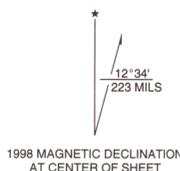
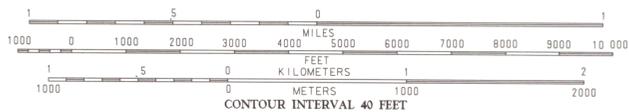


Base map from U.S. Geological Survey
 Big Bend 7.5' Quadrangle, 1985

SCALE 1:24 000



**GEOLOGIC MAP OF THE BIG BEND
 QUADRANGLE, GRAND COUNTY, UTAH**

by
Hellmut H. Doelling and Michael L. Ross
 1998



QUADRANGLE LOCATION

1	2	3	1 Mollie Hogan
2	3	4	2 Cloo SW
3	4	5	3 Dreyer
4	5	6	4 The Window Section
5	6	7	5 Fisher Towers
6	7	8	6 Mash
7	8		7 Bill Creek
8			8 Warner Lake

ADJOINING 7.5' QUADRANGLE NAMES

Field work: by Doelling in 1982, 1983, 1989, and 1993,
 by Ross in 1989 and 1990
 Grant C. Willis, Project Manager
 Lori J. Douglas, Cartographer

DESCRIPTION OF MAP UNITS

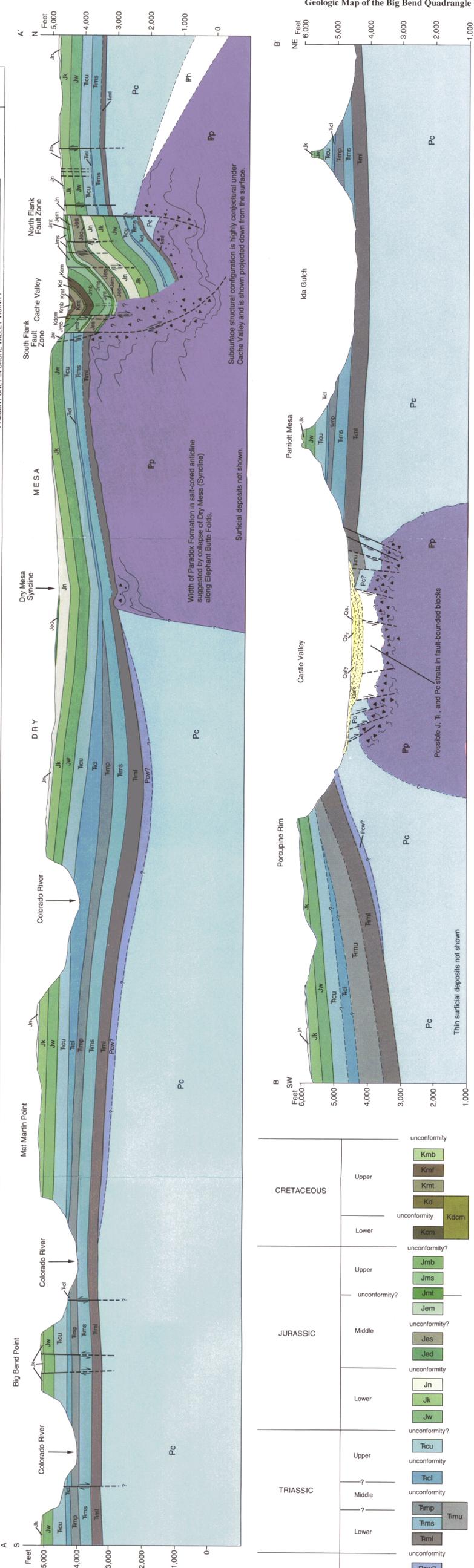
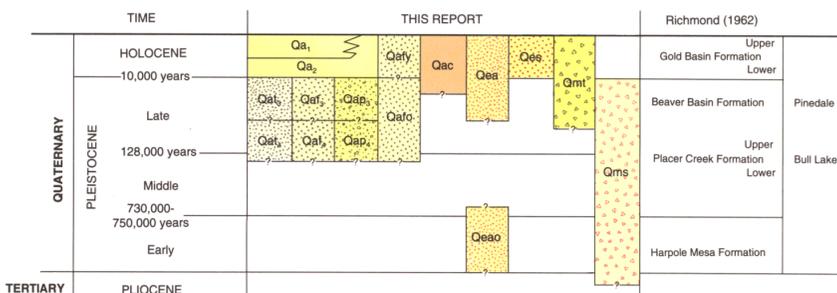
- Qa₁**
Qa₂
 Alluvium - Unconsolidated deposits of poorly to moderately sorted silt, sand, and lenses of gravel; Qa₁ is located in active larger channels and floodplains; Qa₂ deposits form the first surface 6-40 feet (2-12 m) above the active channels and are characterized by weak soil development. Thickness up to 25 feet (8 m).
- Qat₁**
Qat₂
 Alluvial 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; Qat₁ is about 100 feet (30 m) above the river; Qat₂ is about 130 feet (40 m) above the river. Maximum thickness 20 feet (6 m).
- Qaf₁**
Qaf₂
Qaf₃
Qaf₄
 Alluvial-fan deposits - Unconsolidated deposits of poorly sorted, generally unstratified, muddy to sandy cobble gravel; boulders present in proximal areas; Qaf₁, and Qaf₂ form dissected stony surfaces and subtle ridges in Castle Valley; deposits exhibit petrocalcic soils ranging from Stage I to IV; younger (Qaf₁) and older (Qaf₄) deposits form coalesced fans along the margins of Castle Valley. Typical thickness 3-40 feet (1-12 m); in Castle Valley may be up to 350 feet (107 m) thick as basin-fill deposits.
- Qap₁**
Qap₂
 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 derived and have an 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. Maximum thickness 25 feet (8 m).
- 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 slope-wash debris of poorly sorted rock fragments in a sandy to muddy matrix. Thickness 0 to 30 feet (0-9 m).
- Qms**
 Landslide deposits - Large coherent blocks to fragmented masses of bedrock and surficial debris transported downslope by mass movement. Thicknesses vary.
- Qes**
 Eolian sand deposits - Generally fine- to medium-grained quartzose sand forming thin, discontinuous accumulations of sand sheets and small dunes. Thickness up to 10 feet (3 m).
- Qea**
Qeao
 Mixed eolian and alluvial sand deposits - Thin, unconsolidated accumulations of sand deposited and reworked by eolian and alluvial processes; moderately to well sorted; generally restricted to ephemeral washes and hollows. Qeao deposits are mainly sand but contain minor clay and gravel lenses; form thick deposits capped by a Stage V petrocalcic soil suggesting an early Pleistocene age. Qeao thickness locally exceeds 100 feet (49 m).
- Qac**
 Mixed alluvial and colluvial deposits - Poorly sorted, unconsolidated mixtures of clay- through cobble-size detritus with random boulders; clasts vary from subrounded to angular; located along narrow ephemeral washes where colluvium is reworked and transported away by alluvial processes in active channels. Thickness up to 15 feet (4.6 m).
- Mancos Shale**
 Mancos Shale Member - Mostly light-gray marine shale, slope former, commonly containing sandy beds which are slightly more resistant, youngest consolidated unit exposed in Cache Valley. Incompletely exposed in quadrangle; exposed thickness 500+ feet (152+ m).
- Kmb**
 Ferron Sandstone Member - Light-brown to medium-gray sandstone, sandy shale, marine shale, and calcareous shale; thin bedded; more resistant than members above and below; locally fossiliferous near top. Thickness 90-120 feet (27-37 m).
- Kmf**
 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).
- Kmt**
 Dakota Sandstone - Light-gray to yellow-gray sandstone, conglomeratic sandstone, and conglomerate with subordinate gray sandy shale and carbonaceous shale; forms ridge in Cache Valley. Thickness 40-50 feet (12-15 m).
- Kd**
 Dakota Sandstone and Cedar Mountain Formation, undifferentiated - Locally deformed and attenuated, as mapped on the south wall of Cache Valley; description same as for Kd and Kcm. Thickness indeterminate, but does not exceed thickness of combined Kd and Kcm.
- Kdcm**
 Cedar Mountain Formation - Variegated slope-forming mudstone interbedded with ledge-forming gray and calcareous quartz shale, and gritstone. Mudstone is mostly light green, gray, lavender, and white. Thickness 200-240 feet (61-73 m).
- Kcm**
 Morrison Formation
 Brushy Basin Member - Mostly variegated to bright-green, slope-forming mudstone with thin ledges of conglomeratic sandstone, conglomerate, nodular-weathering limestone, and gritstone. Ledge formers are more abundant in the lower part of the member; locally attenuated. Thickness 300-340 feet (91-104 m).
- Jmb**
 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).
- Jms**
 Tidwell Member - Red silty shale, with interbeds of fine-grained yellow sandstone and gray limestone; contains large, white siliceous concretions; lower 6 to 15 feet (1.8 to 4.6 m) thin to medium bedded of fine- to medium-grained, non-calcareous brown sandstone and red siltstone that form a steep slope and that correlate with the Summerville Formation. Thickness 40-60 feet (12-18 m).
- Jmt**
 Entrada Sandstone
 Moab Member - Pale-orange, gray-orange, pale-yellow-brown, or light-gray, fine- to medium-grained, calcareous, massive, cliff-forming sandstone; upper surfaces prominently jointed. Thickness 90-110 feet (27-34 m).
- Jem**
 Slick Rock Member - Red-brown 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 sands; 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-red, fine-grained, silty sandstone; mostly iron-oxide cemented; in irregularly contorted, indistinct "lumpy" medium to thick beds. Thickness 40-60 feet (12-18 m).
- Jn**
 Navajo Sandstone - Orange to light-gray, eolian sandstone, mostly fine grained, cemented with silica 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 (76-122m).
- Jk**
 Kayenta Formation - Moderate-orange-pink, red-brown, and lavender sandstone interbedded with subordinate dark-red-brown to gray-red silty mudstone, lavender-gray intraformational conglomerate, and limestone mostly of fluvial or lacustrine origin; light-orange to light-gray eolian sandstone beds more prominent in upper third; commonly micaceous; mostly cemented with calcite; resistant, forms thick step-like ledges between more massive Navajo and Wingate Sandstones; upper part less resistant and important bench former in quadrangle. Thickness 240-300 feet (73-91 m).
- Jw**
 Wingate Sandstone - Mostly light-orange-brown, moderate-orange-pink, or moderate-red-orange, fine-grained, well-sorted, cross-bedded sandstone; calcareous or siliceous cement; forms nearly vertical cliffs along canyon walls or thick-terrace cliff where shattered; cliff surfaces commonly coated with dark-brown desert varnish. Thickness 250-350 feet (76-107 m).
- Chinle Formation**
 Upper Member - Moderate-red-brown or gray-red, fine- to coarse-grained sandstone and siltstone with subordinate pebbles or gritstone, and gray limestone with prominent ledges; slope-forming units are fine grained and generally display indistinct bedding; ledge-forming units are fine to coarse grained and platy to very thick bedded. Thickness 200-460 feet (61-140 m); sections less than 300 feet (91 m) are generally over or immediately adjacent to diapirs.
- Tcu**
 Lower Member - Mottled gray, purple, and red-brown interbedded sandstone, conglomerate, and siltstone; forms alternating ledges and slopes; contains paleosol layers exhibiting abundant and distinct vertical tubes with fossil plant remains. Thickness 0-380+ feet (0-116+ m), locally missing over or near diapirs and very thick in rim synclines.
- Tcl**
 Moenkopi Formation
 Pariott and Sewemup Members, undivided - undivided where poorly exposed.
- Tmu**
 Pariott Member - Red-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).
- Tmp**
 Sewemup Member - Pale-red-orange to gray-red, slope-forming siltstone with subordinate red-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 diapirs, thick elsewhere.
- Tms**
 Lower member - Red-brown and lavender, silty, ledge-forming sandstone and conglomeratic sandstone and conglomeratic sandstone interbedded with slightly darker red-brown to red-orange, slope- and recess-forming sandstone, siltstone and silty mudstone; micaceous and kfsidaptic; platy to medium bedded, commonly ripplemarked or mudcracked. Thickness 0-450 feet (0-137 m); may be thin or missing over salt diapirs, 270-450 feet (82-137 m) thick in outcrop.
- Tmi**
 Cutler Formation
 White Rim Sandstone Member? - Gray-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.
- Pcw?**
 Arkosic sandstone member - Red-brown and red-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 0-2,350+ feet (0-1,900+ m); upper 1,000 feet (305 m) exposed at surface, probably missing over parts of diapirs.
- Pc**
 Honaker Trail Formation (subsurface only) - Interbedded light-gray to gray, marine limestone, micaceous sandstone, calcareous siltstone, and shale. Maximum thickness indeterminate; probably missing over parts of diapirs; 950 feet (290 m) thick in one drill hole. Symbol only on lithologic column, correlation chart, and cross sections.
- Ph**
 Paradox Formation - Paradox Formation caprock consists of light-gray to yellow-gray, sucrosic gypsum, gypsiferous claystone, silty shale, fine-grained sandstone, and thin-bedded carbonates; disrupted and contorted bedding in two small exposures. Estimated thickness may be as much as 1,000 feet (309 m). Subsurface consists of interbedded coarse crystalline halite and other salts, massive anhydrite, sparse gray dolomite, gray to black shale, and gray siltstone. Estimated thickness 300-9,500+ feet (90-2,900+ m).
- Pp**
 Pinkerton Trail and Molas Formation, undivided (subsurface only) - Pinkerton Trail consists of interbedded gray, marine limestone, dolomite, silty shale, and calcareous siltstone; Molas consists of red-brown to variegated siltstone, red silty shale, calcareous sandstone, and sparse gray limestone lenses. Pinkerton Trail is 120 feet (37 m) thick in Conoco Federal No. 31-1 well and estimated at 100-200 feet (30-60 m) thick across quadrangle; Molas is not present in the well and is estimated at 0-75 feet (0-23 m) across quadrangle. Symbol only on lithologic column and correlation chart.
- Pptm**
 Leadville Formation (subsurface only) - Upper part consists of gray limestone and lower part consists of white to mottled brown dolomite. Thickness 450 feet (137 m) in Conoco Federal No. 31-1 well. Symbol only on lithologic column and correlation chart.
- Mi**
 Devonian rocks, undivided (subsurface only) - Limestone, dolomite, silty shale, and sandstone. Thickness about 340 feet (104 m) in Conoco Federal No. 31-1 well. Symbol only on lithologic column and correlation chart.
- Du**

MAP SYMBOLS

- Contact - dashed where approximate, dotted where concealed.
- Normal fault - dashed where approximate, dotted where concealed; bar and ball on downthrown side, arrow and number give dip of fault surface.
- Anticline - showing trace of axial plane; arrow on trace shows plunge; dashes where approximate.
- Syncline - showing trace of axial plane; arrow on trace shows plunge; dashes where approximate.
- Monocline
- Strike and dip of bedding - inclined, approximated, vertical, local in folded or deformed beds.
- Strike of vertical joint.
- Strike and dip of joint.
- Collapsed depression center.
- Structure contour - drawn on base of Wingate Sandstone; dashes where projected; 200 foot (-61 m) contour interval.
- Closed structure contour
- Prospect, adit, and placer mine - Cu = copper; Ba = barite; Ca = calcite; Au = gold.
- Sand and gravel pit.
- Abandoned oil or gas well.
- Recent rock-fall location and date of movement.
- Line of cross section

SYSTEM SERIES	FORMATIONS AND MEMBERS	SYMBOL	THICKNESS feet (m)	LITHOLOGY	
Quaternary	Surficial deposits	Q	0-350+ (0-107+)	Lower part unexposed unconformity Sandy beds Light-gray shale Sea shells near top Medium-gray shale	
					Cretaceous
Ferron Sandstone Member	Kmf	90-120 (27-37)			
Tununk Shale Member	Kmt	400 (122)			
Dakota Sandstone	Kd	40-50(12-15)	unconformity		
Lower	Cedar Mountain Member	Kcm	200-240 (61-73)	Ridge-forming ledges unconformity?	
	Upper	Brushy Basin Member	Jmb	300-340 (91-104)	
Salt Wash Member		Jms	250 (76)	Lenticular channel sandstones	
Tidwell Member		Jmt	40-60(12-18)	Large chert concretions unconformity?	
Middle	Moab Member	Jem	90-110 (27-34)	Highly jointed Arches	
	Slickrock Member	Jes	250-350 (76-107)	Contorted bedding unconformity	
Entrada Sandstone	Dewey Bridge Member	Jed	40-60(12-18)	Large-scale, high-angle cross-stratification Petritified sand dunes Thin limestone ledges	
	Lower	Navajo Sandstone	Jn	250-400 (76-122)	
Kayenta Formation		Jk	240-300 (73-91)	Prominent vertical cliff former	
Wingate Sandstone		Jw	250-350 (76-107)	Desert-varnished surfaces unconformity?	
Upper	Chinle Formation	Rcu	200-460 (61-140)	"Black Ledge" locally present unconformity Siltcrete horizons Mottled siltstone and sandstone Paleosols unconformity	
	Lower member		Rcl	0-380+ (0-116+)	"Ledgy" Moenkopi Smooth slopes
Middle	Moenkopi Formation	Sewemup Member	Tms	0-470 (0-143)	Ripple marks and rain-drop imprints Thin gypsum beds Mud cracks
		Lower member (combined Ali Baba and Tenderfoot Mbrs.)	Tmi	0-450 (0-137)	Ripple marks Gypsum bed unconformity White eolian sandstone
Lower	Cutler Formation	White Rim Sandstone Mbr?	Pcw?	0-250 (0-76)	Subarkosic and arkosic fluvial and eolian sandstone
		Arkosic sandstone member	Pc	1,000 (305) exposed at surface 6,235+ (1,900+) surface and known subsurface	Thin limestone beds
Permian	Honaker Trail Formation	Ph	0-950+ known subsurface (0-290+)	Interbedded limestone and micaceous sandstone unconformity	
			0-100+ (0-30+) exposed as caprock 300-9,500+ (90-2,900+) surface and known subsurface	Evaporite caprock (gypsum and shale) unconformity	
			100-275 (30-83)	Marker bed-hydrocarbon potential Sylvite and carnallite Salt, anhydrite, shale, limestone, dolomite, siltstone	
Mississippian	Leadville Formation	MI	450 (137) subsurface only	Limestone and dolomite unconformity	
			340 (104) subsurface only	Limestone, dolomite, sandstone, minor shale	
Devonian	Devonian rocks undivided	Du			

CORRELATION OF MAP UNITS



- unconformity
- Kmb**
- Kmf**
- Kd**
- Kcm**
- unconformity
- Jmb**
- Jms**
- Jmt**
- Jem**
- unconformity?
- Jn**
- Jk**
- Jw**
- unconformity?
- Tcu**
- Tcl**
- unconformity
- Tmp**
- Tms**
- Tmi**
- unconformity
- Pcw?**
- Pc**
- unconformity
- Ph**
- unconformity
- Pp**
- Pptm**
- unconformity
- MI**
- unconformity
- Du**