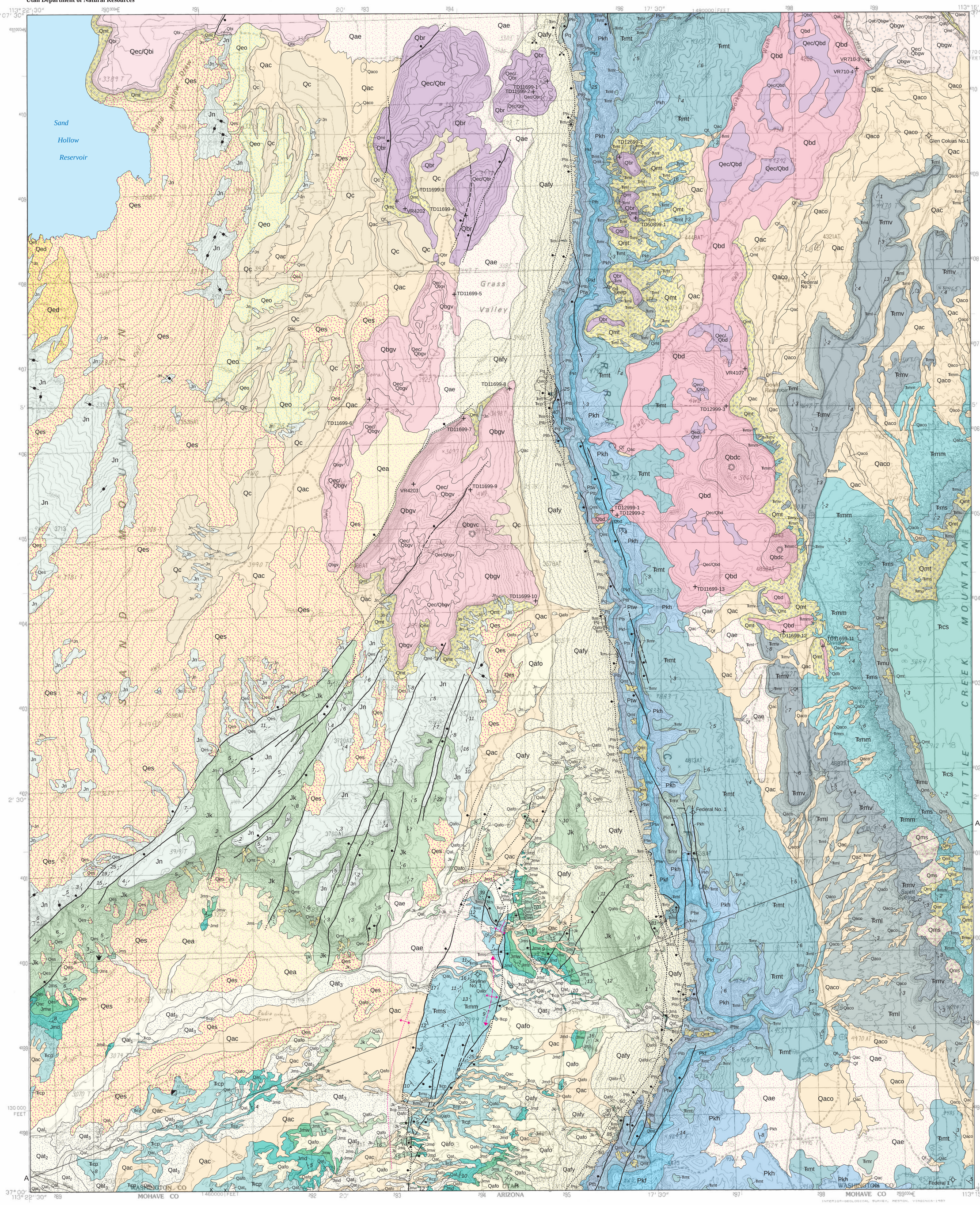
UTAH GEOLOGICAL SURVEY
a division of the
Utah Department of Natural Resources



Base map from U.S. Geological Survey
The Divide 7.5' quadrangle, 1986

Cartographer, Lori J. Douglas

SCALE 1 : 24,000

1 1/2 0 1 MILE

1000 0 1000 2000 3000 4000 5000 6000 7000 FEET

1 .5 0 1 KILOMETER

CONTOUR INTERVAL 20 FEET
NATIONAL GEODETIC VERTICAL DATUM OF 1929

12°58'
230 mils

2004 MAGNETIC DECLINATION
AT CENTER OF SHEET

UTAH

QUADRANGLE LOCATION

1	2	3
4		5
6	7	8

1 Harrisburg Junction
2 Hurricane
3 Virgin
4 Washington Dome
5 Little Creek Mountain
6 Yellowhorse Flat
7 Rock Canyon
8 Whitmore Point

ADJOINING 7.5' QUADRANGLE NAMES

This geologic map was funded by the Utah Geological Survey and the U. S. Geological Survey, National Cooperative Geologic Mapping Program, through Statemap Agreement No. 98HQAG2067

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GEOLOGIC MAP OF THE DIVIDE QUADRANGLE, WASHINGTON COUNTY, UTAH

by

Janice M. Hayden

2004

DESCRIPTION OF MAP UNITS

QUATERNARY

Qal_1 Stream deposits -- *Moderately to well-sorted clay to fine gravel deposits in large active drainages; includes terraces up to 10 feet (3 m) above active channels; 0 to 10 feet (0-3 m) thick.*

Qat_{2-3} Stream-terrace deposits -- *Moderately sorted, well-rounded, pebble- to cobble-size clasts in a muddy to coarse sand matrix. Qat_2 includes deposits adjacent to and dissected by Qal_1; upper surface up to 30 feet (9 m) above active channels; 0 to 20 feet (0-6 m) thick. Qat_3 forms an indurated, pedogenic carbonate-cemented conglomerate; upper surface 30 to 90 feet (9-27 m) above active channels; typically 0 to 40 feet (0-12 m) thick.*

Qafy Younger alluvial-fan deposits -- *Poorly to moderately sorted boulder- to clay-size sediment deposited at the base of the Hurricane Cliffs and locally at the mouths of active drainages; 0 to about 50 feet (0-15 m) thick.*

Qafo Older alluvial-fan deposits -- *Poorly to moderately sorted boulder- to clay-size sediment deposited at the base of the Hurricane Cliffs; forms deeply dissected surfaces; 0 to about 50 feet (0-15 m) thick.*

Qf Artificial-fill deposits -- *Engineered fill and general borrow material used to create small dams; thickness variable.*

Qc Colluvial deposits -- *Poorly sorted, angular to rounded blocks in a muddy to sandy matrix, deposited by sheet wash and soil creep on moderate slopes; only larger deposits mapped, and these locally include eolian, talus, debris-flow, and alluvial deposits too small to map separately; 0 to 20 feet (0-6 m) thick.*

Qes Eolian-sand deposits -- *Well- to very well-sorted, very fine- to medium-grained, well-rounded, usually frosted, mostly quartz sand derived primarily from the Navajo and Kayenta Formations; commonly deposited in irregular hummocky mounds on the lee side of ridges, as well as on Sand Mountain and in Warner Valley; locally forms poorly developed dunes; 0 to 50 feet (0-15 m) thick.*

Qed Eolian-dune-sand deposits -- *Well- to very well-sorted, very fine- to medium-grained, well-rounded, usually frosted, mostly quartz sand in dune form on Sand Mountain; derived primarily from the Navajo Sandstone; 0 to 40 feet (0-12 m) thick.*

Qeo Caliche and eolian-sand deposits -- *Well-developed soil carbonate (Stage IV carbonate of Birkeland and others, 1991) with lesser eolian sand; generally forms planar surfaces on top of the Navajo Sandstone that are covered with nodular caliche and sparse eolian sand; 0 to 10 feet (0-3 m) thick.*

Qmt Talus deposits -- *Very poorly sorted, angular boulders with minor fine-grained interstitial materials; deposited on and at the base of steep slopes; 0 to 20 feet (0-6 m) thick.*

Qms Landslide deposits -- *Very poorly sorted clay- to boulder-size, locally derived debris in chaotic, hummocky mounds; located on steep slopes of Little Creek Mountain below the Shinarump Conglomerate, with slip surfaces in the middle red member of the Moenkopi Formation; thickness highly variable.*

Qae, Qaeo Mixed alluvial and eolian deposits -- *Moderately to well-sorted, clay- to sand-sized alluvial sediment that locally includes abundant eolian sand and minor alluvial gravel; minor pedogenic carbonate development; Qae mapped in small valleys east of the Hurricane Cliffs and in Grass Valley; Qaeo forms deeply dissected deposit in Gould Wash; 0 to 30 feet (0-9 m) thick.*

Qea Mixed eolian and alluvial deposits -- *Well-sorted eolian sand with minor clay- to gravel-size alluvial sediment; locally reworked by alluvial processes; 0 to 20 feet (0-6 m) thick.*

Qac, Qaco Mixed alluvial and colluvial deposits -- *Poorly to moderately sorted clay- to boulder-size sediment in minor drainages; gradational with colluvial deposits; Qac deposits are in active drainages and Qaco deposits are older and are dissected by active drainages; includes minor terraces too small to map separately; 0 to 10 feet (0-3 m) thick.*

Qbgw Gould Wash basalt flow -- *Dark-gray, very fine-grained olivine basalt; abundant olivine phenocrysts; generally 20 to 30 feet (6-9 m) thick; yielded an $^{40}Ar/^{39}Ar$ age of 0.278 ± 0.018 Ma (Downing, 2000); originated at cinder cone to the east in the Little Creek Mountain quadrangle; Qec/Qbgw indicates a veneer of eolian sand and pedogenic carbonate generally less than 3 feet (1 m) thick that partly conceals underlying flow.*

Qbd, Qbdc The Divide basalt flow and cinder cones -- *Dark-gray, very fined-grained olivine basalt to borderline basanite; cascaded over Hurricane Cliffs; north-trending dike in the SW1/4 section 12, T. 43 S., R. 13 W. may have been a partial source of flow; yielded an $^{40}Ar/^{39}Ar$ age of 0.41 ± 0.08 Ma; Qbdc denotes two partially eroded cinder cones; Qec/Qbd indicates a veneer of eolian sand and pedogenic carbonate generally less than 3 feet (1 m) thick that partly conceals underlying flow.*

Qbi Ivans Knoll basalt flow -- *Medium-gray, fine- to medium-grained olivine basalt; olivine phenocrysts up to about 0.1 inch (3 mm) across; forms highland along northwest edge of quadrangle; erupted from vent to north in the Hurricane quadrangle; 15 to 25 feet (5-8 m) thick; yielded $^{40}Ar/^{39}Ar$ ages of 1.03 ± 0.02 Ma and 0.97 ± 0.07 Ma (Biek, 2003b); Qec/Qbi indicates a veneer of eolian sand and pedogenic carbonate generally less than 3 feet (1 m) thick that partly conceals underlying flow.*

Qbr Remnants basalt flow -- *Dark-brownish-black to dark-gray, medium-grained olivine basanite; remnant of deeply eroded cinder cone present near the "Three Brothers"; displaced by the Hurricane fault, and deeply eroded on footwall and partially buried on hanging wall; approximately 40 feet (12 m) thick; yielded $^{40}Ar/^{39}Ar$ ages of 1.06 ± 0.03 Ma and 0.94 ± 0.04 Ma; Qec/Qbr indicates a veneer of eolian sand and pedogenic carbonate generally less than 3 feet (1 m) thick that partly conceals underlying flow.*

Qbgv, Qbgvc Grass Valley flow and cinder cone -- *Very dark-gray, fine- to medium-grained olivine trachybasalt to borderline basalt; partially eroded cinder cone (Qbgvc) has 10-foot-thick (3 m) lava lake and two 10-foot-wide (3 m) dikes that radiate from the center; Qec/Qbgv indicates a veneer of eolian sand and pedogenic carbonate generally less than 3 feet (1 m) thick that partly conceals underlying flow.*

unconformity

JURASSIC

Jn Navajo Sandstone -- *Pale to moderate-reddish-brown, cross-bedded, poorly to moderately well-cemented, well-rounded, fine- to medium-grained, frosted quartz sandstone; strongly jointed; forms cliff; basal transition zone characterized by very thick-bedded, resistant, cross-bedded sandstone layers separated by planar-bedded, silty, fine-grained sandstone with thin mudstone interbeds that display wavy bedding, dark flaser-like laminae, soft-sediment deformation features, and bioturbation; about 2,000 feet (600 m) thick, but only basal 1,000 feet (300 m) exposed in the quadrangle.*

Jk Kayenta Formation -- *Interbedded moderate-reddish-brown siltstone, light-purplish-red to pale-reddish-brown mudstone, and pale-reddish-brown to pale-red, fine-grained, planar-bedded, calcareous, slightly mottled sandstone; includes a few thin dolomite beds, punky gypsum intervals, and prominent ledges and cliffs near the top; dinosaur footprints in Warner Valley near base; 900 feet (270 m) thick.*

Moenave Formation

Jm Moenave Formation, undivided - *Shown on cross section only.*

Jms Springdale Sandstone Member -- *Pale-reddish-brown to grayish-yellow, fine- to medium-grained, medium- to very thick-bedded, cross-bedded sandstone with minor, thin, discontinuous lenses of intraformational conglomerate and interbedded light-purple-gray siltstone near the middle; petrified wood is locally abundant; weathers to pale pink, pinkish gray, and pale reddish purple rounded ledges; 120 feet (36 m) thick.*

Jmw Whitmore Point Member -- *Pale-red-purple to greenish-gray claystone interbedded with pale-brown to pale-red, thin-bedded siltstone with several 2- to 6-inch-thick (5-15 cm) beds of light-greenish-gray dolomitic limestone that contain algal structures and fossil fish scales of* Semionotus kanabensis *(Hesse, 1935; Schaeffer and Dunkle, 1950); nonresistant but locally well exposed; about 80 feet (24 m) thick.*

Jmd Dinosaur Canyon Member -- *Interbedded moderate-reddish-brown siltstone and very fine-grained, thin-bedded, pale-reddish-brown to grayish-red sandstone and mudstone; planar, low-angle, and ripple cross-stratification are common; forms ledgy slopes; 200 feet (60 m) thick.*

unconformity

TRIASSIC

Chinle Formation

Ŧcp Petrified Forest Member -- *Light-brownish-gray to grayish-red-purple bentonitic shale and siltstone with several lenticular interbeds of pale-yellowish-brown, cross-bedded, thick-bedded, resistant sandstone up to 10 feet (3 m) thick; petrified wood is common; shale weathers to a "popcorn" surface with abundant mudcracks due to swelling and shrinking of bentonitic clay; forms a valley; estimated to be 600 feet (185 m) thick.*

unconformity?

Ŧcs Shinarump Conglomerate Member -- *Varies from a grayish-orange to moderate-yellowish-brown, medium- to coarse-grained sandstone, with locally well-developed limonite bands ("picture rock" or "landscape stone"), to a moderate-brown, chert-pebble conglomerate; contains poorly preserved petrified wood fragments; forms a dark-brown to moderate-yellowish-brown cap rock above the Moenkopi Formation; variable in composition and thickness because of deposition in a braided-stream environment; 75 to 165 feet (23-50 m) thick.*

unconformity

Moenkopi Formation

Ŧm Moenkopi Formation, undivided - *Mapped in fault slivers along the Hurricane fault zone.*

Ŧmu Upper red member -- *Moderate-reddish-brown, thin-bedded siltstone and very fine-grained sandstone with some thin gypsum beds and abundant discordant gypsum stringers; ripple marks common in the siltstone; forms a steep slope with a few sandstone ledges; locally includes 20-foot-thick (6 m), fine-grained, resistant sandstone near base; 425 feet (130 m) thick.*

Ŧms Shnabkaib Member -- *Light-gray to pale-red, gypsiferous siltstone with several thin interbeds of dolomitic limestone near the base; upper portion is very gypsiferous and weathers to a powdery soil; forms ledge-slope topography with "bacon-stripe" appearance; 375 feet (115 m) thick.*

Ŧmm Middle red member -- *Interbedded moderate-red to moderate-reddish-brown siltstone, mudstone, and thin-bedded, very fine-grained sandstone with thin interbeds and veinlets of greenish-gray to white gypsum; forms slope with several ledge-forming gypsum beds near base; 360 feet (110 m) thick.*

Ŧmv Virgin Limestone Member -- *Three distinct medium-gray to yellowish-brown marine limestone ledges interbedded with nonresistant, moderate-yellowish-brown, muddy siltstone, pale-reddish-brown sandstone, and light-gray to grayish-orange-pink gypsum; limestone beds are usually 5 to 10 feet (1.5-3 m) thick and contain five-sided crinoid columnals and* Composita *brachiopods; total thickness is generally 75 feet (23 m).*

Ŧml Lower red member -- *Interbedded, slope-forming, moderate-reddish-brown siltstone, mudstone, and fine-grained, slope-forming sandstone; generally calcareous and has interbeds and stringers of gypsum; ripple marks and small-scale cross-beds are common in the siltstone; 200 feet (60 m) thick.*

Ŧmt Timpoweap Member -- *Lower part is light-gray to grayish-orange, thin- to thick-bedded limestone and cherty limestone; weathers to a light-brown meringue-like surface due to blebs of chert; contains few ammonites, gastropods, and brachiopods, and uncommon euhedral pyrite crystals up to 1/4 inch (1 cm) across; upper part is grayish-orange, thin- to thick-bedded, slightly calcareous, very fine-grained sandstone with thin-bedded siltstone and mudstone intervals that weathers yellowish-brown; forms a coherent ledge or low cliff; thickness ranges from 50 to 125 feet (15-37 m).*

Ŧmr Rock Canyon Conglomerate Member -- *Yellowish-gray to light-olive-gray, clast-supported, but grading upward to a matrix-supported, conglomerate with pebble- and cobble-size clasts; basal part contains angular to subangular limestone rip-up clasts and brecciated blocks from the Harrisburg Member of the Kaibab Formation, locally cemented with sparry calcite; rounding increases upward to subrounded, mostly chert clasts near top; thick, locally lenticular bedding; forms cliff and fills paleocanyons eroded into the Harrisburg Member; 0 to 130 feet (0-40 m) thick.*

unconformity

PERMIAN

Kaibab Formation

Pkh Harrisburg Member -- *Light-gray, fossiliferous, sandy, fine- to medium-grained limestone interbedded with red and gray gypsiferous siltstone, sandstone, and gray gypsum beds several feet thick; beds of cherty limestone, sandy limestone, and chert about 30 feet (9 m) thick form resistant low cliff near middle; beds locally distorted due to dissolution of gypsum; forms slope with limestone ledges; thickness varies greatly due to erosion associated with the Permian-Triassic unconformity; 30 to 175 feet (9-53 m) thick.*

Pkf Fossil Mountain Member -- *Yellowish-gray, abundantly fossiliferous, cherty limestone that forms a prominent cliff; silicified fossils include corals, brachiopods, crinoids, and bryozoans; reddish-brown and black chert forms irregularly bedded nodules and causes the outcrop to appear black-banded; 300 feet (90 m) thick.*

unconformity

Toroweap Formation

Ptw Woods Ranch Member -- *Grayish-pink to very pale-orange, very thick-bedded gypsum with interbeds of light-brownish-gray siltstone, pale-red shale, and yellowish-gray to light-gray, laminated to thin-bedded dolomite and limestone; forms slope, commonly covered with talus; beds distorted from dissolution of gypsum; 320 feet (98 m) thick.*

Ptb Brady Canyon Member -- *Medium-light-gray to dark-gray, medium- to coarse-grained, thick-bedded, fossiliferous limestone with reddish-brown chert nodules; contains locally common brachiopods, crinoids, and corals; forms prominent cliff; 200 feet (60 m) thick.*

Pts Seligman Member -- *Consists of three parts: upper part is medium-gray, thin-bedded, sandy limestone; middle part is interbedded yellowish-gray, calcareous, very fine-grained sandstone and grayish-yellow, gypsiferous, calcareous siltstone; and basal part is pale-yellowish-brown, fine-grained sandstone; 115 feet (36 m) thick.*

unconformity

Pq Queantoweap Sandstone -- *Pale-yellow to grayish-pink, calcareous, thick-bedded, fine-grained sandstone; only the upper 75 feet (23 m) is exposed in the quadrangle, but the formation is about 1,300 feet (400 m) thick in the area.*

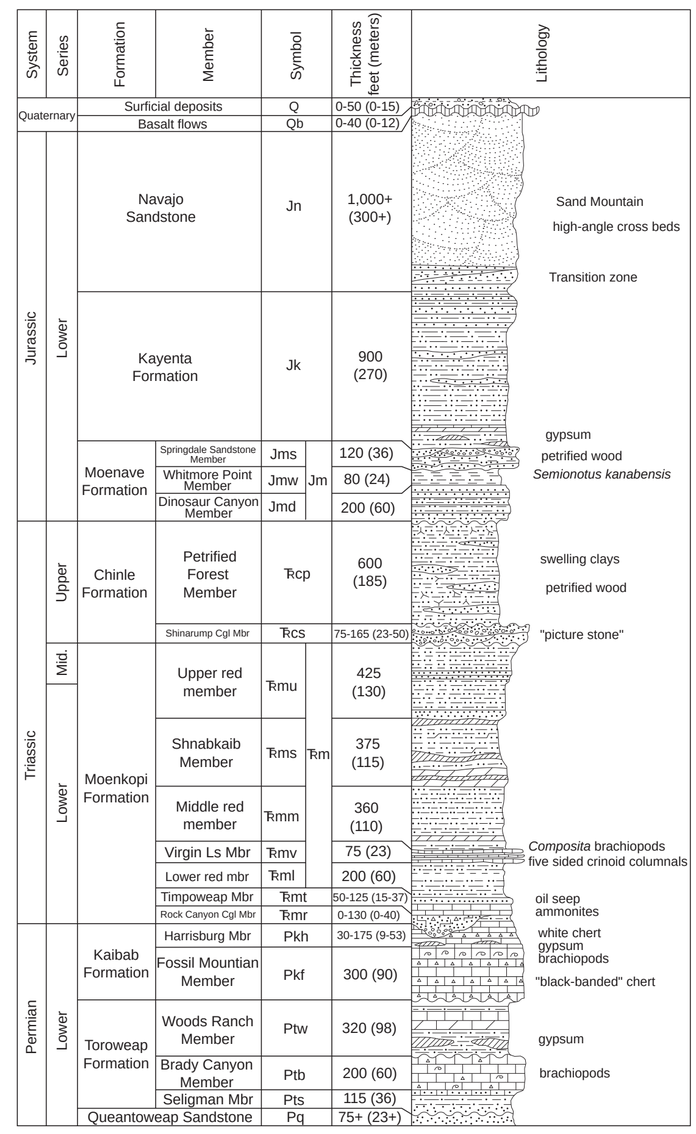
Subsurface Units

Pzu Paleozoic, undivided - *Pre-Queantoweap units shown on cross section only.*

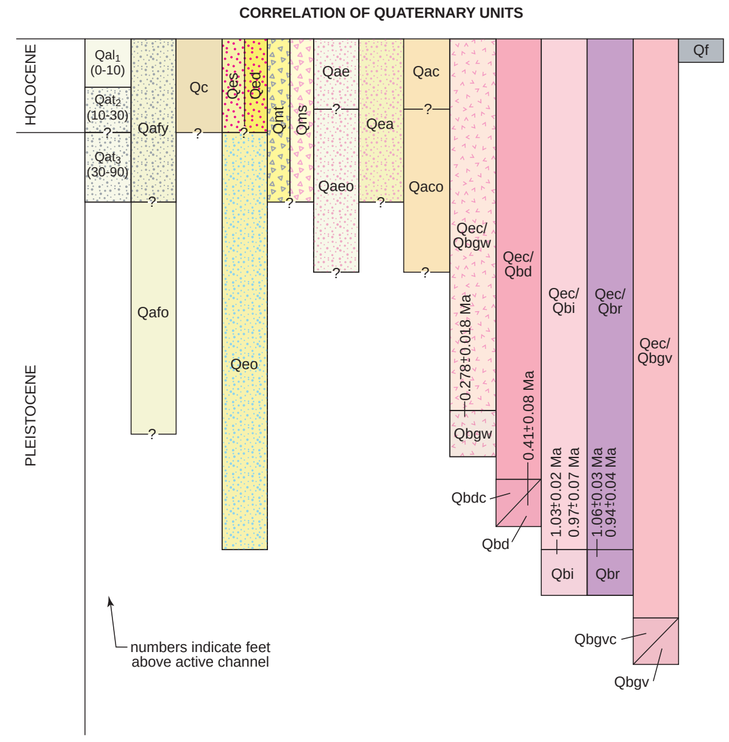
MAP SYMBOLS

- Contact
- High-angle normal fault, dashed where approximately located, dotted where concealed; bar-and-ball on down-thrown side
- Approximate trace of anticline, dotted where concealed; arrows show direction of plunge
- 8 Strike and dip of inclined bedding from field measurements
- 10 Approximate strike and dip of inclined bedding determined from photogrammetry
- Strike of vertical joint
- Sand and gravel pit
- X Uranium prospect
- Mine shaft
- Spring
- oil seep Oil seep
- Federal No.1 Oil exploration test hole, plugged and abandoned, with name
- Cinder cone
- Dinosaur footprints
- TD12999-1 Sample location and number
- A — A' Line of cross section

LITHOLOGIC COLUMN



CORRELATION OF QUATERNARY UNITS



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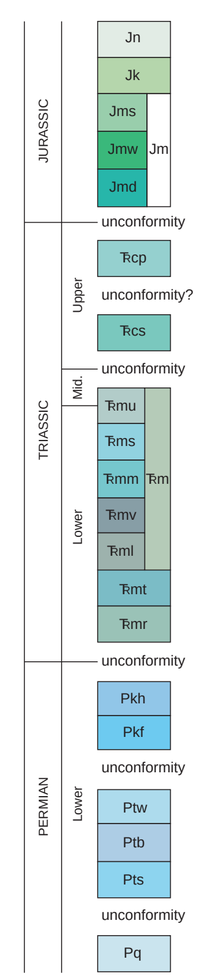

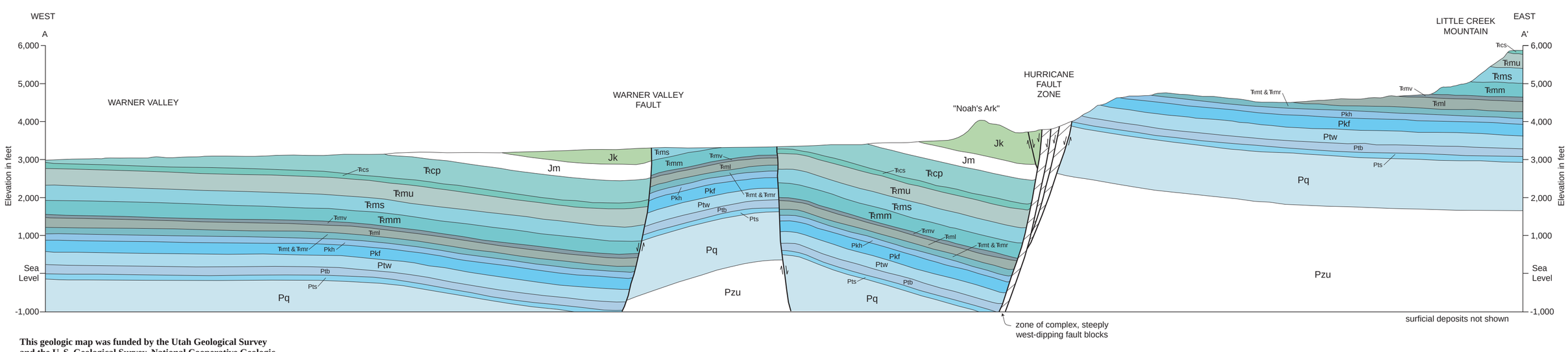

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