstone. Upper part of main body ranges from about 850 ft (260 m) thick in western part of quadrangle where Cow Ridge Member of Green River Formation (Tgcr) is present, to about 1,250 ft (380 m) thick in eastern part of quadrangle where Cow Ridge is absent and upper part includes lateral equivalent of tongue of Wasatch (Twt). Lower part of Wasatch is Paleocene and consists of brown coaly carbonaceous shale in eastern part of quadrangle; elsewhere consists of much dark-gray fissile clay shale, thin even-bedded brown to gray impure fine- to coarse-grained sandstone, as well as dark-gray claystone and sparse varicolored green and purple claystone. Contains a persistent ledge-forming sandstone bed at base in western part of quadrangle. Lower part of main body of Wasatch ranges from about 250 to 450 ft (75-135 m) thick. Two localities in lower part of Wasatch yielded samples containing pollen of Paleocene age. These are samples D1771 from sec. 32, T. 3 N., R. 99 W., collected by A.D. Zapp, and sample D5049 from sec. 36, T. 3 N., R. 100 W., collected by W.J. Hail. Examination and age determinations of the samples were made by R.H. Tschudy. Sample D1771 yielded pollen of middle Paleocene age or possibly younger. Sample D5049 yielded pollen of definite middle Paleocene age, probably early middle Paleocene. The Paleocene-age beds of lower part of main body of Wasatch are correlative with Fort Union Formation as mapped in the Rough Gulch 7 1/2-minute quadrangle (Hail, 1974) to the east, and with lower part of main body of Wasatch as mapped in the Cactus Reservoir 7 1/2-minute quadrangle (Barnum and Garrigues, 1980) to the west and the Calamity Ridge 7 1/2-minute quadrangle (Donnell and Hail, 1984) to the south. Main body of Wasatch is about 1,100 ft (335 m) thick in western part of quadrangle where Cow Ridge Member of Green River Formation (Tgcr) is present, and about 1,700 ft (520 m) thick in eastern part of quadrangle

Twt **Tongue of Wasatch Formation (Eocene)**—Separates Cow Ridge Member of Green River Formation (Tgcr) from higher Green River beds where Cow Ridge is present in western part of quadrangle. Mostly claystone, shale, and sandstone. Claystone and shale are light to medium gray and varicolored greenish gray, light green, yellow, red, and purple. Sandstone is light to dark gray and brown, fine to coarse grained, locally conglomeratic, massive to crossbedded, and locally thin even bedded. Unit includes abundant channel and other lenticular sandstone beds, as well as a few very thin beds of ostracodal sandstone. Merges with main body of Wasatch (Tw) along White River. Unit is mostly nonresistant but some sandstone beds are resistant and form ledges. About 600 ft (180 m) thick

Mesaverde Group (Upper Cretaceous)

Kmvu **Upper unit of Mesaverde Group**—Sandstone, shale, and mudstone; sparse carbonaceous shale and coal beds. Sandstone units are mostly light gray to light brown, fine grained, lenticular, and massive to crossbedded; locally contain thin lenses of clay-pebble conglomerate; locally form resistant ledges. Shale and mudstone are gray to light gray, and commonly include brown carbonaceous shale containing sparse thin coal beds. Nonresistant shale and mudstone beds generally dominate upper part of upper unit. Entire upper unit of Mesaverde Group is probably of nonmarine, flood-basin origin. Contact with underlying coal unit (Kmvc) is gradational and indefinite and probably does not represent a single stratigraphic horizon. Contact with overlying Tertiary beds represents a major regional erosional unconformity. Thickness of unit ranges from about 1,400 to 1,800 ft (430-550 m). Unit is equivalent to upper part of Williams Fork Formation as mapped in the Rough Gulch quadrangle (Hail, 1974) to the east

Kmvc **Coal unit of Mesaverde Group**—Sandstone, light-gray mudstone, brown carbonaceous shale, and coal. Sandstone is light gray, mostly thin bedded, and very fine to fine grained. Coal beds are fairly abundant but most are nonpersistent. Coal from this unit is currently (1993) being mined at the Deserado Mine, about 6 mi (10 km) west of the Divide Creek quadrangle. All rocks are probably of nonmarine flood-basin origin. Unit locally intertongues with lower unit of Mesaverde Group (Kmvl). Thickness of coal unit ranges from about 190 to 670 ft (58-205 m). Unit is equivalent to basal coal-bearing part of Williams Fork Formation as mapped in the Rough Gulch quadrangle (Hail, 1974) to the east

—cm— **Base of main coal zone**—Main coal zone contains the thickest and most abundant coal beds within coal unit of Mesaverde Group. Measured sections show aggregate thickness of coal beds in lower 100 ft (30.5 m) of main coal zone (see map). Thickness of main coal zone about 120-200 ft (37-60 m)

Kmvl **Lower unit of Mesaverde Group**—Sandstone, mudstone, shale, and minor brown carbonaceous shale locally containing thin nonpersistent coal beds. Entire unit is probably of nonmarine flood-basin origin. Sandstone is light yellowish gray to light brown, very fine to fine grained, mostly massive, and lenticular. Mudstone and shale are mostly light gray to brown. A brown carbonaceous shale bed is commonly present at base. Thickness of entire unit ranges from about 650 to 850 ft (200-260 m). Unit is equivalent to that part of the Iles Formation above the basal marine sandstone as mapped in the Rough Gulch quadrangle (Hail, 1974) to the east

Ks **Sego Sandstone of Mesaverde Group**—Sandstone and lesser shale, mostly of marine origin. Unit typically, but not everywhere, consists of two sandstone ledges separated by beds of marine shale, thin sandstone beds, and some carbonaceous shale containing sparse coal streaks. Sandstone is light brown to light yellowish gray, fine to very fine grained, and generally massive but locally thin, flat bedded; forms resistant ledge. Upper sandstone ledge is persistent, is locally bleached white at top, contains burrows of *Halymenites*, and is highest known bed of marine origin in quadrangle. Lower sandstone ledge ranges from locally absent to several tens of feet thick; interbedded with dark-gray marine shale. Thickness highly variable, ranging from about 70 to 200 ft (21-61 m). Unit is equivalent to basal part of Iles Formation as mapped in the Rough Gulch quadrangle (Hail, 1974) to the east

Kc **Castlegate Sandstone (Upper Cretaceous)**—Light-brown to light-yellowish-gray, thin-bedded to massive, very fine grained to fine-grained sandstone; weathers brown. Minor dark-gray shale in lower part. Unit is very hard and resistant; forms persistent ledges, cliffs, and dip slopes. Offshore marine in origin. About 40-60 ft (12-18 m) thick

Km **Main body of Mancos Shale (Upper Cretaceous)**—Mostly brown to gray clay shale; locally sandy or silty. Also contains some nonresistant sandstone and siltstone beds, and several thin bentonite beds. Contains sparse yellow- to orange-weathering, locally fossiliferous, septarian concretions. Top of B sandstone of Dyni (1968), not mapped separately, lies about 130 ft (40 m) below top of main body; B sandstone is about 110 ft (34 m) thick (Gill and Hail, 1975). Presence of other named sandstone or siltstone units below B sandstone could not be determined owing to poor exposure of lower beds. Entire unit is of offshore marine origin. Soft, nonresistant; forms slopes and very poorly exposed lowland areas. Thickness about 5,000 ft (1,525 m)

Kmb **Buck Tongue of Mancos Shale (Upper Cretaceous)**—Brown to gray, mostly brown-weathering clay shale; lesser siltstone and sandstone. Entirely offshore marine in origin. Includes Loyd Sandstone Bed in upper part (not mapped separately), which is massive to thin-bedded, nonresistant offshore marine sandstone and sandy shale, about 30 ft (9 m) thick. Buck Tongue is separated from main body of Mancos Shale by Castlegate Sandstone (Kc). Buck Tongue, including Loyd Sandstone Bed, is about 300-450 ft (90-140 m) thick

Kf **Frontier Sandstone (Upper Cretaceous)**—Upper part mostly interbedded sandstone and lesser dark-gray shale. Sandstone is light brown to gray, very fine to fine grained, and commonly fossiliferous. Upper sandstone beds form prominent resistant ridges and dip slopes. Lower part of unit mostly brown to gray shale, lesser thin sandstone beds, and very sparse thin bentonite beds. Entirely of marine origin. Thickness about 210 ft (64 m)

Kmo **Mowry Shale (Upper Cretaceous)**—Dark-gray, siliceous, platy-weathering marine shale; contains abundant fish scales and bone fragments, and very thin bentonite beds. Relatively nonresistant; forms valley. Thickness about 90 ft (27 m)

Kd **Dakota Sandstone (Upper Cretaceous)**—Only uppermost part crops out in quadrangle. Light-gray to very light brown quartzitic sandstone. Contains sparse chert pebbles and a few beds of dark-gray shale. Hard, resistant; forms conspicuous ledge and dip slope. Entire formation probably about 70 ft (21 m) thick

Contact—Approximately located where uncertain or where obscured by soil cover or vegetation. Short dashed at approximate position where tongue of Wasatch Formation (Twt) merges laterally with main body of Wasatch Formation (Tw)

Syncline—Showing trace of axial plane and direction of plunge

Strike and dip of beds

Measured coal locality—Point of triangle is on base of main coal zone of coal unit of Mesaverde Group. Number is aggregate thickness, in feet, of coal beds within 100 ft (30.5 m) above base of main coal zone. All localities are measured surface sections except the one at east margin of sec. 21, T. 3 N., R. 100 W., which is from USGS drill hole LW-10-DC (Barnum and others, 1977)

Fossil locality—Showing Denver USGS catalog number

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GEOLOGIC MAP OF THE DIVIDE CREEK QUADRANGLE, RIO BLANCO AND MOFFAT COUNTIES, COLORADO

By
William J. Hail, Jr., and Bruce E. Barnum
1993

INTERIOR—GEOLOGICAL SURVEY, RESTON, VIRGINIA—1993

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