PLATE 2

GEOLOGIC MAP of the BIG BEND QUADRANGLE GRAND COUNTY, UTAH

by

Plate 2
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UTAH GEOLOGICAL SURVEY
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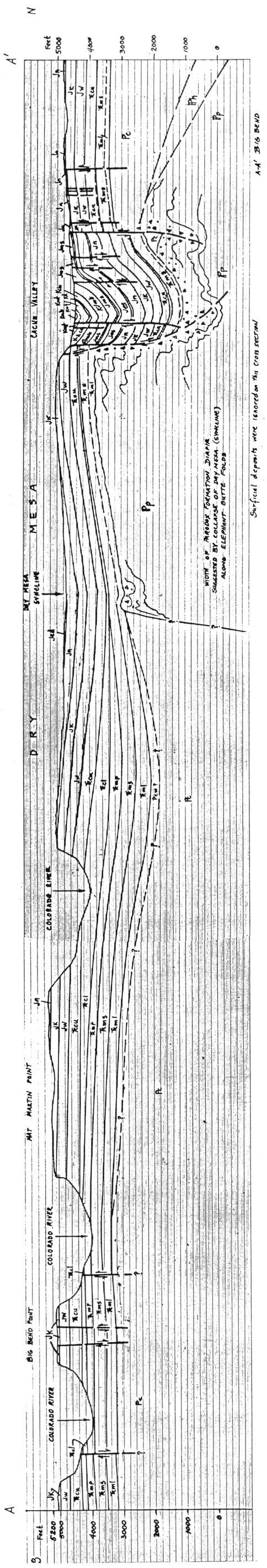
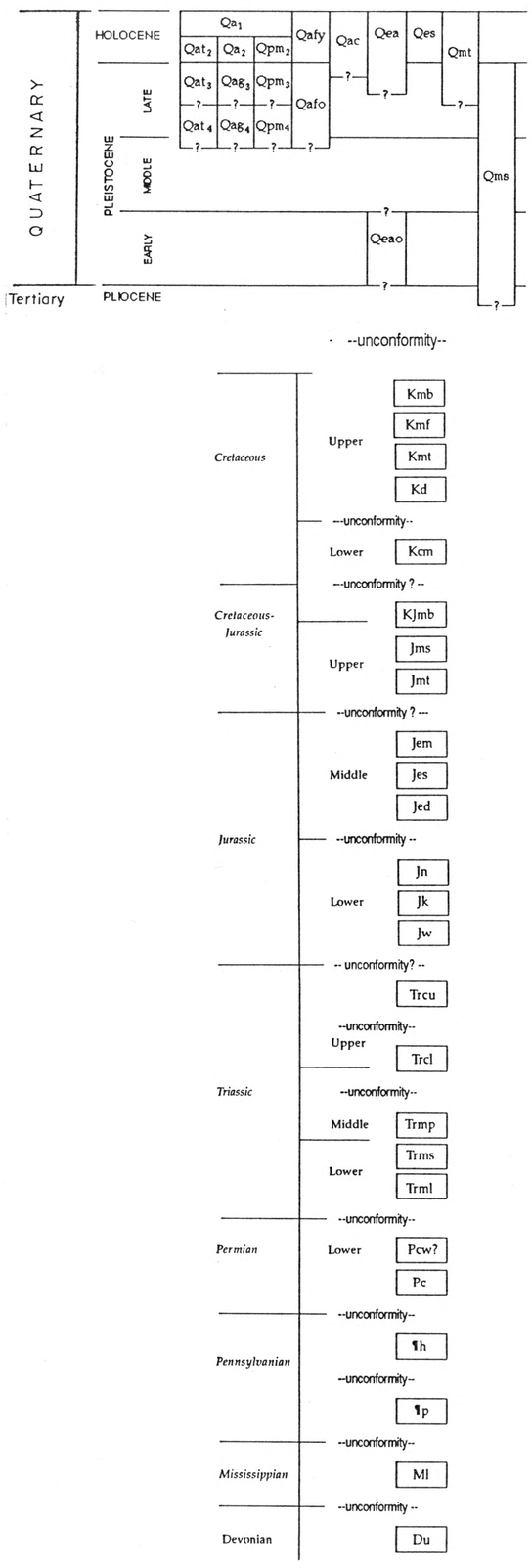


PERIOD	EPOCH	FORMATIONS AND MEMBERS		SYMBOL	THICKNESS Feet (m)	LITHOLOGY
Quaternary	Pleistocene	Surficial deposits			0-350+ (0-107+)	
Tertiary	? Pliocene					
Cretaceous	Upper	Mancos Shale	Blue Gate Shale Member	Kmb	500+ (152+)	Lower part unexposed; —unconformity—; Sandy beds; Light gray shale
			Ferron Member	Kmf	90-120 (27-37)	Sea shells near top
			Tununk Shale Member	Kmt	400 (122)	Medium gray shale
		Dakota Formation		Kd	40-50 (12-15)	—unconformity—
	Lower	Cedar Mountain Formation		Kcm	200-240 (61-73)	Ridge-forming ledges; —unconformity— ?
		Morrison Formation	Brushy Basin Member	KJmb	300-340 (91-104)	Green, zeolitic shale
?	? Upper		Salt Wash Member	Jms	250 (76)	Lenticular channel sandstones
			Tidwell Member	Jmt	40-60 (12-18)	Large chert concretions; —unconformity— ?
Jurassic	Middle	Entrada Sandstone	Moab Member	Jem	90-110 (27-34)	Highly jointed
			Slick Rock Member	Jes	250-350 (76-107)	Arches
			Dewey Bridge Member	Jed	40-60 (12-18)	Contorted bedding; —unconformity—
	Lower	GLEN CANYON GROUP	Navajo Sandstone	Jn	250-400 (76-122)	Large-scale, high-angle cross-stratification; Petrified sand dunes; Thin limestone ledges
			Kayenta Formation	Jk	240-300 (73-91)	Ledge and bench former
			Wingate Sandstone	Jw	240-350 (73-107)	Prominent vertical cliff former; Desert-varnished surfaces
Triassic	Upper	Chinle Formation	Upper member	Trcu	200-460 (61-140)	—unconformity— ?; "Black Ledge" locally present
			Lower member	Trcl	0-380+ (0-116+)	—unconformity—; Silcrete horizons; Mottled siltstone and sandstone; Paleosols
	? Middle	Moenkopi Formation	Pariott Member	Trmp	0-450 (0-137)	—unconformity—; "Ledgy" Moenkopi
			Sewemup Member	Trms	0-470 (0-143)	Smooth slopes; Ripple marks and rain-drop imprints; Thin gypsum beds; Mud cracks
	Lower		Lower member (combined Ali Baba and Tenderfoot Mbrs.)	Trml	0-450 (0-137)	Ripple marks; Gypsum bed
Permian	Lower	Cutler Formation	White Rim Sandstone Mbr ?	Pcw?	0-250 (0-76)	—unconformity—; White eolian sandstone
			Arkosic sandstone member	Pc	0-1,000 (0-305) exposed at surface; 6,235+ (1,900) surface and known subsurface	Subarkosic and arkosic fluvial and eolian sandstone; Thin limestone beds
Pennsylvanian		HERMOSA GROUP	Honaker Trail Formation	IPh	0-930+ known subsurface (0-283+)	—unconformity—; Interbedded limestone and micaceous sandstone
			Paradox, Pinkerton Trail and Molas Formations	IPp	0-100+ (0-30+) exposed as caprock; 3,060+ (933+) surface and known subsurface	—unconformity—; Evaporite caprock (gypsum and shale); Marker bed hydrocarbon potential; Sylvite and carnallite; Salt, anhydrite, shale, limestone, dolomite, siltstone
Mississippian		Leadville Formation		Ml	450 (137) subsurface only	—unconformity—; Limestone and dolomite
Devonian	Upper ? Middle	Devonian rocks undivided		Du	340 (104) subsurface only	—unconformity—; Limestone, dolomite, sandstone, minor shale

CORRELATION OF MAP UNITS



MAP SYMBOLS

- Contact - dashed where approximate
- Normal fault - dashed where inferred; dotted where concealed; bar and ball on downthrown side
- Anticline - showing trace of axial plane; arrow on trace shows plunge; dashed where approximate
- Syncline - showing trace of axial plane; arrow on trace shows plunge; dashed where approximate
- 30 / 15 — Strike and dip of bedding
- Strike of vertical joint
- 16 — Strike and dip of joint
- Collapsed basin center
- 4000 — Structure contour - drawn on base of Wingate Sandstone; dashed where projected; 200-ft contour interval
- 4600 — Closed structure contour
- Cu Ba Au — Prospect, adit, and placer mine - Cu = copper, Ba = barite, Ca = calcite, Au = gold
- Sand and gravel pit
- Abandoned oil or gas well

DESCRIPTION OF MAP UNITS

Qes — Eolian sand deposits --- *Generally fine- to medium-grained quartzose sand forming thin, discontinuous accumulations of sand sheets and small dunes.*

Qea, Qeao — Mixed eolian and alluvial sand deposits --- *Thin accumulations of mainly sand deposited and reworked by eolian and alluvial processes; moderate to well sorted; generally restricted to ephemeral washes and hollows. Qeao deposit is mainly sand, but contains minor clay and gravel lenses; forms a thick deposit capped by a stage V petrocalcic soil suggesting an early Pleistocene age. Local thickness may exceed 160 feet (49 m).*

Qac — Mixed alluvial and colluvial deposits --- *Poorly sorted mixture of clay through cobble size detritus with sporadic boulders; clasts vary from subrounded to angular; located along narrow ephemeral washes where colluvium is reworked and transported away be alluvial processes in active channels. Thicknesses up to 15 feet (5 m).*

Qafy, Qafo — Alluvial fan deposits --- *Deposits of poorly sorted, angular to subrounded boulders, cobbles, and gravels in a crudely-bedded finer grained matrix; form gentle to moderate apron-like slope at the base of bedrock outcrops; younger fan deposits (Qafy) head in gullies of older fan deposits (Qafo). Deposit thicknesses range from 6 to 250+ feet (2-76+ m).*

Qa1, Qa2, Qa3, Qa4 — Alluvial deposits --- *Qa1 and Qa2 contain generally finer grained detritus; consist mainly of poorly to moderately sorted silt, sand, and lenses of gravel; located along Colorado River and the larger crreks and ephemeral washes. Qag3 and Qag4 contain generally coarser grained detritus; consist of poorly sorted, poorly stratified sandy cobble gravel; form dissected stony surfaces and subtle ridges in Castle Valley; deposits exhibit pedogenic carbonate soils ranging from stage I to stage IV.*

Qat2, Qat3, Qat4 — Terrace gravel deposits --- *Moderately sorted, subrounded to rounded, poorly stratified gravel in a gray, calcareous sandy matrix; forms rounded knobs on small hills along the Colorado River; variety of clast lithologies that are exotic to quadrangle; Qat2 is 6-40 feet (2-12 m) above the river; Qat3 is about 100 feet (30 m) above the river; Qat4 is about 130 feet (40 m) above the river.*

Qp2, Qp3, Qp4 — Pediment-mantle deposits --- *Poorly sorted, sandy matrix-supported gravel; locally contains lenses of sand and/or clast-supported gravel; gravel ranges from pebbles to boulders; deposits are locally sourced and have orange-red-purple shading; detritus deposited as a relatively thin veneer on uneven pediment surfaces; mixed alluvial fan, ephemeral stream, colluvial, and eolian processes. Deposits are subdivided based on height above current drainage and grading to alluvial terraces along the river.*

Qmt — Talus deposits and colluvium --- *Generally angular rock fall blocks, boulders, and small fragments deposited as veneers on slopes below ledges and cliffs; colluvium contains additional slopewash debris of poorly sorted rock fragments in a sandy to muddy matrix.*

Qms — Landslide deposits --- *Large coherent blocks to fragmented masses of bedrock and surficial debris transported downslope by mass movement.*

Mancos Shale

Kmb — Blue Gate Shale Member --- *Mostly light-gray marine shale, slope-former, containing local sandy beds which are slightly more resistant; youngest bedrock unit exposed in Cache Valley. Incomplete thickness 500+ feet (152+ m).*

Kmf — Ferron Sandstone Member --- *Light-brown to medium-gray marine sandstone, sandy shale, shale, and carbonaceous shale; thin bedded; slightly more resistant than members above and below, locally fossiliferous near top. Thickness 90-120 feet (27-37 m).*

Kmt — Tununk Shale Member --- *Medium-gray marine shale, slope former containing a few sandy beds, especially near the top; sandy beds are yellow gray to brown gray. Thickness about 400 feet (122 m).*

Kd — Dakota Formation --- *Light-gray to yellow-gray sandstone, conglomeratic sandstone, and conglomerate, with subordinate gray sandy shale and carbonaceous shale; forms ridges in Cache Valley. Thickness 40-50 feet (12-15 m).*

Kdcm Kcm — Cedar Mountain Formation --- *Variegated slope-forming mudstone interbedded with ledge-forming gray and brown quartzite, conglomerate, and gritstone. Mudstone is mostly light green, gray, lavender, and white; locally deformed and attenuated with Dakota Formation (Kdcm), especially on south wall of Cache Valley. Thickness 200-240 feet (61-73 m).*

Morrison Formation

KJmb — Brushy Basin Member --- *Mostly variegated to bright green, slope-forming mudstone with thin ledges of conglomeratic sandstone, conglomerate, nodular weathering limestone, and gritstone; ledgeformers are more abundant in the lower part of the member; locally attenuated. Thickness 300-340 feet (91-104 m).*

Kms — Salt Wash Member --- *Light-yellow-gray, cross-bedded, lenticular, ledge-forming sandstone interbedded with red and gray, slope-forming mudstone and siltstone. Thickness about 250 feet (76 m).*

Kmt — Tidwell Member --- *Reddish silty shale, with interbeds of fine-grained yellow sandstone and gray limestone; lower half of unit slightly more resistant; contains large, white, siliceous concretions in upper half of unit; formerly mapped as Summerville Formation. Thickness 40-60 feet (12-19 m).*

Entrada Sandstone

Jem — Moab Member --- *Pale-orange, grayish-orange, pale yellowish-brown, or light-gray, fine- to medium-grained, calcareous, massive, cliff-forming sandstone; upper surfaces prominently jointed. Thickness 90-110 feet (27-34 m).*

Jes — Slick Rock Member --- *Reddish-orange or brown, very fine- to fine-grained eolian sandstone; calcareous or iron oxide cemented; massive; weathers to form smooth cliffs and bare rock slopes; commonly covered with self-derived sand; not as resistant as Moab Member above, but more resistant than Dewey Bridge Member below. Thickness 250-350 feet (76-107 m).*

Jed — Dewey Bridge Member --- *Dark reddish, fine-grained, silty sandstone; mostly iron oxide cemented; in irregularly contorted, indistinct "lumpy" medium to thick beds; formerly known as Carmel Formation. Thickness 40-60 feet (12-18 m).*

Jn — Navajo Sandstone --- *Orange to light-gray eolian sandstone, mostly fine grained, cemented with silca or calcite; crops out as vertical cliffs in deep canyons and as domes and rounded knolls elsewhere; contains local thin, hard, gray carbonate beds; well displayed, high-angle cross beds. Thickness 250-400 feet (65-122 m).*

Jk — Kayenta Formation --- *Moderate-orange-pink, reddish-brown, and lavender sandstone interbedded with subordinate dark-reddish-brown to grayish-red silty mudstone, lavender-gray intraformational conglomerate, and limestone mostly of fluvial or lacustrine origin; light-orange to light-gray eolian sandstone beds become more prominent in upper third; commonly micaceous; mostly cemented with calcite; resistant, forms thick step-like ledges between the more massive Navajo and Wingate Sandstones, upper part less resistant, important bench former in quadrangle. Thickness 240-300 feet (73-91 m).*

Jw — Wingate Sandstone --- *Mostly light-orange-brown, moderate-orange-pink, or moderate reddish-orange, fine-grained, well-sorted, cross-bedded sandstone; calcareous or siliceous cement; forms nearly vertical cliffs along canyon walls or thick-terraced cliff where shattered; cliff surfaces commonly veneered with dark-brown desert varnish. Thickness 240-350 feet (73-107 m).*

Chinle Formation

Trcu — Upper member --- *Moderate reddish-brown or grayish-red, fine- to coarse-grained sandstone and siltstone with subordinate pebble- or gritstone, and gray limestone; slope-forming with prominent ledges, slope-forming units fine-grained and generally display indistinct bedding, ledge-formers are fine- to caorse-grained, and platy to very thick bedded. Thickness 200-460 feet (61-140 m), sections under 300 feet (91 m) over or immediately adjacent to salt-cored anticlines.*

Trcl — Lower member --- *Mottled gray, purple, and reddish-brown interbedded sandstone, conglomerate, and siltstone; forms alternating ledges and slopes; contain paleosol layers exhibiting abundant and distinct vertical tubes with fossil plant remains. Thickness 0-380+ feet (0-116+ m), locally missing over or near salt-cored anticlines and very thick in irregular depositional basins or synclines peripherally located to salt-cored anticlines.*

Moenkopi Formation

Trmp — Pariott Member --- *Reddish-brown sandstone interbedded with chocolate-brown, orange-brown, or red siltstone, mudstone, and shale; sandstone is fine- to medium-grained and commonly pebbly, micaceous, poorly to well sorted, and forms a series of ledges; siltstones and mudstones form steep slopes. Thickness 0-450 feet (0-137 m), local to the vicinity of the Big Bend quadrangle.*

Trms — Sewemup Member --- *Pale reddish-orange to grayish-red, slope-forming siltstone with subordinate reddish-brown, fine-grained sandstone; thinly laminated to thin bedded; gypsum is common as irregular veinlets and thin beds; commonly cemented with gypsum; sandstone is commonly ripplemarked. Thickness 0-470 feet (0-143 m), locally missing over salt-cored anticlines, thick elsewhere.*

Trml — Lower member --- *Reddish-brown and lavender, silty, ledge-forming sandstone and conglomeratic sandstone interbedded with slightly darker reddish-brown to reddish-orange, slope-and recess-forming sandstone, siltstone and silty mudstone; micaceous and feldspar bearing; platy to medium bedded, commonly ripplemarked or mudcracked. Thickness 0-450 feet (0-137 M), may be missing over salt-cored anticlines, greater than 190 feet (58 m) elsewhere.*

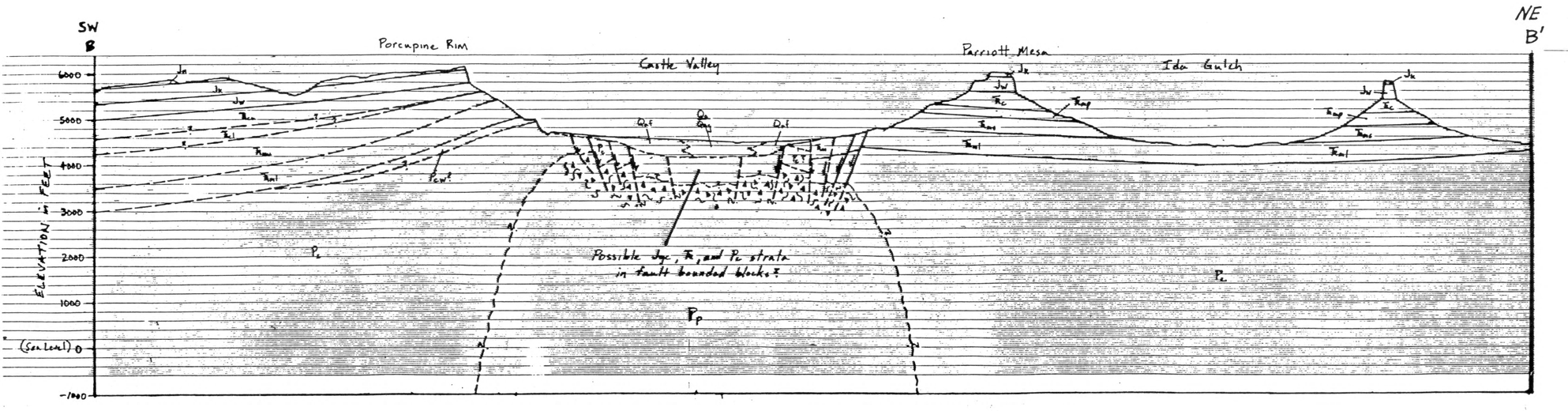
Cutler Formation

Pcw? — White Rim Sandstone Member? --- *Grayish-white, quartzose, high-angle cross-bedded sandstone interbedded with minor siltstone and arkose; massive; resistant cliff-former. Thickness 0-250 feet (0-76 m), exposures limited to southwest flank of Castle Valley.*

Pc — Arkosic sandstone member --- *Reddish-brown and reddish-purple, subarkosic to arkosic sandstone, conglomeratic sandstone, and conglomerate interbedded with silty and sandy mudstone and shale; thin bedded to massive, forms steep slopes, ledges, and cliffs. Thickness 0-6,235+ feet (0-1,900+ m), upper 1,000 feet (305 m) exposed at surface, mostly missing over salt-cored anticlines.*

¶h — Honaker Trail Formation --- *Interbedded limestone and micaceous sandstone, not exposed at the surface. Thickness 0-930+ feet (0-283+ m), missing over salt-cored anticlines.*

¶p — Paradox, Pinkerton Trail, and Molas Formations --- *Sucrosic gypsum, clayey gypsiferous beds, silty shale, sandstone, limestone, and dolomite; contorted bedding in two small exposures; halite and other salts present in subsurface in salt-cored anticlines; upper surface of salt-cored anticlines consists of caprock composed of insoluble rock types. Thickness 1,500-3,060+ feet (457-933+ m) except in salt-cored anticlines where the maximum thickness may approach 9,000 feet (2,700 m).*

Ml — Leadville Formation --- *Limestone and dolomite, subsurface only. Thickness about 450 feet (137 m).*

Du — Devonian rocks undivided --- *Limestone, dolomite, sandstone, minor shale; subsurface only. Thickness about 340 feet (104 m).*