UTAH DNR GEOLOGICAL SURVEY

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UTAH GEOLOGICAL SURVEY
a division of
Utah Department of Natural Resources

STRATIGRAPHIC COLUMN

Ma	System	Series and Stage	Map Unit	Map Symbol	Thickness feet	Thickness meters	Depositional Environment	Dominant Rock Type and Weathering Profile	Notes ($^{40}Ar/^{39}Ar$ ages)
1.8	Quaternary	Holocene and Pleistocene	Surficial deposits and basaltic lava flows	Various Q, QT (Qb)			erosion dominant	sand and gravel, basaltic lava flows	Stacking order of Tertiary units is approximate because of age overlap and age uncertainty; not all units are in contact as shown. Lithology not shown for Tertiary basaltic and andesitic flows, intrusions, Muddy Creek Formation, and lumped units. Unconformities not shown for Tertiary units.
	Tertiary	Pliocene, lower and upper	Basin-fill sedimentary rocks	Ts	1500+	450+	fault-bounded basins to west, but erosion dominates SW Utah. Virgin River integrated with Colorado River	conglomerate, sandstone, siltstone, mudstone	
			Muddy Creek Fm.	Tmcb, Tmc	3000+	900+			
5.3		Pliocene, upper	young rhyolite and dacite lava flows	Trdy	500	150		lava flows	2 to 8.5 Ma
11.6		Miocene, upper	old boulder gravel deposits	Tag	30	9	alluvial fan	conglomerate	Large quartz monzonite boulders on Kolob Plateau (derived from Tipv)
		Miocene, middle	middle rhyolite and dacite lava flows	Trdm	400-1400	120-400		lava flows	
			Ox Valley Tuff	To	4000	1200	Mineral Mtn. intrusion	ash-flow tuffs	14.0 Ma
16.0			Kane Wash Tuff	Tkw	30	10	Kane Springs Wash caldera		14.45 Ma
		Miocene, lower	Racer Canyon Tuff	Tr	1500	450	Telegraph Draw caldera of Caliente caldera complex	ash-flow tuff	18.7 Ma
			Sedimentary Rocks of Page Ranch	Tpr	200	60	river and alluvial fan	conglomerate, sandstone	
			Pine Valley Latite	Tpv	1100	335	derived from eruption of Pine Valley laccolith, triggered by rapid laccolith emplacement and consequent large gravity slides (Tgb)	lava flows	20.4 Ma
			Gravity slide breccia	Tgb	250	75		breccia	
			Volcanic rocks of Comanche Canyon	Tcv	160	50	Stoddard Mtn. intrusion	ash-flow tuff & lava flows	21.78 Ma
			Rencher Formation	Tre	1600	500	Bull Valley intrusion	ash-flow tuff	21.46 Ma to 22.01 Ma
			Rocks of Paradise	Tpa	600	180	Pinto Peak intrusion	lava flows and ash-flow tuff	21.62 Ma to 21.97 Ma
			Quichapa Group: Harmony Hills Tuff	Tqh	500	150	Bull Valley Mountains	ash-flow tuff	22.03 Ma
23.0			Quichapa Group: Condor Canyon Fm.	Tqc	330	110	Caliente caldera		22.8 Ma mostly Bauers Tuff Mbr.
		Oligocene, upper	Quichapa Group: Leach Canyon Formation	Tql (Tq)	500	150	Caliente caldera?		23.8 Ma
			Isom Fm. and enclosing sedimentary rocks	Ti (Tiw)	600	180	Indian Peak caldera	ash-flow tuff, limestone, and tuffaceous sandstone	26 to 27 Ma
28.4		Oligocene, lower	Needles Range Group	Tw	50	15			30 Ma Wah Wah Springs Fm. *unconformity*
33.9		Paleocene and Eocene	Claron Formation: upper member	Tcu (Tc)	520 (300-1600)	160 (90-490)	river and lake sediments modified by soil formation	limestone	
			Claron Formation: lower member	Tcl (Tc)	1090	330		mudstone, siltstone, and sandstone	Pine Valley laccolith intruded here; *unconformity*
			Grapevine Wash Formation	TKg	2000	600	river and alluvial-fan	conglomerate and sandstone	TKg lacks volcanic clasts
65.5			Canaan Peak Fm.	TKcp	0-120	0-35			TKcp has Jurassic volcanic clasts
	Cretaceous	Upper	tectonic breccia (?)	Ktm	0-330	0-100	fault breccia		*unconformity* below Square Top Mtn. thrust fault zone
			Iron Springs Formation: Straight Cliffs Fm. upper unit	Ksu (Ki)	>320 (3000-4000)	>100 (900-1220)	floodplain, river, lagoonal, estuarine enviroments of coastal plain; Tropic is westward-thinning marine tongue	mudstone and sandstone	
			Iron Springs Formation: Straight Cliffs Fm. Tibbet Canyon Mbr	Kst (Ki)	240-450	75-135	shoreface	sandstone	gastropods, coal
			Iron Springs Formation: Dakota Fm and Tropic Shale, undivided	Kdt (Ki)	850	260		mudstone, siltstone, sandstone	large landslides
99.6		Lower	Cedar Mountain Fm.	Kcm	0-100	0-30	river and alluvial plain	conglomerate	*unconformity*
145.5	Jurassic	Middle	Carmel Formation: Winsor Mbr.	Jcw (Jc)	0-320	0-98	sandy mudflat	sandstone and siltstone	*K unconformity*
			Carmel Formation: Paria River Mbr.	Jcp (Jc)	0-160	0-50	restricted shallow marine	gypsum and limestone	alabaster gypsum
			Carmel Formation: Crystal Creek Member	Jcx (Jc)	0-250	0-75	coastal sabkha and tidal flat	mudstone and siltstone	
			Carmel Formation: Co-op Creek Limestone Member	Jcc (Jc)	285-580	87-177	shallow marine	micritic limestone	*Isocrinus* sp.
			Temple Cap Formation: White Throne Mbr.	Jtw	0-130	0-40	coastal dune field	sandstone	*J-2 unconformity?* sandstone ledge pinches out westward in Zion N.P.
175.6			Temple Cap Formation: Sinawava Mbr.	Jts	<10-400	<3-120	coastal sabkha and tidal flat	siltstone and mudstone	*J-1 unconformity* 169 to170 Ma
		Lower	Navajo Sandstone	Jn	1800-2300	550-700	vast eolian dune field of arid west coast tropical desert; basal part is sabkha deposits	sandstone	large, sweeping cross-beds; locally prominent joints; transition zone planar bedded
			Kayenta Formation: Tenney Canyon Tongue	Jkt (Jk)	140-315	43-95	distal river and playa	siltstone, sandstone, and mudstone	
			Kayenta Formation: Lamb Point Tong.	(Jk)	0-60	0-18	eolian dune field	sandstone	sandstone ledge, pinches out west of Zion N.P.
			Kayenta Formation: upper part	Jnl (Jk)	550-1500	165-460	distal river, playa, minor lake	siltstone, sandstone, and mudstone	prominent cliff; Silver Reef mining district
			Kayenta Formation: Springdale Ss. Mbr	Jks	90-150	27-45	braided stream	sandstone	*J-sub Kayenta unconformity*
199.6			Moenave Formation: Whitmore Point and Dinosaur Canyon Mbrs, undivided	JTRm	200-390	60-115	river, lake, and floodplain	sandstone, siltstone, limestone	fish fossils; *"J-0" unconformity*
	Triassic	Upper	Chinle Formation: Petrified Forest Mbr.	TRcp	400-650	120-200	floodplain, lake, stream	claystone, mudstone, sandstone	numerous landslides
228.0			Chinle Formation: Shinarump Cgl. Mbr	TRcs	5-250	2-75	braided river	sandstone and conglomerate	prominent cliff; *TR-3 unconformity*
		Lower	Moenkopi Formation: upper red member	TRmu (TRm)	200-600	60-180	tidal flat	siltstone, sandstone, and mudstone	
			Moenkopi Formation: Shnabkaib Member	TRms (TRm)	350-1000	105-300	tidal flat and coastal sabkha	gypsum, mudstone, and siltstone	"bacon-striped" ledgy slopes
			Moenkopi Formation: middle red member	TRmm (TRm)	300-550	90-170	tidal flat	mudstone, siltstone, gypsum	
			Moenkopi Formation: Virgin Ls. Mbr.	TRmv (TRm)	0-250	0-75	shallow marine	limestone and mudstone	3 limestone ledges to east; 5 limestone ledges to west
			Moenkopi Formation: lower red member	TRml (TRm)	0-300	0-90	tidal flat	mudstone and siltstone	
			Moenkopi Formation: Timpoweap Mbr.	TRmt (TRmtr)	50-180	15-55	shallow marine	limestone and mudstone	
251.0			Moenkopi Formation: Rock Canyon Cgl. Mbr	TRmr (TRmtr)	0-200	0-60	river channel	conglomerate	*TR-1 unconformity*
	Permian	Lower	Kaibab Formation: Harrisburg Mbr	Pkh (Pk)	0-350	0-100	shallow marine & sabkha	gypsum, limestone	gypsum
			Kaibab Formation: Fossil Mountain Mbr	Pkf (Pk)	200-300	60-90	shallow marine	cherty limestone	brachiopods; "black-banded" cliff; *P-k unconformity*
			Toroweap Formation: Woods Ranch Mbr	Ptw (Pt)	65-870	20-265	shallow marine and sabkha	limestone, siltstone, gypsum	gypsum
			Toroweap Formation: Brady Canyon Mbr	Ptb (Ptbs, Pt)	160-250	48-75	shallow marine	limestone, gypsiferous siltstone	
			Toroweap Formation: Seligman Mbr	Pts (Ptbs, Pt)	30-200	9-60			*P-tw unconformity*
			Queantoweap Sandstone	Pq	1400-2000	425-600	shallow marine, beach, coastal dune field	sandstone	"stair-step" topography
299.0			Pakoon Dolomite	Pp (PIPbs)	600-850 (2000)	180-260 (600)	shallow marine	dolomite with minor limestone and gypsum	*P-0 unconformity*
318.1	Pennsylvanian	Lower to Upper	Callville Limestone	IPc (PIPbs)	1500-2000	460-600	shallow marine	limestone with lesser siltstone, sandstone, and dolomite	*unconformity*
	Mississippian	Upper	Scotty Wash Quartzite and Chainman Shale, undivided	Msc	160	50	shallow marine	sandstone and shale	Msc absent in Beaver Dam Mountains
359.2		Lower	Redwall Limestone; Monte Cristo Limestone (west of Beaver Dam Wash)	Mr, Mm	615-850 (1000)	188-260 (300)	shallow marine	limestone	Thunder Springs Mbr.
416.0	Devonian	Upper	Muddy Peak Dolomite	Dm	440-680	135-207	shallow marine	dolomite and sandstone	*unconformity*
	Cambrian	Upper	Nopah Dolomite	Ꞓn (MꞒu)	1300	400	shallow marine	dolomite	Dunderberg Shale equivalent ?
501.0		Upper / Middle	Bonanza King Formation	Ꞓbk (MꞒu)	2600	800	shallow marine	dolomite, with silty limestone in lower part	banded light and dark gray; Chisholm Shale equivalent?
513.0		Middle	Bright Angel Shale	Ꞓba	250-350	75-100	shallow marine	shale, siltstone, sandstone	
542.0		Lower	Tapeats Sandstone	Ꞓt	1300	400	intertidal and nearshore	orthoquartzite and pebble conglomerate	*Great Unconformity 1.2 billion year gap*
	Paleoproterozoic		gneiss, schist, pegmatite	Xu			metamorphic and igneous rocks	gneiss, schist, pegmatite	about 1.7 billion years old

Lumped map symbols: basaltic lava flows, undivided (Tb); andesitic lava flows, undivided (Ta); Tq; Tiw; Tc; Ki; Jc; Jk; TRm; TRmtr; Pk; Pt; Ptbs; Bird Spring Fm. (west of Beaver Dam Wash) (PIPbs); MꞒu.

Depositional Environment (spanning): Volcanic highlands and intermontane basins; sources of ash-flow tuffs; shallow marine (Pakoon Dolomite through Bright Angel Shale).

Plate Tectonic Setting:
- Development of intermontane basins (Paleocene-Eocene) and uplift of western U.S. (Eocene-Oligocene); uplift continues to present day
- Explosive, calc-alkaline volcanism and caldera development
- Bimodal volcanism, onset of basin-range extension and collapse of western-margin of Colorado Plateau
- Hurricane fault
- Foredeep basin (proximal, distal)
- thrust faulting
- Sevier orogeny
- Upper Jurassic-Lower Cretaceous forebulge high (60 m.y. gap in rock record)
- Backbulge basin
- Broad, nearly flat continental interior
- Dominant stream flow to northwest
- Development of island arc at west edge of North America
- Near western margin of Pangea supercontinent very low-relief continental shelf
- Ordovician and Silurian strata removed by erosion associated with the Antler orogeny
- Slowly subsiding shallow-marine basin at western margin of North American craton; Utah hingeline, a long-lived boundary between subsiding marine basin to west and stable continental shelf to east, controls sedimentation
- Part of the Mojave Province

Intrusive units and additional lumped units: Tim Mineral Mountain intrusion (12.1 Ma); Tipv Pine Valley laccolith (20.5 Ma); Tid The Dairy intrusion (21.86 Ma); Tib Bull Valley intrusion (21.98 Ma); Tih Hardscrabble Hollow intrusion (22.02 Ma); Tibm Big Mountain intrusion (22.00 Ma); Tgb (units included); Tqcw; Tqcl; Tqci; KJu; JTRkm; JTRmc; TRcPk; TRu; TRmPt; TRmPk; Pkt; Pkq; PIPpc; Ꞓu