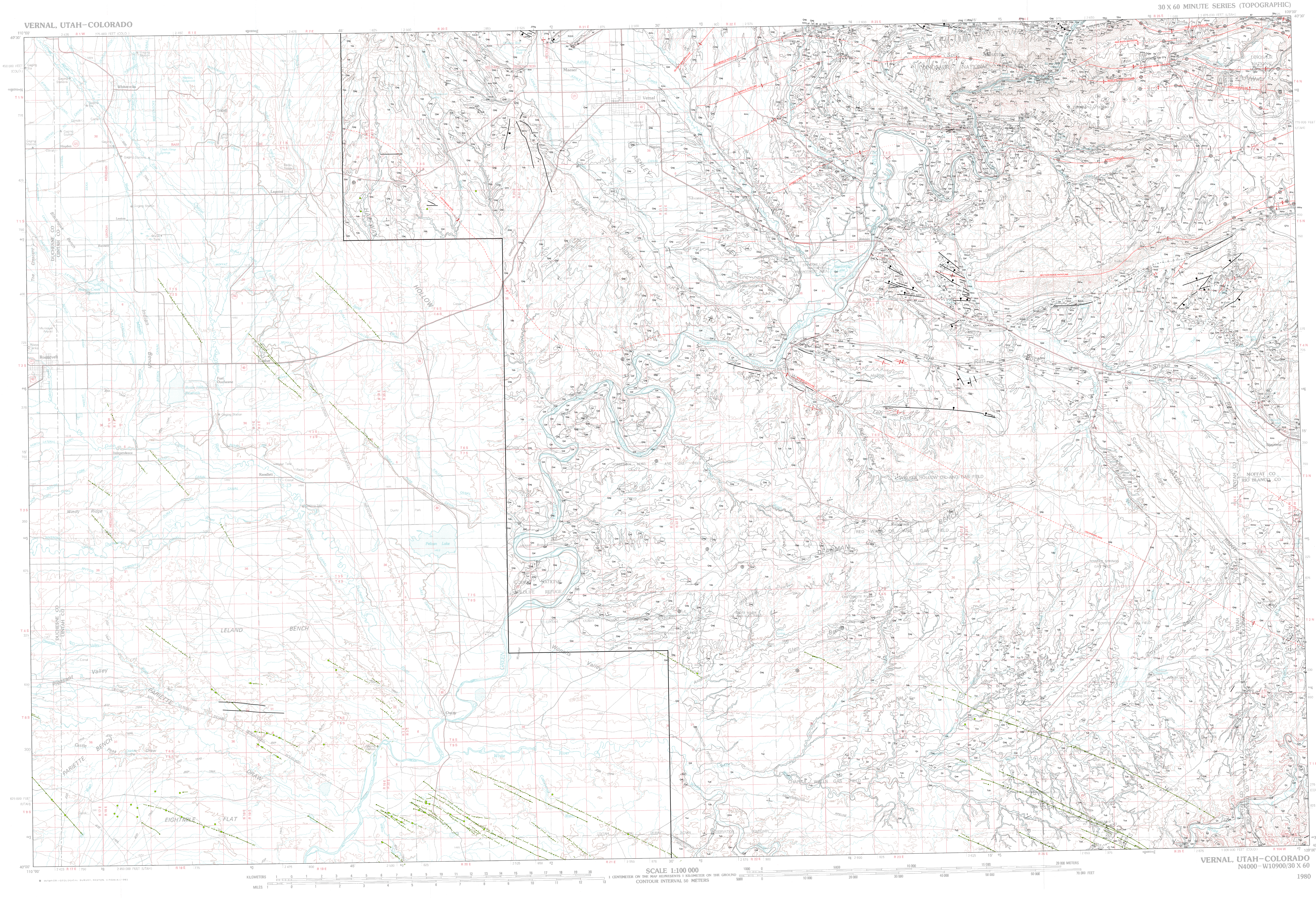

Progress Report Geological Map of the Vernal 30' x 60' Quadrangle, Utah and Colorado
Year 2 of 3

Compiled by Douglas A. Sprinkel

2004

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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 on the Yampa Plateau; 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 YOUNGER ALLUVIAL-FAN DEPOSITS (HOLOCENE) - 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 soft formations, this unit is mostly reworked mud; less than 10 m thick.

Qae MIXED ALLUVIUM AND EOLIAN 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; 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 (HISTORIC) - Modern gravel pit operation mostly along the the flood plain of the Green River; material excavated is from unconsolidated deposits of Qal and Qaf; includes sewage lagoon along Ashley Creek.

Qmf DEBRIS-FLOW DEPOSITS (HISTORIC) - Unconsolidated and poorly sorted heterogenous 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 may be a significant part of this deposit; less than 5 m thick.

Qms SLIDES, SLUMPS AND FLOWS (HOLOCENE AND PLEISTOCENE) - Earthflow 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 for the second year of the project so deposits of different ages can share a common boundary; the topographically highest level is oldest; 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-delveloped 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.

Qaf_2* OLDER ALLUVIAL-FAN DEPOSITS (PLEISTOCENE) - Dissected, unconsolidated, poorly sorted boulders, gravel, sand, and silt; less than 10 m thick. Mapped in the Island Park 7.5-minute quadrangle (Rowley and others, 1981) within the Dutch John 30' x 60' quadrangle, but may be preserved in nearby areas of the Vernal 30' x 60' quadrangle.

Qga* GLACIAL OUTWASH, UNDIVIDED (UPPER 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 Vernal 30' x 60' quadrangle (see Sprinkel, 2002) derived from the high-energy meltwaters of glaciers of undetermined age; thickness not determined but probably less than 10 m thick.

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; these deposits form the highest and oldest gravel deposit that caps the Yampa Plateau in this quadrangle and 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 pebble conglomerate mapped on the Yampa Plateau; biotite and hornblende crystals from a tuff bed yielded K-Ar ages of about 29 Ma (Hansen, 1986) on nearby Diamond Mountain Plateau in the adjoining Dutch John 30' x 60' quadrangle (Sprinkel, 2002); 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; Anderson and Picard (1972) defined it as the uppermost member of the Duchesne River Formation, but preliminary mapping north of Lapoint, Utah, suggests the Starr Flat Member could be strata in the lower part of the overlying Bishop Conglomerate; Bryant and others (1989) obtained fission-track ages of 30 to 34 Ma from the Starr Flat Member in the adjoining Duchesne and Kings Peak 30'x 60' quadrangles; 40-230 m thick

Tdl LAPOINT MEMBER OF DUCHESNE RIVER FORMATION (EOCENE-OLIGOCENE) - 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) 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) report a K-Ar age of 39.3 Ma was obtained from an ashy 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, and Bryant and others (1989) report K-Ar ages 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 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; 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.

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; contains some gilsonite deposits; 60-250 m thick.

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 the southern part of the quadrangle, particulary around Bonanza, Utah; about 275 m thick.

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; intertonues with the underlying Parachute Creek Member of the Green River Formation and the lower contact is irregular and bedding is contorted because of soft-sediment deformation; Mauger (1977) obtained a K-Ar age of 43 Ma from a tuff bed that is likely in the lower part of the undivided Uinta Formation west of the Vernal 30' x 60' quadrangle; 0-100 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 nacholite in which some of the pods have been leached leaving pod-like cavities; includes the Mahogany ledge oil shale unit; 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; exposed thickness in the quadrangle is 0-270 m, but is thicker in the subsurface of the 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; lower part intertongues with underlying Wasatch Formation and is unconformably overlain by the Duchesne Formation near Spring Hollow along the Green River; exposed thickness in the quadrangle is 0-150 m, but is thicker in the subsurface of the Uinta Basin.

Tw WASATCH FORMATION (EOCENE AND PALEOCENE[?]) - Red, yellow, and light-gray friable sandstone, siltstone, claystone, and conglomerate; upper part intertongues with overlying Green River Formation; conglomerate clasts consist of mostly gray limestone (Paleozoic), sandstone (Mesozoic), and some red quartzose sandstone and quartzite (Uinta Mountain Group); 610 m thick.

Tfu* FORT UNION FORMATION (PALEOCENE) - Light-gray, light-brown, light-green, and brown sandstone, shale, and claystone with some carbonaceous shale, coal, siltstone, and conglomerate beds; beds of probable Fort Union age are currently included in the base of the overlying Wasatch Formation; thickness not determined.

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; 425-550 m thick.

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; 200-250 m thick.

Kms MANCOS SHALE (UPPER CRETACEOUS) - Dark-gray, soft, slope-forming calcareous shale containing beds of siltstone and bentonitic clay; 1,500-4,900 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.

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; 52-83 m thick.

Kmd MOWRY SHALE AND DAKOTA SANDSTONE, UNDIVIDED - These formations are locally shown as one unit along Snake John Reef because they were too thin to map separately at this scale. See below for descriptions and thickness.

Kmr MOWRY SHALE (LOWER CRETACEOUS) - Dark-gray, siliceous shale that weathers silver gray; contains abundant fossil fish scales; 10-67 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); 15-76 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; total thickness of map unit is 244-347 m.

Cedar Mountain Formation (Lower Cretaceous) - Purple, gray, and greenish-gray mudstone, siltstone, 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; Morrison is 244-287 m thick .

Jsc STUMP FORMATION, ENTRADA SANDSTONE, AND CARMEL FORMATION, UNDIVIDED - These formation are mapped as one unit where too thin to show separately at this scale; see below for unit description and thickness.

Js STUMP FORMATION (UPPER AND MIDDLE 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; 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; 12-75 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; 30-118 m thick.

JŦg GLEN CANYON SANDSTONE (LOWER JURASSIC AND UPPER TRIASSIC) - Pink, light-gray, and light-brown, resistant, large-scale cross-bedded sandstone; forms cliffs and ridges; top 2-10 m of the formation may include beds of the Middle Jurassic Page Sandstone. Dinosaur tracks of Late Triassic age are preserved in strata at the base of the Glen Canyon Sandstone in Daniels Canyon of the Vernal 30' x 60' quadrangle and 7 m above the base of the Glen Canyon Sandstone in the Red Fleet area of the adjoining Dutch John 30' x 60' quadrangle (Lockley and others, 1992); 180-310 m thick.

Ŧcd CHINLE, MOENKOPI, AND DINWOODY FORMATIONS, UNDIVIDED - Combined where formations are too thin to map at this scale; see below for descriptions and thickness.

Ŧc CHINLE FORMATION (UPPER TRIASSIC) - Purplish-red, purple, light-gray, greenish-gray, light-green, ripple-marked siltstone, sandstone, claystone, shale, and conglomerate; generally forms slopes; base is resistant conglomerate unit named the Gartra Member; 83-121 m thick.

Ŧmd MOENKOPI AND DINWOODY FORMATIONS, UNDIVIDED - Combined as one map unit where formations are too thin to map separately at this scale; see below for descriptions and thickness.

Ŧm 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.

Ŧd 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; 0-162 m thick.

Pp PARK CITY AND PHOSPHORIA FORMATIONS (LOWER PERMIAN) - Combined thickness of Park City and Phosphoria Formations is 20-122 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; 230-472 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; 11-290 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; 65-127 m thick.

Mdh DOUGHNUT SHALE AND HUMBUG FORMATION (UPPER MISSISSIPPIAN) - Combined thickness of map units is 160-181 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; 85-91 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; 130-300 m thick.

NOT EXPOSED IN VERNAL 30' X 60' QUADRANGLE

(The formations are likely in the subsurface of the quadrangle and will be shown on future cross section. In addition, some of these formations are the primary source of clasts for Quaternary and Tertiary units.)

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; upper part forms ledges, middle part forms slopes and ledges, and lower part forms cliffs; Lodore pinches out to the west; 0-180 m thick.

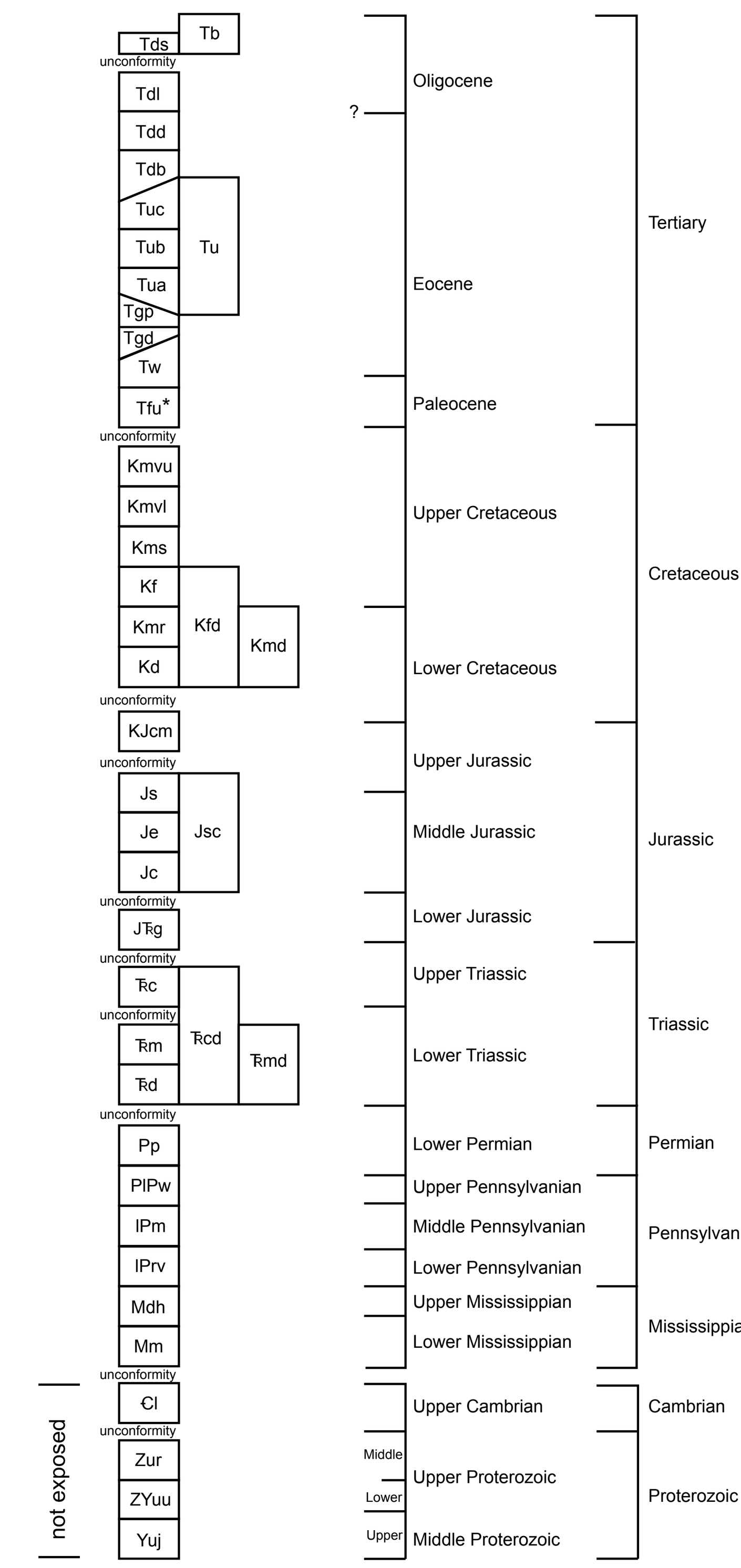
Zur RED PINE SHALE OF THE UINTA MOUNTAIN GROUP (MIDDLE PART OF UPPER PROTEROZOIC) - Dark-gray to dark green-gray shale and siltstone; interbedded with brown-gray to brown-red sandstone and quartzite, thin bedded near base becoming thick bedded near the top; sandstone is medium- to coarse-grained, cross-bedded, 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.

ZYuu UNNAMED FORMATION OF THE UINTA MOUNTAIN GROUP (UPPER AND MIDDLE PROTEROZOIC) - Dark- to light-red, fine- to coarse-grained, quartzose and lithic sandstone and quartzite, sandstone is thick- to medium-bedded; planar-, cross-, and contorted-bedding 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 middle of formation in the Dutch John 30' x 60' quadrangle (Sprinkel, 2002; Sprinkel and others, 2002); as much as 3,500 m thick.

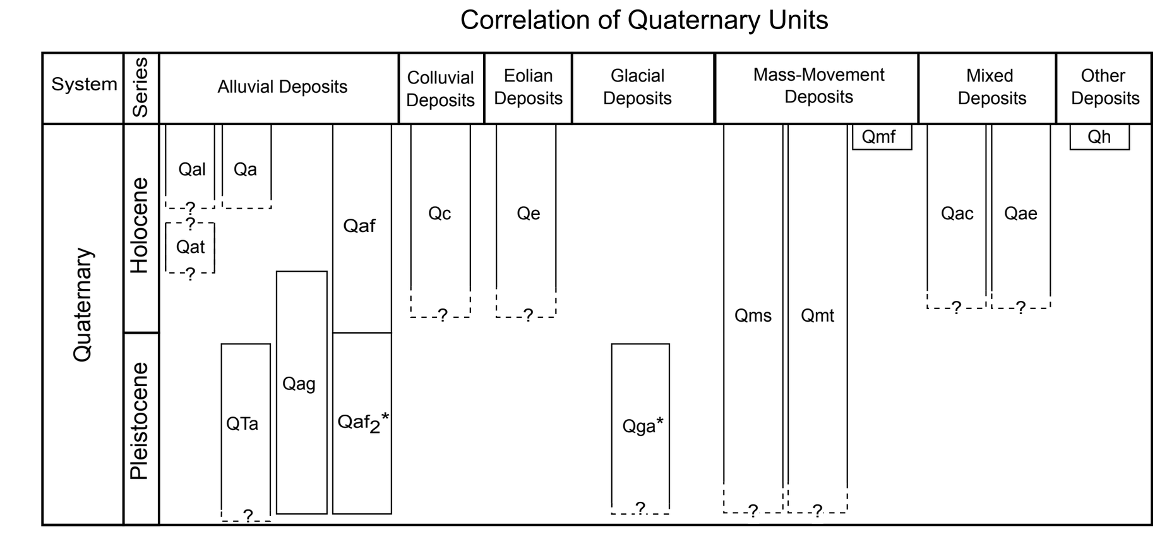
Yuj JESSE EWING CANYON FORMATION OF THE UINTA MOUNTAIN GROUP (MIDDLE PROTEROZOIC) - Dark- to light-red, brown, and reddish-purple pebble to boulder conglomerate interbedded with quartzose and lithic sandstone and shale; clasts are white, pale green, and pink quartzite (from Red Creek Quartzite), subrounded to subangular; thick- to medium-bedded and fining up in individual beds 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 (1986) but mapped as the overlying unnamed formation for the Dutch John 30' x 60' quadrangle (Sprinkel, 2002); 225 m thick.

* Possibly exposed in the Vernal 30' x 60' quadrangle, but not identified and mapped at this time

Correlation of Bedrock Units



Correlation of Quaternary Units



Stratigraphic Column

SYSTEM	SYMBOL	FORMATIONS	Thickness (meters) (not to scale)
Quat.	Q**	Unconsolidated deposits	less than 50
Tertiary	QTa	Older alluvium	less than 10
Tertiary	Tb	Bishop Conglomerate	less than 50
Tertiary	Tds	Starr Flat Member of Duchesne River Formation	40-230
Tertiary	Tdl	Lapoint Member of Duchesne River Formation	120
Tertiary	Tdd	Dry Gulch Creek Member of Duchesne River Formation	less than 150
Tertiary	Tdb	Brennan Basin Member of Duchesne River Formation	220-600
Tertiary	Tu: Tuc	Member C of Uinta Formation	60-250
Tertiary	Tu: Tub	Member B of Uinta Formation	~275
Tertiary	Tu: Tua	Member A of Uinta Formation	0-100
Tertiary	Tgp	Parachute Creek Member of Green River Formation	0-270
Tertiary	Tgd	Douglas Creek Member of Green River Formation	0-150
Tertiary	Tw	Wasatch Formation	610
Tertiary	Tfu*	Fort Union Formation	not determined
Cretaceous	Kmvu	Upper unit of Mesaverde Group	425-550
Cretaceous	Kmvl	Lower unit of Mesaverde Group	200-250
Cretaceous	Kms	Mancos Shale	1,500-4,900
Cretaceous	Kfd: Kf	Frontier Sandstone	52-83
Cretaceous	Kfd: Kmr	Mowry Shale	10-67
Cretaceous	Kfd: Kd	Dakota Sandstone	15-76
Cretaceous	KJcm	Cedar Mountain Formation	0-60
Jurassic	KJcm	Morrison Formation	244-287
Jurassic	Jsc: Js	Stump Formation	40-80
Jurassic	Jsc: Je	Entrada Sandstone	12-75
Jurassic	Jsc: Jc	Carmel Formation	30-118
Jurassic	JŦg	Glen Canyon Sandstone	180-310
Triassic	Ŧcd: Ŧc	Chinle Formation	83-121
Triassic	Ŧcd: Ŧm	Moenkopi Formation	170-260
Triassic	Ŧcd: Ŧd	Dinwoody Formation	0-162
Permian	Pp	Park City and Phosphoria Formations	20-122
Permian	PIPw	Weber Sandstone	230-472
Penn.	IPm	Morgan Formation	11-290
Penn.	IPrv	Round Valley Limestone	65-127
Miss.	Mdh	Doughnut Shale	85-91
Miss.	Mdh	Humbug Formation	75-90
Miss.	Mm	Madison Limestone	130-300
Cam.	Ꞓl	Lodore Formation	0-180
Proterozoic	Zur	Uinta Mountain Group: Red Pine Shale	~0-550
Proterozoic	ZYuu	Uinta Mountain Group: Unnamed Formation	as much as 3,500
Proterozoic	Yuj	Uinta Mountain Group: Jesse Ewing Canyon Formation	225

LITHOLOGY (not exposed in the quadrangle: Ꞓl through Yuj)

NOTES:
- Alpine glaciers in Uinta Mountains. Capture of Green River by Colorado River
- Crustal relaxation; Uinta Mountains down-dropped along Uinta fault zone and drainage patterns change in eastern Uintas.
- Crustal stability; Gilbert Peak erosion surface forms and Bishop Conglomerate is deposited; Uinta Mountain Group is well exposed
- 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
- Contains gilsonite deposits
- Mahogany oil shale zone
- Uinta Mountains continue to uplift and erode; creation of Lake Uinta as the Uinta Basin continues to subside; contains oil shale and oil reserves
- Uinta Mountains continue to uplift and erode locally exposing the Uinta Mountain Group; subsidence of Uinta Basin; gas reservoir in Uinta Basin
- Unconformity, about 6 m.y.; TK boundary and the extinction of dinosaurs
- Uplift of Uinta Mountains begins near end of Cretaceous
- Strata thins to east
- End of great Western Interior Seaway
- Gas reservoir in Uinta Basin
- Unconformity, about 5 m.y.
- Fossil fish scales in Mowry
- Gas reservoir in Uinta Basin
- K-1 unconformity, abpout 2 m.y.
- K-0 unconformity, about 25 m.y.
- Abundant dinosaur remains
- J-5 unconformity, about 2 m.y.
- *Belemnites* fossils
- J-3 unconformity, about 1 m.y.
- *Isocrinus* fossils
- J-2 unconformity, about 14 m.y.; top of Glen Canyon Sandstone may include Page Sandstone
- Ankareh and Steinaker Fm. of some workers
- Gartra Member
- Tr-3 unconformity, about 15 m.y.
- Tr-1 unconformity, about 6 m.y.
- Phosphate deposits
- Unconformity, about 3 m.y.
- Forms cliffs and important oil reservoir in the Rocky Mountains
- Forms cliffs, contains marine fossils
- Unconformity, about 220-350 m.y.
- Forms the core of Uinta Mountains; Flaming Gorge Dam constructed in this unit

**See Correlation of Quaternary Units for symbols

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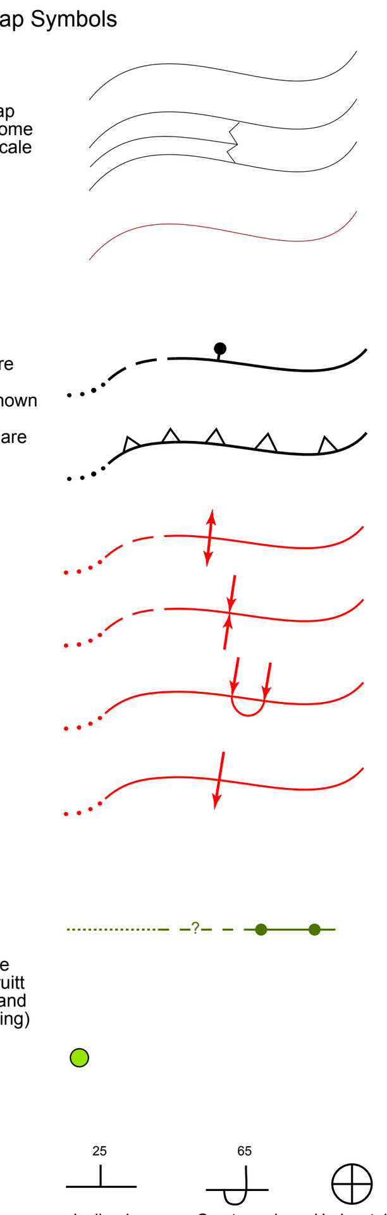
Map Symbols



CONTACTS
Stratch contact is used to show where map units are combined when they become too thin to map separately at this scale

MAHOGONY OIL SHALE in the Parachute Creek Member of the Green River Formation

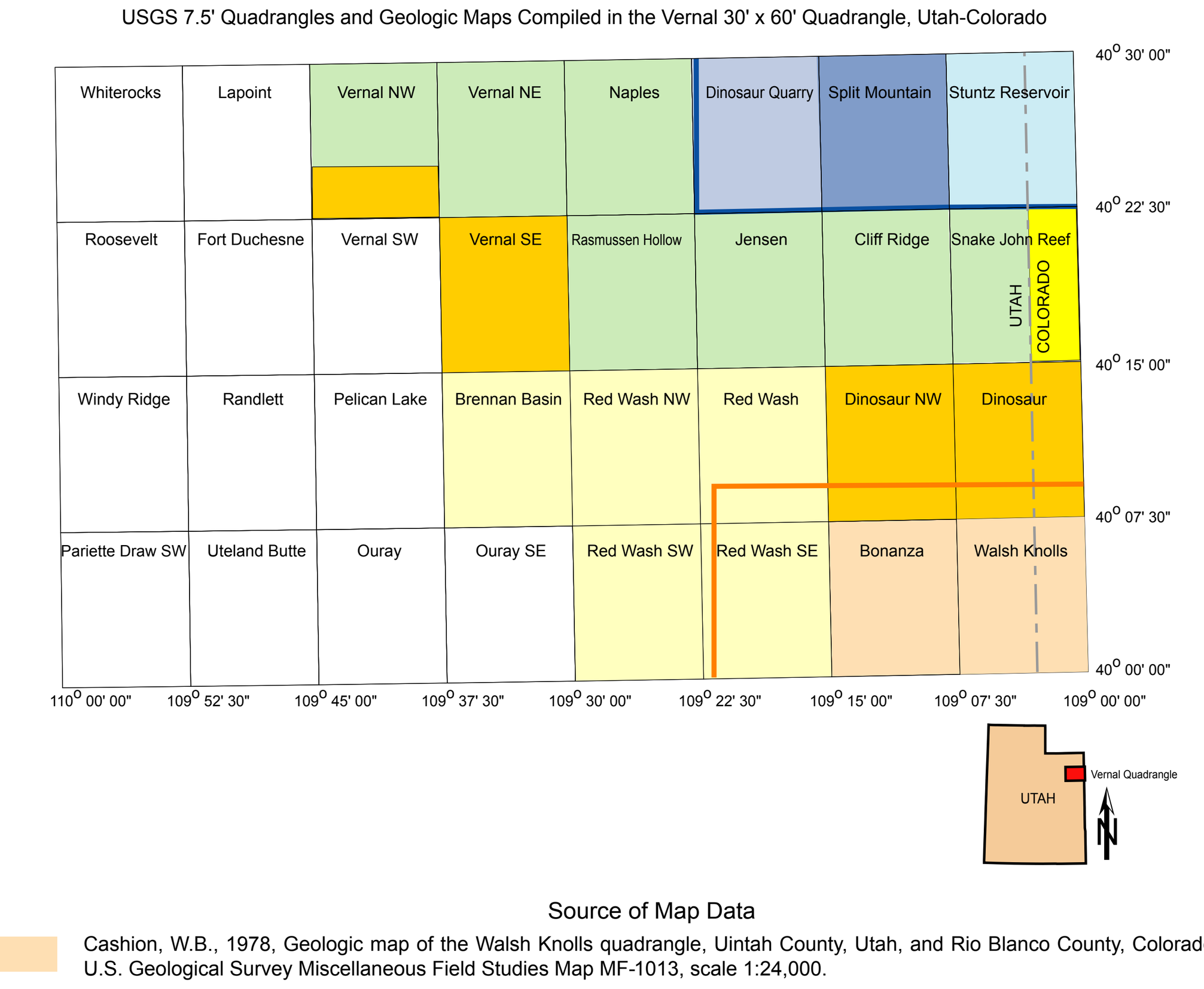
FAULTS
Steeply dipping - Dashed where approximately located; dotted where concealed; bar and ball on downthrown side where offset is known
Reverse - dotted where concealed; teeth are on upthrown side

FOLD AXIS
Anticline - Dashed where approximately located; dotted where concealed
Syncline - Dashed where approximately located; dotted where concealed
Overturned syncline - Dotted where concealed
Monocline - Dotted where concealed

GILSONITE
Veins - Solid where known; dotted where concealed; dashed and queried where uncertain; source of gilsonite veins in unmapped area is from Pruitt (1961), Hintze and others (2000), and Sprinkel (2004, unpublished mapping)
Prospects - potential gilsonite location identified from air photos but not verified

STRIKE AND DIP OF BEDDING

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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Progress Report Geologic Map of the Vernal 30' x 60' Quadrangle, Utah and Colorado

Year 2 of 3

Compiled by Douglas A. Sprinkel

2004