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STEAMBOAT WELL 21B-5 GEOLOGY

STEAMBOAT 21B-5, Lithology & Mineralogy Recalc. to 30-ft Intervals JH 02/21/05

Dilational Microbreccia	Euhedral Hydrothermal Crystals	Shearing	Slickensides	Vugs	Alternate Interval	DEPTH INTERNAL	PHYLLITE or PHYLL	BTE HNFLS. & HNFLSC METASED	META-ANST	MQTET	HBL-BTE GRTD.	SCORIA.	"PUNKY" BRECCIA	GG & UBX	VNLTS	OVERALL ALTN INTENSITY	CHL/MFC	SER/FSP	ARGILL.	EP	PY	LIMONITE	CPY	HM	CMT	MS-2	MS-3A	"OTHER" (specify)	MOS_2	MS-1	ANDST VOLCANICLASTICS & TUFF	VOLC'S.	BTE GRANITE	OPAL	CALCITE
						110-140'	61	34				3			2	M			M			1.4													
						140-170'	9	10.5				4	76		0.5	M			M			0.6													
		X	X			170-200'	39.5	58				2	Tr		0.5	M			M			1													
						200-230'	0.5	36	60	2		1			0.5	VW	W	VW	VW			0.2													
						230-260'	5	20.5	72			0.5			1	W	W	VW	W			1													
						260-290'	64	10	25						1	M-S	M-S	W	M-S			0.5													
						290-320'	15	7	74			1.5			2.5	W-M	W-M	VW	W-M			0.4													
						320-350'	1		96			2			1	VW	W	VW	VW			Tr													
		X				350-380'	6	3	90						1	W	W	VW	W			0.3													
		X				380-410'	12	81.5	2	1.5		0.5			2.5	M-S	M	W	M			0.7													
		X				410-440'	25	72		1		Tr			2	M	M	VW	M	2.3		Tr		Tr											
		X	X			440-470'	30.5	62		6		Tr		Tr	1.5	M	M	VW	M	1.5															
	X	X	X			470-500'	NO SAMPLE																													
	X					500-530'		97		2				Tr	1	M	W	VW	W-M	0.9	0.1				6										
						530-560'		96		2		Tr (cvd)			2	M	W	VW	M	1.2	Tr														
						560-590'		96.5		2				Tr	1.5	W	W	VW	W	1.7	0.2				8										
	X	X	X			590-620'	2	93		2				0.5	2.5	W	W	VW	W	1.5	Tr														
		X	X			620-650'		96.5		1				Tr	2.5	M	M	VW	W-M	0.7	0.1														
						650-680'		95		1					1.5	W-M	M	VW		0.2	0.1		Tr												
						680-710'		98		1					1	W-M	M	VW		0.5			Tr												
						710-740'		96		3					1	W-M	M	VW		0.3															
		X	X			740-770'		95.5		3				0.5	1	M-S	M-S	W-M	W-M	0.5	Tr														
						770-800'		95.5		3				0.5	1	M	W-M	VW	W-M	0.4															
		X				800-830'		94.5		3					1.5	W-M	M	VW	W-M	0.1							1							
		X				830-860'		95		4	Tr				1	W-M	M	VW	W-M	0.9							Tr							
		X				860-890'		92.5		2	1				2.5	W	M	VW	W-M	1							2							
		X			20'	890-910'		92		2	Tr				3	W-M	M	VW	W-M	1.8	Tr			0.1			3							
					40'	910-950'					95			Tr	Tr	W	W	W		0.3	0.5		0.1	Tr		Tr	4	1 fxln; 9 diort.						
		X				950-980'					93.5			Tr	0.5	VW	W	VW		0.4	0.5		0.1				6							
						980-1010'					98			Tr		VW	VW	VW		0.3	0.2		Tr				2							
						1010-1040'					100			Tr	Tr	VW	VW	VW		Tr	0.4		0.1				Tr			Tr				
						1040-1070'					100				Tr	VW	VW	VW		0.2	0.3		Tr				Tr	Tr fxln; qtz drt						
						1070-1100'					100			Tr		W	VW	W		0.3	0.2		Tr				Tr							
		X				1100-1130'					99			Tr	Tr	VW	W	VW		0.2	0.2		Tr				1							
		X				1130-1160'					97.5			1	0.5	VW	W	VW		0.1	0.1						1							
						1160-1190'					99.5			0.5	Tr	VW	VW	VW		0.3	0.1						Tr							
						1190-1220'					100			Tr	Tr	VW	VW	VW		0.7	Tr						Tr			Tr				
		X				1220-1250'					100			0.5	0.5	VW	W	VW		0.6	0.1		Tr				Tr							
						1250-1280'					97.5	Tr		1	0.5	W	W	W		0.3	0.1						1							
						1280-1310'					99	Tr			Tr	VW	VW	VW		0.1	Tr						1							

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Dilational Microbreccia	Euhedral Hydrothermal Crystals	Shearing	Slickensides	Vugs	Alternate Interval	DEPTH INTERNAL	PHYLLITE or PHYLL	BTE HNFLS. & HNFLSC METASED	META-ANST	MQTET	HBL-BTE GRTD.	SCORIA.	"PUNKY" BRECCIA	GG & UBX	VNLTS	OVERALL ALTN INTENSITY	CHL/MFC	SER/FSP	ARGILL.	EP	PY	LIMONITE	CPY	HM	CMT	MS-2	MS-3A	"OTHER" (specify)	MOS_2	MS-1	ANDST VOLCANICLASTICS & TUFI	VOLC'S.	BTE GRANITE	OPAL	CALCITE
						1310-1340'					99			Tr	Tr	VW	VW	VW		0.1	Tr						1								
						1340-1370'					98			Tr	1	VW	VW	VW		Tr	Tr		Tr				1								
			X			1370-1400'					100			Tr		VW	VW	VW		0.3	Tr						Tr								
						1400-1430'					100			Tr		VW	VW	VW		0.2	0.1		Tr				Tr								
						1430-1460'					100					VW	VW	VW		0.2	Tr			Tr											
						1460-1490'					100					VW	VW	VW		0.2	Tr			Tr											
						1490-1520'					100				Tr	VW	VW	VW		0.1	Tr			Tr			Tr								
						1520-1550'					100			Tr	Tr	VW	VW	VW		0.6	Tr			0.2			Tr								
						1550-1580'					100			Tr	Tr	VW	VW	VW		0.6			Tr	0.1			Tr								
						1580-1610'					100	Tr		Tr	Tr	VW	VW	VW		0.1				Tr			Tr								
						1610-1640'					99.5				0.5	VW	WV	VW		0.3				Tr											
						1640-1670'					99.5	Tr			0.5	VW	WV	VW		0.2			Tr	Tr			Tr								
						1670-1700'					97.5				0.5	W	W	W		0.6				Tr			2								
		X				1700-1730'					99			Tr	Tr	W	W	W		0.7				0.1			1								
		X	X			1730-1760'					100			Tr	Tr	W	W	W		0.8	Tr			Tr			Tr								
						1760-1790'					100			Tr	Tr	W	W-M	W		Tr	0.1			Tr			Tr								
						1790-1820'					100				Tr	VW	W	VW		Tr				Tr			Tr								
						1820-1850'					99					VW	W	VW		Tr				Tr			1								
						1850-1880'					100			Tr	Tr	W	W	VW		0.1				Tr			Tr			Tr					
						1880-1910'					100				Tr	M	W-M	W		Tr				Tr			Tr								
						1910-1940'					100			Tr		W	W-M	W						Tr											
						1940-1970'					100				Tr	W	W-M	W		0.1				Tr			Tr								
						1970-2000'					99			1	Tr	W	W-M	W		0.7				Tr			Tr								
						2000-2030'					100				Tr	W	W-M	W		Tr	0.1			Tr			Tr								
						2030-2060'					100			Tr	Tr	W	W-M	W		0.7	0.1			Tr			Tr								
						2060-2090'					100			Tr	Tr	W	W-M	W		0.5	Tr			Tr											
						2090-2120'					99.5			0.5	Tr	W	W-M	W		0.5	0.1			Tr			Tr								
	X	X				2120-2150'					77.5			0.5	Tr	W-M	M-S	W-M		0.4	0.1			0.1	22		Tr								
						2150-2180'	NO SAMPLE																													
	X	X	X			2180-2210'					70			Tr	Tr	M	M-S	W		0.3	0.8			Tr	30										
						2210-2240'					85					W	W-M	W		0.4	0.1			Tr	15		Tr								
			X			2240-2270'					91			1	Tr	W	W-M	W		0.6	0.1			Tr	5		3								
X	X		X			2270-2300'					20			3.5	1.5	W-M	W-M	W-M		0.5	0.5				5		70								
X		X	X			2300-2330'					21			2	1	W-M	M	M		0.6	1.2		0.1				75			1					
		X	X			2330-2360'					67			2	1	M-S	S	M-S		0.6	0.6			0.2			31								
						2360-2390'					48.5			1.5	Tr	M-S	S	M-S		0.3	0.3			Tr			48			2					
						2390-2420'					31			Tr		W	W-M	W		0.4				Tr			68			1					
						2420-2450'					91			Tr	Tr	VW	W	VW		0.2	0.1			Tr			9								
						2450-2480'					96			Tr	Tr	W	W-M	W		0.8	0.1						2			2					
		X	X			2480-2510'					99			Tr		VW	W	VW		0.3	0.2		Tr	Tr			1								

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						2510-2540'					37				Tr	VW	W	VW		1	0.2		Tr	Tr			61			2				
		X	X			2540-2570'					6			Tr	Tr	W	W	W		1	0.2		Tr				91			3				
		X				2570-2600'					9			Tr	Tr	W-M	W-M	W-M		0.8	Tr						88			3				
		X				2600-2630'					4			Tr	0.5	VW	W	W		1.1							95.5							
						2630-2660'					4					VW	W	VW		1.2							96							
		X	X			2660-2690'					1			Tr	0.5	W	W	W		1	0.1						98.5							
			X			2690-2720'					2				Tr	W	W	W		1	0.4						98							
						2720-2750'					5					W	W-M	W		1.3	0.3		Tr				93			2				
		X	X			2750-2780'					15				Tr	VW	W	VW		1.3	0.7						84			1				
		X	X			2780-2810'					51			0.5	0.5	VW	W	VW		1.5	0.8		Tr	Tr			47			1				
						2810-2840'					75				Tr	W-M	M	W-M		0.7	0.2		Tr	Tr			24	1 apl						
		X	X			2840-2870'					88			Tr	Tr	W-M	M	W-M		0.4	1.2			Tr			12	Tr apl						
						2870-2900'					94			Tr	Tr	W	W-M	W		0.3	0.4			Tr			6							
						2900-2930'					98				Tr	W	W-M	W		0.3	0.4		Tr	Tr			2							
						2930-2960'					97				Tr	W	W-M	W		0.3	0.4			Tr			3							
						2960-2990'					98			Tr	Tr	W	W	W		0.5	0.3			Tr			2							
		X				2990-3020'					99.5			0.5		W-M	M	W-M		Tr	0.6		Tr	Tr	7									
		X				3020-3050'					99.5			0.5	Tr	W	W	W		0.1	0.5			Tr			Tr							
	X			X		3050-3080'					99			Tr	0.5	VW	VW	VW		Tr	0.2			Tr				0.5 apl						
	X					3080-3110'					100				Tr	VW	W	VW		Tr	0.3													
	X					3110-3140'					100				Tr	VW	W	VW		Tr	0.3		Tr											
						3140-3170'					100				Tr	VW	W	VW		Tr	0.2		Tr											
	X					3170-3200'					100	Tr		Tr	Tr	VW	W	VW		Tr	0.2													
	X					3200-3230'					99.5			Tr	Tr	VW	W	VW		0.1	0.2		Tr				0.5							
	X	X				3230-3260'					100			Tr	Tr	VW	W	VW		Tr	0.6		Tr											
						3260-3290'					99				0.5	VW	W	VW		Tr	0.3						0.5							
						3290-3320'					100			Tr		VW	W	VW			0.2													
						3320-3350'					100					VW	W	VW		Tr	Tr													
	X		X			3350-3380'					100			Tr	Tr	VW	W	VW		0.1	0.2		Tr											
						3380-3410'					100			Tr		VW	W	VW		Tr	0.2													
						3410-3440'					100					VW	W	VW		0.1	0.3													
	X					3440-3470'					99				0.5	VW	W	VW			0.7						0.5							
						3470-3500'					99.5			Tr	0.5	VW	W	VW			0.5													
						3500-3530'					93					W	M	VW		0.1	0.2		Tr		7									
						3530-3560'					90					W	M	VW			Tr		Tr		10									
						3560-3590'					93					W	M	VW			0.1		Tr		7									
						3590-3620'					95					W	M	VW		Tr	0.1				5									
						3620-3650'					100					VW	W-M	VW		Tr	0.2		Tr											
						3650-3680'					100					W	M	VW		0.1	0.2		Tr											
	X					3680-3710'					100					W	M	VW		Tr	0.4		Tr											

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						3710-3740'					100				Tr	M	M-S	W		0.1	0.9		0.1												
						3740-3770'					100			Tr	Tr	M	M-S	W		0.2	1		Tr												
						3770-3800'					100					M	M-S	W		0.2	1.3		Tr												
						3800-3830'					100	Tr		Tr		M	M-S	W		0.2	0.4		Tr												
						3830-3860'					100					M	M-S	W		0.2	0.4			Tr			Tr	Tr andst							
		X				3860-3890'					99			1	Tr	M-S	S	M		0.1	1.2		0.1				Tr								
	X	X				3890-3920'					100			Tr	Tr	W-M	M	W		0.1	1.1		0.1	Tr				Tr rhy							
		X				3920-3950'					99.5	Tr		Tr	0.5	W-M	M	VW		0.1	1		0.1					Tr vss							
						3950-3980'					100				Tr	W-M	M	VW		Tr	0.8														
		X				3980-4010					100			Tr	Tr	W-M	M	VW		Tr	0.6														
						4010-4040'					100			Tr	Tr	W-M	M	VW		0.2	0.9								Tr						
						4040-4070'					100			Tr		W	W-M	VW		0.3	0.6		Tr												
						4070-4100'					100			Tr		W	W-M	VW		0.3	0.9		Tr	Tr				Tr rhy							
						4100-4130'					100			Tr		W	W-M	VW		0.1	0.8		Tr												
						4130-4160'					100			Tr		W	W-M	VW		0.2	0.3														
						4160-4190'					100					W-M	M	W		0.3	0.7		Tr												
			X			4190-4220'					100			Tr	Tr	W	M	VW		0.2	0.4		Tr						Tr						
						4220-4250'					100			Tr	Tr	W	M	VW		Tr	0.6		Tr						Tr						
						4250-4280'					100				Tr	W-M	M	VW																
						4280-4310'					99.5			0.5	Tr	W-M	M	W			0.7		Tr						Tr						
						4310-4340'					100			Tr		W	W-M	VW		Tr	0.4		Tr						Tr						
						4340-4370'					100	Tr		Tr		W	W-M	VW		Tr	0.2								Tr						
			X			4370-4400'					100	Tr		Tr		W	M	VW		0.1	0.1		Tr												
						4400-4430'					100			Tr	Tr	W	M	VW		0.3	0.3														
						4430-4460'					99			1		W	M	VW		Tr	0.3		Tr						Tr						
		X				4460-4490'					99			1	Tr	W-M	M-S	W		0.3	0.4		Tr												
		X	X			4490-4520'					99.5			Tr	0.5	M	M-S	W-M		0.1	0.3		Tr						0.1			Tr bslt			
						4520-4550'					99			Tr	1	W	W-M	VW		0.3	0.5		0.1						0.2			Tr bslt			
	X					4550-4580'					99.5			Tr	0.5	W-M	M	VW		0.4	0.4		Tr						0.1						
						4580-4610'					100				Tr	W-M	M	VW		0.2	0.5		0.1						Tr			Tr gabbr			
						4610-4640'					100			Tr	Tr	W-M	M	VW		0.3	0.3		0.1						Tr						
						4640-4670'					100			Tr	Tr	W-M	M	VW		0.2	0.2		0.1						Tr						
		X				4670-4700'					100			Tr	Tr	W-M	M	W		0.4	0.3		0.1						Tr						
		X				4700-4730'					99			1		W-M	M	W		0.5	0.6		0.1						Tr						
						4730-4760'					99					W-M	M	W		0.8	0.5		0.1						Tr			1 fxln; qtz dior			
		X				4760-4790'					99.5				Tr	W-M	M	W		0.9	0.3		0.1				0.5								
		X				4790-4820'					99				Tr	W-M	M	VW		0.3	0.4		0.1				1		Tr						
						4820-4850'					100				Tr	W-M	M	VW		0.4	0.3		Tr				Tr		Tr						
		X				4850-4880'					100			Tr		W-M	M	VW		0.6	0.3		Tr						Tr						
						4880-4910'					100			Tr		W-M	M	VW		0.4	0.2		Tr	Tr					Tr						

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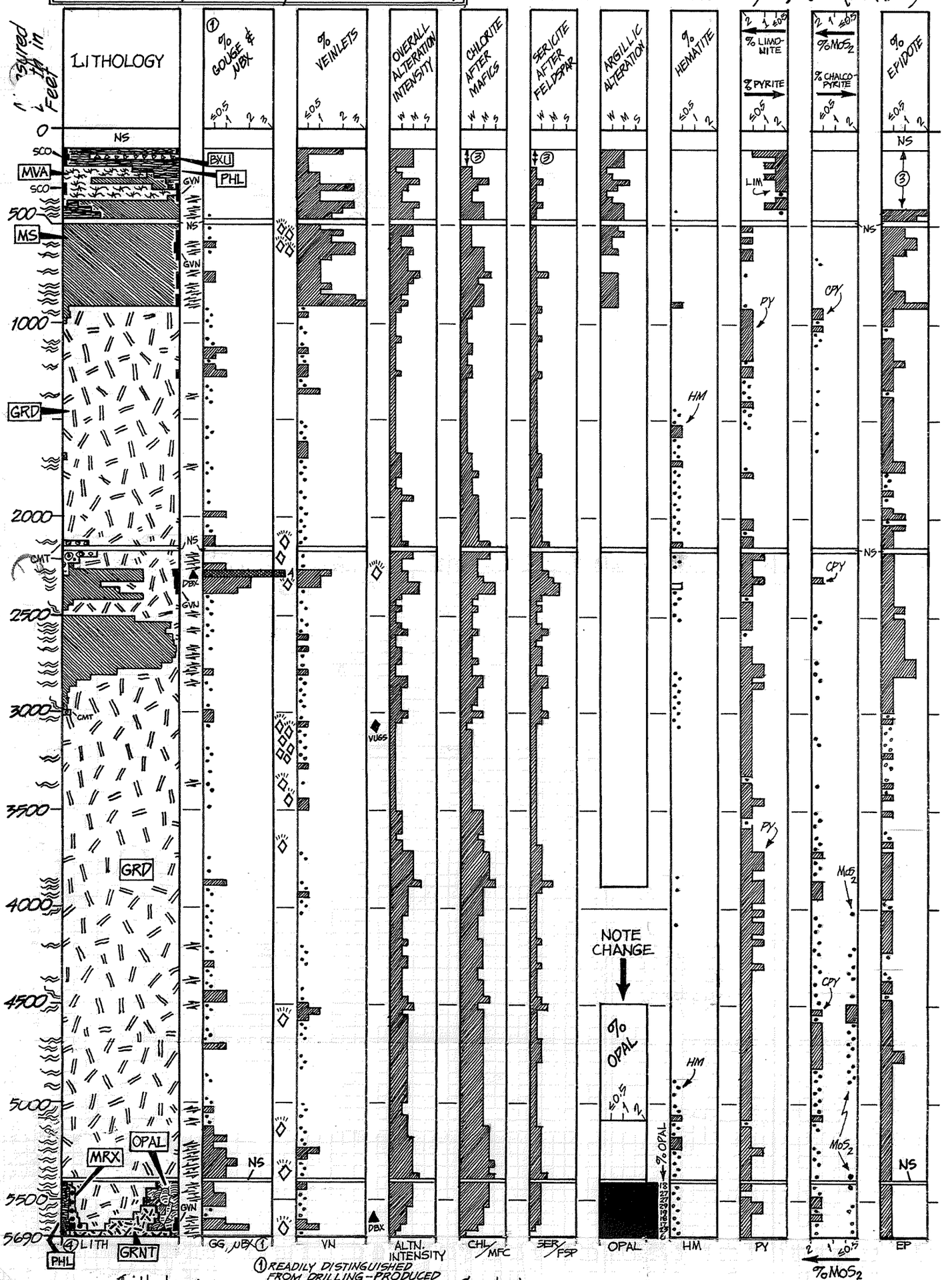
		X				4910-4940'					100					W-M	M	VW		0.3	0.3		Tr	Tr									Tr		
						4940-4970'					100					W-M	M	VW		0.2	0.2		Tr	Tr									Tr		
						4970-5000'					100			Tr		W-M	M	VW		0.2	0.2		Tr												
						5000-5030'					100			Tr	Tr	W	M	VW		0.3	0.2		Tr	Tr											
		X	X			5030-5060'					99.5			0.5	Tr	W	M	VW		0.1	0.1		Tr	Tr											
		X				5060-5090'					100			Tr	Tr	W-M	M	VW		0.2	0.1		0.1	0.2											
		X	X			5090-5120'					100			Tr		W-M	M	VW		0.4	Tr		Tr	Tr											
	X					5120-5150'					99.5			0.5	Tr	W-M	M-S	W		0.4	0.1		Tr	Tr											
		X				5150-5180'					99.5			0.5	Tr	W-M	M-S	W		0.6	0.1			Tr											
						5180-5210'					99			1	Tr	M	M-S	W		0.4	0.2			0.1											
		X	X			5210-5240'					99.5			0.5	Tr	M	M-S	W		0.3	0.1		Tr	0.1											
		X	X			5240-5270'					98			1	1	M	M-S	W		0.2	0.7		Tr	Tr											
X		X	X			5270-5300'					98.5			1	0.5	M	M-S	W		0.4	0.3		Tr	Tr											
X		X	X			5300-5330'					98.5			1.5	Tr	M	S	W		0.3	0.3		Tr	Tr											
		X	X			5330-5360'					99			1	Tr	M	M-S	W		0.3	0.1			Tr											
	X	X	X		40'	5360-5400'					99			1	Tr	M-S	S	W-M		0.5	0.5		Tr	Tr					Tr							
					20'	5400-5420'	NO SAMPLE																													
		X	X			5420-5450'	3				73			0.5	0.5	M	M-S	W		0.4	0.4		Tr	Tr			1		Tr	Tr	3				18	1
	X		X			5450-5480'	7				60			0.5	Tr	M	M-S	W		0.2	Tr		Tr	Tr			Tr			0.5	4				27	1
		X	X			5480-5510'	7				60.5			1	Tr	M	M-S	W		0.3	0.5		0.1	Tr			0.5			Tr	3	Tr andst			27	1
		X				5510-5540'	9				56			1	Tr	M	M-S	W		0.1	0.7		0.1	Tr			Tr		Tr	Tr	2	1 andst			29	2
		X				5540-5570'	7				59			Tr	Tr	W-M	M	W		0.2	0.8		Tr	Tr			1		Tr	1	2			11	19	Tr
		X	X			5570-5600'	6				48			Tr	Tr	W-M	M	W		0.1	0.4		0.1	Tr			3			Tr	5	Tr andst		20	18	Tr
X		X	X			5600-5630'	7				27.5			1	0.5	W-M	M	W		0.2	0.4		Tr	Tr			2		Tr	1	6			38	17	Tr
	X	X	X			5630-5660'	12				15			2	1	W	W-M	VW		0.3	0.5			Tr			Tr			Tr	10	Tr andst		37	23	Tr
						5660-5690'	2				2			Tr	Tr	VW	VW	Tr		0.3	0.4		Tr	Tr			Tr		Tr	Tr	3			87	6	Tr

WELL 21B-5, SUMMARY GEOLOGIC LOG

J. Hulen and S. Johnson 02/23/05 (DRAFT)



Lithology

- PHL PHYLLITE &/OR PHYLLONITE: ④ UNALTERED BELOW 5420 FT
- BXU BRECCIA OF UNKNOWN ORIGIN
- MVA META-ANDESITE
- MS METASEDIMENTARY ROCKS
- GRD HORNBLENDE-BIOTITE GRANODIORITE
- GRNT BIOTITE GRANITE
- MRX MISCELLANEOUS "EXOTIC" ROCK TYPES, PRINCIPALLY REDDISH VOLCANICLASTICS (NOT METAMORPHOSED) } CHIPS TYPICALLY ROUNDED (PEBBLES & GRIT?)
- OPAL COMMONLY DELICATELY BOTRYOIDAL TO CORALLINE; FRESH, GLASSY
- SCO - SCORIA
- GVN GOUGE, MICROBRECCIA, & VEINLETS, UNDIVIDED
- CMT - CEMENT

① READILY DISTINGUISHED FROM DRILLING-PRODUCED "BIT GOUGE"

Symbols

② EUHEDRAL HYDROTHERMAL CRYSTALS
② VUGS
② DILATIONAL MICROBRECCIA
② SLICKENSIDES
• TRACE
' FEET
" INCHES
% PER CENT
& AND
≤ LESS THAN OR EQUAL TO
② ≈ SHEARING

② THESE FEATURES OCCUR IN TRACE TO VERY MINOR AMOUNTS ONLY. BELOW 5420 FT, SLIX ARE FOUND MOSTLY ON REDDISH VOLCANICLASTICS.

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HM - HEMATITE • MFC - MAFICS
M - MODERATE • MoS_2 - MOLYBDENITE
m - METERS • xBX - MICROBRECCIA
NS - NO SAMPLE • LITH - LITHOLOGY
PY - PYRITE • SER - SERICITE
S - STRONG (INTENSE) • SLIX - SLICKENSIDES
VN - VEINLETS
W - WEAK

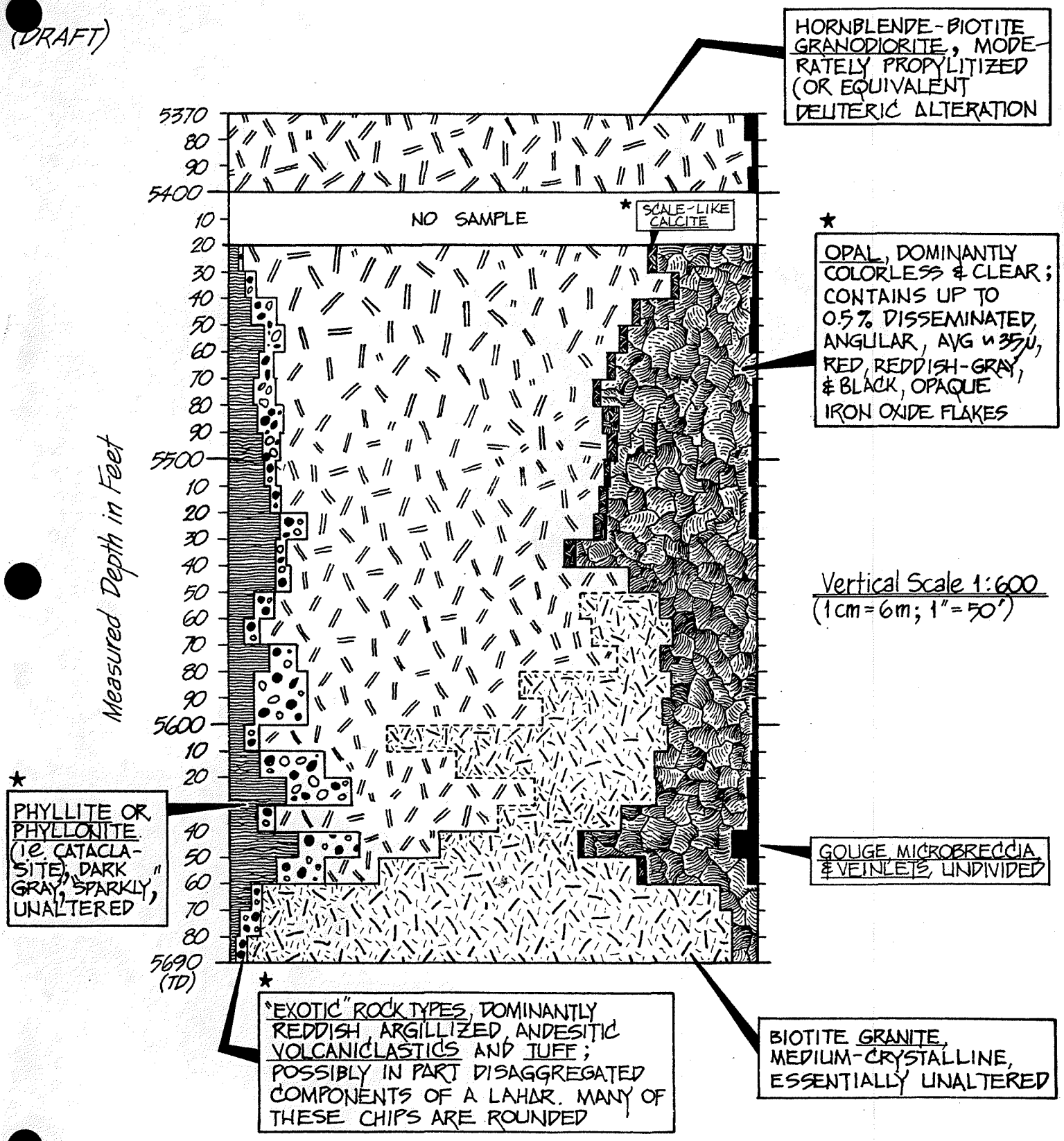
③ PROBABLY PRESENT, BUT MASKED BY ARGILLIC ALTERATION

Vertical Scale 1: 7200 (1" = 720')

WELL 21B-5, EXPANSION OF LITHOLOGIC COLUMN, 5370-5690'

J. Hulen and S. Johnson, February 19, 2005

(DRAFT)

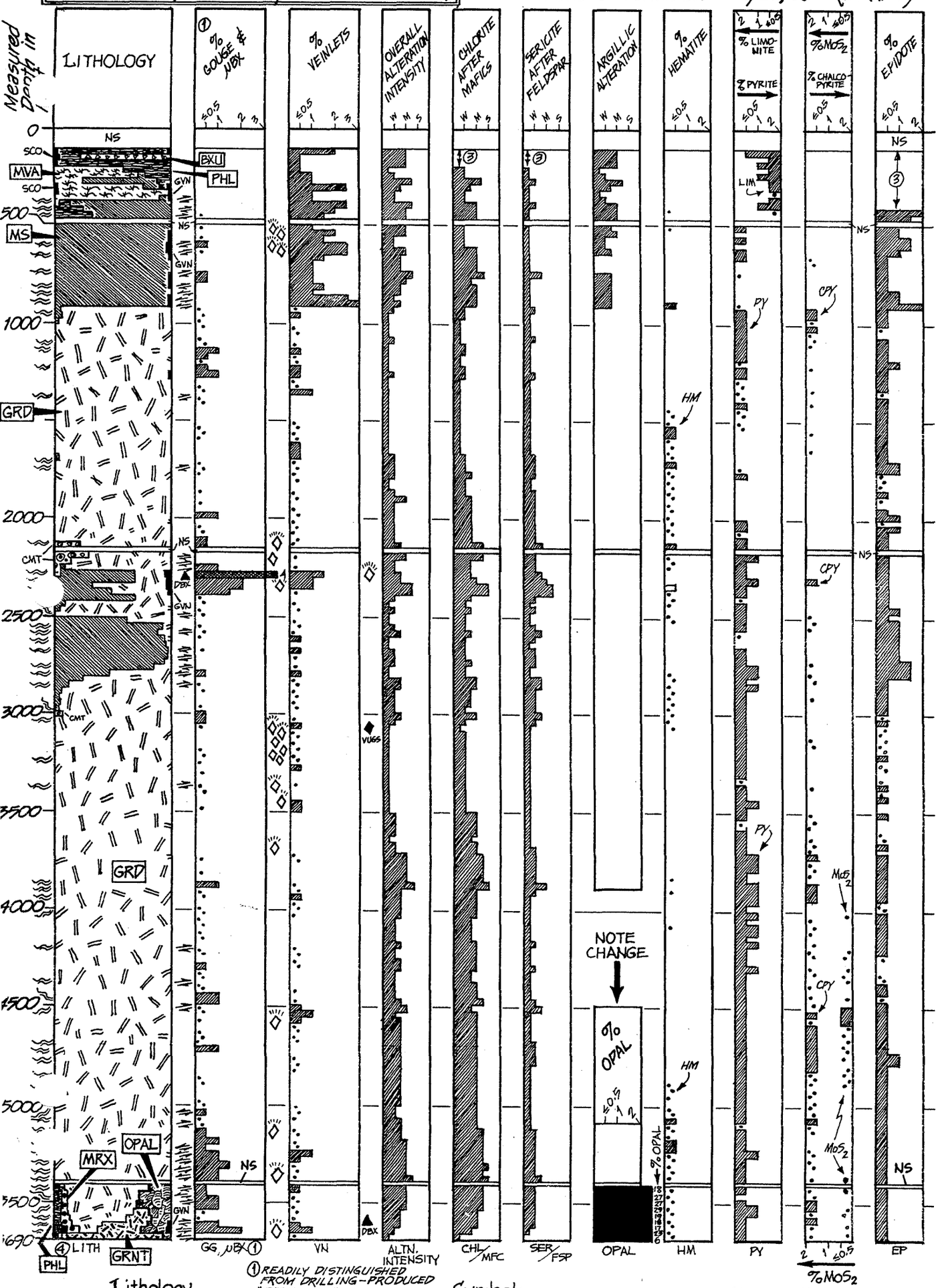


Not unambiguously indigenous based on binocular microscopic examination only. Further tests (e.g. petrographic and SEM analysis) in progress‡ to assess this possibility.

‡ AS OF 02/19/05

WELL 21B-5, SUMMARY GEOLOGIC LOG

J. Hulen and S. Johnson 02/23/05 (DRAFT)



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Symbols

② ◇ EUHEDRAL HYDROTHERMAL CRYSTALS
② ♦ VUGS
② ▲ DILATIONAL MICROBRECCIA
② ≈ SLICKENSIDES
• TRACE
' FEET
% PER CENT
" INCHES
& AND
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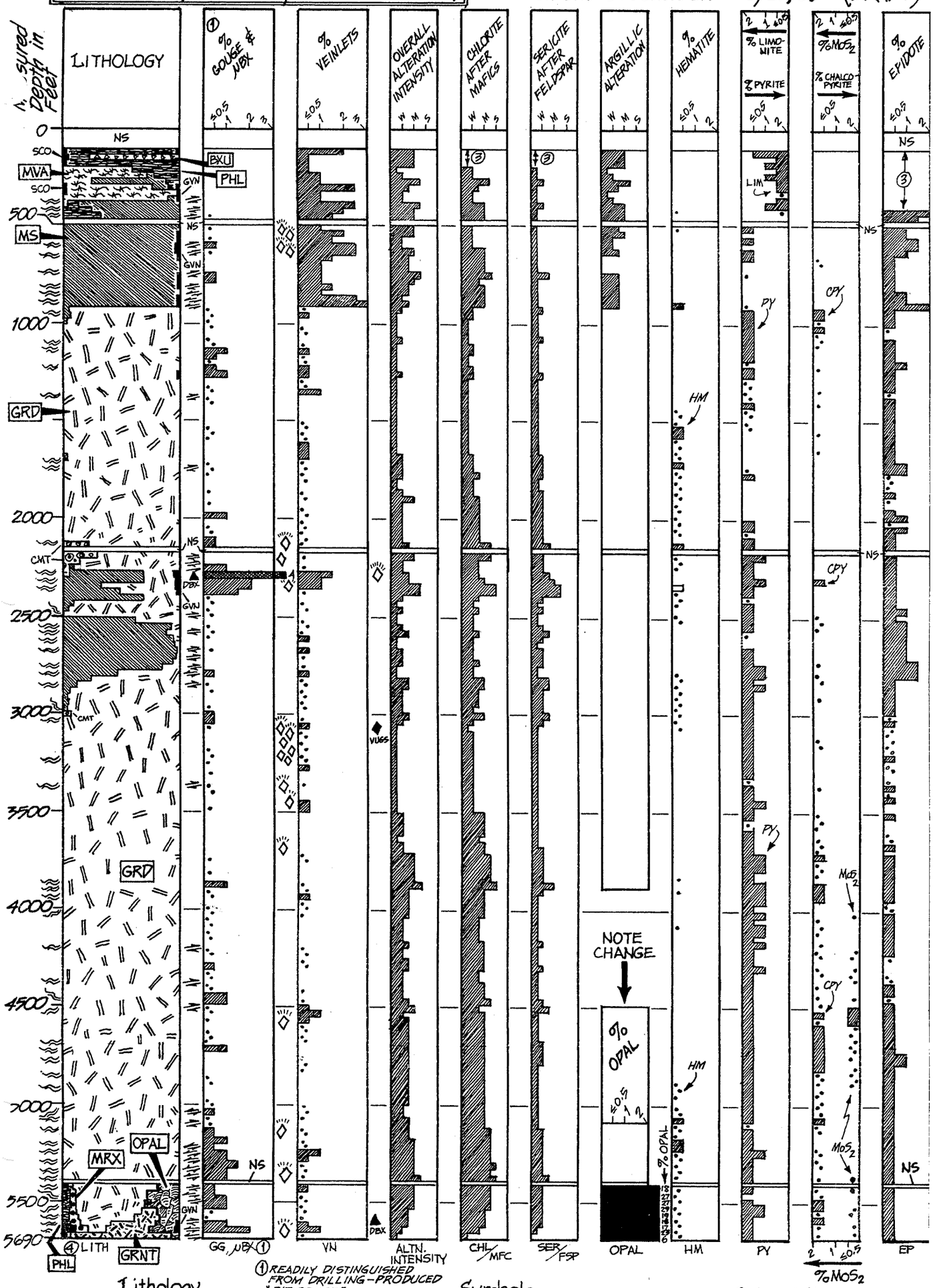
WELL 21B-5, SUMMARY GEOLOGIC LOG

J. Hulen and S. Johnson 02/23/05 (DRAFT)



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- CMT-CEMENT

Symbols

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② VUGS
② DILATIONAL MICROBRECCIA
② SLICKENSIDES
• TRACE
' FEET
" INCHES
% PER CENT
& AND
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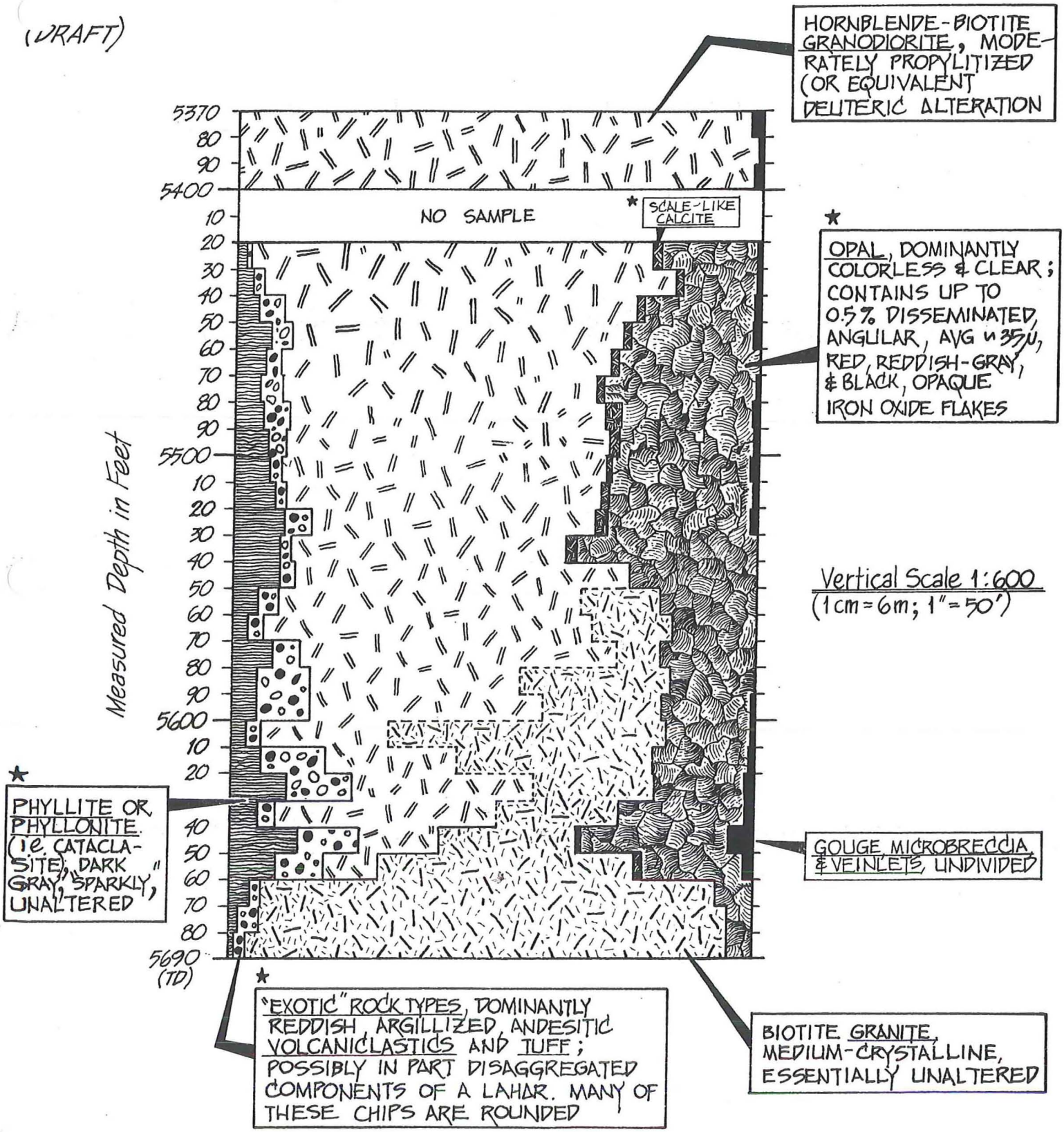
Vertical Scale 1: 7200 (1"=720

WELL 21B-5, EXPANSION OF LITHOLOGIC COLUMN, 5370-5690'

J. Hulen and S. Johnson, February 19, 2005

(DRAFT)



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‡ AS OF 02/19/05

WELL 21B-5, EXPANSION OF LITHOLOGIC COLUMN, 5370-5690'

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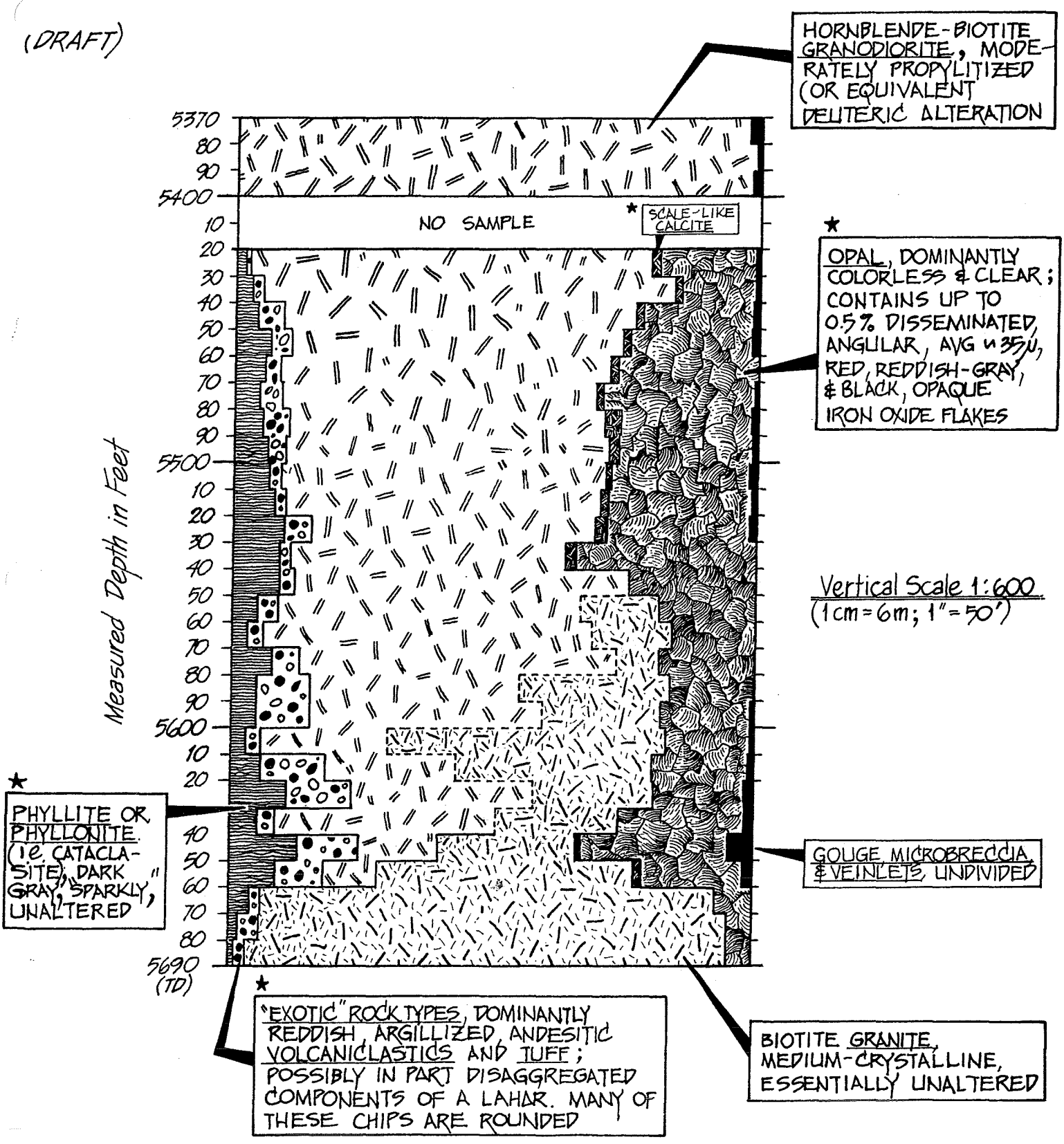

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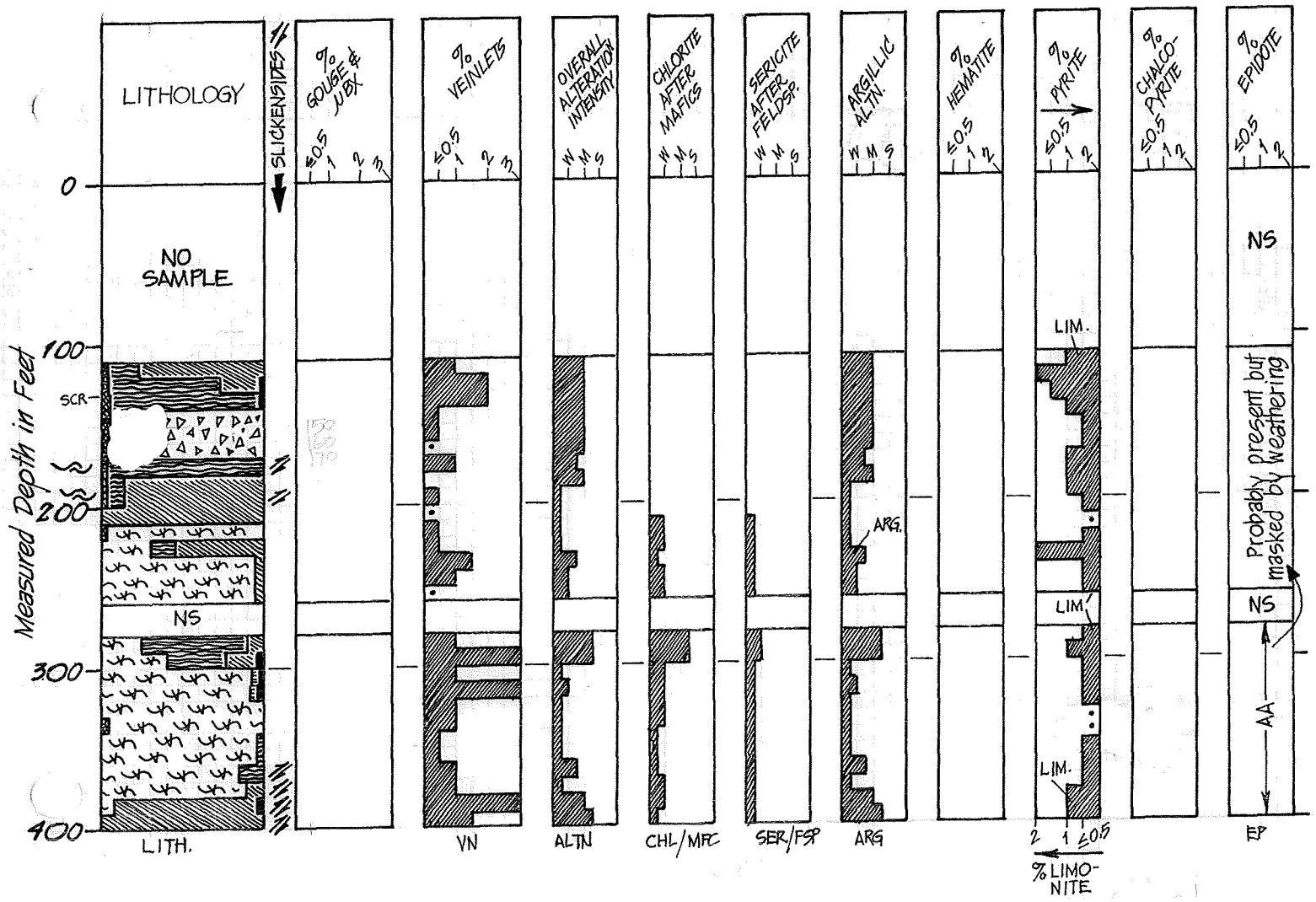
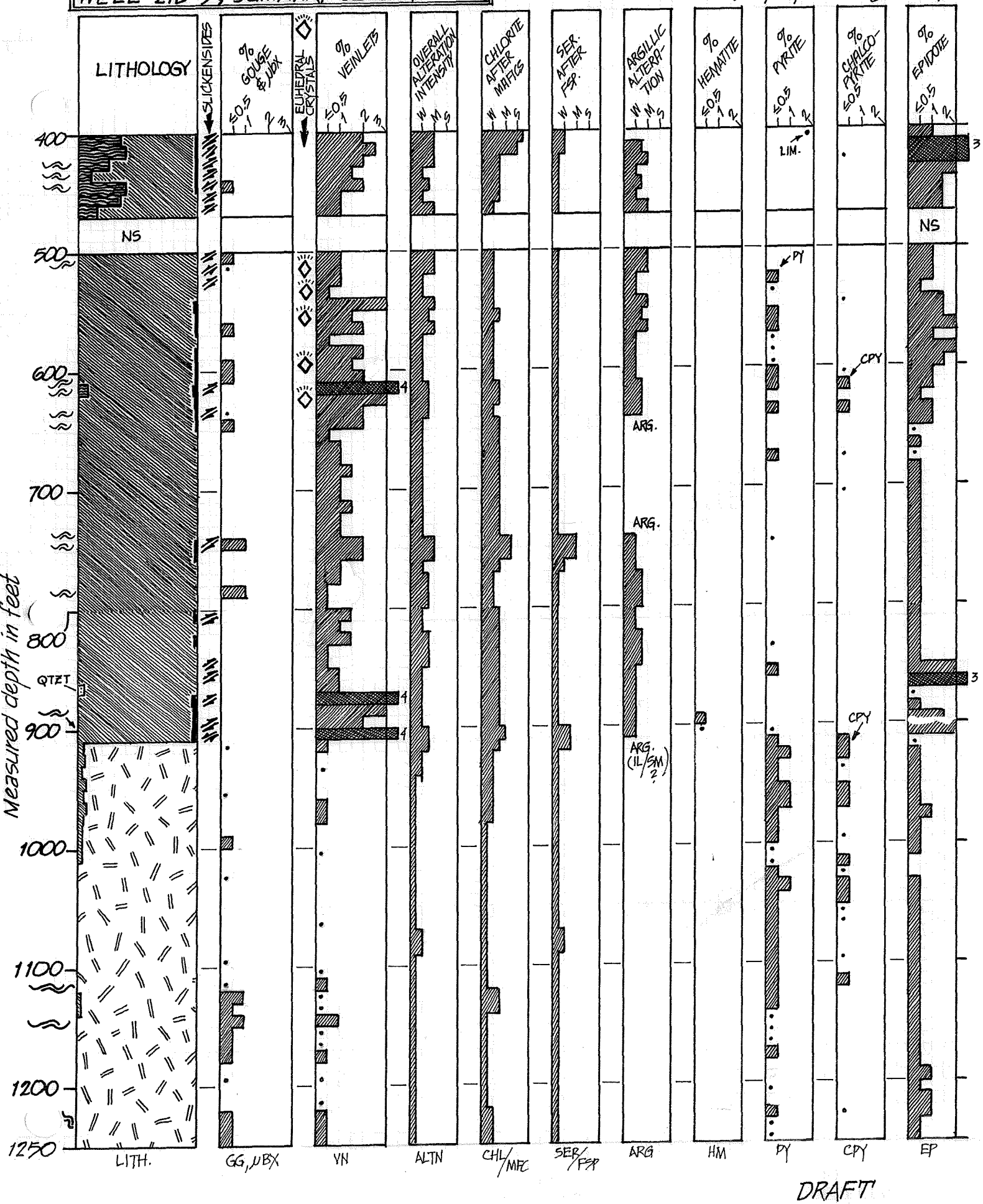
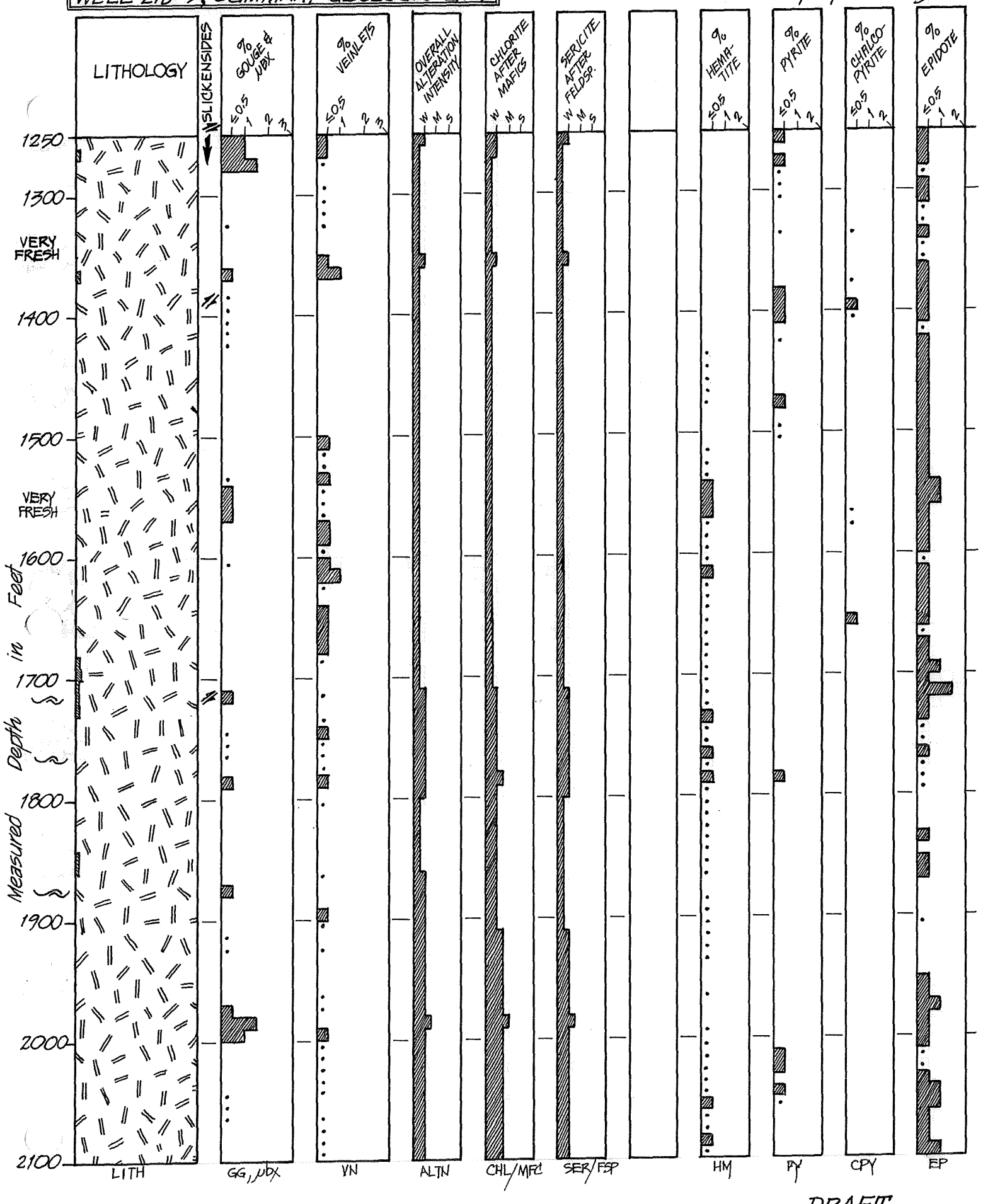

LITHOLOGY
SLICKENSIDES
% GOUGE & JUBX
≤0.5 1 2 3
% VEINLETS
≤0.5 1 2 3
OVERALL ALTERATION INTENSITY
W M S
CHLORITE AFTER MAFICS
W M S
SERICITE AFTER FELDSP.
W M S
ARGILLIC ALTN.
W M S
% HEMATITE
≤0.5 1 2
% PYRITE
≤0.5 1 2
% CHALCO-PYRITE
≤0.5 1 2
% EPIDOTE
≤0.5 1 2
0
100
200
300
400
Measured Depth in Feet
NO SAMPLE
SCR
NS
LIM.
ARG.
LIM
LIM.
NS
Probably present but masked by weathering
AA
LITH.
VN
ALTN
CHL/MFC
SER/FSP
ARG
2 1 ≤0.5
% LIMO-NITE
EP

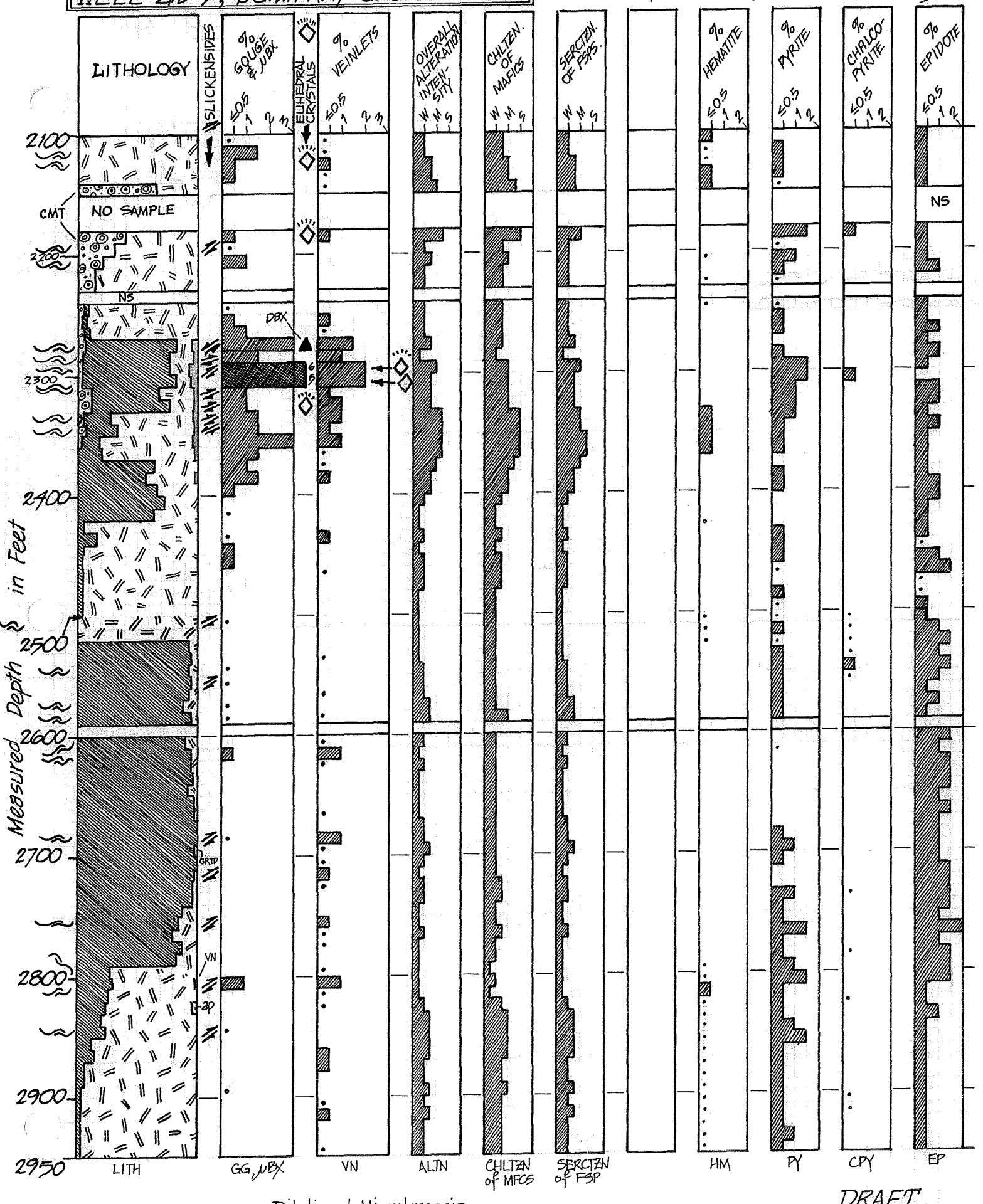

LITHOLOGY
SLICKENSIDES
% GOUGE & µBX
EUHEDRAL CRYSTALS
% VEINLETS
OVERALL ALTERATION INTENSITY
CHLORITE AFTER MAFICS
SER. AFTER FSP.
ARGILLIC ALTERATION
% HEMATITE
% PYRITE
% CHALCOPYRITE
% EPIDOTE
≤0.5 1 2 3
W M S
LIM.
NS
PY
CPY
ARG.
ARG.
ARG. (IL/SM) ?
QTZT
400
500
600
700
800
900
1000
1100
1200
1250
Measured depth in feet
LITH.
GG, µBX
VN
ALTN
CHL/MFC
SER/FSP
ARG
HM
PY
CPY
EP

DRAFT


LITHOLOGY
SLICKENSIDES
% GOUGE & xBX
≤0.5 1 2 3
% VEINLETS
≤0.5 1 2 3
OVERALL ALTERATION INTENSITY
W M S
CHLORITE AFTER MAFICS
W M S
SERICITE AFTER FELDSP.
W M S
% HEMA-TITE
≤0.5 1 2
% PYRITE
≤0.5 1 2
% CHALCO-PYRITE
≤0.5 1 2
% EPIDOTE
≤0.5 1 2
1250
1300
VERY FRESH
1400
1500
VERY FRESH
1600
1700
1800
1900
2000
2100
Measured Depth in Feet
LITH
GG, xBX
VN
ALTN
CHL/MFC
SER/FSP
HM
PY
CPY
EP

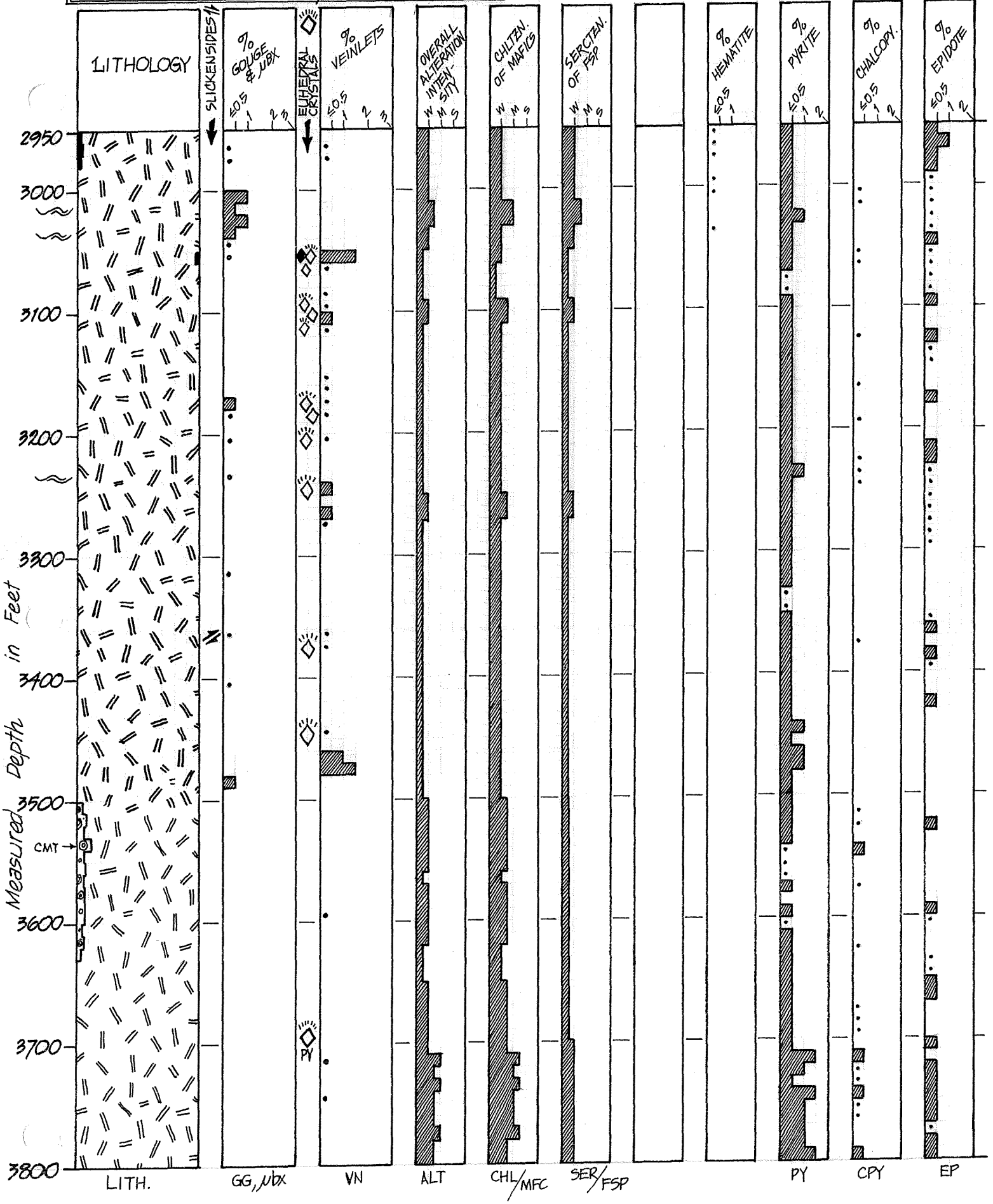
DRAFT

WELL 21B-5, SUMMARY GEOLOGIC LOG

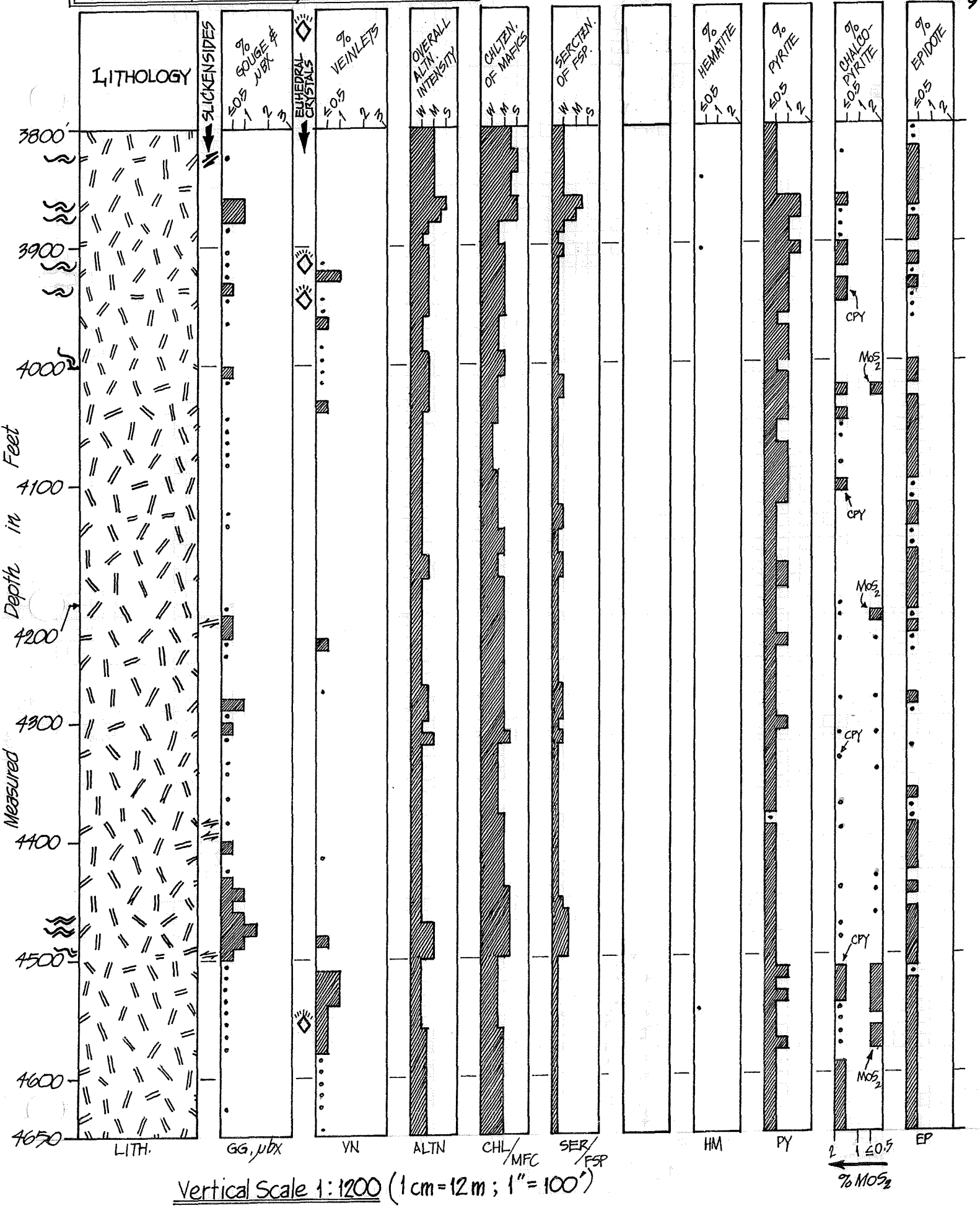


▲ = Dilational Microbreccia

DRAFT


LITHOLOGY
SLICKENSIDES
% GOUGE & µBX
≤0.5 1 2 3
EUHEDRAL CRYSTALS
% VEINLETS
≤0.5 1 2 3
OVERALL ALTERATION INTENSITY
W M S
CHLTZN. OF MAFICS
W M S
SERCTZN. OF FSP
W M S
% HEMATITE
≤0.5 1
% PYRITE
≤0.5 1 2
% CHALCOPY.
≤0.5 1 2
% EPIDOTE
≤0.5 1 2
2950
3000
3100
3200
3300
3400
3500
3600
3700
3800
Measured Depth in Feet
CMT
PY
LITH.
GG, µbx
VN
ALT
CHL/MFC
SER/FSP
PY
CPY
EP

WELL 21B-5, SUMMARY GEOLOGIC LOG



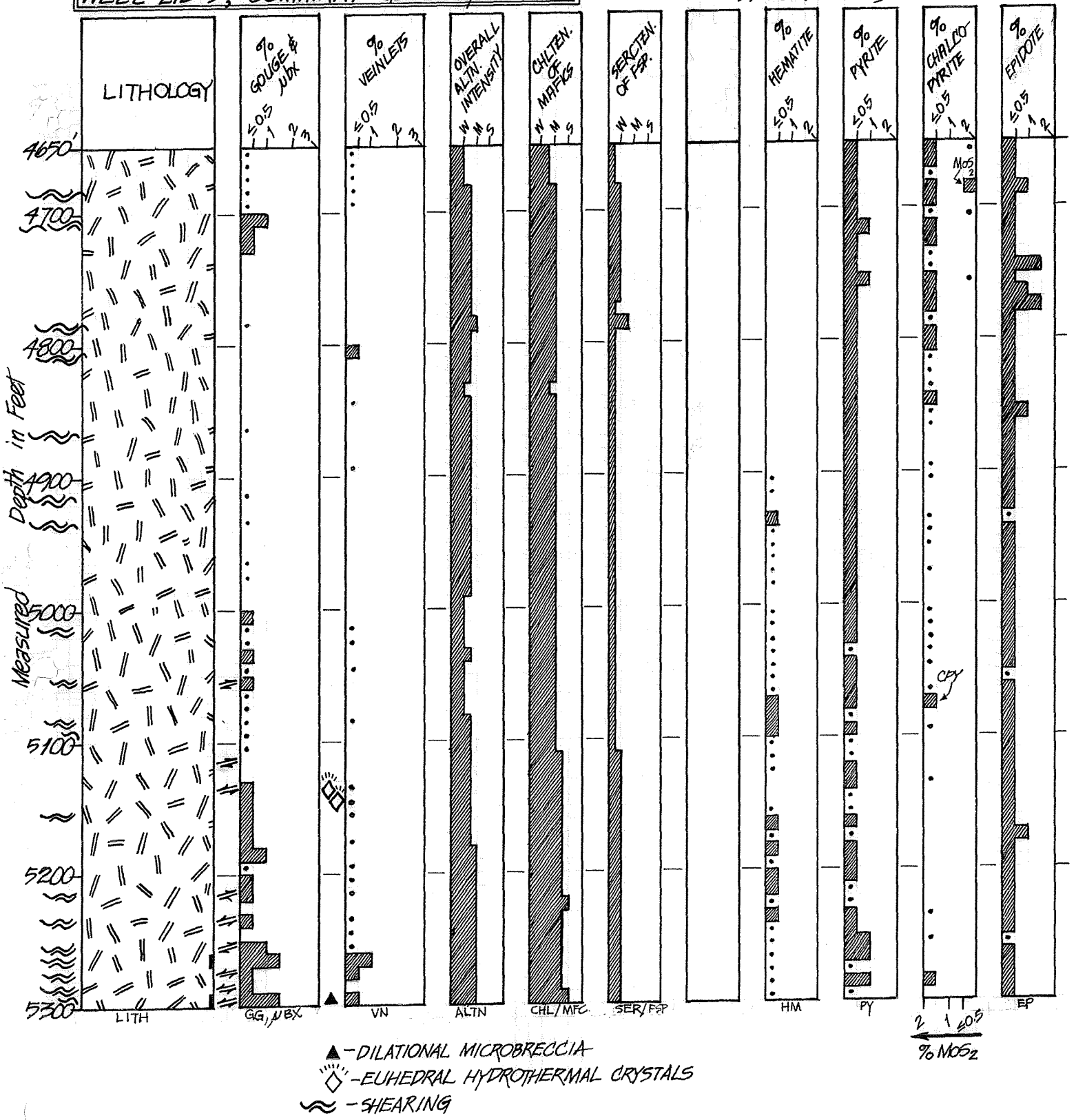
Vertical Scale 1:1200 (1 cm = 12 m ; 1" = 100')

DRAFT

WELL 21B-5, SUMMARY GEOLOGIC LOG

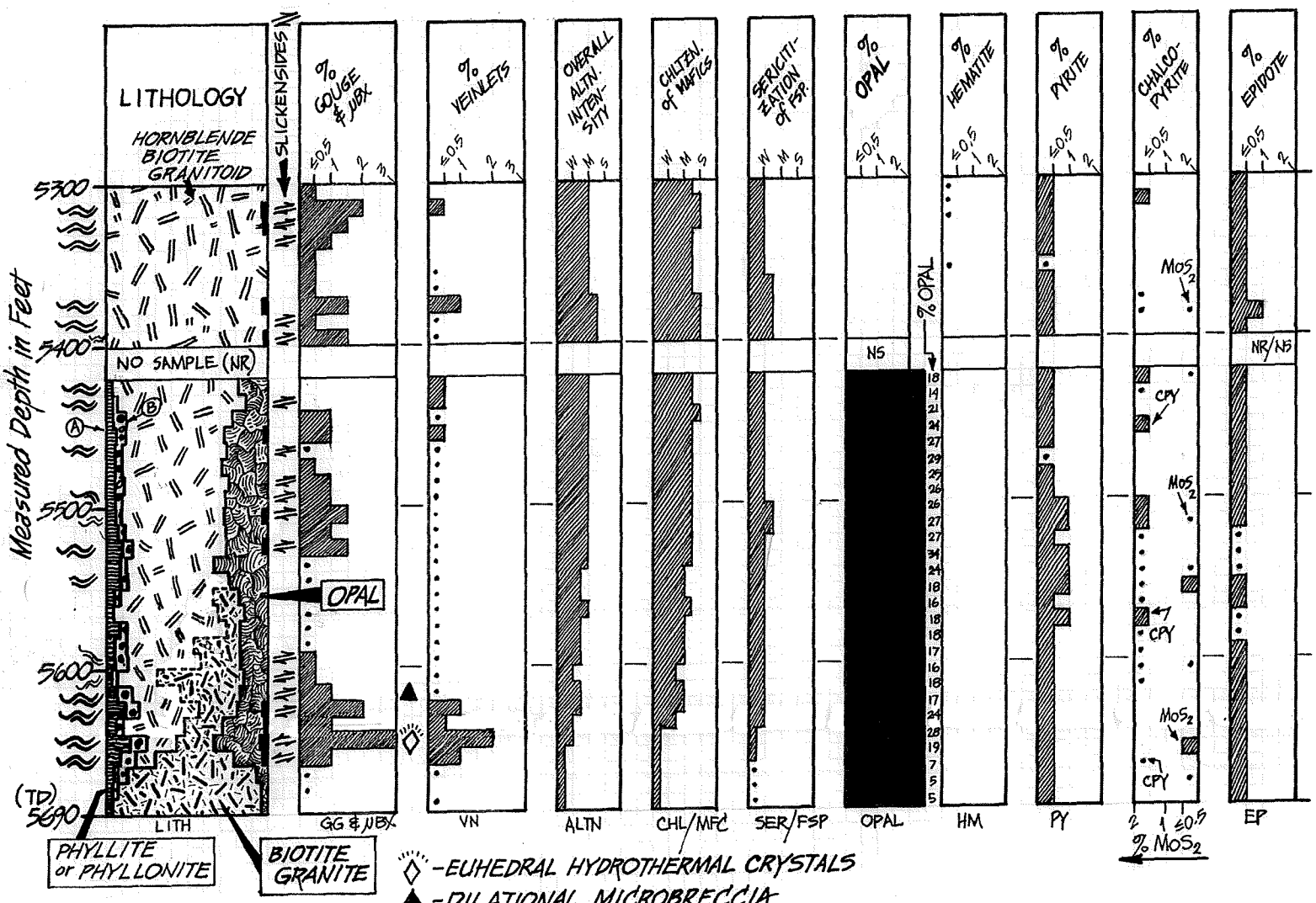
J. Hulen
S. Johnson

January 5, 2005



WELL 21B-5, SUMMARY GEOLOGIC LOG

J. Hulen & S. Johnson Feb. 21, 2005



Ⓐ FRESH, DARK GRAY, PHYLLITE OR PHYLLONITE

Ⓑ "EXOTIC" CHIPS (MANY ROUNDED), MOSTLY REDDISH, ARGILLIZED, ANDESITIC VOLCANICLASTICS & TUFF.

Vertical Scale 1:1200
(1 cm = 12 m; 1" = 100')

NOTE: BECAUSE THE INTERVAL 5420-5690' IS LITHOGICALLY COMPLEX*, IT IS ILLUSTRATED IN EXPANDED FORM ON THE FOLLOWING PAGE (pg. 9)

* AND UNUSUAL

STEAMBOAT 21B-5 Lithology & Mineralogy Recalc. to 30-ft Intervals

JH 02/21/05

DEPTH INTERVAL	PHYLLITE OR PHYLL.	BTE HNFLS. & HNFLSC. META-SED	META-RHDST / MGTBT	HBL-BTE GRTD.	SCORIA	"PUNKY" BRECCIA	GG & JBX	VNLTS	OVERALL ALTN INTENSITY	CHL/MFC	SER/FSP	ARGILL.	EP	PY / LIMONITE	CPY / HM	CMT
110-140'	61	34			3			2	M			M		1.4		
140-170'	9	10.5			4	(76)		0.5	M			M		0.6		
170-200'	39.5	58			2	Tr		0.5	M			M		1		
200-230	0.5	36	(60)/(2)		1			0.5	VW	W	VW	VW		0.2		
230-260'	5	20.5	72		0.5			1	W	W	VW	W		1		
260-290'	64	10	25					1	M-S	M-S	W	M-S		0.5		
290-320'	15	7	74		1.5			2.5	W-M	W-M	VW	W-M		0.4		
320-350	1		96		2			1	VW	W	VW	VW		Tr		
350-380'	6	3	90					1	W	W	VW	W		0.3		
380-410'	12	81.5	2 / 1.5		0.5			2.5	M-S	M	W	M		0.7		
410-440'	25	72	1		Tr			2	M	M	VW	M	2.3	Tr	Tr	
440-470'	30.5	62	6		Tr		(Tr)	1.5	M	M	VW	M	1.5			
470-500'	NO SAMPLE															
500-530'		97	2				Tr	1	M	W	VW	W-M	0.9	(0.1)		(6)
530-560'		96	2		Tr (cvd)			2	M	W	VW	M	1.2	Tr		
560-590'		96.5	2				Tr	1.5	W	W	VW	W	1.7	0.2		(8)
590-620'	2	93	2				0.5	2.5	W	W	VW	W	1.5	Tr		
620-650'		96.5	1				Tr	2.5	M	M	VW	W-M	0.7	0.1		
650-680'		95	1					1.5	W-M	M	VW		0.2	0.1	Tr	
680-710'		98	1	Page 1 of 7				1	W-M	M	VW		0.5		Tr	
710-740'		96	3					1	W-M	M	VW		0.3	PY		
740-770'		95.5	3				0.5	1	M-S	M-S	W-M	W-M	0.5	Tr		
770-800'		95.5	3				0.5	1	M	W-M	VW	W-M	0.4			
800-830'		94.5	3	H-B GRTD				1.5	W-M	M	VW	W-M	0.1			(1) MS2
830-860'		95	4	Tr				1	W-M	M	VW	W-M	0.9			(F) MS-2
860-890'		92.5	2	1				2.5	W	M	VW	W-M	1			(2) MS-2
890-910' (20 ft)		92	2	Tr				3	W-M	M	VW	W-M	1.8	Tr	0.1	(3) MS-2

STEAMBOAT 21B-5 Lithology & Mineralogy Recalc, to 30-ft intervals

JH 02/22/05

DEPTH INTERVAL	PHYLL.	MS-3A	HBL-BTE GRTZ	"OTHER" (specify)	GG & PBX	VN/TS	ALTN. INTENSITY	CHL/MFC	SER/FSP	PY	HM	CPY	MOSS	EP	CMT
(40 ft) 910-950'		4	95	Tr MS-2 1 fxln q diort.	Tr	Tr	W	W	W	0.5	Tr	0.1		0.3	
950-980'		6	93.5		Tr	0.5	VW	W	VW	0.5		0.1		0.4	
980-1010'		2	98		Tr		VW	VW	VW	0.2		Tr		0.3	
1010-1040'		Tr	100	Tr. MS-1	Tr	Tr	VW	VW	VW	0.4		0.1		Tr	
1040-1070'		Tr	100	Tr fxln qtz drt		Tr	VW	VW	VW	0.3		Tr		0.2	
1070-1100'		Tr	100		Tr		W	VW	W	0.2		Tr		0.3	
1100-1130'		1	99		Tr	Tr	VW	W	VW	0.2		Tr		0.2	
1130-1160'		1	97.5		1	0.5	VW	W	VW	0.1				0.1	
1160-1190'		Tr	99.5		0.5	Tr	VW	VW	VW	0.1				0.3	
1190-1220'		Tr	100	Tr. MS-1	Tr	Tr	VW	VW	VW	Tr				0.7	
1220-1250'		Tr	100		0.5	0.5	VW	W	VW	0.1		Tr		0.6	
1250-1280'		1	97.5	Tr. scoria	1	0.5	W	W	W	0.1				0.3	
280-1310'		1	99	Tr scoria		Tr	VW	VW	VW	Tr				0.1	
1310-1340'		1	99		Tr	Tr	VW	VW	VW	Tr				0.1	
1340-1370'		1	98		Tr	1	VW	VW	VW	Tr		Tr		Tr	
1370-1400'		Tr	100		Tr		VW	VW	VW	Tr				0.3	
1400-1430'		Tr	100		Tr		VW	VW	VW	0.1		Tr		0.2	
1430-1460'			100				VW	VW	VW	Tr	(Tr)			0.2	
1460-1490'			100				VW	VW	VW	Tr	Tr	page 2 of 7		0.2	
1490-1520'		Tr	100			Tr	VW	VW	VW	Tr	Tr			0.1	
1520-1550'		Tr	100		Tr	Tr	VW	VW	VW	Tr	0.2			0.6	
1550-1580'		Tr	100		Tr	Tr	VW	VW	VW		0.1	Tr		0.6	
1580-1610'		Tr	100	Tr scoria	Tr	Tr	VW	VW	VW		Tr			0.1	
1610-1640'			99.5			0.5	VW	VW	VW		Tr			0.3	
1640-1670'		Tr	99.5	Tr scoria		0.5	VW	VW	VW		Tr	Tr		0.2	
1670-1700'		2	97.5			0.5	W	W	W		Tr			0.6	
1700-1730'		1	99		Tr	Tr	W	W	W		0.1			0.7	

STEAMBOAT 218-5, Lithology & Mineralogy Recalc. to 30-ft Intervals

DEPTH INTERVAL	PHYLL.	MS-3A	H-B GRID.	"OTHER"	GG & JBX	VN-LS	ALTN INT.	CHY/MFC	SER/PSP	EP	PY	HM	CPY	MOS2	CMT
1730-1760'		Tr	100		Tr	Tr	W	W	W	0.8	Tr	Tr			
1760-1790'		Tr	100		Tr	Tr	W	W-M	W	Tr	0.1	Tr			
1790-1820'		Tr	100			Tr	VW	W	VW	Tr		Tr			
1820-1850'		1	99				VW	W	VW	Tr		Tr			
1850-1880'		Tr	100	Tr MS-1	Tr	Tr	W	W	VW	0.1		Tr			
1880-1910'		Tr	100			Tr	M	W-M	W	Tr		Tr			
1910-1940'			100		Tr		W	W-M	W			Tr			
1940-1970'		Tr	100			Tr	W	W-M	W	0.1		Tr			
1970-2000'		Tr	99		1	Tr	W	W-M	W	0.7		Tr			
2000-2030'		Tr	100			Tr	W	W-M	W	Tr	0.1	Tr			
2030-2060'		Tr	100		Tr	Tr	W	W-M	W	0.7	0.1	Tr			
2060-2090'			100		Tr	Tr	W	W-M	W	0.5	Tr	Tr			
2090-2120'		Tr	99.5		0.5	Tr	W	W-M	W	0.5	0.1	Tr			
2120-2150'		Tr	77.5		0.5	Tr	W-M	M-S	W-M	0.4	0.1	0.1			22
2150-2180'	NO SAMPLE														
2180-2210'			70		Tr	Tr	M	M-S	W	0.3	0.8	Tr			30
2210-2240'		Tr	85				W	W-M	W	0.4	0.1	Tr			15
2240-2270'		3	91		1	Tr	W	W-M	W	0.6	0.1	Tr			5
2270-2300'		70	20		3.5	1.5	W-M	W-M	W-M	0.5	0.5				5
2300-2330'		75	21	½ MS-1	2	1	W-M	M	M	0.6	1.2		0.1		
2330-2360'		31	67		2	1	M-S	S	M-S	0.6	0.6	0.2			
2360-2390'		48	48.5	2 MS-1	1.5	Tr	M-S	S	M-S	0.3	0.3	Tr			
2390-2420'		68	31	½ MS-1	Tr		W	W-M	W	0.4		Tr			
2420-2450'		9	91		Tr	Tr	VW	W	VW	0.2	0.1	Tr			
2450-2480'		2	96	½ MS-1	Tr	Tr	W	W-M	W	0.8	0.1				
2480-2510		1	99		Tr		VW	W	VW	0.3	0.2	Tr	Tr		
2510-2540'		61	37	½ MS-1		Tr	VW	W	VW	1	0.2	Tr	Tr		

STEAMBOAT 21B-5, Lith. & Min. Recalc. to 30-ft. Intervals

JH 02/22/05

DEPTH INTERVAL	PHYLL.	MS-3A	H-B GRID.	"OTHER" (spacing)	GG & MBL	VNLTS	ALTN. INTENSITY	CHL/MFC	SER/FSP	EP	PY	HM	CPY	MOSZ	CMT
2540-2570'		91	6	3 MS-1	Tr	Tr	W	W	W	1	0.2		Tr		
2570-		88	9	3 MS-1	Tr	Tr	W-M	W-M	W-M	0.8	Tr				
2600-2630		95.5	4		Tr	0.5	VW	W	W	1.1					
2630-2660'		96	4				VW	W	VW	1.2					
2660-2690'		98.5	1		Tr	0.5	W	W	W	1	0.1				
2690-2720'		98	2			Tr	W	W	W	1	0.4				
2720-2750'		93	5	2 MS-1			W	W-M	W	1.3	0.3		Tr		
2750-2780'		84	15	1 MS-1		Tr	VW	W	VW	1.3	0.7				
2780-2810'		47	51	1 MS-1	0.5	0.5	VW	W	VW	1.5	0.8	Tr	Tr		
2810-2840'		24	75	spl. (1)		Tr	W-M	M	W-M	0.7	0.2	Tr	Tr		
2840-2870'		12	88	Tr spl.	Tr	Tr	W-M	M	W-M	0.4	1.2	Tr			
2870-2900'		6	94		Tr	Tr	W	W-M	W	0.3	0.4	Tr			
2900-2930'		2	98			Tr	W	W-M	W	0.3	0.4	Tr	Tr		
2930-2960'		3	97			Tr	W	W-M	W	0.3	0.4	Tr			
2960-2990'		2	98		Tr	Tr	W	W	W	0.5	0.3	Tr			
2990-3020'			99.5		0.5		W-M	M	W-M	Tr	0.6	Tr	Tr		7
3020-3050'		Tr	99.5		0.5	Tr	W	W	W	0.1	0.5	Tr			
3050-3080'			99	0.5 spl.	Tr	0.5	VW	VW	VW	Tr	0.2	Tr			
3080-3110'			100			Tr	VW	W	VW	Tr	0.3				
3110-3140'			100			Tr	VW	W	VW	Tr	0.3		Tr		
3140-3170'			100			Tr	VW	W	VW	Tr	0.2		Tr		
3170-3200'			100	Tr scor.	Tr	Tr	VW	W	VW	Tr	0.2				
3200-3230'		0.5	99.5		Tr	Tr	VW	W	VW	0.1	0.2		Tr		
3230-3260'			100		Tr	Tr	VW	W	VW	Tr	0.6		Tr		
3260-3290'		0.5	99			0.5	VW	W	VW	Tr	0.3				
3290-3320'			100		Tr		VW	W	VW		0.2				
3320-3350'			100				VW	W	VW	Tr	Tr				

STEAMBOAT 21B-5, Lithology & Mineralogy Recalc. to 60-ft Intervals

JH 02/22/05

DEPTH INTERVAL	PHYLL	MS-3A	H-B GRID	"OTHER" (SPECIFY)	GS& JAROSITE	VNLIS	ALTN. INTENSITY	CHL/MFC	SER/FSP	EP	PY	HM	CPY	MoS_2		CMT
3350-3380'			100		Tr	Tr	VW	W	VW	0.1	0.2		Tr			
3380-3410'			100		Tr		VW	W	VW	Tr	0.2					
3410-3440'			100				VW	W	VW	0.1	0.3					
3440-3470'		0.5	99			0.5	VW	W	VW		0.7					
3470-3500'			99.5		Tr	0.5	VW	W	VW		0.5					
3500-3530'			93				W	M	VW	0.1	0.2		Tr			7
3530-3560'			90				W	M	VW		Tr		Tr			10
3560-3590'			93				W	M	VW		0.1		Tr			7
3590-3620'			95				W	M	VW	Tr	0.1					5
3620-3650'			100				VW	W-M	VW	Tr	0.2		Tr			
3650-3680'			100				W	M	VW	0.1	0.2		Tr			
3680-3710'			100				W	M	VW	Tr	0.4		Tr			
3710-3740'			100			Tr	M	M-S	W	0.1	0.9		0.1			
3740-3770'			100		Tr	Tr	M	M-S	W	0.2	1		Tr			
3770-3800'			100				M	M-S	W	0.2	1.3		Tr			
3800-3830'			100	Tr scor.	Tr		M	M-S	W	0.2	0.4		Tr			
3830-3860'		Tr	100	Tr and st.			M	M-S	W	0.2	0.4	Tr				
3860-3890'		Tr	99		1	Tr	M-S	S	M	0.1	1.2		0.1			
3890-3920'			100	Tr rhy	Tr	Tr	W-M	M	W	0.1	1.1	Tr	0.1			
3920-3950'			99.5	Tr sco. Tr vss	Tr	0.5	W-M	M	VW	0.1	1		0.1			
3950-3980'			100			Tr	W-M	M	VW	Tr	0.8					
3980-4010'			100		Tr	Tr	W-M	M	VW	Tr	0.6			MoS_2		
4010-4040'			100		Tr	Tr	W-M	M	VW	0.2	0.9			(Tr)		
4040-4070'			100		Tr		W	W-M	VW	0.3	0.6		Tr			
4070-4100'			100	Tr rhy	Tr		W	W-M	VW	0.3	0.9	Tr	Tr			
4100-4130'			100		Tr		W	W-M	VW	0.1	0.8		Tr			
4130-4160'			100		Tr		W	W-M	VW	0.2	0.3					

STEAMBOAT 21B-5, Lithol. & Mineralogy Recalc. to 30-ft Intervals

scale-like → OPAL, CAL

DEPTH INTERVAL	PHYLL	MS-3A	MS-1	ANDST. VOLCANI-CLASTICS & TUFF	VOLC'S.	SCORIA	HBL-BTE GRTD	BTE. GRA-NITE	GG, NBX	VNLIS	ALTN INT.	CHL/MFC	SER/FSP	EP	PY	HM	CPY	MO S2	OPAL	CAL
4160-4190'							100				W-M	M	W	0.3	0.7		Tr			
4190-4220'							100		Tr	Tr	W	M	VW	0.2	0.4		Tr	(Tr)		
4220-4250'							100		Tr	Tr	W	M	VW	Tr	0.6		Tr	(Tr)		
4250-4280'							100			Tr	W-M	M	VW		0					
4280-4310'							99.5		0.5	Tr	W-M	M	W		0.7		Tr	(Tr)		
4310-4340'							100		Tr		W	W-M	VW	Tr	0.4		Tr	(Tr)		
4340-4370'						Tr	100		Tr		W	W-M	VW	Tr	0.2			(Tr)		
4370-4400'						Tr	100		Tr		W	M	VW	0.1	0.1		Tr			
4400-4430'							100		Tr	Tr	W	M	VW	0.3	0.3					
4430-44[illegible]0							99		1		W	M	VW	Tr	0.3		Tr	(Tr)		
4460-4490'	≈						99		1	Tr	W-M	M-S	W	0.3	0.4		Tr			
4490-4520'	≈				Tr. bslt		99.5		Tr	0.5	M	M-S	W-M	0.1	0.3		Tr	(0.1)		
4520-4550'					Tr. bslt		99		Tr	1	W	W-M	VW	0.3	0.5		0.1	(0.2)		
4550-4580'	◇						99.5		Tr	0.5	W-M	M	VW	0.4	0.4		Tr	(0.1)		
4580-4610'					Tr. gabbr.		100			Tr	W-M	M	VW	0.2	0.5		(0.1)	(Tr)		
4610-4640'							100		Tr	Tr	W-M	M	VW	0.3	0.3		(0.1)	(Tr)		
4640-4670'							100		Tr	Tr	W-M	M	VW	0.2	0.2		(0.1)	(Tr)		
4670-4700'	≈						100		Tr	Tr	W-M	M	W	0.4	0.3		(0.1)	(Tr)		
4700-4730'	≈						99		1		W-M	M	W	0.5	0.6		(0.1)	(Tr)		
4730-4760'					1 fxln qtz dior.		99				W-M	M	W	0.8	0.5		(0.1)	(Tr)		
4760-4790'	≈	0.5					99.5			Tr	W-M	M	W	0.9	0.3		(0.1)			
4790-4820'	≈	1					99			Tr	W-M	M	VW	0.3	0.4		(0.1)	(Tr)		
4820-4850'		Tr					100			Tr	W-M	M	VW	0.4	0.3		Tr	(Tr)		
4850-4880'	≈						100		Tr		W-M	M	VW	0.6	0.3		Tr	(Tr)		
4880-4910'							100		Tr		W-M	M	VW	0.4	0.2	Tr	Tr	(Tr)		
4910-49[illegible]	≈						100	Tr			W-M	M	VW	0.3	0.3	Tr	Tr			
4940-4970'							100	Tr			W-M	M	VW	0.2	0.2	Tr	Tr			

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WELL 21B-5 : Lith. & Min. Recalc. to 30-ft Intervals

JH 02/23/05

scale-like

DEPTH INTERVAL	PHYLL	MS-SR	MS-I	ANDESITIC-RHY VOLCANICLASTICS & TUFF	VOLC's	SCORIA	H-B GRTD	BTE GRANITE	GG/UBX	VNLTS	ALTN. INT.	CHK/MFC	SER/FSP	EP	PY	HM	CPY	MOSZ	OPAL	CALCITE
4970-5000'							100		Tr		W-M	M	VW	0.2	0.2		Tr			
5000-5030'							100		Tr	Tr	W	M	VW	0.3	0.2	Tr	Tr			
5030-5060'							99.5		0.5	Tr	W	M	VW	0.1	0.1	Tr	Tr			
5060-5090'							100		Tr	Tr	W-M	M	VW	0.2	0.1	0.2	0.1			
5090-5120'							100		Tr		W-M	M	VW	0.4	Tr	Tr	Tr			
5120-5150'							99.5		0.5	Tr	W-M	M-S	W	0.4	0.1	Tr	Tr			
5150-5180'							99.5		0.5	Tr	W-M	M-S	W	0.6	0.1	Tr				
5180-5210'							99		1	Tr	M	M-S	W	0.4	0.2	0.1				
5210-5240'							99.5		0.5	Tr	M	M-S	W	0.3	0.1	0.1	Tr			
5240-5270'							98		1	1	M	M-S	W	0.2	0.7	Tr	Tr			
5270-5300'							98.5		1	0.5	M	M-S	W	0.4	0.3	Tr	Tr			
5300-5330'							98.5		1.5	Tr	M	S	W	0.3	0.3	Tr	Tr			
5330-5360'							99		1	Tr	M	M-S	W	0.3	0.1	Tr				
(40 ft) 5360-5400'							99		1	Tr	M-S	S	W-M	0.5	0.5	Tr	Tr	Tr		
(20 ft) 5400-5420'	NO SAMPLE																		↓	
5420-5450'	3	1	Tr	3			73		0.5	0.5	M	M-S	W	0.4	0.4	Tr	Tr	Tr	18	1
5450-5480'	7	Tr	0.5	4			60		0.5	Tr	M	M-S	W	0.2	Tr	Tr	Tr		27	1
5480-5510'	7	0.5	Tr	3	Tr. andst		60.5		1	Tr	M	M-S	W	0.3	0.5	Tr	0.1		27	1
5510-5540'	9	Tr	Tr	2	± andst		56		1	Tr	M	M-S	W	0.1	0.7	Tr	0.1	Tr	29	2
5540-5570'	7	1	1	2			59	11	Tr	Tr	W-M	M	W	0.2	0.8	Tr	Tr	Tr	19	Tr
5570-5600'	6	3	Tr	5	Tr andst		48	20	Tr	Tr	W-M	M	W	0.1	0.4	Tr	0.1		18	Tr
5600-5630'	7	2	1	6			27.5	38	1	0.5	W-M	M	W	0.2	0.4	Tr	Tr	Tr	17	Tr
5630-5660'	12	Tr	Tr?	10	Tr. andst		15	37	2	1	W	W-M	VW	0.3	0.5	Tr			23	Tr
5660-5690'	2	Tr	Tr	3			2	87	Tr	Tr	VW	VW	Tr	0.3	0.4	Tr	Tr	Tr	6	Tr

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** NOTE: UNAMBIGUOUS CONTAMINANTS (CEMENT, RUST, STEEL, PAINT, LCM) OMITTED FOR CALCULATION

** NOTE: SLICKENSIDES & SHEARING IN TRACE AMOUNTS ONLY (TO VERY MINOR), BELOW 5420', MOST COMMONLY IN/ON ANDESITIC VOLCANICLASTIC & TUFF CHIPS.

Logging Notes | STEAMBOAT 21B-5 | J. Hulen, S. Johnson | 11/16/04

0-110' No Sample

110-120' Large Chips (4-20 mm; 10 mm) | 0.7 Limonite

③ Scoria, med-dk. gray but partly-completely coated w/ microns-thick rind that is matte opaque grayish-maroon to grysh-purple. Unaltered

(~20% is PHYLLONITE W/ PORPHYROCLASTS (see 170-180'))

① Veinlets. Goethitic limonite (earthy) ± minor clay

Bleached, weathered, biotitic metasandstone, metasiltstone, & bte hornfels, undivided. Chips commonly subrounded, & comm. bounded by one or more limonite-encrusted fracture surfaces

a.k.a. MS-3A

M Argillic altn - prob. weathering-induced

120-130' Smaller chips (<1-10 mm; 3-4 mm) | 2 Limonite

③ Scoria ② VVF, aa (limonite ± clay)

MS-3A, aa, more limonite. → M argillzn.

Est. (~25) MS-3A &

(70) Phyllite/Phyllonite w/ "knotty" or "nubbly" appearance due to porphyroclasts [SEE 170-180']

130-140'

Chips smaller still (<0.5-9 mm; 1-1.5 mm)

Est. (20) MS-3A (14) phyllonite

1.5 ↓ Limonite

(4) Scoria, aa

(2) Metaquartzite (a.k.a. (MS-1))

(tr) Clear, colorless Quartz (fr. granitoid?)

~~(4) MS-3A~~, weathered (comm. "rotty" appearance), Limon.-stained, punky

• M Argillzn. (weathering)

(2) VVF — Limonite ± clay; qtz

No: Mstly phyllite/phyllonite → see 170-180'

140-150'

Bimodal chip size
1 — <<0.5mm to 1.5 mm
2 — 3-15 mm (6-7 mm)

1 Limonite

Tr. CMT

(5) Scoria, aa

(20) MS-3A, aa, many chunks mod-well-rndd Limonite-stained, M Argillzn

(15) MS-3A (5) phyll.

Color — motled lt. orange and lt. grayish-orange to grayish-yellow.

± Phyllite/phyllonite (Est. 3:1)

(0.5) VVF, aa

breccia contains up to 5% <0.5-mm VESICLES

(74.5) BRECCIA, punky, spongy, crumbly, porous. Color aa. sub↓ to Subrndd. clasts <0.5-15 mm (1-2 mm) embdd. in a matrix of silt- & fine-sand-size grains only loosely indurated. Clasts are dom. decomposed ("rotten") MS-3A, but include ~4% scoria. Matrix appears to be largely entirely disaggregated & decomposed MS-3A.

~2% of clasts are pure white, apparently microgranular material that could be decomposed pumice.

2

• M Argillzn. (~10% ≥ Soltd.)

Logging Notes | STEAMBOAT 21B-5 | J. Hulen, S. Johnson | 11/18/04

140-150' ADDENDUM

At first glance, the punky breccia making up most of this sample (and the next) appears much like a poorly-washed & fines-rich cuttings that have simply "dried together in the bag", then been broken up to form "artificial breccia" chips.

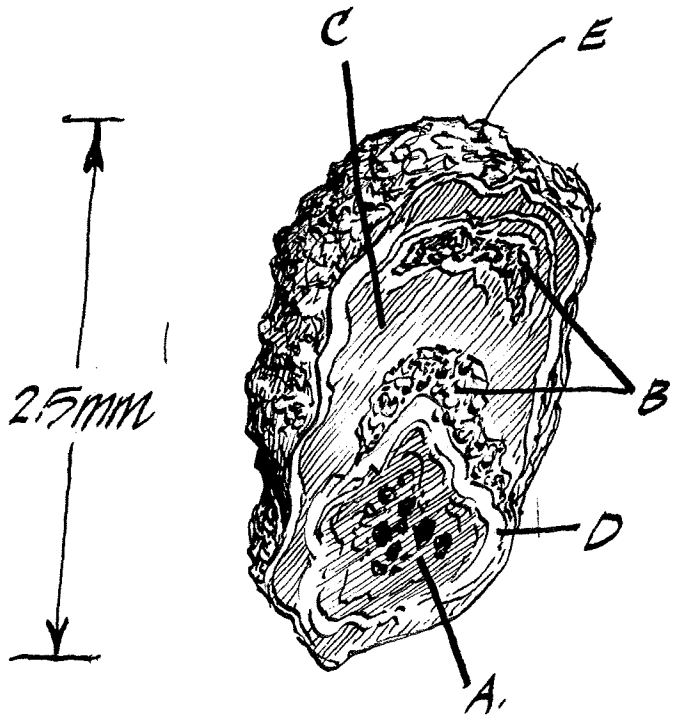
However, several features of the punky breccia support an indigenous origin for the material.

A. Though soft, it is actually more competent than simply dried cuttings aggregates would be.

B. It is cemented rare locally with clay and opal in various combinations.

C. It is locally cut by clay veinlets.

Additional Note: The breccia contains a few clasts of vein quartz-limonite



IN VIAL 1

DRILL CHIP FROM "SPONGY" POROUS BRECCIA, 160-170'

A. OPALIZED vfg SANDSTONE W/ CONCENTRATION OF NON-MAGNETIC DARK OPAQUE GRAINS

B. OPALIZED SILTSTONE

C. TRANSL. LT GRAY OPAL ± CHALCEDONY

D. WHITE OPAQUE OPAL ± CHALCEDONY

E. "NUBBLY" TO BOTRYOIDAL SURFACE, LOCALLY W/ EMBEDDED SILT & SAND GRAINS

Logging Notes

STEAMBOAT 21B-5

J. Hulen
S. Johnson

11/16/04

150-160'

(81.5) "spongy", porous BRECCIA, same as 140-150', exc. color is v. lt. brnsh-gray

0.5 limonite

(12) MS-3A (10) (7) (5) phyllite, same as 140-150'

& Phyllite/Phyllonite (est. 2:1)

M Argillen. (12%)

(3) SCORIA, As above

(0.5) VVF (limonite ± clay)

160-170'

(72) "spongy", porous BRECCIA, aa M Argillen (10%)

0.3 limonite

(3) Scoria, aa (Tr) VVF aa

(25) MS-3A (9) (7) (16) phyllonite as discrete chips <1 to 10 mm dia. Many are subrndd.

→ phyllite/phyllonite (est. 1:2)

** Here and in the previous 3 samples, the discrete MS-3A chips could well ~~be~~ have been clasts in the breccia.

170-180'

—Calcite veinlet fragments appear

—Sample dominated by phyllite or phyllonite.

1 Limonite

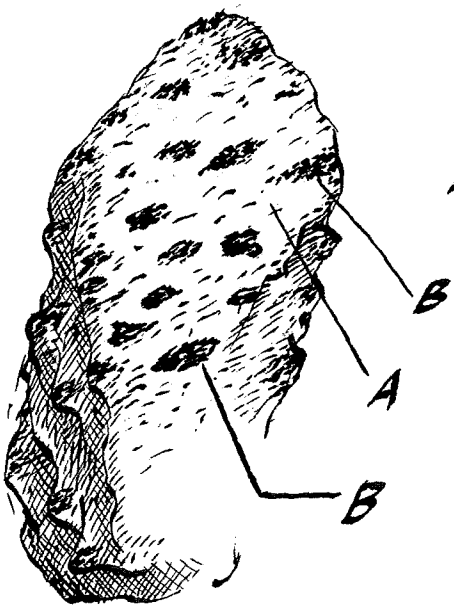
(1) VVF—CAL (bladed), as discrete chips

(Tr) "spongy", porous, crumbly breccia, as above

(2) scoria, aa. Ash-sized chips/fragments

170-180' cont'd.

(97) PHYLLITE or v. micaceous PHYLLONITE, weathered, limonite-stained. ca ⅔ has a "knotty" appearance due to apparent porphyroclasts of more resistant protolith



← 5 mm →

A — Micaceous micro-granular matrix grains predominantly <50μ dia. Pearlescent, v. lt-lt. grayish-brown (comparatively soft)

B — Commonly ovoid to crudely lenticular clasts of biotite-rich metasandstone/metasiltstone, med. grayish brown, relatively resistant.

★ Implication is that cataclasis followed metamorphism.

• Overall W-M Argillic Altn (5-7% ≤ altd.) (i.e. argillzd)

180-190'

(10) Phyllite, rarely w/ "knotty" appearance, as above.

(2) Scoria, aa

(88) MS-3A, comm. dense & hard

• M Argillzn (None ≥ ≤ altd.)

1 Limonite

Weathered & Limonite-stained

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190-200'

(1) (10) Phyllonite, aa
(2) Scoria, aa
(0.5) VVF — Limonite ± Clay
(87.5) MS-3A, comm. dense, hard
• VW Argillzn. (None ≥ altd.)

1 Limonite

200-210'

(3) Meta-Andesite, med-dk. gray, dense, hard, comm. plag. microlites
(5) MS-1 (2) Phyllonite, aa (Tr) VVF, aa
(90) MS-3A → mostly dense, hard, & med-dk brnsh-gray & grayish-brn.
• VW Argillzn (1% ≤ altd)

0.3 Limonite.

210-220'

(2) Scoria, aa (2) MS-1
(0.5) VVF (95.5) Meta-Andesite
→ vxln, med-dk. gray to sl. grnsh-gray
• Nearly fresh → W chl/mfc → VW ser/plag. (2% ≤ altd. : ~~X~~ argillzn)

Tr. Limonite

220-230'

(0.5) VVF — Limonite. — Cal. — Clay ± lim., cal.
(1) Scoria, aa (20) MS-3A
(78.5) Meta-Andesite, aa
• Overall VVW Argillzn → W chl/mfc → VVW ser/plag. (2% ≤ Altd. : argillzn)

0.3 Limonite

230-240' — Argillzn. increases —

2 Limonite

(2) MS-1
(15) Phyllonite, aa, with "knotty" texture
(30) Meta-Andesite, aa
(1.5) Veinlets
— Limonite ± clay
— Clay ± limonite
Clay is white to pale yellow, probably nontronite in part.
(51.5) MS-3A

• Altn. overall W-M Argillic → VW chl/mfc ser/plag (10% ≥ ≦ altd.)

240-250' — Argillzn VW again —

0.5 Limonite

(5) MS-3A aa
(1) VVF, mstly clay aa
(94) Meta-Andesite, aa

250-260'

VVW Argillic (& v. patchy) superimposed on W chl/mfc. (No chips ≥ ≦ altd.

240-250'

0.3 Limonite

(1) Scoria, aa (Tr) VVF
(5) MS-3A
(94) Meta-Andesite, aa

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STEAMBOAT 218-5

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S. Johnson

11/17

260-280' No Sample

280-290'

(25) Meta-Andesite, aa, rel. fresh
(10) MS-3A, also rel. fresh
(1) Vn/ts — Lt. grnsh-gray to lt grayish yel.-green clay (probably montronite) ± limonite
(64) "Knotty"-textured, porphyroclastic ~~textured~~ Phyllonite, strongly argillized. V. lt. yel.-gray speckled w/ gray-green.

Argillization M-S → M-S chl/mfc → (35%) ≥ S altd.

0.5 Limonite

290-300'

(40) Meta-Andesite, aa
(1) Scoria, aa — Fresh
(20) MS-3A, rel. fresh
(3) VVF, aa
(36) Phyllonite, aa — S argil/zd.

• M-S Argillzn. aa → M-S chl/mfc → (20%) ≥ S altd.)

0.7 Limonite

300-310'

(2) Scoria, aa + CAL
(1) VVF — clay ± limonite
(3) Phyllonite, aa
(94) Meta-Andesite

cal. is younger

0.2 Limonite

• VW Argillzn. → W chl/mfc → (2% ≥ S altd.)

310-320'

(2) Scoria, aa
(3) VVF — clay ± limonite calcite, calcite ± (limonite, clay)
(5) Phyllonite, aa
(90) Meta-Andesite, aa

0.3 Limonite

• W Argillzn. → W chl/mfc → (4% ≥ S altd.)

320-330'

— ENORMOUS CHIPS (5-22 mm; 13 mm) —

(1) VVF, aa
(99) Meta-Andesite, aa

0.1 Limonite

• VW Argillzn. → W chl/mfc → (None ≥ S Altd.)

330-340'

— ENORMOUS CHIPS, aa —

(1) VVF, aa
(5) Scoria, aa
(94) Meta-Andesite, aa

Tr. Limonite

• Altn. all AA (VW Argillz'n)

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340-350'

—ENORMOUS CHIPS, aa—

Tr. limonite

(2.5) Phyllonite, aa

(97) Meta-Andesite, aa
Dense, hard, little altered

(0.5) VVF — Clay - (limonite)

→ • VW Argillzn. — VW chl/mfc (None ≥ S altd.)

350-360'

—ENORMOUS CHIPS — aa —

Tr. limonite

— All same aa —

360-370'

—smaller chips (<1-10 mm; 4-5 mm)

0.5 Limonite

(1) VVF — Clay ± limonite. — CAL

(15) Phyllonite & ~~Poss.~~ Prob. MS-3A
Selectively Argillzd.,

(84) Meta-Andesite, aa

Overall W/M Argillzn. → W chl/mafics →
(7% ≥ S altd.)

(1) Poss. 1/2 of each

Younger

370-380'

—LARGER CHIPS AGAIN—

0.3 Limonite

(1) VVF — aa

(10) MS-3A

(89) Meta-Andesite, aa
massive, v. little bte, hbl & magnetite-rich

Rel. fresh

• VW Argillzn. aa
(2% Str altd.

380-390' — BIMODAL CHIP DISTRIBUTION — A → 3-13 mm (~7 mm); B → <0.5-3 mm (~1.5 mm) | 1 Limonite

(1) (~7) META-ANDESITE, aa, msv, larger chips, rel. unaltd.

(3) VVF → CLAY ± cal, limonite

(~90) MS-3A, richer in bte, finer-grained, comm. speckled-appearing; selectively altered.

- W-M Argillzn. → W chl/mfc → (9% ≥ S altd.) Argillzn

390-400' | 1 Limonite

(1.5) VVF, — CAL ± (clay, limonite)

(Tr) scoria

(1) (~5?) MS-1 (bte-poor metaqtzt

(93.5) MS-3A

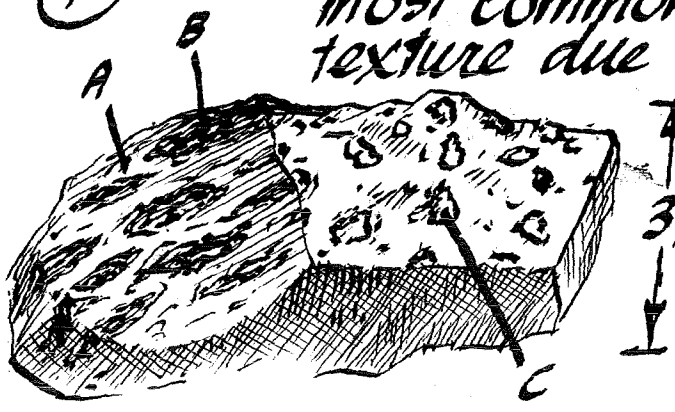
- M-S Argillzn. & M silicification (30% ≥ S Altd.)

400-410' | Tr. Limonite

SAMPLE STRONGLY CHLORITIC

(1) SCORIA

(1) (~35) PHYLLONITE, same as 170-180', most commonly with a "knotty" texture due to porphyroclasts. | C. X-sec. of rod-like p-clast



A. Pale grnsh-gray, soft, ugranular matrix, micaceous

B. Med. grnsh-gray, rel. hard porphyroclasts. qtz + fsp. - chl.

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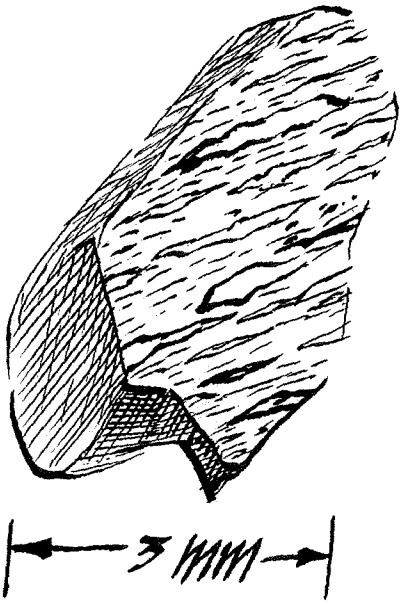
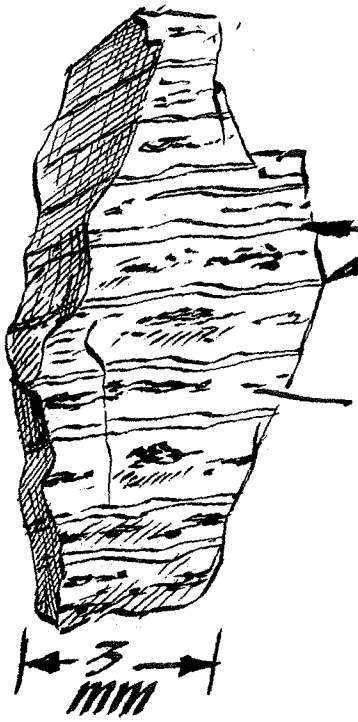
400-410' continued

Tr. X Limonite
1 EPIDOTE





(62) MS-3A
(V. Approx. - could include some phyllonite)

(2) VVF — Chl
— Cal ± clay, limonite
— Clay ± cal

● M ⟍ M Propyl. → ≤ Chltzn of mfc; → W ser/fsp (35% ≤ altd.) ↳ chl

410-420'

(1)

(2.5) VVF, aa
(~40) PHYLLONITE, aa
" (57.5) MS-3A

2.5 EP

W-M Argillzn superimposed on M Propyl., aa (35% (~) ≤ altd).

420-430'

(2) VVF — CAL ± clay

(Tr) SCORIA, aa

(~25) PHYLLONITE, aa

← V. approx. gradational w/ MS-3A

selectively argillized.

(1)

(~73) MS-3A —

W-M chl/mfc.

• OVERALL: M Argillzn superimposed on W-M Propyl.

→ Many pcs. so altered crumble readily, decompose in water

2.5 EP

Tr. cpy

430-440'

(~10?) PHYLLONITE (V. approx. — gradational w/ MS-3A.)

(1)

(Tr) scoria, aa

(2) MS-1 (Metaqtzt.)

(1.5) VVF — Mostly calcite — Also older EP

(86.5) MS-3A

• W Argillic Altn → W-M chl/mfc (3% S altd.)

2 EP

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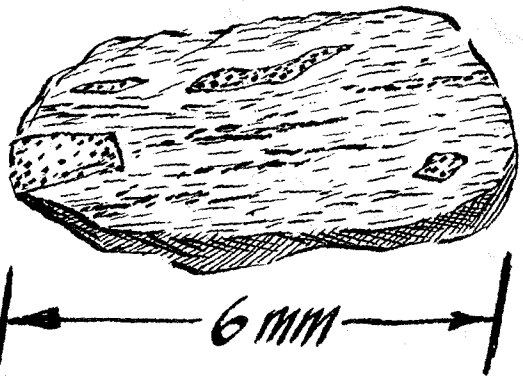
440-450'

(1)



(40) ~~30~~ % PHYLLONITE, ad. - V. Approx., as this rock type is gradational to MS-3A.

The chips identified as phyllonite are restricted to those w/ clearly cataclastic texture such as the one pictured above left.

(2) VVF — Mostly Calcite

(7) MS-1 (Metaquartzite), but anomalous in being buff to buff-white (as opposed to the typical grnsh-gray) & in being commonly epidote-rich — 7% is

(0.5) CRUSH MICROBRECCIA (CMBX) — White, calcite-cemented

(49.5) MS-3A, but gradational with the phyllonite described above.

- W-M Argillic Altn, superimposed on W-M Propyl. → W-M Chl/mfcs. (7% ≥ S altn.)

450-460'

(35) ? CATACLASITE / Phyllonite, aa
(Once again, very approximate)
Gradational with MS-3A %

(Tr) scoria, aa
(1) VVF —— CHL (at least 2 generations)

1.5 EP

(6) MS-1 (Meta-qtz, buff mostly, & epidotized, aa)
(58) MS-3A, as above

(5% ≥ S altn)
• W Argillzn on W Propyl. → W-M chl/mfc

460-470'

(0.5) scoria, aa
(14.5) PHYLLONITE, aa
friable, crumbly, streaky & commonly subtly porphyroclastic texture.
(3) MS-1 mostly buff & epidotized
(1) VVF, aa (81) MS-3A

1.5 EP

(Tr)

M Argillzn. — on W Propyl.
W chl/mfc (10% ≥ S altd.)

470-500' No Sample

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500-510' — 6 CMT

- (3) MS-1, some epidote-rich
- (0.5) CMBX, cal-cmtd.
- (1) VVF cal ± clay, multiple generations
- (95.5) MS-3A
- cal vnlts
- • M Argillzn. on W Propyl. → W chl/mfc (10% ≥ S Altn.)

1 EP (in MS-1)

510-520' — 7 CMT, Tr LCM

- (4) MS-1
- (1) VVF
- (Tr) CMBX
- (95) MS-3A
- • Altn. all aa
- CAL

0.1 EP

520-530' — 5 CMT

- (1) VVF — CH. — chl-ep. — CAL
- (4) MS-1
- (95) MS-3A
- • W Argillic on VW Propyl. (3% ≥ S Altn.)

1 EP
0.3 PY

530-540' — 2 CMT

- (0.5) VVF, aa
- (2) MS-1
- (97.5) MS-3A
- • Altn all aa
- CAL

0.5 EP
Tr. PY

15

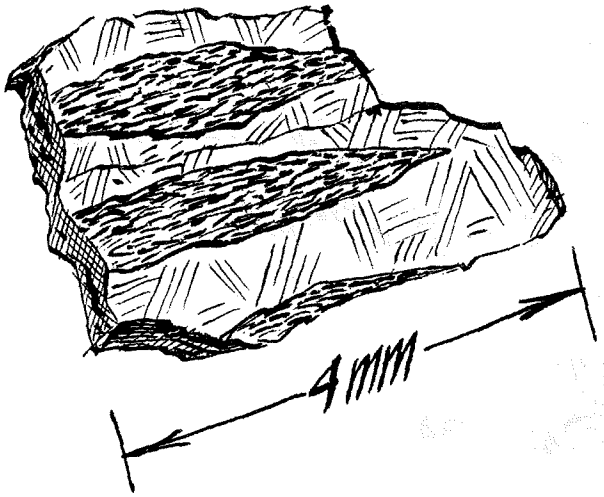
540-550'

Tr R#s
Tr. CMT

(Tr) Scoria (CVD)
(3) VVF — Cal
(3) MS-1 (94) MS-3A

Tr. CPY
1.5 EP
0.3 GNT

• ~~M~~ W-M Argillzn. on W Propyl. → W Chl/mfc.
(~~5~~ 10% ≥ ≤ altd.)
poss. more



550-560'

Much Finer Cuttings (<0.5-4 mm; 1 mm)

Tr CMT

cal

(1.5) VVF — Cal (multiple generations)
(2) MS-1 (97.5) MS-3A

1.5 EP
0.1 py

• ~~W~~ W-M Argill. on W Propyl → W-M Chl/mfc W ser/fsp.
(5% ≥ ≤ altd.

560-570'

9 CMT
Tr. paint

(2) VVF — aa (3) MS-1
(0.5) CMBX (94.5) MS-3A

0.5 py
2 EP

~~M~~ W-M Argillzn → W Propyl → W chl/mfc ser?
(~~10 20~~ % ≥ ≤ altd.) ← More like 10%

Bfe mostly fresh but fsps altd.

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570-580'

13 CMT Tr. paint

(0.5) VVF — CAL (97.5) MS-3A
(2) MS-1

1 EP
Tr. py

- W Argillic on W propyl. → W chl/mfc (5% ≥ ≤ altd.)

580-590

3 CMT Tr. paint (green)

(w 15) Bte-Rich Phyllite gradational to MS-3A; distinct from the porphyroclastic phyllonite recorded higher in the well
- rel. fresh

(2) VVF — Cal (4) MS-1 (79) MS-3A

- Altn all aa

2 EP
Tr. py

590-600'

(4) MS-1 w (15) Phyllite aa
(0.5) CMBX — cal-cmtd.
(1.5) VVF — Cal, lam., not "frozen" to wallrock

- Altn all aa

1.5 EP
Tr. PY

600-610'

1 CMT

(w 17) PHYLLITE gradational to MS-3A
(0.5) CMBX (2) VVF, aa
(80.5) MS-3A,

- Altn aa

1 EP
0.3 PY
Tr CPY

610-620'

(11) ⋔ ≈ (4) VVF — Cal, transl. opaque white to buff white; not "frozen" to wallrock; laminated commonly; <0.1-1.5 mm wide

0.3 cpy
0.2 py
0.7 EP

(17) Phyllite, aa, transitional to MS-3A

(7) (17) ? Phyllonite/cataclasite; different from above, less "ordered" in appearance; commonly slickensided; comm. porphyroclastic; comm. "knotty" or "warty" aspect.

(3) MS-1 (79) MS-3A, Gradational to phyllite Many chips subrounded, resembling pebbles (probable drill-milling)

- W-M Argillic or Clay-Ser Altn on → W propyl — W-M chl/mfc (10% ≥ S ≥ altd.)

620-630'

3 CMT

(3) VVF, aa (1) MS-2 Qtz-Ep-Garnet Hornfels

0.5 EP

(2) MS-1 (10) Phyllite, gradational to MS-3A

→ some w/pale green tremolite

(84) MS-3A, aa, Many chips subrounded to well-rounded.

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- W M Clay-Ser → W propylitic → W-M chl/mfc (7% ≥ S ≥ altd.)

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630-640'

(Tr) CMBX (15) Bte-rich Phyllite gradational to MS-3A.

0.3 PY
0.1 CPY
1 EP

(2) MS-1
(2) VVF — Cal. → Chl (81) MS-3A; Many chips well-rounded (prob. drill milling)

- W-M Clay-Ser Altn on → W Propyl. Altn
  W chl/mfc → (~4% ≥ ≦ altn.)

640-650'

"Chunkier" Chips (Phyllite mostly gone)

(0.5) CMBX (3) Phyllite, aa
(2) MS-1 (2) VVF—cal
(92.5) MS-3A, mstly Bte. Hnfls.

0.7 EP

1 w. PT

- W Propyl. → W-M chl/mfc → VW ser/fsp
  (1% ≥ ≦ Altn.)

650-660'

(Tr) MS-2 (Tr) MS-1 (0.5) VVF, aa
(99.5) MS-3A, Mostly Bte. Hnfls

Tr. EP

- Altn. all aa

Tr. CMT

660-670'

(1) MS-1 (1) VVF — ~~X~~ Cal
(98) MS-3A, aa

0.5 EP

670-680'

Tr CMT

① VVF — Cal (2 gen.)
② MS-1 —
97 MS-3A

FL

0.2 py
Tr cpy
Tr. EP

• W Propyl. → W-M chl/mfc — (<1% ≤ dltd.) → VW ser/fsp →

680-690'

1.5 VVF — aa, but w/chl.
98.5 MS-3A

• Attn. all aa

FL

0.5 EP

690-700'

① VVF — cal aa
③ MS-1 96 MS-3A

• Attn all aa

0.5 EP

700-710'

1 CMT

All aa —
except stained w/oil (?) diesel]

Tr. cpy
0.3 EP

710-720'

— some caving —
Interpreted indigenous =
4 MS-1 1.5 VVF
94.5 MS-3A

• Attn all aa

0.3 EP

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720-730

0.3 EP

-Some Caving-

Among interpreted indigenous chips:

① VVF — CAL ± chl — CHL ③ MS-1 ⑯ MS-3A

W Propyl → W-M chl/mfc → W ser/fsp (3-4% ≥ salt'd.)

730-740

① VVF aa ⑥ MS-1

⑬ MS-3A - Appearing to be more phyllitic overall but cannot reliably quantify due to small chip size.

0.3 EP

• Altn. aa (alg)

740-750

① CMBX selectively argillized. ± calcite-cemented.

② VVF — CAL ± chl, (clay)

⑦ MS-1 ⑩ MS-3A, def. phyllite in part

0.5 EP

Tr. py

• Wk Argillzn. superimposed on M Propyl. → M-S chl/mfc → M ser/fsp (17-20% ≥ altn.)

750-760

② VVF, aa

in fact, all aa

0.5 EP

760-770'

① 1-2 mm chips of clear, colorless, massive quartz — does not look hydrothermal — more as if derived from granitoid. | 0.5 EP

① VVF, — Cal ± chl, lam., aa

③ MS-1 ⑨⑤ MS-3A, def incl. some phyllitic material.

• W-X Argillic Altn superimposed on W Propyl. → W-M chl/mfc → (5% ≥ ≦ Altn.)

770-780'

Tr Msv qtz, aa ① VVF aa

④ MS-1 ⑨⑤ MS-3A, less phyllitic than above. | 0.5 EP

• W-M Argillic Altn. (on) W. Propyl. → W Chl./mfc → (7% ≥ ≦ Altn.)

780-790'

⓪.⑤ VVF Tr Grld QTZ ② MS-1 ① CMBX ⑨⑦.⑤ MS-3A | 0.3 EP

≈≈ • Altn same as 760-70'

790-800'

⓪.⑤ VVF Tr MS-2 ② MS-1 ⑨⑦.⑤ MS-3A | 0.3 EP

• Altn all aa

Tr. CMT

Logging Notes | STEAMBOAT 21B-5 | J. Hulen & S. Johnson | Dec. 19, 2004

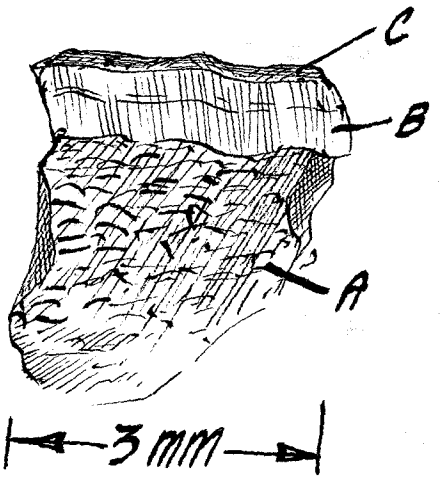
800-810' (11)

0.2 EP
0.3 ROSE GARNET

Tr. cu grease
Tr CMT
Tr. R&S

(4) MS-1 (Metaquartzite), o/o to o/o, vfg-fg, buff-white, v. lt. gray-buff, & v. lt., sl. grnsh-gray. Seems only partially recrystallized. Tr. epidote.

(1) MS-2 quartz-Chlorite-calc-silicate hornfels (± calcite)



A. Argillized MS-3A. Bte partially chloritized.

B. calcite, transl., sl. brnsh. lt. gray - transversely microfibrous.

c. Calcite, aa, braided longitudinally with pale orange dolomite.

(1.5) → VVF -Cal -Cal-Dol.

wk arg. on w-m wk chl/grnpyl. mafics | vw ser/plag

(93.5) MS-3A Quartz-Plagioclase-Biotite ± Tremolite/Actinolite Hornfels. ~0.3% beautiful deep-pink transp. euh. GARNET porphyroblasts ≤1 mm

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810-820'

Xc CMT 1.5%

① VVF cal; cal-dol., aa
these are delicate, not "frozen" to the wallrock;
(epithermal)
also comm. delicately banded

③ MS-1 ① MS-2 Tr mx/n GRTD.

Altn. AA ⑨⑤ MS-3A

0.1 EP

820-830'

Tr. CMT

(1.5) VVE. Cal; Cal-dol; Dol. (pale orange) vnlts epithermal; comm. delicately banded; fr. " 0.05-1 mm. wide

③ → MS-1 ① MS-2 Tr mx/n GRTD.

94.5 → MS-3A

0.1 ep

W-M arg. on VW-W prop
W-M chl/mfc VW ser/fsp
5% ≥ S altd.

830-840'

Tr. R&S
Tr. cmt

(0.5) VVE, aa ~~②~~ ④ MS-1 (chlte) ① MS-2

Tr GRTD 94.5 MS-3A Altn. AA

Tr. PY
0.2 EP

840-850'

Tr. "Pebbles" - well-rounded up to 3 mm, dark brn-gray metasiltstone. Likely a product of caving and "drill-milling"

&S
r. LCM
5 CMT

(1) on cal vnlt.

0.5 VVE, aa ③ MS-1 ① MS-2

Tr mx/n GRTD 95.5 MS-3A

Altn AA

0.5 EP

Logging Notes

STEAMBOAT 21B-5

J. Hulen & S. Johnson 12/19/04

850-860' (1)

Coarser cuttings; More granitoid; Some caving?

0.1 pyrite
2 EP (metm.)

0.5 CMT

① VVF → cal.; No obv. dol.; Tr. blue-gray clay. Bndd. white (transl.) cal up to 2.5 mm. wide

⑤ MS-1 ④ MS-2 (comm. "resinous"-looking grnsh-brn; could contain msv garnet.

⑧⑧ MS-3A

② mx/n GRTD, aa. (str. "propyl").

3% ≥ ≤ altd. wk. arg on wk. propyl.
w-m chl/mfc vw ser/fsp.

860-870'

① VVF ⑤ MS-2, ep-rich
③ MS-1 ② mx/n GRTD ⑧⑨ MS-3A

3 EP (mtm.

Tr. Cu-grease
0.5 CMT

* Note Several "chips" are of a type of breccia consisting of MS-3A clasts in a matrix of disaggregated and finely ground and recemented MS-3A — Could be a sampling artifact, but ...

* Also a few well-rounded "pebbles" of MS-3A

Increase in VVF

870-880'

(3.5) VVF → Cal., opaque to transl. white; comm. laminated; up to at least 5 mm. thick; not "frozen" to wallrock in fact, most of these veinlets have been broken out and exist as free (discrete) chips

(1) MS-1 (Tr) GRTD (95.5) MS-34

• Altn. as above

Tr. ep

880-890'

(3) VVF, aa Cal, comm. delicately laminated; tr. pale orange dol.

(2) MS-1 (Tr) GRTD (95) MS-34

• Altn. aa

0.1 ep

890-900'

• Much coarser chips. (comm. > 6 mm)

(2) VVF, aa (2) MS-2

(2) MS-1 (Tr) Grtd. (94) MS-34

** ~ 1% "Pseudobreccia", same as 860-870'

• Altn aa

1.5 EP (MTM.)

0.1 HM

Logging Notes | STEAMBOAT 21B-5 | J. Hulen, S. Johnson | 12/19/04

900-910'

(1) (4) VVF, mostly lam. cal, aa (same as 870-880'. Tr. pale orange dol.

Tr. cmt

(3) MS-1 (3) MS-2 (Tr) mx/n GRTD (90) MS-34

Many chips "bleached" appearing — (chl-ser)

2 ep Tr. HM
Tr. py

5% ≥ ≤ altd. M chl/mfcs W-M ser/fsp

wk argillic on wk-mod. propyl.

910-920'

• Color change — whitish.

(5) MS-34 (Tr) GG (grtd. protolith)

0.3 cpy
0.5 py
Tr CINNABAR IN GOUGE.

(3) fx/ln bte-hbl qtz diorite; 10-15% total mafics. (0.5) VVF, cal aa

(91.5) mx/n hbl-bte grtd. [7-9% tl. mafics]

w-m chl/mfc
w-m ser/fsp

5% ≥ ≤ altd [chl-ser altn.]

920-930'

(6) MS-3A (94) mx/n. GRTD.

0.7 py (1)
0.2 cpy
0.3 ep.

w chl/mfc
vw ser/fsp

vw ALTN chl-ser ± ep, i.e. propyl.

930-940'

(Tr) VVF (3) MS-3A (Tr) MS-2
(97) mx/n. GRTD.
• w propyl. w chl/mfc w-m ep/mfc vw/ser/fsp

0.3 py
Tr. cpy
0.5 EP

940-950'

(7) MS-3A (93) mx/n GRTD
• altn aa (VFL)

0.1 py
0.3 EP

Tr. cmt

950-960'

(5) MS-3A (some rndd. & cvd.)
(95) mx/n GRTD
(Tr) GG (VFL)
• VW ~~prplyl~~ propyl. w chl/mfs vw ser/fsp

0.7 py
0.2 cpy
0.2 EP

1 cmt

960-970'

(0.5) VVF cal ± dol (pale orng.) (93) mx/n GRTD
(7) MS-3A
• Altn. aa

0.7 py
0.2 cpy
0.1 EP

Tr. cmt
~~Tr~~ & pmt

970-980'

(0.5) VVF, aa
(5) MS-3A (94.5) mx/n GRTD.
• Altn. aa

1 EP
0.2 py

980-990'

(VVFL) (Tr) fx/n gtz. drt
(3) MS-3A (97) mx/n. GRTD.
• vvw propyl. vw chl/mfc vvw ser/fsp none > 5, altd.

0.5 EP
0.5 py

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Logging Notes | STEAMBOAT 218-5 | J. Hulen, S. Johnson 12/19/84

990-1000'	★(0.5) GG & CMBX; one chip int. argillized (?) & very porous (2) MS-3A (97.5) mx/n. GRTD. • A/tn vvw aa [VFL]	0.2 EP 0.2 py Tr. cpy
1000-1010'	(2) MS-3A (1) fx/n qtz drt (Tr) VVF cal & bright orange dol. • vvw altn aa [VFL]	Tr. py 0.1 EP
1010-1020'	(Tr.) MS-3A (100) mx/n GRTD many pcs. weakly FeOx-stained • vvw altn. aa [VFL]	Tr. py | 0.1 cpy
1020-1030'	-All as above- exc. (Tr) GG	Tr. cpy / 0.1 py
1030-1040'	(1) MS-3A (Tr) MS-1 (99) mx/n GRTD • vvw altn aa [VFL]	1 py 0.2 cpy 0.1 EP
1040-1050'	(Tr) MS-3A (Tr) fx/n QD (100) mx/n GRTD • vvw altn aa [VFL]	0.2 EP 0.5 py 0.1 cpy

1050-1060'

(Tr) fx/lt QD (100) mx/lt GRTD

- VVW altn. aa (VFL) Arz abundance of fresh glassy feldspars.

0.1 EP
0.2 py
Tr. cpy

1060-1070'

0.5 cement

(Tr) MS-3A (100) mx/lt. GRTD, aa
(Tr) VVF cal

- VVW altn aa (VFL)

0.3 EP
0.2 py
Tr. cpy

1070-1080'

(100) mx/lt. GRTD

0.3 EP
0.2 py

- W altn w ser/fsp
  W-m chl/mafics
  5% ≥ S altd. (X grysh-yellow msv sericite (probably m.l. IL/SM)

1080-1090'

same as 1060-1070'
[VFL]

0.5 EP
0.2 py

1090-1100'

(Tr) GG (Tr) MS-3A
(100) fx/lt GRTD, aa

- VVW altn. aa (VFL)

** abundant fresh glassy fsp

0.2 py
Tr. cpy
0.2 EP

Logging Notes | STEAMBOAT 21B-5 | J. Hulen, S. Johnson | Dec. 19, 200

1100-1110'
(Tr) VVF (cal)
(100) mx/n grtd
• vvw altn aa (VFL)
0.2 py
0.1 EP

1110-1120'
Monotonous
0.1 cpy 0.2
0.2 py EP
(0.5) (Tr) VVF cal-dol, white & pale orange
(100) mx/n grtd
• vw altn (VFL)
→ also bright orange dol. (distinctive)
& (Tr) GG

1120-1130'
(1) CMBX, mostly lt. grayish-yellow — grtd protolith
(2) MS-3A
(Tr) VVF aa
(97) mx/n GRTD • vvw altn aa
0.3 EP
0.1 py

1130-1140'
(0.5) CMBX, aa
(2) MS-3A
(Tr) VVF dol, cal
(97.5) mx/n GRTD
• vvw altn aa
i.e., vvw propyl.; vw chl/mfc; vvw ser/fsp
0.2 EP
0.2 py

1140-1150
(1) MS-3A (97) mx/n GRTD
• vvw altn aa
(1) CMBX (1) VVF cal±dol, comm. laminated
0.1 EP
Tr. py

1150-1160'

(0.5) cmbx (Tr) VVF cal (Tr) MS-3A

(99.5) mx/n GRTD

• vvw altn aa (VFL)

0.1 EP
Tr. py

1160-1170'

Tr: R&S

—All aa—

• vvw altn

0.1 EP
Tr. py

1170-1180'

(0.5) cmbx (0.5) VVF cal ± dol.

(Tr) MS-3A (99) mx/n. GRTD

• vvw altn. aa

0.2 EP
0.3 py

1180-1190

(100) mx/n GRTD aa

• vvw altn aa
abundant fresh glassy plagioc.

0.5 EP
0.1 py

1190-1200'

(Tr) cmbx (Tr) VVF (Dol.-cal)

(100) mx/n grtd., aa

• vw altn, aa

1 EP
Tr. py

1200-1210'

(Tr) MS-1 (100) mx/n grtd

• vvw altn aa

0.5 EP
Tr. py

1210-1220'

(Tr) MS-3A (Tr) VVF aa

(100) mx/n GRTD, aa

• vw altn aa
vw chl/mfc
vvw ser/fsp 3% ≥ ≤ altd.

0.7 EP
Tr. py

Logging Notes | STEAMBOAT 21B-5 | J. Hulen S. Johnson | 12/19/07

1220-1230' ≈ (0.5) CMBX

(0.5) VVF cal ± dol, white to pale orange, comm. laminated

0.2 py
0.7 EP
Tr. cpy

(Tr) MS-3A (99) mxln. GRTD

• VW propyl. → w chl/mfc vvw ser/fsp ≤1% ≥ sltd.

1230-1240' — All aa —

0.5 EP
Tr. py

0.5 cmt

1240-1250' — All aa —

0.5 EP
Tr. py

0.5 cmt

1250-1260' (Tr) ✕ brnsh-red scoria-zsh (prob. caved)

0.5 EP
0.3 py

(1) cmbx (0.5) VVF ✕ (1) MS-3A

(97.5) mxln GRTD

• W propyl → w/ser/fsp w/chl/mfcs 1% ≥ sltd.

1260-1270'

① GG
⑤ VVF → cal, DOI → latter comm.
vivid med., sl. brnsh-orange
② MS-3H ⑯.⑤ mx/n. GRTD
• VW propyl., aa

0.3 EP

Tr. LCM

1270-1280'

①.⑤ CMBX
Tr VVF — ~~All aa~~ —
Tr MS-1
① MS-3H
⑰.⑤ mx/n. GRTD aa

0.2 EP
0.1 py

Tr. LCM

1280-1290'

⑩⓪ mx/n GRTD aa

0.3 EP.
0.1 py

1290-1300'

Very Fresh (VFL)
Tr VVF (cal)
⑩⓪ mx/n GRTD
• vvw propyl. aa

Tr. EP
Tr. py

1300-1310'

—All aa—

~~TK~~ EP(0.3)
Tr. py

1310-1320'

—All aa— Tr exc. qtz-ser VVF

Tr. py
0.3 EP

MONOTONOUSLY FRESH

Logging Notes | STEAMBOAT 218-5 | J. Huler, S. Johnson | 12/19/04

1320-1330' — Tr. cmt / Tr. LCM

(VVFA) [post-treadmill shakes] — Tr. EP

(Tr) GG (Tr) VVF cal, dol.

(1) MS-3A (99) mx/n hbl-bte GRD.

- vvw propyl. → vw chl/mfc, vvw ser./fsp

→ bte & hbl mostly black & shiny; fsps. fresh and glassy

1330-1340' — Tr EP

All aa

1340-1350' — Tr. cpy / Tr py 0.1 EP

All aa, exc (GS)

1350-1360' — Tr R$S

(0.5) VVF cal, dol — Tr. EP

(99.5) mx/n GRD

- vw propyl aa

1360-1370' — 7 LCM (VOL.) / ~.05 cmt

- Appearance of abund. LCM — Tr. EP

(2) MS-3A (1) VVF cal, dol, comm. lam. dol. comm. vivid sl. brnsh-orange ← ★

(0.5) CMBX

(96.5) mx/n GRD, "cloudy" fsps

- lt propyl. → lt ser/fsp, lt chl/mfcs

35

1370-1380'

4 LCM
2 cmt

(1) MS-3A
(99) mx/n GRD

• VW prqyk. → w chl/mfc
VW sler/fsp.
(VFL)

0.4 EP

1380-1390'

(1) (Tr) GG (Tr) MS-3A
(100) mx/n GRD (VFL)
• VW altn aa
even sphere fresh

Tr. cpy
0.2 EP

1390-1400'

Tr cmt

—All aa— (VFL)
(no exc. six)

0.3 EP
0.2 PY

1400-1410'

Tr cmt

—All aa— (VFL)

0.3 PY
0.1 cpy
0.3 EP

1410-1420'

Tr. cmt.

—All aa— (VFL)

0.1 py
Tr. cpy
0.3 EP

1420-1430'

—All aa— (VFL)

Tr. EP

Logging Notes | STEAMBOAT 21B-5 | J. Hulen, S. Johnson | 12/19/84

1430-1440'

Tr. cement
Tr. LCM

(100) Essentially fresh mxln hbl-bte GRTD; mafics shiny black; fsps. transparent & glassy; even sphene fresh
• vvw propyl. vvw chl/mfc vvw ser/fsp no chip ≥ ⅓ altd.

0.1 EP
Tr. py

1440-1450'

— all aa — (VFL)

Tr. cmt
Tr. LCM

0.3 EP
Tr. HM

1450-1460'

(Tr) VVF — bright red-orange dol.
— Otherwise all aa — (VFL)

0.2 EP
Tr. HM

~~1470-1480'~~ 1460-1470'

— All aa — (no vnlts) (VFL)

0.1 EP
Tr. HM

1470-1480'

— All aa — (VFL)

Tr. HM
0.3 EP
0.1 py

1480-1490'

〃 All AA 〃

Very Fresh GRTD

0.1 EP

1490-1500'

Tr. R&S

〃 All AA 〃

Very Fresh GRTD

0.2 EP
Tr. qty

1500-1510'

Tr R&S
Tr. cmt.
Tr grn. paint metallic

(0.5) VVF – [ca]-DOL; latter is translucent med. red-orange
Very distinctive

(Tr) MS-3A (99.5) mx/n GRTD

• vvw propyl. → vw chl/mfc
vvw sec/fsp

0 ≥ S altd.

〃

1510-1520'

(Tr) VVF aa (Tr) MS-3A • Alt'n aa
(100) mx/n GRTD aa

0.1 EP
Tr. HM

(Tr) VVF, orange dol. aa
(100) mx/n. GRTD, aa

0.3 EP
Tr. HM

1520-1530'

Logging Notes | STEAMBOAT 21B-5 | J. Hulen, S. Johnson | 12/20/0

1530-1540'

(0.5) VVF, Dol, bright transl. red-orange, ± white cal.

(Tr) GG, chl-qtz-ser altered

(99.5) mx/n GRTD, aa

• vw propyl. → w chl/~~mfc~~ mfc
vw ser/fsp.

Tr. ≥ S altn.

0.4 EP
Tr. HM

1540-1550'

(0.5) GG, aa (Tr) VVF aa

(1) MS-3A (cvd)

(98.5) mx/n. GRTD aa

• vw propyl. 3% ≥ saltd (chl-ep-hm-"SALMON" COLORED → kfsp)

Tr LCM

1 EP
0.2 HM

1550-1560'

—All aa—

Tr. cmt
Tr LCM
Tr R&S

& 1 EP
0.3 HM
Tr. py

1560-1570'

—All aa—

Tr. CPY
0.5 EP
0.1 HM

',5
CM

1570-1580'

(0.5) VVF pale salmon to vivid orange dol ± cal.

(99.5) mx/n GRTD aa

• VW propyl. aa

0.3 EP
Tr. HM
Tr. cpy

1580-1590'

-All aa-

0.1 EP
Tr. HM

1590-1600'

(Tr) MS-3A (caved) (Tr) VVF, aa (Tr) scoria (caved)

(100) mx/n GRTD, aa

• Altn aa

Tr. LCM
Tr. cmt

0.2 EP
Tr. HM

1600-1610'

(Tr) scoria (caved)

(0.5) VVF pale salmon to vivid orange dol.

(Tr) GG

(99.5) mx/n GRTD aa

• Altn aa

1 LCM
Tr cmt

Tr. EP
Tr. HM

1610-1620'

(1) VVF aa, some vivid red-orange

(99) mx/n GRTD

• VVW propyl., aa

0.3 EP
0.1 HM

Logging Notes | STEAMBOAT 21B-5 | J. Hulen, S. Johnson | 12/20/04

1620-1630' | Tr. LCM | (Tr) VVF salmon to vivid-orange dolomite. | 0.2 EP, Tr. HM

(100) mx/n GRTD aa
VVF propyl. VW chl/mfs 0≥≤alteration VVW ser/fsp

1630-1640' | "Bank-Facade" Rock | 0.3 EP, Tr. HM

-all aa-
btc black, hbl green-black } and shiny
Plagioclase transparent and glassy

1640-1650' | (sknxxx) | 0.2 EP, Tr. HM

-All aa-

Tr. LCM
Tr CMT

Resume 12/22/04 | 0.3 EP, 0.1 cpy, Tr. HM

1650-1660' | (Tr) scoria (CVD) | (0.5) VVF aa | (995) mx/n GRTD all aa | "Glassy" fresh fsp

Tr. LCM | (Tr) MS-34 (likely CVD) | 41 | (VFL)

1660-1670

Tr. EP
Tr. HM

— All aa — (VFL)

1670-1680

0.5 EP
Tr. HM

— All aa — (VFL)

Tr. cmt

1680-1690

③ MS-3A (cvd.) (Tr) VVF — orange dol.

(97) mXln GRTD
• All aa (VFL)

0.5 EP
Tr. HM

1690-1700

1 cmt

④ MS-3A (likely cvd) (96) mXln GRTD
• VW propyl
W chl/mf 1% ≥ 5 alld.
VW ser/fsp

0.7 EP
Tr. HM

1700-1710

Tr wax (2)

② MS-3A (98) mXln GRTD aa
• VW propyl W chl/mf
VW ser/fsp
1% ≥ 5 alld.

0.3 EP
Tr. HM
Tr. py

Logging Notes

STEAMBOAT 218-5

J. Hulen
S. Johnson

12/22/04

1710–1720'

(11) Tr

(0.5) CMBX – qtz-ser-chl – qtz ep

(Tr) VVF salmon dolomite

1.5 EP
Tr. HM

(1.5) MS-34 (cv) (98) mx/n GRD

→ • W propyl. → W chl/mfcs W ser/fsp 2% ≥≤ altd.

1720–1730'

(3) MS-34 (cv) (97) mx/n GRD
• altn. all aa

0.5 EP
0.1 HM

Tr. K&S

1730–1740'

(Tr) MS-34 (Tr) VVF
(100) mx/n GRD
• altn. all aa

0.1 EP
0.1 HM

1740–1750'

(K) (0.5) VVF dol-cal
kaolin
***

(Tr) CMBX
(99.5) mx/n GRD aa
• altn. all aa

Tr. EP
Tr. HM

1750-1760'

(Tr) VVF aa (Tr) CMEX aa (VFL)

(100) mx/n GRTD aa
• Altn all aa

Tr. EP
Tr. HM

1760-1770'

(Tr) CMEX (Tr) VVE aa
(100) mx/n GRTD, aa
• Altn ad

0.1 EP
Tr. HM (0.1)
Tr. qpy

1770-1780'

(Tr) VVF orange dol. (Tr) FX/n mfc-rich bte-hbl QD

(100) mx/n. GRTD
• Altn aa (VFL)

Tr. EP
Tr. HM

1780-1790'

(0.5) VVF – orange dol.
** – qtz-ser-py

(X) CMEX chl-qtz-ser-py alt'd. (0.5)

(Tr) MS-3A (cvd)

(99) mx/n GRTD
• W propyl → w-m chl/mfc w ser/fsp.

0.3 py
0.1 HM
Tr. EP

1790-1800'

(100) mx/n GRTD, aa
% altn aa, exc. W chl/mfc.

Tr. EP

Logging Notes

STEAMBOAT 21B-5

J. Hulen
S. Johnson

12/2
of

1800-1810'

Tr VVF salmon dol.
100 mxln hbl.-btc grtd., aa
• VW propyl → w chl/mfc
VW ser/fsp
0 ≥ 5 altd.
→ Even sphene-fresh

Tr. HM

1810-1820'

Tr. cmt.

Tr MS-3A (cvd)
Tr MS-1 (chltc. metagtet) (cvd)
100 mxln GRTD
• Altn aa VFL "glassy" feldspar

Tr. HM

1820-1830'

0.5 cmt

Tr MS-3A (cvd.)
100 mxln GRTD aa
• Altn aa (VFL)

Tr. HM

1830-1840'

Tr. CCM

Tr MS-1 Tr MS-3A
100 mxln GRTD aa
• Altn aa (VFL)

0.1 EP
Tr. HM

1840-1850'

3 MS-3A (cvd.)
97 mxln GRTD aa
• Altn aa (VFL)

Tr. HM

1850–1860'

(2) MS-3A (cvd, likely)
(Tr) MS-1 (")
(98) ~~MS-2~~ mx/n. GRD
• Altn. aa (VFL)

0-1 EP
Tr. HM

1860–1870'

(Tr) VVF - pale orange dol
(1) MS-3A (cvd
(99) mx/n GRD aa
(W) prop'l w chl/mfs [≠ fsp]
vw ser/fsp

0-1 EP
Tr. HM
1 ≥ Salt'd.

1870–1880'

(0.5) CMBX → chl-gtz-ser altn
(Tr) MS-3A
(99.5) mx/n GRD aa
• Altn aa

Tr. green paint

1880–1890'

(100) mx/n GRD, aa
• Altn aa

Tr. HM

1890–1900'

(0.5) VVF, cal & salmon to orange-red dol.
(Tr) MS-3A
(99.5) mx/n. GRD, aa
• Altn aa

Tr HM

Tr. cement

Logging Notes | STEAMBOAT 2185 | J. Hulen / S. Johnson | 12/22/81

1900-1910'

Tr) MS-3H

Tr) VVF white calcite & salmon to red-orange dol.

100) mx/n GRTD (hbl.-bte)

VFL

• W propyl. altn → W chl/mfs
VW chl/fsp
VW ser/fsp

fsps have cloudy pale grnish cast

0 ≥≤ altd.

0.1 HM
Tr. EP

1910-1920'

Tr) cmbx-chl/qtz/ser

100) mx/n GRTD, aa

FL

• W propyl. → W-m chl/mfs
VW chl/fsp
VW ser/fsp

2% ≥≤ altd.

Tr. HM

1920-1930'

Tr) CMBX aa Tr) VVF "salmon" dol.

100) mx/n GRTD, aa

• Altn aa

Tr. HM

1930-1940'

100) mx/n GRTD

• Altn aa → sl. cloudy sl. grayish-green fsp.

Tr. HM

1940-1950'

Tr. MS-3H

100) mx/n. GRTD

• Altn. aa

FL

Tr. R&S

1950-1960

(100) mxln GRD, aa
• Altn aa (VFL)

0.1 EP

1960-1970

(Tr) VVF → pale orange dol.
(100) mxln GRD, aa
• Altn aa (VFL)

0.1 EP
Tr - HM

1970-1980

(0.5) CMBX (Tr) VVF (dol.)
(Tr) MS-3A
(99.5) mxln GRD., aa
• Altn aa, but 3% ≥ saltn.

1 EP

1980-1990

(1) MS-3A (carved)
(1.5) CMBX qtz-ser-chl±ep
(97.5) ~~CMBX~~ mxln GRD aa
• W-M propyl → M chl/mfc
W chl/plag
5% ≥ saltn. W-M ser/fsp

0.5 EP

1990-2000

(Tr) MS-3A (0.5) VVF cal
(1) CMBX, aa
(98.5) mxln. GRD, aa
• W propyl same as 1910-1920

0.5 EP
Tr. HM

Tr. R&S

Logging Notes | Steamboat 21B-5 | J. Hulen, S. Johnson | 12/22/04

2000-2010'

Tr. VVF white-calcite & pale orange dol

Tr. MS-3A (caved)

Tr. RFS

- wk propyl → w-m chl/mfc, w-chl/fsp, vw-w ser/fsp — 2% ≥ 5 altd.
- → the rock has a somewhat "cloudy" appearance because the fsps. are * commonly translucent (as opposed to clear and "glassy" above) due to chl-ser altn.

0.1 EP
Tr. HM

hbl. in part "saussuritized"

2010-2020'

- Local pink stain probably ink

-All aa-

Tr. EP
Tr. HM
0.2 py

2020-2030'

-All aa-
hbl. in part "saussuritized"

0.1 py
Tr. HM
Tr. EP

2030-2040'

-All aa-
exc. Tr GG, Tr FX/m mfc-rich bte-hbl QDT

Tr. cmt
Tr. RFS

0.1 HM
0.1 EP

A

2040-2050'

(Tr) VVF → dol-cal, pale orange

(100) mx/n HBL-BTE GRTD

(Tr) GG → qtz-ser

- W propyl. (or chem. equiv. deuterte)

→ W-m chl/mfc, W chl/fsp, W ser/fsp

sphene gen. fresh lt. amber color & transp

0.7 EP
Tr. HM
0.2 py

2050-2060'

(100) mx/n GRTD aa

2-3% of chips are salmon-pink (2nd KF) qtz-enriched, & w/ s-vs chl/mfc mfc

(Tr) GG → qtz-ser (dol.)

1 EP
0.1 HM
Tr. py

2060-2070'

(Tr) VVE <20μ, red-orange dol.

(Tr) GG → qtz-ser-[ep]

(100) mx/n GRTD, aa

- Altn. as above but some plag distinctly gray-green

0.5 EP
Tr. HM

2070-2080'

(100) mx/n GRTD, aa

- Altn aa; perhaps lessening slightly

0.5 EP
Tr. HM

Logging Notes Hulen Johnson | STEAMBOAT 21B-5 | 12/23/04

2080-2090'

(Tr) VVF → <20% red-orange dolomite

(Tr) SG, qtz-ser-chl → qtz-ser-py-100%

(100) mxln HBL-BTE GRTD aa ~~1-4~~ 1-15%
total mfc
• W propyl. alty
w-m chl/mfc
w chl/fsp
w ser/fsp
→ 1-4% ≥ 5 altd-salmon-colored (2nd KFSP); ≤ chl/mfc; enriched in EP.

Tr. Py
0.5 EP
0.1 HM

2090-2100'

(Tr) MS-3A (cvd.)
Oth. all aa

0.1 EP
Tr. HM

2100-2110'

- All aa -

Tr. LCM
Tr R&S

0.5 EP
0.1 HM

2110-2120'

* (1.5) GG & vbx, white to buff- and greenish-white qtz-ser ± chl, py

(Tr) VVF cal-dol, white & orange.

(98.5) mxln hbl.-bte grtd.
aa • altn aa

0.3 EP
Tr. HM
0.3 Py

2120-2130'

qtz

(0.5) VVF → qtz
→ cal-dol (white & orange)

0.3 EP
0.2 PY
Tr. HM

(0.5) GG & CMBX, aa
(99) mxln GRTD aa
• Altn. aa exc W-M propyl (M chl/mrfe)

2130-2140'

(0.5) GG & CMBX, aa
(Tr) VVF → cal-dol.
(99.5) mxln GRTD, aa
• Altn. aa

0.1 HM
0.1 PY
0.5 EP

2140-2150'

(65) CEMENT
(Tr) MS-3A
(Tr) VVF aa
(35) MXLN GRTD, aa
• M propyl M-S chl/mrfe
W-M chl/fsp
W-M ser/fsp

0.1 HM
Tr. PY
0.3 EP

2150-2180'

NO SAMPLE

---

(40) CEMENT (0.5) GG & CMBX qtz-ser ± chl. ± py

1.5 PY
0.2 CPY
0.3 EP

2180-2190

qtz

52

(0.5) VVF qtz ± ser, py
20% ≥ Saltd. →
(50) mxln. GRTD aa
• M-S propyl
S chl/mrfe
W-M chl/fsp
W-M ser/fsp

Logging Notes | STEAMBOAT 21B-5 | J. Hulen, S. Johnson | Dec. 23, 2004

0.3 EP
Tr. py

2190-2200'

(30) CEMENT

(Tr) GG — qtz-ser-[chl]

(1) (70) mx/n HBL-BTE GRTD, aa

• W propyl. W-M chl/mfc W chl/fsp W ser/fsp

1 LCM

2200-2210'

(20) CEMENT

(1) GG, CMBX — qtz-ser-py ± [chl]

(79) mx/n GRTD aa

• W-M propyl.

1 py
0.1 EP
Tr. HM

2210-2220'

(15) CEMENT

(Tr) MS-3A, likely caved.

(85) mx/n GRTD

• W propyl.

2 LCM

0.7 EP
0.1 py

2220-2230'

(15) CEMENT

(85) mx/n GRTD

• W propyl. fsps "cloudy" transl. greenish-gray due to ser-chl. altn.

1 LCM

Tr. EP
Tr. py
Tr. HM

2230-2240' — No Sample

2250-2260' (~~2250-2260'~~)

5 cmt
5 LCM

2240-2250'

④ MS-3A, incl. hornfels
Tr MS-1
Tr GG, aa
96 mx/h GRTD, aa
• W propyl. aa

[nothing obvious in the chips explains the lost circulation]

0.5 EP
Tr. HM
Tr. PY

2250-2260'

3 LCM
5 cmt

~~20~~ VVF — dol, (orange)
05 — cal-qtz-ser
0.5 GG — qtz-ser
③ MS-3A
② FX/h mfc-rich hbl-bte QDXT
94 mx/h GRTD, aa
• W propyl. aa

0.2 EP
~~Tr~~
0.1 PY

2260-2270'

5 LCM
5 cmt

Fine (size) cuttings avg. ≈ 0.7 mm

1 GG & CMBX qtz-ser.
Tr VVF aa
• W propyl. aa
③ MS-3A foliated, bte-rich, vfx/n
Tr MS-1
96 mx/h GRTD, aa

1 EP
0.1 PY

2270-2280'

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Logging Notes | STEAMBOAT 21B-5 | J. Hulen, S. Johnson | Dec. 23, 2004

2270-2280'

Large change - sample much darker.

0.5 EP

7 cmt

2 LCM

4 chl-ser vnlt.

3 GG and CMBX — typically yellowish-white and intensely altered. Altn is clay or clay-ser, comm. dessiccation-cracked [swelling clay component, i.e. smectite or M-L IL/SM

▲ (dbx)

1.5 VVF
- chl-ser
- cal
- cal-chalcedony → some botryoidal.

25 mXln GRTD

70.5 MS-3A — w/ 1/4 blchd-appearing; oth.: vfXln, dk. brnsh to greenish-gray. shiny & VFL → W-M ser

• W propyl. exc. for clay or clay-ser altn. in the breccia as described above

---

2280-2290

1 LCM

5 CMI

4

1.5 GG & vbx, aa

1 VVF aa

20 mXln GRTD aa

73.5 MS-3A, aa commonly phyllitic; ~~comm~~ overall vw prop W ser/fsp (not all chips)

0.7 EP

0.1 py

55

2290–2300'

slix common

Much more strongly altered & mineralized

1.5 py
Tr. unkn. pale-gray brass "flakes"

0.3 EP

15 LCM
3 cmt
Tr wax?
[hard, mucilaginous]
wh-ck

shearing very common

qtz

** ⑥ GG & vbx – most pcs. intensely qtz-ser ± chl, py altered

② VVF → qtz, cal, qtz-cal, chl-qtz-ser } all ± py

⑮ mx/n GRTD ⑦⑦ MS-3A, aa, but comm. sheared & slickensided

overall (but not all chips):
M chl/mfcs, M ser/fsp

• M propyl ± "clay-ser"

2300–2310'

1.5 py
<
0.2 cpy

3 cmt
3 LCM

⑤ GG & CMBX, aa (poss. more)

② VVF, aa

② MS-1

⑫ mx/n GRTD aa ⑦⑨ MS-3A comm. sheared

• altn. aa, w/ wk. local silicification

Logging Notes

STEAMBOAT 21B-5

J. Hulen
S. Johnson

12/23/0[illegible]

2310-2320

(12) CEMENT

(1) Tr (Tr) MS-1

(1) GG & CMBX aa

(0.5) VVF aa

(30) mx/n GRTD aa

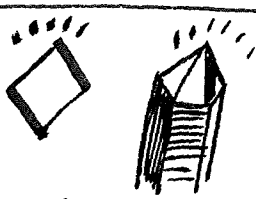
(56.5) MS-3A

1 PY
0.5 FEP

• W-M propyl
W-M chl/mfc
W-M ser/fsp.

2320-2330

(12) CEMENT



1 EP
1 PY

2 LCM
Tr. R&S

(1) → on qtz-PY vnlt & several other chips.

(1) GG & UBX (1) VVF, aa

(1) MS-1 (20) mx/n GRTD aa

(65) MS-3A

• A/tn. aa

2330-2340

(1)

"Green-and-pink" (KFSP, chl, & hem)

0.5 HM
0.5 EP
0.5 PY
(1)

3 cmt
1 LCM

(1.5) GG & CMBX (1) VVF - qtz-ser ± chl, py - cal

(25) MS-3A (72.5) mx/n GRTD.

• M-S propyl.

S chl/mfc
M chl/fsp
M ser/fsp
} overall, but not all chips.

2340–2350'

3 LCM

(7) cement

(1.5) GG, cmbx, aa

(0.5) VVF, aa

(23) MS-3H aa

0.5 py
0.1 EP
0.1 HM

(11) tr ≈≈ • M-S propyl. aa

2350–2360'

2 cmt
1 LCM

(11) common ≈≈≈

0.3 py
0.1 HM
0.5 EP

(3) GG & cmbx – qtz-ser
comm. ≈ qtz-ser-chl } ± py

(1) VVF — qtz-ser ± chl, py
— cal

(1) MS-1 (15) MS-3H (80) mx/n. GRD, aa

• M-S Propyl. 5 chl/mfc
M-S set/fsp

2360–2370'

0.4 EP
0.3 py
0.1 HM

(1.5) GG & cmbx, aa

(Tr) VVF, aa

(3) MS-1 (20) MS-3H

(75.5) mx/n GRD

• Alt'n aa

Logging Notes

STEAMBOAT 21B-5

J. Hulen
S. Johnson

Dec. 23, 2004

Incompletely Washed

2370-2380'

2 LCM

(1) GG, cmbx (1) MS-1
(Tr) VVF (33) mx/n GRTD
(65) MS-3A

0.3 EP

• M propyl.

2380-2390'

1 LCM

Incompletely washed

(1.5) GG, cmbx qtz-ser / qtz-ser-chl } ± py
(0.5) VVF qtz-ser-py (1) MS-1
(35) mx/n GRTD, aa (59) MS-3A

0.5 py
0.3 EP

• W-M propyl.

2390-2400'

1 LCM
1 cmt

Incompletely Washed

(0.5) GG, cmbx aa (30) mx/n GRTD
(2) MS-1 (67.5) MS-3A aa

1 EP
0.5 py

• W-M propyl. → M chl/mfc
W-M ser/fsp.

2400-2410'

Apparently Fresher

Definitely • WK propyl.

(Tr) GG, cmbx (4) mx/n GRTD
(75) MS-3A — mostly fresh, v. dk. gray, vf-x/n bte-qtz-plag. hornfels

0.7 EP

59

2410–2420'

Tr. LCM

(1) MS-1
(Tr) GG, cmbx, aa
(35) mx/n GRTD
(64) MS-3A (mostly hornfels)

0.3 EP

2420–2430'

Tr. cmt
Tr LCM

(5) MS-3A
(95) mx/n GRTD ~~VFL~~
• vw propyl.

Tr- HM
0.1 EP

2430–2440'

1 cmt

(0.5) VVF qtz-ser-cal-py 2 mm-wide
(17) MS-3A (Tr) GG
(82.5) mx/n. GRTD
• w propyl.

0.3 py
0.5 EP

2440–2450'

Tr LCM

(4) MS-3A
(96) mx/n. GRTD
• vw propyl.

0.1 py
Tr. ep

Logging Notes | STEAMBOAT 21B-5 | J. Hulen, S. Johnson | Dec. 23, 200

2350-2360'

Tr R&S

(0.5) GG, CMBX qtz-ser-chl.
(2) MS-1 (2) MS-3A
(95.5) mx/n GRTD, aa
• wk propyl. → W-M chl/mfc
W ser/plag
W chl/plag.

1 EP
0.2 py

2460-2470'

(3) MS-1 (2) MS-3A
(Tr) VVF → cal-chl
(95) mx/n. GRTD
• wk propyl, aa

1.5 EP
Tr. py

2470-2480'

Tr. LCM

Tr. R&S

(2) MS-3A
(98) mx/n GRTD, aa (VFL)
• wk. propyl., aa

Tr. EP

2480-2490'

(2) MS-3A

(98) mx/n GRD, aa

0.5 py
Tr. EP

- vw propyl. aa w chl/mfc vw ser./pl. (VFL)

→ feldspars mostly colorless, transparent, glassy-appearing
bte black, shiny
hbl. greenish-black/shiny

2490-2500

-All aa-

0.5 EP
Tr. py

Logging Notes

STEAMBOAT 21B-5

J. Hulen
S. Johnson

11/12/04

Tr. cpy
Tr. py
TP HM
0.3 EP

2500-2510

(100) Medium-crystalline hornblende-biotite granitoid (MXLN HBL-BTE GRTD). Hypidiomorphic-granular. Avg. xl. size ~ 2mm; up to 4 mm. 3-5% HBL, greenish-black. 7-10% bronze-black to greenish-black BTE. 20% clear to sl. translucent colorless QTZ. 65-70% glassy, transp.-transl. fsp, v. lt. gray, uniform color & texture but suspect plag > kfsp. Tr. waxy brnsh-yellow to clear lt. amber sphene. 0.5-1% diss. dk-gray to black magnetite (<0.5 mm. grains)

Tr. LCM

(4P) ~ (same chip)

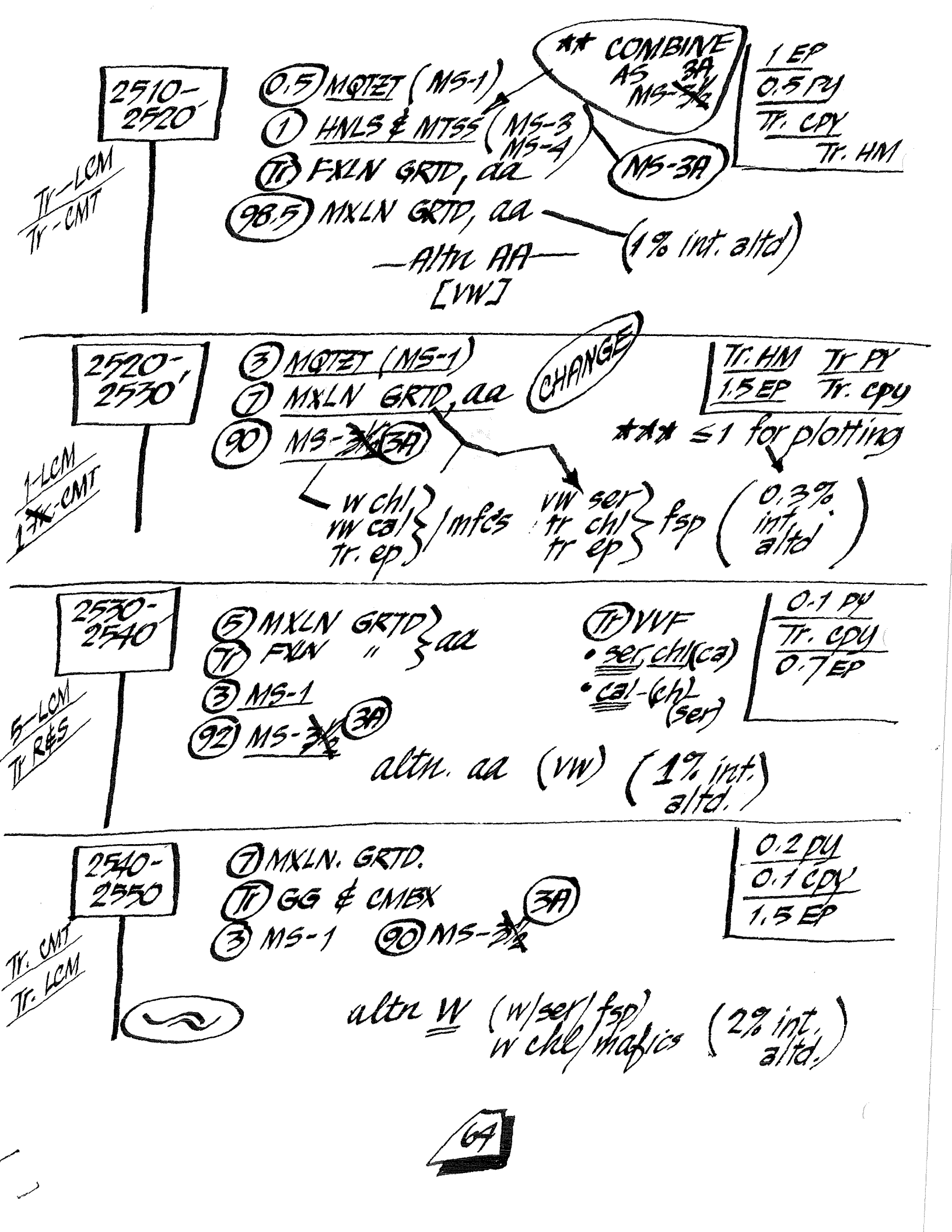
w chl, w-ca, tr-ep } /mfs vw-ser, tr-chl, tr-ep } /fsp 1% INT. ALTN.

(Tr) GG & CMBX, ser-chl altd. ~

(Tr) BTE. HNFLS, vfxln

(Tr) METHQTZT, bte-poor

(Tr) FXLN QTZ DRT

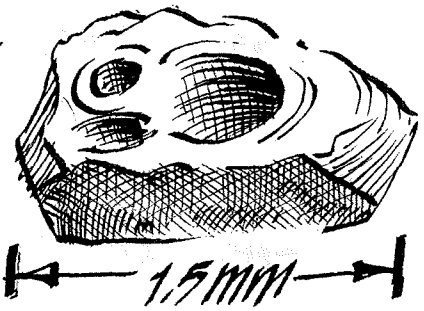

2510-2520'
Tr-LCM
Tr-CMT
0.5 MQTET (MS-1)
1 HNLS & MTSS (MS-3 MS-4)
11 FXLN GRTD, aa
98.5 MXLN GRTD, aa
Altn AA [VW]
(1% int. altd)
** COMBINE AS 3A MS-½
MS-3A
1 EP
0.5 PY
Tr. CPY
Tr. HM
2520-2530'
1-LCM
1-K-CMT
3 MQTET (MS-1)
7 MXLN GRTD, aa
90 MS-½ (3A)
CHANGE
w chl
vw cal
Tr. ep
mfcs
vw ser
tr chl
tr ep
fsp
(0.3% int. altd)
Tr. HM
1.5 EP
Tr PY
Tr. cpy
*** ≤1 for plotting
2530-2540'
5-LCM
Tr RES
5 MXLN GRTD
7 FXLN "
aa
3 MS-1
92 MS-½ (3A)
Tr VVF
• ser chl (ca)
• cal-(ch) (ser)
0.1 PY
Tr. CPY
0.7 EP
altn. aa (VW) (1% int. altd.)
2540-2550
Tr. CMT
Tr. LCM
7 MXLN. GRTD.
Tr GG & CMBX
3 MS-1
90 MS-½ (3A)
0.2 PY
0.1 CPY
1.5 EP
altn W (w/ser/fsp w chl/mafics (2% int. altd.)

J. Hulen 11/12/04
S. Johnson

STEAMBOAT 21B-5

** 1 chip coarse felsic ash ??

[must be caved?]



2550-2560'

* 1 LCM
Tr. rust
Tr. cmt.

11 Tr

(Tr.) CMBX (1%)
(5) MXLN GRTD
(3) MS-1
(92) MS-3½ (3A)

w/ tr. pale rose-colored garnet

Tr. coal
0.2 py
1 EP

w altn, same aa → (1% int. altd.)

2560-2570'

6 LCM

(Tr) VVF ser-(chl)-(cal)
(3) MS-1
(90) MS-3½ (3A)
(7) MXLN GRTD

w altn aa w/ 0.5% int. altn

0.3 py
0.5 EP

2570-2580'

4 LCM
Tr cv

(Tr) CMBX ~
(Tr) GG
(11) MXLN GRTD
(2) MS-1
(87) MS-3½ (3A)

w/ tr. pale rose-colored garnet

W-M altn → w/ chl/mfcs → W-M ser/fsp → 5% int. altd.

0.7 EP
Tr. py
0.1 py

2580-2590'

4 LCM
Tr cmt

(Tr) CMBX ~
(7) MXLN GRTD
(2) MS-1
(Tr) VVF - ser, chl
(93) MS-3½ (3A)
(65)

W-M altn aa → W-M chl/mafs → W-M ser/fsp → 5% int. altd.

0.3 EP

2590-2600 — NO SAMPLE

2600-2610

Character of sample changes — some larger chips, some partially rounded (drill-milling?) — less altn.

1 CMT
1 LCM
prob. minor cvng.

Tr.

Tr VVF (CHL-ser)

1.5 EP

10 MXLN GRTD

1 MS-1

89 ~~MS-3A~~ MS-3A

w altn → w chl/mfs → w ser/fsp → 3% int. altd.

2610-2620

prob. minor cvng
1 CMT

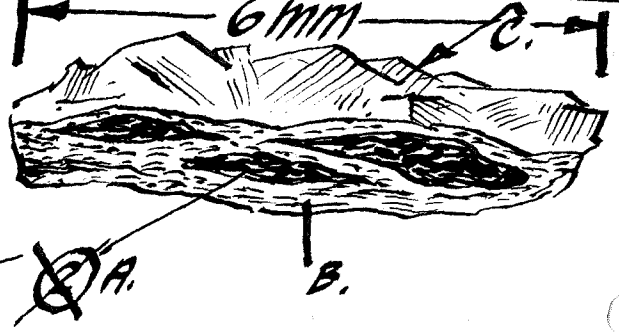
0.5 Tr GG

Tr. CMBX

2.5 VVF

1 ? CAL-ser-(ck)

Tr-w



~~####~~ A. — White to v. lt. gray-brn GG, int. sheared, strongly serctzd.

B — Lenticular enclaves of sheared, mod. serctzd. bte. hrnfls

C — Unsheared, nearly opaque White calcite

5 MXLN GRTD

94.5 MS-3A

1 EP
Tr. py

vw altn → w chl/mfc → vw ser/fsp.
< 1% int altd.

Logging Notes

STEAMBOAT 218-5

J. Hulen
S. Johnson
11/13/04

2620–2630'

(Tr) VVF (5) MXLN GRTD
CAL
(95) MS-3A (w/gnt) [mstly hnfls]

1.5 EP

Tr RES
Tr. LCM

w altn. aa → <1% int. altd

2630–2640'

(3) MXLN GRTD
(97) MS-3A (w/rose gnt) [mostly hnfls]

1 EP

5 LCM

vw altn aa → <1% int. altd.

2640–2650'

(9) MXLN GRTD
(91) MS-3A [mostly hnfls]

1.5 EP

2 LCM
Tr. RES

w chl/mfc → vw altn aa → <1% int altd.

2650–2660'

(2) MXLN GRTD
(98) MS-3A [bte hnfls] w/rose gnt

1 EP

1 LCM

~~XXX~~ vw altn aa → <1% int altd.

2660–2670'

(Tr) VVF
(2) MXLN GRTD
(98) MS-3A [bte hnfls w/gnt

1.5 EP

LCM

67

→ altn all aa → (<1% int altd.)

2670-2680'

Tr LCM

① MXLN GRTD.

⑨⑨ MS-3A (bte hnfls)

Tr VVF • CAL-cht-(ser) [1 am.]

w altn → w chl/mfc → w ser/fsp
<1% int. altd.

1 EP

2680-2690'

1 LCM

Tr

~~ Tr

① VVF • CAL-ser-(chl) Tr GG
• SER-chl-cal

→ readily separable from host rock i.e., not "frozen"

① MXLN GRTD ✕

⑨⑧ MS-3A (bte hnfls w/<1% rose gnt)

w altn, aa ~2% int. altd.

1.5 EP
0.3 py

2690-2700'

3 LCM

Tr VVF • QTZ-ser-(py) * NEW

② MXLN GRTD

⑨⑧ MS-3A, aa

0.7 py
0.7 EP

W-M propyl. → ~~W~~ chl/~~mfc~~ → W-M ser/fsp.

→ in hnfls, bte mstly fresh ~3% int.

2700-2710'

2 LCM

① MXLN GRTD

⑨⑨ MS-3A, aa

Tr VVF cal

1.5 EP
0.3 py

W propyl. ~2% int. altd

→ w chl/mfcs → w ser/fsp

Logging Notes | STEAMBOAT 21B-5 | J. Hulen, S. Johnson | 11/13/04

2710-2720' (4' Tr)

(0.5) VVF — Cal ser-chl-cal
(1.5) MXLN GRTD
(Tr) MS-1 (98) MS-3A (bte lmfls w/ <0.5% rose garnet

0.7 EP
0.1 PY

vw propl. → w chl/~~lmfs~~ mfc → vw ser/fsp → (<1% int. altd.)

2720-2730' (2 LCM)

(X) VVF — Ser-chl-cal
(3) MXLN GRTD
(97) MS-3A (w/ rose garnet)

1 EP

w propyl — w-m chl/mfc → w ser/fsp → (some chlzd. & silicified → 3% ~~1%~~ int. alt.)

2730-2740' (Tr. R&S, 1 LCM)

(1) MS-1 (96) MS-3A
(3) MXLN GRTD

0.7 py
Tr. cpy
1.5 ~~py~~ EP

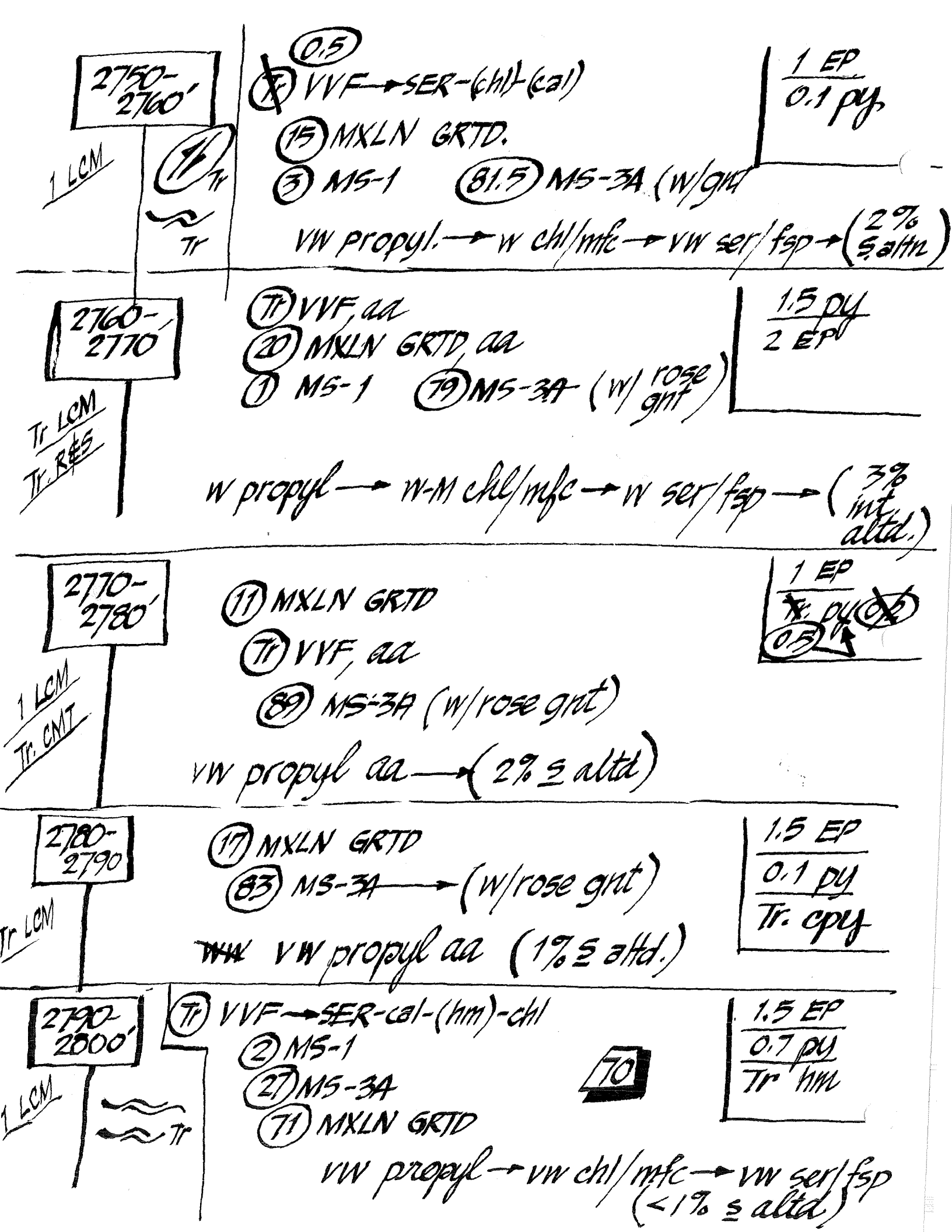
altn aa → (2% int. altd)

2740-2750' (4 LCM, 3VD)

* Tr. argillized ppytic andesite (CVD)
(11) MXLN GRTD
(4) M-1 (85) MS-3A (w/ rose gnt)

1.5 EP
0.2 py
(Tr. asp?)

vw ~~altn~~ prop altn aa → (2% int altd)

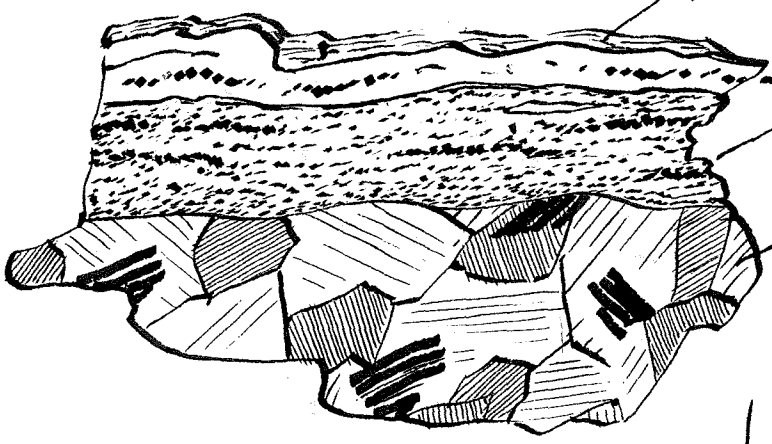

2750-2760'
1 LCM
1 Tr
Tr
(0.5) VVF → SER-(chl)-(cal)
(15) MXLN GRTD.
(3) MS-1
(81.5) MS-3A (w/grt
VW propyl. → w chl/mfc → VW ser/fsp → (2% ≤ altn
1 EP
0.1 py
2760-2770'
Tr LCM
Tr. R&S
(Tr) VVF, aa
(20) MXLN GRTD, aa
(1) MS-1
(79) MS-3A (w/ rose gnt)
1.5 py
2 EP
w propyl → w-M chl/mfc → w ser/fsp → (3% ≤ alt.)
2770-2780'
1 LCM
Tr. CMT
(11) MXLN GRTD
(Tr) VVF, aa
(89) MS-3A (w/rose gnt)
VW propyl aa → (2% ≤ altd)
1 EP
0.5 py
0.5
2780-2790
Tr LCM
(17) MXLN GRTD
(83) MS-3A → (w/rose gnt)
VW propyl aa (1% ≤ altd.)
1.5 EP
0.1 py
Tr. cpy
2790-2800'
1 LCM
Tr
(Tr) VVF → SER-cal-(hm)-chl
(2) MS-1
(27) MS-3A
(71) MXLN GRTD
70
VW propyl → vw chl/mfc → vw ser/fsp
(<1% ≤ altd)
1.5 EP
0.7 py
Tr hm

Logging Notes

STEAMBOAT 21-5 J. Hulen / S. Johnson 11/13/04

2800-2810

1.5 EP
1.5 PY
Tr. HM



chip X-sec.

1 LCM

(1) Tr

VM

A – Int. propylitized GRTD

B – sheared, int. qtz-chl-ser-(cal)-altd. gouge

C – sheared, qtz-ser-(py)-altd. (int.) gouge

D – sheared, cal-SER zone (GG)

~~0.1~~ (1) GG & CMBX (see sketch)

(1) VVF → QTZ-SER-chl-cal-py in var. comb.

(30) MS-3A (68) MXLN GRTD (<1% altd.)

VW propyl → w chl/mfc → vvw ser/fsp

2810-2820'

0.1 HM
0.2 py
0.5 EP

(Tr) VVF SER-chl-cal-(hm)

(27) MS-3A (73) MXLN GRTD

CM

vvw Propyl → vw chl/mfc → vvw ser/fsp

<1% altd.

71

2820-2830'

2 LCM / Tr CMT

(3) APLITE, f-m/h, pinkish-white, <0.3% bte. Fresh

(25) MS-3A (Tr) VVF SER-chl-(cal)

(72) MXLN GRTD (Tr) MS-1

0.5 EP / Tr HM / Tr cpy / 0.2 py

w Propyl → W-M chl/mfc → w/ser/fsp (2% ≤ altd)

2830-2840'

Tr LCM

(1) APLITE, aa

(20) MS-3A (79) MXLN GRTD

1 EP / 0.3 PY / Tr HM

i.e VS SER/FSP; BLCHNG OF BTE.

W-M Propyl → M chl/mfc → w-m ser/fsp (5% ≤ altd.

2840-2850'

Tr LCM

(1) APLITE, aa (Tr) CMBX

(23) MS-3A (76) MXLN GRTD

1 PY / Tr HM / 0.3 EP

(1) Tr

Tr

— Altn all aa —

2850-2860'

2 LCM

(Tr) APLITE (13) MS-3A

(87) MXLN GRTD

— Altn all aa —

0.5 EP / 1 PY / Tr HM

2860-2870'

(1) VVF → SER-qtz-(py) (0.5) & QTZ (py) —

(16) MS-3A

(14.5) (85) MXLN GRTD

— Altn all aa —

1.5 PY / 0.5 EP / Tr. HM

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Logging Notes — STEAMBOAT 21B-5

J. Hulen
S. Johnson
11/13/04

2870–2880'

(7) MS-3A (~~X~~) VVF (0.5) SER-QTZ-(PY) (~~92.5~~) MXLN GRTD (92.5)

0.2 PY
0.5 EP
Tr. HM

Tr LCM

W propyl → W-M chl/mfc → W ser/fsp (3% ≤ altd.)

2880–2890'

(7) MS-3A (93) MXLN GRTD

0.3 EP
~~0.2~~ PY (0.1)
Tr. HM

Tr LCM

Altn aa (w/2% ≤ altd.)

2890–2900'

(3) MS-3A (97) MXLN GRTD (Tr) CMBX

Tr. HM
0.5 PY
0.2 EP

Tr LCM

M chl/mfc → w/ser/fsp
~~Altn aa~~ (w/3% ≤ altd.)
W-M propyl. ↳ & M

2900–2910'

(Tr) VVF → SER-QTZ-PY
(3) MS-3A (97) MXLN GRTD

0.5 EP
0.3 PY
Tr. HM

Tr LCM

W propyl → W-M chl/mfc → w/ser/fsp (2% ≤ altd.)

2910-2920'

(0.5) (Tf) VVF → SER-(chl) → QTZ-ser-py

(1) MS-3A (98.5) MXLN GRTD

0.2 py (0.5) 0.3 EP Tr cpy

0.5 LCM Tr R&S

W-M Propyl → W-M chl/mfc → W-M ser/fsp [3% ± altn]

2920-2930'

(2) MS-3A (98) MXLN GRTD

0.2 EP Tr. HM 0.3 py Tr cpy

Tr LCM

W Propyl → W-M chl/mfc → W ser/fsp (1% ± altd)

2930-2940'

(1) FXLN HBL BTE GRTD (enclaves ±, xenoliths ±)

(2) MS-3A (97) MXLN GRTD

0.2 EP 0.3 PY Tr HM

Tr LCM

—Altn all aa—

2940-2950'

(Tf) VVF → SER-qtz-(PY)

(3) MS-3A (97) MXLN GRTD

0.5 EP 0.7 PY Tr HM

1 LCM Tr CMT

—Altn aa, but (2% ⑤ altd.)

2950-2960'

(3) MS-3A (97) MXLN GRTD

—Altn all aa—

0.3 EP 0.3 PY Tr. HM

LCM

Logging Notes — STEAMBOAT 21B-5 — J. Hulen / S. Johnson — 11/13/04

2960–2970' — 1 LCM

(4) MS-3A, some w/ rose garnet
(Tr) CMBX & GG (Tr) VVF → CHL-SER QTZ
(96) MXLN GRTD

1 EP / 0.2 PY / Tr. HM

W Propyl. Altn → W chl/mfc → W ser/fsp [1% ≤ altd.]

2970–2980' — 1 LCM

(Tr) CMBX (Tr) VVF → QTZ-chl-ser-(py)
(3) MS-3A w/ rose gnt (97) MXLN GRTD, aa

0.3 EP / 0.3 PY / Tr. HM

Altn. aa, exc. (2% ≤ altd.)

2980–2990' — 4 CMT, Tr LCM, Tr R&S

–Incompletely Washed– –coarser cuttings–

(100) MXLN HBL-BTE GRTD.

0.2 EP / 0.5 PY

Altn. aa, exc. (3% ≤ altd.)

2990–3000' — 01 CMT, LCM, green paint

–Incompletely Washed–

(100) MXLN GRTD, aa

Tr. EP / 0.3 PY / Tr. HM

Altn aa, exc. (1% ≤ altd.)

3000-3010'

7 CMT
Tr. LCM

100% MXLN GRTD

Tr. EP
0.5 py
Tr. cpy
Tr. HM

—Altn. aa, exc (1% ≤ altd.)

3010-3020'

1 CBX, granulated, altd VS to SER-CAL-chl-(py)

99 MXLN GRTD

Tr. cpy
Tr. EP
1 py / Tr. cpy

5 CMT
Tr. R&S
Tr. LCM

W-M Propyl → M chl/mfc → W-M ser/fsp
(5% S-VS altd)

3020-3030'

~~1~~ 0.5 CMBX → chl-ser-qtz-py altd.

Tr VVF → SER-py-qtz

99.5 ~~100~~ MXLN GRTD

Tr. EP
~~0.5~~ py 0.1

Tr. CMT
Tr. LCM

—Altn aa, exc (3% S-VS altd.

3030-3040'

1 CMBX, aa

Tr MS-3A

99 MXLN GRTD

Tr. EP
0.4 py
Tr. HM

CMT
Tr LCM

— Altn. all aa —

3040-3050'

Tr CMBX

100 MXLN GRTD

— Altn all aa —

0.2 EP
0.5 py

CMT

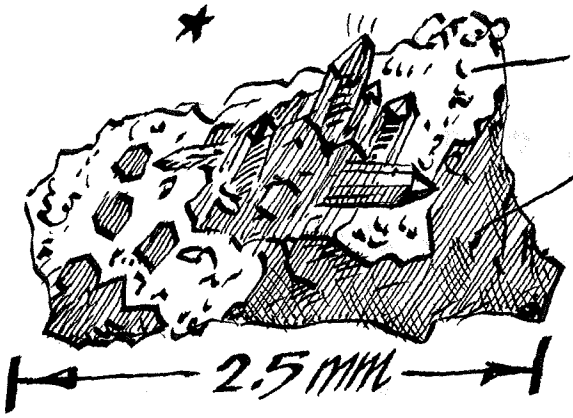
Logging Notes

STEAMBOAT 218-5

J. Hulen
S. Johnson
11/13/04

3050-3060'

1 CMT
Tr R&S
Tr Cu-grease
Tr LCM



Tr. EP
0.5 PY
Tr. cpy
Tr. asp(?)

A. Msv to euhedral-prismatic, translucent white quartz (hydrothermal) w/ pyrite ± asp?

B. ~~Pale~~ pinkish-white to orange-white encrustation — calcite in part but mostly an unknown phase — NO: at high magnification, the substance is pearlescent and almost certainly sericite

- Also: 1.5 mm chunks of clear, colorless, "Iceland spar" calcite

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* (1.5) VVF → ± qtz-ser-CAL
- CAL
- QTZ-ser-(py)

(Tr) GG - SER-qtz-(py) ± cal

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(1) APLITE/ALASKITE

(97.5) MXLN GRTD

ww propyl, i.e:
w chl/~~mfc~~ mfc
vw ser/fsp, ±
(<1% S altd.)

— Sphene Fresh —

Tr. cpy
0.2 py
Tr. EP

3060-3070'

Tr, Cu grade
Tr R&S

(Tr) VVF, aa
(100) MXLN GRTD, aa
↳ Altn. aa ↳

All "super-fresh"

3070-3080'

Tr. LCM
Tr. R&S
Tr. CMT

(100) MXLN GRTD → fsps g/assy clear, v. fresh

Tr. EP

VVW propyl, i.e., VW chl/mfc, VVW ser/fsp, & (<< 1% ≤ altd.)

3080-3090'

Tr LCM

(100) MXLN GRTD
VVW propyl, aa

Tr. EP
Tr. py

3090-3100'

5 CMT
Tr LCM
Tr R&S

(Tr) VVF
• QTZ-(ser)-(py)
(100%) MXLN GRTD.

0.1 EP
0.4 py

W Propyl, i.e., W-M chl/mfcs, W ser/fsp, (↳ 4% ≤ altd.)
& Tr KF/plag

3100-3110'

2 CMT
Tr R&S
Tr LCM

(0.5) VVF → • QTZ-py-(ser)
• QTZ-(ser)
(99.5) MXLN GRTD
— Altn aa —

0.5 py

Logging Notes

STEAMBOAT 21B-5

J. Hulen
S. Johnson

11/14/04

3110-3120'

Tr. LCM
Tr R&S
~~O.E~~ CMT
(1)

(Tr) VVF
• CAL

rhombic & "water-clear"

(100) MXLN GRTD

VW Propyl, i.e., W chl/mfc KW ser/fsp
(~2% ≤ altd.)

0.2 py

3120-3130'

Tr R&S
Tr LCM

(100) MXLN GRTD
~Altn aa (1% ≤ altd.)

0.1 EP
0.2 py
Tr. cpy

3130-3140'

Tr R&S
Tr. LCM

(100) MXLN GRTD
• Altn aa

Tr. EP
0.5 PY

3140-3150

1 R&S

(Tr) VVF → CAL-SER-qtz
(100) MXLN GRTD
• Altn aa

Tr. EP
0.3 py

3150-3160

Tr LCM

(100) MXLN GRTD
• Altn. aa

0.2 py

3160-3170'

Tr. R&S

(Tr) VVF → CAL-ser-chl

(100) MXLN GRTD

0.2 py
Tr. cpy

VW Propyl, i.e., W chl/mfc, VVW ser/fsp, ≤ (<1% ≤ altd.)

3170-3180'

Tr. R&S

qtz

(0.5) GG → SER-chl-qtz altd.

Tr. ~~BL~~ BSLTC. SCORIA-ASH likely caved

0.1 EP
0.2 py

(Tr) VVF
• QTZ-(ser)-(py)

(Tr) FXLN HBL-BTE GRTD

(99.5) MXLN GRTD, aa

• Altn AA

3180-3190'

Tr. R&S

qtz.

(Tr) CMBX → serctzd.

(Tr) VVF → QTZ-ser-py

(100) MXLN GRTD.

• Altn aa

0.3 py

3190-3200'

Tr. LCM
Tr CMT
Tr R&S

(100) MXLN GRTD

• Altn aa

0.2 py
Tr cpy

Logging Notes

STEAMBOAT 21B-5 Hulen Johnson 11/14/04

3200-3210

Tr. LCM

qtz

(VFL), Finer cuttings

(Tr) GG

(Tr) VVF → SER-QTZ-(chl)(py)

Altn aa (VW Propyl ± 1% S altd.)

0.3 py

3210-3220

2 LCM
Tr R&S

(Tr) MS-3 (VFL)

(100) MXLN GRTD

—Altn. aa—

0.1 EP
0.2 py

3220-3230

1 LCM

(1) ~~(X)~~ MS-3 ~~(X)~~ — & FeOx-stained)

→ 1 lg. pc argillzd (likely CVD)

(99) MXLN GRTD

← Altn aa—

Tr. cpy
~~Tr~~ EP (0Z)
0.1 py

3230-3240

1 LCM
-&S
Tr

(Tr) GG, CMBX — SER-qtz-chl altd

(100) MXLN GRTD,

— Altn aa —

Tr EP
Tr. cpy
0.7 py

3240-3250'

(0.5) VVF → QTZ-py-(ser)
QTZ-unkn. gray s=

(99.5) MXLN GRTD

0.5 py
Tr epy
0.1 ynkn., si. reddish-gray s=

1 cu-grease
Tr R&S
1 unk. metal

some tarnished blue

—Alt'n aa—

3250-3260'

(100) MXLN GRTD

Tr. EP
0.5 py

1 CMT
1 LCM
Tr. R&S

W Propyl → W-M chl/mfc → W ser/fsp (3% salt)

3260-3270'

(0.5) VVF • SER-py-(qtz)
• QTZ-py-(ser)

(99.5) MXLN HB GRTD

Tr EP
0.3 py

Tr R&S
2 LCM
Tr CMT

—Alt'n aa—

3270-3280'

(TR) VVF aa
(0.5) MS-3A

(99.5) MXLN HB GRTD

Tr EP
0.2 py

2 LCM
CMT
Tr R&S

• Alt'n aa

Logging Notes

STEAMBOAT 218-5

J. Hulen
S. Johnson

11/14/01

3280-3290'

1 LCM
Tr CMT

(100) MXLN H-8 GRTD -II (only u 5% mfc)

Tr. EP
0.3 py

VW Propyl. → W ch/mfc → VW ser/fsp
(1% ≤ altd.)

3290-3300'

Tr LCM
Tr. R&S
Tr CMT

(100) MXLN GRTD-II
• Altn. aa

0.2 py
Tr. ep

3300-3310'

Tr LCM
Tr R&S

(100) MXLN GRTD-II
• Altn. aa

0.2 py

3310-3320

Tr LCM
Tr CMT

(Tr) CMBX → SER-ch-qtz-(py) altd.
(100) MXLN GRTD-II
• Altn. aa

0.1 Py

3320-3330'

Tr LCM
Tr CMT

(100) MXLN GRTD-II
• Altn. aa

0.1 py

3330-3340'

Tr LCM

(100) MXLN GRTD-II
• Altn. aa

Tr. py

3340-3350'

Tr. CMT / Tr. R$S / Tr. LCM

(100) MXLN GRTD-II

Tr. EP
Tr. PY

• Altn. aa (VFL)

3350-3360'

NO SAMPLE

3360-3370'

Tr R$S / Tr. LCM / Tr. CMT

(4) Tr

One chip is frag. of calcite-ser? vnlt
CAL >> (ser) —— CAL is "water-clear". SER(??) is pearlescent white; occurs as a shrinkage-cracked film on several surfaces. (drilling additive)

0.2 EP
0.3 py

(0.5) VVF → CAL-(ser)
CAL-qtz-(ser) 4f

(Tr) CMBX

(99.5) MXLN GRTD II

• Altn. aa

3370-3380'

Tr CMT / Tr R$S / Tr LCM

qtz

(Tr) VVF → qtz-ser-py

(100) MXLN GRTD II

Tr. cpy
0.3 py

• Altn. aa

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Logging Notes

STEAMBOAT 21B-5

J. Hulen
S. Johnson

11/14/04

3380-3390'

1 CMT
Tr R&S
1 CMT

(100) MXLN GRTD II (~5% mfc)

0.1 EP
0.3 PY

VVW Propyl → W chl/mfc → VVW ser/fsp ¢
(≤1% altd)

3390-3400'

1 LCM
Tr. CMT

(100) MXLN GRTD II

• Altn. aa

Tr. EP
0.1 PY

3400-3410'

2 LCM
1 CMT

(100) MXLN GRTD II

(Tr) GG chl-ser-(qtz) altd

0.3 PY

VW Propyl. → W/chl/mfc → VW ser/fsp.
(<1% altd)

3410-3420'

3 LCM
Tr. CMT
Tr R&S

Tr HM-impregnated bte-bearing metasits, rounded grit grain — prob. rvd.

(100) MXLN GRTD II • Altn aa

0.2 PY

3420-3430'

2 LCM
Tr R&S
0.5 CMT

(100) MXLN GRTD II

• Altn aa

0.3 EP
0.2 PY

3430-3440'

3 LCM Tr CMT

(100) MXLN GRTD II

• Altn. aa

0.4 py

3440-3450'

12 LCM Tr CMT

py (1/mm) ← pyritohedron

(Tr) VVF → QTZ-ser-py

(100) MXLN GRTD II

• Altn. aa

0.7 py

3450-3460'

(1)

X cmt

8 LCM Tr R&S

* (1) MS-3A (CVD?)

~~100~~ (99) MXLN GRTD II

• Altn aa

0.5 py

3460-3470

10 LCM Tr. CMT

(1) VVF → QTZ-ser-py

* (Tr) MS-3A, aa

(99) MXLN GRTD II

• Altn aa, but (2% ≤ altd).

1 py

3470-3480'

3 LCM Tr CMT

(Tr) CMBX

* (1.5) VVF → QTZ-ser-py
→ SER-qtz-chl-(py)

(98.5) MXLN GRTD II

• Altn aa, but (3% ≤ altd.)

~~1% py~~ 1

Logging Notes | STEAMBOAT 21-5 | J. Hulen, S. Johnson | 11/4/04

3490-3500' | Tr R&S, 2 LCM, Tr CMT

3480-3490' | (0.5) CMBX → QTZ-ser-(py) altd. | (99.5) MXLN GRTD II (2) (7-8% mfc) | 0.5 py

VW Propyl → W chl/mfc → VW ser/fsp (2% ≤ 24d.)

3490-3500' | Tr CMT, Tr LCM, Tr R&S

Much finer cuttings | 0.1 py

(VFL)

(100) MXLN GRTD II

• Altn. aa, but (<1% ≤ altd.)

RESUME 01/03/05

3500-3510 | 5 CMT, Tr R&S

(VFL) | 0.1 py

(5) CMT, ♦ matte grayish-pink lightly speckled with dark gray → W-M chl/mfc → VW ser/plag.

• W propyl • 2% ≥ ≤ altd.

3510-3520' | [9] cement, aa | 0.2 py / Tr cpy

(95) BTE-HBL GRTD, aa

• W propyl., aa → 3% ≥ ≤ altd

even sphene commonly fresh.

3520-
~~3540~~
32

Tr R&S

VFL

(7) CEMENT, aa

(93) H-B GRTD., aa

- W propyl → w-m chl/mfc
- 3% ≥≤ altd. w chl/fsp vw ser/fsp

0.1 EP
0.3 py
Tr. cpy

3530-
3540'

Tr R&S

(13) CEMENT, aa

(87) HB GRTD, aa

- Altn aa
- ~~3~~ 4% ≥≤ altd.

0.1 py

3540-
3550'

Tr. R&S

(7) CMT, aa

(93) HB GRTD, aa

- Altn. aa
  3% ≥≤ altd.

Tr. py
~~0.2~~ cpy
0.1

3550-
3560'

Tr. R&S
Tr. LCM

(9) CMT aa

(91) HB-GRTD, aa

- Altn aa
  2% ≥≤ altd

Tr. py

3560-
3570'

(6) CMT

(94) HB GRTD, aa (VFL)

- WW propyl.
  ww ser/fsp w chl/fsp.
  w chl/mfc
  2% ≥≤ altd.

Tr. py

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Logging Notes

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Jan-3 2005 J. Hallen

0.2 py / Tr. cpy

3570-3580'

1 R&S

(7) CMT, aa

(93) HB GRTD, aa

• W propyl. → W-M chl/mfc
W chl/fsp
VW sbr/fsp

3580-3590

(7) CMT, aa

(93) HB GRTD, aa

• Altn aa

—

3590-3600'

(7) CMT

(93) HB GRTD, aa

(Tr) VVF ~~QTZ~~ - [py]

• Altn aa

0.1 ep / 0.1 py

3600-3610'

(4) CMT aa

(%) HB GRTD, aa

• Altn aa (FL)

Tr. ep / Tr. py

3610-3620'

Tr. LCM

(5) CMT, aa (Tr) FXLN BH QDT

(95) HB GRTD, aa

• Altn aa (FL)

0.2 py

3620-3630'

3 LCM

(3) CMT

(97) HB GRTD, aa

VFL

• VW propyl. → W chl/mfs
VW " / fsp

VW ser/fsp

0.1 py
Tr. cpy

3630-3640'

2 CMT

4 LCM

(100) HB GRTD, aa

VFL

• Altn. aa

Tr. ep
0.3 py

3640-3650'

2 CMT

6 LCM

Tr. R&S

(100) HB GRTD aa VFL

• Altn aa

Tr. ep.
0.2 py

3650-3660'

1 LCM

1 CMT

Tr. R&S

~~DC~~ (100) HB GRTD, aa FL

W propyl → W-m chl/mfs
W chl/fsp

VW ser/fsp

0.1 EP
0.2 py

Logging Notes

STEAMBOAT 218-5

J. Hulen 01/03/05

3360-3660

3660-3670

Tr. cmt.

(100) mx/n hbl.-bte grtd. aa

- W propyl. → w-m chl/mfe
  w chl/fsp
  vw ser/fsp.

0.1 ep
0.1 py

3670-3680

Tr: LCM CMT R&S

SKNXXX!

(100) HB GRTD aa

- Altn aa

4% ≥ altn.

Tr. cpy
0.2 py

3680-3690

3 LCM

Tr: CMT R&S

(100) HB GRTD, aa

- Altn aa

0.3 py
Tr. cpy

3690-3700

Tr: LCM CMT R&S

4 py prob. repl.

(100) HB GRTD aa

- Altn aa

0.4 py
Tr. cpy

Jan. 4, 2005

3700-3710'

Tr CMT
2 LCM
Tr R&S

(100) mx/n HB GRTD, aa

0.4 py
0.1 ep

- wk propyl. → W-M chl/mfc
  W chl/fsp
  W ser/fsp

chltzn of fsp imparts a dull transl. gray-green coloration to much of the fsp – presumably plagioclase.

3710-3720'

4 LCM
Tr CMT
Tr. R&S

** ALTN. & MINRLZN. INCREASE

1.5 py
0.2 cpy

(Tr) VVF → qtz-ser-py

(100) mx/n HB GRTD aa, exc.:

- mod. propyl. → M-S chl/mfc
  W-M chl/fsp
  W ser/fsp

pyrite occurs primarily as diss, anh-euh grains up to 0.7 mm in dia, (avg < 0.5 mm), and as irreg. aggregates of these grains up to 3 mm. in dia. Plag is replaced preferentially, then hbl, then bte.

→ ~5% of chips ≥ S altered

Logging Notes | STEAMBOAT 21B-5 | 01/04/05 | J. Hulen

3720-3730'

(100) mx/n HB GRTD.
- W-M propyl → w/ ser/fsp, w chl/fsp, M chl/mfc
- ⊙ → 3% ≥ s altd.

0.7 py
0.1 ep
Tr. cpy

3 LCM
Tr R&S
Tr. CMT

3730-3740'

mottled grayish-green, white, & transl. lt. gray to greenish-gray, & colorless
(100) mx/n HB GRTD, aa
- M propyl. → W-M chl/fsp, W ser/fsp, M-S chl/mfc
- ⊙ 4-5% ≥ s. altd

0.3 ep
0.5 py
Tr. cpy

2 LCM
Tr. R&S
Tr. CMT

3740-3750'

(Tr) vfx/n qtz-plag-biotite HNFLS
(100) mx/n HB GRTD aa
- W-M propyl. → W ser/fsp, W chl/fsp, M chl/mfcs.
- ⊙ 3% ≥ s altd.

(Tr) VVF chl-ser-qtz-py

1.5 py
0.1 cpy
0.1 ep

1 cmt
4 LCM

3750-3760'

(100) mx/n HB GRTD, aa
- Alt'n. aa

0.7 py
0.3 ep
Tr. cpy

2 LCM
Tr. cmt

3760-3770'

3 LCM
Tr. CMT

(Tr) CRUSH MICROBRECCIA
~~qtz-ser-chl~~

(100) mx/n HB GRTD aa
• Alt n. all aa

0.7 py
Tr. cpy
0.1 ep

3770-3780'

Tr. CMT
1 LCM

(100) mx/n HB GRTD, aa
• M propyl
W-M chl/fsp
W ser/fsp
M-S chl/mfs
⊙ 4-5% ≥≤ altd.

0.7 py
Tr. ep

3780-3790'

1 CMT
Tr R&S

(100) mx/n HB GRTD, aa
• W-M propyl.
W chl/fsp
W ser/fsp
W-M chl/mfc
⊙ 2-3% ≥≤ altd.

1 py
0.3 ep.

3790-3800'

2 CMT
~~FR&S~~
Tr. R&S
Tr. con-gealed oil?

(100) mx/n HB GRTD aa
• Altn. all AA

1.3 py
0.1 cpy
0.2 ep

Logging Notes | STEAMBOAT 218-5 | 01/04/05 J. Hulen

3800-3810'

(100) mxln HB GRTD, aa

0.4 py
Tr. ep

2 LCM
Tr. CMT

- M propyl. → w-m chl/fsp
  w ser/fsp
  M-s chl/mfcs.
- ⊙ u 4% ≥ S altd.

3810-3820'

(100) mxln HB GRTD, aa

- Altn. aa

0.3 py
Tr. ep

1 cmt
2 LCM

3820-3830'

(Tr) SCORIA → must be caved

(Tr) CMBX → chl-qtz-ser-[py]

(100) mx/n HB GRTD, aa

- Altn. aa exc. S chl/~~mfc~~ mfc.
- ⊙ 6-7% ≥ S altd.

0.5 ep
0.4 py
Tr. cpy

1 cmt
1 LCM

3830-3840'

(Tr) ANDESITE, rndd. gbbl-
must be caved.

- Altn all aa.

0.5 py
0.3 ep

5 LCM

3840-3850'

3 LCM
1 cmt
Tr. R&S

(100) mx/n HB GRTD, aa

- Altn. aa exc. M-S chl/mfc.

0.5 py
Tr. hm
0.2 ep

3850-3860'

4 LCM
Tr. cmt

(Tr) qtz-plag-bte HNFLS

- Altn. aa (all)

0.3 py
0.1 ep

3860-3870

Strongly altered and W-M sulfidized

1.5 py
0.2 cpy
0.2 ep

- M-S phyllic altn. on M propyl. (overall S altn.)

M-S ser/fsp, W-M chl/fsp, S chl/mfc

◎15% ≥ VS altn

(1) CMBX chl-qtz-ser ± py

(Tr) VVF ser.

(99) mx/n H-B GRTD, aa

Logging Notes | STEAMBOAT 21B-5 | J. Hulen | 01/04/05

3870-3880'

1 LCM
Tr. cmt

① CMBX qtz-chl-ser ± py

1.5 py
Tr. cpy
Tr. ep

① MS-3A (98) mx/n H-B GRTD aa
W-M chl/fsp
M ser/fsp
S chl/mfc
• M-S altn.

~~3870-3880'~~

3880-3890'

3 LCM
Tr cmt

(Tr) MS-3A aa
(Tr) CMBX aa
(100) mx/n H-B GRTD aa
W ser/fsp; W chl/fsp; W-M chl/mfc; • W-M altn

0.2 ep
0.7 py
Tr. cpy

3890-3900'

5 LCM
1 CMT

(100) mx/n GRTD, aa
VW ser/fsp
W chl/fsp
W-M chl/mfc
• W propyl.

~~0.5~~ py 0.7
0.2 ep
Tr. cpy

Tr CMBX

3900-3910'

1.5 LCM
Tr. cmt

97

(Tr) Felsic Volcanic prob. cvd
~~100~~ mx/n GRTD aa (99.5)
W ser/fsp.
W chl/fsp
M chl/mfc
• W-M propyl.
(0.5) VVF qtz-py-[opal?]

1.5 py
Tr. hm
0.1 cpy

3910-3920'

(Tr) VOLCANICLASTIC SS likely caused

(Tr) CMBX

(Tr) VVF → qtz-py

100 mx/m H-B Grtd. aa

YW ser/fsp; YW chl/fsp; M chl/mfc • W-M propyl.

0.1 cpy
1 py
0.1 ep

3 LCM
Tr. cmt
Tr. R&S

py

3920-3930'

(Tr) CMBX

(Tr) SCORIA — cvd prob.

(1) VVF cal (blocky) [zeol.]z
qtz-cal (bldd.)

99 mx/m H-B GRTD, aa • Altn. aa

→ poss. also zeolite clear stubby prisms

SUSPECT LAUMONTITE, BUT ✓

1 py
Tr. ep

2 LCM
~~X~~ 0.5 cmt

3930-3940'

0.5 CMBX qtz-ser-chl±py

99.5 mx/m HB GRTD qtz-diorite

• Altn. all aa

0.3 ep
1 py
0.1 cpy

3 LCM

Logging Notes | STEAMBOAT 218-5 | 01/04/05 J. Hulen

3940-3950'

◇ qtz

(Tr) VVF qtz cal > & qtz-cal

(Tr) CMBX aa

0.1 cpy
1 py
Tr. ep

2 LCM
Tr. CMT
Tr R&S

(100) mx/n. H-B GRTD, aa

VW-W ser/fsp
W chl/fsp
M chl/mfc
} • W-M propyl.

3950-3960'

(Tr) VVF — cal, pale salmon-colored, transl., blocky

1 py
Tr. ep

1 LCM
Tr. CMT

(100) mx/n. HB GRTD, aa

• Altn aa

3960-3970'

(0.5) VVF cal, aa

(99.5) mx/n H-B GRTD

0.5 py
Tr. ep

3 LCM
Tr cmt
Tr. R&S

VW ser/fsp
W chl/fsp
W-M chl/mfc
} • W propyl.

◎ 2% ≥ ≤ altn

3970-3980'

3 LCM
Tr cmt

(100) mx/n H-B GRTD aa
• Alt n aa

1 py

3980-3990'

1 LCM
Tr: cmt, R&S

(Tr) VVF (100) mx/n H-B GRTD aa
• Alt n aa

0.5 py

3990-4000'

2 LCM
Tr cmt
Tr R&S

(Tr) q-s-py VVF (100) mx/n H-B GRTD aa

(Tr) CMBX chl-gtz-ser

0.7 py

VW ser/fsp → W chl/fsp, M chl/mfcs } • W-M propyl.

Logging Notes | STEAMBOAT 21B-5 | Hulen Johnson | 02/19/05

4000–4010'

(0.5) GG & CMBX

(Tr) VVF (Tr) MS-3A

(99.5) H-B GRTD

m chl/mfcs
w chl/fsp
vw ser/fsp
} w-m propyl

Tr, cmt
1 R&S

0.5 py
0.1 ep

4010–4020'

(Tr) GG, CMBX (Tr) VVF

(100) H-B GRTD

w-m chl/mfcs
w chl/fsp
w/ ser/fsp
} w-m propyl.

Tr cmt
Tr: 1 LCM
Tr R&S

1 py
0.2 ep

4020–4030'

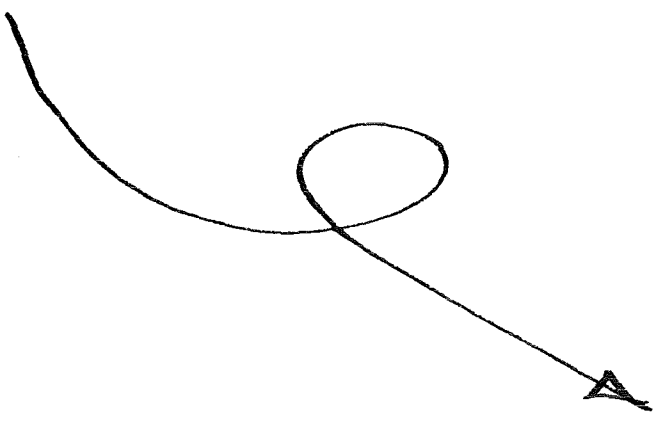
(MOLYBDENITE) appears →

(Tr) MS-3A

(100) H-B GRTD.
[altn aa]

Tr. R&S
Tr LCM
Tr cmt

0.2 cpy
0.1 MoS_2
1 pyrite



4030-4040'

Tr. cmt
Tr. R&S
Tr. LCM

(Tr.) MS-3A (0.5) VVF
- cal
- gtz-py

0.3 EP
0.7 py

(99.5) H-B GRTD aa
w-m chl/fsp
m chl/mfcs
vw ser/fsp
} w-m propyl.

---

less altn

4040-4050'

Tr- cmt
Tr. thick
goe-mgnt.
flakes

(Tr.) GG

(100) H-B GRTD.
w-m chl/mfcs
w ch/fsp
vw ser/fsp
} w propyl.

1 py
0.1 cpy
0.5 ep

4650-60'

(Tr) GG (Tr) MS-3A

(100) H-B GRTD.
w chl/mfcs.
vw chl/fsp
vw ser/fsp
}

0.3 ep
Tr. cpy
0.5 py

Logging Notes

STEAMBOAT 21B-5

Hulen-Johnson

02/19/05

4060-4070'

Tr. GG

100 H-B GRTD, aa

w chl/mfc
vw chl/fsp
vw ser fsp
} w propyl.

Tr. cmt
~~LCM~~ ①
Tr R&S

Tr. cpy
0.3 py
0.2 ep

4070-4080

all aa

5 LCM
1 mt
Tr R&S

1 py
Tr. hm
0.3 ep

4080-4090'

All aa

1 py
Tr cpy
0.3 ep

4090-4100'

Tr porphyritic felsic volcanic (grayish-pink)

Tr MS-3A

100 H-B GRTD, aa
w-m chl/mfc
w chl/fsp
vw ser/fsp

Tr. HM
0.7 py
0.3 ep

1 cm
0.5 cmt
Tr R&S

4100-
4110'

Tr cmt
Tr R&S
Tr LCM

Tr. MS-3A

100 H-B GRTD

W-m ~~W~~ chl/mfc
VW ser/fsp
W chl/fsp

} W propyl.

1 py
0.1 epy

Tr. ep

4110-
4120'

0.5 cmt
Tr R&S

all aa

1 py
Tr. ep

4120-
4130'

1.5 LCM
Tr R&S
Tr cmt

Tr CMBX

100 H-B GRTD, aa

W-m chl/mfc
W chl/fsp
W ser/fsp

} W propyl.

0.4 py
0.3 ep

4130-
4140'

all aa
slightly more
ser/fsp

0.3 py
0.5 ep

Logging Notes

STEAMBOAT 21B-5

Hulen Johnson

02/20/05

4140-4150'

Tr. cmt
Tr R&S
Tr LCM

(100) H-B GRTD, aa
m·chl/mfc
w-chl/fsp
vw ser/fsp

0.3 py
Tr. ep

4150-4160'

1 LCM
Tr R&S
Tr CMT

(All aa)

0.2 py
Tr. ep

4160-4170'

LCM
CMT
R&S

↳ 5% anomalously large chips (5-8 mm vs 1 mm avg)

(100) H-B GRTD aa
w ser/fsp
w-m chl/fsp
w-m chl/mfc
} w-m propyl

0.5 py
~~X~~
0.3 ep

4170-4180'

cmt
R&S
LCM

↳ 5% big chips, aa

(All aa)

0.7 py
0.3 ep

A few outsized chips aa

4180-4190'

0.5 LCM
0.5 R&S
Tr. CMT

(100) HBL-BTE GRTD aa

m · chl/mfcs
w-m · chl/fsp
vw ser/fsp
} w propyl.

0.7 py
Tr. cpy
0.3 ep

4190-4200'

0.5 LCM
0.5 CMT
Tr. R&S

[All aa]

monotonous

0.5 py
0.3 ep

4200-4210'

2 LCM
0.5 cmt
Tr R&S

(Tr) GG

(100) H-B GRTD. aa

m chl/mfcs
w chl/fsp
vw ser/fsp
} w prpyl.

0.3 py
Tr. cpy
0.3 ep

4210-4220'

1 LCM
0.5 CMT
Tr. R&S

MOLYBDENITE RE-APPEARS

(Tr) VVF qtz-(moly) / ~~(1)~~ (0.5) CMBX chl-qtz-ser

~~(100)~~ (99.5) H-B GRTD. aa

m chl/mfcs
w-m chl/fsp

0.1 MoS_2
0.5 py
Tr_{ep} / Tr_{cpy}

(1)

Logging Notes | STEAMBOAT 218-5 | Hulen Johnson | Feb. 20, 2005

4220-4230'

- (0.5) CMBX, ml-qtz-ser
- (99.5) H-B GRTD, aa
  - m chl/mfcs
  - w chl/fsp
  - vw ser/fsp
  - } W propyl.

1 LCM
Tr. cmt
Tr. R&S

0.5 py
0.1 ep

4230-4240'

- (0.5) VVF
  - qtz-py
  - qtz-moly
- (Tr) CMBX
- (99.5) H-B GRTD aa [altn. aa]

4 LCM
Tr. R&S

Tr. cpy | Tr MoS_2
0.1 py
Tr. ep

4240-4250'

- (Tr) CMBX
- (Tr) VVF
  - qtz-ser-py
- (100) H-B GRTD aa [altn. aa]

3 LCM
0.5 R&S

0.5 py
Tr. ep

4250-4260'

- (100) H-B GRTD, aa [altn. aa]

3 LCM
Tr R&S
Tr cement

0.5 py

4260-4270'

2 LCM
Tr R&S

(100) H-B GRTD aa

M chl/mfc
W chl/fsp
VW ser/fsp
} W propyl.

0.3 py

4270-4280'

2 LCM
Tr R&S

(Tr) VVF qtz-ser

(100) H-B GRTD, aa

M chl/mfc
W chl/fsp
W ser/fsp
} W-M propylitic

0.5 py

4280-4290'

Tr. cmt
2 LCM
Tr R&S

(1) GG & cmbx

(99) H-B GRTD, aa

[alln aa]

Tr. MoS_2
Tr. cpy
~~X~~ 0.5 py
0.2 ep

4290-4300'

Tr cmt
Tr R&S
1 LCM

(Tr) cmbx qtz-ser-chl

(100) H-B GRTD.

0.5 py
Tr. ep

Logging Notes

STEAMBOAT 21B-5

Hulem
Johnson

02/20/05

4300-4310

2 LCM
1 R&S

(0.5) CMBX; chltc.

(99.5) H-B GRTD. aa

M chl/mfc
W chl/fsp
VW ser/fsp
} W propyl.

1 py

4310-4320'

1 LCM
Tr. R&S

(Tr) CMBX aa

(100) H-B GRTD aa

M-S chl/mfc
W-M chl/fsp
W ser/fsp
} M propyl.

Tr. MoS_2
Tr. cpy
0.5 py

4320-4330'

1 LCM
Tr R&S

Alteration Diminishes

(100) H-B GRTD aa

W-M chl/mfc
W chl/fsp
VW ser/fsp
} W propyl.

Tr. ep
0.3 py

4330-4340'

5 LCM
Tr. R&S
...IT

(0.5) GG & CMBX qtz-ser-chl

(99.5) H-B GRTD aa

[altn. aa]

0.3 py
Tr. cpy

4340 - 4350'

0.5 LCM
Tr. R&S
Tr. cement

(Tr) CMBX

~~X~~ (100) H-B GRTD., aa

[altn. aa]

0.2 py
Tr. MoS_2

4350 - 4360'

1 LCM
Tr. R&S
Tr. cmt

(100) H-B GRTD aa

[altn. aa]

Tr. SCORIA

0.2 py

4360 - 4370'

Tr cmt
1 LCM
Tr R&S

(Tr) CMBX

(100) H-B GRTD. aa

[altn aa]

0.1 ep
0.2 py

4370 - 4380'

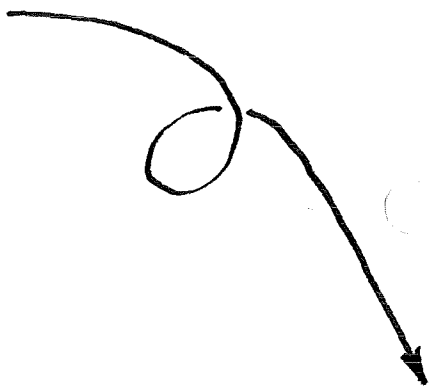
0.5 LCM
Tr R&S
Tr CMT

Tr. SCORIA

(100) H-B GRTD., aa

[altn. aa]

Tr. ep.
Tr. cpy
0.3 py



Logging Notes

STEAMBOAT 21B-5

J. Hulen
S. Johnson

02/20/05

4380-4390'

1/

Tr. CMBX

100 HBL-BTE GRTD.

Tr. ep
Tr. py

1 LCM
Tr. R&S

Tr MS-~~31~~

M chl/mfc
W chl/fsp
VW ser/fsp
} W propyl.

4390-4400'

1/

100 HBL-BTE GRTD., aa

[altn aa]

0.2 ep
0.1 py
Tr. cpy

Tr { cmt
R&S
LCM

4400-4410'

~~1/~~

0.5 CMBX qtz-chl-ser

99.5 HBL-BTE GRTD aa

[altn aa]

0.3 ep
0.3 py

1.5 LCM
0.5 R&S

4410-4420'

Tr VVF qtz-cal-ser-chl

100 H-B GRTD aa

[altn. aa]

0.2 ep
0.2 py

2 LCM
.5 R&S

4420-4430'

5 LCM
1 CMT
1 R&S

(Tr) CMBX

(100) H-B GRTD, aa

[altn aa]

0.3 ep
0.3 py

4430-4440'

3 LCM
1 R&S
Tr. cmt.

(0.5) CMBX

(99.5) H-B GRTD, aa

[altn. aa]

Tr. MoS_2
0.2 py

4440-4450'

2 LCM
1 R&S

~~(Tr)~~ CMBX (1)

~~(100)~~ H-B GRTD, aa

(99) → M-S chl/mfc
W- chl/fsp
W ser/fsp
} M propyltc.

Tr. MoS_2
0.3 py
Tr cpy | 0.1 ep

4450-4460'

1 LCM
1 R&S

(0.5) CMBX

(99.5) H-B GRTD, aa

[altn. aa]

0.3 py

Logging Notes | STEAMBOAT 218-5 | Hulen Johnson | 02/~~29~~/05

4460-4470'

1 R&S
1 LCM
Tr CMT

(1) Gouge and crush microbreccia, lt. greenish-buff, grayish-green, and greenish-white.
qtz-ser-chl

0.2 ep
Tr. MoS_2
0.3 py

(99) Hornblende-biotite Granodiorite,

M-S chl/mfc
W chl/fsp
W-M ser/fsp
} M propylitic alteration

4470-4480'

1 LCM
1 R&S

(1.5) GG & CMBX aa

(98.5) H-B GRD aa
[altn. aa]

0.3 ep
0.4 py
Tr cpy

4480-4490

1 LCM
Tr R&S

(1) GG & CMBX
(0.5) VVF

(98.5) HB GRTD aa
[altn. aa]

0.5 py
0.5 ep
Tr. cpy

4490-4500'

1 LCM
Tr R&S

(0.5) GG & CMBX

(99.5) H-B GRTD aa
[altn. aa]

0.3 py
0.1 ep

Logging Notes | STEAMBOAT 218-5 | J. Hulen 01/04/05

4500-4510

(Tr) basalt-cvd.

(Tr) CMBX q-ch-ser

(100) mx/n H-B GRTD aa

2 LCM
1 R$S

0.2 EP
0.3 py

Tr-vw ser/fsp
vw-w chl/fsp
w-m chl/mfc
} • W propyl

4510-4520'

(Tr) basalt-cvd

(1) VVF · qtz
· qtz-py
· qtz-MoS_2-py-[cpy]

need to confirm

0.3
~~X~~ MoS_2?
0.2 cpy
Tr. ep
0.7 py

2 LCM
Tr R$S

more powdery

→ med-dk gray metallic, mx/n, w/gray streak, but not ductile like coarser moly → could be an unknow sulfide or sulfosalt — too little for XRD.

(99) mx/n H-B GRTD, aa

• Alt'n aa

I.

4520-4530'

Tr R&S
Tr. cmt
Tr. LCM

(1) VVF, aa — mostly mx/n qtz

(99) mx/n H-B GRTD

• Altn aa

(Tr) bslt, cvd

0.2 MoS_2 (?)	
0.3 ep	
0.5 py	0.1 cpy

4530-4540'

Tr. R&S

(1) VVF
mx/n qtz ± MoS_2 ± cpy
crsr-x/n pure MoS_2 ± cpy

(99) mx/n H-B GRTD
• Altn. aa

fairly certain ID (yes)
ductile, soft greasy/metallic med/sl. bluish-gray

0.3 MoS_2	
~~0.1~~ ep 0.3	
0.1 cpy	0.7 py

4540-4550'

Tr. LCM
Tr R&S

(Tr.) basalt — cvd

(0.5) VVF, same as 4510-4520'

(Tr) CMBX qtz-chl-ser

(99.5) mx/n. H-B GRTD, aa • Altn aa

0.1 MoS_2 (?)	
Tr. hm	0.2 ep
Tr. cpy	0.3 py

4550-4560'

Tr. R&S

qtz

(0.5) VVF — aa ± pure late euh qtz

(99.5) mx/n H-B GRTD, aa

• Altn aa

Tr. MoS_2	
0.5 ep	
0.3 py	Tr cpy

II.

Logging Notes | STEAMBOAT 218-5 | J. Hulen 01/04/05

4560-4570'

Coarse MoS_2 flake 1.5 mm x 0.1 mm

(Tr) cmbx

0.2 MoS_2
0.5 EP
0.3 py
Tr. cpy

Tr. R&S

(0.5) VVF – qtz (wx/n) – MoS_2 – [py, cpy]
– pure MoS_2 (see above)

(99.5) mx/n H-B GRTD, aa

w chl/fsp
vw ser/fsp
M chl/mfc
} • W-M propyl.

4570-4580'

(0.5) VVF, aa

(Tr) cmbx

(99.5) mx/n H-B grtd. aa.

• Alt'n aa

0.1 MoS_2
0.3 EP
0.7 py
Tr. cpy

Tr. LCM
1 R&S

4580-4590'

(Tr) VVF, aa

(100) mx/n H-B GRTD, aa

• Alt'n aa

just slightly more intense.

Tr. MoS_2
0.5 py
0.2 ep

III.

4590-4600'

Tr. LCM
Tr. R&S

(Tr) VVF, aa

(100) mx/n HB GRTD, aa

• Altn aa

0.5 py
0.3 cpy **
0.2 ep
Tr. MoS_2

4600-4610'

Tr. LCM
Tr. R&S

(Tr) str. propyl. µdiorite or µgabbro

(Tr) VVF → qtz

(100) mx/n H-B GRTD aa

• Altn aa

0.1 cpy
0.2 ep
0.5 py

4610-4620'

Tr LCM
Tr R&S

(Tr) VVF → µx/n qtz ± MoS_2

(100) mx/n H-B GRTD aa

• Altn. aa

0.3 py
0.1 cpy
0.1 ep
Tr MoS_2

4620-4630'

IV.

(Tr) VVF → aa

(Tr) CMBX → qtz-chl-ser

(100) mx/n. HB GRTD, aa

• Altn. aa

(Tr) MS-3B cvd.

0.5 Ep
Tr. MoS_2
0.1 cpy | 0.3 py

Logging Notes — STEAMBOAT 21B-5 — Hulen & Johnson — 01/05/05

4630-4640'

(100) mx/n H-B GRTD.
• Alt'n all aa

0.3 EP
0.2 cpy
0.3 py

2 LCM
Tr. R&S

4640-4650'

(Tr) VVF — mx/n qtz/MoS_2
(100) mx/n. H-B GRTD., aa
• Alt'n aa

0.3 py
0.2 cpy
0.5 ep
Tr. MoS_2

Resume 01/05/05

4650-4660'

* 1-mm chunk of chalcopyrite

0.2 cpy
0.3 ep
0.3 py
Tr. MoS_2

4 LCM

(Tr) CMBX qtz-chl-ser. ✱ grnsh-white
(Tr) VVF — qtz/MoS_2 aa
(100) mx/n H-B GRTD, aa

vw ser/fsp
vw chl/fsp
w-m chl/mfc
} • W propyl

V.

4660-, 4670'

1 LCM
Tr R&S

* 1-m (≥) cpy x/ (broken) att. to tf. sl. orange-pink (salmon) KFSP

0.2 cpy
0.2 py
0.1 ep

(Tr) CMBX aa (Tr) VVF, aa

(100) mx/n H-B & GRTD aa
• Altn aa

4670-
4680'

3 LCM
Tr. R&S

(100) mx/n H-B GRTD, aa
• Altn aa

Tr. MoS_2 (prob. CVD)
0.2 ep
Tr. cpy
0.1 py

4680-
4690'

3 LCM
Tr. R&S

(Tr) (Tr) CMBX

(Tr) VVF – qtz-py
– qtz.-MoS_2

0.1 MoS_2
0.1 cpy
0.7 EP
0.5 py

(100) mxln H-B GRTD aa, exc:

wk ser/fsp
wk chl/fsp
M chl/mfc
} • W-M propyl.

** Note: both MoS_2 & cpy occur in part as diss. grains, comm. intergrown w/ ep

VI.

Logging Notes | STMBT. 21B-5 | Hulen & Johnson | 01/05/05

4690-4700'

(Tr) CMBX (Tr) VVF
-qtz-py

(100) mx/n H-B GRTD, aa
• Altn. aa, i.e. W-M propyl

0.4 EP
0.1 cpy
0.3 py

0.5 LCM
0.5 R&S

4700-4710'

(1) CMBX

(99) mx/n H-B GRTD aa
• Altn. aa

0.5 ep
Tr. MoS_2
Tr. cpy
0.5 py

Tr. LCM
Tr. R&S

4710-4720'

(0.5) CMBX
(99.5) mx/n HB GRTD, aa
• Altn aa

0.7 py
0.1 cpy
0.5 ep

6 LCM (VOL.)
Tr. R&S

4720-4730'

— All aa —

0.5 py
0.1 cpy
0.5 ep

7 LCM

VII.

4730-4740'

2 LCM
Tr R&S

② fx/n B-H QDT
(98) mx/n H-B GRTD aa

VW-W ser/plag
W chl/ "
M chl/mfc
} • W-M propyl.

0.5 py
Tr. cpy
0.5 ep

4740-4750'

1 LCM
Tr R&S

(100) mx/n H-B GRTD, aa
• Alth. aa

1.5 ep
0.3 py
Tr. cpy

4750-4760'

3 LCM
Tr. R&S

(Tr) fx/n B-H QDT
(100) mx/n H-B GRTD aa
• Alth aa
MoS_2 diss.

5
0.3 ep
0.7 py
0.1 cpy
& Tr. MoS_2

4760-4770'

Tr. LCM

(100) mx/n H-B GRTD, aa
• Alth. aa

1 EP
0.1 cpy
0.2 py

VIII.

Logging Notes | STEAMBOAT 21B-5 | Hulen, Johnson | 01/05/05

4770-4780'

(100) mx/n H-B GRTD aa

VW ser/fsp
W chl/fsp
M chl/mfc
} • W-M propyl

0.5 py
0.1 cpy
1.3 EP

4780-4790'

1 CMT

(Tr) cmbx → qtz-chl-ser

0.3 py
0.3 ep
Tr. cpy

(1) MS-3A, unaltered, cvd.

(99) mx/n HB GRTD aa

(Tr) VVF – mx/n qtz.

W-M ser/fsp
W chl/fsp
M chl/mfc
} • mx M propyl.

4790-4800'

Tr LCM
Tr R&S

(2) MS-3A, unaltd., cvd.

VW ser/fsp
W chl/fsp
M chl/mfc
} • W-M propyl

0.2 ep
0.3 py
Tr. cpy 0.1

IX

4800-4810'

Tr. R&S

(shearing)

(0.5) VVF → CAL-QTZ-py-(cpy) — MoS_2

0.1 MoS_2
0.1 cpy
0.5 py
0.3 ep.

• Altn. aa (99.5) mx/n HB GRTD aa

4810-4820'

1 LCM
Tr. R&S
Tr. cmt.

(100) mx/n. H-B GRTD, aa

• Altn aa, sl. wkr.

0.3 ep
Tr. cpy
0.3 py

4820-4830'

5 LCM
Tr. R&S

(100) mx/n H-B GRTD, aa

• Altn. aa

0.3 ep
0.3 py
Tr. cpy

4830-4840'

1 LCM
Tr. R&S

More Leucocratic (~7% TL MFC

(Tr) MS-3A, cvd.

(100) mx/n H-B GRTD aa

vw ser/fsp
vw chl/fsp
v-m chl/mfc
} • w propyl.

0.5 ep
0.3 py
Tr. cpy

X

Logging Notes

STEAMBOAT 21B-5

J. Hulen & S. Johnson

01/05/05

4840-4850'

(Tr) VVF — Qtz - MoS_2 - py - (cpy)

(100) mx/n H-B GRTD, aa

- vw ser/fsp
- w chl/fsp
- M chl/mfc

• W-M propyl

12-15% TL MFC

4 LCM
Tr. cmt
Tr. R&S

Tr. MoS_2
0.1 cpy
0.5 ep
0.3 py

4850-4860'

(100) mx/n H-B GRTD, aa

• Alt'n aa, but sl. wkr.

3 LCM
Tr. CMT
Tr. R&S

Tr. cpy
0.3 py
1 ep

4860-4870'

(Tr) CMBX — chl - qtz - ser

(100) mx/n H-B GRTD, aa

• Alt'n aa

4 LCM
Tr. R&S

0.3 py
Tr. cpy
0.5 ep
Tr MoS_2

4870-4880'

(100) mx/n H-B GRTD, aa

• Alt'n aa

7 LCM (vol.)
Tr R&S
Tr. cmt

XL

0.3 py
0.2 ep

4880-
4890'

3 LCM

(100) mx/n H-B GRTD, aa

• Altn. aa

0.5 ep
0.2 py

4890-
4900'

Tr. LCM

(Tr) VVF —Qtz-MoS_2 (μx/n)
—MoS_2 (fx/n)

(100) mx/n H-B GRTD aa

• Altn aa

Tr MoS_2
0.3 py
0.4 ep

& Tr. cpy

4900-
4910'

Tr. LCM
Tr. cmt

(100) mx/n H-B GRTD, aa

• Altn aa,
exc. W ser/fsp.

0.3 ep
0.2 py
Tr. cpy

& Tr. HM

4910-
4920'

1 LCM

(Tr) CMBX

(100) mx/n H-B GRTD, aa

• Altn aa
w/ vw ser/fsp

Tr. HM
0.5 ep
0.3 py

XII.

Logging Notes — STEAMBOAT 21B-5

J. Hulen 01/05/05
S. Johnson

4920-4930'

(100) mxln. H-B GRTD, aa
• Altn aa, i.e. W-M propyl.

0.4 ep
0.3 py

5 LCM (vol)

4930-4940'

(Tr) CMBX — Qtz-ser-chl ± hem.
≈≈ (Tr)
(100) mxln H-B GRTD aa
• Altn aa

0.1 HM
Tr. EP
0.2 py
Tr. cpy

2 LCM

4940-4950'

(Tr) CMBX aa
(100) mxln H-B GRTD aa
• Altn aa

Tr. cpy
0.2 py
0.1 ep
Tr. HM

2 LCM

4950-4960'

— All AA —

Tr. cpy
Tr hm
0.4 ep
0.2 py

1 LCM

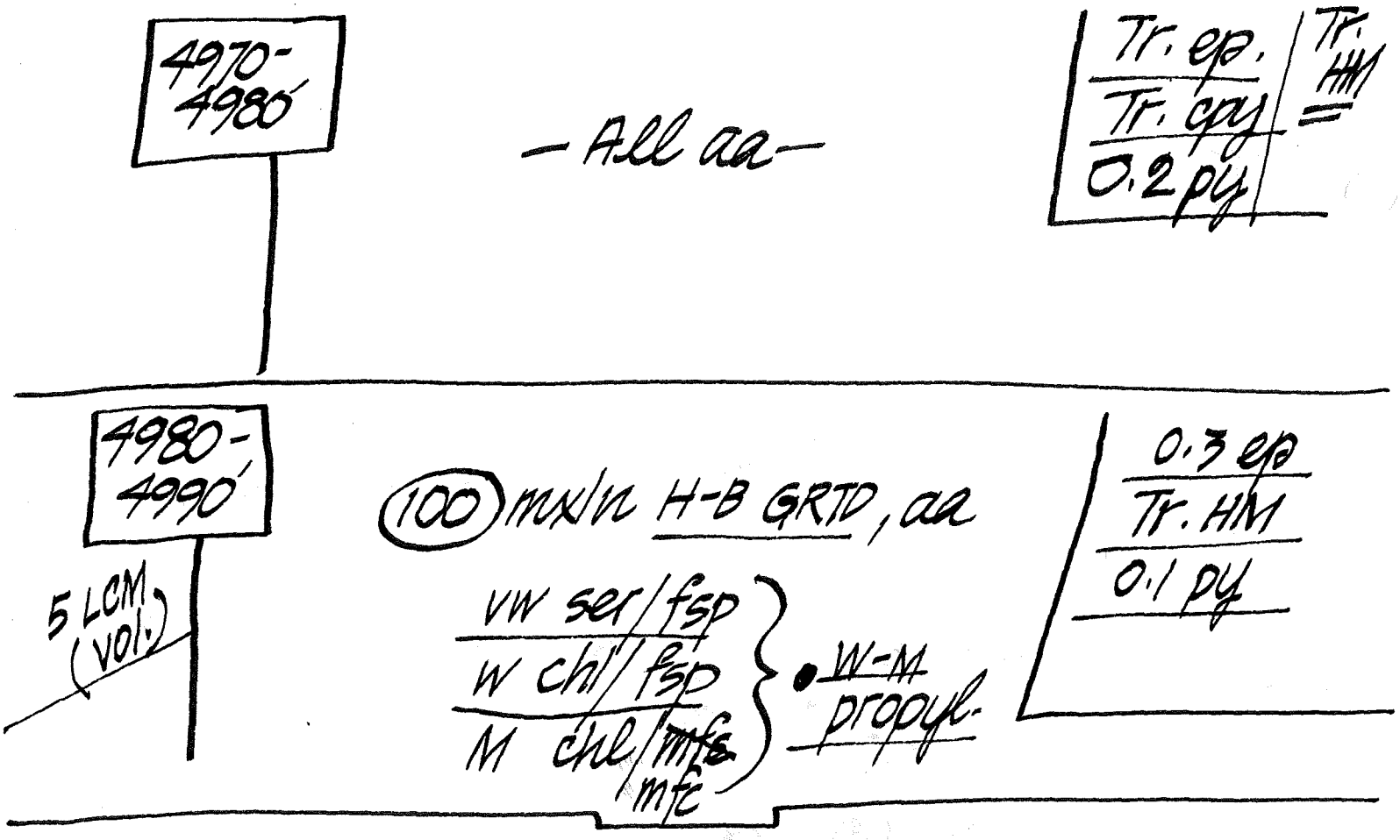
4960-4970'

(Tr) CMBX, aa
(100) mxln. H-B GRTD, aa
• Altn aa

Tr. HM
0.1 ep
0.2 py

2 LCM
Tr. R&S

XIII.


4970-4980
-All aa-
Tr. ep.
Tr. cpy
0.2 py
Tr. HM
4980-4990
5 LCM (vol.)
(100) mxln H-B GRTD, aa
vw ser/fsp
w chl/fsp
M chl/mfc mfc
W-M propyl
0.3 ep
Tr. HM
0.1 py

Logging Notes

STEAMBOAT 21B-5

J. Hulen
S. Johnson

5000-5010'

Tr. R&S
6 LCM

(0.5) GG & CMBX - qtz-ser-chl
(99.5) HBL-BTE GRTD

- VW ser/fsp
  VW chl/fsp
  M chl/mfc
  } w propyl.

0.3 ep
0.3 py
Tr. HM
Tr. cpy

5010-5020'

17 LCM
Tr. cmt.
Tr. R&S

(Tr) CMBX aa (Tr.) VVF hem
~~1000~~ (100) H-B GRTD aa

- Alt aa

(tr.)

0.1 py
Tr. cpy
0.1 ep
Tr. HM

5020-5030'

5 LCM
Tr. R&S

(Tr) CMBX, aa (Tr) VVF qtz-chl-ser crudely lam.
(100) H-B GRTD, aa

- Alt aa

0.5 EP
0.1 py
Tr. cpy
Tr. HM

5030-5040'

10 LCM

(0.5) CMBX (99.5) H-B GRTD, aa

VW ser/fsp
W-m chl/fsp
m chl/mfcs
} • W-m propyl.

0.1 EP
0.1 CPY
Tr. py
Tr. HM

A.

5040-5050

3 LCM
Tr. R&S

(Tr) CMBX (Tr) VVF
~~gtz~~ (hem) - chl

(100) H-B GRTD aa
VW scr/fsp
W chl/fsp
m chl/mfc
• wk. propyl.

0.1 EP
0.2 py
Tr. cpy
Tr. HM

5050-5060

10 LCM
Tr R&S

~~~ (tr) (0.5) CMBX
(1) (tr)
• Altn. aa
~~(1)~~ (99.5) H-B GRTD, aa

Tr. EP
0.1 py
Tr HM

5060-5070

3 LCM
Tr. R&S

(Tr) CMBX
(100) H-B GRTD, aa
• Altn aa

Tr. cpy
0.1 EP
Tr. HM
0.1 py

5070-5080

3 LCM

(Tr) CMBX aa
(100) H-B GRTD aa
• Altn. aa, exc. ↓ 10% of the fsp is suffused with hem, and is thereby stained lt-med orange-pink (salmon)

0.2 HM
0.5 EP
0.2 cpy
0.1 py

B.
~~~

Logging Notes | STEAMBOAT 21B-5 | J. Hulen, S. Johnson | 01/10/05

5080-5090'

2 LCM
1 R&S
Tr. cmt.

(Tr) ≈≈≈

(Tr) VVF
—chl-hm-qtz (no k)

(Tr) CMBX —chl-ser-qtz ±(hem)

vw ser/fsp
w chl/fsp
m chl/mfc
} • W-M propyk

Tr. py
0.2 HM
0.1 EP

~7% of the fsps are stained lt.-med. orange-pink (salmon) by hem.

5090-5100'

2 LCM
1 R&S
Tr cmt

(Tr) CMBX, aa ≈≈≈ (Tr)

(100) H-B GRTD aa

• Altn aa, exc tr. dissolution ∅ in fsps altd to chl-ser ± only ~3% of fsp stained pink

0.5 EP
0.1 py
0.1 HM
Tr. cpy

5100-5110'

3 LCM
0.5 R&S

—All AA, exc. no obv. shearing

0.3 EP
Tr. py
Tr HM

C.

01/12/05

5110–5120'

3 LCM
0.5 R&S

(1) Tr

(100) mx/n H-B GRTD, aa

M-S ~~X~~ chl/mfc
W-M chl/fsp
W ser/fsp
} • W-M propyl.

∠ 3% of fsp is salmon-pink,

0.4 EP
Tr HM
Tr. py

Tr R&S

5120–5130'

2 LCM

(100) mx/n H-B GRTD, aa

• Altn. aa

0.3 EP
0.1 PY
Tr. HM

5130–5140'

2 LCM

Tr R&S

(Tr) VVF qtz (0.5) CMBX qtz-chl-ser

(99.5) H-B GRTD, aa

• Altn aa

0.5 EP
0.1 PY
Tr. cpy

5140–5150'

4 LCM

Tr R&S

~~(Tr)~~ CMBX-QTZ-(chl)-ser (0.5)

(tr) VVF (qtz)

0.3 EP
Tr. py

D,

Logging Notes

STEAMBOAT 218-5

J. Hullen
S. Johnson

01/12/05

5150-5160'

7 LCM
Tr. R&S

(Tr) VVF
— uxln QTZ-(py)
— ser-qtz-CHL

(7) CMBX
(0.5)

(99.5) mxln H-B GRTD, aa
m-s chl/mfc
w-m chl/fsp
w ser/fsp
• W-M propyl

0.4 EP
Tr. py
Tr HM

5160-5170'

7 LCM
0.5 R&S

(0.5) CMBX aa

(99.5) mxln H-B GRTD, aa
m chl/mfs
w-m chl/fsp
w ser/fsp
• W-M propyl.

0.2 PY
0.1 HM
0.3 EP

5170-5180'

11 LCM
Tr R&S

— All same as 5150-60'

1 EP
Tr. py
Tr. HM

5180-5190'

2 LCM

(1) CMBX, aa

(99) mxln H-B GRTD, aa
M-S chl/mfc
M chl/fsp
W ser/fsp
• M propyl.

E.

0.5 EP
0.2 py
0.1 HM

~~X~~

5190-5200

2 LCM / Tr R&S

(Tr) CMBX, aa (Tr) VVF - hm

(100) mx/n H-B GRTD, aa

• Altn aa (M PROPYL.)

0.2 py
0.1 hm
0.5 ep

5200-5210

6 LCM / Tr R&S

(0.5) CMBX, aa
(Tr) VVF
— chl-cal

(99.5) mx/n H-B GRTD aa
• Altn aa

0.3 EP
0.1 py
0.1 hm

5210-5220

5 LCM / 0.5 R&S

(Tr) ≈ All as above
ex Tr VVF is hm

0.1 HM
Tr. py
0.2 EP

5220-~~5280~~

5230

1 LCM

(100) mx/n HB GRTD, aa
• Altn. aa

Tr. py
0.2 ep
Tr. hm

F.

Logging Notes

STEAMBOAT 21B-5

Hulen, Johnson

01/12/05

5230-5240'

2 LCM
Tr R&S

(0.5) CMBX & GG (Tr) VVF -q-ch-hm -hm

(1) Tr (99.5) mx/n H-B GRTD, aa

s chl/mfcs
w-m chl/fsp
w ser/fsp } • M PROPYL

0.5 EP
0.3 py
0.1 hm
Tr. cpy

5240-5250'

3 LCM
0.5 R&S

(Tr) ~~DVE~~ VVF-mx/n qtz-(py)

(100) mx/n H-B GRTD

m-s chl/mfc
w-m chl/fsp
w ser/fsp } • M propyl.

0.5 py
0.3 ep
Tr. hm

5250-5260'

1.5 LCM
Tr, CMT
0.5 R&S

(1) GG & CMBX - qtz-ser-chl ± (py, hm)

(1) → common on GG & CMBX

(0.5) VVF
-qtz-ser-chl
~~chl + ?~~
- cal-chl-qtz

(98.5) • A/tn. aa

0.7 py
Tr. cpy
Tr. hm

5260-5270

1 LCM
Tr. R&S

cuttings more finely ground

(0.5) ~~1~~ VVE — QTZ (mx/n) - py

(1.5) GG & CMBX, aa

(97.5) ~~99.5~~ H-B GRTD, aa

• A/tn. aa

1 py
Tr. hm
0.3 EP

G.

Finely Ground

5270-5280'

A ★ MILESTONE

1 LCM Tr R&S

comm. (0.5) VVF qtz-cal

(1+) Tr (0.5) GG & CMBX

(99) mx/n H-B GRTD.

• Altn aa

Tr
0.X HM
Tr. py
0.2 ~~EP~~ EP

★★★★ x-sec many lenticular chips of qtz-ser chl altered GG with slix on both sides

5280-5290'

4 LCM
0.5 R&S

RA

(0.5) GG & CMBX aa

(1+) Tr (99.5) mx/n H-B GRTD, aa

• Altn aa

0.4 EP
0.7 py
0.1 cpy
Tr. HM

5290-5300'

4' LCM
Tr R&S

(1+) Tr aa (1.5) GG & MBX

(0.5) VVF qtz-cal-[ser chl py]

(98) mx/n H-B GRTD, aa

• Altn aa

0.5 EP
0.2 py
Tr. HM

5300-5310'

~~5~~ 5 LCM

— Incomplete Wash —

(0.5) GG & CMBX, aa

(99.5) mx/n HBL-BTE GRTD. aa

• Altn. aa

0.3 EP
0.1 py
Tr HM

H.

Logging Notes

STEAMBOAT 2185

J. Hulen
S. Johnson

Jan. 12, 2005

5310-5320'

2 LCM
Tr. R&S

(1') (2) GG & CMBX qtz-ser-chl±cpy, cal, hm=

0.5 py
0.1 cpy
0.3 ep
Tr. ~~chl~~
hm

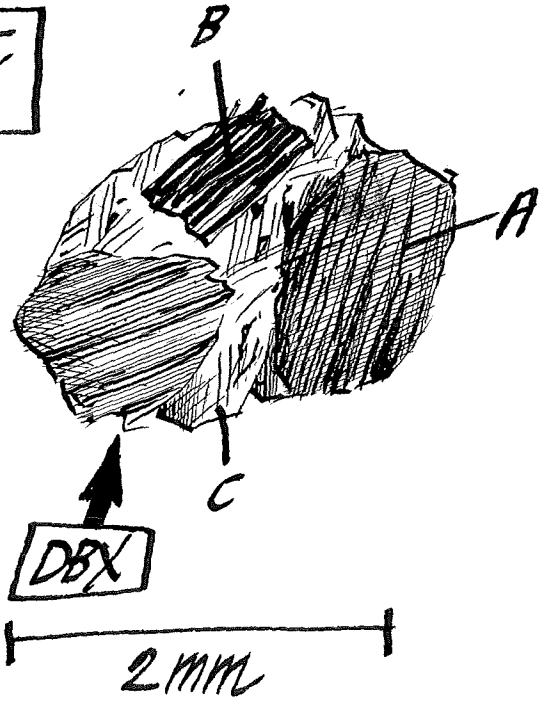
(0.5) VVF chl-ser-qtz-CAL ± py

(97.5) MX/M HBL-BTE GRD, aa

S chl/mica
W ser/fsp
W-M chl/fsp
} • M ~~chl/fe~~ propyk.

5320-5330'

3 LCM
Tr R&S



A. slickensided qtz-ser-chl-altered GG

B. Chloritized Bte Flake

C. White calcite BX CEMENT

0.2 py
0.3 EP
Tr HM

(1') (1.5) GG, CMBX, & DBX

(98.5) MX/M H-B GRD

I.

5330-
5340'

2 LCM
Tr. R&S

(Tf) MS-3A (qtz-plag-bte hornfels)

(11) 

0.3 EP
0.2 py
Tf HM

*** This single chip, by contrast with the associated GRD, is unaltered (fresh bte)

(1) GG & CMBX aa

(99) mxln H-B GRD, aa
• Altn AH

5340-
5350'

1 LCM
Tr R&S

0.5 CMBX aa

(Tr) ~~X. VHF~~ VVF qtz-CAL (-chl, ser, [py])

(99.5) mxln H-B GRD, aa

m-s chl/mfc
w-m chl/fsp.
~~VHF~~ w ser/fsp } • M propyl.

0.3 EP
0.1 py
Tr. HM

5350-
5360'

-All AA ~~&VHF~~ exc s chl/mfc

0.2 EP
Tr. py
Tr. HM

J.

Logging Notes | STEAMBOAT 21B-5 | Hullen Johnson | 01/12/05

5320-5370

3 LCM
1 RUST

(0.5) CMBX [qtz]-ser-chl ± cal, hm, py

(99.5) mx/n H-B GRTD aa
S chl/mfc
W-M chl/fsp
W ser/fsp
} • M propyl

0.3 EP
0.1 py
Tr. hm

5370-5380

1 RUST
LCM

(1.5) ~~CMBX~~, aa

qtz, chl

(1) VVF
- qtz-chl-cal
- ch-QTZ
- qtz-ser-[qtz]

0.1 EP
0.1 py
~~hm~~ 0.1
Tr. cpy

← Looks to be top of broken quartz crystal (milky); coated with 10-50 "spinach-green" chlorite rosettes.

(97.5) H-B GRTD, aa
S chl/mfc
W-M chl/fsp
W-M ser/fsp
} M-S propyl

K.

X

5380-5390'

Tr LCM
0.5 RUST

11

Tr, subtle

(1) MS-34 (fresh bte)

(0.5) CMBX, aa
(Tr) VVF
~~qtz ep~~
~~qtz-chl-ser~~

(98.5) H-B GRTD, aa
M-S propyl.

Tr.
~~0.1 MoS2~~
Tr. cpy
0.5 py
0.7 ep
Tr. HM

5390-5400'

11

cuttings have somewhat "bleached" aspect

(1.5) CMBX -qtz-chl-ser±[py]
-qtz-ser-py

(Tr) VVF aa

(98.5) mxln H-B GRTD, aa
• M-S propyl.

(Tr) Metaquartzite
vitreous, dense mottled lt-med. translucent gray with rare opaque dk. gray specks.

0.3 py
0.5 ep
0.1 Hm

5400-5420

NO SAMPLE (NO RETURNS)

Logging Notes | STEAMBOAT 21B-5 | J. Hulen, S. Johnson | 02/18/05

5420-5430'

Tr LCM ① R&S ① Thick, rough-surfaced goethite ± hem flakes.

0.5 py
0.1 cpy
0.3 ep
Tr MoS_2

(0.5) VVF qtz-cal chl, ep, hm, ① "Fluffy" opal (17) "GLASSY" OPAL

(1.5) "collonaded" scalenohedral calcite ± goethite (scale-like) Tr qtz

① Andesitic volcaniclastic tfs, seds and ~~x~~ lithic-vitric tuff, undivided.

(75) (77) H-B GRTD, aa
M-S chl/mfcs
W-M chl/fsp
VW-W ser/fsp

① MS-3A ② Fresh gray phyllonite

→ REFER TO 5500-~~5520~~ 5510 FOR DETAILED DESCRIPTIONS OF THESE COMPONENTS.

5430-5440'

Tr. LCM Tr CMT ② R&S (1.5) Thick goe-mag flakes

Tr (Tr) MS-3A

(1) ② (2) Volc. seds./tuff, aa ③ (3) phyllonite, aa

(0.5) 0.5 VVF qtz, cal, hm ① (1) "Fluffy" opal aa

① (1) collonaded calcite aa (13.5) ③ "glassy" opal aa

(79) (78) H-B GRTD aa [altn. aa]

5440-5450'

Big Increase in phyllonite and other exotic rock types as well as opal

(Tr) LCM (2) R&S (2) Thick goe-magt. flakes → some w/green paint.

(5) Andesitic volc. mds-ss and lithic-vitric tuff, undivided. comm. brick-red, grayish-red, and grayish-maroon with gray-green clasts. Int. argillized.

0.2 py
0.5 ep

(3) MS-3A (Tr) SCORIA (4) Fresh gray phyllonite

Tr. cpy

(Tr) quartzite. (2) "fluffy" opal (19) "glassy" opal

(Tr) amphibolite (1) "collonaded" scale-like calcite (Tr) cmt

~~(2)~~ (65) H-B GRTD aa. → s chltz. of mfs
W-M " of fsp
W ser of fsp

(1) GG & CMBX qtz-ser-py-chl

5450-60'

(2) CMT (Tr) LCM (3) R&S (1.5) Thick goe-mgnt flakes

also tfcs ss

(4) volc seds/tuff aa — chips commonly well-rounded

(1) cement (7) (8) fresh gray phyllonite. (0.5) VVF

(1) GG & cmbx. (1) QTZT (1) "~~collonad~~" collonade" calcite

(1) MS-3A (2) "fluffy" (opaque, microporous, buff-white) opal

(22) (28.5) "glassy" opal (53) (51) HBL-BTE GRTD, aa (Tr) GABBRO [?]

[altn aa]

Logging Notes

STEAMBOAT 218-5

Hulen, Johnson

02/19/05

5460-5470'

0.1 ¶ cpy
0.5 ep

④ LCM ② R&S ⑪ dk turquoise-colored paint also malachite-green paint.

③ Thick rough-surfaced flakes of goethite-mant. (some w/ paint on one side — clearly artificial) → some of the bright green "paint" could be corroded copper (still, artificial)

② CEMENT

(35) ③ Volcaniclastic (andesitic, mostly) sandy mds to muddy ss and lithic-vitric tuff, undivided: commonly grayish-red to -pink or brick red — intensely argillized; chips/grains commonly well-rounded.

(7) ⑥ Fresh gray phyllonite.

(25) (28) ㉕ OPAL glassy, colorless, ~~#~~ transparent, → to lt-med brnsh-gray → to rarely transl. typically containing ∿ 0.5% uniformly diss., ± FeOx flakes 10-100μ (avg ∿ 30μ) in diameter. Commonly one or more sides of these opal chips have intricately botryoidal to coralline surfaces

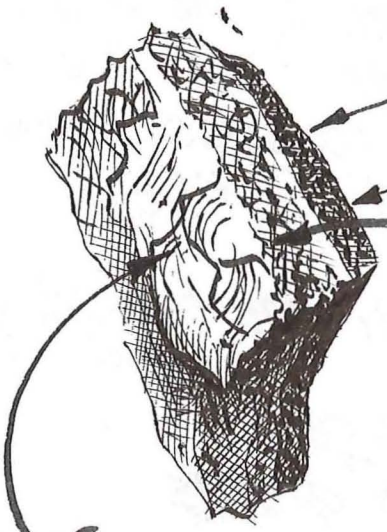
NONE OF THE OPAL IS UNAMBIGUOUSLY ATTACHED TO ACTUAL ROCK.

→ A few opal chips, however, incorate angular to sub-rounded clasts of silicified volcaniclastic ss apparent

② opaque buff-white, pumice-like microporous "fluffy" or "spongy" opal

→New Find←

! This might nail the opal's origin



A. Microgranular Magnetite w/ surface "sheen" of FeS_2 (med-dk gray, submetallic <10μ

B. Microgranular OPAL transl-opaque buff-white & colorless-transparent. Appears to contain a few grains of silt ↳ 30-40μ

C. colorless, transparent opal w/a trace to 0.1% diss. FeOx flakes

① scale-like calcite, as above

TF MS-3A

52 HBL-BTE GRTD, aa

58.5

[alteration aa]

Logging Notes | STEAMBOAT 21B-5 | Hulen Johnson | 02/19/05

5470-5480'

Tr LCM ② R&S ② Thick mgnt-goe flakes and plates

0.2 ep
Tr. py

Tr cement ④ (4.5) volc. seds/tuff aa

(5.5) ⑤ fresh gray phyllonite, aa.

② "fluffy" opal ~~2~~ "glassy" opal ← (27) (28)

~~0~~ quartzite (1.5) (0.5) GG & cmbx

(58) ⑤⑥ H-B GRTD, aa [altn. aa]

5480-5490'

Tr. LCM ② R&S ① mgnt-goe flakes.

0.3 py
0.5 ep

① cement

~~0.5~~ (1) GG, chltc.

⑤ volc. seds/tuff aa

⑥ phyllonite aa

1/

③ scale-like calcite, aa

② "fluffy" opal, aa (24) ㉓ "glassy" opal

Tr ~~qtzt~~ ⑤⑥ (59) H-B GRTD, aa

Logging Notes

STEAMBOAT 21B-5

J. Hulen
S. Johnson

02/15/05

5500-5510'

Complex Sample; Multiple Components

(A) LCM – Cottonseed hulls & fibers – 3 %

(B) Rusted steel shavings – ~~3~~ 1 %

(C) Coarse, magnetite-goethite flakes "bumpy" surfaces, up to 3 x 3 x 1 mm. magnetic, with the appearance of scale 2 %

1 py
0.3 cpy

(D) Cement – 1 %

(E) Red volcaniclastic silty to sandy tuffaceous mudstone (possibly a "dirty tuff"); medium grayish-red to grayish-maroon; punky, int. argillized. 2 (2) %

← also less commonly grnish-gray.

(F) Tuffaceous ss, rel. clean, mostly qtz. & fsp, vfg, friable, lt. grayish-pink to buff-white Tr (Tr)

(x) = recalc. to eliminate unambiguous component [e.g., LCM]

a)

(G) Porphyritic andesite, med. grayish-red to grayish-maroon (like tfcs. mds.) w/ buff- to faintly greenish-white opaque argillized (clay-sericitized?) phenocrysts. Tr (Tr)

(H) Qtz-plag. biotite hornfels, speckled brown & transl. to opaque lt-med gray to buff-gray. 1 (1) %

(I) Qtz-fsp-bte PHYLLITE or PHYLLONITE 6 (7) %

v. f. x/n (< 100 μ; mostly < 50 μ), med-dk, seemingly bluish-gray — shiny/sparkly strongly foliated & lineated

- Note: the dark gray biotite in this rock is anomalous for the system's Mesozoic metasediments, in which biotite is usually brown.

(J) Hbl-Bte GRANITOID (mx/n) and its crystalline constituents 55.5 (62.5) %

M-S chltz. of mfcs. W-M chltzn. of plag.

W-M ser. of fsps

6)

Logging Notes

STEAMBOAT 21B-5

J. Hulen
S. Johnson

02/15/05

5500-5510' cont'd

(K) "spongy" microporous OPAL (& vxlh. quartz) buff-white, opaque to feebly translucent.

2 (2) %

→ to med. gray

→ to transl.,

(L) glassy, colorless, transparent OPAL mostly loose, angular chips up to ~~*~~ 5 mm in dia. Many of these chips have one or more surfaces that are intricately botryoidal to coralline. ~~XX~~ ~1/5 of these opal chips are cloudy & contain dissem., angular chips and flakes (mostly <100μ) of a black metallic substance.

- Many chips thinly encrusted with the "spongy" opal described above. ——— on rare such chips the "spongy" opal is green-stained

22 (24) %

c)

(M) "spongy" ~~mica~~ μxln, μporous calcite buff-white, identical to "K" opal otherwise — has the appearance of scale.

1 (1) %

(N) bladed? calcite — platy chips consisting of translucent grayish-brown xls. growing from a flat brownish-orange to dark brownish-gray 20-100μ FeOx substrate. (non-magnetic

Tr (Tr)

(O) Microbreccia — clasts of the red volcaniclastic sediment described above [E & F] embedded in fxln-mxln transl. pink to white calcite. 0.5% (0.5)

(P) GOUGE — qtz-ser(ch) ± cal. totally altered — med. gray-green. commonly slickensided; a few lenticular chips slickensided both sides. up to 4x4x1.5 mm

1% (1)

some chips foliated like this.

also some clearly with GRTD protolith. pale grish-gray

Logging Notes | STEAMBOAT 218-5 | J. Hulen, S. Johnson | 02/15/05

5500–5510'

Observations bearing on the origin of the OPAL in this sample

- None is unambiguously attached to rock. A few chips may be opal-veined, but this will need to be checked using SEM
  - A few opal chips, however, encapsulate angular, lt. gray to buff-white, <0.5-mm chips of uncertain composition.

5510–5520

Ⓐ LCM – 1 Ⓑ Rusted Steel – 3 (0.3 ep) (1 py, 0.2 cpy, tr. MoS2)

Ⓒ Magnetite-goethite flakes – 2 Ⓓ cement – ~~1~~ 0.5

Ⓔ Red volcaniclastic tuffaceous mudstone — 1 (1)

Ⓕ Tfcs. volc. ss — 1 (1)

Ⓖ Pdytc. Andesite — 0.5 (0.5)

Ⓗ HNFLS (MS-3A) — ~~tr~~ 0.5 (0.5)

Ⓘ PHYLLITE or PHYLLONITE – 7 (8)

Ⓙ HBL-BTE GRTD. – 7 altn PA 55 [52]

e)

5510-5520, cont'd

Ⓚ "spongy" opal — 2 (2)

Ⓛ glassy opal — 23 (25)

Ⓜ "spongy" calcite — 1 (1)

Ⓝ ~~DK~~ stubby-prismatic calcite w/ FeOx (limonite) flat substrate — 0.5 (0.5)

Ⓞ Microbreccia —

Ⓟ Gouge, chloritic, as above — 1 (1)

Ⓠ Metaquartzite, gray to gray-buff to greenish-gray — 0.5 (0.5)

Ⓡ Paint — trace.

5520-5530'

② LCM ③ R&S ② mag-goe flakes [0.5] 0.5 vBX

② cmt ③ [3] ftfs volc ss — mostly andesitic to mds comm. brick red to maroon w/ gray-green lithic clasts. 0.5 [0.5] qtzt

0.5 py
Tr. cpy

② argill'd. andesite & pplytic brec. [2]

Tr MS-3A [0] ⑨ Phyllite or Phyllonite gray, fresh, aa

Tr ep

48 [54] H-B altn. aa GRTD, aa [1] ① "spongy" opal [26] 24 "glassy" opal

Tr "spongy" calcite

② stubby-prismatic [2] calcite aggr. on flat FeOx substrates

① [1] CHLTC. GG

f)

STEAMBOAT 21B-5

02/16/05

5530-5540'

③ LCM
⑤ R&S
② cement
[Tr] Tr MS-3A
[9] ⑧ phyllite or phyllonite – fresh, sparkly, lineated, med.-dk. gray

≠ coarse, "nubbly"
② Goethite-magnetite flakes

0.7 py
Tr. ep
Tr. cpy

[2] ② tfcs andesitic muddy ss & sandy mds. grayish-red, grayish-maroon, and grayish-green, int. argillzd or clay-sercitzd.

[53] ㊻ [altn. aa] HBL-BTE GRTD.

[2] ② "spongy" calcite → both scale-like in appearance

[4] ③ "spongy" opal

[30] ㉖ glassy opal

[also a few composite "scale" chips]

≠ some of these are clearly artificial, coated one side with flexible Cu-green paint

---

5540-5550'

④ LCM
② R&S
② Magnetite-Goethite flakes, aa
② cement

[3] ③ (comm. andesitic) volcaniclastic, poss. tfcs, mudstone, siltstone, and sandstone. ≠ Wide range of colors aa, w/addition of gray-buff & buff-white

[1] ① MS-3A
[9] ⑧ PHYLLONITE, fresh, aa

[1] (some rounded) ① METAQUARTZITE
[Tr] Tr "spongy" calcite

Tr DBX – phyllonite & frags. in milky qtz

Tr. MoS_2
Tr. cpy
1 py
Tr. ep

[1] ① "spongy" opal
[23] ㉑ "glassy" opal

55 H-B GRTD, aa [altn aa] [62]
Tr GG [Tr]

9)

5550-5560'

Dramatic Increase in the % of fresh biotite — suspect new granitoid devoid of hornblende. say, BIOTITE GRANITE

0.5 ep	0.1
1 py	☆☆ MoS_2
Tr. cpy	

① LCM
③ R&S
① Thick goethite-magnetite flakes
② Cement
② Volcaniclastic sandy mudstone to muddy ss and grit. Intensely argillized. Range of colors incl. grayish-red & -maroon; grayish-green
• Many of these chips distinctly rounded

[2] ② Metaqtzt — some chips also rounded
[2] ② "spongy" or "fluffy" opal, opaque buff-white, aa
[16] ⑮ "glassy" opal, aa
[1] ① MS-3A [5] ⑤ Fresh gray phyllonite as above. w/ 1% disseminated cubic pyrite porphyroblasts <0.5 mm

~~20~~ 15 [16] BTE GRANITE
(assuming ~4% loose fresh bte flakes are not LCM.
tr-VW chl/bte.
tr. chl/fsp; ser/fsp.

~~~~ [56] HBL-BTE GRTD, aa
M-S chl/tzn. of bte/hbl
W-M " " fsp
W- ser/fsp.
~~~~

Logging Notes

STEAMBOAT SB21B-5

Hulen, Johnson 02/16/05

5560-5570'

④ LCM ③ CMT
③ R&S ① Goe-Mgt Flakes
[1] ① volcaniclastic seds, aa
[2] ② MS-3A
[0.5] 0.5 "Fluffy" opal (scale-like)
[Tr] Tr " calcite (")
[15] 13 "Glassy" opal ("; hyalite)
[3] ③ Fresh gray phyllonite
[16.5] ~15 BIOTITE GRANITE, aa [altn aa]
[62] ~54.5 H-B GRTD, aa [altn aa]

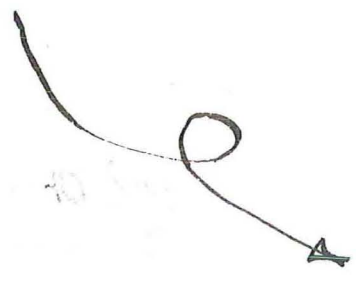
0.3 py
Tr cpy
0.1 ep.

Incompletely Washed

5570-5580'

~~⑦~~ LCM ① Goe-Mgt Flakes
④ R&S ② CMT
[1] ① Metaqtzt. ② Volcaniclastic [2] Seds., aa
[2] ② MS-3A [8] ⑦ phyllonite, aa
[17] 15 "Glassy" opal; [1] ① "Fluffy" opal, aa
[8] ~7? Biotite Granite, aa (a guess, really)
[61] ~51 H-B GRTD, aa [altn. aa.]

0.2 cpy
0.7 py



2)

5580-5590'

③ LCM
⑥ R&S

② Goe-Mgt thick flakes

② Cement

chips commonly rounded.

[5] ④ Volcaniclastic Sediment, aa int. argillized.
[1] ① Andesite, aa, int. argllzd., grayish-pink.

0.1 py
Tr. cpy
Tr. ep

[4] ③ MS-3A, aa
[Tr] Tr Metaqtzt.

[5] ④ Phyllonite, aa.
[Tr] Tr Green Paint

[1] ① "Fluffy" opal
[17] ⑮ "Glassy" opal

~~U 30~~ BTE GRANITE, aa
[29] 25 fresh

~~U 29~~ H-B GRTD, aa
34 [altd. aa]

5590-5600'

④ LCM
⑤ R&S
① Goe-Mgt Flakes
① Cement

[7] ⑥ Str. argillized volcaniclastic (mostly andesitic) seds, aa - may include andesitic vitric-lithic tuff (aka matrix)

0.4 py
Tr qtz
0.3 ep

1/2 on T. seds
€ gg

[3] ③ MS-3A
[Tr] Tr Meta-qtzt.

0.5 ~~X~~ chloritic gouge
[0.2]

[5] ④ fresh gray phyllonite aa

U 20 BTE GRANITE, aa fresh
[22.5]

57.5 H-B GRTD aa
[38.5] [altn. aa]

17 OPAL

i)

Logging Notes

STEAMBOAT 21B-5

Hulen Johnson

02/16/05

5600-5610

Fresh Biotite Granite definitely more abundant

0.3 py
Tr cpy
Tr MoS_2
0.2 ep

(2) LCM (5) R&S (3) CMT (1) Goe-Mgt Flakes (Thick)

[2] (2) Volcaniclastic seds. [0.5] (0.5) GOUGE, chlte some hmtte

[0.5] (0.5) MS-3A (3) phyllonite, aa

(1) on Tseds

[1] (1) "Fluffy" opal, aa (Tr) blocky/prismatic calcite & FeOx flat substrate

[Tr] (Tr) Metaquartzite

[15] (13) "Glassy" Opal, aa

[28] ∪25? H-B GRTD, aa

∪44? [53] BIOTITE GRANITE, aa fresh

5610-5620'

chips of the new granite itself appear — w/ fresh biotite

(1) GG [1]

0.3 py
Tr cpy
0.2 ep

(4) LCM, aa
(7) R&S, aa
(1) Mgt-Goe, Flakes, aa
(2) Cement
[17] (15) "Glassy" opal
(1) "Fluffy" opal [1]

★ [9] (9) Volcaniclastic seds & vitric-lithic tuff, aa. ** chips commonly well rounded; less commonly sheared & slickensided.

[1] (1) Metaquartzite.
[2] (2) MS-3A
[6] (5) Fresh gray phyllonite aa
• veined w/calcite, qtz (-py, cpy) — poss. opal

∪20 [23] H-B GRTD altd., aa

∪33 [37] Fresh Bte Granite

5620-5630'

④ LCM
⑦ R&S

① CEMENT

0.5py
0.3ep

② Mgt-Goe Flakes aa

[8] ⑦ volcaniclastic (andesitic, commonly) sediments & lithic-vitric tuff, undivided. strongly argillized (or clay-sericitized) and chloritized

- chips commonly rounded
- chips commonly sheared & slickensided
- Various colors — most common are grayish-red & maroon, and gray-green (chloritic)

~~②~~ ③ MS-3A [3]

① Meta-qtzt [1]

[11] ⑨ phyllonite, med-dk. gray, foliated/lineated, fresh, but commonly cut by < 1-mm milky quartz and calcite veinlets.

[16] ⑭ "glassy" opal [1] ① "fluffy" opal

[2] ② calcite-cmtd crush-microbreccia & gouge ~~clast~~ clasts MS-3A & H-B GRTD.

④20 [23] ? BTE GRANITE

④29 [36] HB GRTD aa

e)

Logging Notes

STEAMBOAT 218-5

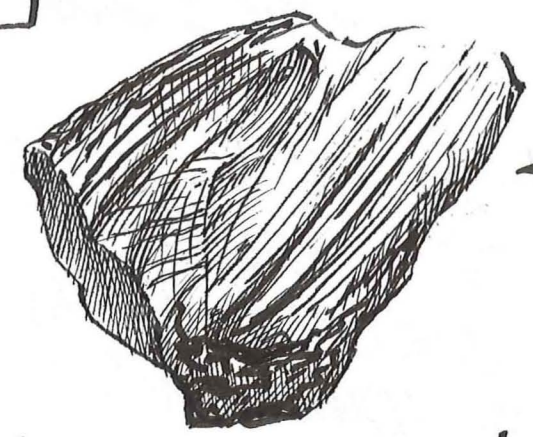
Hulen
Johnson

02/16/05

5630-5640'

NO SAMPLE → No: found it see end of log

5640-5650'



gray-brown & gray-green, shiny, heavily slickensided andesitic tuff — common in this sample

0.5 py
0.2 ep

[Andesitic]

[11] (10) Volcaniclastic mds/slts/ss and lithic-vitric tuff undivided. aa, but more extensively sheared & slickensided (see illus). grayish-red, -maroon, & -green the most common colors. Intensely argillized. A few chips moderately- to well-rounded.

[1] (1) Andesite — chips visually similar to volcaniclastic

(2) LCM

(6) ~~(5)~~ R&S

(2) Mgt-Goe flakes

(Tr) cement

(3) GOUGE & CMBX

[3]
- gray-green, chloritic
- lt. gray to buff-white, qtz-ser-py

m)

[2] ② ~~④~~ VVF —
-cal
-qtz (sugary)

[1] ① QTZT (?) could be sugary vein quartz

[13] ⑫ Phyllonite, med-dk gray, strongly foliated & lineated; "sparkly"; mod. veined with quartz (msv milky to sugary) & minor transl. white calcite.

FRESH, unaltered; looks more like cataclasite ~~to pc~~ than a metamorphic rock.

[26] ㉓ "Glassy" opal

[2] ② "fluffy", opaque buff-white opal

[1] ① Blocky to stubby-scalenohedral, brown to yell.-gray calcite as aggregates (plate-like) of xls. growing sub-⊥ outward from filmy, FeOx (earthy) flat substrates

[23] ㉓ 420? BTE GRANITE
-fresh

[17] ㉓ 415? H-B GRTZ as above

Tr green paint

n)

Logging Notes

STEAMBOAT 218-5

Hulen Johnson 02/16/05

"CLEANER"

5650-5660'

Tr LCM ③ R&S

0.3 ep
0.5 py

① Goe-mgnt "thick" flakes

Tr cement

[9] ⑨ volc. seds/tuff, aa, commonly red

[1] ① chltc. gouge, aa (& cmbx)

[1] ① VVF qtz, cal

[9] ⑨ Fresh gray phyllonite aa

[18] ⑰ "Glassy" opal, aa

[1] ① "spongy" opal, aa

[1] ① scale-like calcite, as above.

~10? [10] HBL-BTE GRTD [altn aa]

47 [50] Fresh BTE GRANITE aa

5660-5670'

Much Finer & Fresher cuttings

0.3
0.5 ep
~~py~~
~~MoS_2~~
0.1

Tr LCM Tr Mgt-Goe "thick" flakes Tr cement

[1] ① R&S

[2] ② volc. seds/tuff, aa Tr [Tr] Gouge, aa

[4] ④ phyllonite, aa [7] ⑦ "glassy" opal

[Tr] Tr "spongy" opal [81]

~5? [5] H-B GRTD, aa

81 Fresh BTE granite aa BLACK BIOTITE

Discrete ductile flakes; blue-gray metallic ≤ 1m x 0.1 mm

5670-5680'

Tr LCM
2 R&S
Tr mgt-goe flakes
[4] 4 volc. seds./tuff, aa
[Tr] Tr chltc. gouge & cmbx, aa
[Tr] Tr MS-3A [2] 2 phyllonite aa
[5] 5 "glassy" opal aa
[Tr] Tr H-B GRTD aa
87 BTE GRANITE aa
[89] W chl/bte
VW chl/fsp
VVW ser/fsp

0.5 pg
Tr. cpy
0.2 ep

5680-5690'

Tr LCM
2 R&S
Tr mgt-goe flakes
Tr cement
[Tr] Tr qtzt [2] 2 volc. seds/tuff
[Tr] Tr VVF [1] 1 phyllonite aa
[5] 5 "glassy" opal
[5]
92 BTE GRANITE
[94] aa [altn. aa]

Tr MoS_2
0.3 ep
0.5 pg

FIN

Logging Notes

STEAMBOAT 218-5

Hulen Johnson

02/19/05

ADDENDUM

0.5
~~EP~~ EP
0.2 PY

5630-5640'

(Tr.) LCM (4) R&S (2) Thick flakes of goe-mgnt

(1) CMT

(3) Andesitic volcaniclastics & lithic-vitric tuff undivided. reddish to greenish, ~~X~~

(4f) on

(1) MS-3A (Tr) Granitoid grit grains

(5) Phyllonite, fresh; gray; aa.

(1) GG & cmbx (0.5) VVF (1) "Fluffy" opal aa

(23) "Glassy" opal, aa

microporous, spongy, opaque buff-white.

(4 23.5) BTE GRANITE [fresh]

(4 36) HB-BTE GRD, aa [altn. aa]