

Interim Geologic Map of the Rays Valley Quadrangle, Utah County, Utah

by

Kurt N. Constenius

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Map Unit Descriptions

- Qal** Stream and floodplain alluvium (Holocene) - Sand, silt, clay, and gravel in channels and floodplains; composition depends on source area; 0 to 20 feet (0-6 m) thick.
- Qaf** Alluvial-fan deposits, undivided (Holocene and upper[?] Pleistocene) - Mostly sand, silt, and gravel that is poorly stratified and poorly sorted; typically deposited at drainage mouths; some fans deflect active stream channels; generally less than 40 feet (12 m) thick.
- Qafo** Older alluvial-fan deposits (Pleistocene) - Mostly sand, silt, and gravel that is poorly stratified and poorly sorted; Qafo fans are deeply incised by younger drainages and are likely middle Pleistocene in age; some may be as old as early Pleistocene or Pliocene. Only upper extent is in map area; better developed to west in Billies Mountain quadrangle, where it is capped by gently dipping surfaces; to west up to 240 feet (70 m) above adjacent Diamond Fork and about this thickness is exposed.
- Qac** Alluvium and colluvium (Quaternary) - Includes stream and fan alluvium, colluvium, and, locally, mass-movement deposits; 0 to 20 feet (0-6 m) thick.
- Qc** Colluvium (Quaternary) - Includes slopewash and soil creep; composition depends on local bedrock; mapped in northwest corner of quadrangle; generally less than 20 feet (6 m) thick.
- Qct** Colluvium and talus, undivided (Quaternary) - Angular debris at the base of and on steep, variably vegetated slopes; estimate 0 to 10 feet (0-3 m) thick.
- Qms** Slides and slumps (Quaternary) - Poorly sorted clay- to boulder-sized material; generally characterized by hummocky topography, main and internal scarps, and chaotic bedding in displaced bedrock; locally includes flow deposits; morphology becomes subdued with age; dip-slopes of Tertiary units, particularly the lower member of the Green River Formation (Tgl), are the most susceptible to mass movements; thicknesses highly variable.
- Tgm** Green River Formation, middle member (middle Eocene) - Lower part is dominantly dark brown, light-bluish-gray-weathering, fissile to platy, thinly laminated oil shale and marlstone; only lower part exposed on east side of map area; upper part of middle member, exposed to east of map area, is mostly greenish-gray and gray mudstone, gray siltstone, and tan, fine- to medium-grained sandstone; distinctive small steel-blue to dark-bluish-gray concretions throughout middle member; at least 2200 feet (670 m) thick in complete sections.
- Tgl** Green River Formation, lower member (middle Eocene) - Greenish-gray, fissile to blocky

shale and mudstone as very thick beds separated by thinly laminated, gray marlstone; also contains gray-green, waxy-textured claystone and thin-bedded, brown-weathering sandstone that is locally micaceous; rare vertebrate fossils (gar scales, turtle and crocodile scutes) found as lag deposits in fluvial sandstone; oil shale, some with crushed fossil gastropod shells (samples KNC092299-11 and KNC102099-4), common near base; at least 1200 feet (365 m) thick.

- Tc** Colton Formation (lower Eocene) - Medium- to coarse-grained, light-gray, light-brown-weathering, calcareous sandstone in thin to thick beds; interbedded with medium-gray, microcrystalline limestone, and red-brown, gray and gray-green mudstone; top of formation in Rays Valley quadrangle is at the top of an extremely fossiliferous sandstone bed containing *Unionidae* bivalves, gastropods, and vertebrate fossils (gar scales, crocodile teeth, crocodile and turtle scutes and bones) (sample KNC102099-1) (H.G. Pierce, University of Nebraska State Museum, written communication, 2000); 100 to 170 feet (30-50) m thick.
- Tf** Flagstaff Limestone (lower Eocene) - Medium-gray, very thick-bedded, microcrystalline limestone; weathers white and light gray; hard and brittle; forms cliffs; interbedded with less-resistant, variegated brick-red, purplish-gray, maroon, red-brown, yellow and gray marlstone and calcareous mudstone that weathers light gray; light-gray to gray, thick beds of pebble to cobble conglomerate sporadically intercalated with other lithologies; light-gray, thin- to medium-bedded, medium- to coarse-grained sandstone increases in abundance up section; 330 to 400 feet (100-120 m) thick.
- Tn** North Horn Formation, upper member (upper Paleocene and lower Eocene) - Lower part is brick-red, thick- to very thick-bedded mudstone, marlstone, siltstone, and sandstone. Upper part is unstratified to crudely thick-bedded, medium-gray-weathering, dense, microcrystalline limestone and marlstone, some light gray, but predominantly mottled brick red, purplish gray, maroon, red brown, yellow and gray; some upper limestone beds (sample KNC051600-4) contain late Paleocene-early Eocene fossil aquatic gastropods *Hydrobia* sp., *Viviparidae* sp., and *Lioplacoididae* sp. and the bivalves *Unionidae* sp. and *Elliptio* sp. (H.G. Pierce, University of Nebraska State Museum, written communication, 2000); a late Paleocene age for the upper part of the unit is based on the presence of palynomorphs *Carya veripites*, *Alnus* sp., *Ulmipites* sp., and *Kurzipites* sp. (Horton and others, 2004). Conglomerate locally present as thick, lenticular, channel-fill deposits containing pebbles to rare boulders of Pennsylvanian-Permian Oquirrh Formation. Total upper member about 400 to 560 feet (120-170 m) thick.
- TKn** North Horn Formation, lower “Red Narrows” member (Upper Cretaceous, Maastrichtian, and Paleocene) - Light- to medium-gray or brick-red or red-brown conglomerate, commonly discolored by red-colored slopewash from thin, interbedded, red mudstone; medium- to very thick-bedded; cobble- to boulder-sized clasts of Pennsylvanian-Permian Oquirrh Formation sandstone, quartzite, and limestone predominate; rare lignite and dark-

gray carbonaceous shale containing terrestrial and aquatic fossil gastropods found in uppermost part of unit along Diamond Fork near Coal Mine Campground (samples KNC061400-9 and KNC101401-1); palynomorphs from these carbonaceous shales suggest a late Paleocene age based on the presence of *Carya veripites*, *Alnus* sp., *Ulmipites* sp., and *Kurzipites* sp. (see Horton and others, 2004, figure 2, site 6, sample P1); 934 feet (285 m) thick in Amoco Cottonwood Canyon #1 well (calculated using 8° dip), thickens in subsurface to south and southeast to as much as 1640 feet (500 m) thick (this report; Horton and others, 2004; see also Walton, 1959).

- Kpc** Price River Formation and Castlegate Sandstone (Upper Cretaceous, Campanian-Maastrichtian) - Light-gray, thick- to very thick-bedded, cobble to boulder conglomerate, dominated by well-rounded, gray and tan, quartzite clasts; largest boulders exceed 10 feet (3 m) across; minor intercalated sandstone; conglomerate contains light silvery-gray sandstone matrix; matrix also characterized by white, smooth- to earthy-textured, clay blebs; occasional yellow-brown and brownish-black iron oxide cement also noted in both outcrop and in borehole cuttings; lithic clasts are >99% Pennsylvanian-Permian Oquirrh Formation quartzite, quartzite clasts derived from Proterozoic Mutual Formation and Cambrian Tintic Quartzite present in trace amounts; overlain and underlain with angular unconformity by TKn and Kcm, respectively; thickness varies from 0 where unit has been eroded away beneath lower “Red Narrows” member (TKn) to 340 feet (103 m) in Amoco Cottonwood Canyon #1 well (calculated using 8° dip), and 402 feet (123 m) in Mountain Fuel Thistle Dome #1 well (calculated using 20° dip).
- Kcm** Cedar Mountain Formation (Lower Cretaceous) - Mapped on west edge of Rays Valley quadrangle. In Billies Mountain quadrangle to west, variegated greenish-gray, red-brown, and lavender mudstone, interbedded with gray, red, and buff, coarse- to fine-grained sandstone and siltstone; minor nodular limestone and conglomerate; 465 feet (142 m) thick (Young, 1976). Includes Morrison Formation of some workers (for example Imlay, 1980).
- Jsv** Summerville Formation (Middle Jurassic) - Red-orange mudstone, siltstone, and sandstone; mapped on west edge of Rays Valley quadrangle and to west in Billies Mountain quadrangle and conformably overlies Curtis Formation; seismic data suggest this unit subcrops in the southwest part of the Rays Valley quadrangle, unconformably below lower “Red Narrows” member of North Horn Formation; see Imlay (1980) for correlation; 395 feet (120 m) thick (Young, 1976).
- Jce** Curtis and Entrada Formations, undivided (Middle Jurassic) - Barely exposed in this quadrangle, larger exposures in Billies Mountain quadrangle, and, from seismic data, present in subsurface unconformably below North Horn Formation in west half and southeast corner of Rays Valley quadrangle (Constenius and others, 1999); lateral equivalent of lower (Curtis Member of) Stump and Preuss Formations; see Imlay (1980) for more information. Curtis - Greenish-gray, sandy shale, mudstone, and sandstone,

with minor dark-red-brown sandstone; about 400 feet (120 m) thick. Entrada - Dark-red, red-brown, and purplish red-brown, with minor light-gray and light-brown, thin- to medium-bedded sandstone and siltstone; about 1000 feet (300 m) thick.

- Ja** Arapien Shale (Middle Jurassic) - Mapped in Billies Mountain quadrangle, and, from seismic data, present in subsurface unconformably below North Horn Formation in west half and southeast corner of Rays Valley quadrangle (Constenius and others, 1999); lateral equivalent of Giraffe Creek and Leeds Creek members of Twin Creek Limestone. Light-gray-green and light-gray shale interbedded with light-gray, tan-weathering, ripple cross-laminated, calcareous siltstone and sandstone; minor interbeds of red shale, light-yellow-gray sandstone, and gray-green to brown, micritic limestone; thickness about 560 feet (170 m).
- Jtwl** Twin Creek Limestone, Watton Canyon, Boundary Ridge, Rich, Sliderock, and Gypsum Spring Members (Middle Jurassic) - Unit mapped to west in Billies Mountain quadrangle where Giraffe Creek and Leeds Creek members are indistinct and are shown by some workers as the Arapien Shale; from seismic data, present in subsurface unconformably below North Horn Formation in northwest and southeast parts of Rays Valley quadrangle (Constenius and others, 1999); about 600 feet (180 m) thick (Imlay, 1980).
Watton Canyon Member (Middle Jurassic) - Dark-gray, medium- to thick-bedded, lime micrite to wackestone with oolites and pelecypod fragments; resistant ridge former; micrites display a characteristic spaced, bedding-normal fracture; about 350 feet (110 m) thick in east Billies Mountain quadrangle (after Young, 1976).
Boundary Ridge Member (Middle Jurassic) - Red to purplish-red shale and siltstone, and minor gray siltstone; recessive and poorly exposed; 200 feet (60 m) measured in east Billies Mountain quadrangle (Young, 1976).
Rich, Sliderock and Gypsum Spring Members (Middle Jurassic) - Light-gray, soft, shaly limestone in upper part; dark-gray, thick-bedded, bioclastic limestone in middle, and thin (5-foot [1.5-m] thick) purple shale at base; 455 feet (140 m) measured in east Billies Mountain quadrangle (Young, 1976).
- Jn** Navajo Sandstone (Lower Jurassic) - Red-brown, salmon, and buff, massive-weathering, cross-bedded, moderately cemented to friable, noncalcareous, well-rounded, fine- to medium-grained sandstone, with common frosted grains; Nugget Sandstone of some previous workers (for example Baker, 1947); mapped in northwest part of quadrangle and unconformably overlain by North Horn Formation (TKn); about 1450 feet (385-440 m) thick (this report; Baker, 1947).
- Trau** Ankareh Formation, upper member (Upper and Lower[?] Triassic) - Brick-red, reddish-brown, purplish-red, and reddish-gray, thin-bedded mudstone, siltstone, and medium- to thin-bedded, fine-grained sandstone; siltstone is locally micaceous; some calcareous siltstone; green reduction spots common; mapped in northwest part of quadrangle, where only upper member likely exposed; in part unconformably overlain by North Horn

Formation; Baker (1947) reported a total thickness of 1530 feet (466 m) to the west in the Billies Mountain quadrangle.

SUBSURFACE UNITS

Well data for interpretations of lithologies, formation tops, and structural geology are from multiple sources. Wells (with data sources) include: Amoco Cottonwood Canyon #1 (Welsh, 1981 and unpublished log; American Stratigraphic Company (Amstrat) Report D-5855, 1984; Tooke Engineering mudlog; and dipmeter log; Mountain Fuel Supply (MFS) Thistle Dome #1 (Welsh, 1981; Amstrat log number D-4238, 1972; and dipmeter log); and older wells drilled in Diamond Fork anticline (Neighbor, 1959; Welsh, 1981, Sun Diamond Fork #2).

- Tra Ankareh Formation (Upper and Lower Triassic) - Brick-red, reddish-brown, purplish-red, and reddish-gray, thin-bedded mudstone, siltstone, calcareous siltstone and fine-grained sandstone; minor purplish gray and gray mudstone and siltstone; coarse-grained sandstone to pebble conglomerate of middle member not recognized; 1973 feet (601 m) penetrated in Amoco Cottonwood Canyon #1 well, but structurally repeated in uppermost part of formation; over 4037 feet (1230 m) of steep-dipping and thrust-faulted Ankareh drilled in MFS Thistle Dome #1 well; about 1550 feet (480 m) thick in exposures to west (Baker, 1947).
- TRt Thaynes Formation, undivided (Lower Triassic) - Greenish-gray to brownish-gray, thin-bedded, silty limestone and fine-grained, calcareous sandstone; exposed in Billies Mountain quadrangle. Neighbor (1959) reported a dip-corrected, subsurface thickness of 1450 feet (440 m) on Diamond Fork anticline in Billies Mountain quadrangle and Baker (1947) reported 1340 feet (410 m) measured at mouth of Diamond Fork, Billies Mountain quadrangle.
- TRtu Thaynes Formation, upper member (Lower Triassic) - Gray siltstone with some grayish-green shale and greenish-gray limestone; about 700 feet (215 m) thick in Amoco Cottonwood Canyon #1 well (calculated using 8° dip).
- TRad Ankareh Formation, Decker tongue of Smith (1969) (Lower Triassic) - Dark-red to brownish-red, micaceous siltstone and silty shale with minor fine-grained sandstone; about 220 feet (65 m) penetrated on Diamond Fork anticline (after Welsh, 1981, log; not dip adjusted), and about 321 feet (98 m) drilled in Amoco Cottonwood Canyon #1 well (calculated using 6° dip).
- TRtl Thaynes Formation, lower member (Lower Triassic) - Greenish-gray to brownish-gray, thin-bedded, siltstone, silty limestone and limestone; brachiopod shells common in parts; 600 feet (180 m) penetrated in Sun Oil Diamond Fork #2 well on Diamond Fork anticline (after Welsh, 1981, text and log; not dip adjusted); 1053 feet (321 m) drilled in Amoco Cottonwood Canyon #1 well, not dip adjusted because fold-hinge in lower part of unit.

- TRW Woodside Shale (Lower Triassic) - Dark-red to red-brown shale and siltstone; 600 feet (180 m) thick corrected for dip on Diamond Fork anticline (Neighbor, 1959); about 880 feet (268 m) penetrated in Diamond Fork anticline (Welsh, 1981, log; not adjusted for dip) and 780 feet (238 m) drilled in Amoco Cottonwood Canyon well (calculated using 5° dip).
- Ppf Park City Formation, Franson Member - Dolomite; light tannish gray and brown; weathers very light tannish-gray to white; very thick bedded; silty to sandy; with small, quartz-filled vugs and light-gray, white, tan, and brown chert as nodules and stringers; commonly highly fractured to brecciated; minor white to light gray anhydrite and shale; about 820 feet (250 m) penetrated in Diamond Fork anticline, Billies Mountain quadrangle (Gerster and Plympton units of Welsh, 1981; not dip adjusted); about 660 feet (203 m) drilled in Amoco Cottonwood Canyon #1 well (Sinbad and Plympton units on Welsh unpublished log) (calculated using 6° dip); Baker and others (1949) reported more than 830 feet (>250 m) exposed in Wasatch Range.
- Ppm Phosphoria Formation, Meade Peak Phosphatic Member - Very dark gray to black, fissile, siliceous shale; lesser dark-gray and black, pelletal phosphatic shale and phosphatic limestone and dolomite that weather very dark gray with bluish cast; occasional thin-bedded, medium-gray siltstone with brown and gray laminations; 230 to 320 feet (70-98 m) penetrated in Diamond Fork anticline, Billies Mountain quadrangle, and 305 feet (93 m) penetrated in Amoco Cottonwood Canyon #1 well (Welsh, unpublished log) (calculated using 6° dip, though may be structurally thickened by small-scale faulting and folding).
- Ppg Park City Formation, Grandeur Member - Dominantly dolomite in upper two-thirds that is medium to dark gray and fine to medium crystalline, with dispersed, white, chert nodules; lower part is medium-gray, shelly, dolomitic lime wackestone; both parts thick bedded, with dark-gray, 0.4- to 0.8-inch-thick (1-2 cm) chert layers; in the Amoco Cottonwood Canyon #1 well, 788 feet (240 m) were penetrated (calculated using 6° dip). Baker (1947) reported an 883-foot (269 m) thickness to west in the Wasatch Range.
- Pdc Diamond Creek Sandstone/Formation (Permian) - Light-gray, tan, and orangish-red-brown, very fine- to medium-grained sandstone, with siliceous cement, and minor dolomite and anhydrite cements; minor thin beds of white anhydrite. In contrast, exposures in Little Diamond Creek area, Billies Mountain quadrangle, are ledge-forming, buff- and salmon-colored, cross-bedded, medium- to coarse-grained sandstone with lesser thin-bedded, sandy limestone and dolomite; 1273 feet (388 m) drilled in Amoco Cottonwood Canyon #1 well (calculated using 6° dip). Baker (1947) reported an 835-foot (255-m) thickness to west in Granger Mountain quadrangle.
- Pk Kirkman Limestone (Permian, Wolfcampian) - Very light gray, gray and very dark gray, thick- to medium-bedded, unstratified to thinly laminated, dolomitic limestone;

intraformational breccia makes up upper two-thirds of Kirkman and consists of dark-gray to black beds of chaotic, thinly laminated, limestone breccia clasts, and lighter gray beds of unstratified, dolomitic limestone; anhydrite at base of unit; contains rare, thin beds of red-weathering, gray, sandy limestone; strong fetid odor when broken; white calcite veins common; 190 or 300 feet (60 or 90 m) penetrated in Diamond Fork anticline, Billies Mountain quadrangle, depending on contact with underlying Granger Mountain Formation (after Welsh, 1981 text and log, not dip adjusted), and 325 feet (100 m) were drilled in the Amoco Cottonwood Canyon #1 well (calculated using 6° dip).

Pogm Oquirrh Formation, Granger Mountain Member (Permian, Wolfcampian) - Gray, limy, very fine grained sandstone and siltstone; minor beds with black films (track and trail markings?); interbedded with gray, dolomitic sandstone, dolomite, and light-gray limestone; 2813 feet (857 m) penetrated by Cottonwood Canyon #1 well; 8200 to 10,255 feet (2500 to 3126 m) thick on Wallsburg Ridge north of the quadrangle (after Baker, 1976, using our contact; and Welsh, 1981; respectively). Oldest unit penetrated by boreholes in area.

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- Young, G.E., 1976, Geology of Billies Mountain quadrangle, Utah County, Utah: Brigham Young University Geology Studies, v. 23, part 1, p. 205-280, scale 1:31,680.

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- Merrill, R.C., 1972, Geology of the Mill Fork area, Utah: Provo, Utah, Brigham Young University Geology Studies, v. 19, pt. 1, p. 65-88, scale 1:50,000.
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- Prescott, M.W. 1958, Geology of the northwest quarter of the Soldier Summit [15'] quadrangle, Utah: Provo, Utah, Brigham Young University Research Studies, Geology Series, v. 5, no. 2, 44 p., scale 1:31,680.

Map Symbols


 contact, dashed where approximately located, dotted where concealed

 normal fault, dashed where approximately located, dotted where concealed, ball and bar on hanging wall


fold hinge-zone trace (red), dashed where approximately located (extrapolated where concealed), arrow indicates plunge, upright

 anticline

 syncline


 mass-movement scarp


strike and dip of bedding

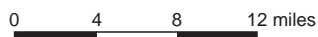
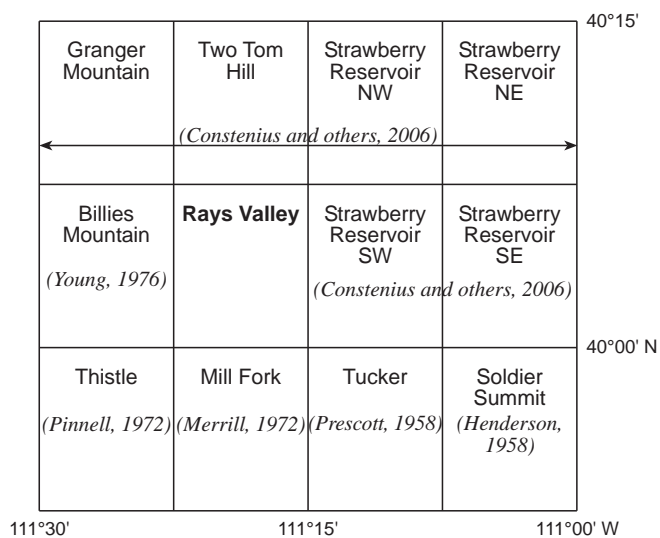
 upright

 horizontal

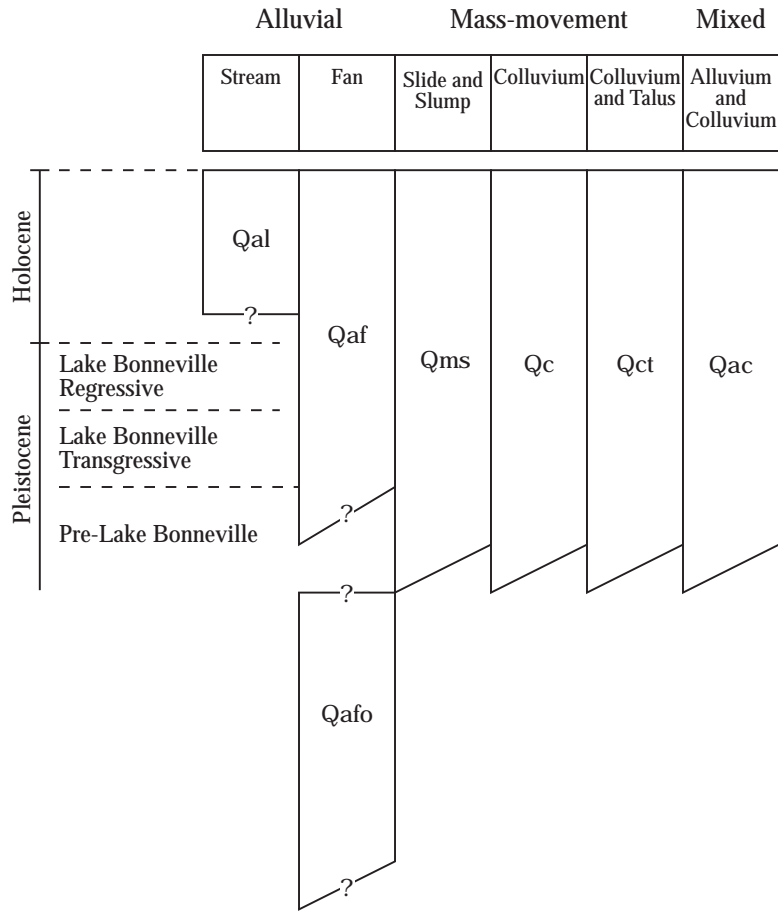
 KNC102099 sample location with number

 springs
H=hot to warm
C=cold
S=sulphur
M=methane bubbles

 boreholes, with name
Amoco Cottonwood Canyon



Index to Rays Valley (**bold**) and adjacent quadrangles, central Utah. See reference list for adjacent geologic mapping (*authors and dates in italics*).



RAYS VALLEY QUADRANGLE
QUATERNARY CORRELATION CHART

EXPOSED UNITS

Unconformity

Tgm
Tgl
Tc
Tf
Tn
TKn

Unconformity

Kpc

Unconformity

Kcm

Unconformity

Jsv
Jce
Ja
Jtwl

Unconformity

Jn

Unconformity

Rau

SUBSURFACE UNITS

Ra	
Rt	Rtu
	Rad
	Rtl
Rw	

Unconformity

Ppf
Ppm
Ppg
Pdc
Pk
Pogm

RAYS VALLEY QUADRANGLE BEDROCK CORRELATION CHART

