



VERNAL, UTAH-COLORADO



Green colored area above represents the approximate distribution of Ute and Ouray Indian Reservation lands.

Interim Geologic Map of the Vernal 30' x 60' Quadrangle, Uintah and Duchesne Counties, Utah, and Moffat and Rio Blanco Counties, Colorado

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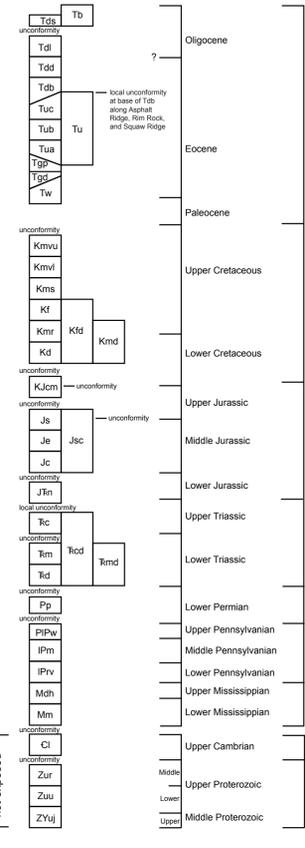
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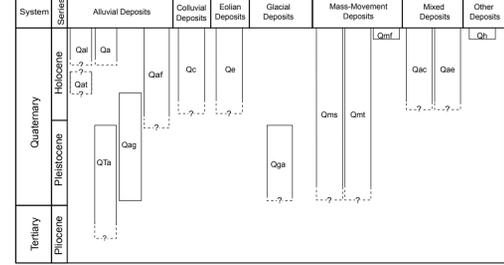
Description of Map Units

Qal	FLOOD-PLAIN ALLUVIUM (HOLOCENE) - Unconsolidated silt, sand, and gravel in flood plains of Green River and Ashley and Brush Creeks; 1-30 m thick.
Qa	ALLUVIUM (HOLOCENE) - Unconsolidated mud, silt, sand, and gravel in small intermittent stream drainages; less than 5 m thick.
Qat	TERRACE DEPOSITS (HOLOCENE) - Unconsolidated to locally cemented silt, sand, gravel, cobbles, and boulders; remnants of alluvial terraces deposited along the Green River and Ashley and Brush Creeks; less than a few tens of meters thick.
Qaf	ALLUVIAL-FAN DEPOSITS (HOLOCENE AND PLEISTOCENE) - Unconsolidated, poorly sorted boulder, gravel, sand, and silt; less than 30 m thick.
Qac	MIXED ALLUVIUM AND COLLUVIUM (HOLOCENE) - Unconsolidated mud, silt, sand, and gravel in intermittent stream drainages and in areas of low topographic relief. On the Mancos Shale or other formations, this unit is mostly reworked mud and grades into Qae; less than 10 m thick.
Qae	MIXED ALLUVIUM AND COLLUVIUM DEPOSITS (HOLOCENE) - Unconsolidated alluvial mud, silt, and sand mixed with well-sorted, fine-grained, windblown sand and silt; many of these deposits are in tributary stream channels of the Green River, along smaller streams, and in other intermittent stream drainages and grades into Qac in places; less than 10 m thick.
Qe	EOLIAN DEPOSITS (HOLOCENE) - Unconsolidated, well-sorted, fine-grained, windblown sand and silt; less than 10 m thick.
Qc	COLLUVIUM (HOLOCENE) - Heterogeneous mixture of boulders, gravel, cobbles, sand and silt that may grade into talus, landslide, and alluvial deposits, thin to a few tens of meters thick.
Qh	DISTURBED GROUND (HISTORICAL) - Gravel pit operations mostly along the flood plain of the Green River; material excavated is from unconsolidated deposits of Qal and Qat; includes sewage lagoon along Ashley Creek and larger earthen-dams for reservoirs.
Qmf	DEBRIS-FLOW DEPOSITS (HISTORICAL) - Unconsolidated and poorly sorted heterogeneous mixture of boulders, gravel, sand, silt, and mud; matrix supported; less than 2 m thick.
Qmt	TALUS DEPOSITS (HOLOCENE AND PLEISTOCENE) - Unconsolidated and unstratified angular rock fragments that accumulate at the base of cliffs. Colluvium is a locally significant part of this deposit; less than 5 m thick.
Qms	SLIDES, SLUMPS AND FLOWS (HOLOCENE AND PLEISTOCENE) - Earth flow and rotational slumps and slides in formations prone to slope failure; some Qms units may include mass movements of slightly different age or may share a common boundary with an adjoining mass movement.
Qag	ALLUVIAL-GRAVEL DEPOSITS (HOLOCENE AND PLEISTOCENE) - Unconsolidated to moderately consolidated, poorly sorted sand, gravel, cobbles, and boulders deposited on near-planar bedrock surfaces; as many as four levels are recognized but are not subdivided so deposits of different ages can share a common boundary; the topographic highest level is defined; weak to strong soil profile developed in all levels with the best-developed profile in the topographically highest deposit; some calcium carbonate (caliche, stage I) developed on the underside of clasts in younger (lower) deposits and well-developed calcium carbonate (caliche, stage IV) in upper 1 m of highest (oldest) deposit; some deposits may not be alluvial in origin; less than 2 m thick.
Qga	GLACIAL ALLUVIAL OUTWASH, UNDIVIDED (UPPER PLEISTOCENE) - Unconsolidated, well-sorted, mud to pebbles and sand deposits in the Whitecliffs Canyon drainage in the northwest part of the quadrangle (see Sprinkel, 2002) derived from the high-energy meltwaters of glaciers of undetermined age; thickness not determined but probably less than 10 m.
Qta	OLDER ALLUVIUM (PLEISTOCENE AND UPPER TERTIARY?) - Unconsolidated, poorly sorted, silt, sand, gravel, and cobble to boulder deposit; clasts are subangular to subrounded Uinta Mountain Group, mostly matrix-supported with internal channel deposits. Qta forms the highest and oldest gravel deposit that caps the Yampa Plateau in this quadrangle; mapped as Qaco (Sprinkel, 2002) on the nearby Diamond Mountain Plateau in the adjoining Dutch John 30' x 60' quadrangle; less than 10 m thick.
Tb	BISHOP CONGLOMERATE (OLIGOCENE) - Light-gray to pinkish-gray, friable sandstone with tuffaceous interbeds, and poorly sorted, loosely cemented, boulder to pebbly conglomerate mapped on the Yampa Plateau; an ash bed preserved on the south flank of the Yampa Plateau; see below for descriptions and thickness.
Tds	STARR FLAT MEMBER OF DUCHESNE RIVER FORMATION (OLIGOCENE) - Reddish-brown, reddish-purple, yellowish-gray, and greenish-gray, fine- to coarse-grained sandstone, siltstone, mudstone, and conglomerate; sandstone and mudstone; contains abundant light-greenish-gray bentonite beds; mostly nonresistant and thin- to very thin bedded; late Eocene (Duchesne) age is assigned to the Lapoint Member based on vertebrate fossil assemblage; see Anderson and Picard (1972) for summary of the fossils and the assigned age; Anderson and Picard (1972, p. 2) reported a K-Ar age of 38.3 Ma from an ashly siltstone bed at the Lapoint Dry Gulch contact; McDowell and others (1973) obtained a K-Ar age of 40.3 Ma from the base of the Lapoint Member; Bryant and others (1989) reported a K-Ar age of 35.7 to 40.3 Ma, also from near the base of the member; 120 m thick in quadrangle.
Tdd	DRY GULCH CREEK MEMBER OF DUCHESNE RIVER FORMATION (EOCENE) - Medium-reddish-brown and purplish-gray, fine-grained sandstone, siltstone, mudstone, and conglomerate; dominated by slope-forming siltstone and mudstone with ledge-forming thin-bedded sandstone; contains some vertebrate fossils; see Anderson and Picard (1972) for summary of fossils; less than 150 m thick.
Tdb	BRENNAN BASIN MEMBER OF DUCHESNE RIVER FORMATION (EOCENE) - Light- to medium-red, light-reddish-brown, and yellowish-gray, fine- to medium-grained lithic sandstone and siltstone with minor amounts of mudstone and conglomerate; contains well-developed paleosols; the basal part of the Brennan Basin Member, as much as 60 m, intertongues with the underlying Uinta Formation throughout most of the quadrangle; the contact is placed at the base of a resistant reddish-brown sandstone bed that lies on the uppermost variegated mudstone bed of the Uinta Formation; the Brennan Basin Member, however, lies unconformably on beds of the Green River Formation near Square Ridge and Mesaverde Group along Asphalt Ridge; contains a diverse assemblage of Late Eocene age fossils; see Anderson and Picard (1972) for a summary of the fossils and age of the Brennan Basin Member; 220-600 m thick.
Tu	UINTA FORMATION (EOCENE) - Consists of three members but combined where members are too thin to map separately at this scale or where uncertain; see below for unit description and thickness.

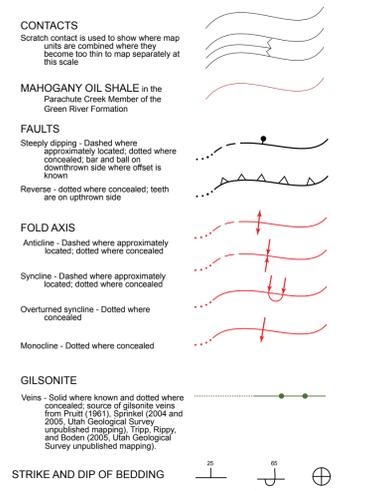
Correlation of Bedrock Units



Correlation of Quaternary Units



Map Symbols



Stratigraphic Column

SYSTEM	SYMBOL	FORMATIONS	Thickness (meters)	LITHOLOGY	NOTES	
Quaternary	Qal	Unconsolidated deposits	less than 50		Alpine glaciers in Uinta Mountains. Capture of Green River by Colorado River. Coastal relevation; Uinta Mountains down-dropped along Uinta fault zone and drainage patterns change in eastern.	
Tertiary	Qta	Older alluvium	less than 10			
	Tb	Bishop Conglomerate	less than 50			
	Tds	Starr Flat Member of Duchesne River Formation	40-230		Clastic stability; Gilbert Peak erosion surface forms and Basin; drainage change in eastern.	
	Tdd	Lapoint Member of Duchesne River Formation	120		Local uplift near the northern margin of the Uinta Basin; the Duchesne River Fin unconformably overlies the Green River Fin through the Mesaverde Group from near Square Ridge to Asphalt Ridge; the Duchesne River Formation is interbedded with Uinta Formation in the Uinta Basin.	
	Tdd	Dry Gulch Creek Member of Duchesne River Formation	less than 150			
	Tdb	Brennan Basin Member of Duchesne River Formation	200-600		Contains glauconitic deposits.	
	Tu	Member B of Uinta Formation	60-250			
	Tua	Member A of Uinta Formation	>275			
	Tgp	Parashute Creek Member of Green River Formation	0-150		Mahogany oil shale zone.	
	Tgd	Douglas Creek Member of Green River Formation	0-170		Uplift of Uinta Mountains begins near end of Oligocene.	
Cretaceous	Tw	Wasatch Formation	as much as 610		Uplift of Uinta Mountains begins near end of Oligocene. Unconformity, about 6 m; TK boundary and the extinction of dinosaurs.	
	Kmw	Upper unit of Mesaverde Group	425-550		Strata thin to east.	
	Kmv	Lower unit of Mesaverde Group	200-250		End of Western Interior Seaway.	
	Kms	Mancos Shale	1,500-4,900			
	Kfr	Frontier Sandstone	52-83		Gas reservoir in Uinta Basin. Unconformity, about 5 m.	
	Kd	Mowry Shale	10-67		Gas reservoir in Uinta Basin. Unconformity, about 2 m.	
	Kk	Dakota Sandstone	15-76		Abundant dinosaur remains.	
	Klcm	Cedar Mountain Formation	0-60		K-J unconformity, about 25 m.	
	Jc	Morrison Formation	244-287		J-S unconformity, about 2 m.	
	Jd	Stump Formation	40-60		Bentonite fossils.	
Jurassic	Jk	Entrada Sandstone	12-75		J-L unconformity, about 14 m; top of Nugget Sandstone may include Purple Sandstone.	
	Jc	Carmel Formation	300-118			
	Jn	Nugget Sandstone	180-310			
	Tc	Chinle Formation	83-121		Arkane and Steinkjer F of some workers. Garta Member.	
	Td	Moenkopi Formation	170-260		T-U unconformity, about 15 m.	
	Tm	Moenkopi Formation	0-162			
	Pp	Park City and Phosphoria Formations	20-122		Phosphate deposits. Unconformity, about 3 m.	
	Pf	Phosphoria Formation	0-162			
	Ppw	Weber Sandstone	230-472		Forms cliffs and important reservoir in the Rocky Mountains.	
	Pm	Morgan Formation	11-280			
Permian	Pvr	Round Valley Limestone	85-127			
	Pdh	Doughnut Shale	75-90			
	Mh	Humburg Formation	75-90			
	Mm	Madison Limestone	130-300		Forms cliffs; contains marine fossils. Unconformity, about 220-300 m.y.	
	Ci	Lodore Formation	0-180			
	Zur	Red Pine Shale	-0-550		Unconformity, about 200 m.y.	
	Proterozoic	Zu	Unnamed Formation	as much as 3,500		Forms the core of Uinta Mountains; Flaming Gorge Dam constructed in the unit.
		Zyu	Jesse Ewing Canyon Formation	225		not exposed in the quadrangle.

*See Correlation of Quaternary Units for symbols

NOT EXPOSED IN VERNAL 30' X 60' QUADRANGLE

(The formations below are exposed in the adjoining Dutch John 30' x 60' quadrangle and are likely in the subsurface of this quadrangle. In addition, some of these formations are the primary source of clasts for Quaternary and Tertiary units in the Vernal 30' x 60' quadrangle. These formations will be shown on cross sections in the final version of this map.)

LODOPRE FORMATION (UPPER CAMBRIAN) - Light-brown to greenish-gray sandstone underlain by pink to tan to pale-greenish-gray glauconitic shale interbedded with tan to pale-green sandstone; base is variegated (pink, gray, and pale-green) coarse- to medium-grained cross-bedded sandstone; locally pebbly; Lodore pinches out to the west; 0-160 m thick.

RED PINE SHALE OF THE UTAH MOUNTAIN GROUP (MIDDLE PART OF UPPER PROTEROZOIC) - Dark-gray to dark green-gray shale and siltstone; interbedded with brown-gray to brown-red sandstone and quartzite, thin bedded near base becoming thick bedded near the top; sandstone is medium to coarse grained, cross-bedded, and siliceous; age is based on palynomorphs recovered from base of formation in the southwest part of the Dutch John 30' x 60' quadrangle (Sprinkel, 2002; Sprinkel and others, 2002); estimated at 0-550 m thick.

UNNAMED FORMATION OF THE UTAH MOUNTAIN GROUP (UPPER PROTEROZOIC) - Dark- to light-red, fine- to coarse-grained, quartzite and lithic sandstone and quartzite; sandstone is thick to medium bedded; planar, contorted and cross-bedded is preserved; some beds contain tool and groove marks, ripples, and mudcracks; contains considerable red, green, and dark-gray micaceous shale interbeds and some conglomerate; age is based on palynomorphs recovered from near top of formation in the Dutch John 30' x 60' quadrangle (Sprinkel, 2002; Sprinkel and others, 2002) and detrital zircon grains (770 Ma) from lower part of Oa unit (Fanning and Dettler, 2005); as much as 3,500 m thick.

JESSE EWING CANYON FORMATION OF THE UTAH MOUNTAIN GROUP (UPPER AND MIDDLE PROTEROZOIC) - Dark- to light-red, brown, and reddish-purple pebbly to boulder conglomerate interbedded with quartzite and lithic sandstone and shale; clasts are white, pale green, and pink quartzite (from Red Creek Quartzite), subrounded to subangular; thick- to medium-bedded and friable; contains pebbles as well as the formation as a whole; age is based on palynomorphs (Sprinkel and others, 2002) preserved in a down-faulted block defined as basal Jesse Ewing Canyon Formation by Sanderson and Wiley (1983) but also includes the overlying unnamed formation for the Dutch John 30' x 60' quadrangle (Sprinkel, 2002); 225 m thick.

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