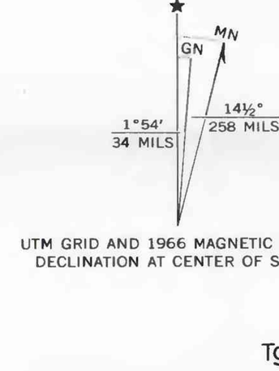
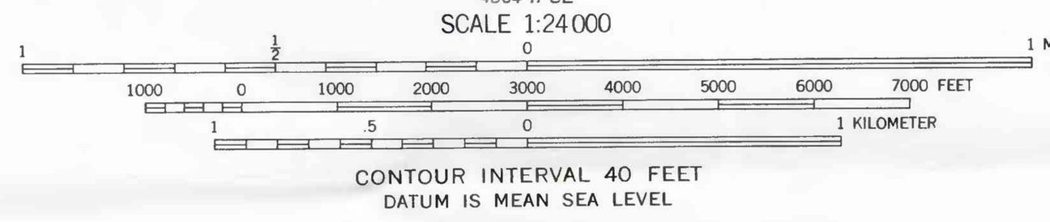
DEPARTMENT OF THE INTERIOR
UNITED STATES GEOLOGICAL SURVEY

MISCELLANEOUS FIELD
STUDIES MAP MF-837
WHITE ROCK QUAD., COLO.

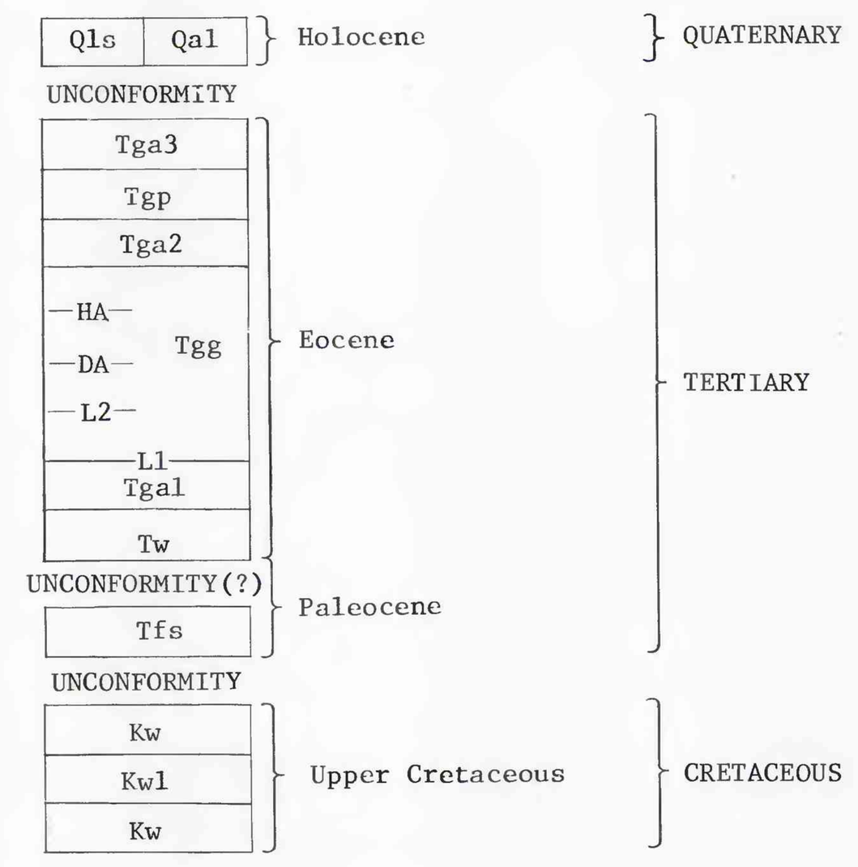
Base from U.S. Geological Survey, 1966

Geology mapped in 1975





CORRELATION OF MAP UNITS



CONTACT--Dashed where approximately located

FAULT--Dotted where concealed; dashed where approximately located. Bar and ball on downthrown side; displacement where given is in feet. Arrows indicate direction of movement on cross sections

AXIS OF SYNCLINE--Arrow shows direction of plunge

STRIKE AND DIP OF BEDDING

cb 24 COAL BED--Trace shown by line; isolated coal outcrops shown by X; thickness where given is in feet

STRUCTURE CONTOURS--Drawn on top of L1. Dashed where datum is above land surface. Contour interval 100 feet (30.5 m) and 500 feet (152 m)

7000

6600 Structural depression

DESCRIPTION OF MAP UNITS

Qls LANDSLIDE DEPOSITS (HOLOCENE)--Slump blocks developed in the Garden Gulch Member of the Green River Formation and associated with coal seams and shale in the Williams Fork Formation

Qal ALLUVIAL DEPOSITS (HOLOCENE)--Mostly silt and sand as much as 60 ft (18 m) thick along Strawberry and Deep Channel Creeks

GREEN RIVER FORMATION (EOCENE)

Anvil Points Member--Anvil Points units are westward thinning sequences made up dominantly of sandstone and lesser amounts of finer grained clastics. The units are dominantly fluviatile in the east and grade westward into units entirely lacustrine

Tga3 Unit 3--Light-gray to white, fine- to medium-grained, calcareous medium- to thick-bedded sandstone forming ledges and cliffs. Locally differential cementation and weathering have produced irregularly shaped sandstone nodules. Unit crops out only in the SW¼ sec. 18, T 3 N., R. 95 W. and at the section line between sections 12 and 13, T. 3 N., R. 96 W. Thickness about 240 ft (73 m). Top is eroded

Tga2 Unit 2--Light-gray to white, fine- to medium-grained, calcareous sandstone, medium to thick bedded; forms ledges and cliffs. The unit thickens from 150 ft (46 m) at the NW¼SW¼ sec. 30, T. 3 N., R. 95 W. to 280 ft (85 m) near the center of sec. 18, T. 3 N., R. 95 W. It thickens northwestward to as much as 450 ft (137 m) near the center of sec. 12, T. 3 N., R. 96 W. Unit same as upper part or unit 2 (Tga2) of the Anvil Points as mapped in the Indian Valley quadrangle to the west (Pipiringos and Rosenlund, 1976) and approximately equivalent to the upper part (Tgau) of the Anvil Points as mapped in the Buckskin Point quadrangle to the south (Pipiringos and Johnson, 1975)

Tgal Unit 1--Mostly sandstone, some siltstone and shale. The sandstone is light gray, fine to coarse grained, calcareous, medium bedded to massive, and forms cliffs, ledges and slopes. The sandstone beds are lenticular and commonly occupy channels cut in the underlying rocks in the southeastern part of the area. The siltstone and shale are gray and form slopes. The unit includes a few thin red beds near the base in the southeastern part of the quadrangle. The contact with the underlying Wasatch Formation is gradational, intertonguing and generally poorly exposed. Consequently a persistent chert pebble zone about 600-700 ft (183-213 m) below the top of this unit was arbitrarily mapped as the base of the Anvil Points along the foot of the east-facing escarpment that crosses the mapped area in a northwestern-southeastern direction. Lacustrine shale, siltstone and sandstone beds are scarce in the southern part but make up the upper half to one-third of the unit in the northwestern part of the quadrangle. In the southwestern part of the quadrangle, the chert pebble zone could not be found and the contact of the Anvil Points and the underlying Wasatch Formation is placed at the indefinite change from cliff-forming sandstone above to slope-forming variegated claystone and siltstone below. As mapped, the thickness of unit 1 of the Anvil Points ranges from about 600 ft (183 m) to 800 ft (244 m) and averages about 700 ft (214 m). It is thickest in the southeastern part of the quadrangle and thins both westward and northward. It equals the lower part (Tgal) of the Anvil Points as mapped in the Indian Valley quadrangle to the west and the Buckskin Point quadrangle to the south (Pipiringos and Rosenlund, 1976; Pipiringos and Johnson, 1975). The top of unit 1 was arbitrarily placed at the top of the lowest persistent and mappable limestone bed (L1) of Garden Gulch Member. It is described at the end of the section on the Garden Gulch Member

Tgp Parachute Creek Member--Mostly light gray to white platy barren marlstone, minor amounts of papery fissile low-grade oil shale and thin-bedded, very fine to fine-grained light-gray sandstone. This member is locally present in the northwest part of the quadrangle where it is about 250 ft (76 m) thick. It seems to equal that part of the Parachute Creek below the B-groove and above unit 3 of the Anvil Points as mapped in the southwestern part of the Buckskin Point quadrangle (Pipiringos and Johnson, 1975)

Tgg Garden Gulch Member--Mostly dark gray shale and olive-gray claystone commonly interbedded with dolomite, dolomite concretions, and stromatolites. The member includes many ledges of medium-grained sandstone and several ledges of ostracodal, oolitic, and pisolitic sandy limestone beds. At least one kerogen-rich papery fissile oil-shale zone is present. The contact of the Garden Gulch with the underlying unit 1 of the Anvil Points (Tgal) is intertonguing and gradational. Consequently, the base of the Garden Gulch was arbitrarily placed at the top of the first persistent limestone bed (L1) above unit 1 of the Anvil Points. This limestone zone is described at the end of this section. The thickness of the Garden Gulch as mapped ranges from about 920 ft (280 m) near the center of the quadrangle to about 300 ft (91 m) near the center of the SW¼ sec. 7, T. 3 N., R. 95 W.

— HA — High algal zone--Zone of spheroidal stromatolites. The stromatolites are as much as 4 ft (1.2 m) in diameter. They were observed and mapped only in a few square miles near the center of the mapped area. They are identical in appearance to those in the next lower stromatolite zone. The high algal zone is as much as 14 ft (4 m) thick. The top of the zone is about 150 ft (46 m) to 320 ft (98 m) below the top of the Garden Gulch. The line on map shows top of zone

— DA — Dimpled algal zone--Zone of spheroidal stromatolites as much as 6 ft (2 m) in diameter. Surfaces ornamented by circular, shallow dimplelike equidistant depressions. The "dimples" are 1-3 in. (2.5-7.6 cm) in diameter and about 0.5 in. (2 cm) deep. The zone is about 10 ft (3 m) thick. It resembles the second algal zone mapped in the Buckskin Point quadrangle (Pipiringos and Johnson, 1975, map unit 2A) in size, persistence and stratigraphic position, but not in appearance. Deposition of the two zones seems penecontemporaneous. The top of the DA zone is about 170 ft (52 m) to 280 ft (85 m) below the top of the HA zone. The line on map shows top of zone

— L2 — The L2 zone--The L2 zone comprises two light-gray to pinkish-gray ostracodal limestone beds, each of which grade downward into fine- to medium-grained light-gray calcareous sandstone beds. The two sandstone and limestone sequences are separated by about 20 ft (6 m) of greenish-gray fissile clay shale. The basal 5 ft (1.5 m) of the clay shale parting characteristically contains a thin zone of brownish stromatolites. The upper sandstone bed rarely exceeds 5 ft (1.5 m) in thickness, but the lower one frequently is as much as 25 ft (8 m) thick; both sequences are locally oolitic and pisolitic. In the southeastern part of the area, the limestones are absent, but the sandstone beds persist and usually make a conspicuous ledgy zone. The top of the L2 zone is from 55 ft (17 m) to 100 ft (30 m) below the top of the DA zone. The line on map shows top of zone

— L1 — The L1 zone--Commonly consists, in descending order, of sandy pisolitic limestone about 1.5 ft (0.5 m) thick, oolitic and ostracodal limestone 6 ft (1.8 m) thick, and light-gray fine- to medium-grained calcareous thin-bedded, current ripple-marked sandstone 6-35 ft (1.8-11 m) thick. The sequence makes a prominent cliff throughout the mapped area. In the south-central part of the area between Smith Gulch and Windy Gulch, the L1 zone has an ostracodal limestone bed at the base 3-8 ft (1-2.4 m) thick separated from the L2 limestone zone by alternating beds of fine-grained sandstone, pisolite, stromatolitic layers and locally some greenish-gray fissile shale. The entire L1 zone is as much as 40 ft (12 m) thick. The top of the L1 zone is 155-220 ft (47-67 m) below the top of the L2 zone. The line on map shows top of zone, which was arbitrarily mapped as the top of Tgal

Tw WASATCH FORMATION (EOCENE AND PALEOCENE)--Mainly sandy claystone and siltstone containing lenses and channels of medium- to coarse-grained cross-bedded sandstone. The sandstone beds are thicker, more numerous, and more conspicuous than they are in the quadrangles adjacent to the west, south-west, and south. The upper part of the Wasatch yielded vertebrate fossils of early to middle Eocene age. These fossils were collected from outcrops in the southwestern part of the area stratigraphically about 750 ft (229 m) below the top of the formation. They were identified by L. C. Gazin of the U.S. National Museum. The lower part of the Wasatch as mapped includes rocks of Paleocene age. Fossil spores and pollen from a 5-ft (1.5-m) thick carbonaceous shale bed about 735 ft (224 m) above the base of the Wasatch were identified by R. H. Tschudy as being of late Paleocene age. The lower part of the Wasatch in the White Rock quadrangle is of the same age, lithology, and appearance as rocks assigned to the Fort Union Formation in central and southern Wyoming (Yenne and Pipiringos, 1954, locs. 8, 9, 10; Pipiringos, 1955, p. 100; 1961, p. A10-A13; Denson and Pipiringos, 1969; Reynolds, 1968; 1971). It was tentatively included in and mapped with the Wasatch pending further investigation into the nature of the Fort Union-Wasatch contact and the feasibility of mapping it. In general, the claystone beds in the Eocene portion are variegated ochre, lavender, red, and green; the Paleocene claystone beds tend to be drab gray and white, and include a few thin rusty-brown to nearly black ferruginous zones, and at least one papery fissile brown carbonaceous shale bed already mentioned. The change from the variegated Eocene to the drab Paleocene part of the Wasatch occurs in an interval that generally is poorly exposed. If there is an erosional break between the two parts of the Wasatch in this area it is inconspicuous and difficult to find. The basal contact of the Wasatch is concealed throughout the quadrangle and whether it is unconformable cannot be determined. The Wasatch as mapped ranges in thickness from about 2,300 ft (701 m) to 3,300 ft (1,006 m). It probably is about 4,500 ft (1,372 m) thick in the subsurface in the southwestern part of the mapped area based on the nearest control point, test hole 24-23 Federal; it was drilled in 1975 by Jack Grynberg and Associates in sec. 23, T. 2 N., R. 96 W., of the White River City quadrangle, about 0.5 mile (0.8 km) southwest of the southwest corner of the mapped area. The thickness of the Eocene part of the Wasatch averages about 2,500 ft (762 m) throughout the quadrangle

FORT UNION FORMATION (PALEOCENE)

Tfs Sandstone member--Dominantly sandstone, light gray, which weathers buff, tan or brown, medium to coarse grained. Several conglomerate beds 1-4 ft (0.3-1.2 m) thick occur in the basal 40-70 ft (12-21 m) of the sandstone. Clasts are principally black, gray, and red chert and quartzite; pale-red, lavender, and pink volcanic rocks with white feldspar phenocrysts are common. The conglomerate clasts are locally as much as 6 in. (15 cm) in diameter, but generally average about 1 in. (2.5 cm). Member contains lesser amounts of brown-weathering iron-oxide concretions, limestone concretions and olive-gray shale, claystone and siltstone, carbonaceous and coaly shale and coal. The iron-oxide concretions are spheroidal and commonly as much as 5 ft (1.5 m) in diameter; the limestone concretions are spheroidal to oblate spheroidal, as much as 2 ft (0.6 m) in diameter and weather rusty-yellow and buff. The member contains several carbonaceous zones one of which is about 27 ft (8 m) thick and a few coal beds one of which is at least 6 ft (1.8 m) thick. The coal occurs about 600 ft (183 m) above the base in the NE¼NW¼NE¼SW¼ sec. 35, T. 3 N., R. 95 W. The sandstone beds of this member make prominent ridges and spectacular, steep bare rock walls. The intervening softer sequences make strike valleys. The member ranges in thickness from about 1,200 ft (366 m) to 1,400 ft (427 m) on the surface, and from about 800 ft (244 m) to 1,200 ft (366 m) in the subsurface in the nearest wells in the White River City and Indian Valley quadrangle. The conglomeratic beds in the lower part of the sandstone member may or may not be equivalent to the Ohio Creek Formation of Paleocene age. In the White Rock quadrangle, the conglomerate commonly contains volcanic clasts; according to D. L. Gaskill of the U.S. Geological Survey (unpub. data, 1976) however, volcanic clasts are absent in the Ohio Creek Formation in the type locality north of the West Elk Mountains in west-central Colorado. The base of the Fort Union Formation has long been thought to rest with erosional unconformity on underlying rocks in this region (Gale, 1910, p. 42, 75). The contact is characterized by a change from coarse-grained rocks above to fine-grained rocks below

Kw WILLIAMS FORK FORMATION (UPPER CRETACEOUS)

Interbedded sandstone, siltstone, clay shale, carbonaceous shale, and coal. Most of the sandstone is light gray to brown, fine to medium grained, lenticular, as much as a few hundred feet thick, and makes prominent ridges. Some of the sandstone beds are white, fine grained, and persistent. One such bed, whose top ranges from about 1,100 ft (335 m) to about 1,800 ft (550 m) below the top of the formation was traced into the Lion Canyon Sandstone Member of the Williams Fork (Hancock and Eby, 1930, p. 206, pl. 19) in sec. 6, T. 2 N., R. 94 W. The coaly sequence above the Lion Canyon and below the Fort Union probably is a Lance equivalent, inasmuch as rocks in a similar stratigraphic position near the top of the Williams Fork in the Rough Gulch quadrangle (Hail, 1974, description of map unit Kwf) contain the gastropod *Tulotomops thompsoni* (White) which is restricted to the Lance and equivalent formations. The remainder of the formation exposed at the surface below the top of the Lion Canyon Sandstone Member is about 1,930 ft (590 m) thick in the vicinity of the No. 1 U.S.A., Chorney test well drilled by the Tennessee Gas Transmission Co. in the northeast corner of the mapped area. The base of the Williams Fork Formation is not exposed in the White Rock quadrangle. However, the Trout Creek Sandstone Member of the Iles Formation, which directly underlies the Williams Fork, crops out in the Cidatel Plateau quadrangle about 2,000 ft (610 m) northeast of the No. 1 U.S.A., Chorney well site. Calculations from surface observations in the northeastern part of the mapped area suggest that the top of the Trout Creek Sandstone Member probably was penetrated by the drill at a depth of about 380 ft (116 m) in the No. 1 U.S.A., Chorney well; and that the interval between the tops of the Trout Creek and Lion Canyon Sandstone Member is about 2,300 ft (701 m). The electric log of this well cannot be used to verify the top of the Trout Creek in the No. 1 U.S.A. Chorney well because the well was cased to 800 ft (244 m) before logging. Fortunately the upper 800 ft (244 m) were sampled and the American Stratigraphic Company lithologic log shows the top of a sandstone at about 420 ft (128 m) that may be the top of the Trout Creek. The total thickness of the Williams Fork Formation in the northeastern part of the mapped area is estimated to be about 4,000 ft (1,219 m)

Kwl Lion Canyon Sandstone Member--Sandstone, very light gray to white and fine grained; the grains are rounded and well sorted. Locally the sandstone is separated into an upper and lower part by a shale and siltstone sequence that includes sandstone concretions containing marine fossils not far below the base of the upper sandstone. The maximum thickness of the sequence is about 200 ft (61 m)

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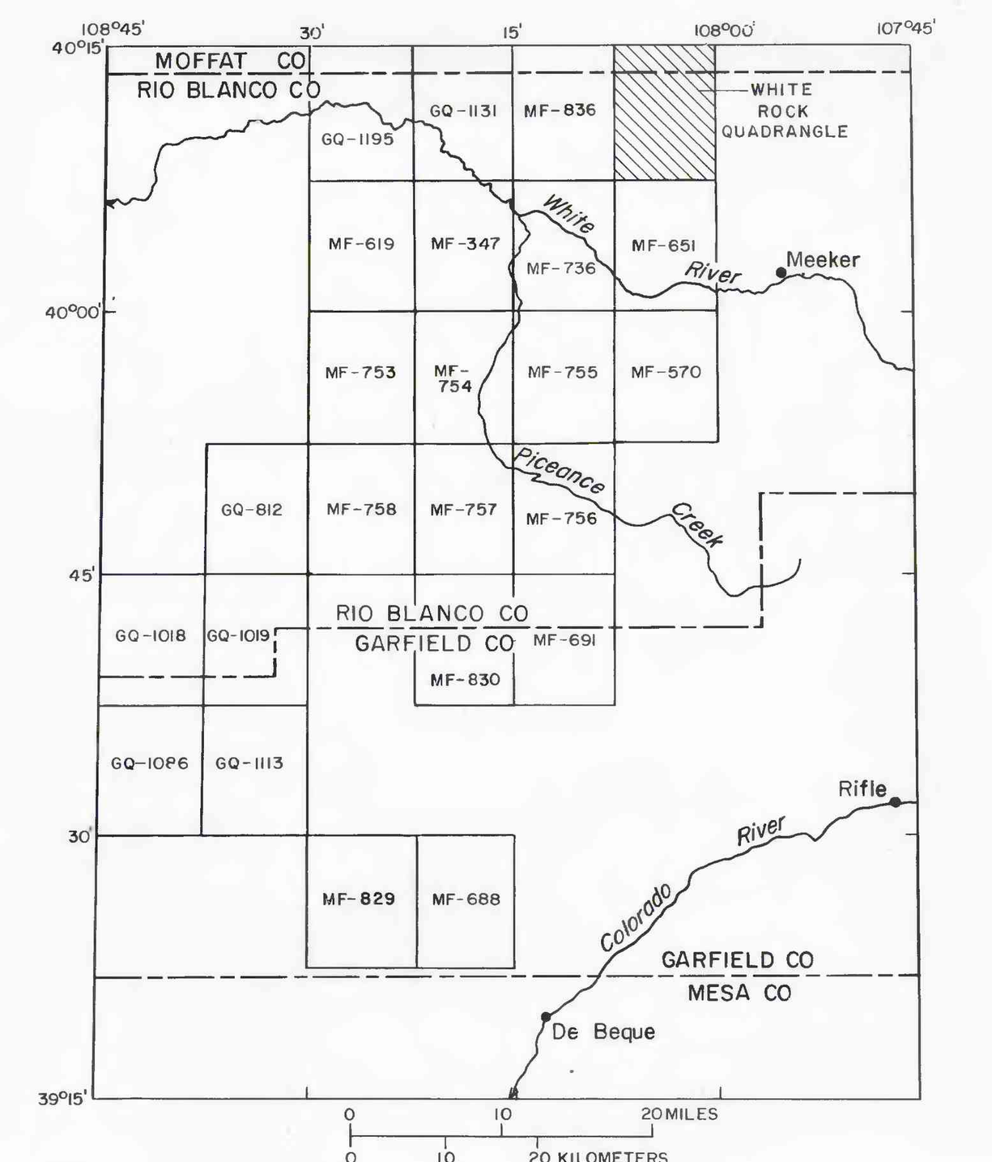

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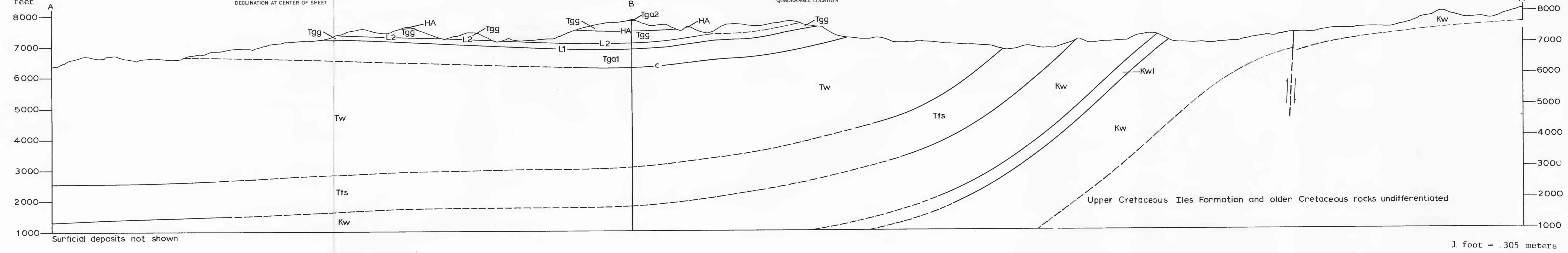

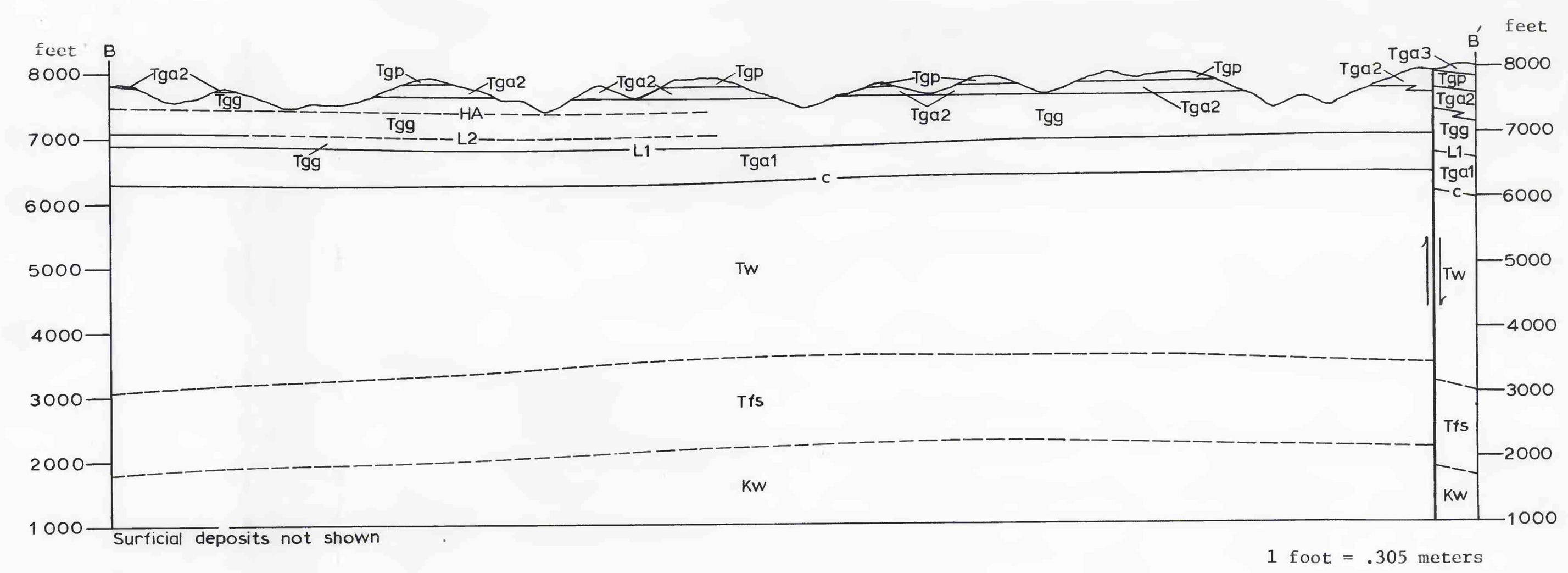

PRELIMINARY GEOLOGIC MAP OF THE WHITE ROCK QUADRANGLE, RIO BLANCO AND MOFFAT COUNTIES, COLORADO

By

G. N. Pipiringos and Gene C. Rosenlund

1977

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