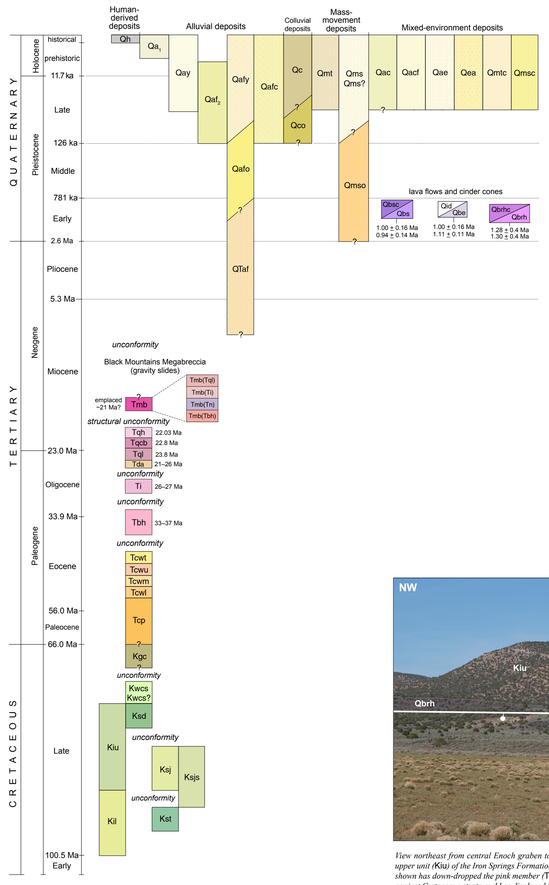
UTAH GEOLOGICAL SURVEY
a division of
Utah Department of Natural Resources

Plate 2
Utah Geological Survey Open-File Report 775DM
Interim Geological Map of the Summit Quadrangle

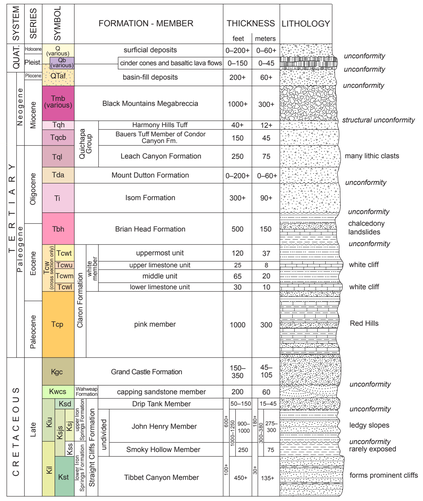
GEOLOGIC UNITS

- Qh — Artificial fill
- Qa_1 — Stream alluvium
- Qay — Young alluvium
- Qaf_2 — Level-2 fan alluvium
- Qafy — Younger fan alluvium
- Qafc — Coalesced fan alluvium
- Qafo — Older alluvium
- Qc — Colluvium
- Qco — Older colluvium
- Qms — Landslide deposits
- Qms(Qbe) Qms?(Qbe) — Landslide deposits of the Elliker Basin lava flow
- Qmso — Older landslide deposits
- Qmso(Qbe) Qmso(Qbe?) — Older landslide deposits of Elliker Basin lava flow
- Qmso (Tqh) — Older landslide deposits of Harmony Hills Tuff
- Qmso (Tqcb) — Older landslide deposits of Bauers Tuff Member of the Condor Formation
- Qmso (Tql) — Older landslide deposits of Leach Canyon Formation
- Qmso (Ti) — Older landslide deposits of Isom Formation
- Qmso (Tcwl) — Older landslide deposits of lower white member of the Claron Formation
- Qmso (Tcp) — Older landslide deposits of pink member of the Claron Formation
- Qmso (Ksj) — Older landslide deposits of John Henry Member of the Straight Cliffs Formation
- Qmt — Talus
- Qac — Alluvium and colluvium
- Qacf — Alluvium, colluvium, and fan alluvium
- Qae — Alluvium and eolian sand
- Qea — Eolian sand and alluvium
- Qmtc — Talus and colluvium
- Qmsc — Landslides and colluvium
- Qbs — Summit lava flow
- Qbsc — Summit cinder cone
- Qbe — Elliker Basin lava flow
- Qbrh — Red Hills lava flow
- Qbrhc — Red Hills cinder cone
- QTaf — Basin-fill deposits
- Tmb — Black Mountains Megabreccia deposits, undivided
- Tmb (Tql) — Black Mountains Megabreccia deposits of Leach Canyon Formation
- Tmb(Ti) — Black Mountains Megabreccia deposits of Isom Formation
- Tmb (Tn) — Black Mountains Megabreccia deposits of Needles Range Group, undivided
- Tmb (Tbh) — Black Mountains Megabreccia deposits of Brian Head Formation
- Tqh — Quichapa Group, Harmony Hills Tuff
- Tqcb — Quichapa Group, Bauers Tuff Member of Condor Canyon Formation
- Tql — Quichapa Group, Leach Canyon Formation, undivided
- Tda — Mount Dutton Formation, alluvial facies
- Ti — Isom Formation, undivided
- Tbh — Brian Head Formation, middle volcaniclastic unit
- Tcwt — Claron Formation, uppermost mudstone, siltstone, and sandstone unit of white member
- Tcwu — Claron Formation, upper limestone unit of white member
- Tcwm — Claron Formation, middle mudstone, siltstone, and sandstone unit of white member
- Tcwl — Claron Formation, lower limestone unit of white member
- Tcp — Claron Formation, pink member
- Kgc — Grand Castle Formation
- Kwcs Kwcs? — Capping sandstone member of the Wahweap Formation
- Kiu — Iron Springs Formation, upper unit
- Kil — Iron Springs Formation, lower unit
- Ksd — Straight Cliffs Formation, Drip Tank Member
- Ksjs — Straight Cliffs Formation, John Henry and Smoky Hollow Members, undivided
- Ksj — Straight Cliffs Formation, John Henry Member
- Kst — Straight Cliffs Formation, Tibbet Canyon Member

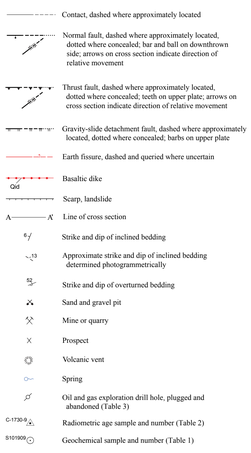
CORRELATION OF MAP UNITS

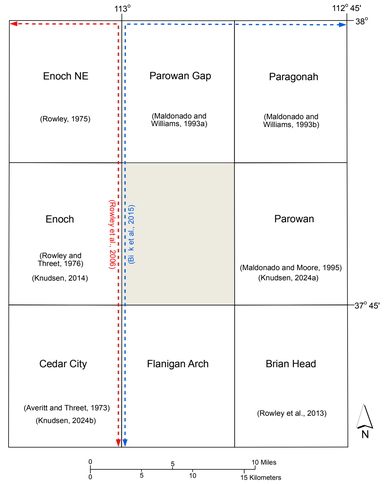


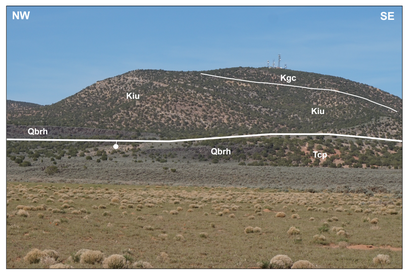
LITHOLOGIC COLUMN



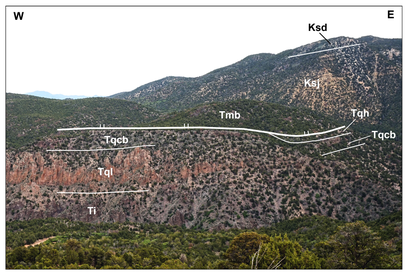
MAP SYMBOLS



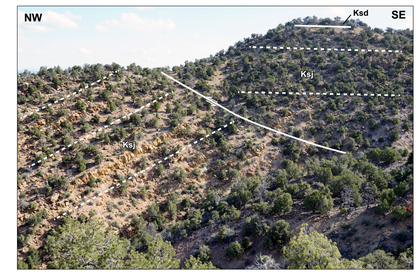




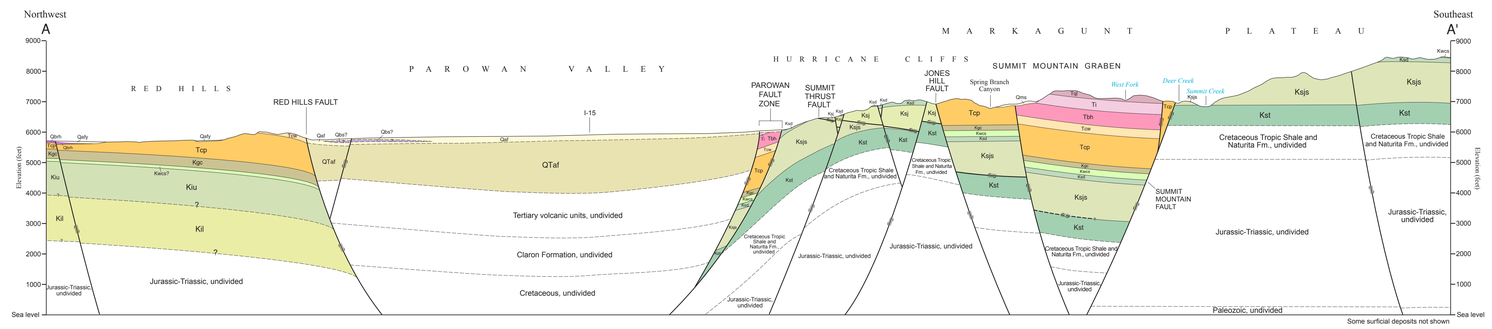
View northeast from central Enoch graben toward the Red Hills where the Grand Castle Formation (Kgc) and the upper unit (Kiu) of the Iron Springs Formation dip gently southeast. The west-dipping, eastern graben-bounding fault shown has down-dropped the pink member (Tcp) of the Paleogene Claron Formation approximately 350 feet (105 m) against Cretaceous strata and has displaced the ~1.3 Ma Red Hills lava flow (Qbrh) about 60 feet (18 m).

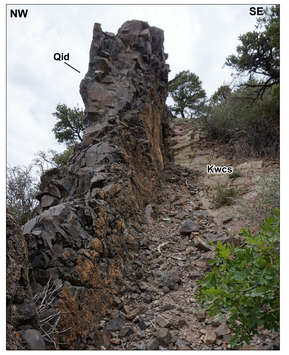


The Goat Ledges of Summit Canyon expose the quadrangle's most complete Oligocene–Miocene volcanic section, which is overlain by the chaotic volcanic debris of the Black Mountains Megabreccia (Tmb). In the distance, the Drip Tank Member (Ksd) caps the large hillside of John Henry Member (Ksj), both of the Straight Cliffs Formation. View is towards the north. Tqh, Harmony Hills Tuff; Tqcb, Bauers Tuff Member of Condor Canyon Formation; Tql, Leach Canyon Formation; Ti, Isom Formation.



The Sevier-age Summit thrust fault is well exposed in lower Cheney Spring Canyon just south of Summit. Here, the fault places gently dipping Straight Cliffs strata over a lower plate of steeply northwest-dipping Straight Cliffs strata. View is towards the northeast. Ksd, Drip Tank Member of the Straight Cliffs Formation, Ksj, John Henry Member of the Straight Cliffs Formation, dotted lines represent bedding form lines.





One of four basaltic dikes (Qid) exposed in West Fork Braffits Creek. This northeast-trending dike intruded the capping sandstone member (Kwcs) of the Wahweap Formation and is as much as 5 feet (1.5 m) thick. View is toward the northeast.

Table 1. *Whole-rock major- and trace-element geochemistry of volcanic rocks in the Summit 7.5' quadrangle (https://ugspub.nr.utah.gov/publications/open_file_reports/ofr-775/ofr-775.xlsx).*

Sample No.	Lava Flow or Formation Name	Easting (NAD27)	Northing (NAD27)	Map Symbol[1]	Rock Type[2]	J Code	K Code	L Code	Lab Used	Collected by	SiO2[3,4]	Al2O3[3,4]	Fe2O3[3,4]	CaO[3,4]	MgO[3,4]	Na2O[3,4]	K2O[3,4]	Cr2O3[3]	TiO2[3,4]	MnO[3,4]	P2O5[3,4]	SrO[3]	BaO[3]	LOI[3]	Total	Ag[5]	Ba[3,4]	Ce[3,4]	Cs[3,4]	Cr[3,4]	Cs[3,4]	Cu[3,4]	Dy[3]	Er[3]	Eu[3,4]	Ga[3]	Gd[3,4]	Hf[3,4]	Ho[3]	La[3,4]	Lu[3,4]	Mo[3]	Nb[3,4]	Nd[3,4]	Ni[3,4]	Pb[3]	Pr[3]	Rb[3,4]	Sc[3,4]	Sm[3,4]	Sn[3]	Sr[3,4]	Ta[3,4]	Tb[3,4]	Th[3,4]	Tl[3]	Tm[3,4]	U[3,4]	V[3]	W[3]	Y[3,4]	Yb[3,4]	Zn[3,4]	Zr[3,4]
NE29	Red Hills[6]			Qbrh	basaltic andesite				USGS	Nealey et al. (1997)	53.60	15.70	9.09	7.51	7.18	3.46	1.47		1.32	0.14	0.41			0.02			669	62.6	36.0	288	0.30	52			1.72		5.66	4.59		29.7	0.38		18.0	27.8	143			24	24	5.73		548	1.0	0.79	2.9		0.42	0.65			27	2.75	79.7	198
NE30	Red Hills[6]			Qbrh	basaltic andesite				USGS	Nealey et al. (1997)	53.50	15.80	9.10	7.43	7.24	3.45	1.49		1.31	0.14	0.39			nd			659	60.4	37.0	261	0.29	46			1.69		5.56	4.50		29.2	0.38		16.0	27.7	155			22	23.7	5.61		573	0.9	0.76	2.6		0.42	0.63			26	2.62	77.6	211
NE4	Red Hills[6]			Qbrh	basalt				USGS	Nealey et al. (1997)	51.40	16.40	10.00	9.57	5.80	3.17	0.88		1.29	0.16	0.25			0.44			453	40.8	34.0	150	0.17	59			1.45		4.80	3.53		19.2	0.39		11.0	20.6	63			17	29.6	4.62		466	0.4	0.76	2.3		0.43	0.62			33	2.7	77.4	178
NS5	Summit (near Braffits Creek)[7]			Qbs	basalt				USGS	Nealey et al. (1997)	50.00	16.40	9.43	9.21	7.11	3.56	1.22		1.39	0.16	0.64			nd			942	95.3	35.0	227	0.04	51			2.08		5.89	4.47		49.7	0.37		40.0	40.2	94			18	26.3	7.10		846	1.9	0.83	6.7		0.42	1.24			26	2.58	78.1	194
NS7	Summit (Cinder Hill)[8]			Qbs	basalt				USGS	Nealey et al. (1997)	50.40	16.10	9.54	9.29	7.57	3.54	1.22		1.36	0.16	0.64			nd			921	96.4	37.0	258	0.17	50			2.08		5.79	4.62		49.0	0.38		38.0	40.6	101			19	27.9	7.39		876	1.9	0.82	6.5		0.41	1.58			29	2.57	76	214
NS8	Summit (Cinder Hill)[8]			Qbs	basalt				USGS	Nealey et al. (1997)	50.40	16.70	9.29	9.34	6.74	3.65	1.21		1.37	0.16	0.64			nd			957	98.9	33.0	204	0.16	57			2.09		6.10	4.50		50.8	0.38		39.0	39.9	94			19	24.6	7.21		867	1.9	0.85	6.8		0.41	1.60			27	2.5	77.5	210
S042110-1	Elliker Basin	325683	4182210	Qbe	shoshonite	2	2	1	ALS Chemex	Biek et al. (2015)	52.43	16.26	8.34	7.29	5.26	3.41	3.74	0.03	1.80	0.13	0.81	0.16	0.27	0.01	99.94	<1	2250	146.0	27.1	120	0.31	33	5.53	2.91	3.03	21.0	9.99	9.10	1.04	65.3	0.37	<2	19.7	72.6	63	16	18.85	36.7		11.80	2	1355	1.0	1.19	5.6	<0.5	0.39	0.96	161	<1	26.5	2.4	109	380
S042110-2	Elliker Basin	325487	4181259	Qbe	basaltic andesite	2	2	1	ALS Chemex	Biek et al. (2015)	52.95	15.91	8.30	7.38	5.75	3.34	3.40	0.03	1.74	0.13	0.72	0.14	0.24	0.03	100.05	<1	2030	128.0	29.0	160	0.31	31	5.40	3.03	2.77	20.2	9.06	8.60	1.03	57.9	0.37	<2	18.0	64.9	79	15	16.55	33.5		10.65	2	1230	1.0	1.14	5.1	<0.5	0.37	0.85	162	1	26	2.37	109	361
S042110-3	Elliker Basin	325106	4182023	Qbe	shoshonite	2	2	1	ALS Chemex	Biek et al. (2015)	52.54	16.09	8.29	7.54	5.21	3.35	3.53	0.02	1.78	0.13	0.79	0.15	0.26	0.42	100.10	<1	2270	140.5	27.2	120	0.29	32	5.45	2.94	2.89	20.7	9.39	8.80	1.01	64.3	0.36	<2	18.9	70.8	63	16	18.15	33.2		11.35	2	1340	1.0	1.19	5.3	<0.5	0.40	0.85	160	<1	26.3	2.34	111	378
S042110-4	Basers Tuff	324839	4182246	Tqcb	rhyolite	1	7	9	ALS Chemex	Biek et al. (2015)	72.70	14.11	1.75	1.12	0.36	3.69	5.20	0.01	0.33	0.05	0.06	0.04	0.12	0.53	100.05	<1	1105	113.5	1.5	30	5.06	5	3.39	2.18	1.07	16.5	5.62	7.50	0.72	60.4	0.32	2	15.2	41.0	<5	24	12.60	177		6.29	1	252	1.1	0.70	33.2	<0.5	0.32	6.86	21	3	19	2.14	36	268
S042210-1	Summit	328496	4183150	Qbs	basalt	2	2	1	ALS Chemex	Biek et al. (2015)	50.29	16.35	9.25	9.21	7.50	3.56	1.20	0.04	1.43	0.16	0.56	0.08	0.11	0.09	99.83	<1	912	92.4	35.4	270	0.13	49	4.97	2.81	2.05	18.8	6.71	4.50	1.00	49.3	0.38	<2	33.9	39.9	102	9	10.90	17		7.15	1	709	1.7	0.95	6.7	<0.5	0.40	1.60	205	1	24.9	2.37	94	214
S101709-2	Red Hills	325772	4191926	Qbrh	basaltic andesite	2	1	1	ALS Chemex	Biek et al. (2015)	52.00	15.49	9.85	8.26	7.56	3.16	1.11	0.03	1.20	0.15	0.25	0.05	0.07	0.76	99.94	<1	563	48.3	41.2	300	0.32	48	4.84	3.00	1.41	18.2	5.43	4.00	0.95	23.4	0.41	<2	10.2	24.4	166	12	6.10	23		5.03	1	425	0.5	0.85	3.1	<0.5	0.40	0.63	161	<1	25.1	2.73	93	165
S101709-3	Leach Canyon Fm.	325380	4186049	Tql	rhyolite	1	2	9	ALS Chemex	Biek et al. (2015)	72.55	12.94	1.82	2.18	0.52	2.88	4.99	<0.01	0.26	0.05	0.07	0.02	0.06	1.45	99.80	<1	522	72.4	3.6	10	3.71	6	2.23	1.43	0.65	16.0	3.61	4.30	0.40	44.2	0.24	2	14.8	24.0	10	25	7.45	180.5		3.67	1	178.5	1.2	0.45	28.9	<0.5	0.21	5.72	28	2	12.6	1.53	30	139
S101709-4	Summit	325409	4186218	Qbs	basalt	2	2	1	ALS Chemex	Biek et al. (2015)	49.90	16.20	9.51	9.70	7.39	3.50	1.18	0.03	1.39	0.16	0.58	0.09	0.11	0.22	99.96	<1	932	86.1	36.0	250	0.07	44	4.78	2.66	1.93	17.9	6.60	4.60	0.90	47.1	0.35	<2	35.0	38.6	112	11	10.20	13.3		6.86	1	775	1.7	0.92	6.3	<0.5	0.36	0.94	199	<1	23.7	2.38	91	204
S101909-1	Summit	327385	4182262	Qbs	basalt	2	2	1	ALS Chemex	Biek et al. (2015)	50.22	16.28	9.62	9.41	7.28	3.63	1.27	0.03	1.46	0.16	0.59	0.09	0.11	-0.27	99.89	<1	966	97.0	36.7	250	0.20	59	5.06	2.99	2.06	19.1	7.15	4.90	0.97	50.3	0.36	<2	36.2	39.9	101	10	10.55	17.4		6.85	2	750	1.8	0.94	7.0	<0.5	0.39	1.59	206	1	25	2.45	96	232

NOTES:
[1]Map symbols are those used on this geologic map of the Summit 7.5' quadrangle
[2]Rock names based on the TAS classification diagram of LeBas et al. (1986)
[3]Major oxides reported in weight percent by X-ray fluorescence; minor and trace elements by inductively coupled plasma mass spectrometry in parts per million
[4]Samples from Nealey et al. (1997): only general locations provided; major elements determined by wavelength dispersive X-ray spectroscopy; trace elements by instrumental neutron activation analysis; Nb, Y, and Cu determined by energy dispersive X-ray spectroscopy
[5]LOI = Loss on ignition

Table 2. *K-Ar formation age.*

Lava Flow	Map Symbol	Sample number	K-Ar age (Ma)	Mineral	Longitude	Latitude	Lab used	Reference	Comments
Summit	Qbs	C-1730-8A	0.94 ± 0.14	whole rock	-112.9592	37.7700	USGS	Anderson and Mehnert (1979)	
Summit	Qbs	C-1730-9	1.00 ± 0.16	whole rock	-112.9597	37.7733	USGS	Anderson and Mehnert (1979)	incorrectly listed as 112° 58' 35''

NOTES:
Age uncertainty = 2 standard deviations

Table 3. *Oil and gas exploration well information.*

Operator	Well Name	API Well Number	Year Abandoned	Qtr/Qtr	Section	Township-Range	Latitude	Longitude	Elevation	Total Depth (feet)	Formation Tops (feet)
Moutain Fuel Supply Co.	Little Salt Lake Gov't 1 (WSW)	43-021-10758	1963	NESE	9	34S-10W	37.8592	-112.97825	6113	4400	Jurassic, undivided: 2929 Monzonite: 3490

Source: Utah Division of Oil, Gas and Mining Data Explorer: https://dataexplorer.ogm.utah.gov/