CC18-a

CHEVRON SHALE OIL COMPANY
DRILL HOLE RECORD

DRILL HOLE No. CC 18
DRILL AREA

COORDINATES		COLLAR ELEV	TD		
N	E				

DRILL CO	DRILLER	CORE SIZE	DIA. HOLE	CASING	DATE START	DATE COMPL

RADIOMETRIC LOG	LOGGER	TD LOGGED		

GEOLOGIC LOG BY C. Scott C. Creighton

DEPTH	ELEV.	ROCK UNIT	DESCRIPTION
40		silty mlstn	silty mrlst to sandy sltst, slightly laminated no to thin laminations, gray - yellow brn (oxidized) occasional black layers (Fe?, carbon?) along bedding plane & fractures; muscovite assoc. w sandy layers, pyrite in lenses along bedding plane & also in irregular cavities
50			
60			61.9 - 63.0 med-fine gr yellow ss
		silty mlstn	63.5 - 64.2 calcareous mudstone, blocky, hematite stained fractures containing $CaCO_3$
70		ss	70.5 v fg sandstone, upper contact folded. FeOx along fractures and disseminated. rk yellow-brn in color mod. fractured
80			
		mdstn	87.7 highly contorted mudstn - fractured
90		ss	89.9

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DEPTH	ELEV.	ROCK UNIT	DESCRIPTION
		SS	lt. brn to gray fine grained ss, less oxidized, mod well sorted, tr. mica
			oxidized fractured zone distorted
100			units of coarser gr. ss 15% (98.0 - 98.7) low $CaCO_3$ %
			(104') 2mm x 1cm (plant stem?) carbonaceous material
110			110.0 - 111.0 coarser grained
		O.Sh	111.8
			fractured lean o.sh
120		slty mrlst	fracture has platy white - clear mineral: no effervescence, H=2 exibits phosphorescence of lt. green
			mrlst: lo - hi silt content
			broken, brecciated @ 119 - 120 core loss 120.0 - 120.8
			126.3 - 127.5 pyrite lenses
			128.9 thin (few mm) coal layer
130			fractured - limonite stain, sulfides present pyrite in cavities 130.0 - 134.0
			o.sh. med grade
140		O.Sh. slst	barren zone - 1" - 137.9, 138.1
			mrlst 139.1 - 139.6
			pyrite lenses 139.6 - 140.0
		mrlst	140.0 - 145.0 sltst w/ small < 1mm spots, partially laminated
150			145.0 - 152.0 mrlst
		mrlst/s.s.	1/2" pyrite layer @ 145.3
			3" slst layer @ 146.4
			1mm carbon layer @ 146.7
160			1/2" pyrite lense 148.7
		mrlst	152.0 - 160.8 mrlst with sandstone (35%) interbeds; of total 60% fractured; lt brn - gray s.s effervesces; minor mica & barite w/ s.s.

REMARKS:

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DEPTH	ELEV.	ROCK UNIT	DESCRIPTION
		mrlst	164.2 sltst 1"
			160.8 - 171.2 mrlst lam - nonlam
170			dip @ 166.3 : 12° from horizontal → 5" unit
			pyrite in lenses 1721.2 - 172.0
		O.sh.	O.sh. lean - rich
			tar w white mineral : non-effervescing hi hardness, hyalite in appearance
			170.3, 171.0, 169.2 possible tuffs
180			188.1 pyrite lenses 1½ unit 7% pyrite
			1cm brown tuff
		O.sh	
			mrlst, laminated pyrite lenses < 1% but occur throughout
190		mrlst.	191.8 - 192.4 fractured 25° from vertical ; spots of tar
			196.0 - 197.0 non-lam. mrlst
200			
			206.5 - 210 contorted bedding
			209. - 210 pyrite 1% total
210		mrlst /ss.	gray mrlst w brown to gray S.S. interbeds (30%); pyrite almost 1%
			carbon lens (fossil?) 3-5 mm thick @ 212.7
			215 - 216 contorted bedding
			mrlst 70% laminated
220		mrlst	less pyrite than above unit
230			
		mrlst /ss	brown to gray S.S with mrlst interbeds
			mrlst 20% sand initially
			fine - med grained S.S - tar causes brn coloration
			pyrite .5% locally 1-2%
			vug

REMARKS: assay 171.2 - 187.0

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DEPTH	ELEV.	ROCK UNIT	DESCRIPTION
		mrlst / ss.	
240			
			S.S. % increases ↓
250			251 - 253 Carbonaceous 1½% in med grained sand
260			
			75% sand
			lean - mod o.sh.
270		o.sh.	270.4 - 2" zone 80% tar moderately brecciated
			271.7 - 274.3 lean - barren
			white (tuff?) zones - white opaque mineral, spheroidal - leathular (calcite?)
			276.5 278.8 279.5 (2cm thick) 280.4 ↓ possible total replacement, some tar (20%) flourescent
280			
		mrlst	o.sh. grades into mrlst w hi silt content
			283.3 - 285.0 slightly fractured; dk (Fe?) coating on some fractures; pyrite - 1%; gilsonite limited to minor fractures; mostly non laminated mrlst
			fracture (near parallel) .8 ft pyrite occurs ⊥ to fracture, trace pyrite along fracture white, phosphorescent, non reactive, mineral H ~ 3 : (Gypsum?)
290			
		mrlst / ss.	vfg s.s. - silty mrlst pyrite in 1-3 mm spots pyrite ~ 1% total, usually in vfg s.s.
			292.5 pyrite (sulfide) aggregates filling 1" cavity - occurs in broken zone
			S.S. 60%
300			mrlst has higher tendency to fracture
			few mm thick carbonaceous layer
			309.0 - 310.4 Pyrite 3-5% occurring as spots

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310		mrlst / ss.	
			316.0 - 318.5 slightly broken
320			4" zone dike appearance of calcareous sltst/ss. zone above broken lam mrlst
			318.5 - 319.5 3-5% pyrite spotted
330		mrlst	mrlst slst
			329.6 - 337.0 well laminated
			broken, non-laminated 337.0 - 338.3
			nonlaminated 338.3 - dike
340			reworked appearance - 4" zone @ 340.7
		sltst/mrlst	sandy sltst grades into & alternates w silty mrlst more pyrite (but < 1%) than above unit
350			359.2 - 360 dike appearance as above (mud crack filling) sandy siltst. 70%
			355.0 - 356.7 3-5% pyrite along fractures & as spots
360			25° dip ½ ft interval
			366 - 367 fractured w tar vug @ 366.9
370			
			374.6 - 377.8 well lam mrlst

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DEPTH	ELEV.	ROCK UNIT	DESCRIPTION
380		slts/ mrlst	380.6 - 383.4 limonite stained sltst (coarse grained) slightly fractured (oxidized)
		mrlst	386.3 - 386.9 & 388.8 - 389.4 calc. sltst. mrlst. - well lam.
390		o.sh.	med grade o.sh
		mrlst	fractured 35° of horizontal minor tar 395.2 - 396.0 minor gypsum
400		o.sh.	
		mrlst	slightly tar brecciated areas 403.5 8" unit 408.3 3" unit 406.8 4" unit 412.4 2" unit possible analcitized tuffs (3) 1" unit
410			8" near vertical fractured area gilsonite lined trace of gypsum heavily brecciated & broken rich in gilsonite/tar calcite xtals 416.4 - 10" zone & 418.3 - 8" zone minor brecciation @ 417.7 8" zone
		o.sh.	brecciated with above, non-lam.
420		mrlst	425.0 - 427.3 stromatolite appearance
430		o.sh.	partially laminated sltst-tar interfingers 431.-432.3 tar brecciated @ 430.5 - 10" unit (minor)
		mrlst.	432.3-439.0 highly fractured (near parallel) dk coating along fractures (gisonite/tar) some gypsum
440			4" H.brown oxidized appearance; tar & gypsum in small cavities (1mm) 442.8 - 444.3 fractured, near vertical tar & possible Fe (black) coating along fractures 445.2 - 447.2 stromatolite appearance 447.8 - 452.0 broken, barren marl

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DEPTH	ELEV.	ROCK UNIT	DESCRIPTION
450		mrlst	minor o.sh interbeds 444.4, 445.2, 447.7 hi silt/sand content 448.7 - 453.0
		o.sh.	o.sh. mostly mod. mrlst 458.0 - 461.6
460		mrlst	fracture 35° core axis 4" reduced iron (black) assoc w/ gypsum?
			1 ft. fractured & oxidized, flaking of o.sh near fracture ↳ near parallel to core axis weathered appearance
470			1½" analcitized tuff, white
480			several concoidal fractures
490			
			1 cm tar & analcitized tuff
500			
510			mrlst 514 - 515
			506.0 - 509.8 slight tar breccia possible minor calcite filling of fractures 1cm analcitized tuff minor pyrite as spots along bedding plane

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		o.sh.	
520		mrlst	519.0 - 522.2 mrlst well lam.
			522.2 - 523.4 o.sh.
		o.sh.	mrlst 525-526 527-528
530			lean o.sh. 533-534
		mrlst	
540			minor fractures w̄ pyrite (cubic xtals) & gypsum — mrlst 542-543 547-549
		o.sh.	
550			fractured 2' section (35%) gypsum, pyrite, free sulfur coating (fractures)
			1" tuff unit fine - course grained, tar
560		mrlst	
		o.sh.	1" tuff very fine grained, some tar. minor pyrite 1" fine grained tuff w̄ tar — cavity filling by gypsum and blue - lilac, botryoidal mineral (chalcanthite? $CuSO_4 \cdot 5H_2O$)
570			3" very fine grained tuff w̄ o.sl interbeds (30%) 574.7 - 576.4 very lean o.sh - non lam marl 3" broken tuff unit highly analcitized vfg
580			580.9 - 582.2 near parallel fractures; tar, pyrite, gypsum in minor amts 35% tuff(fg) w̄ tar 65 % o.sh. — mrlst 575-576 3" slst, non-lam, spots of tar — 587-589 somewhat leaner o.sh.

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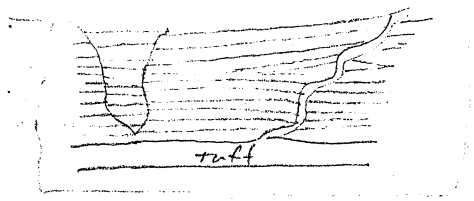
DEPTH	ELEV.	ROCK UNIT	DESCRIPTION
		o.sh.	
590			591.2 - 592.4 crystalline tuff, fine-med grain, o.sh interbeds (20%) some tar, pyrite
600			1½" crystalline tuff, fine-med gr, tar
610			several thin ~1 cm tuffs — mrlst 615-616, 624-625
			614 - 618 Lean - mrlst tuff unit (1cm) which appears to be injecting a dike into above lean o.sh. which has slippage plane & widening in one direction
620			
			626.4 - 628.5 40% tuff 60% o.sh. Stromatolite app. tuff is fine-med grn (xtalline), tar, some analcite
630			
640			639.6 - 640.4 brecciated by gilsonite/tar 35% of total is C_T
			2" zone of hairline $NaHCO_3$ fractures
650			mrlst 647-648, 659-660
		mrlst	

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		O.Sh.	
660			
			669 - 671 near vertical fracture abundant pyrite xtals some tar & gypsum
670			
			674.0 - 676.5 rich o.sh. w sandy appearance
		A	A groove 676 - 678 slightly weathered, pyrite in lenses along bedding plane, minor tar
		mrlst	
680			3" brecciated w tar
		A groove	weathered appearance of marl
			25° to core axis fracture, 2" unit, minor pyrite xtals & gypsum
			gradual change into o.sh
			lean o.sh. 680-681
			½ug w contorted beds
		O.Sh.	
690			690.3 2" tuff fine-med grain
			692.0 - 694.7 vitric. xtalline tuffs interbedded w o.sh. ↳ no tar ↳ some tar tuffs 45%
			9" fracture zone: near parallel to core axis mucho calcite, some pyrite xtals, some gypsum red brown stain (orange in uv) ?
700			
			mrlst 700-701 710-711
			707.1 - 708.2 reworked app. unconsolidated
710			708.2 4" unit tuff tar, fine grained, (gypsum?) MM
			707 - 712.8 very lean
720			
			thin (3 mm) unit, highly reactive xtal linations. ⊥ to bedding plane, powdery on outside of core (nahcolite?) green-brown color
			2" tuff unit, fine grained, rich in tar

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		o.sh	
730			dip increases, reaches max @ 40° amongst brecciated o.sh. @ 731.6 ; unit terminates @ 733.4 contorted beds
740			739.8 - 741.2 dk lenses rather than complete laminations
			745.3 - 746.0 brecciated, contorted beds
750			1 cm units of spots w/ powdery covering (≤ 1mm) in size (nahcolite?) 750.6 & 750.8
			1" analcitized tuff
		mrlst	wafered & fractured 756.8 - 757.6 ↳ 10° to core axis
760		o.sh.	759.9 - 761.4 parallel to core axis fracture gypsum, minor pyrite 759.0 - slippage (slump) 1" displacement 760 - 761.4 mrlst 761.9 - 762.4 & 765.4 - 765.8 sandy looking rich o.sh.
770			4" fractured area of lean o.sh.
		o.sh.	1" sltst layer (slightly calcareous)
			o.sh grades into mrlst
		mrlst	775.9 - 777.9 highly fractured analcite xtals common
780		B groove	vfg. white rock w/ black needles (lithic tuff?) 4cm unit vfg gray-white rock ; rich in pyrite or s.s.
			lean o.sh. 780-781 785-786
790			783.0 - 793.6 broken, wafered, fractured upper part rich in $CaCO_3$ w/ red tint (manganese?)
		o.sh.	lean - mod o.sh. 2" unit vfg tuff two (1cm) o.sh layers interbedded

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DEPTH	ELEV.	ROCK UNIT	DESCRIPTION
		o.sh.	
800			6" fracture & broken area 800.4
		o.sh./ mrlst.	lean o.sh. to well-lam mrlst
			800.9 vfg clean tuff, minor pyrite 4 cm unit
			2" vfg tuff, dk gray, clay lenses (alteration) occur thruout
			803.6 - 805.5 broken & fractured
810			806.8 tuff as above, 5 mm thick
			808.8 2" gray-black, vfg tuff
			tuff: color grades from brown at bottom to grayish black at top
			3½" unit vfg.
820			yellow brown vfg tuff
		o.sh.	med - hi grade o.sh. 3 distinct rich bands 1-1½" 826.5, 827.1, 827.8
		mrlst	
		o.sh.	828 - 829.0 sandy appearance
			828.6 - 829.0 tuffaceous beds intermixed w o.sh.
830			med grade o.sh
			833.5 - 834.5 sandy appearance
			mrlst 835-836, 851-852
840			calcareous sltst 1½ cm lt brn
		mrlst	well laminated, gray-buff mrlst
850		o.sh.	med - rich o.sh.
			2" tuff dk brown (tar) fg, white replacement mineral in spots & along veins H~3, nonreactive; tuff located in rich o.sh.
		mrlst	1" tuff beds 854.5 & 855.1
			mrlst lam - nonlam
860			859.2 - 860.1 many cavities 1 mm - 1" long in lean o.sh.
			little vitrillization
			½ cm white, amorphous, SiO_2 (chert?) lean o.sh. 859-860
		o.sh.	lean - mod o.sh. small (1 in) vug

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DEPTH	ELEV.	ROCK UNIT	DESCRIPTION
		o.sh	
870			5" section pyrite lenses in lean o.sh. ~1%
		mrlst	nonlamlam mrst — lean o.sh. 878-879
880			883.0 - 889.3 few mm - 1 cm clastic layers interbedded with mrlst 10% total
			886.0 - 888.7 broken & fractured some tar breccia
890			sharp contact
		o.sh	mod o.sh grading into mrlst 10" fracture & broken mrlst
900		mrlst	4" zone of pyrite lenses along bedding plane ~1% total
		o.sh.	mod grade o.sh. broken o.sh.
			core loss 906.1 - 907.4
910			lean o.sh. 915-917, 919-920
			core loss 912.1 - 912.9
		mrlst	mrlst w̄ lean o.sh w̄ assoc. 15-20° dip most of unit is broken; wafered, fractured; mrlst is more broken than o.sh. Pyrite fills cavities and is in lenses along bed plane
920			
		o.sh.	lean o.sh. 922.0 - 924.0 wavy bedding 922.0 - 926.0 wafered, broken, fractured
930			lean o.sh. grades into mrlst
		mrlst	wafered broken fractured, some pyrite increased silt content ↓ — lean o.sh. 933-934

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DEPTH	ELEV.	ROCK UNIT	DESCRIPTION
		mrlst	lean o.sh. 939-940
940			
			1" s.s. unit as below 2" s.s unit buff - lt. brn.
950			core loss 947.6 - 958.1
960		mrlst	as above
		o.sh.	lean o.sh.
			buff - gray
970		mrlst	
		mrlst / clastics	7" s.s. unit gray - gray buff
		o.sh.	lean o.sh. TD. 978.0

REMARKS: