

MAP UNITS

(see booklet for complete unit descriptions)

Qal ₁	Level-1 stream and floodplain deposits
Qal ₂	Level-2 stream deposits
Qal ₃	Young stream deposits, undivided
Qal ₄	Stream-terrace deposits
Qal ₅	Level-1 alluvial-fan deposits
Qal ₆	Level-2 alluvial-fan deposits
Qal ₇	Younger alluvial-fan deposits, undivided
Qalp	Alluvial-fan deposits, related to Provo shoreline and regressive phase of Lake Bonneville
Qalb	Alluvial-fan deposits, related to Bonneville shoreline and transgressive phase of Lake Bonneville
Qalc	Level-4 alluvial-fan deposits, pre-Bonneville lake cycle
Qald	Level-5 alluvial-fan deposits, pre-Little Valley and/or Pokes Point lake cycles
Qale	Older alluvial-fan deposits, undivided
Qc	Colluvial deposits
Qg	Glacial deposits, undivided
Qgp	Glacial deposits of Pinedale age
Qgmp	Glacial moraines of Pinedale age
Qh	Fill and disturbed land
Qil	Lacustrine silt and clay, undivided
Qidp	Deltaic deposits, related to the Provo shoreline and regressive phase of Lake Bonneville
Qidp	Lacustrine gravel and sand, related to the Provo shoreline and regressive phase of Lake Bonneville
Qidp	Lacustrine sand and silt, related to the Bonneville shoreline and transgressive phase of Lake Bonneville
Qidp	Lacustrine silt and clay, related to the Provo shoreline and regressive phase of Lake Bonneville
Qidb	Deltaic deposits, undivided, related to the Bonneville shoreline and transgressive phase of Lake Bonneville
Qidgb	Deltaic gravel and sand, related to the Bonneville shoreline and transgressive phase of Lake Bonneville
Qidgb	Lacustrine gravel and sand, related to the Bonneville shoreline and transgressive phase of Lake Bonneville
Qidb	Lacustrine sand and silt, related to the Bonneville shoreline and transgressive phase of Lake Bonneville
Qidb	Transgressive-phase deposits, undivided
Qmdf	Debris-flow deposits
Qmf	Earth-flow deposits
Qmsh	Historical landslide deposits
Qms	Landslide deposits
Qms?	Landslide deposits?
Qmso	Older landslide deposits
Qmf?	Lateral spread deposits?
Qmt	Talus deposits
Qai	Alluvial and colluvial deposits, undivided
Qai	Colluvial and talus deposits, undivided
Qia	Lacustrine and alluvial deposits, undivided
Qiam	Lacustrine and alluvial and marsh deposits, undivided
Qmc	Mass movement and colluvial deposits, undivided
Qmjc	Younger alluvial-fan deposits over Twin Creek Limestone and Gypsum Springs Formation, undivided
Qmjc	Younger alluvial-fan deposits over Nugget Sandstone
Qmjc	Younger alluvial-fan deposits over Ankaresh Formation
Qmjc	Younger alluvial-fan deposits over Thaynes Formation
Qmjc	Alluvial-fan deposits, related to Provo shoreline and regressive phase of Lake Bonneville over Ankaresh Formation
Qmjc	Deltaic deposits related to the Provo shoreline and regressive phase of Lake Bonneville over Twin Creek Limestone and Gypsum Springs Formation, undivided
Qmjc	Deltaic deposits related to the Provo shoreline and regressive phase of Lake Bonneville over Nugget Sandstone
Qmjc	Deltaic deposits related to the Provo shoreline and regressive phase of Lake Bonneville over Ankaresh Formation
Qmjc	Deltaic deposits related to the Provo shoreline and regressive phase of Lake Bonneville over Thaynes Formation
Qmjc	Lacustrine gravel and sand related to the Bonneville shoreline and transgressive phase of Lake Bonneville over Twin Creek Limestone and Gypsum Spring Formation, undivided
Qmjc	Lacustrine gravel and sand related to the Bonneville shoreline and transgressive phase of Lake Bonneville over Nugget Sandstone
Qmjc	Lacustrine gravel and sand related to the Bonneville shoreline and transgressive phase of Lake Bonneville over Ankaresh Formation
Qmjc	Lacustrine gravel and sand related to the Bonneville shoreline and transgressive phase of Lake Bonneville over Thaynes Formation
Qmjc	Lacustrine sand and silt deposits related to the Bonneville shoreline and transgressive phase of Lake Bonneville over Twin Creek Limestone and Gypsum Spring Formation, undivided
Qmjc	Lacustrine sand and silt deposits related to the Bonneville shoreline and transgressive phase of Lake Bonneville over Ankaresh Formation
Qmjc	Alluvial and colluvial deposits, undivided, over Twin Creek Limestone and Gypsum Spring Formation, undivided
Qmjc	Alluvial and colluvial deposits, undivided, over Ankaresh Formation
Qmjc	Alluvial and colluvial deposits, undivided, over Ankaresh Formation
Tid	Lamprophytic dikes and sill
Tid	Silicic dikes
Tind	Intermediate dikes and sills
Jjgc	Twin Creek Limestone, Giraffe Creek Member
Jji	Twin Creek Limestone, Leeds Creek Member
Jjw	Twin Creek Limestone, Watson Canyon Member
Jjb	Twin Creek Limestone, Boundary Ridge Member
Jjr	Twin Creek Limestone, Rich Member
Jjs	Twin Creek Limestone, Slidrock Member
Jjc	Twin Creek Limestone and Gypsum Spring Formation, undivided
Jjag	Slidrock Member of Twin Creek Limestone and Gypsum Spring Formation, undivided
Jjg	Gypsum Spring Formation
Jjn	Nugget Sandstone
Ta	Ankaresh Formation, undivided (see stacked units and figure 2 on plate 2)
Tau	Ankaresh Formation, upper member
Tag	Ankaresh Formation, Garra Grit Member
Tam	Ankaresh Formation, Mahogany Member
Tt	Thaynes Formation
Tt	Medal resistant limestone marker bed (Rt)
Tw	Woodside Shale
Pp	Park City and Phosphoria Formations
PPw	Weber Sandstone
Prv	Round Valley Limestone
Mdo	Doughnut Formation
Mh	Humbag Formation
Md	Deseret Limestone
Mg	Gardison Limestone
MDf	Fitchville Formation
Cm	Maxfield Limestone
Co	Ophir Formation
Cl	Tintic Quartzite
Zn	Mutual Formation
Zbcq	Big Cottonwood Formation, quartzite
Zbcs	Big Cottonwood Formation, shale and siltstone
Zbc	Big Cottonwood Formation, undivided (see cross section)

LITHOLOGIC COLUMN

AGE	FORMATION	MAP UNIT SYMBOL	THICKNESS Feet (Meters)	LITHOLOGY
JURASSIC	Twin Creek Limestone	Jjgc	120-180 (~35-55)	Top not exposed in quadrangle
		Jji	>150 (>457)	
		Jjw	420-580 (128-177)	
		Jjb	120-160 (36-49)	
		Jjr	220-250 (67-76)	
		Jjs	120-130 (37-40)	
	Gypsum Spring Formation	Jjg	5-150 (0-45)	J-2 Unconformity
	Nugget Sandstone	Jjn	800-1300 (244-400)	J-3 Unconformity? J-5 Unconformity?
	Ankaresh Formation	Ta	150-210	T-3 Unconformity
		Tau	70-100 (20-30)	
		Tam	800-900 (245-280)	
TRIASIC	Thaynes Formation	Tt	1800-2400 (550-730)	Tt (medial limestone marker bed)
		Tt	1800-2400 (550-730)	
		Tt	1800-2400 (550-730)	
	Woodside Shale	Tw	400-1000 (120-300)	T-1 Unconformity
	Park City and Phosphoria Formations	Pp	700-900 (210-280)	Fault
PERMIAN	Weber Sandstone	PPw	1200-3000 (365-900)	Fault
		PPw	1200-3000 (365-900)	
		PPw	1200-3000 (365-900)	
	Round Valley Limestone	Prv	500-1000 (120-300)	Mount Raymond Thrust
	Doughnut Formation	Mdo	1000 (300)	
MISSISSIPPIAN	Humbag Formation	Mh	700-900 (210-280)	Mount Raymond Thrust in Neffs Canyon
		Mh	700-900 (210-280)	
		Mh	700-900 (210-280)	
	Deseret Limestone	Md	500-900 (150-275)	Dale's Phosphatic Member?
	Gardison Limestone	Mg	350-600 (105-180)	
DEVONIAN	Fitchville Formation	MDf	150-200 (50-60)	Major Unconformity - Much thicker to the north
		MDf	150-200 (50-60)	
		MDf	150-200 (50-60)	
	Maxfield Limestone	Cm	5-60 (0-20)	Unconformity
	Ophir Formation	Co	170-250 (50-75)	
CAMBRIAN	Tintic Quartzite	Cl	1000-1400 (300-400)	Unconformity
		Cl	1000-1400 (300-400)	
		Cl	1000-1400 (300-400)	
	Mutual Formation	Zn	800-1200 (250-360)	Unconformity
	Big Cottonwood Formation	Zbcq	12,000+ (3600+)	
PROTEROZOIC	Big Cottonwood Formation	Zbcs	12,000+ (3600+)	Unconformity
		Zbcs	12,000+ (3600+)	
		Zbcs	12,000+ (3600+)	
	Big Cottonwood Formation	Zbc	12,000+ (3600+)	Unconformity
		Zbc	12,000+ (3600+)	

Qal ₁	Level-1 stream and floodplain deposits
Qal ₂	Level-2 stream deposits
Qal ₃	Young stream deposits, undivided
Qal ₄	Stream-terrace deposits
Qal ₅	Level-1 alluvial-fan deposits
Qal ₆	Level-2 alluvial-fan deposits
Qal ₇	Younger alluvial-fan deposits, undivided
Qalp	Alluvial-fan deposits, related to Provo shoreline and regressive phase of Lake Bonneville
Qalb	Alluvial-fan deposits, related to Bonneville shoreline and transgressive phase of Lake Bonneville
Qalc	Level-4 alluvial-fan deposits, pre-Bonneville lake cycle
Qald	Level-5 alluvial-fan deposits, pre-Little Valley and/or Pokes Point lake cycles
Qale	Older alluvial-fan deposits, undivided
Qc	Colluvial deposits
Qg	Glacial deposits, undivided
Qgp	Glacial deposits of Pinedale age
Qgmp	Glacial moraines of Pinedale age
Qh	Fill and disturbed land
Qil	Lacustrine silt and clay, undivided
Qidp	Deltaic deposits, related to the Provo shoreline and regressive phase of Lake Bonneville
Qidp	Lacustrine gravel and sand, related to the Provo shoreline and regressive phase of Lake Bonneville
Qidp	Lacustrine sand and silt, related to the Bonneville shoreline and transgressive phase of Lake Bonneville
Qidp	Lacustrine silt and clay, related to the Provo shoreline and regressive phase of Lake Bonneville
Qidb	Deltaic deposits, undivided, related to the Bonneville shoreline and transgressive phase of Lake Bonneville
Qidgb	Deltaic gravel and sand, related to the Bonneville shoreline and transgressive phase of Lake Bonneville
Qidgb	Lacustrine gravel and sand, related to the Bonneville shoreline and transgressive phase of Lake Bonneville
Qidb	Lacustrine sand and silt, related to the Bonneville shoreline and transgressive phase of Lake Bonneville
Qidb	Transgressive-phase deposits, undivided
Qmdf	Debris-flow deposits
Qmf	Earth-flow deposits
Qmsh	Historical landslide deposits
Qms	Landslide deposits
Qms?	Landslide deposits?
Qmso	Older landslide deposits
Qmf?	Lateral spread deposits?
Qmt	Talus deposits
Qai	Alluvial and colluvial deposits, undivided
Qai	Colluvial and talus deposits, undivided
Qia	Lacustrine and alluvial deposits, undivided
Qiam	Lacustrine and alluvial and marsh deposits, undivided
Qmc	Mass movement and colluvial deposits, undivided
Qmjc	Younger alluvial-fan deposits over Twin Creek Limestone and Gypsum Springs Formation, undivided
Qmjc	Younger alluvial-fan deposits over Nugget Sandstone
Qmjc	Younger alluvial-fan deposits over Ankaresh Formation
Qmjc	Younger alluvial-fan deposits over Thaynes Formation
Qmjc	Alluvial-fan deposits, related to Provo shoreline and regressive phase of Lake Bonneville over Ankaresh Formation
Qmjc	Deltaic deposits related to the Provo shoreline and regressive phase of Lake Bonneville over Twin Creek Limestone and Gypsum Springs Formation, undivided
Qmjc	Deltaic deposits related to the Provo shoreline and regressive phase of Lake Bonneville over Nugget Sandstone
Qmjc	Deltaic deposits related to the Provo shoreline and regressive phase of Lake Bonneville over Ankaresh Formation
Qmjc	Deltaic deposits related to the Provo shoreline and regressive phase of Lake Bonneville over Thaynes Formation
Qmjc	Lacustrine gravel and sand related to the Bonneville shoreline and transgressive phase of Lake Bonneville over Twin Creek Limestone and Gypsum Spring Formation, undivided
Qmjc	Lacustrine gravel and sand related to the Bonneville shoreline and transgressive phase of Lake Bonneville over Nugget Sandstone
Qmjc	Lacustrine gravel and sand related to the Bonneville shoreline and transgressive phase of Lake Bonneville over Ankaresh Formation
Qmjc	Lacustrine gravel and sand related to the Bonneville shoreline and transgressive phase of Lake Bonneville over Thaynes Formation
Qmjc	Lacustrine sand and silt deposits related to the Bonneville shoreline and transgressive phase of Lake Bonneville over Twin Creek Limestone and Gypsum Spring Formation, undivided
Qmjc	Lacustrine sand and silt deposits related to the Bonneville shoreline and transgressive phase of Lake Bonneville over Ankaresh Formation
Qmjc	Alluvial and colluvial deposits, undivided, over Twin Creek Limestone and Gypsum Spring Formation, undivided
Qmjc	Alluvial and colluvial deposits, undivided, over Ankaresh Formation
Qmjc	Alluvial and colluvial deposits, undivided, over Ankaresh Formation
Tid	Lamprophytic dikes and sill
Tid	Silicic dikes
Tind	Intermediate dikes and sills
Jjgc	Twin Creek Limestone, Giraffe Creek Member
Jji	Twin Creek Limestone, Leeds Creek Member
Jjw	Twin Creek Limestone, Watson Canyon Member
Jjb	Twin Creek Limestone, Boundary Ridge Member
Jjr	Twin Creek Limestone, Rich Member
Jjs	Twin Creek Limestone, Slidrock Member
Jjc	Twin Creek Limestone and Gypsum Spring Formation, undivided
Jjag	Slidrock Member of Twin Creek Limestone and Gypsum Spring Formation, undivided
Jjg	Gypsum Spring Formation
Jjn	Nugget Sandstone
Ta	Ankaresh Formation, undivided (see stacked units and figure 2 on plate 2)
Tau	Ankaresh Formation, upper member
Tag	Ankaresh Formation, Garra Grit Member
Tam	Ankaresh Formation, Mahogany Member
Tt	Thaynes Formation
Tt	Medal resistant limestone marker bed (Rt)
Tw	Woodside Shale
Pp	Park City and Phosphoria Formations
PPw	Weber Sandstone
Prv	Round Valley Limestone
Mdo	Doughnut Formation
Mh	Humbag Formation
Md	Deseret Limestone
Mg	Gardison Limestone
MDf	Fitchville Formation
Cm	Maxfield Limestone
Co	Ophir Formation
Cl	Tintic Quartzite
Zn	Mutual Formation
Zbcq	Big Cottonwood Formation, quartzite
Zbcs	Big Cottonwood Formation, shale and siltstone
Zbc	Big Cottonwood Formation, undivided (see cross section)

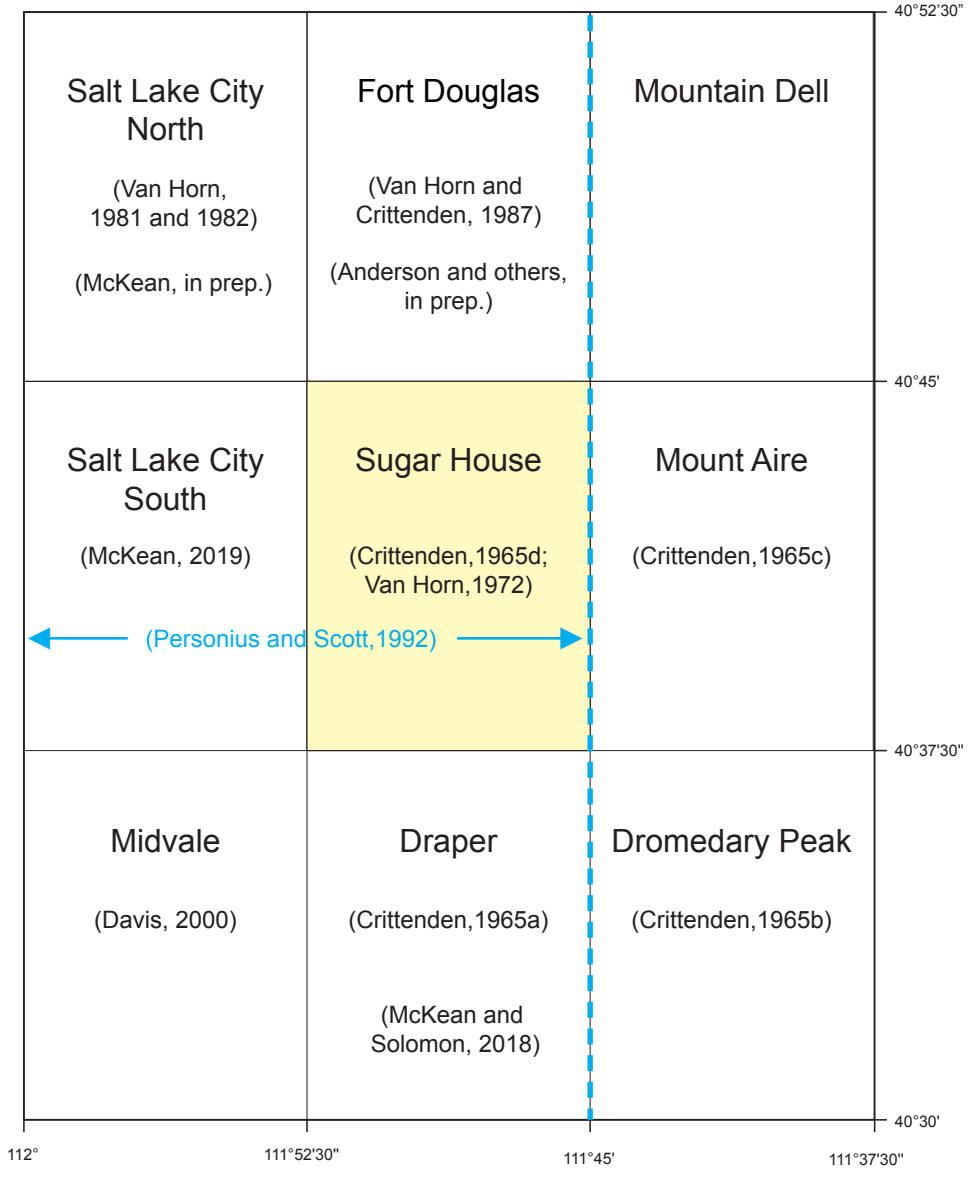


Figure 1. Index map showing selected geologic maps available for the Sugar House and surrounding 7.5' quadrangles.

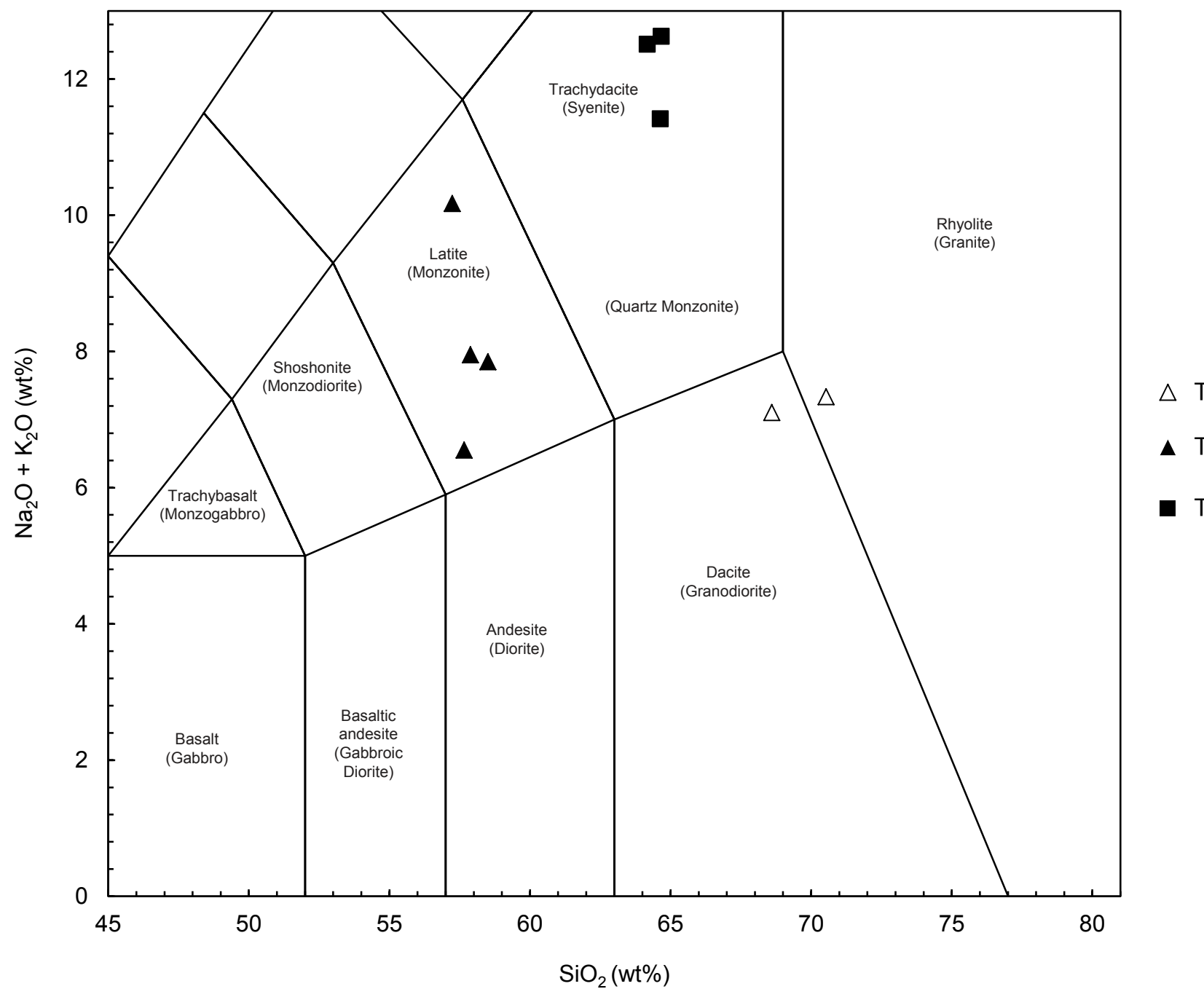


Figure 3. Total alkali-silica classification for igneous rocks of the Sugar House 7.5-minute quadrangle (values have been normalized to 100% on a volatile-free basis). Classification diagram from Le Bas and others (1986), with phonitic (holocrystalline) names from Middlemost (1994) in parentheses; see McKean (2017b) for whole-rock geochemical data; silicic dikes (Tsd), intermediate dikes and sills (Tind), and lamprophytic dikes and sills (Tid).

CORRELATION OF GEOLOGIC UNITS

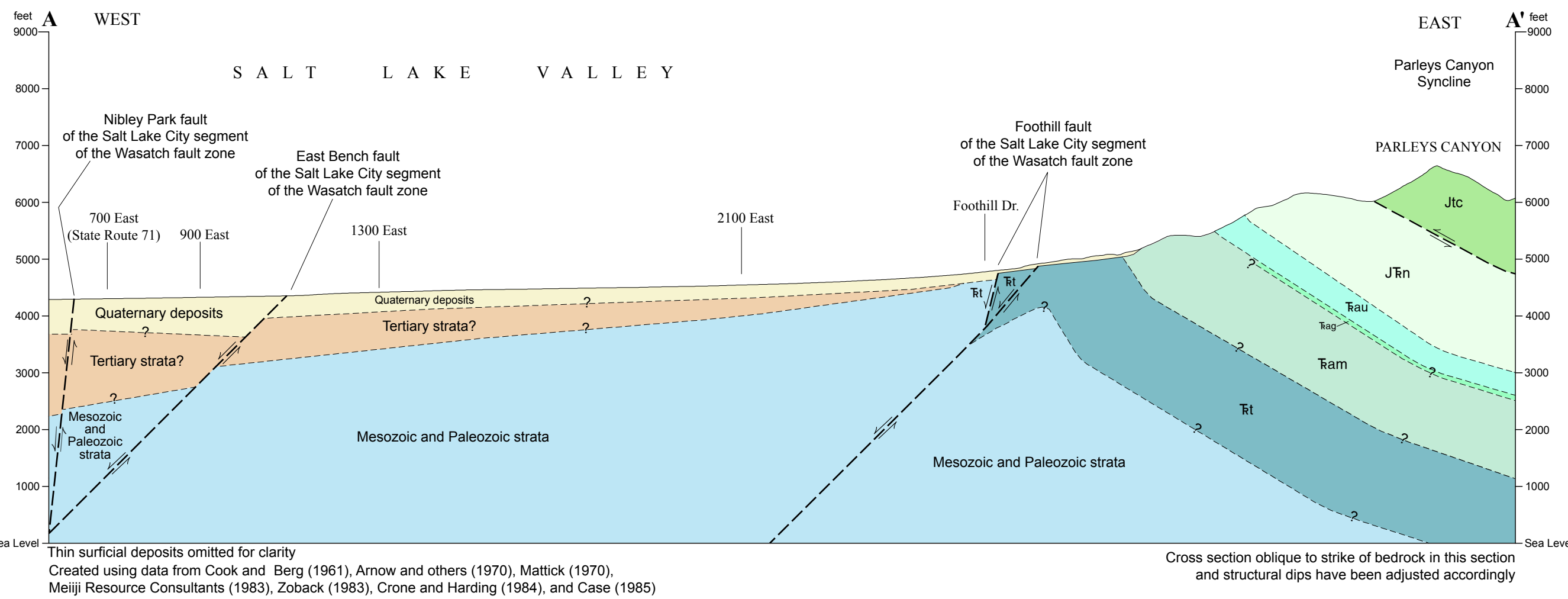
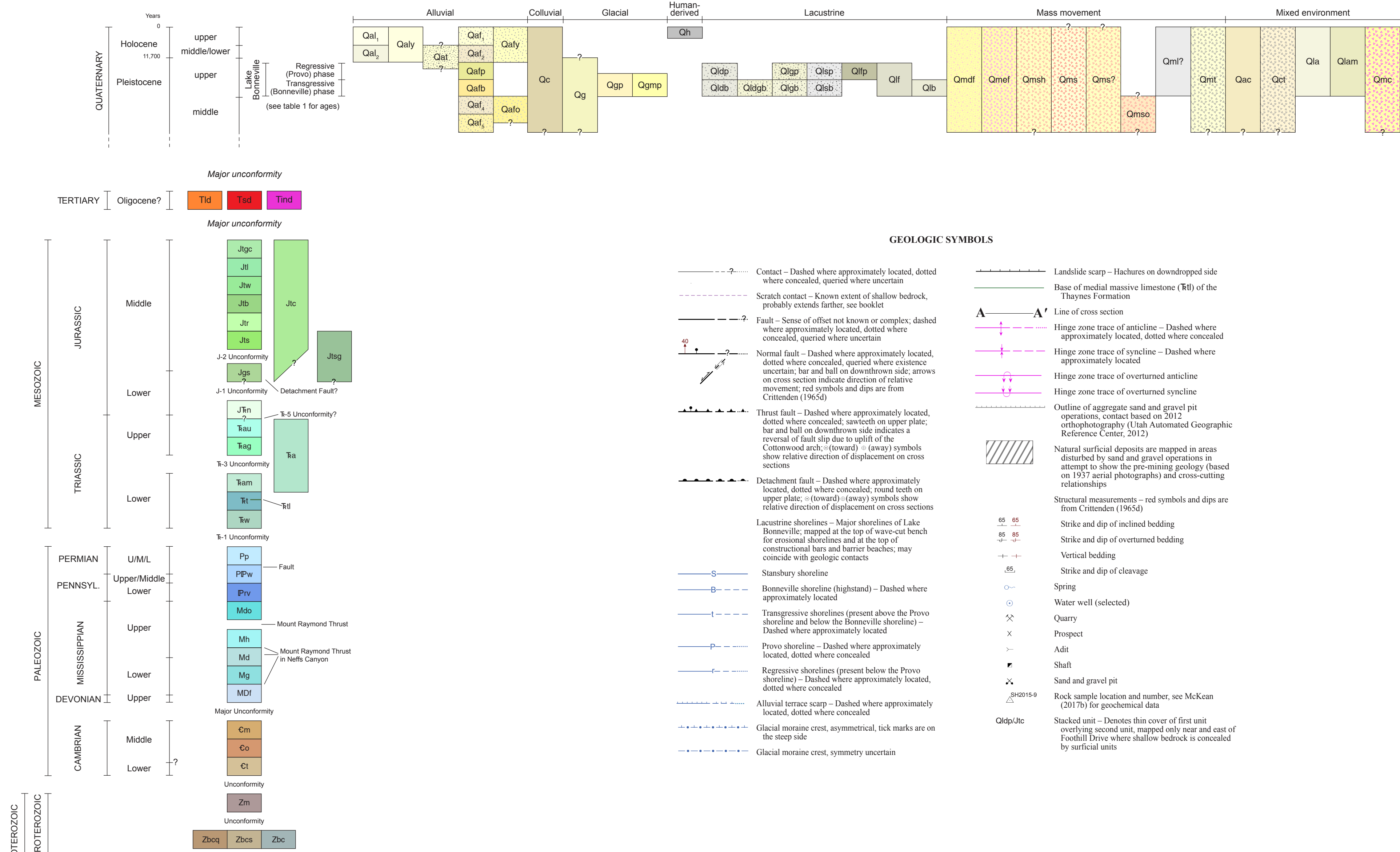


Figure 2. Inset map of shallow bedrock area near and east of Foothill Drive, where Marshall (1964a, 1964b, 1969) identified shallow bedrock in deep sever and water main trenches in 1947. Surficial deposits have been removed to show the shallow bedrock relationships; see plate 1 for the location and surficial geology. Thickness of surficial deposits is uncertain.

