Description of Map Units

Qf DISTURBED GROUND (HISTORICAL) - Gravel pit operations mostly along the flood plain of the Green River; material excavated is from unconsolidated deposits of Qal and Qaf; includes sewage lagoon along Ashley Creek and larger earthen dams for reservoirs.

Qmf DEBRIS-FLOW DEPOSITS (HISTORICAL) - Unconsolidated and poorly sorted heterogenous mixture of boulders, gravel, sand, silt, and mud; matrix supported; less than 2 m thick.

Qal FLOOD-PLAIN AND CHANNEL ALLUVIUM (HOLOCENE) - Unconsolidated silt, sand, and gravel in flood plains of Green River, Ashley and Brush Creeks, and Pleasant Valley Wash; locally grade into Qac; 1-30 m thick.

Qat TERRACE DEPOSITS (HOLOCENE) - Unconsolidated to locally cemented silt, sand, gravel, cobbles, and boulders; remnants of alluvial terraces 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; locally grade into Qac; 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 soft formations, this unit is mostly reworked mud; locally grade into Qae, Qaf, and Qal; less than 10 m thick.

Qae MIXED ALLUVIUM AND EOLIAN DEPOSITS (HOLOCENE) - Unconsolidated alluvial mud, silt, and sand mixed with 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 locally grade into Qac; 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.

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.

Qa PIEDMONT AND BASIN ALLUVIUM, UNDIVIDED (HOLOCENE AND PLEISTOCENE[?]) - Variably consolidated, poorly to moderately sorted sand, gravel, cobbles, and boulders deposited on near-planar bedrock surfaces; more than one level recognized but not subdivided so deposits of different ages can share a common boundary; poorly to well-developed soil profile developed in all levels with the best-developed profile in the topographically highest deposit; less than 2 m thick.

Qas1 YOUNGEST SOUTH FLANK PIEDMONT ALLUVIUM (HOLOCENE AND UPPER PLEISTOCENE) - Unconsolidated to poorly consolidated, poorly sorted sand, gravel, cobbles, and boulders; poorly developed soil profile and stage I pedogenic carbonate (caliche) coatings on underside of clasts; mapped in the northern part of the quadrangle where traceable from Dutch John 30' x 60' quadrangle (Sprinkel, 2006); less than 2 m thick.

Qas2 YOUNGER SOUTH FLANK PIEDMONT ALLUVIUM (UPPER PLEISTOCENE) - Unconsolidated to moderately consolidated, poorly sorted sand, gravel, cobbles, and boulders; poorly to well-developed soil profile and stage II-III pedogenic carbonate (caliche) coatings of clasts in upper 1 m of deposit; mapped in the northern part of the quadrangle where traceable from Dutch John 30' x 60' quadrangle (Sprinkel, 2006) and topographically higher than Qas1; less than 3 m thick.

Qga GLACIAL ALLUVIAL OUTWASH, UNDIVIDED (PLEISTOCENE) - Unconsolidated, well-rounded, mostly red quartzose sandstone and quartzite (Uinta Mountain Group) boulders to pebbles and sand deposits in the Whiterocks Canyon drainage in the northwest part of the quadrangle (see Sprinkel, 2006) derived from the high-energy meltwaters of glaciers of undetermined age; thickness not determined but probably less than 10 m.

Qas3 OLDER SOUTH FLANK PIEDMONT ALLUVIUM (MIDDLE PLEISTOCENE) - Variably consolidated, poorly sorted, silt, sand, gravel, and cobble to boulder deposit; subangular to subrounded clasts dominated by quartz sandstone and quartzite of Uinta Mountain Group; mostly matrix-supported with clast-supported channel deposits; well-developed soil profile with stage III-IV carbonate (caliche) cementation; some clasts coated with iron-manganese deposits; boulders are scattered on surface as lag deposit; deposit typically "rests" on Bishop Conglomerate but does "rest" on pre-Bishop units in places; forms the highest and oldest gravel deposit that caps the Yampa Plateau in this quadrangle; also mapped in the Dutch John 30' x 60' quadrangle (Sprinkel, 2006); less than 10 m thick in quadrangle.

Tb BISHOP CONGLOMERATE (OLIGOCENE) - Light-gray to pinkish-gray, friable sandstone with tuffaceous interbeds, and poorly sorted, loosely cemented, boulder to pebble conglomerate mapped on the Yampa Plateau; an ash bed near the base of the Bishop on the Yampa Plateau yielded $^{40}Ar/^{39}Ar$ weighted mean age on sanidine of about 34 Ma (Kowallis and others, 2005); a stratigraphically higher ash bed on the Diamond Plateau in the adjoining Dutch John 30' x 60' quadrangle yielded an $^{40}Ar/^{39}Ar$ age on sanidine of 30.5 Ma (Kowallis and others, 2005), which is similar to K-Ar ages of 28.5 Ma (hornblende) and 29.5 Ma (biotite) reported by Hansen (1986); less than 50 m thick.

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 fine-grained beds dominate the member and coarsen upward; resistant and thick-bedded; Bryant and others (1989) obtained fission-track ages in zircon of 30.0 to 36.7 Ma from the member in the adjoining Duchesne and Kings Peak 30' x 60' quadrangles; Anderson and Picard (1972) defined the Starr Flat as the uppermost member of the Duchesne River Formation, but it is likely correlative with the Bishop Conglomerate because of similar stratigraphic relations and age (see Hansen, 1986; Bryant and others, 1989, Kowallis and others, 2005); 40-230 m thick.

Tdl LAPOINT MEMBER OF DUCHESNE RIVER FORMATION (OLIGOCENE AND EOCENE) - Light-reddish-brown and yellowish-gray, fine-grained sandstone, siltstone, and mudstone; contains abundant light-greenish-gray bentonite beds; mostly nonresistant and thin- to very thin bedded; late Eocene (Duchesnean) in age based on vertebrate fossil assemblage and K-Ar age (mineral not reported) of 39.3 Ma from an ashy siltstone bed at the Lapoint-Dry Gulch Creek contact (Anderson and Picard, 1972); three K-Ar ages on biotite of 35.7 to 40.3 were obtained from near the base of the Lapoint Member (McDowell and others, 1973; Mauger, 1977); exposed thickness 120 m, but as much as 300 m thick in subsurface of Uinta Basin.

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 (Anderson and Picard, 1972); 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 exposed basal part of the Brennan Basin Member intertongues with the underlying Uinta Formation and is as much as 60 m thick; 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 Squaw Ridge and Mesaverde Group along Asphalt Ridge; contains a diverse assemblage of vertebrate fossils of Late Eocene age; see Anderson and Picard (1972) for a summary of the fossils and age of the Brennan Basin Member; exposed thickness 220-600 m, but as much as 1040 m thick in subsurface of Uinta Basin.

Tu UINTA FORMATION (EOCENE) - Consists of three members but combined where members are too thin to show separately at map scale or where member identification uncertain; see below for unit description and thickness; combined exposed thickness of map unit is 335-745 m.

Tuc MEMBER C OF UINTA FORMATION (EOCENE) - Soft, light-gray, greenish-gray, white, grayish-purple, red, and pale-yellow shale, mudstone, claystone, and minor sandstone with local tuffaceous interbeds; consists mostly of Horizon C of Osborn (1929), Peterson and Kay (1931), and Kay (1934); informally referred to as the Myton member by some authors; the base of member C is placed near the Amynodon sandstone of Riggs (1912); forms the badlands topography characteristic of Fantasy Canyon (section 12, T. 9 S., R. 22 E., Uintah County); contains some gilsonite deposits; exposed thickness 60-250 m, but as much as 570 m thick in subsurface of Uinta Basin.

Tub MEMBER B OF UINTA FORMATION (EOCENE) - Light-gray, light-greenish-gray, light-brown, and light-purple, mudstone and claystone with interbeds of greenish-gray, yellow, and brown fine-grained sandstone; contains minor conglomerate and tuffaceous beds; forms nonresistant slopes and thin resistant ledges; consists mostly of Horizon B of Osborn (1929), Peterson and Kay (1931), and Kay (1934); these beds are included in the informal Wagonhound member of some authors; contains significant gilsonite deposits in southern part of quadrangle, particulary around Bonanza, Utah; exposed thickness about 275 m, but 108-508 m thick in subsurface of Uinta Basin.

Tua MEMBER A OF UINTA FORMATION (EOCENE) - Yellowish-gray and yellowish-brown, fine- to very fine grained sandstone and siltstone; contains minor conglomerate, shale, and tuffaceous interbeds; forms resistant beds; consists of Horizon A of Osborn (1929), Peterson and Kay (1931), and Kay (1934); these beds are included in the informal Wagonhound member of some authors; intertongues with the underlying Parachute Creek Member of the Green River Formation; the lower contact is irregular and bedding is contorted because of soft-sediment deformation; generally thins northward; 0-220 m thick.

Tgp PARACHUTE CREEK MEMBER OF GREEN RIVER FORMATION (EOCENE) - Moderately resistant, light- to medium-gray, light- to medium-brown, yellow, organic-rich marlstone, siltstone, sandstone, and oolitic limestone; contains pods of nahcolite, some of which have been leached leaving cavities; includes the Mahogany oil-shale zone; upper part intertongues with overlying Uinta Formation near the White River drainage in the southeast part of the quadrangle but pinches out and is unconformably overlain by the Duchesne Formation near The Rim Rock to the north; exposed thickness 0-270 m, but 335-1230 m thick in subsurface of Uinta Basin.

Tgd DOUGLAS CREEK MEMBER OF GREEN RIVER FORMATION (EOCENE) - Soft to moderately resistant, light- to medium-gray, light- to medium-brown, yellow, and light-gray siltstone, sandstone, shale, and cherty and oolitic limestone; base is light-brown ostracodal limestone of Long Point Bed (Johnson, 1984); unconformably overlain by the Duchesne Formation near Spring Hollow along the Green River; exposed thickness 0-150 m, but 284-425 m thick in subsurface of Uinta Basin.

Tgr-Tw GREEN RIVER-WASATCH FORMATIONS TRANSITION ZONE (EOCENE) - Intertonguing beds of Green River (lithotypes similar to Douglas Creek Member) and Wasatch Formations identified only in wells; represents interval between the base of Long Point Bed and the main body of the Wasatch Formation; shown on cross sections only; 75-265 m thick.

Tw WASATCH FORMATION (EOCENE AND PALEOCENE[?]) - Red, yellow, and light-gray friable sandstone, siltstone, claystone, and conglomerate; conglomerate clasts consist mostly of gray limestone (Paleozoic), sandstone (Mesozoic), and some red quartzose sandstone and quartzite (Uinta Mountain Group); upper part intertongues with overlying Douglas Creek Member of Green River Formation where the transition zone is not identified; lower part intertongues with underlying Flagstaff Member of Green River Formation where identified; 300-920 m thick where undivided, but is 245-620 m thick for main body of Wasatch Formation.

Tgf FLAGSTAFF MEMBER OF GREEN RIVER FORMATION (EOCENE) - Mostly medium- to dark-gray carbonate, light-gray sandstone, light-gray to green-gray claystone; only identified in subsurface from lithologic and geophysical well logs; intertongues with Wasatch Formation; shown on cross section only; 70-800+ m thick.

Kmvu UPPER UNIT OF MESAVERDE GROUP (UPPER CRETACEOUS) - Moderately resistant, light-gray to pale-grayish-orange, fine-grained, lenticular cross-bedded sandstone with carbonaceous shale and thick coal beds; may include beds of the Tuscher, Farrer, and Neslen Formations; exposed thickness 450-550 m, but as much as 695 m thick in subsurface of Uinta Basin.

Kmvl LOWER UNIT OF MESAVERDE GROUP (UPPER CRETACEOUS) - Resistant, light-gray, tan, and light-yellow, cross-bedded sandstone with subordinate gray carbonaceous shale and minor coal; likely includes beds of the Sego Sandstone, Buck Tongue of the Mancos Shale, and Castlegate Sandstone; locally defined by Walton (1944) as the Rim Rock Formation; exposed thickness 200-250 m, but 120-340 m thick in subsurface of Uinta Basin.

Kms MANCOS SHALE (UPPER CRETACEOUS) - Dark-gray, soft, slope-forming, calcareous shale containing beds of siltstone and bentonitic clay; 1360-1700 m thick.

Kfd FRONTIER SANDSTONE, MOWRY SHALE, AND DAKOTA SANDSTONE, UNDIVIDED - These formations are shown as one unit along part of the south flank of the Yampa Plateau; see below for descriptions and thickness; combined thickness of map unit is 75-235 m.

Kf FRONTIER SANDSTONE (UPPER CRETACEOUS) - Upper part resistant, light-brown to light-gray and yellow, fine-grained and ripple-marked sandstone with local petrified wood and fossils; lower part soft, light- to dark-gray calcareous shale; may include minor limestone and coal beds in the lower part; exposed thickness 50-85 m, but as much as 100 m thick in subsurface of Uinta Basin.

Kmd MOWRY SHALE AND DAKOTA SANDSTONE, UNDIVIDED - These formations are locally shown as one unit along Snake John Reef because they are too thin to show separately at map scale. See below for descriptions and thickness; combined thickness of map unit is 25-150 m.

Kmr MOWRY SHALE (UPPER AND LOWER CRETACEOUS) - Dark-gray, siliceous shale that weathers silver gray; contains abundant fossil fish scales; age based on Obradovich and Cobban (1975), Cobban and Kennedy (1989), Molenaar and Cobban (1991), and unpublished palynological data; 10-70 m thick.

Kd DAKOTA SANDSTONE (LOWER CRETACEOUS) - Upper and lower resistant, yellow and light-gray, medium- to coarse-grained sandstone beds separated by a carbonaceous shale; contains coal beds in exposures along the flank of Split Mountain (Doelling and Graham, 1972); 15-80 m thick.

KJcm CEDAR MOUNTAIN FORMATION AND MORRISON FORMATION - Cedar Mountain is mapped with the underlying Morrison Formation because it is generally thin and the contact with the underlying Morrison is difficult to determine despite being a major unconformity representing about 25 Ma; combined thickness of map unit is 245-350 m.

Cedar Mountain Formation (Lower Cretaceous) - Purple, gray, and greenish-gray mudstone, siltstone, and minor sandstone and limestone; contains calcrete beds that weather out as carbonate nodules; 0-60 m thick.

Morrison Formation (Upper Jurassic) - Upper Brushy Basin Member consists of soft, banded, variegated (light-gray, olive-gray, red, and light-purple) shale, claystone, siltstone, and minor cross-bedded sandstone, conglomerate, and bentonite. Lower Salt Wash Member consists of resistant, light-gray to white, cross-bedded sandstone; dinosaur remains are preserved in the Salt Wash Member at Dinosaur National Monument; exposed thickness 245-290 m thick, but as thin as 160 m in subsurface.

Jsc STUMP FORMATION, ENTRADA SANDSTONE, AND CARMEL FORMATION, UNDIVIDED - These formations are mapped as one unit where too thin to show separately at map scale; see below for unit description and individual formation thickness; combined thickness of map unit is 140-295 m.

Js STUMP FORMATION (UPPER JURASSIC) - Upper Redwater Member is greenish-gray and light-green, slope-forming shale with glauconitic, fossiliferous (belemnites) sandstone and limestone. Lower Curtis Member is resistant, light-gray to greenish-gray, cross-bedded, fossiliferous, glauconitic sandstone, oolitic limestone, and fissile shale; palynomorph assemblage from base of Curtis indicates Oxfordian age (Wilcox and Currie, 2006; Brian Currie, Miami University (Ohio), verbal communication, March 15, 2006); J-3 unconformity of Pipiringos and O'Sullivan (1978) is at base of Curtis Member; total thickness is 40-80 m.

Je ENTRADA SANDSTONE (MIDDLE JURASSIC) - Upper reddish-brown siltstone and fine-grained sandstone and a lower light-gray, pink, and light-brown sandstone; lower sandstone is resistant to erosion and forms cliffs and ridges; 15-75 m thick.

Jc CARMEL FORMATION (MIDDLE JURASSIC) - Medium- to dark-red, green, and gray sandy shale, sandstone, siltstone, limestone, and gypsum; upper part is mostly slope-forming red shale, siltstone, and sandstone underlain by a middle gypsiferous unit; lower part is mostly red siltstone and thin, ledge-forming limestone, which is commonly oolitic and fossiliferous; 85-140 m thick.

J'Rn NUGGET SANDSTONE (LOWER JURASSIC AND UPPER TRIASSIC) - Pink, light-gray, and light-brown, resistant, massive-weathering, large-scale cross-bedded sandstone; locally contains carbonate lenses (playa) and fluvial lenses (wadi) near top; forms cliffs and ridges; mapped as Navajo Sandstone prior to 1964 by several workers, however, the nomenclature was changed to Glen Canyon Sandstone by Poole and Stewart (1964) and adopted by several workers; I have abandoned the use of Glen Canyon Sandstone and adopted Nugget Sandstone, which is present in the western Uinta Mountains. I have restricted the Nugget Sandstone to the upper eolian beds and included the lower flat-lying sandstone and carbonate beds in the underlying Chinle Formation; vertebrate tracks of Jurassic age preserved in a fluvial lens near the top of Nugget Sandstone near Red Fleet Resevoir (Hamblin and others, 2000) in Dutch John 30' x 60' quadrangle; casts of vertebrate tracks of Late Triassic age are preserved on underside beds near or at the base of typical Nugget Sandstone in this quadrangle near Dinosaur National Monument and at McConkie Ranch in Dutch John 30' x 60' quadrangle (Lockley and others, 1992); 155-275 m thick.

Ŕcd CHINLE, MOENKOPI, AND DINWOODY FORMATIONS, UNDIVIDED - Combined where formations are too thin to show at map scale; see below for descriptions and thickness; combined thickness of map unit is 255-550 m.

Ŕc CHINLE FORMATION (UPPER TRIASSIC) - Purplish-red, purple, light-gray, greenish-gray, light-green, ripple-marked siltstone, sandstone, claystone, shale, and conglomerate that locally contains abundant petrified wood; generally forms slopes; upper 26-36 m is light-reddish-brown planar laminated sandstone, cross-bedded sandstone, siltstone, and variegated mudstone that is correlated with Bell Springs Member of Nugget Sandstone by Jensen and Kowallis (2005); impressions of the vertebrate tracks of Late Triassic age (the mates of overlying casts found in overlying Nugget) may be preserved; base is resistant conglomerate unit named the Gartra Member; 85-125 m thick.

Ŕmd MOENKOPI AND DINWOODY FORMATIONS, UNDIVIDED - Combined as one map unit where formations are too thin to show separately at map scale; see below for descriptions and thickness; combined thickness of map unit is 170-425 m.

Ŕm MOENKOPI FORMATION (LOWER TRIASSIC) - Medium- to dark-red, reddish-brown, green, and gray, ripple-marked siltstone, fine-grained sandstone, and shale with gypsum and limestone beds; mostly "soft," slope-forming unit; 170-260 m thick.

Ŕd DINWOODY FORMATION (LOWER TRIASSIC) - Light-gray, greenish-gray, light-brown, and brown, thin-bedded, ripple-marked shale, siltstone, and sandstone with minor amounts of limestone. "Soft," slope-forming unit along the flanks of the Yampa Plateau; 0-165 m thick.

Pp PARK CITY AND PHOSPHORIA FORMATIONS (LOWER PERMIAN) - Combined thickness of Park City and Phosphoria Formations is 20-125 m.

Franson Member of Park City Formation - Gray, thick- to thin-bedded, cherty limestone and dolomite interbedded with brownish-gray sandstone and red to ochre shale; generally resistant and forms ledges and cliffs.

Meade Peak Phosphatic Shale Member of the Phosphoria Formation - Slope-forming, dark-gray, phosphatic shale with interbeds of sandstone and limestone.

Grandeur Member of Park City Formation - Light-gray to light-brownish-gray sandstone, dolomite, and limestone; generally resistant and forms ledges and cliffs.

PIPw WEBER SANDSTONE (LOWER PERMIAN TO MIDDLE PENNSYLVANIAN) - Light-gray to yellowish-gray, very thick bedded sandstone with interbeds of limestone in the lower part; highly cross-bedded sandstone in the upper part; forms steep cliffs and ridges; 230-475 m thick.

IPm MORGAN FORMATION (MIDDLE PENNSYLVANIAN) - Light- to medium-red, yellow, and gray shale and siltstone, light- to medium-gray fossiliferous and red cherty limestone, and light-red-gray, fine-grained, locally cross-bedded sandstone; 10-290 m thick.

IPrv ROUND VALLEY LIMESTONE (LOWER PENNSYLVANIAN) - Light-gray to light-blue-gray, thin- to very thick bedded limestone interbedded with soft, red shale; limestone is fossiliferous and cherty; chert is blue gray and yellowish gray, but red to pink jasperoid chert is common in the region; forms ledges and cliffs; only exposed in Split Mountain; 65-130 m thick.

Mdh DOUGHNUT SHALE AND HUMBUG FORMATION (UPPER MISSISSIPPIAN) - Combined thickness of map units is 160-185 m; only exposed in Split Mountain.

Doughnut Shale - Dark-gray shale, with some red shale near base, with beds of coarse sandstone, limestone, and "coal;" shale is slope forming and clayey; only exposed in Split Mountain; 85-95 m thick.

Humbug Formation - Light-gray to red, fine-grained to very fine grained, "soft" to resistant sandstone interbedded with light-gray limestone and red to black shale; sandstone is locally cross-bedded and hematitic near top of formation; 75-90 m thick.

Mm MADISON LIMESTONE (UPPER AND LOWER MISSISSIPPIAN) - Mostly dark-gray, medium to coarse crystalline, cherty limestone; chert is typically light gray; regionally contains numerous caves and sinkholes; only exposed in Split Mountain; base not exposed, regionally 130-300 m thick.

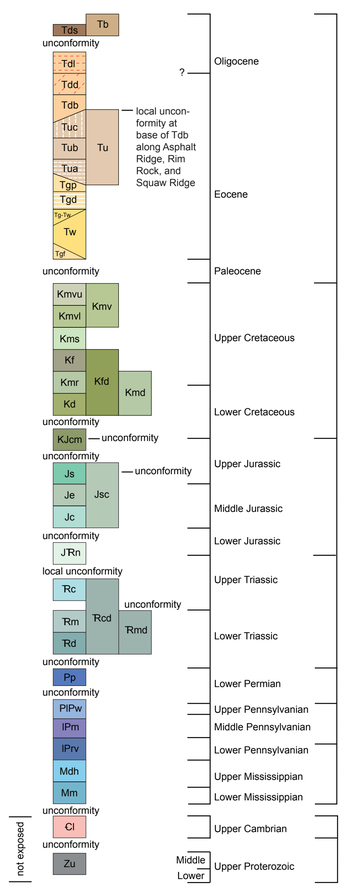
NOT EXPOSED IN VERNAL 30' X 60' QUADRANGLE

The formations below are exposed in the adjoining Dutch John 30' x 60' quadrangle and are likely present in subsurface of this quadrangle (see cross sections). In addition, some of these formations are the primary source of clasts for Quaternary and Tertiary units in the Vernal 30' x 60' quadrangle.

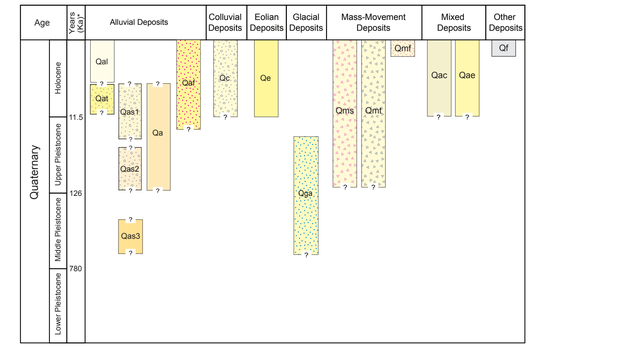
Ꞓl LODORE FORMATION (UPPER CAMBRIAN) - Light-brown to greenish-gray sandstone underlain by pink to tan to pale-greenish-gray glauconitic shale interbedded with tan to pale-green sandstone; base is variegated (pink, gray, and pale-green) coarse- to medium-grained cross-bedded sandstone; locally pebbly; Lodore pinches out to the west; 0-180 m thick.

Zu UINTA MOUNTAIN GROUP (NEOPROTEROZOIC [MIDDLE AND LOWER?]) - Dark- to light-red, fine- to coarse-grained, quartzose and lithic sandstone and quartzite; sandstone is thick to medium bedded with planar, contorted and cross-bedding; 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 middle of formation in the Dutch John 30' x 60' quadrangle (Sprinkel and Waanders, 2005; Sprinkel, 2006) and detrital zircon grains (770 Ma) from lower part of the unit (Fanning and Dehler, 2005); as much as 3500 m thick, but thins southward; not likely present south of Asphalt Ridge and Snake John Reef.

Correlation of Bedrock Units



Correlation of Quaternary Units



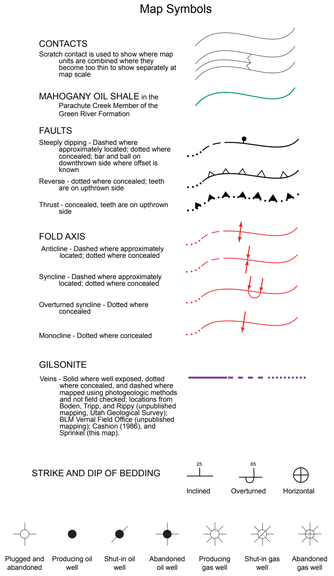
Stratigraphic Column

SYSTEM	SERIES	SYMBOL	FORMATIONS	Thickness* (meters) (not to scale)	LITHOLOGY	NOTES
Quaternary	Holocene	Q**	Unconsolidated deposits	less than 50		Alpine glaciers in Uinta Mountains. Capture of Green River by Colorado River
	Pleistocene	Qas3	South Flank peidmont alluvium	less than 10		Crustal relaxation; Uinta Mountains down- dropped along Uinta fault zone and drainage patterns change in eastern Uintas
Tertiary	Oligocene	Tb	Bishop Conglomerate	less than 50		
		Tds	Starr Flat Member of Duchesne River Formation	40-230		Crustal stability, Gilbert Peak erosion surface forms and Bishop Conglomerate is deposited; Uinta Mountain Group is well exposed
	Eocene	Tdl	Lapoint Member of Duchesne River Formation	120		
		Tdd	Dry Gulch Creek Member of Duchesne River Formation	less than 150		
		Tdb	Brennan Basin Member of Duchesne River Formation	220-600		Local uplift near the northern margin of the Uinta Basin; the Duchesne River Fm unconformably overlies the Green River Fm through the Mesaverde Group from near Squaw Ridge to Asphalt Ridge; the Duchesne River Formation is interbedded with Uinta Formation in the Uinta Basin
		Tu: Tuc	Member C of Uinta Formation	60-250		
		Tu: Tub	Member B of Uinta Formation	about 275		Contains gilsonite deposits
		Tu: Tua	Member A of Uinta Formation	0-220		
		Tgp	Parachute Creek Member of Green River Formation	0-270		Mahogany oil shale zone
		Tgd	Douglas Creek Member of Green River Formation	0-150		Uinta Mountains continue to uplift and erode; creation of Lake Uinta as the Uinta Basin continues to subside; contains oil shale and oil reserves
		Tg-Tw	Green River-Wasatch Formations transition zone	75-265		
		Tw	Wasatch Formation	300-920		Uinta Mountains continue to uplift and erode locally exposing the Uinta Mountain Group; subsidence of Uinta Basin; gas reservoir in Uinta Basin
		Tgd	Flagstaff Member of Green River Formation	70-800+		Unconformity, about 6 m.y.; TK boundary and the extinction of dinosaurs
Cretaceous	Upper	Kmvu	Upper unit of Mesaverde Group	450-550		Uplift of Uinta Mountains begins near end of Cretaceous Mesaverde Group is gas reservoir in Uinta Basin
		Kmvl	Lower unit of Mesaverde Group	200-250		contains minor coal
		Kms	Mancos Shale	1360-1700		End of Western Interior Seaway
		Kfd: Kf	Frontier Sandstone	50-85		Gas reservoir in Uinta Basin Unconformity, about 5 m.y.
		Kfd: Kmr	Mowry Shale	10-70		Fossil fish scales in Mowry
	Lower	Kfd: Kd	Dakota Sandstone	15-80		Gas reservoir in Uinta Basin
			Cedar Mountain Formation	0-60		K-1 unconformity, about 2 m.y.
Jurassic	Upper	KJcm	Morrison Formation	245-290		K-0 unconformity, about 25 m.y. Abundant dinosaur remains
	Middle	Jsc: Js	Stump Formation	40-80		J-5 unconformity, about 2 m.y. *Belemnites* fossils
		Jsc: Je	Entrada Sandstone	15-75		J-3 unconformity, about 1 m.y.
		Jsc: Jc	Carmel Formation	85-140		*Isorinus* fossils
	Lower	J'Rn	Nugget Sandstone	155-275		J-2 unconformity, about 14 m.y.; top of Nugget Sandstone may include Page Sandstone
Triassic	Upper	Ŕcd: Ŕc	Chinle Formation	85-125		Ankareh and Steinaker Formation of some workers Gartra Member
	Lower	Ŕcd: Ŕm	Moenkopi Formation	170-260		R-3 unconformity, about 15 m.y.
		Ŕcd: Ŕd	Dinwoody Formation	0-165		R-1 unconformity, about 6 m.y.
Permian	Lower	Pp	Park City and Phosphoria Formations	20-125		Contains phosphate deposits
Pennsylvanian	Upper	PIPw	Weber Sandstone	230-475		Unconformity, about 3 m.y. Forms cliffs and important oil reservoir in the Rocky Mountains
	Middle	IPm	Morgan Formation	10-290		
	Lower	IPrv	Round Valley Limestone	65-130		
Mississippian	Upper	Mdh	Doughnut Shale	85-95		
			Humbug Formation	75-90		
	Lower	Mm	Madison Limestone	130-300		Forms cliffs, contains marine fossils Unconformity, about 220-350 m.y.
Cambrian	Upper	Ꞓl	Lodore Formation	0-180		Base of Madison Limestone and underlying formations are not exposed in the quadrangle
Neoproterozoic	Middle	Zu	Uinta Mountain Group	0-3500		Unconformity, about 200 m.y.
	Lower?					Uinta Mountain group forms the core of Uinta Mountains; not likely preserved south of Asphalt Ridge and Snake John Reef

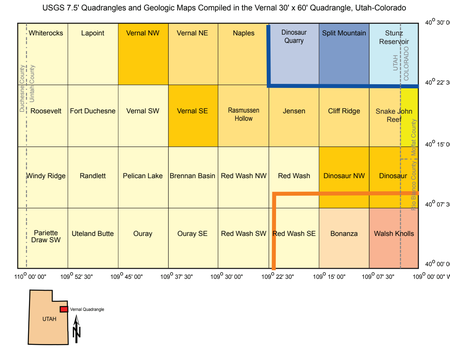
*Exposed thickness; does not include subsurface thickness

**See Correlation of Quaternary Units for symbols

Map Symbols



USGS 7.5' Quadrangles and Geologic Maps Compiled in the Vernal 30' x 60' Quadrangle, Utah-Colorado



Source of Map Data

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