SCALE 1:100,000
Contour interval 40 meters
Supplementary contour interval 10 meters

2 1 0 2 4 6 8 10 Kilometers

2 1 0 2 4 Miles

Base from U.S.G.S. Tule Valley, Ely, Fish Springs, and Kern Mountains 30' x 60' quadrangles

2002 MAGNETIC DECLINATION AT CENTER OF SHEET

13° 30'
240 MILS

GEOLOGIC MAP OF THE TULE VALLEY 30' x 60' QUADRANGLE AND PARTS OF THE ELY, FISH SPRINGS, AND KERN MOUNTAINS 30' x 60' QUADRANGLES, NORTHWEST MILLARD COUNTY, UTAH

by

Lehi F. Hintze and Fitzhugh D. Davis

2002

UTAH

Plate 1 of 2
Map 186
Utah Geological Survey
a division of
Utah Department of Natural Resources
in cooperation with **U.S. Geological Survey**
Statemap Agreement No. 00HQAG0109

GIS compilation: Basia Matyjasik and Angela Wadman
Cartographer: James Parker
Project Manager: Jon King

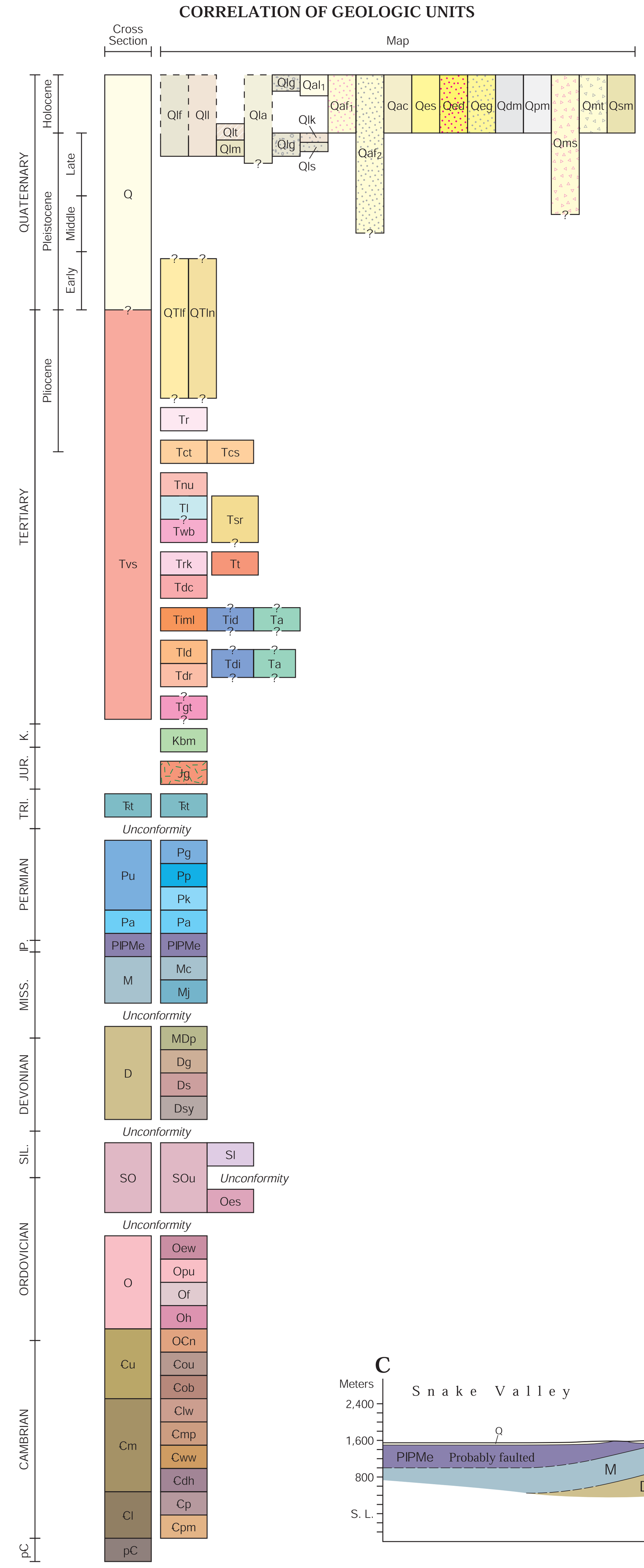
Map 186
Geologic Map of the Tule Valley 30' x 60' Quadrangle, and parts of the Ely, Fish Springs and Kern Mountains 30' x 60' Quadrangles, Northwest Millard County, Utah

by
Lehi F. Hintze and Fitzhugh D. Davis

2002

UTAH GEOLOGICAL SURVEY
a division of
UTAH DEPARTMENT OF NATURAL RESOURCES
in cooperation with
THE UNITED STATES GEOLOGICAL SURVEY
STATEMAP Agreement No. 00HQAG109

CORRELATION OF GEOLOGIC UNITS



DESCRIPTION OF GEOLOGIC UNITS

Q — Quaternary surficial units, undivided--Cross section only; for included units see correlation chart and descriptions.

Qlf — Fine-grained lacustrine deposits--Grayish-tan, tan, and light-gray, calcareous silts that are deep-water sediments of Lake Bonneville, Lake Tule, Lake Gunnison (all late Pleistocene), and Sevier Lake (when it contained surface water in the Holocene); locally includes younger alluvium; thickness 10 feet (3 m) or less.

Qll — Lacustrine lagoon deposits--Sand, silt, clay, and silty marl that accumulated in lagoons behind gravel barrier beaches of Lake Bonneville; locally includes younger alluvium; generally less than 10 feet (3 m) thick.

Qlt — Lacustrine tufa--White to light-gray, shore-zone tufa deposited in Lake Tule; 1 to 4 feet (0.3-1.2 m) thick.

Qlm — Lacustrine marl--Fine-grained, thinly bedded to laminated, white to light-gray, offshore to deep-water marl deposited in Lake Bonneville; ostracodes abundant throughout marl and, locally, gastropods present at top and base of marl; 0 to 30 feet (0-9 m) thick.

Qla — Lacustrine and alluvial deposits, undifferentiated--Mixed and reworked, gravelly lacustrine and alluvial deposits on piedmont slopes; grades from pebbly sand and silt to sandy pebble gravel; 0 to 12 feet (0-3.7 m) thick, but may be thicker locally.

Qlg — Lacustrine gravel--Shore-zone gravel deposited in Lake Bonneville, Lake Tule, Lake Gunnison, and Sevier Lake; chiefly silty, fine- to coarse-grained sand and gravel; gravel content is generally greater than 50 percent; 0 to 18 feet (0-5.5 m) thick; gravel of Lake Bonneville, Lake Tule, and Lake Gunnison is late Pleistocene. Beach gravel of Sevier Lake is adjacent to playa mud (Qpm) and is Holocene.

Qlk — Lacustrine carbonate sand--Lacustrine sand and pebbly sand that consists of white and light-gray, carbonate pellets, carbonate-coated gastropods, and ooids deposited in Lake Bonneville; 0 to 10 feet (0-3 m) thick.

Qls — Lacustrine sand-- Fine- to coarse-grained sand, marly sand, and pebbly sand deposited in Lake Bonneville as beaches, spits, and offshore bars; 0 to 30 feet (0-9 m) thick.

Qal₁ — Alluvium, late Holocene--Youngest alluvium in the channel and floodplain of Baker Creek; consists of sand, silt, and clay with probable lenses of gravel; generally 0 to 20 feet (0-6 m) thick, but may be thicker locally.

Qaf₁ — Younger alluvial-fan deposits-- Poorly sorted silt, sand, and pebble, cobble, and boulder gravel deposited by streams, sheetwash, debris flows, and flash floods on alluvial fans, and in canyons and mountain valleys; post-Bonneville shoreline in age; generally 0 to 40 feet (0-12 m) thick, but locally may exceed 60 feet (18 m).

Qaf₂ — Older alluvial-fan deposits--Poorly sorted silt, sand, and pebble, cobble, and boulder gravel deposited by streams, debris flows, and flash floods on alluvial fans, and in canyons and mountain valleys above the Bonneville shoreline; includes colluvium in canyons and mountain valleys; mostly Pleistocene and pre-Lake Bonneville in age, but locally includes younger material; up to 200 feet (60 m), or more, in thickness.

Qac — Alluvium and colluvium, undifferentiated--Mixed alluvial and colluvial deposits that consist of fluvially reworked, coarse-grained colluvium and/or alluvium with a significant colluvial component; also includes talus; only mapped on margins of Tule Valley; generally 0 to 50 feet (0-15 m) thick, but may be thicker locally.

Qes — Eolian sand--Windblown sand in sheets, low irregular mounds, shrub-coppice dunes, and narrow, northeast-trending ridges that are largely stabilized by vegetation; mostly silty, well-sorted, fine-grained quartz sand; 0 to 10 feet (0-3 m) thick.

Qed — Eolian dunes--Chiefly parabolic, linear, and dome dunes in Tule Valley that are active and not stabilized by vegetation; mostly well-sorted, fine-grained quartz sand, but some calcite and gypsum sand is present; 3 to 30 feet (1-9 m) thick.

Qeg — Eolian gypsum--Sand-sized gypsum deposited in windblown sand sheets in the central and eastern parts of Tule Valley; 0 to 10 feet (0-3 m) thick.

Qdm — Deltaic mud--Holocene mud of the Sevier River delta at the northeastern end of the Sevier Lake playa; likely 0 to 30 feet (0-9 m) thick.

Qpm — Playa mud--Laminated, silty fine sand, silt, and clayey silt that are infused with various salts, chiefly gypsum and calcium carbonate; saline mud is as much as 900 feet (274 m) thick beneath the Sevier Lake playa but only the uppermost few feet are Quaternary; thickness of salty mud in the other playas is probably 20 feet (6 m) or less.

Qms — Mass movements, slides, and slumps--Primarily mapped in the Swasey Peak area of the northern House Range where limestone blocks of the Dome Limestone and Marjum Formation have slumped or slid downslope on the less resistant Chisholm Formation and Wheeler Shale, respectively; small, isolated slides or slumps are present in many mountainous areas, but are too small to show at 1:100,000 scale; generally 0 to 120 feet (0-37 m) thick, but may be thicker in places.

Qmt — Mass movements, talus--Poorly sorted, angular boulders with minor fine-grained interstitial material on and at the base of steep slopes at one site in the House Range, and in the Drum Mountains; only the largest deposits can be shown at map scale; 0 to 60 feet (0-18 m) thick.

Qsm — Marsh deposits associated with springs--Gray to black, organic silt, clayey silt, and sandy silt; Tule Valley marsh deposits tend to be carbonate-rich and saline; possibly up to 20 feet (6 m) thick.

QTlf — Fine-grained lacustrine deposits of Sevier Desert--Brown and light-olive-gray, calcareous, lacustrine silt and silty clay with minor sand; offshore to deep-water sediments that are Pliocene to middle Pleistocene in age; 0 to 872 or more feet (0-265+ m) thick.

QTln — Near-shore lacustrine limestone of Sevier Desert--Light-gray limestone and conglomeratic limestone that comprise the shoreline facies of QTlf; up to 90 feet (27 m) thick.

Tvs — Tertiary volcanic and sedimentary units, undivided--Cross section only; for included units see correlation chart and descriptions.

Tr — Rhyolite of Whirlwind Valley--Light-gray, flow-layered, microfelsitic, devitrified rhyolite that may be a Miocene intrusive dome similar to ~6 Ma topaz rhyolites to north in Juab County.

Tcs — Conglomerate and tuffaceous sandstone--Weakly consolidated, pebble to cobble conglomerate and sandstone with interbedded tuffaceous sandstone on the northeast flank of the House Range; dips valleyward about 10 degrees; about 1,000 feet (300 m) exposed.

Tct — Conglomerate and tuff of Confusion Range--Light-gray, tuffaceous siltstone, sandstone, limestone, and conglomerate and air-fall, micaceous tuff; dips 20 degrees into valley; up to about 2,000 feet (600 m) thickness exposed.

Tnu — Upper Needles Range Group--Crystal-rich, dacitic ash-flow tuff, mainly of the Wah Wah Springs Tuff; age about 30.5 Ma; thickness up to 400 feet (120 m).

Tsr — Skull Rock Pass Conglomerate--Unconsolidated, bouldery conglomerate of Paleozoic clasts that lies above Tunnel Spring and Red Knolls Tuffs and beneath tuffs of the Needles Range Group; matrix is locally tuffaceous and contains rare igneous rock clasts; as much as 320 feet (98 m) thick.

Tl — Lacustrine limestone and breccia--Light-gray limestone that locally contains plant and fresh-water snail fossils; as much as 100 feet (30 m) thick in House Range and up to 200 feet (60 m) thick in Mile-and-a-Half Canyon in Confusion Range. Thinner similar limestones in Confusion Range are included in unit Tct. Basal cemented breccia of Cambrian dolomite and limestone fragments, as much as 115 feet (35 m) thick, is present only in House Range.

Twb — Windous Butte Tuff--Pink, rhyolite ash-flow tuff; small exposures at Toms Knoll in the Conger Range, and south of Wheeler Amphitheater in the House Range; Ar/Ar age 31.4±0.5 Ma; may be younger than unit Tl; less than 20 feet (6 m) exposed.

Tt — Tunnel Spring Tuff--White, crystal-rich, poorly welded, rhyolite ash-flow tuff that contains abundant xenoliths of Paleozoic rocks; characterized by well-formed, small, doubly terminated, quartz crystals; K-Ar age 35.4 Ma; maximum thickness about 50 feet (15 m) in map area.

Trk — Red Knolls Tuff--Grayish-pink, crystal-rich, dacite ash-flow tuff found east of the House Range; Ar/Ar age 36.5 Ma; about 200 feet (60 m) thick.

Tdc — Volcanic sequence of Dennison Canyon--Mostly a volcanic conglomerate of sub-rounded boulders, cobbles, and pebbles in an ashy volcanic matrix; includes basal pink ash-flow tuff about 500 feet (150 m) thick, overlain by about 1,500 feet (460 m) of andesitic volcanic debris flows with 500 feet (150 m) of interbedded hornblende-andesite lava flows and lesser debris flows at top of sequence; Ar/Ar ages 36.7 to 37.1 Ma; thickness about 2,000 to 2,500 feet (600-760 m).

Ta — Altered Cambrian and Tertiary rocks--Includes altered Cambrian strata and Tertiary rocks in the Drum Mountains and altered Cambrian strata on the west side of House Range. Age of alteration is thought to be about 36 Ma, the same as the adjacent Tertiary intrusions in the Drum Mountains; but, the age is Tertiary(?) in Cambrian strata elsewhere on the map.

Tdi — Drum Mountains intrusions--Two small intrusive bodies of dark-gray, finely crystalline diorite in the Drum Mountains.

Tid — Diorite dikes in the House Range--Two northeasterly trending dikes, one between Marjum Pass and Wheeler Amphitheater, the other in Sawtooth Canyon east of Notch Peak.

Timl — Mt. Laird intrusive dikes--Rhyodacitic porphyry dikes that cut the Drum Mountains Rhyodacite in the Little Drum Mountains; age 37 Ma; as much as 900 feet (275 m) wide.

Tld — Little Drum Formation--Intercalated andesitic tuff and bouldery volcanic conglomerate; Ar/Ar ages 37.6 and 38.5 Ma, but overlies Drum Mountains Rhyodacite; thickness 1,500 to 2,325 feet (450-708 m).

Tdr — Drum Mountains Rhyodacite--Rusty- and maroon-weathering flows and breccias, and dark-green, vesicular lavas; Ar/Ar ages ~37 Ma, but may be reset by Mt. Laird and Drum Mountain intrusions; thickness about 2,000 feet (600 m). Pyroxene latite of Black Point, about 1,000 feet (300 m) thick, is also included in this map unit.

Tgt — Welded tuff near Gandy--Isolated, small outcrop of brown, glassy, crystal-poor, welded tuff; about 50 feet (15 m) thick; age unknown.

Kbm — Breccia along tear faults in the House Range--Breccia with horizontal slickensides is present along most of the east-southeasterly tear faults in the northern House Range; widest breccia is mapped along the North Swasey tear fault, where it is about 30 feet (9 m) wide (width exaggerated on map).

Jg — Notch Peak quartz monzonite--Coarsely crystalline, porphyritic, quartz monzonite stock with sills that intrude Middle Cambrian strata; K-Ar age 170 Ma.

Ŧt — Thaynes Formation--Yellowish-gray claystone, platy siltstone, fine-grained sandstone, and brown limestone; maximum thickness about 1,935 feet (590 m).

Pu — Upper Permian, undivided--Cross section only; for included units see correlation chart and descriptions.

Pg — Gerster Limestone--Light-brownish-gray, ledge-forming, bioclastic limestone interbedded with shaly limestone; abundant invertebrate marine fossils; maximum thickness about 1,100 feet (335 m).

Pp — Plympton Formation--Yellow- or olive-gray, fine-grained, cherty dolomite with interbeds of siltstone, sandstone, and gypsum in upper half; thickness 690 feet (210 m).

Pk — Kaibab Limestone--Massive, light-gray, cherty, bioclastic limestone and limy dolomite; thickness 480 to 600 feet (146-180 m).

Pa — Arcturus Formation--Mostly fine-grained, poorly indurated, yellowish-gray sandstone, with some 6-10 foot (2-3 m) interbeds of limestone and limy dolomite that are cyclically spaced; more than 2,700 feet (820 m) thick.

PIPMe — Ely Limestone--Cyclic alternations of medium-gray, ledge-forming, bioclastic limestone and slope-forming, platy, silty limestone; chert common throughout as nodules, concretions, and irregular beds; corals, brachiopods, crinoids, and other invertebrate fossils are common; thickness 1,850 to 2,000 feet (560-610 m).

M — Mississippian, undivided--Cross section only; for included units see correlation chart and descriptions.

Mc — Chainman Formation--Interbedded mudstone, clayey limestone, siltstone, black shale, sandstone, and gritstone; mostly thin-bedded but with some thick-bedded, resistant limestone beds; generally forms low topography and poor exposures; thickness 1,600 to 1,800 feet (490-550 m), thinning northward.

Mj — Joana Limestone--Medium-gray, thick-bedded to massive limestone; common fossils are corals, gastropods, crinoid stems, and brachiopods; cherty beds in lower third; thins from 300 feet (90 m) in the southern part of the map area to zero at Granite Mountain north of map area.

D — Devonian, undivided--Cross sections only; for included units see correlation chart and descriptions.

MDp — Pilot Shale--Yellow-weathering, platy, calcareous siltstone and shale with thin beds of dolomitic siltstone; generally non-resistant and poorly exposed; 830 feet (250 m) thick.

Dg — Guilmette Formation--Chertless, gray dolomite and limestone that forms resistant ledges and cliffs; stromatoporoids abundant in some beds; contains thin sandstone beds in upper third; basal 650 feet (200 m) is massive solution-cavern limestone breccia; thickness is 2,550 to 2,650 feet (775-810 m).

Ds — Simonson Dolomite--Interbedded dark-brownish-gray, sugary dolomite and light-gray, laminated dolomite; poorly preserved stromatoporoids abundant in some beds; typically about 660 feet (200 m) thick.

Dsy — Sevy Dolomite--Light- to medium-gray, medium-bedded, locally laminated, unfossiliferous dolomite; upper third contains frosted quartz sand grains; typically about 1,300 feet (400 m) thick.

SO — Silurian-Upper Ordovician, undivided--Cross section only; for included units see correlation chart and descriptions.

SOu — Laketown and Ely Springs Dolomites, undivided--Mapped in the vicinity of Mile and a Half Canyon in the Confusion Range, where the geology is structurally complex, and near Gandy.

Sl — Laketown Dolomite--Banded dark- and light-brownish-gray, cherty, cliff-forming dolomite; silicified corals and brachiopods common in upper part; 920 to 1,100 feet (280-336 m) thick.

Oes — Ely Springs Dolomite--Dark-brownish-gray, generally unfossiliferous, ledge- and cliff-forming dolomite; 552 to 620 feet (168-189 m) thick.

O — Middle and Lower Ordovician, undivided--Cross section only; for included units see correlation chart and descriptions.

Oew — Eureka-Crystal Peak-Watson Ranch Formations, undivided--These formations are too thin to show individually at the 1:100,000 scale; listed from the top downward. Eureka Quartzite is light-gray, medium- to fine-grained quartzite that weathers reddish-brown; characteristically pitted with pock-marks about 0.5 inch (1 cm) across; forms orange cliffs conspicuous among the gray carbonate rocks; thickness 450 feet (137 m). Crystal Peak Dolomite is interbedded, thin-bedded, light-olive-gray dolomite and bluish-gray, silty limestone; *Eofletcheria* coral fossils are common; thickness 90 feet (27 m). Watson Ranch Quartzite is interbedded orangish-brown, fucoidal quartzite and bluish-gray, silty limestone and dolomite; thickness 200 feet (60 m).

Opu — Upper Pogonip Group, undivided--Consists of four formations too thin to show individually at the 1:100,000 scale; listed from the top downward. Lehman Formation--Interbedded, bluish-gray, silty limestone and shale; abundant ostracodes, brachiopods, trilobites, and other fossils; thickness is 200 feet (60 m). Kanosh Shale--Light-olive-gray, fissile shale with interbeds of thin-bedded, bioclastic limestone made up of brachiopod, ostracode, trilobite, and echinoderm fragments; up to 550 feet (170 m) thick. Juab Limestone--Medium-gray, medium- to thick-bedded, silty, ledge-forming limestone; contains orthid brachiopods; about 160 feet (50 m) thick. Wah Wah Limestone--Medium-gray, medium- to thick-bedded, silty limestone interbedded with olive shale; fragmented trilobites common in some beds; about 250 feet (75 m) thick.

Of — Fillmore Formation--Medium-gray, thin- to medium-bedded limestone and intraformational, flat-pebble, limestone conglomerate interbedded with light-olive and yellowish-gray shale; about 1,800 feet (550 m) thick.

Oh — House Limestone--Medium-bluish-gray, thick-bedded to massive, cherty limestone; thickness about 500 feet (152 m).

Ꞓu — Upper Cambrian, undivided--Cross section only; for included units see correlation chart and descriptions.

OꞒn — Notch Peak Formation--Dark-brownish-gray dolomite and gray limestone that commonly contain stromatolites; some beds cherty; forms massive cliffs; about 1,700 feet (520 m) thick.

Ꞓou — Orr Formation, upper members, undivided--Consists of four members, in descending order: Sneakover Limestone Member, Corset Spring Shale Member, Johns Wash Limestone Member, and Candland Shale Member; shale members carry several trilobite zones; aggregate thickness about 860 feet (260 m) where exposed in House Range.

Ꞓob — Orr Formation, Big Horse Limestone Member--Medium- to dark-gray, mottled limestone; oolitic and bioclastic in upper half, which bears *Crepicephalus* sp. trilobites; barren in lower half; forms ledges and cliffs; 715 feet (218 m) thick where exposed in House Range.

Ꞓm — Middle Cambrian, undivided--Cross section only; for included units see correlation chart and descriptions.

Ꞓlw — Lamb Dolomite and Trippe Limestone, or Weeks Limestone, undivided--Weeks Limestone is a trilobite-bearing, platy, silty limestone found only in the central House Range; 1,200 feet (366 m) thick; equivalent strata in other areas are mostly barren limestone and dolomite of the Lamb and underlying Trippe formations, which include a number of distinctive, white, laminated dolomite beds; thickness 1,180 to 1,290 feet (360-395 m).

Ꞓmp — Marjum or Pierson Cove Formation--In the central House Range the Marjum Formation is a sequence of trilobite-bearing, dark-gray limestone and limy shale; 530 to 1,410 feet (162-430 m) thick; equivalent strata elsewhere are dark-gray, mottled, massive, dolomitic limestone and thin-bedded, light-gray dolomite of the Pierson Cove; 800 to 1,200 feet (243-370 m) thick.

Ꞓww — Wheeler-Swasey-Whirlwind Formations, undivided--Listed from top downward. Wheeler Shale is olive, platy, calcareous shale about 460 to 900 feet (140-275 m) thick, with abundant *Elrathia* trilobites; Swasey Limestone is a gray, massive, cliff-forming limestone 180 to 250 feet (55-76 m) thick; Whirlwind Formation is interbedded, thin-bedded limestone and shale, with coquinas of *Ehmaniella* trilobites, and is about 140 feet (43 m) thick.

Ꞓdh — Dome-Chisholm-Howell Formations, undivided--Listed from top downward. Dome Limestone is massive, forms cliffs, and is about 320 feet (98 m) thick; Chisholm Formation is interbedded, thin-bedded, fossiliferous limestone and olive shale, and is about 215 feet (66 m) thick; Howell Limestone forms a massive cliff that is dark-gray in the lower half and light-gray above, and is 330 to 645 feet (101-196 m) thick.

Ꞓl — Lower Cambrian, undivided--Cross section only; for included units see correlation chart and descriptions.

Ꞓp — Pioche Formation--Dark-green, micaceous phyllite interbedded with light-brown to greenish-black quartzite; trace-fossil tubular trails and vertical *Skolithus* tubes are common; orange-weathering dolomite beds common in uppermost Pioche; thickness about 415 to 600 feet (127-183 m).

Ꞓpm — Prospect Mountain Quartzite--Pinkish-gray, medium- to coarse-grained quartzite; small-scale cross-bedding and thin beds of grit and pebble conglomerate are common; estimated thickness 4,000 feet (1,200 m) or more.

pꞒ — Precambrian, undivided--Cross section only.

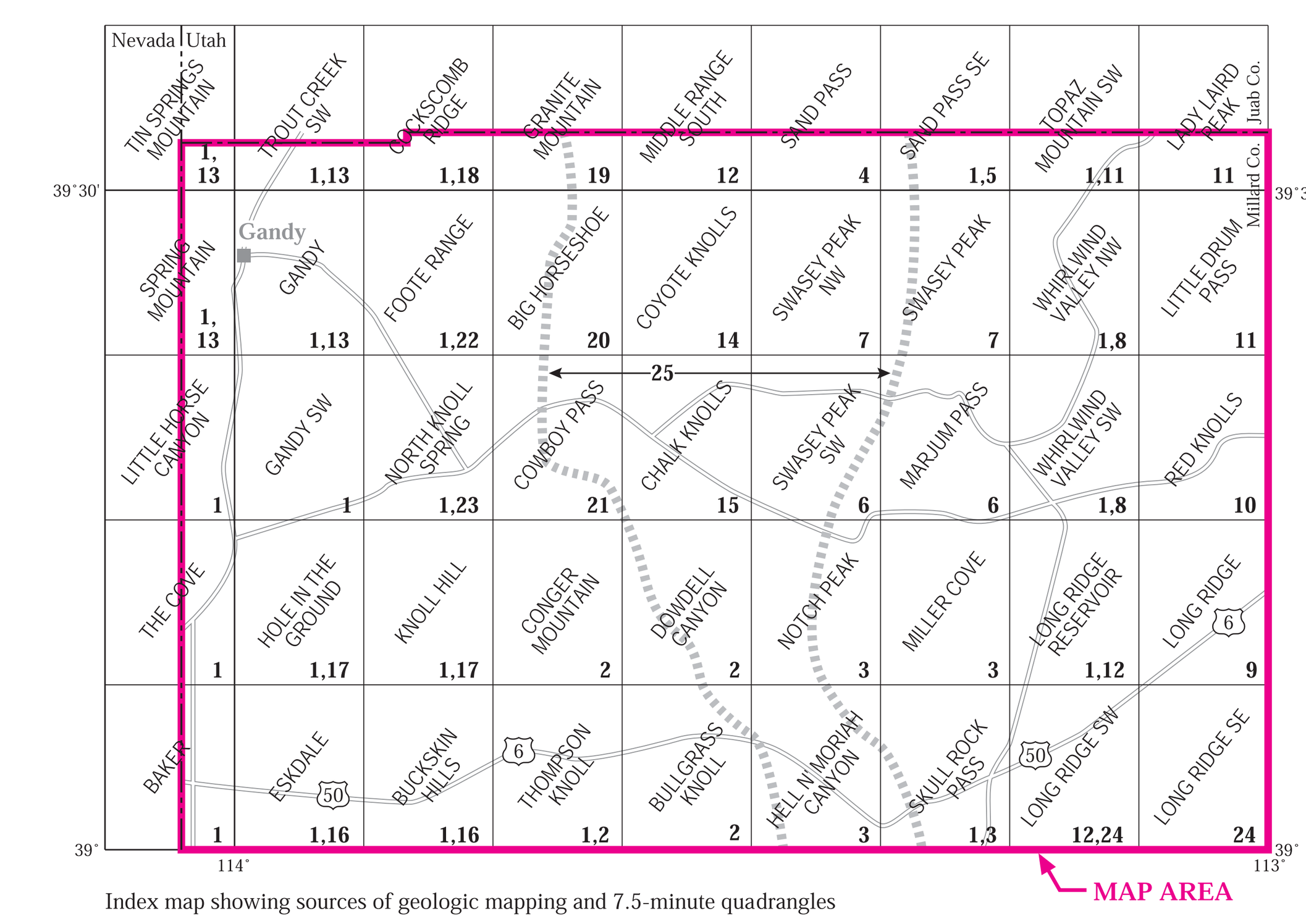
LITHOLOGIC COLUMN

AGE		MAP SYMBOL	MAP UNIT	THICKNESS FEET	THICKNESS METERS	SCHEMATIC COLUMN	OTHER INFORMATION
Q.	P.-H.	Q-various	Alluvial, lacustrine, eolian, and playa deposits	0-200	0-60		
TERTIARY	P.-H.	QTlf,QTln	Fine lake sediments (lf); shoreline deposits (ln)	0-870+	0-265+		Pliocene to mid-Pleistocene
TERTIARY	MIO.-PLIO.	Tr	Rhyolite of Whirlwind Valley	Intrusion?			Age uncertain; less than 20 Ma
TERTIARY	MIO.-PLIO.	Tcs	Conglomerate and tuffaceous sandstone	0-1,000+	0-300+		
TERTIARY	MIO.-PLIO.	Tct	Conglomerate and tuff (of Confusion Range)	0-2,000+	0-600+		Includes air-fall tuffs with small biotite flakes
TERTIARY	OLIGOCENE	Tnu	Upper Needles Range Group	0-400	0-120		30.5 Ma ash-flow tuffs
TERTIARY	OLIGOCENE	Tsr,Tl	Skull Rock Pass Cg (Tsr); Lacustrine limestone (Tl)	0-320	0-100		
TERTIARY	OLIGOCENE	Twb	Windous Butte Tuff	<20	<6		31.4 Ma Ar/Ar
TERTIARY	OLIGOCENE	Trk,Tt	Red Knolls Tuff (Trk);Tunnel Spring Tuff (Tt)	0-200	0-60		Trk 36.5 Ma Ar/Ar; Tt 35.4 Ma
TERTIARY	OLIGOCENE	Tdc	Volcanic sequence of Dennison Canyon	0-2,500±	0-760±		36.7-37.1 Ma Ar/Ar
TERTIARY	EOCENE	Ta	Altered Cambrian and Tertiary rocks	---	---		In Drum Mts. and west of House Range
TERTIARY	EOCENE	Tdi,Tid,Timl	Drum Mts. intrusion (Tdi); Diorite dike (Tid); Mt. Laird intr. (Timl)				Tdi and Timl 36-37 Ma
TERTIARY	EOCENE	Tld	Little Drum Formation	0-2,300	0-700		37.6 and 38.5 Ma Ar/Ar
TERTIARY	EOCENE	Tdr	Drum Mountains Rhyodacite and pyroxene latite	0-2,000	0-600		36.9 and 37.6 Ma Ar/Ar (reset?)
TERTIARY	EOCENE	Tgt	Welded tuff near Gandy	50	15		Age unknown
K.		Kbm	Breccia along tear faults in the House Range	0-30 ft (0-10 m) wide			
J.		Jg	Notch Peak granitic intrusion in the House Range	Intrusion			170 Ma
TRIASSIC		Ŧt	Thaynes Formation	1,935	590		Ammonites, sponges
PERMIAN		Pg	Gerster Limestone	1,100	335		*Punctospirifer pulcher*
PERMIAN		Pp	Plympton Formation	690	210		
PERMIAN		Pk	Kaibab Limestone	480-600	146-180		
PERMIAN		Pa	Arcturus Formation	2,700+	820+		Gypsum beds in upper part
PENN.		PIPMe	Ely Limestone	1,850-2,000	560-610		Fusulinids near top; Cyclic cherty fossiliferous limestone
MISSISSIPPIAN		Mc	Chainman Formation	1,600-1,800	490-550		Fossils common near top
MISSISSIPPIAN		Mj	Joana Limestone	0-300	0-90		Thins northward
DEVONIAN		MDp	Pilot Shale	830	250		
DEVONIAN		Dg	Guilmette Formation	2,550-2,650	775-810		Spaghetti stromatoporoids common; Massive limestone breccia
DEVONIAN		Ds	Simonson Dolomite	540-930	165-283		
DEVONIAN		Dsy	Sevy Dolomite	1,300-1,600	400-490		Light-gray dolomite
SIL.	SOu	Sl	Laketown Dolomite	920-1,100	280-335		Cherty dolomite
ORDOVICIAN	SOu	Oes	Ely Springs Dolomite	550-620	168-189		
ORDOVICIAN		Oew	Eureka - Crystal Peak - Watson Ranch Fms, undivided	700-740	214-226		
ORDOVICIAN	Pogonip Group	Opu	Lehman - Kanosh - Juab - Wah Wah Fms, undivided	1,160	353		Many fossils
ORDOVICIAN	Pogonip Group	Of	Fillmore Formation	1,800	550		Thin-bedded intraformational conglomerate and olive shale
ORDOVICIAN	Pogonip Group	Oh	House Limestone	500	152		*Symphysurina*
CAMBRIAN		OꞒn	Notch Peak Formation	1,700	520		Algal stromatolites
CAMBRIAN		Ꞓou	Orr Formation, upper members, undivided	860	260		*Dunderbergia*
CAMBRIAN		Ꞓob	Orr Formation, Big Horse Limestone Member	715	218		*Crepicephalus*; Bioclastic limestone
CAMBRIAN		Ꞓlw	Lamb - Trippe / Weeks Formations, undivided	1,180-1,290	360-395		White laminated dolomite
CAMBRIAN		Ꞓmp	Marjum - Pierson Cove Formations	530-1,400	162-430		Dark-gray limestone
CAMBRIAN		Ꞓww	Wheeler - Swasey - Whirlwind Fms, undivided	880-1,227	268-374		*Elrathia kingi*; *Ehmaniella*
CAMBRIAN		Ꞓdh	Dome - Chisholm - Howell Fms, undivided	865-1,185	264-361		*Glossopleura*
CAMBRIAN		Ꞓp	Pioche Formation	415-600	127-183		Phyllite with tracks and burrows; *Olenellus* trilobites
CAMBRIAN		Ꞓpm	Prospect Mountain Quartzite	4,000±	1,200±		Pink and orange quartzite
pꞒ		pꞒ	Precambrian metasedimentary rocks	---	---		On cross section only

Diagram is schematic--- no fixed thickness scale

MAP AND CROSS-SECTION SYMBOLS

- CONTACT--Dashed where location inferred.
- NORMAL FAULT--Dashed where location inferred; dotted where concealed; queried where speculative on cross section; bar and ball on downthrown side; arrows show relative movement on cross section. (On map) (Shown vertical or inclined on cross section)
- NORMAL FAULT--Inferred and delineated from gravity data; concealed; bar and ball on downthrown side.
- TEAR FAULT--High-angle fault with strike-slip offset; dotted where concealed; arrows show relative movement on map; T means toward and A means away on cross section A-A'. (Map) (Cross section)
- REVERSE FAULT--Dotted where concealed; R on upthrown side; arrows show relative movement on cross section. (Map) (Cross section)
- STEEPLY DIPPING FAULT--Includes faults where sense of motion not known or complex; dashed where location inferred; dotted where concealed.
- THRUST FAULT--Dashed where location inferred; dotted where concealed; queried where speculative on cross section; barbs on upper plate; arrows show relative movement on cross sections. (Map) (Cross section)
- ATTENUATION FAULT--Younger over older rocks with strata thinned or cut out between; barbs on upper plate; arrows show relative movement on cross section C-C'. (Map) (Cross section)
- LINEAMENT--Linear features visible on aerial photographs; present in Drum Mountains Rhyodacite in Little Drum Mountains; probably joints or steeply dipping faults with small offset.
- FOLD AXES--Location approximate; arrows on axes show plunge; dotted where concealed.
  - anticline
  - syncline
  - overturned syncline
- 65 42 STRIKE AND DIP OF BEDDING--Inclined, overturned.
- 6 STRIKE AND DIP OF PLANAR FEATURES IN VOLCANIC ROCK--Present in Little Drum Mountains.
- DEEP EXPLORATION WELL--Map symbol on left, cross-section symbol on right.
- SINKHOLE-- In Ely Limestone on east side of Snake Valley (section 8, T. 19 S., R. 18 W.); host unit uncertain on east flank of House Range (N1/2 section 35-36 line, T. 18 S., R. 13 W.).
- SHORELINES--Dashed were inferred, dotted where concealed.
  - G Lake Gunnison shoreline
  - P Provo shoreline of Lake Bonneville
  - B Bonneville shoreline of Lake Bonneville
- Qlf/QTaf Indicates thin cover of the first unit overlying the second unit.



Index map showing sources of geologic mapping and 7.5-minute quadrangles

TULE VALLEY 30' x 60' source list for geologic mapping

1. Davis, F.D., 1990-1995, unpublished mapping of surficial geology of the valley areas for this publication, scales 1:24,000 and 1:100,000, except those parts covered by Oviatt (1989) and Sack (1990).
2. Hintze, L.F., 1974, Preliminary geologic map of the Conger Mountain [15'] quadrangle, Millard County, Utah: U.S. Geological Survey Miscellaneous Field Studies Map MF-634, scale 1:48,000.
3. Hintze, L.F., 1974, Preliminary geologic map of the Notch Peak [15'] quadrangle, Millard County, Utah: U.S. Geological Survey Miscellaneous Field Studies Map MF-636, scale 1:48,000.
4. Hintze, L.F., 1980, Preliminary geologic map of the Sand Pass quadrangle, Juab and Millard Counties, Utah: U.S. Geological Survey Miscellaneous Field Studies Map MF-1151, scale 1:24,000.
5. Hintze, L.F., 1980, Preliminary geologic map of the Sand Pass NE and Sand Pass SE quadrangle, Juab and Millard Counties, Utah: U.S. Geological Survey Miscellaneous Field Studies Map MF-1150, scale 1:24,000.
6. Hintze, L.F., 1981, Preliminary geologic map of the Marjum Pass and Swasey Peak SW quadrangles, Millard County, Utah: U.S. Geological Survey Miscellaneous Field Studies Map MF-1332, scale 1:24,000.
7. Hintze, L.F., 1981, Preliminary geologic map of the Swasey Peak and Swasey Peak NW quadrangles, Millard County, Utah: U.S. Geological Survey Miscellaneous Field Studies Map MF-1333, scale 1:24,000.
8. Hintze, L.F., 1981, Preliminary geologic map of the Whirlwind Valley NW and Whirlwind Valley SW quadrangles, Millard County, Utah: U.S. Geological Survey Miscellaneous Field Studies Map MF-1335, scale 1:24,000.
9. Hintze, L.F., and Davis, F.D., 1992, Geologic map of the Long Ridge quadrangle, Millard County, Utah: Utah Geological Survey Map 141, 10 p., scale 1:24,000.
10. Hintze, L.F., and Davis, F.D., 1992, Geologic map of the Red Knolls quadrangle, Millard County, Utah: Utah Geological Survey Map 142, 10 p., scale 1:24,000.
11. Hintze, L.F., 1987-91, unpublished mapping, scale 1:24,000, includes bedrock and surficial geology in Little Drum Pass quadrangle; revision of Leedom, S.H., 1974, Little Drum Mountains, an early Tertiary shoshonitic volcanic center in Millard County, Utah: Brigham Young University Geology Studies, v. 21, part 1, p. 73-108, scale 1:48,000; Pierce, C.R., 1974, Geology of the southern part of the Little Drum Mountains, Utah: Brigham Young University Geology Studies, v. 21, part 1, p. 109-129, scale 1:48,000; Dommer, M.L., 1980, The geology of the Drum Mountains, Millard and Juab Counties, Utah: Brigham Young University Geology Studies, v. 27, part 3, p. 55-72, scale 1:40,000; and Nutt, C.J., Thorman, C.H., Zimbelman, D.R., and Gloyn, R.W., 1991, Geologic setting and trace-element geochemistry of the Detroit mining district, west-central Utah, *in* Raines, G.L., Lisle, R.E., Schafer, R.W., and Wilkinson, W.H., editors, Geology and ore deposits of the Great Basin, symposium proceedings: Reno, Geological Society of Nevada, p. 491-509.
12. Hintze, L.F., 1990, 1993-94, unpublished mapping of Cambrian, Ordovician, Devonian, and Tertiary bedrock for this publication, scale 1:24,000.
13. Hintze, L.F., 1993-94, unpublished bedrock mapping for this publication, scale 1:24,000; modifying mapping later partially published as Gans, P.B., Miller, E.L., and Lee, Jeffrey, 1999, Geologic map of the Spring Mountain quadrangle, Nevada and Utah; Nevada Bureau of Mines and Geology, Field Studies Map 18, 12 p., scale 1:24,000.
14. Hose, R.K., 1963a, Geologic map and section of the Cowboy Pass NE quadrangle, Confusion Range, Millard County, Utah: U.S. Geological Survey Miscellaneous Investigations Map I-377, scale 1:24,000.
15. Hose, R.K., 1963b, Geologic map and sections of the Cowboy Pass SE quadrangle and adjacent area, Confusion Range, Millard County, Utah: U.S. Geological Survey Miscellaneous Investigations Map I-391, scale 1:24,000.
16. Hose, R.K., 1965a, Geologic map and sections of the Conger Range SE quadrangle and adjacent area, Confusion Range, Millard County, Utah: U.S. Geological Survey Miscellaneous Investigations Map I-435, scale 1:24,000.
17. Hose, R.K., 1965b, Geologic map and sections of the Conger Range NE quadrangle and adjacent area, Confusion Range, Millard County, Utah: U.S. Geological Survey Miscellaneous Investigations Map I-436, scale 1:24,000; additional outcrops to west from L.F. Hintze, 1989, unpublished mapping for this publication; mapping of Tertiary units modified locally by L.F. Hintze for this publication.
18. Hose, R.K., 1974, Geologic map of the Trout Creek SE quadrangle, Juab and Millard Counties, Utah: U.S. Geological Survey Miscellaneous Investigations Map I-827, scale 1:24,000.
19. Hose, R.K., 1974, Geologic map of the Granite Mountain SW quadrangle, Juab and Millard Counties, Utah: U.S. Geological Survey Miscellaneous Investigations Map I-831, scale 1:24,000; mapping of Tertiary units modified locally by L.F. Hintze for this publication.
20. Hose, R.K., and Repenning, C.A., 1963, Geologic map and sections of the Cowboy Pass NW quadrangle, Confusion Range, Millard County, Utah: U.S. Geological Survey Miscellaneous Investigations Map I-378, scale 1:24,000; mapping of Tertiary units modified locally by L.F. Hintze for this publication.
21. Hose, R.K., and Repenning, C.A., 1964, Geologic map and sections of the Cowboy Pass SW quadrangle, Confusion Range, Millard County, Utah: U.S. Geological Survey Miscellaneous Investigations Map I-390, scale 1:24,000.
22. Hose, R.K., and Ziony, J.I., 1963, Geologic map and sections of the Gandy NE quadrangle, Confusion Range, Millard County, Utah: U.S. Geological Survey Miscellaneous Investigations Map I-376, scale 1:24,000; mapping of Tertiary units modified locally by L.F. Hintze for this publication.
23. Hose, R.K., and Ziony, J.I., 1964, Geologic map and sections of the Gandy SE quadrangle, Confusion Range, Millard County, Utah: U.S. Geological Survey Miscellaneous Investigations Map I-393, scale 1:24,000.
24. Oviatt, C.G., 1989, Quaternary geology of part of the Sevier Desert, Millard County, Utah: Utah Geological and Mineral Survey Special Studies 70, 41 p., scale 1:100,000.
25. Sack, Dorothy, 1990, Quaternary geologic map of the Tule Valley, west-central Utah: Utah Geological Survey Map 124, scale 1:100,000, locally modified by F.D. Davis and L.F. Hintze.