

SSGF WELL DEL RANCH 8

DR-8



Well Del Ranch-8, Lithology & Mineralogy, Recalc. to 60-ft Intervals JH 01/28/05

cvd	Euhedral Hydrothermal Crystals	Ostracods	Redbeds	Shearing	Slickensides	Alternate Interval	Depth Interval	GRVL	SS CHL/SS	MDS & SLTS	NOD ANH	GYP	GG & μBX	VNLTS	CA/MDS	CA/SS	EP	AC	PY	HM	SP	GN	CPY	CV	CMT
						65'	0-375' (NS)																		
							375-440'		22	17	1				VS	VS									60
							440-500'		49	5	7				VS	VS			Tr						39
							500-560'		42	17	9	1			VS	VS			0.6						31
							560-620'		-	65	34	1			VS	VS			1.5						
		X					620-680'		2	84	14				VS	VS			0.2						
		X					680-740'		-	96	4				VS	VS									
		X					740-800'		40.5	58	1.5				VS	VS								CV	
		X					800-860'		87	13					S	S								CV	
		X					860-920'		46.5	53	0.5				S	S			Tr					CV	
		X					920-980'		24	76					S	S								CV	
							980-1040'		19	81				Tr	M-S	M-S			Tr		Tr				
		X					1040-1100'		67/W	33	Tr (cvd?)				M	W-M			Tr						
		X					1100-1160'		66/W	34					W-M	W-M			Tr						
		X					1160-1220'		70/W	30					M	W-M			Tr				Tr		
		X					1220-1280'		57/W-M	43					W-M	W					0.1		Tr		
							1280-1340'		72/W	28					M	VW									
							1340-1400'		56/W-M	44					M	-			Tr						CV
							1400-1460'		78/W-M	22					W-M	-			0.5		0.3	0.1	Tr		CV
							1460-1520'		71/VW	29					M-S	W-M			0.2						CV
							1520-1580'		33	67					S	M									
							1580-1640'		85	15					M-S	M									
							1640-1700'		40	60					M-S	W									
							1700-1760'		20	80					M-S	W									
							1760-1820'		27	73					M-S	W									
							1820-1880'		72	28					M-S	W									
							1880-1940'		75.5	24	0.5				M-S	W									
							1940-2000'		43	57	Tr				M	W									
							2000-2060'		43	57					S	-									
							2060-2120'		40	60					M-S	M									
?	?						2120-2180'		20	80	Tr				S	M-S									
							2180-2240'		38	62					S	S									
							2240-2300'		66	34	Tr				S	M-S									
							2300-2360'		57	43					S	M									
							2360-2420'		64	36	Tr				S	M									
							2420-2480'		2.5	96	1.5				S	M			0.1						
							2480-2540'		1	94	5				S	M			0.6						
							2540-2600'		9	91	Tr				S	M			0.3						
							2600-2660'		50	49.5	0.5				S	M									
							2660-2720'		55	45					S	M-S	Tr								
							2720-2780'		24.5	75	0.5				S	W-M			0.2					Tr	
							2780-2840'		40	60					S	S			Tr					Tr	
							2840-2900'		43	57					S	M-S	0.2		0.1					Tr	
							2900-2960'		57	43					M	M	0.3		0.3					0.1	
							2960-3020'		51	49					M	M	Tr		0.2						
							3020-3080'		34	66					S	M-S			0.3						
							3080-3140'		36	64					S	M-S			0.2						
							3140-3200'		93 ^{mg/VW}	7					S	M			0.2						
							3200-3260'		40/VW	60					S	M			0.2						
							3260-3320'		67	33					S	M-S			0.2		0.1				
					X		3320-3380'		65/W	35					M-S	W-M			0.1						
							3380-3440'		86/W	14					W-M	W	Tr?		0.2						
					X	52'	3440-3500'		31/VW	68.5		0.5			W-M	W									CV
						50'	3500-3550'		15	85					S	M			0.1						
							3550-3610'		14	86					S	M									
							3610-3670'		27	72	1				M-S	M-S			0.2						
							3670-3730'		5.5	93	1.5				S	M			0.2						

Well Del Ranch-8, Lithology & Mineralogy, Recalc. to 60-ft Intervals JH 01/28/05

cvd	Euhedral Hydrothermal Crystals	Ostracods	Redbeds	Shearing	Slickensides	Alternate Interval	Depth Interval	GRVL	SS CHL/SS	MDS & SLTS	NOD ANH	GYP	GG & μBX	VNLTS	CA/MDS	CA/SS	EP	AC	PY	HIM	SP	GN	CPY	CV	CMT
X					X		3730-3790'		45/W-M	54	1			1	M-S	W-M			Tr					0.5	
X							3790-3850'		9/VW	91	Tr			Tr	M-S	W-M			0.8					0.1	
X					X		3850-3910'		33.5/W-M		Tr			0.5	M	W	Tr		0.5					0.1	
							3910-3970'		24/VW	76	Tr			Tr	S	M	Tr		0.2					Tr	
							3970-4030'		4	96	Tr				M-S	M			0.1						
							4030-4090'		48/W	52					M	W-M	Tr								
							4090-4150'		30/VW	70					M	M			0.1						
				X	X		4150-4210'		43/VW	57		Tr			M	M									
							4210-4270'		32	68					M	M			0.1					0.1	
						90'	4270-4360'		38/VW	62					M	M			Tr					Tr	
							4360-4420'		73	27		Tr			M	M									
							4420-4480'		51.5/W-M	48				0.5	W-M	W			Tr					0.1	
							4480-4540'		46	54					M	M			0.3					0.1	
							4540-4600'		40	60					M	M									
							4600-4690'		63	57					M	M			0.1						

Well Del Ranch 8 Lith & Mineralogy Recalc. to 60-ft Internals

JH 01/28/05

DEPTH INTVL (NS)	GRVL	49	NDS # (SPTS)	NDS AMT S/P	66 JBX	VALTS	CR/ NDS	CR/ 49	EP	AC	PI	HM	SP	SN	CPY	Notes
0-375																(CMT)
375-440		22	17	1			VS	VS								(6)
440-		49	5	7			VS	VS			(T)					(3)
500-		42	17	9			VS	VS			0.6					(3)
560-		-	65	34			VS	VS			1.5					
620-		2	84	14			VS	VS			0.2					
680- (R)		-	96	4			VS	VS								
740- (R)		40.5	58	1.5			VS	VS								(CV)
800- (R)		87	13				S	S								(CV)
860- (R)		46.5	53	0.5			S	S			Tr					(CV)
920- (R)		24	76				S	S								(CV)
980-		19	81			(T)	M-S	M-S			Tr		(T)			
1040-		67	33				M	W-M			Tr					
1100- (R)		66	34				W-M	W-M			Tr					
1160- (R)		70	30				M	W-M			Tr					(T)
1220- (R)		57	43				W-M	W					(0.1)			Tr
1280-		72	28				M	VW								
1340-		56	44				M	-			Tr		Tr			(CV)
1400-		78	22				W-M	-			0.5		0.3	(0.1)		(CV)
1460-		71	29				M-S	W-M			0.2					(CV)
1520-		33	67				S	M								
1580-		85	15				M-S	M								
1640-		40	60				M-S	W								
1700-		20	80				M-S	W								
1760-		27	73				M-S	W								
1820-		72	28				M-S	W								
1880-		75.5	24	0.5			M-S	W								
1940-		43	57	Tr			M	W								
2000-		43	57				S	-								
2060-		40	60				M-S	M								
2120-		20	80	Tr			S	M-S								
2180-																

e2 cid?

Well Del Ranch-8, Lith & Mnrlgy. Recalc. to 60-ft Intervals

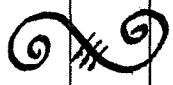
GRVZ	SP	NDS # (SIS)	NOD RANK	GR # NDS #	WNLTS	CO / MDS	CR / SP	EP	AL	PY	HM	SP	SN	CPY	(CV)
2180-	38	62				S	S								
2240-	66	34	TR			S	M-S								
2300-	57	43				S	M								
2360-	64	36	TR			S	M								
2420-	2.5	96	1.5			S	M			(0.1)					
2480-	1	94	5			S	M			0.6					
2540-	9	91	TR			S	M			0.3					
2600-	50	49.5	0.5			S	M								
2660-	55	45				S	M-S	(TR)							
2720-	24.5	75	0.5			S	W-M			0.2				(TR)	
2780-	40	60				S	S			TR				TR	
2840-	43	57				S	M-S	0.2		0.1				TR	
2900-	57	43				M	M	0.3		0.3				0.1	
2960-	51	49				M	M	TR		0.2					
3020-	34	66				S	M-S			0.3					
3080-	36	64				S	M-S			0.2					
3140-	* 93 ^{mg} vw	7				S	M			0.2					
3200-	40 ^{vw}	60				S	M			0.2					
3260-	67	33				S	M-S			0.2		0.1			
3320-	65 ^w	35				M-S	W-M			0.1					
3380-	86 ^w	14				W-M	W	TR?		0.2					
3440-	31 ^{vw}	68.5		(0.5)		W-M	W								
3500-	15	85				S	M			0.1					
3550-	14	86				S	M								
3610-	27	72	1			M-S	M-S			0.2					
3670-	5.5	93	1.5			S	M			0.2					
3730-	45 ^{w-m}	54	1		(1)	M-S	W-M			TR				(0.5)	
3790-	9 ^{vw}	91	TR		TR	M-S	W-M			0.8				0.1	
3850-	33.5 ^{w-m}		TR		(0.5)	M	W	(TR)		0.5				0.1	
3910-	24 ^{vw}	76	TR		TR	S	M	TR		0.2				TR	

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VA
VA (50-ft)
#

Well Del Ranch-8, Lith & Mineralogy Recale. to 60-ft intervals JH 01/28/05

GRVL	SS / chl / %	MDS # (size)	MOD RHY	GS JST	VNLTS	CP / MDS	CP / %	EP	PC	RY	HIM	GR	GN	CPY	(C)
3970-	4	96	Tr			M-S	M			0.1					
4030-															
4030-	48/W	52				M	W-M	(Tr)							
4090-	30/VW	70				M	M			0.1					
4150-	43/VW	57		Tr		M	M								
4210-	32	68				M	M			0.1				0.1	
4270-	40/VW	60				M	M							Tr	
4300-	36	67		Tr		M	M			0.1					
4360-	73	27				M	M								
4420-	51.5/W-M	48			0.5	W-M	W			Tr				0.1	
4480-	46	54				M	M			0.3				0.1	
4540-	40	60				M	M								
4600-	63	37				M	M			0.1					
4690-															



WELL DEL RANCH-8, REDRILL, Lith. & Min. Recalc. to 60-ft intervals
 JH 01/28/05 intervals

GRIL	SS	MDS# (SITE)	NOD RANK	GS JBR	VALTS	CP/MDS	CP/SS	EP	AC	PI	HIM	SR	GN	CPY	(2)
(90) 2880-2970	49	51	TR			S	M	0.1		TR					
2970-3030	48	52				S	M	TR		0.1					
3030-3090	34	66				S	M	TR		TR					
3090-3150	35	65				S	S	TR		0.3					
3150-3210	77 _w	23				W-M	W-M			TR					
3210-3270	46 _w	54				W	W-M			0.2					
3270-3330	67 _{vw}	33				W-M	W-M			0.1					
3330-3390	71	29				S	M								
3390-3450	80	20				S	S			TR					
3450-3510	60	40				S	S								
3510-3570	66	34				M-S	W-M								
3570-3630	80	20				M-S	W-M								

J. Hulen binoc. mic.
logging notes

DR-8 12/20/02

75-380':

~~5 pp~~
5 pbbles &
pbb. frags
85 CMT
(some
incorporating
rond.
pebbles)

③ mds, matte
lt. grysh-
orange

% of
indigenous

→ ③ 30%

5 AN

① 0.5 nodular anhydrite,
white, opaque

→ ① 5%

① sltst, matte lt
grysh-orange

→ ① 10%

⑤ 5.5 ss (to coarse
slts) v. fgr (avg \approx
0.1 mm), matte lt.
buff-orange overall

→ ⑤ 55%

380-
410'

80 CMT aa
5 pbbles aa
Tr Alum.

indigenous			
② nod AN	15 slts	15 53 mds	aa 30 ss
⊙	⊙	aa ⊙	⊙

2 AN



410-
440'

40 cement
3 plastic
foam?

• Many chip clusters
cemented with vitreous
colorless, vesicular plastic (?)

Tr py
2 AN

② nod AN	5 slts	15 mds	78 muddy sand / ss
⊙	⊙	⊙	v fgr (avg \approx 0.1 mm), overall matte, sl. grayish orange
matte lt. grsh. orange	matte lt. grysh. orange		

①

DR-8, cont'd.

both white opaque, vxn
& transl. gray vxn (res/rd.)

440-470'
12% CMT

4 nod AN	13 s/ts	15 mds	68 ss
	aa	aa	aa
			v.f-f gr. (avg. v.d. 1 mm)
			matte, lt., grayish-pink to grayish-orange

4 AN
0.2 py

→ mstly matte, lt.
sl. grayish-orange;
w/ 1/10 matte, lt.
sl. yel.-gray

py vxn, assoc w/ AN nodes ▲

470-500'

65% CEMENT

8 nod AN	6 s/ts	9 mds	12 ss

23 AN
1 py

23 nod AN 17 s/ts 26 mds 34 ss +
recalc. indigenous
of
very approx

4

500-530'

55% CEMENT

13 nod AN	1 gyp. hoppers	7 s/ts	25 mds	54 v.f-gr. ss
				lt. orange to grsh.-org.

13 AN
0.5 py

530-560'

next page

2

530-560'
 (7% CEMENT)

(2) gyp. hopper xls
 $\leq 5 \times 1 \times 0.7$ mm
 colorless, transp. to translucent

(15% nod AN)
 ≤ 10 mm

74 mds,
 w/ 1/2 ea. matte
 lt. grsh. orange
 & matte
 lt. yell. gray

955
 22

2 GYP
 15 AN
 1 py



uxln. pyrite columnar aggregate origin unknown



560-590'
 (2) CMT

(35) AN (nod & xln)

\leq ~~6mm~~
 6mm.

white & pague, uxln ovoid, warty surface, lt.-med. gray, transl. prismatic xl. intergrowths. comm. intgrown. w/ py

rextzd. nodes comm. v. porous (15-20% ϕ)
 Δ ? of v. soluble evap. phases

(3)

(65) mds

1/5 matte lt. sl. yell. gray
 1/5 matte, lt. sl. grysh-orange

1.5 py
 Tr. comm.

py uxln, comm. black, intergrown w/ & growing on anh.

bacterial SO_4^{2-} reduction



DR-E, cont'd.

590-620' : (33) nod & xln ANH / 1 gyp hoppers / 66 mds
 (aa) mostly sl. yel. gray
 1.5 py / 33 AN / 1 gyp
 ≤ 6 mm
 xln = vext. red. ↑

620-650 Tr. pbbls (15) nod AN
 > 95% xln white opaque
 85 mds 795% matte, lt., sl. yel. gray
 < 5% grsh-orange AA
 Tr. py / 15 AN
 ≤ 8 mm

650-680' (13) nod AN
 84 mds (3) ss VFG, lt. grayish-red, quite well indurated
 0.3 py / 13 AN
 ≤ 9 mm

680-710' (5) nod AN
 2 slts 93 mds, reasonably well-indurated
 3/5 bright grayish-red "redbed" matte but
 2/5 matte, lt., sl. yell.-gray AA
 5 AN

(4)

△

✓ Hulen binoc. mic.
logging notes

DR-8

12/20/02

710-~~715~~
740'

^{aa}
2 nod. / 2 slts
AN

96 mds
7/10 matte but
quite bright
grayish-red
3/10 matte, sl.
yel., lt. gray

2AN



740-
770'
u15 CVD

2 nod.
AN

3 slts
aa
⊙
≡

74 mds
u 3/5
grsh.-red
u 2/5 lt.
yel. gray
aa, ⊙
≡

11 ss
v.fgr (avg. u0.1 mm)
buff-white to
v. lt. buff-gray
⊙
≡

2AN

some nod.
w/ grayish-red
mud clinging

770-
800'
Tr.
paint

1 nod.
AN
all
opaque
white

3 slts
aa
⊙
≡

25 mds
aa
same
proportions
⊙
≡

71 ss ^{u0.4 mm}
v.fgr (avg. u0.1 mm)
red. clean
mostly matte
lt. grayish-pink

1AN



● CHANGE

800-
830'
u15 CVD

7
slts
⊙
≡

3 mds
aa

90 ss ^{u0.6 mm}
fgr (avg. u0.15 mm)
lt. grayish-pink
"REDBED"
quite "clean"

830-
860
u40% CVD
chips up
20 mm
dia

9
slts
⊙
≡

7 mds
aa
⊙
≡

84 ss
aa
lt. grayish-pink

⑤



OVER



DR-8, cont'd.

860-895'

1 med AN	13 slts mostly lt. yel. gray ⊙	33 mds 3/4 lt. yel. gray 1/4 grush-red ⊙	53 ss aa ⊙ III lt. grsh-red
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1 AN
Tr pr

890-920

≤ 17 CVD

=	17 slts aa ⊙	42 mds aa 1/2 grush-red 1/3 yell. gray ⊙	41 ss ⊙
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920-950

≤ 20 CVD

7 slts aa ⊙	62 mds 1/2 ea grush-red & lt. yel.-gray	31 ss ⊙
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950-980'

13 slts ⊙	70 mds aa 1/2 ea red & yel.-gray	17 ss ⊙
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980-1010'

21 slts	66 mds	13 ss	Tr VVF (sp)
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0.3 SP
0.1 AN

all a mixture of light gray & lt. grayish-red to lt. grayish-maroon

⊙ sp is transl. lt. brown: one vein fragment is 2x2x0.5 mm.

J. Hulen binoc.
mic. logging notes

DR-8

12/21/02

● CHL appears in ss matrix

1010-1040'

21 slts | 54 mds | 25 ss

⊙±

⊙

~~⊙±~~

⊙±

Tr. py

→ dom. lt. graysh-buff to lt. graysh-green
f. gr. (avg \approx 0.1 mm), argillaceous
many chips conspicuously chloritic

→ mds & slts. mix of matte lt.
yellowish- to greenish-gray
& matte lt. grayish-red ("redbed")

1040-1070'

Tr. pbbles,
cmt,
R&S

⊙
Tr.
nod
AN

13 slts
⊙±

17
mds
⊙

71
ss
⊙±

→ fgr (avg. \approx 0.1 mm, \leq 0.4 mm)

\approx $\frac{3}{4}$ lt. grayish-green
pearlescent
(chloritic) (usu. ⊙)

\approx $\frac{1}{4}$ lt. grayish-red, matte

⊙

⊙

Tr py

⑦



DR-8 cont'd 12/21/02

1070-1100'

7 slts / 30 mds / 63 ss
Tr. py
(f-gr.)

range in color from
(all matte) lt. gray through
light-greenish-gray
to light grayish-red (red-bed)

1100-1130'

15 slts / 25 mds / 60 ss
Tr. py
f. gr. (avg. ≤ 0.1 mm, ≤ 0.7 mm)
1/3 grayish-red (lt.)
1/3 grayish-green (lt.)

calcite cement gone,
chlorite cement in
likely followed by precip.

1130-1160'

10 slts / 19 mds / 71 ss
Tr. py
vf. gr.
3/4 grayish-red
1/4 grayish-green

1160-
1190'

⑨ slts $\frac{1}{2}$ ea. lt. grayish-red
& lt. grnsh-gray ⑨

⑮ mds aa ⑨=

⑦⑥ ss vf-fgr (avg ≈ 0.1 mm; < 0.5 mm)

⑨± $\frac{0}{0}$, $\frac{1}{8}$ lt. grayish-red ⑨//
 $\frac{1}{8}$ lt. (grnsh-gray) ~~⑨~~



1190-
1220'

⑳ slts ranging from lt. (buff gray)
through lt. grnsh-gray to
lt. grayish-red ("redbed")

⑨ ⑮ mds aa

Tr. py
Tr. epy

⑨± ④ ss $\frac{1}{3}$ lt. gray-buff ⑨//
v-fgr to fgr $\frac{1}{3}$ lt. grayish-red ⑨//
 $\frac{0}{0}$ $\frac{1}{3}$ lt. grayish-green,
chloritic ~~⑨~~

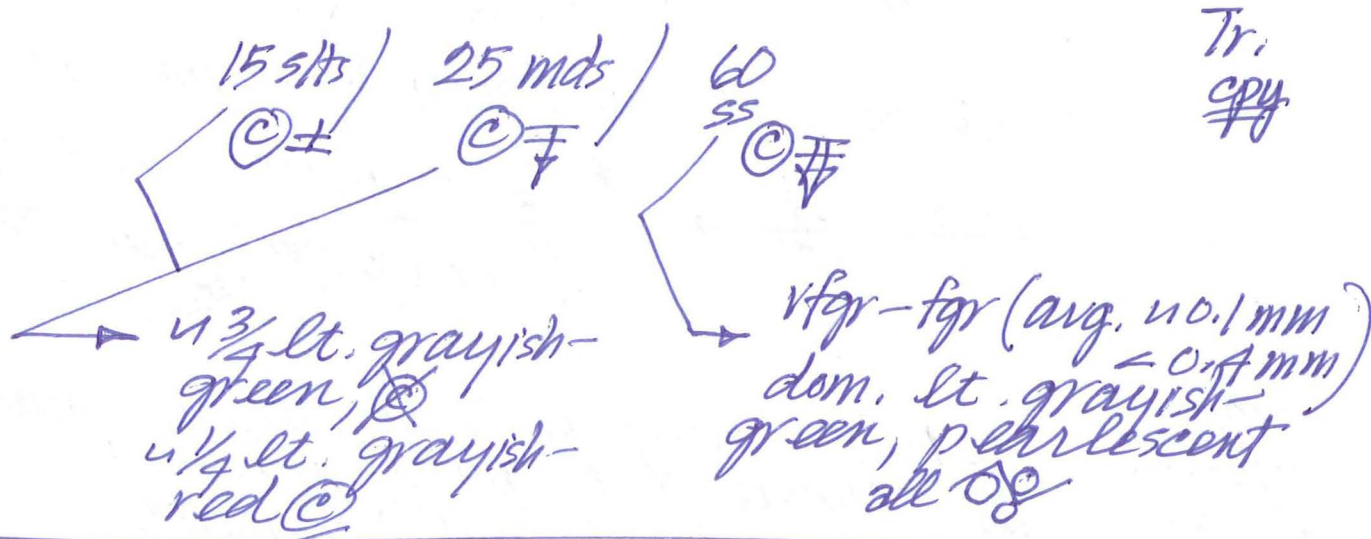
⑨



DR-8, cont'd

1220-1250' ⁸⁸ 23 slts / ⁸⁸ 23 mds / 54 ⁸⁸ ss / Tr VVF (sp.) ^{0.1 sp}

1250-1280' • Rock becoming more altered (chloritic)



1280-1310' 15 slts / 11 mds / 74 ss

vfg, \odot mostly lt. grayish-green

1310-1340' 1.5 AN, but CVD

17 slts / 13 mds / 70 ⁸⁸ ss

1340-1370' 1.5 AN but suspect CVD

17 slts / 35 mds / 48 ⁸⁸ ss

Tr. sp

10

J. Hulen binoc. mic.
logging notes

DR-8

12/21/02

1370-1400'

≤ 58%
CVD

3 LIGNITE

1 R&S

presumed
indigenous

11 slts

⊙

25 mds

⊙

64 ss

fg, lt.

grayish-gray
pearlescent

Tr. py
Tr. epy

suspect even
some of this
is caved.

1400-
1430

≤ 60%
CVD

Comparatively S⁻-rich

7 slts
⊙±

15 mds
⊙±

78 ss

exc. for
probable
reddish
caved
clips

1% py
0.5 sp

Tr. epy
0.1 gn

ny as clots
up to 1.5 mm

recrystallizing
framework
grains

fg (avg n 0.15 mm; < 0.5 mm)
lt. grayish-green

sp as single
x/s ≤ 0.7 mm
& as scattered
intergranular
cement

1435-1460

suspect
significant
caving

(guessing)
AA??

0.3 py

1460-
1490

27 slts
⊙

5 mds
⊙

68 ss
⊙±

0.3 py



DR-8, continued

1490-1520'

9% CMT

≤ 40% CVD

→ 2.e., ^{one} population of chips w/ dia's 5-20x those of a ^{second} (presumably indigenous) population

5% basalt chips
olivine-bearing
some with cement clinging

19 slts / 7 mds / 74 ss
⊙ / ⊙ / ⊙
v. fine (avg ~ 0.1 mm)
some coarse slts

matte, v. light, gray buff to gray

1520-1550'

● chlorite has vanished (hydroth.) — rx gray, fresh, and calcareous

≤ 65% CVD.

15 slts / 55 mds / 30 ss ⊙
⊙ / ⊙

→ matte, lt. gray to sl. brownish or yellowish-gray.
no green ≡ no chlorite

→ v. lt. gray-buff to buff white.

→ same as mds. but ranging to buff white



J. Hulen br noc.
mic. logging notes

DR-8

1550-1580' 11 slts | 54 mds | 35 ss
 (C) | (C) | (C) #
 ← matte, lt. gray buff to buff-white → matte, v. lt-lt, gray to sl. brownish or yellowish-gray → v. lt. gray-buff to buff-white
 ○

1580-1610' 7 slts^{aa} | 9 mds^{aa} | 84 ss^{aa}
 (C) | (C) | (C)

1610-1640' 7 slts^{aa} | 7 mds^{aa} | 86 ss^{aa} fgr (avg v 0.15 mm)
 (C) | (C) | (C)

1640-1670' 3 slts^{aa} | 52 mds^{aa} | 45 ss^{aa}
 (C) | (C) | (C)

1670-1700' 5 slts^{aa} | 60 mds^{aa} | 35 ss^{aa} → f-gr, (avg. v 0.15 mm; < 0.4 mm)
 (C) | (C) | (C)
 matte buff-white to lt. buff gray
 white interstitial clay (kaol.?)

1700-1730' 3 slts^{aa} | 62 mds^{aa} | 35 ss^{aa}
 (C) | (C) | (C)

→ v. uniform matte, lt. gray to matte, lt. sl. yel.-gray

(13)

DR 8, cont'd.

1730-
1760'

^{aa} 5 slts | ^{aa} 90 mds | ^{aa} 5 ss
 ◎ | ◎ | ◎

VERY
FRESH
LOOKING

← uniform matte lt. gray
to sl. brnsh. lt. gray,
some chips w/ conspicu-
ous organic debris (≤ 1.5%)

1760-
1790'

^{aa} 7 slts | ^{aa} 91 mds | ^{aa} 2 ss
 ◎ | gray ◎ | ◎

1790-1820'

^{aa} 5 slts | ^{aa} 42 mds | ^{aa} 53 ss
 ◎ | gray ◎ | ◎

fresh

1820-1850'

^{aa} 5 slts | ^{aa} 27 mds | ^{aa} 68 ss
 ◎ | ◎ gray | ◎

vfg - fg,
buff-white to
v. lt. buff-gray

1850-1880'

3 slts | 21 mds | 76 ss
 ◎ | ◎ | ◎

buff-white to
lt. gray-buff
mostly fgr (u d. 0.15 mm)
but a few chips
mgr (avg. u 0.3 mm
< 0.6 mm)

← $\frac{2}{3}$ matte lt. gray, AA
 $\frac{1}{3}$ matte lt. grayish-red ("redbed")

Tr. nod.
AN

1880-
1910' 3 slts / 21 mds / 76 ss
Tr. nod.
AN

mostly vfg (avg \approx 0.1 mm) & fgr (avg \approx 0.15 mm) but \approx 1/20 of clups are mgr (avg. \approx 0.25^{-0.30} mm); mostly lt. gray to lt. buff-gray; a few buff-white typically 5-7% diss. intergranular white clay (kaol.?)

1910-
1946'

1 AN

1 nod AN
free, & in ss as well as mds.

5 slts / 19 mds / 75 ss
w/ ea same colors as sandstone

\approx 3/5 matte lt. gray to slightly grish-gray
 \approx 2/5 lt. grayish-red to grayish maroon

1946-
1976'

Tr. nod.
AN

17 slts
"red and gray"

13 mds
"red and gray"

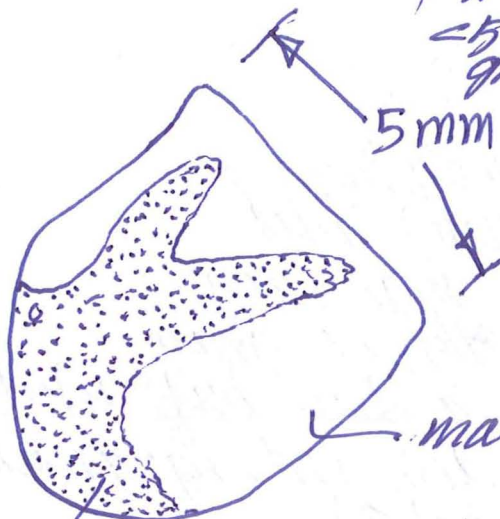
70 ss
"red & gray"

mostly vfg-Tr. AN fgr \approx 5% mgr.

DR-8, cont'd

1970-2000':

3 slts | 82 mds | 15 ss^{aa}
 795% matte lt. gray | mostly for buff-white
 <5% matte grayish-red



liquefaction texture?
loading?

matte lt. gray @ mds

fg. lt. buff-gray ss

HUGE CHANGE

2000-2038':

3 cement
 Tr Alum.
 3 bslt. chips
 1.5 R & S

100% clean buff-white ss

v. fgr. mostly disagg. into chips < 0.7mm. dia.

color & appearance would lead one to guess @ but ...

4 CEMENT

2 Lignite

Tr. insect parts

1 R & S

Tr. Alum.

2038-2060'

97% slts | 3 ss^{aa}

matte, v. lt - H. buff-gray

J. Hulén; binoc. mic.
logging notes

DR-8

12/21/02

2060-
2090'

5 slts | 87 mds | 8 ss
③ | ③ | ③

5 CEMENT

Tr. ALUM

1 R & S


2/3 matte lt. gray

1/3 matte lt. grayish-maroon 

2090-
2120'

³² 7 slts | ³² 21 mds | 72 ss ③
③ | ③

Tr. CNT,
R & S

v. f. gr. (avg. D. 0.07-0.1 mm)
barely above
coarse silt
v. lt. gray buff to
v. lt. lt. brownish-gray


● Cuttings suddenly very fine (small)
(avg. ≤ 1 mm)

2120-
2150'

0.2
silica
spheres
Tr.
R & S

Tr. red.
AN

Tr.
slts
③

³² 97 mds ③ | ³² 3 ss ③

1/4 matte lt. grayish maroon ("redbed")
3/4 matte lt. gray, very uniform
texture and
coloration

17



DR-8, continued

2150-
2180'

2 R&S
1 Lign.
Tr. silica
spheres

Tr. ostracods (CVD?)	15 slts ⊙ ≡	48 mds ⊙ ≡ 795% matte v. lt-lt. gray ≡ 5% matte lt. gray maroon	37 ss ⊙ ≡ v. fine v. lt. gray buff ⊙ ≡
-------------------------	-------------------	--	--

2180-
~~2200~~
2210'

2 R&S
Tr. insect parts
Tr. Lign. / Tr. LCM

22 17 slts ⊙ ≡	22 38 mds ⊙ ≡ same color propor- tion	22 45 ss ⊙ ≡
-------------------------	--	-----------------------



small-volume sample

2210-
2240'

2 R&S
1 Lign.
Tr. bslt
(w/ cmt.
clinging)
Tr. LCM
Tr. insect
parts.
1 CMT
Tr. silica
spheres

22 7 slts ⊙ ≡	22 63 mds ⊙ ≡ 799% matte lt. gray	22 30 ss ⊙ ≡
------------------------	---	-----------------------

2240-
2270
1 R&S
1 CMT
Tr bsst

Tr. nod AN	13 slts	35 mds	52 ss
⊙ ≡	⊙ ≡	⊙ ≡	⊙ ≡

CVD?
prob. not see below
matte lt. gray
v. fgr (avg 0.1 mm)
matte lt. gray-buff

2270-
2300
Tr. R&S

Tr. nod AN	^{aa} 5 slts	^{aa} 15 mds	80 ss
⊙ ≡	⊙ ≡	⊙ ≡	⊙ ≡

not CVD
v fgr, matte lt. gray-buff
pass w/ a scant trace
of intergranular hydro-
thermal chlorite.

2300-
2330
Tr Liqn.
Tr R&S

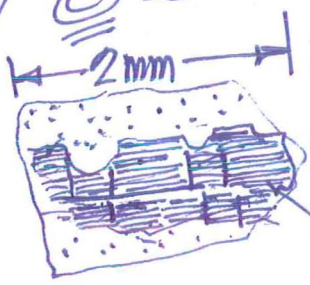
^{aa} 7 slts	^{aa} 36 mds	^{aa} 57 ss
⊙ ≡	⊙ all matte lt. gray	⊙ ≡

2340-
2360

← AA →

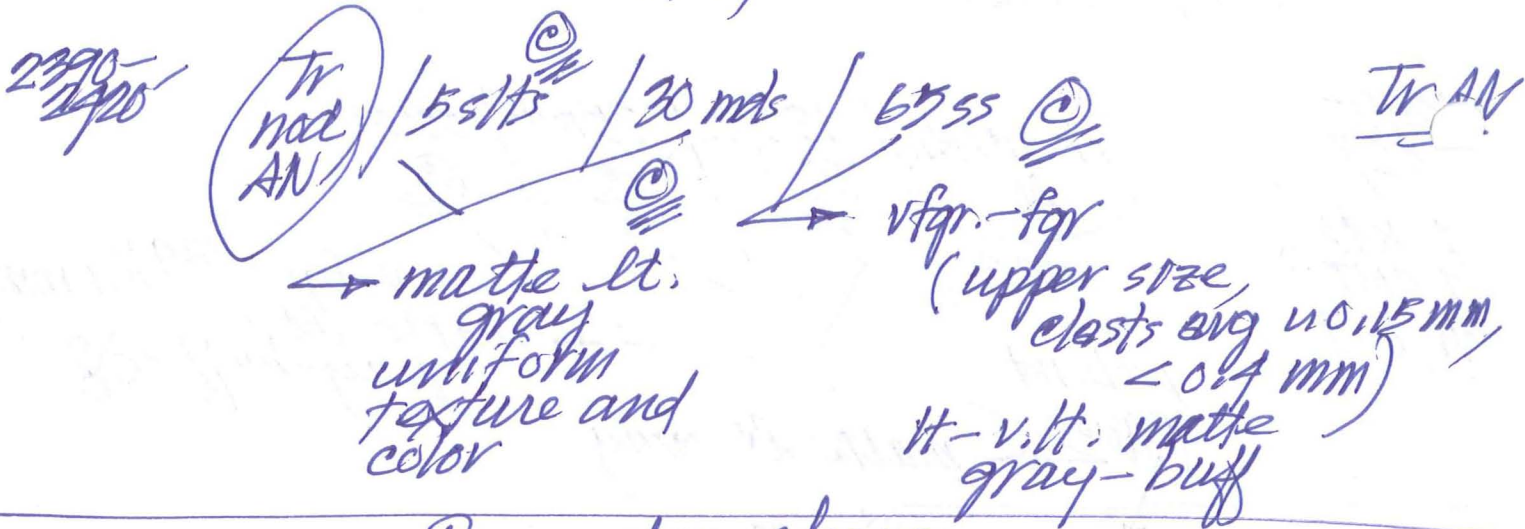
2360-
2390

^{aa} 5 slts	^{aa} 32 mds	63 ss
⊙ ≡	⊙ all matte lt. gray	⊙ ^{aa} ≡

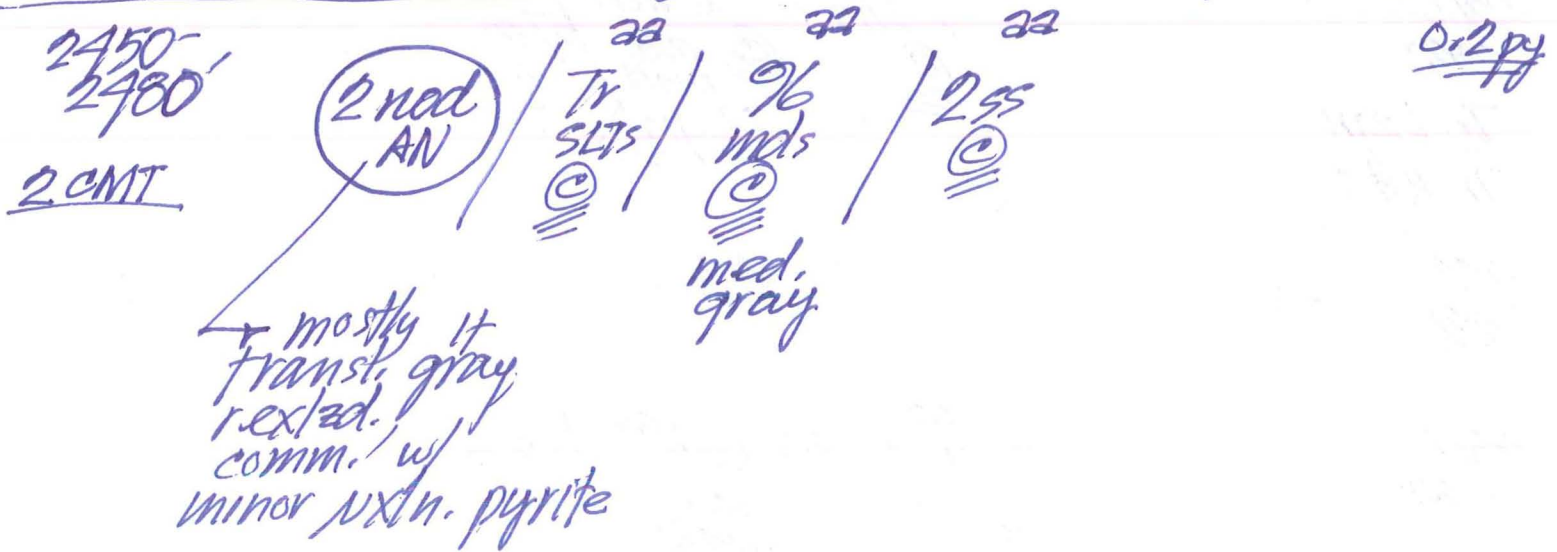
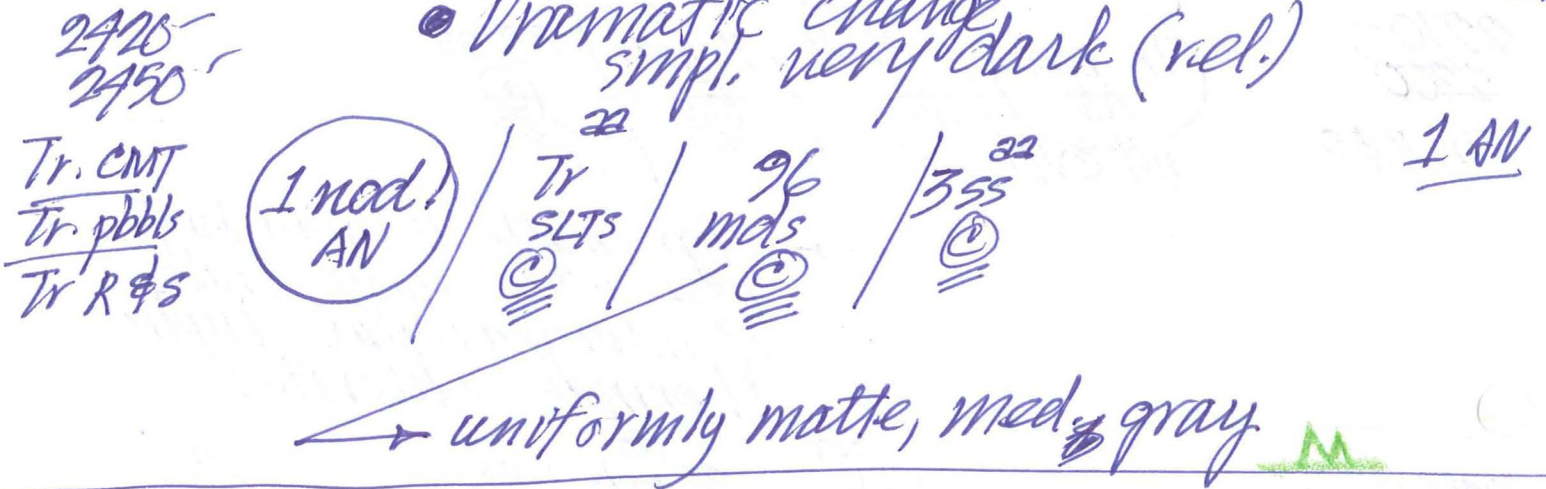


black
wood
on flat
surface

DR-8, cont'd.



• Dramatic change simpl. very dark (rel.)



J. Hulen bruce. mvc.
logging notes

DR-8 12/21/02

• Larger chips; more micaceous

2480-
2510'
Tr. insect
parts.

5 nod/xln
AN

Tr
sfts

95 ©
mds

Tr
ss

5 AN
0.5 py

→ many nods
assoc. w/
xln. pyrite,
as higher in
cap

→ matte medium gray
crsr mica conspicuous
some ~~laminar~~ lamina
surfaces erratically
coated w/ dark gray films
(org.?)



2510-
2540'

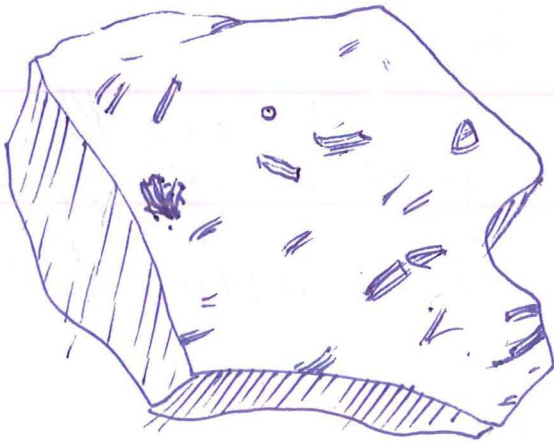
4 nod
AN

3 sfts

92 ©
mds

1 ss

0.7 py
4 AN



This really
should be
a traceable
horizon

10 mm

some
mds bedding surfaces
littered w/ organic
debris, as sketched
above

21

DR-8, cont'd.

2540-
2570'

Tr mod AN

25 sfts

91 mds

7 ss

0.3 py

Tr AN

Tr. silica spheres

Tr. CMT

vfg-fgr
(upper sizes
avg 4.0-15 mm)

→ overall v. lt.
buff-gray, but
speckled w/ intergranular
white clay

2570-
2600'

7 sfts

82 mds

11 ss

0.2 py

some
few chips
are matte
dark gray
(org.?)

2600-
2630'

11 sfts

34 mds

55 ss

continuum
matte lt-med
gray

vfg-fgr (< 0.15 mm
avg. dia.)
matte lt. gray-buff
w/ 1% diss. black
cealy organic debris

2630-
2660'

1 mod
AN
CVD?

7 sfts

47 mds

45 ss

→ many chips very
well laminated.

J. Kullen bonoc.
mrc. logging notes

DR-8 12/21/02

2660-
2690'
1 R&S

7 slts / 46 mds / 47 ss

matte, lt.-med gray; many chips consprc. laminated
f. gr. (avg. \approx 0.15 mm. dia) matte lt buff-gray to gray-buff

2690-
2720'

• Tr epidote appears
aa

Tr. EP

5 slts / 33 mds / 62 ss

fgr-~~ss~~
~~latter avg.~~
avg. grain size \leq 0.2 mm.
(~~#~~ max 0.5 mm)

color change: ss predom. lt. slightly grayish-pink

2720-
2750'

1 nod AN

5 slts / 85 mds / 9 ss

0.3 py
Tr. epy

2750-
2780'

5 slts / 54 mds / 41 ss

gray-buff & buff-gray to buff-white, the latter with greenish-yellow speckles (EP)

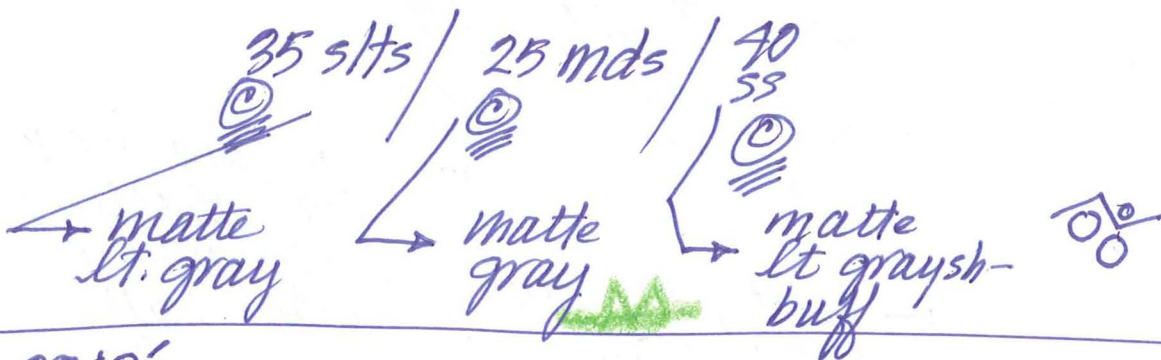
(23)

Tr CMT

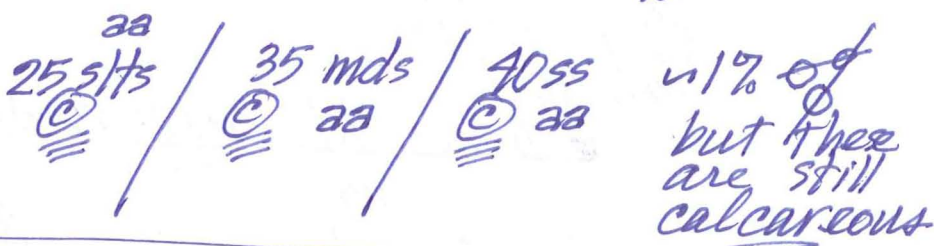
DR-8, cont'd

2780-2810

Tr. py



2810-2840'



Tr. py
Tr. cpy

2840-2870'
1 R&S

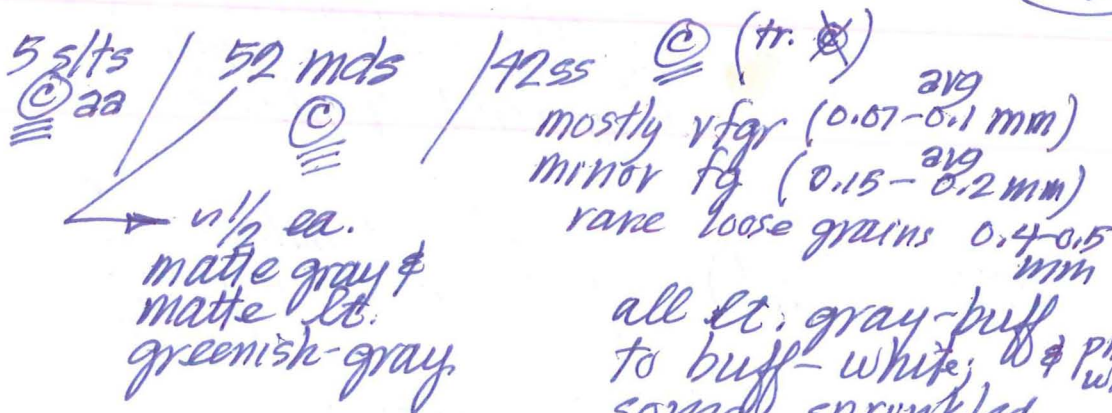


0.1 py
Tr. cpy

2870-2900'

● EPIDOTE RE-APPEARS

0.3 EP



mostly vfg (0.07-0.1 mm) avg
 minor fg (0.15-0.2 mm) avg
 rare loose grains 0.4-0.5 mm

all lt. gray-buff to buff-white; w/ pinkish white some sprinkled with yellow-grn EP

2900-2930' 9 slts / 58 mds / 33 ss 0.5 EP / 0.3 py

⊙ ⊙ ⊙

matte lt-med. gray vfg - fgr
lt. pinkish-buff to lt. grayish-buff
minor intergranular
lt. grayish-yel. epibole

2930-2960' 5 slts / 15 mds^{aa} / 80 ss 0.3 py / 0.1 epy / Tr. EP

⊙ ⊙ ⊙

lt. grayish buff lt. - med. gray mostly fgr, lt. grayish-buff to grayish-pink

sulfides erratically diss. single grains < 0.02 mm dia, to clots up to 0.7 mm dia encompassing several grains

2960-2990' 8 slts^{aa} / 15 mds^{aa} / 77 sa Tr. EP / 0.2 py

⊙ ⊙ ⊙

Tr. bug parts a few chips lt. grayish-green and

2990-3020' 7 slts^{aa} / 68 mds^{aa} / 25 ss Tr. EP / 0.1 py

⊙ ⊙ ⊙

all lt.-med. matte gray

very fresh-looking

DR-8 (OH), cont'd

3020-3050'

3 slts / 74 mds / 23 ss ²⁸
 lt-med. matte gray

0.3 py

3050-3080'

15 slts / 117 mds / 45 ss ²⁸
 matte lt. gray / 4 matte lt-med gray

0.2 py

3080-3110'

● ss noticeably coarser-gr.

0.2 py

5 slts / 13 mds / 82 ss, ²⁸
 f-mgr, avg. 0.15-0.2 mm

up to 0.6 mm, overall light gray sl. grysh., pink & very "clean" looking & moderately well sorted

3110-3140'

5 slts / 34 mds / 41 ss ²⁸
 gray

0.2 py

3140-3170'

● ss has lt. greenish cast & is coarser

0.3 py

2 slts / 9 mds / 91 ss ²⁸

f-mgr (avg. 0.25-0.3 mm) up to 1 mm

mottled lt. grysh-pink & grayish-buff & lt. grayish-green, somewhat pearly

↳ ~~1~~ 1 slts / 5 mds / 94 ss mgr, aa
 © 08
 ↳ a few of the green-er grains ©
 0.1 py

3200-3230' 11 slts / ~~11~~ 62 mds lt-med. matte gray / 27 ss © but mostly v. fgr-fgr & argill.
 0.2 py

3230-3260' 5 slts / © 42 mds gray / 53 ss © fgr
 0.3 py

3265-3290' 3 slts / 23 mds med.-dc. matte gray / 74 ss © fgr v. lt. grayish-buff to grayish-pink
 ● mds. much darker
 ● SPHALERITE
 0.1 sp
 0.1 py

3290-3320' ~~11~~ 1 slts / 39 mds med. matte gray / 60 ss ©
 0.2 py

3320-3350' 3 slts / 42 mds © gray / 55 ss ©

3350-3380' next page

DP-8(OH), contd.

3350-
3380'

● ss noticeably greener & more chloritic

0.2 py

⚡ Tr

2 slts / 23 mds / 75 ss © ±

↳ 90% matte lt-med. gray ©
10% med matte gray-green

↳ fgr, lt-med. buff green to green buff, very φ (est. ~20%), chloritic, pearly

3380-
3410'

4 slts / 13 mds / 87 ss © ±
© ± / ~80% © / 32 © ±
~20%

0.3 py

3410-
3440'

⚡

2 slts / 13 mds / 85 ss / Tr VVF © ±
© ± / © ± / 30 © ±

0.2 py
Tr. sp?

mostly lt. gray-green pearly, very φ

3440-
3470'

● all rx. types fresh again

⚡ m

3 slts / 59 mds / 37 ss ©

"shale" many chips. lenticular
↳ matte, lt med. gray to sl. greenish-gray.

↳ mostly fgr, occ. m.gr., dom. lt. grayish-pink a few lt. grayish-green, as above ©

J. Hulen brnoc. mvc.
logging notes

DR8-OH

12/23/02

3470-~~3500~~

3490'
(TV) temp.

3 slts / 72 mds. / 25 ss
⊙
⊙

0.2 py
0.1 cpy

→ v fgr (avg n 0.15 mm),
lt. sl. grayish-pink
to grayish-buff,
⊙

→ matte, med-dk, gray to
sl. brownish-gray

DEEPENING

3490-
3520'

3 slts / 82 mds / 15 ss
⊙ 22 ⊙ 22
fgr

~~Tr. py~~
oil

in 50% caved
fragments

ndt up to
16x chip
dia. of a
1st population

3520-
3550'

> 95% caved -
do not use

3550-
3580'

5 slts / ~~82~~ 82 mds / 13 ss 22
⊙ 22 ⊙ fgr
gray-pink

Tr. AN

→ med.-dk.
gray

3580-
3610

3 slts / 82 mds 15 ss
all AA

very fresh →

DR 8 ~~2610-2645~~, cont'd

3610-3640

● Very fresh-appearing

5 slts / 47 mds / 48 ss

In py

matte, lt-med. (occ. ~~dark~~ dark) gray

v. lt. grayish-pink to grayish buff or vfg.

3640-3670

2 nod AN

mostly retext to lt-med. transl. gray, comm. w/ vln pyrite

3 slts

90 mds

uniformly matte med. gray

5 ss

Out py 2 AN

3670-3700

1 nod AN

1 slts

92 mds

6 ss

Out py 1 AN

3700-3730

2 nod AN

incl. v. 50% < 1 mm vln white warty-surfaced ovoid nodules

94 mds

4 ss

2 AN In py

3730-3760

1 nod AN

7 slts

61

mds

3/SS

Tr VVF

1 AN

In bug winged

4 Tr

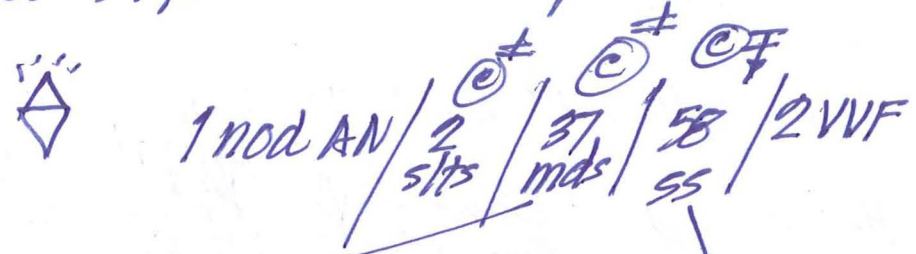
matte, lt.-med. gray (no green)

vfg - fgr, v. lt. gray-buff to buff-gray or

J. Hulén brncc. mrc. DR-8 12/26/02
 logging notes

3760-3790

- Much of the ss ⁽¹⁵⁾ greener
- Conspicuous chalcopyrite



Tr py!
 1% cpy
 2 AN

\swarrow 1/5 matte
 \swarrow 1/5 lt-med gray green
 \swarrow 1/5 lt-med gray
 \searrow vfg- fgr.
 \searrow 1/5 lt. gray buff, aa
 \searrow 1/5 lt-med. greenish-gray, pearly, chloritic.

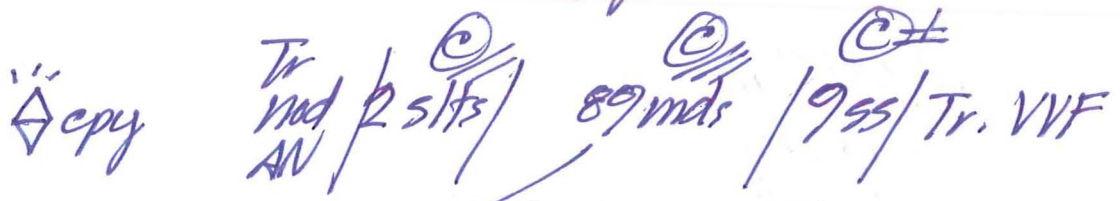


cpy mostly as free xl. chips, some w/ broken & faceted edges, up to 2 mm dia. strong "peacock tarnish"

3790-3820

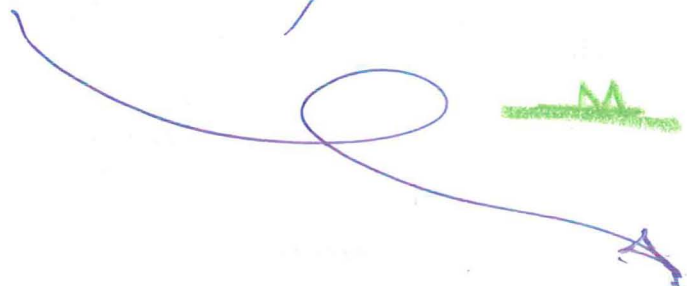
- change back: mostly c mds. fresh-looking

1 py
 0.1 cpy
 0.3 AN



\swarrow >99% matte.
 \swarrow lt.-med. gray

py mostly vxn, syngenetic, bedded/laminated



DR-8 12/26/02

3820-
3850'

Tr
nod. AN | 1 shts | 90 mds | 9 ss @

0.5 py
0.2 AN

⊙
↳ matte, lt-med. gray

3850-
3880'

Tr
nod
AN | 2.5 shts | 37 mds

60 ss @
fg - vfg
w/ med. gray-green
w/ buff-gray
w/ lt gray-green

Tr EP
0.7 py
0.2 cpy

EP pre-dates ANH

greenish-brown
epidote (?) needles
≤ 0.2 x 0.01 mm
embedded
in AN

chlorite



mud substrate



3880-
3910

0.5
nod
AN | 4.5 shts | 9 mds | 7 ss
22
@

Tr EP
0.7 AN
0.3 py

↳ matte,
med. dk
gray

3910-
3940'

● Much of the mudstone is
very dark gray

Tr
nod
AN | 3 shts | 64 mds | 33 ss @

Tr EP
0.2 AN
0.2 py

↳ matte,
med. dark
gray

↳ vfg - fg
79% v. lt. gray-buff
to buff-white
25% gray-green



J. Hulen brnoc. mrc.
logging notes

DR-8 12/26/02

● Very fresh-looking

3940-
3970

5 slts/

80
mds

| 1555 | Tr
VVP

0.3 AN
Tr. ep
or 1 pg

matte, med-dk
gray w/ faint
brownish undertone

vfg - fg
lt. buff-gray
to buff-white

3970-
4000

● very fine cuttings
avg. 4.07mm, rarely up to ~~2mm~~ 2mm

0.2 AN
or 1 pg

Tr. nod.
AN

| 97 mds

| 355

Very
fresh

matte, med.-dk.,
sl. brownish-gray;
very well indurated; breaks into
sharp-edged flakes that are
translucent toward the edges

4000-
4030

| 1. slts/ | 94 mds
gray

| 555

29 φ w/ chl.
clots in
interstices

30% buff-white to
buff-gray

DR-8, continued.

4030-
4060'

ep. cal.
qtz
cpf

7 slts | 56 mds | 37 ss | Tr. VVF

Tr. E
0.3 cpy

matte,
lt through
dark gray

mostly
lt. buff-gray
to buff white
inner lt. greenish-
gray chlorite



4060-
4090'

9 slts | 33 mds | 58 ss
continuum

FRESH-
LOOKING

Tr. py

matte, lt.
through
dark-gray -
no green

v. fig.
argill., dense,
non-φ, φ,
mostly matte
lt. gray

4090-
4120'

5 slts | 60 mds | 35 ss

FRESH
LOOKING

0.1 py

matte, lt-
med. gray
w/ slight
brownish
undertones



4120-	22	22	22	
4150'	5 slts /	70 mds /	25 ss	Tr. py
	Ⓢ	Ⓢ	Ⓢ	0.2 AN

4150-	(Tr. nod AN)			
4180'	Tr GG	5 slts /	48 mds /	47
	chlorite	Ⓢ	Ⓢ	ss
	med.			Ⓢ
	grayish			
	green			
	(crushed &			
	sheared			
	ss)			
		← matte, lt through dark gray		
			← vfg - fgr mostly lt. buff-gray some grish-buff to greenish lt. gray	

4180-		22	22	
4210'	5 slts /	56 mds /	39 ss	0.1 py
		gray	Ⓢ	0.1 py

4218-		22	22	
4220	3 slts /	62 mds /	35 ss	0.1 py
4240'		gray	Ⓢ gray-buff	

4240-		22	22	
4270'	7 slts /	64 mds /	29 ss	0.2 py
		gray	Ⓢ gray-buff	0.1 AN

4270-		22	25	
4300'	3 slts /	54 mds /	43 ss	greenish
		gray	Ⓢ gray-buff	vfg - fgr

DR-8, cont'd.

4300-
4330'

7 slts

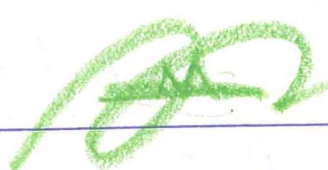
56 mds @
22
gray

37 ss
22
@

Tr. VF
vf-fgr.

0.2 AN
Tr. cpy

lt. grayish-pink to
gray-buff to
buff white
⊗



4330-
4360'

5 slts

60 mds @
22
gray

35 ss
22
Tr VF

0.1 AN
0.1 py



4360-
4390'

2 slts

25 mds
22
@
gray

73 ss
22
@

vfgr-fgr, ⊗
v. lt. grayish-pink to
grayish-buff
and buff white

4390-
4420'

3 slts
22

25 mds
22
@
gray

72 ss
22
color 22
and everything else



4420-
4450'

● Alteration appears again

10.5 VVF

0.2
cpy

8 slts
6.5

78 mds
@

15 ss
@

0.3 AN

↙ > 90% gray
< 10% lt
gray-green

↘ mostly lt-med.
gray-green
and chloritic
minor lt. gray-buff

J. Hulen binoc. mic. DR-8 12/26/02
 logging notes

● coarser ss

Tr. py
Tr. cpy

4450-4480' : 1 slts | 12 mds | 87 ss
 (C) (C)

mostly matte, lt-med. gray
 fgr - (rarely) mgr. avg 0.15-0.2 mm < 0.4 mm; sparkling, lt. greenish buff to pinkish-buff mostly ϕ , tr. ϕ

4480-4510' 5 slts | 48 mds²² | 97 ss²² gray | gray-buff
 (C) (C) 0.5 py 0.1 cpy

4510-4540' 3 slts | 52 ss | 45 ss
 all AA

4540-4570' 2 slts | 35 mds | 63 ss ● FRESH
 all AA

4570-4600' 1 slts | 82 mds | 17 ss
 all AA

A

DR-8, continued

4600-4630':

3 sfts / 60 mds / 37 ss FRESH
all aa

4630-4660'

2 sfts / 23 mds / 75 ss u 0.3 py
Tr. cpy

AA

all AA

4660-4690'

1 sft / 22 mds / 77 ss
all aa

→ fgr, rarely mgr. fairly clean, mostly buff-white to pinkish white

FIN

J. Hulen binoc.
mic. exam notes

DR-8

12/22/02

● REDRILL

~~2900~~
~~2910~~
~~2920~~

2880-2910':

15 slts 42 mds	43 ss	
⊙ matte lt. gray	⊙ ↳ matte gray to lt. sl. greenish- gray	⊙ ↳ matte lt. gray-buff to buff-gray vfg - fgr ⊙

Tr. py

2910-2940':

8 22 17 slts	37 22 44 mds	78 55 28 ss
⊙	⊙	⊙

2940-
2970':

⊙ Tr
AN

4 22 4 slts	27 50 22 67 mds	35 45 23 ss
⊙	⊙ matte, lt-med. gray	⊙

0.1 EP

Tr. py

2970-
3000'

~~5~~
~~15~~ slts

↳ u/2 ea. matte
lt. gray and
matte lt.
grnsh-gray
⊙

46 46 mds
u/3 matte lt gray to med. gray
u/4 matte lt. grnsh- gray
⊙

⊙ (25)

~~49~~ ⊙
~~49~~ ss

vfg to fgr
u 2/5 ⊙
u 1/5 ⊙
range of color
from v. lt.
gray-buff to
buff white
& v. lt. grayish-green.

0.3 EP

0.1 py

DR-e, cont'd. (REDPILU)

3000-
3030'

~~6~~ 5 sfts
matte
v. lt. gray
⊙

~~47~~ 56 mds
mostly
matte lt-
med. gray
⊙

~~47~~ 55
lt. gray-buff
to lt. sl.
greenish-buff
or -gray
mostly fgr
(avg. 46.15 mm)
⊙

0.3 py
0.1 EP

3030-
3060'

~~20~~ 10 sfts
⊙

~~22~~ 55 mds
⊙

~~22~~ 35
⊙

Tr. EP
Tr. py

3060-
3090'

~~22~~ 10 sfts
⊙

~~22~~ 57 mds
⊙

~~22~~ 33 sfts
⊙

Tr. py

3090-
3120'

~~4~~ 22 15 sfts
⊙

~~22~~ 62 mds
⊙

~~34~~ 22 35
⊙

0.5 py
Tr. EP

3120-
3150'

~~22~~ 3 15 sfts
⊙

~~22~~ 60 mds
⊙

~~22~~ 37 35
⊙

0.2 py

3150-
3180'

⊙ COLOR CHANGE
GRAY → GREEN

~~4~~ 7 sfts
matte
lt. grayish
green
⊙ ±

~~18~~ 23 mds
2/3 matte lt.
grayish-green
1/3 matte lt-med
gray
⊙ ±

~~78~~ 75 v fgr - fgr
matte lt.
greenish-buff
to greenish-gray
⊙

Tr. py

⊙ 26

J. Hulen brnc. mic.
logging notes

DR-8

12/22/02

(REDRILL)

3180-3210':

4 slts / 20 mds / 76 ss

matte lt gray

matte lt. med gray

v. fgr-fgr.

matte lt. greenish-buff to greenish-gray

3210-3240':

color change

15 slts / 33 mds / 25 ss

matte lt. greenish-gray

1/3 matte gray

1/2 matte med-dk. grayish-green

lt. greenish-buff to buff- or gray-green

> 95% fgr

< 5% ss

0.3 py

3240-3270':

9 slts / 51 mds / 26 ss

Tr. py

3270-3300':

2 slts / 17 mds / 81 ss

matte lt. sl. grayish buff

0.1 py

3300-3330'

5 slts / 42 mds / 53 ss

matte lt. sl. grayish-buff

Tr. py

(27)

DR-8, cont'd

REDRILL

3330-
3360'

²⁹
~~18~~ mds
①
↳ matte
med. gray

⁷¹
~~87~~ ss
lt. sl. graysh-
pink to graysh-
buff
figr. ①
(avg. v. 0.15 mm)

3360-
3390'

AA

very fresh-looking

3390-
3420'

11 mds
①

89 ss ①
aa

3420-
3450'

5 slts
①

²⁵
~~35~~ mds
aa ①

~~65~~ ss ①
aa

Tr. py.

3450-80'

7 slts
①

38 mds
aa ①

aa
55 ss ①

3480-
3510'

7 slts
①

28 mds
aa ①

65 ss ①

