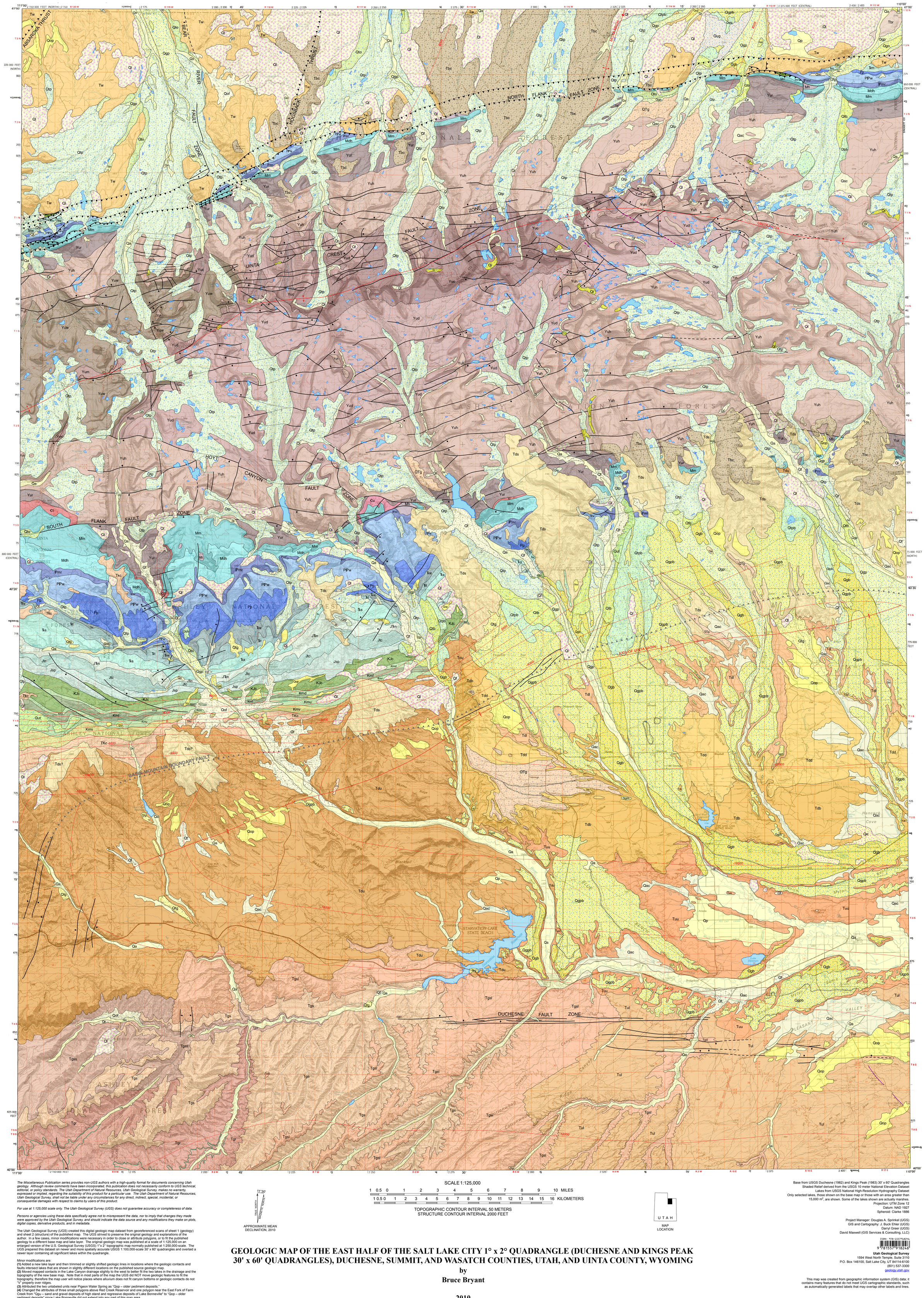
UTAH GEOLOGICAL SURVEY
a division of
Utah Department of Natural Resources

Plate 1
Utah Geological Survey Miscellaneous Publication 10-1DM
Geologic Map of the East Half of the Salt Lake City 1° x 2° Quadrangle



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The Utah Geological Survey (UGS) created this digital geologic map dataset from georeferenced scans of sheet 1 (geology) and sheet 2 (structure) of the published map. The UGS strived to preserve the original geology and explanations of the author. In a few cases, minor modifications were necessary in order to close or attribute polygons, or to fit the published geology to a different base map and lake layer. The original geologic map was published at a scale of 1:125,000 on an enlarged version of the U.S. Geological Survey (USGS) 1° x 2° topographic map normally published at 1:250,000-scale. The UGS prepared this dataset on newer and more spatially accurate USGS 1:100,000-scale 30' x 60' quadrangles and overlaid a newer layer containing all significant lakes within the quadrangle.

Minor modifications are:
(1) Added a new lake layer and then trimmed or slightly shifted geologic lines in locations where the geologic contacts and faults intersect lakes that are shown in slightly different locations on the published source geologic map.
(2) Moved mapped contacts in the Lake Canyon drainage slightly to the west to better fit the two lakes in the drainage and the topography of the new base map. Note that in most parts of the map the UGS did NOT move geologic features to fit the topography, therefore the map user will notice places where alluvium does not fit canyon bottoms or geologic contacts do not "v" properly over ridges.
(3) Attributed the two unlabeled units near Pigeon Water Spring as "Qop – older pediment deposits."
(4) Changed the attributes of three small polygons above Red Creek Reservoir and one polygon near the East Fork of Farm Creek from "Qgu – sand and gravel deposits of high stand and regressive deposits of Lake Bonneville" to "Qop – older pediment deposits" since Lake Bonneville did not extend into any part of this map area.
(5) Changed the attributes of two polygons in the northeast corner of the Duchesne 30' x 60' quadrangle from "Qpg – sand and gravel deposits of high stand of Lake Bonneville" to "Qtg - terrace gravels" (the outcrops could also be interpreted as "Qgp – outwash deposits of Pinedale age".)
(6) Changed the attributes of a small polygon on the border of the Kings Peak and Duchesne 30' x 60' quadrangles, near the western edge of the map, from "Tc – conglomerate" (a unit described as being in the Salt Lake salient in the west portion of the 1° x 2° quadrangle) to "TKc – conglomerate."

APPROXIMATE MEAN DECLINATION, 2010

SCALE 1:125,000

1 0.5 0 1 2 3 4 5 6 7 8 9 10 MILES
1 0.5 0 1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 KILOMETERS

TOPOGRAPHIC CONTOUR INTERVAL 50 METERS
STRUCTURE CONTOUR INTERVAL 2000 FEET

MAP LOCATION

Base from USGS Duchesne (1982) and Kings Peak (1983) 30' x 60' Quadrangles
Shaded Relief derived from the USGS 10 meter National Elevation Dataset
Lakes from USGS National High-Resolution Hydrography Dataset
Only selected lakes, those shown on the base map or those with an area greater than 15,000 m^2, are shown. Some of the lakes shown are actually marshes.
Projection: UTM Zone 12
Datum: NAD 1927
Spheroid: Clarke 1866

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GIS and Cartography: J. Buck Ehler (UGS)
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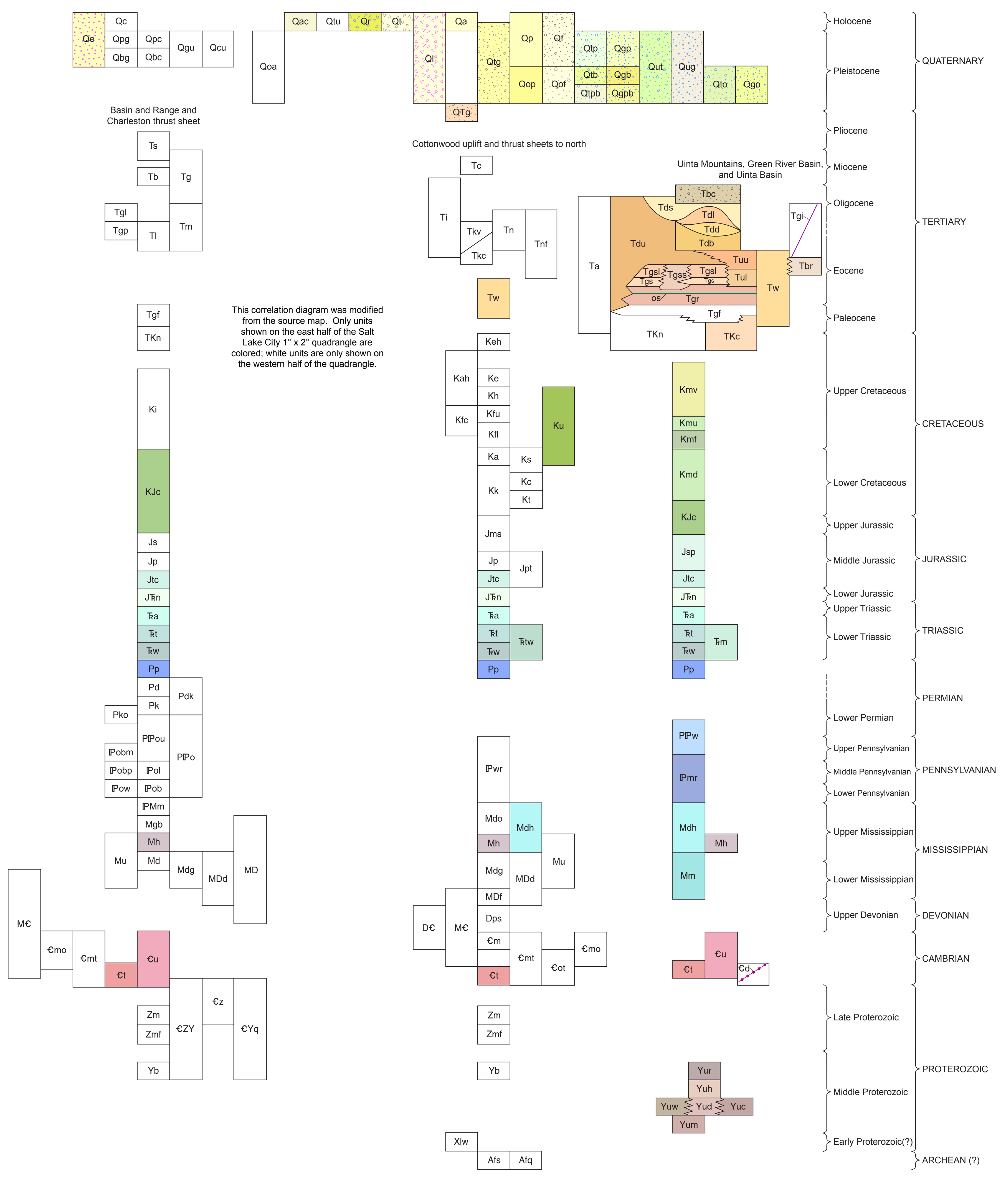
This map was created from geographic information system (GIS) data; it contains many features that do not meet UGS cartographic standards, such as automatically generated labels that may overlap other labels and lines.

GEOLOGIC MAP OF THE EAST HALF OF THE SALT LAKE CITY 1° x 2° QUADRANGLE (DUCHESNE AND KINGS PEAK 30' x 60' QUADRANGLES), DUCHESNE, SUMMIT, AND WASATCH COUNTIES, UTAH, AND UINTA COUNTY, WYOMING

by
Bruce Bryant

2010
(digitized and modified from U.S. Geological Survey Miscellaneous Investigations Series Map I-1997, 1992)

CORRELATION OF MAP UNITS



This explanation sheet was digitized from sheets 1 and 2 in *Geologic and Structure Maps of the Salt Lake City 1° x 2° Quadrangle, Utah and Wyoming* (B. Bryant, 1992, U.S. Geological Survey Miscellaneous Investigations Series Map I-1997, 3 sheets, scale 1:125,000), with minor revisions in 2007 by J. Buck Ehler, Utah Geological Survey (UGS). It was created to accompany the digital map and the geographic information system (GIS) files, not the published map. Only the units and features that are included in the east half of the Salt Lake City 1° x 2° quadrangle are presented here.

DUCHESNE RIVER LITHOLOGIC COLUMN

		SYMBOL	FORMATION	THICKNESS Feet	THICKNESS Meters	LITHOLOGY
CENOZOIC	Q		Alluvial and glacial deposits	0-?	0-?	
	O-M	Tbc	Bishop Conglomerate?	0-50?	0-15?	29 Ma
		Tdu	Duchesne River Formation	0-1500	0-460	Four members, (Tds, Tdl, Tdd, Tdb)
	EOCENE	Tuu Tul	Uinta Formation	1800-5400	550-1645	upper part (Tuu); lower part (Tul)
		Tgr	Green River Formation; Parachute Creek and Douglas Creek members interfinger	1800-2400	550-730	Subsurface Oil producing; Three interbedded lithofacies, (Tgsl=ss and ls; Tgss=ss; Tgs=saline); also includes claystone
	PALEOCENE	TKc	Currant Creek Fm 1500-4800 feet thick west of Duchsene River: Wasatch Fm (Tw)	780	240	Ss, red and green clay; Colton of some reports
			Flagstaff Fm or Mbr (Tgf*) of Green River Fm	70-300?	20-90?	Tan, gray carbonate, clay, and sandstone
			North Horn Formation (TKn)	600-4000?	180-1300?	
MESOZOIC	CRETACEOUS	Kmv	Mesaverde Group	1700-5200	520-1580	Thickens to west; Coal
		Kmu	Mancos Shale	1700-2600	520-800	
		Kmf	Frontier Sandstone	450-660	140-200	
		Kmd	Mowry Shale and lower Mancos	~450	~140	
			Dakota Sandstone			Buckhorn Conglomerate Member 0-50 feet
		KJc	Cedar Mountain Formation	100-160	30-50	
			Morrison Formation	1100-1500	335-460	
	JURASSIC	Jsp	Stump/Curtis Formation	140-210	40-65	
			Preuss Sandstone	670-800	205-245	Entrada of some reports
		Jtc	Twin Creek Limestone	540-950	165-290	Thins to east
		JTRn	Nugget Sandstone	1100-1300	335-400	Navajo of some reports
	? TRIASSIC	TRa	Upper Ankareh/Stanaker/Chinle Fm	300-485	90-150	
			Gartra Grit Mbr	25-100	8-30	
			Lower Ankareh Formation	700-1000	200-300	
		TRt	Thaynes Formation	550-650	170-200	Thins to east
		TRw	Woodside Shale	700-1000	215-300	Thickens to east
			Dinwoody Formation	0-85	0-25	
PALEOZOIC	P	Pp	Park City and Phosphoria Fms	425-625	130-190	
	PENN	PPw	Weber Sandstone	1000-1600	300-500	
		Pmr	Morgan Formation	200-330	60-100	
			Round Valley Formation	200-400	60-120	
	MISS	Mdh	Doughnut Shale	200-250	60-75	
			Humbug Formation	~350	~110	
		Mm	Deseret Limestone	~650	~200	
			Gardison/Lodgepole Limestone	250-500	75-150	"Madison" of old reports
	D		Devonian strata	0-40	0-12	
	Ꞓ	Ꞓmo*	Maxfield Limestone	0-350	0-110	
			Ophir Formation	0-100	0-30	
		Ꞓt	Tintic Quartzite	0-325	0-100	** Research since this map was published determined that the Uinta Mountain Group is 770-740 Ma
PRECAMBRIAN	PROTEROZOIC	Yur	Red Pine Shale	0-2000	0-610	
		Yuh	Uinta Mountain Group: Hades Pass unit of Wallace	~6000-7000	~1800-2100	Maroon to purplish-red
		Yuw	Mt. Watson Fm: Mt Agassiz unit (Yud); Dead Horse Pass (Yud)	1800-3000	550-900	Light gray to white
		Yum	Moosehorn Lake unit of Wallace	500-1000	150-300	

* = not shown on this map

Thicknesses are diagrammatic, no fixed scale.

This lithologic column is provided as an additional resource for the map user. It is not intended to completely match the map units shown on plate 1. However, it provides the user with a more current representation of the stratigraphy within the map area. It was created by Jon K. King of the Utah Geological Survey from various sources to better understand the stratigraphic relationships in the area.

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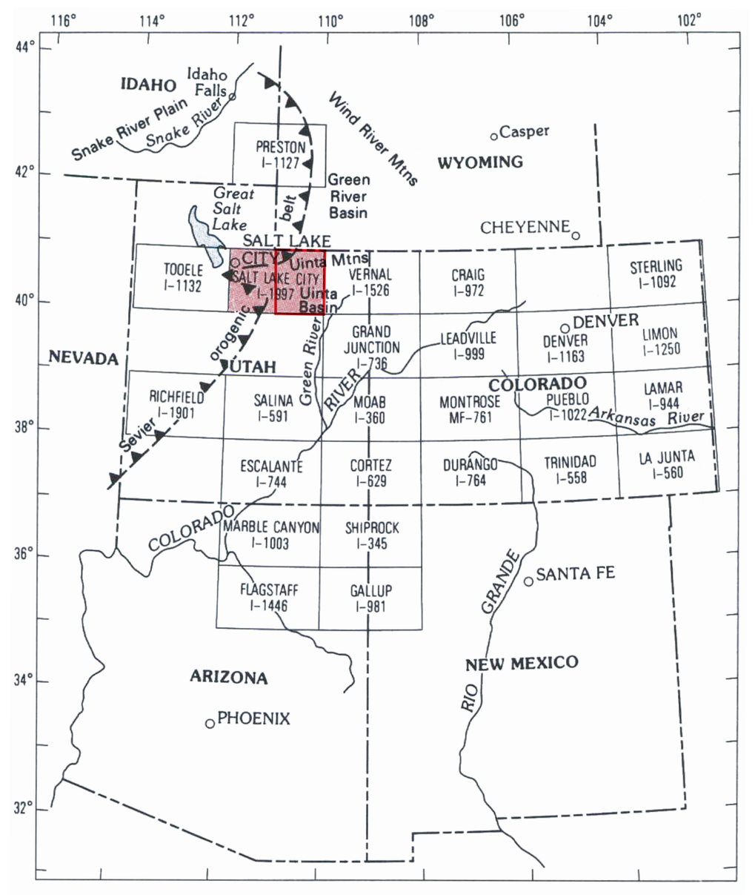
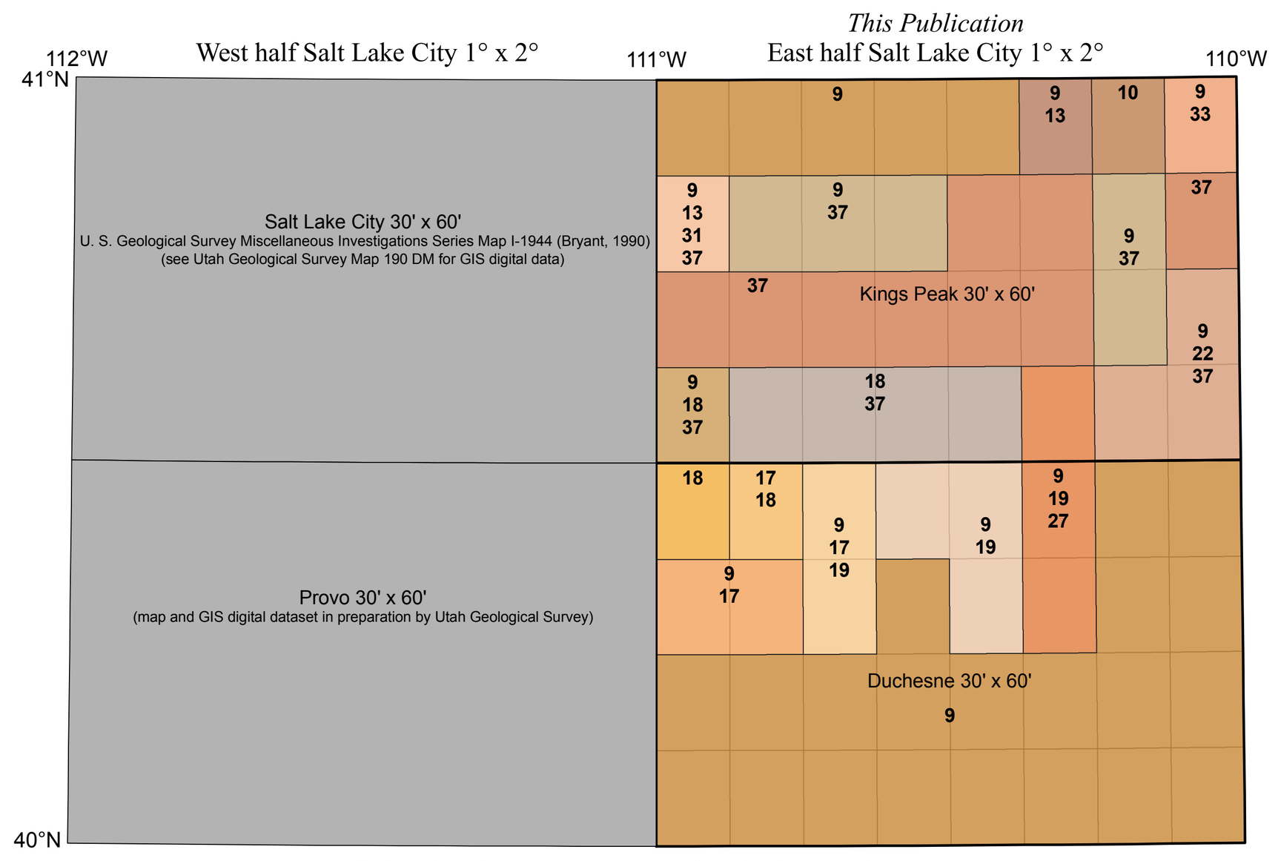
Sprinkel, D.A., and Waanders, G., 2005, Stratigraphy, organic microfossils, and thermal maturation of the Neoproterozoic Uinta Mountain Group in the eastern Uinta Mountains, northeastern Utah, *in*, Dehler, C.M., Pederson, J.L., Sprinkel, D.A., and Kowallis, B.J., 2005, Uinta Mountain Geology: Utah Geological Association Publication 33, p. 63-74.

Dehler, C.M., Porter, S.M., De Gray, L.D., Sprinkel, D.A., and Brehm, A., 2007, The Neoproterozoic Uinta Mountain Group revisited - a synthesis of recent work on the Red Pine Shale and related undivided clastic strata, northeastern Utah, U.S.A., *in* Link, P.K., and Lewis, R., editors, Proterozoic basins of northwestern U.S.: Society for Sedimentary Geology Special Publication 86, p. 151-166.



Index map showing location of Salt Lake City 1° x 2° quadrangle and other published 1° x 2° geologic maps in the area. Heavy, dashed, barbed line shows eastern edge of Sevier Orogenic Belt.



Index showing major sources of geologic map data.

INTRODUCTION

This digital dataset covers the east half of the Salt Lake City 1° x 2° quadrangle, Utah and Wyoming, which was published as U.S. Geological Survey Miscellaneous Investigations Series Map I-1997 in 1992 and is available only as a paper map. Since its publication, the demand for digital and geographic information system (GIS) geologic maps has increased. The Utah Geological Survey (UGS) has responded by creating digital datasets and GIS files of new and previously published geologic maps. The Salt Lake City 1° x 2° quadrangle includes the Salt Lake City, Provo, Kings Peak, and Duchesne 30' x 60' quadrangles. The UGS published a digital geologic map of the Salt Lake City 30' x 60' quadrangle in 2003, and is currently completing a new geologic map of the Provo 30' x 60' quadrangle. New geologic mapping of the Kings Peak and Duchesne 30' x 60' quadrangles has not yet begun and will take several years to complete. This digital dataset and these GIS files, which cover these two quadrangles, are meant to satisfy the demand for a digital geologic map of this area until new geologic mapping can be completed. The source of this dataset is the published geologic map of the 1° x 2° quadrangle. Minor modifications and revisions were made in 2007 by J. Buck Ehler, Utah Geological Survey, including improving the fit to the base map and labeling previously unlabeled map units. Most of the supporting explanatory materials that accompany this dataset were taken from sheet 3 of the published map. We only give descriptions of map units that are present in the east half of the quadrangle, but did not remove discussions of west-half locations or features that are mentioned in these descriptions.

DESCRIPTION OF MAP UNITS

Qac — **Alluvium and colluvium** (Holocene) – Sand, gravel, silt, and clay. Includes solifluction deposit north of Fish Lake in northeastern corner of quadrangle.

Qr — **Rock glacier** (Holocene) – Angular boulders and cobbles at the surface, embedded in a matrix of sand, silt, and possibly ice below the surface. Deposit has a convex cross profile. Maximum thickness several tens of meters.

Qt — **Talus and colluvium** (Holocene) – Angular pebble to boulder gravel, with or without matrix of silt and sand, and gravelly sand and silt; massive to crudely bedded. Maximum thickness about 10 m.

Qa — **Alluvium** (Holocene) – Boulder to pebble gravel, sand, silt, and clay deposited in channels and flood plains of streams. Thickness as much as 3 m.

Qe — **Eolian sand** (Holocene and Pleistocene) – Silty to slightly clayey, fine- to medium-grained sand. Forms dunes as high as 7 m.

Ql — **Landslide deposits** (Holocene and Pleistocene) – Clay to large blocks of rock more than several tens of meters in diameter, deposited by sliding and slumping; includes some material deposited by debris flows.

Qp — **Pediment deposits** (Holocene and Pleistocene) – Boulder, cobble, and pebble gravel in a sand and silt matrix.

Qf — **Alluvial and debris-fan deposits** (Holocene and Pleistocene) – Gravel, sand, and silt; locally contains boulders. Crudely bedded to nonbedded.

Qtg — **Terrace gravels** (Holocene and Pleistocene) – Pebble and cobble gravel, sand, and silt deposited by streams; terraces are several to more than 100 m above modern flood plains. Some deposits may be glacial outwash.

Qop — **Older pediment deposits** (Pleistocene) – Boulder, cobble, and pebble gravel, sand, and silt on dissected pediment remnants.

Qof — **Older alluvial-fan and debris-fan deposits** (Pleistocene) – Poorly sorted gravel, sand, and silt; locally contains boulders; crudely bedded to nonbedded. Fan surfaces are above present drainages and are inactive. Maximum thickness about 10 m.

Qtp — **Till of Pinedale age** (Pleistocene) – Poorly sorted bouldery till. As mapped, may include some colluvium, talus, and landslide deposits.

Qgp — **Outwash deposits of Pinedale age** (Pleistocene) – Poorly sorted gravel and sand.

Qtb — **Till of Bull Lake age** (Pleistocene) – Poorly sorted bouldery till. Bull Lake till contains fewer undrained depressions, and terminal moraines are more widely breached by streams than are Pinedale moraines. Age based on studies by Osborn (1973) and Nelson and Weisser (1985) south of the Uinta Mountains.

Qgb — **Glacial outwash of Bull Lake age** (Pleistocene) – Poorly sorted gravel and sand; surface graded to terminal moraine of Bull Lake age.

Qtpb — **Till of pre-Bull Lake age** (Pleistocene) – Poorly sorted bouldery till. Generally more dissected than till of Bull Lake age; locally forms broad, high, gently sloping moraines, such as those east of the Yellowstone River.

Qgpb — **Glacial outwash of pre-Bull Lake age** (Pleistocene) – Poorly sorted gravel and sand in terraces graded to pre-Bull Lake moraines.

Qut — **Till** (Pleistocene) – Till deeply dissected by Holocene and Pleistocene erosion along Yellowstone River in east-central part of quadrangle.

Qug — **Glacial outwash** (Pleistocene) – Along Beaver Creek in northeastern corner of quadrangle. Compound outwash apron formed during several glaciations; surface material probably mainly of Bull Lake and Pinedale ages.

Qto — **Till of pre-Pinedale age** (Pleistocene) – Poorly sorted bouldery till having more subdued morainal topographic expression than till of Pinedale age. Mapped on north side of Uinta Mountains and at their west end, where the age of tills older than till of Pinedale age is unknown. Many of these deposits may be of pre-Bull Lake age.

Qgo — **Glacial outwash of pre-Pinedale age** (Pleistocene) – Poorly sorted gravel and sand in terraces graded to moraines of till of pre-Pinedale age.

QTg — **Gravel** (Pleistocene or Pliocene) – Unconsolidated pebble, cobble, and boulder gravel underlying highest terraces in Steamboat Mountain area of the Uinta Basin and in the Salt Lake salient (upper Tertiary Hooper Canyon Formation of Van Horn, 1981), and on the north flank of the Uinta Mountains in the northeastern part of the quadrangle. Also mapped in T. 3 N., R. 7 E. in north-central part of the Salt Lake City 1° x 2° quadrangle, where it apparently is lag from underlying gravel, and north of Strawberry Reservoir in south-central part, where it consists of colluvium, landslide debris, and gravel, much of which was derived from the Upper Cretaceous and Paleocene? Currant Creek Formation. Maximum thickness about 40 m.

Tbc — **Bishop Conglomerate** (Oligocene) – Boulder to pebble conglomerate and sandstone. Poorly cemented and rarely forms outcrops. A bed of tuff and tuffaceous sandstone is locally exposed near or at its base. As much as 150 m thick on north and south sides of the Uinta Mountains.

Tkc — **Conglomerate** (Oligocene and Eocene) – Boulder, cobble, or pebble conglomerate containing fragments of sandstone derived from Mesozoic and upper Paleozoic formations that underlie the Keetley Volcanics. Clasts of Nugget Sandstone conspicuous. Contains a few lahars and beds of tuff and volcanic gravel. Includes the Oligocene Tibble Formation north of Mt. Timpanogos (Baker and Crittenden, 1961; Baker, 1964b). Zircon from tuff in conglomerate south of Red Creek Mountain south of the western Uinta Mountains has a zircon fission-track age of 44.9 Ma (C. W. Naeser, written commun., 1980). Maximum thickness about 800 m.

Tgi — **Gilsonite vein** (Upper Eocene or younger) – At Castle Peak in southeastern corner of quadrangle.

Duchesne River Formation (Oligocene, Eocene and Paleocene)

Tds — **Starr Flat Member** (Oligocene) – Ranges from pale-red, moderate-red, reddish-brown, grayish-red boulder conglomerate, sandstone, and minor siltstone and claystone near Uinta Mountains to yellowish-gray sandstone and minor gray and greenish-gray siltstone and claystone near the axis of the Uinta Basin. Unconformably overlies older part of Duchesne River Formation along south flank of the Uinta Mountains in Dry Mountain, Tabby Mountain, and Rock Creek areas. Rapid southward transition to conformable relations and finer-grained, sandstone-rich facies. Maximum thickness about 600 m.

Tdl — **Lapoint Member** (Oligocene) – Predominantly gray siltstone and claystone; includes some beds of orangish-gray sandstone and a few beds of limestone. Contains Duchesnian (probably earliest Chadronian) vertebrate fauna (Emry, 1981) 26 km east of quadrangle. Maximum thickness about 300 m.

Tdd — **Dry Gulch Member** (Oligocene) – Moderate-red and grayish-red sandstone and siltstone and gray claystone. Maximum thickness about 200 m.

Tdb — **Brennan Basin Member** (Oligocene and upper Eocene) – Moderate-red, grayish-red, reddish-brown, yellowish-brown, and yellowish-orange sandstone and less abundant reddish-brown siltstone. A few beds of pebble conglomerate. Contains Uintan (latest Eocene) vertebrate fauna 20 km east of quadrangle (Emry, 1981). Maximum thickness about 200 m.

Tdu — **Duchesne River Formation undivided** (Oligocene, Eocene, and Paleocene) – Moderate-red, grayish-red and gray sandstone, moderate-red siltstone, pale-red to moderate-red pebble to boulder conglomerate and, in the northeastern exposures of the unit, gray siltstone and claystone. Interfingers with upper member of Uinta Formation north of Duchesne and with members of the Duchesne River Formation in the Rock Creek area. Contact with alluvial facies rocks (Ta) at west margin of Uinta Basin near Wadsworth Peak is arbitrary. In Diamond Fork area, includes some beds of marginal lacustrine facies rocks that were included in Green River and Uinta Formations by Baker (1976).

Uinta Formation (Eocene)

Tuu — **Upper member** – Gray mudstone and a few thin beds of sandstone and limestone. Dominantly alluvial in origin but contains some lacustrine beds. Interfingers with Duchesne River Formation (Tdu) west of Duchesne and with part of the sandstone and limestone facies (Tgsl) of the Green River Formation east of Duchesne.

Tul — **Lower member** – Dark-greenish-gray and gray mudstone containing lenticular beds of yellowish-gray, gray, and light yellowish-brown sandstone as much as 6 m thick and scattered continuous beds of white to light-graylacustrine marlstone as much as 3 m thick. Minor beds of grayish-red siltstone and brownish-gray- to yellowish-brown-weathering limestone. A few thin coaly beds. Dominantly fluvial in origin but contains some lacustrine beds. Interfingers with sandstone and limestone facies (Tgsl) of the Green River Formation southeast of Duchesne.

Green River Formation (Eocene and Paleocene)

Tgsl — **Sandstone and limestone facies** (Eocene) – Gray to moderate brown thin-bedded sandstone, siltstone, shale, and limestone. White and dark-gray limestone. Sandstone locally fills channels cut into underlying rocks. Ostracods, gar pike scales, and lenses and stringers of light-brownish-gray chert in some limestone beds. Plant fragments in some beds and a few partings of coaly material. A few greenish-gray and grayish-red siltstone and shale interbeds. Deposited in a marginal lacustrine environment. South of Strawberry Reservoir, unit contains less sandstone than to the east and some beds of oil shale about one meter thick. Grades laterally to sandstone facies (Tgss) and grades downward into saline facies. To east, intertongues with lower member of the Uinta Formation (Tul). As much as 300 m thick.

Tgss — **Sandstone facies** (Eocene) – Generally thin-bedded sandstone containing a few siltstone, shale, and limestone interbeds. Deposited in a deltaic environment.

Tgs — **Saline facies** (Eocene) – Gray to moderate-brown limestone, claystone, dolomite, siltstone, sandstone, oil shale, and tuff. Limestone beds characterized by mottled texture on weathered surface because of dissolution of calcite crystals and saline minerals. Limestone in upper part contains gray chert. Contains beds of mixed halite and sodium-carbonate minerals as much as 6 m thick in the subsurface in the Duchesne area (Dyni and others, 1985). Upper contact with sandstone and limestone facies (Tgsl) is gradational. Intertongues with and grades laterally into sandstone and limestone facies to east and with Duchesne River Formation (Tdu) to the west. As much as 350 m thick.

Tgr — **Main body** (Eocene) – Gray and greenish-gray limestone, shale, sandstone, oil shale, and tuff. As much as 800 m thick.

os — **os** – Oil shale marker bed in the mahogany zone; oil shale 3-4 m thick contains a 2-4 cm thick tuff bed in its upper half.

Tbr — **Bridger Formation** (Eocene) – Yellowish-gray to light-yellowish-brown, brownish-gray, and white, thinly laminated limestone containing nodules and lenses of brownish-black and dark gray chert, and white, very light greenish-gray, and yellowish-gray medium-grained sandstone, red silty sandstone, carbonaceous siltstones, and silty limestone. Mapped only in northeastern corner of quadrangle. At least 150 m thick.

Tw — **Wasatch Formation** (Eocene and Paleocene) – Moderate-red, grayish-red, pale-red, reddish-brown, and gray sandstone, conglomerate, siltstone, and mudstone. Contains scattered thin lenticular beds of light-purplish-gray to light-gray non-marine limestone. Rapid facies changes. Conglomerate contains a variety of pebble- to boulder-size clasts, reflecting diverse source rocks. Maximum stratigraphic thickness in the Mountain Dell-Porterville area on eastern side of Wasatch Range is about 1,500 m and north of the upper reaches of the Weber River is about 1,200 m. In Chalk Creek, near the northern border of area a yellowish-gray-weathering conglomerate forms a basal unit as much as 100 m thick and is overlain by a markedly finer grained sequence of variegated sandstone and siltstone that is overlain by or interfingers to the south with coarse conglomerate derived from Paleozoic and Precambrian rocks of the Uinta uplift. Palynomorphs indicate the lower 200-300 m of the formation is late Paleocene in this area (Lamerson, 1982; Jacobson and Nichols, 1982; Nichols and Bryant, 1990). North of the Uinta Mountains, facies change from coarse conglomerate on the flank of the mountains to sandstone and siltstone, and then to lacustrine rocks of the Green River Formation and lacustrine and alluvial rocks of the Bridger Formation in the Green River basin. The transition to the Green River and Bridger Formations occurs very close to the quadrangle boundary from west of Blacks Fork east to Burnt Fork. This transition is mostly concealed by landslides and slumping involving the overlying Bishop Conglomerate and, in the Beaver Creek-Burnt Fork region in the northeastern corner of quadrangle, by a tongue of Wasatch conglomerate.

TKc — **Currant Creek Formation** (Paleocene? and Upper Cretaceous) – Conglomerate, sandstone, siltstone, and mudstone. Gray, rounded-boulder conglomerate, moderate-red silty sandstone and light-gray sandstone in western part of outcrop belt in central part of quadrangle. Variegated siltstone, sandstone, pebble conglomerate, and a few beds of mudstone in eastern part of belt. At Red Creek, basal 140 m composed of gray silty mudstone, grayish-red and moderate-red siltstone and silty mudstone, medium-grained sandstone, and quartz- and chert-pebble conglomerate. At Red Creek and east of the Duchesne River, basal part contains palynomorphs of the *Aquilapollenites quadrilobus* Interval Zone of late Campanian or early Maastrichtian age (Nichols and Bryant, 1986) and east of the Duchesne River, ostracodes *Timiriasevia* sp., *Cypridea* sp., and a new genus and species; and charophytes *Stellatochara mundula, Mesochara* (two new species), *Strobilochara* sp., and a new genus and species of Late Cretaceous age (R. M. Forester, written commun., 1980). Thickness 0 -1,500 m.

Kmv — **Mesaverde Formation** (Upper Cretaceous) – White, light-gray, and yellowish-gray sandstone; gray siltstone; and dark-gray carbonaceous shale and coal. Iron-oxide-rich concretions in some beds; sandstone crossbedded in part. Crops out on south side of the Uinta Mountains. In the Red Creek-Currant Creek area in south-central part of quadrangle, lower 250 m contains some beds with marine fossils. Lenticular coal beds as much as 5 m thick in upper part of formation at Red Creek. In the Red Creek-Currant Creek area, pollen characteristic of the *Chatangiella* Interval Zone and the *Proteacidites refusus* Interval Zone and megafossils (*Pleuriocardia subcurtum*) indicate that the Mesaverde is Coniacian to Santonian in age (Nichols and Bryant, 1986; W. A. Cobban, written commun., 1979). Thickness ranges from 1,650 m in Currant Creek drainage to 550 m at Dry Mountain east of Duchesne River.

Mancos Shale and Dakota Sandstone

Kmu — **Upper member of Mancos Shale** (Upper Cretaceous) – Medium- to dark-gray and bluish-gray shale and a few beds of gray shaly limestone and calcareous shaly sandstone. Thickens from 500 m to 800 m, from west to east, along the south flank of the Uinta Mountains.

Kmf — **Frontier Sandstone Member of Mancos Shale** (Upper Cretaceous) – White and light-yellowish gray to light-yellowish-brown, fine- to coarse-grained, locally pebbly, cross-bedded sandstone, mudstone, siltstone, and coal. From 135 to 230 m thick; thins and intertongues with shale to the east.

Kmd — **Lower member and Dakota Sandstone**

Lower member of Mancos Shale (Lower Cretaceous) – Dark-gray sandy to silty shale, 25 m thick; 3-5 m of siliceous black shale containing teleost fish scales, which is the local equivalent of the Aspen or Mowry Shale of Early Cretaceous age; in the Red Creek area, black shale 95 m thick. Total thickness 110-130 m.

Dakota Sandstone (Lower Cretaceous) – White to light gray, medium- to coarse-grained, crossbedded, locally pebbly sandstone in two units separated by gray, black, pink and greenish-gray shale. Total thickness from 45 to 70 m.

Ku — **Upper and Lower Cretaceous rocks** – Gray shale, and yellowish-gray sandstone. North of Uinta Mountains, near Moffit Pass, unit contains siliceous shale and coal and correlates with lower member of Frontier Formation (Kfl) and Aspen Shale (Ka). West of Bald Knoll, southwest of the Uinta Mountains, and east of Beaver Creek in the northeastern corner of the quadrangle, correlates with Mesaverde Formation (Kmu) and (or) Frontier Member of the Mancos Shale (Kmf).

KJc — **Cedar Mountain Formation** (Lower Cretaceous) and Morrison Formation (Upper Jurassic) – White, medium-grained sandstone; light-reddish-brown sandstone, calcareous sandstone, and sandy siltstone; light-pinkish-gray sandy limestone; gray nodular limestone; variegated mudstone and siltstone, and gray conglomerate containing chert and quartzite pebbles as much as 10 cm in diameter. Mapped south and southwest of the Uinta Mountains. Thickness from 355 to 810 m; thins eastward.

Jsp — **Stump Formation and Preuss Sandstone** – Mapped along south flank of Uinta Mountains.

Stump Formation – 45 to 67 m thick.

Redwater Member (Upper Jurassic) – Light- to dark-gray-green shale; greenish gray siltstone; and light-gray, white, dark-greenish-gray and brown limestone and glauconite sandstone.

Curtis Member (Middle Jurassic) – Greenish-gray and white, fine-grained calcareous and glauconite sandstone; in Currant Creek area, white, pink, red, dark-red, and pale-lavender limestone and sandy limestone; gray shale locally in upper part.

Preuss Sandstone (Middle Jurassic) – Reddish-brown, grayish-red, light-red, and moderate-red silty sandstone, sandstone, and silty shale. Contains anhydrite and salt in the subsurface in the Chalk Creek and East Canyon graben areas (Lamerson, 1982) where it is locally thickened tectonically. About 300 m thick in the Wasatch Range. Thins eastward along the south flank of the Uinta Mountains from 240 m to 135 m at Lake Fork River.

Jtc — **Twin Creek Limestone** (Middle Jurassic) – Thin- to medium-bedded gray, light-gray, and purplish-gray limestone containing some beds of grayish-red to brown siltstone and sandstone. Thickness 850 m near Parleys Canyon and 400 m near Peoa. Thins eastward along south flank of Uintas to 125 m at Lake Fork River where it contains shale, especially in lower part.

JTRn — **Nugget Sandstone** (Jurassic? and Triassic?) – Pale-grayish-orange fine-grained sandstone, and white quartz sandstone. Planar bedded in lower part, crossbedded in upper part. Becomes whiter and more entirely crossbeddedin the eastern part of quadrangle. Thickness 400 m in Parleys Canyon area, 280 m near Peoa, and 180-210 m along south flank of the Uinta Mountains.

TRa — **Ankareh Formation** (Upper and Lower Triassic)

Upper member (Upper Triassic) – Moderate-red, grayish-red, and grayish-purple mudstone and fine-grained sandstone. Thickness about 210 m in the Wasatch Range and 90-115 m in the Uinta Mountains.

Gartra Member (Upper Triassic) – White to pale-purple, massive, crossbedded, coarse-grained to pebbly quartzite. Thickness as much as 70 m in Wasatch Range; 8-30 m in Uinta Mountains.

Mahogany Member (Lower Triassic) – Purplish-gray and pale-red sandstone, mudstone, and a few thin limestone beds. Thickness 215-305 m.

TRt — **Thaynes Limestone** (Lower Triassic) – Light-gray, thin- to thick-bedded limestone, brownish-gray siltstone, and subordinate light-gray sandstone, pale-red silty limestone, light-gray shaly limestone, and dark-greenish-gray siltstone and shale. In eastern part of quadrangle, interfingers and intergrades with nonmarine redbeds above and below. At Lake Fork River, unit consists of thin- to medium-bedded sandstone, siltstone, and limestone in the lower part, and gray to light-reddish-brown mudstone, shale, siltstone and subordinate beds of limestone and gypsum in the upper part. Thickness 600 m north of Emigration Canyon and 110 m at Lake Fork River on the south side of the Uinta Mountains.

TRw — **Woodside Formation** (Lower Triassic) – Grayish-red, grayish-purple, reddish-brown, and moderate-red shale, siltstone, and fine-grained sandstone, and thin white limestone beds that grade to grayish-red siltstone. Locally a few tens of meters of green or greenish-gray shale and siltstone, at the base, is a tongue of the Dinwoody Formation. White, gray, and greenish-gray beds of shale, siltstone, and limestone in the upper part in the eastern part of the quadrangle south of the Uinta Mountains represent interbeds of and gradation into the Thaynes Limestone. Thickness 120 m north of Red Butte Canyon, 300 m near Park City, and 200-300 m along flanks of Uinta Mountains.

TRtw — **Thaynes Limestone and Woodside Shale** – Widely mapped in Wasatch Range and northeast flank of Uinta Mountains.

TRm — **Moenkopi Formation** (Lower Triassic) – Moderate-red and reddish-brown siltstone and yellowish-gay and pinkish-gray sandstone. Partial section 200 m thick exposed in Burnt Fork area in northeastern corner of quadrangle.

Pp — **Park City Formation and related rocks** (Permian) – Fossiliferous and cherty, gray to pinkish-gray limestone, calcareous siltstone, and cherty sandstone containing, in the middle, a dark-gray phosphatic shale (Meade Peak Phosphatic Shale Member of Phosphoria Formation). Upper part contains about 30 m of moderate-red siltstone and mudstone, reddish-brown and pale-red sandstone and subordinate cherty limestone (the Mackentire Tongue of the Phosphoria Formation of Williams, 1939) in the Lake Fork River and Burnt Fork areas. Thickness 100 m in eastern part of the quadrangle and 700 m on Hobble Creek in southeastern part.

PPw — **Weber Sandstone** (Lower Permian to Middle Pennsylvanian) – Pale-yellowish-gray to white crossbedded quartzite and calcareous sandstone and a few beds of light-gray to white limestone and dolomite. Large-scale crossbedding prominent in upper part in eastern half of quadrangle. The top of the Weber is entirely of Middle Pennsylvanian age in the Wasatch Range (Van Horn and Crittenden, 1987), but Permian (Wolfcampian) foraminifera occur in the uppermost part of the formation in the Uinta Mountains (Bissell, 1964). Thickness generally from 300 to 500 m; ranges from 150 to 750 m south of City Creek Canyon, where attenuated by bedding faults and thickened by folding or fault repetition; and is 600 m east of head of American Fork Canyon.

Pmr — **Morgan Formation and Round Valley Limestone** – Mapped in the Uinta Mountains.

Morgan Formation (Middle Pennsylvanian) – Grayish-red calcareous siltstone and silty limestone; light-greenish-gray siltstone; grayish-red or reddish-brown sandstone; gray fossiliferous limestone containing gray, yellowish-gray, reddish-brown, or pinkish-orange chert; and white to light-gray sandstone. Contact with overlying Weber Quartzite gradational. About 100 m thick.

Round Valley Limestone (Lower Pennsylvanian) – Light-gray-weathering, gray to dark-gray, fossiliferous limestone containing gray and reddish-gray chert and interbeds of gray and light-green shale and siltstone, grayish-red silty shale, and sandstone and sandy limestone. Pale-reddish-orange silicified fossils characteristic. Thickness 130 m in Wasatch Range and 60 m on the north side of the Uinta Mountains.

Mh — **Humbug Formation** (Upper Mississippian) – Medium- to dark-gray limestone and dolomite, and limestone breccia containing beds of reddish-brown to yellowish-gray, brown-weathering sandstone and sparse interbeds of red siltstone. Thickness 100-280 m.

Mdh — **Doughnut Formation and Humbug Formation**

Doughnut Formation (Upper Mississippian) – Medium-gray thin-bedded limestone containing pods of dark-gray to black chert and abundant fossils. A zone from 10- to 30-m-thick of black, greenish, or locally reddish shale at the base contains thin beds of greenish-gray to rusty-weathering silty limestone. Basal black shale contains thin beds of dark-gray limestone and rusty-weathering sandstone in the Uinta Mountains. About 130 m thick in Wasatch Range and 60-90 m in Uinta Mountains.

Humbug Formation – See description above.

Mm — **Madison Limestone** (Upper and Lower Mississippian) – Fine- to coarse-grained, dark-gray dolomite and limestone; abundant gray and white chert in some beds. Dark- to light-gray, thin- to medium-bedded, fossiliferous limestone near base. At base in many places in the western part of the Uinta Mountains are a few meters of dolomite underlain by dolomitic shale and sandstone, and conglomerate, which correlate with the lower part of the Fitchville Formation and the Pinyon Peak Limestone of Late Devonian age (Spreng, 1979). As much as 300 m thick.

Ꞓt — **Tintic Quartzite** (Middle and Lower Cambrian) – Medium- to thick-bedded; fine- to coarse-grained; white, pale-yellowish-gray, or pale-reddish-brown quartzite. Conglomeratic beds in lowest 100 m. Thickness 250-300 m in Wasatch Range. As much as 100 m is locally preserved below pre-Late Devonian unconformity around Uinta Mountains. Is Early Cambrian in Charleston thrust sheet (Baker, 1973) and Early and Middle Cambrian in autochthonous section of the Cottonwood uplift (Bromfield and others, 1970). Inferred to be Middle Cambrian in the Uinta Mountains.

Ꞓd — **Diabase** (Cambrian) – Occurs as dikes 2-6 m thick south and southeast of Gilbert Peak in the Uinta Mountains in northeastern part of quadrangle. Whole rock K-Ar age 552 ± 21 Ma (Ritzma, 1983).

Ꞓu — **Cambrian rocks** –
Northeast of Rock Creek in the Uinta Mountains: Limestone with pink mottling, sandy yellowish-gray limestone, pinkish-gray limestone, grayish-red sandstone, and coarse-grained sandstone overlying yellowish-brown glauconitic sandstone containing green shale interbeds and shaly sandstone above quartzite. The lower two units resemble the Lodore Formation mapped in Dinosaur National Monument 100 km to the east. About 140 m thick.

Uinta Mountain Group

Yur — **Red Pine Shale** (Middle Proterozoic) – Grayish-black to olive-drab siltstone and shale containing thin discontinuous beds of quartzite and arkose. Contains much sandstone and conglomerate between Stillwater Fork and West Fork of Blacks Fork. Maximum thickness about 1,800 m north of Castle Peak in the western Uinta Mountains. Whole rock Rb-Sr age 952 Ma (Crittenden and Peterman, 1975).

Yuh — **Hades Pass unit of Wallace** (1972) (Middle Proterozoic) – Grayish-red, brownish-red, and whitish-gray quartz sandstone, arkose, and shale containing thick moderate-red lenticular shale beds on the northern side and thin discontinuous olive-drab shale beds on the southern side of the Uinta Mountains. Thickness 1,800-3,000 m.

Yuw — **Mount Watson unit of Wallace** (1972); Sanderson (1984) (Middle Proterozoic) – Thick-bedded, yellowish-gray to grayish-white, lithic arkose and fine-grained quartzite containing thin, lenticular, olive-drab shale and siltstone beds. About 1,000 m thick.

Yud — **Dead Horse Pass unit of Wallace** (1972) (Middle Proterozoic) – Pink to red, fine- to medium-grained quartzite and arkosic quartzite. Some beds of olive to dark-olive-green and, locally, reddish-brown shale and siltstone. Includes the Mount Agassiz unit of Wallace (1972). About 900 m thick. Intertongues with Mount Wilson unit of Wallace (1972).

Yuc — **Red Castle unit of Wallace** (1972) (Middle Proterozoic) – Moderate-red to grayish-red and reddish-brown, pebbly, arkosic sandstone and feldspathic shale and siltstone. More than 730 m thick. Intertongues with Dead Horse Pass unit of Wallace (1972).

Yum — **Moosehorn Lake unit of Wallace** (1972) (Middle Proterozoic) – Moderate-red to reddish-brown and olive to dark-olive-green shale and siltstone containing thin lenticular quartzite and arkose beds. About 300 m thick.

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MAP SYMBOLS

- Contact
- Fault – dashed where inferred, dotted where concealed. Only direction of latest movement shown. In the thrust belt many faults have a complex history.
- High-angle fault – dashed where approximately located, dotted where concealed. Bar and ball on down thrown side.
- Thrust fault – dotted where concealed, sawteeth on upper plate.
- Basin-Mountain Boundary thrust fault
- 2000 — Structure contours – Very approximately located. Drawn on top of Dakota Sandstone. Few wells penetrate the Dakota. Mostly extrapolated downward from wells reported to penetrate Cretaceous rocks. Contour intervals 2000 ft (610 m).
- Anticline – showing direction of plunge
- Syncline – showing direction of plunge
- Scarp – Prominent scarp between levels of terraces in the Uinta Basin. (Arrows point downslope.)
- Oil-shale marker bed in the mahogany zone (os)
- Gilsonite vein (Tgi)
- Diabase dike (Ꞓd)