(12)

Oilfield Research Laboratories

GENERAL INFORMATION & SUMMARY

Company Jackson Bros. Lease Hendrickson Well No. 3

Location NE SW NE

Section 17 Twp. 25S Rge. 9E County Greenwood State Kansas

Name of Sand	Bartlesville
Top of Core	2317.0
Bottom of Core	2371.5
Top of Sand	2327.0
Bottom of Sand	2370.2
Total Feet of Permeable Sand	33.2
Total Feet of Floodable Sand	8.0

Distribution of Permeable Sand:

Permeability Range Millidarcys	Feet	Cum. Ft.
0 - 1	12.6	12.6
1 - 5	11.6	24.2
5 - 10	8.0	32.2
10 & above	1.0	33.2

Average Permeability Millidarcys	3.4
Average Percent Porosity	15.4
Average Percent Oil Saturation	15.8
Average Percent Water Saturation	64.1
Average Oil Content, Bbls./A. Ft.	190.
Total Oil Content, Bbls./Acre	7,459.
Average Percent Oil Recovery by Laboratory Flooding Tests	3.0
Average Oil Recovery by Laboratory Flooding Tests, Bbls./A. Ft.	37.
Total Oil Recovery by Laboratory Flooding Tests, Bbls./Acre	295.
Total Calculated Oil Recovery, Bbls./Acre (Primary & Secondary)	1,490.
Packer Setting, Feet	
Viscosity, Centipoises @	
A. P. I. Gravity, degrees @ 60 °F	
Elevation, Feet	

Fresh water mud was used as the circulating fluid while taking this core. The core was sampled and the samples sealed in cans by a representative of Oilfield Research Laboratories. The well was drilled in virgin territory.

FORMATION CORED

The detailed log of the formation cored is as follows:

Depth Interval, Feet	Description
2317.0 - 2327.0	Gray sandy shale.
2327.0 - 2331.5	Grayish light brown, shaly sandstone.
2331.5 - 2335.4	Gray, calcareous, shaly sandstone.
2335.4 - 2355.6	Grayish light brown, shaly sandstone.
2355.6 - 2368.6	Light brown, shaly sandstone.
2368.6 - 2370.2	Gray shaly sandstone.
2370.2 - 2370.7	Shale.
2370.7 - 2370.9	Coal.
2370.9 - 2371.5	Gray shaly sandstone.

Coring was started at a depth of 2317.0 feet in sandy shale and completed at 2371.5 feet in shaly sandstone. This core shows a total of 39.3 feet of sandstone. For the most part, the pay is made up of light brown, shaly sandstone.

PERMEABILITY

For the sake of distribution, the core was divided into two sections. The weighted average permeability of the upper and lower sections is 0.96 and 4.8 millidarcys respectively; the overall average being 3.4 (See Table III). By observing the data given on the coregraph, it is

noticeable that the sand has an irregular permeability profile. The permeability of the sand varies from impermeable to a maximum of 14. millidarcys.

PERCENT SATURATION & OIL CONTENT

The sand in this core shows a low weighted average percent oil saturation, namely, 15.8. The weighted average percent oil saturation of the upper and lower sections is 14.8 and 16.7 respectively. The weighted average percent water saturation of the upper and lower sections is 69.6 and 60.0 respectively; the overall average being 64.1 (See Table III). This gives an overall weighted average total fluid saturation of 79.9 percent. This low total fluid saturation indicates considerable fluid was lost during coring most of which was probably oil.

In an effort to determine whether or not any flushing of the sand occurred during coring, all of the saturation samples were analyzed for chloride content. The results of these tests are given in Tables VI and VII. From the data given in these tables and on the coregraph, it is evident that some flushing did occur since the zones of higher permeability show the lower chloride content.

The weighted average oil content of the upper and lower sections is 172 and 203 barrels per acre foot respectively; the overall average being 190. The total oil content, as shown by this core, is 7,459 barrels per acre of which 2,060 barrels are in the pay sand section (See Table III).

LABORATORY FLOODING TESTS

The sand in this core responded to laboratory flooding tests, as a total recovery of 295 barrels of oil per acre was obtained from 8.0

feet of sand. The weighted average percent oil saturation was reduced from 21.0 to 18.0, or represents an average recovery of 3.0 percent. The weighted average effective permeability of the samples is 0.225 millidarcys, while the average initial fluid production pressure is 48.8 pounds per square inch (See Table V).

By observing the data given in Table IV, you will note that of the 39 samples tested, 21 produced water and 8 oil. This indicates that approximately 21 percent of the sand represented by these samples is floodable pay sand. The tests also show that the sand has a fairly uniform effective permeability to water.

CONCLUSION

The results of the laboratory tests indicate that efficient primary and secondary operations in the vicinity of this well should recover approximately 1,490 barrels of oil per acre or an average of 186 barrels per acre foot from the 8.0 feet of floodable pay sand analyzed in this core. The recovery values were calculated using the following data and assumptions:

Original formation volume factor	1.22
Reservoir water saturation, percent	45.0
Average porosity, percent	15.8
Oil saturation after flooding, percent	18.0
Performance factor, percent	50.0
Net floodable pay sand, feet	8.0

This core indicates a reservoir having a good oil saturation, a moderate water saturation and fairly uniform effective permeability to water.

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SUMMARY OF PERMEABILITY & SATURATION TESTS

TABLE III

Company Jackson Bros. Lease Hendrickson Well No. 3

Depth Interval, Feet	Feet of Core Analyzed	Average Permeability, Millidarcys	Permeability Capacity Ft. x Md.
2327.0 - 2347.6	11.6	0.96	11.10
2347.6 - 2370.2	21.6	4.8	102.64
2327.0 - 2370.2	33.2	3.4	113.74

Depth Interval, Feet	Feet of Core Analyzed	Average Percent Porosity	Average Percent Oil Saturation	Average Percent Water Saturation	Average Oil Content Bbl./A. Ft.	Total Oil Content Bbls./Acre
2327.0 - 2347.6	16.7	14.8	14.8	69.6	172	2,869
2347.6 - 2370.2	22.6	15.7	16.7	60.0	203	4,590
2327.0 - 2370.2	39.3	15.4	15.8	64.1	190	7,459

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RESULTS OF WATER DIFFERENTIATION TESTS

TABLE VI

Company Jackson Bros. Lease Hendrickson Well No. 3

Sample No.	Depth, Feet	Chloride Content of Brine in Sand ppm	Percent Water Saturation		
			Connate	Drilling & Foreign	Total
1	2327.1	99,200			
2	2328.1	115,300			
3	2329.1	101,100			
4	2330.1	105,800			
5	2331.1	114,250			
6	2336.1	84,400			
7	2337.1	95,400			
8	2338.1	88,600			
9	2339.1	106,000			
10	2340.1	98,600			
11	2341.1	98,300			
12	2342.1	110,000			
13	2343.1	102,750			
14	2344.1	122,300			
15	2345.1	118,900			
16	2346.1	114,250			
17	2347.1	90,000			
18	2348.1	99,000			
19	2349.1	120,025			
20	2350.1	96,700			
21	2351.1	105,700			
22	2352.1	94,800			
23	2353.1	104,000			
24	2354.1	106,200			
25	2355.1	98,200			
26	2356.1	122,000			
27	2357.1	93,000			
28	2358.1	107,200			
29	2359.1	101,250			
30	2360.1	89,800			
31	2361.1	88,800			
32	2362.1	101,200			
33	2363.1	106,100			
34	2364.1	111,550			
35	2365.1	99,200			
36	2366.1	105,300			
37	2367.1	102,350			
38	2368.1	102,750			
39	2369.1	89,650			

Note: ppm — parts per million

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RESULTS OF LABORATORY FLOODING TESTS

TABLE IV

Company Jackson Bros. Lease Hendrickson Well No. 3

Sample No.	Depth, Feet	Effective Porosity Percent	Original Oil Saturation %	Original Oil Saturation Bbls/A.Ft.	Oil Recovery %	Oil Recovery Bbls/A.Ft.	Residual Saturation % Oil	Residual Saturation % Water	Residual Saturation Bbls/A.Ft.	Volume of Water Recovered cc*	Effective Permeability Millidarcys**	Initial Fluid Production Pressure Lbs/Sq.In.
1	2327.1	12.5	11	107	0	0	11	81	107	0	Imp.	-
2	2328.1	16.1	32	399	0	0	32	49	399	0	Imp.	-
3	2329.1	16.1	22	274	0	0	22	58	274	0	Imp.	-
4	2330.1	14.5	7	79	0	0	7	78	79	0	Imp.	-
5	2331.1	13.0	18	181	0	0	18	72	181	0	Imp.	-
6	2336.1	14.7	12	137	0	0	12	59	137	0	Imp.	-
7	2337.1	15.6	22	266	0	0	22	56	266	0	Imp.	-
8	2338.1	14.4	7	78	0	0	7	83	78	0	Imp.	-
9	2339.1	15.6	14	169	0	0	14	62	169	0	Imp.	-
10	2340.1	15.4	17	203	0	0	17	60	203	0	Imp.	-
11	2341.1	14.7	6	68	0	0	6	90	68	0	Imp.	-
12	2342.1	14.7	22	251	0	0	22	73	251	0	Imp.	-
13	2343.1	14.6	11	125	0	0	11	80	125	0	Imp.	-
14	2344.1	14.6	14	158	0	0	14	80	158	0	Imp.	-
15	2345.1	15.5	17	204	0	0	17	80	204	2	0.100	50
16	2346.1	14.2	14	154	0	0	14	73	154	0	Imp.	-
17	2347.1	14.3	20	222	0	0	20	76	222	0	Imp.	-
18	2348.1	15.8	27	331	7	86	20	78	245	7	0.200	50
19	2349.1	15.6	25	302	6	73	19	69	229	2	0.100	50
20	2350.1	16.3	19	240	2	25	17	71	215	5	0.200	50
21	2351.1	16.0	21	261	2	25	19	69	236	2	0.100	50
22	2352.1	16.2	19	238	2	25	17	74	213	13	0.300	50
23	2353.1	15.0	17	198	0	0	17	79	198	5	0.200	50
24	2354.1	14.5	13	146	0	0	13	62	146	0	Imp.	-

Notes: cc—cubic centimeter.

*—Volume of water recovered at the time of maximum oil recovery.

**—Determined by passing water through sample which still contains residual oil.

Company: Jackson Bros. Lease: Hendrickson Well No.: 3

Sample No.	Depth, Feet	Producing Formation	Original Oil Saturation		Permeability		Residual Saturation			Volume of Water Recovered c/	Minimum Recovery Attained	Residual Oil Saturation, Pore Volume Basis
			S	Lbs/A.F.	S	Lbs/A.F.	S Oil	S Water	Lbs/A.F.			
25	△ 2355.1	16.2	19	238	2	25	17	74	213	10	0.300	50
26	△ 2356.1	14.1	19	208	1	11	18	77	197	9	0.300	50
27	△ 2357.1	15.6	15	181	0	0	15	79	181	10	0.300	50
28	△ 2358.1	16.4	19	242	2	25	17	73	217	11	0.300	50
29	□ 2359.1	16.5	13	166	0	0	13	79	166	11	0.300	50
30	□ 2360.1	16.2	13	163	0	0	13	79	163	16	0.400	40
31	□ 2361.1	16.2	9	113	0	0	9	82	113	8	0.200	50
32	△ 2362.1	15.5	12	144	0	0	12	85	144	8	0.300	50
33	△ 2363.1	16.0	18	223	0	0	18	81	223	15	0.300	40
34	△ 2364.1	16.9	15	196	0	0	15	77	196	11	0.300	50
35	△ 2365.1	16.9	22	288	0	0	22	73	288	19	0.400	40
36 contaminated with FeS	□ 2366.1	15.3	20	238	0	0	20	76	238	7	0.200	50
37	○ 2367.1	15.0	17	198	0	0	17	63	198	0	Imp.	-
38	△ 2368.1	16.3	11	139	0	0	11	79	139	13	0.300	40
39	□ 2369.1	16.5	17	217	0	0	17	79	217	16	0.400	40

Notes: c—Cubic centimeters.

c—Volume of water recovered at the time of maximum oil recovery.

c—Determined by passing water through sample which still contains residual oil.

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RESULTS OF SATURATION & PERMEABILITY TESTS

TABLE 1-B

Company Jackson Bros. Lease Hendrickson Well No. 3

Sample No.	Depth, Feet	Effective Porosity Percent	Percent Saturation			Oil Content Bbls. / A Ft.	Perm., Mill.	Feet of Sand		Total Oil Content	Perm. Capacity Ft. X md.
			Oil	Water	Total			Ft.	Cum. Ft.		
1	2327.1	12.3	10	80	90	95	0.57	0.6	0.6	57	0.34
2	2328.1	16.2	32	47	79	402	3.8	1.0	1.6	402	3.80
3	2329.1	15.8	20	57	77	245	0.75	1.0	2.6	245	0.75
4	2330.1	14.6	7	77	84	79	0.52	1.0	3.6	79	0.52
5	2331.1	13.0	18	70	88	181	Imp.	0.9	4.5	163	0.00
6	2336.1	14.9	11	58	69	127	Imp.	1.2	5.7	152	0.00
7	2337.1	15.6	22	57	79	266	2.4	1.0	6.7	266	2.40
8	2338.1	14.2	5	82	87	55	0.42	1.0	7.7	55	0.42
9	2339.1	15.5	12	62	74	144	0.25	1.0	8.7	144	0.25
10	2340.1	15.3	15	61	76	178	0.69	1.0	9.7	178	0.69
11	2341.1	14.5	3	92	95	34	0.81	1.0	10.7	34	0.81
12	2342.1	14.6	21	72	93	238	Imp.	1.0	11.7	238	0.00
13	2343.1	14.7	11	79	90	125	Imp.	1.0	12.7	125	0.00
14	2344.1	14.6	15	78	93	170	0.28	1.0	13.7	170	0.28
15	2345.1	15.7	16	71	87	195	0.51	1.0	14.7	195	0.51
16	2346.1	14.4	14	73	87	157	Imp.	1.0	15.7	157	0.00
17	2347.1	14.2	19	74	93	209	0.33	1.0	16.7	209	0.33
18	2348.1	15.6	27	71	98	327	0.87	1.0	17.7	327	0.87
19	2349.1	15.2	25	51	76	295	0.71	1.0	18.7	295	0.71
20	2350.1	16.3	19	54	73	240	3.1	1.0	19.7	240	3.10
21	2351.1	16.2	21	65	86	264	3.3	1.0	20.7	264	3.30
22	2352.1	16.2	18	54	72	226	6.2	1.0	21.7	226	6.20
23	2353.1	14.6	17	71	88	192	3.5	1.0	22.7	192	3.50
24	2354.1	14.3	14	62	76	155	1.8	1.0	23.7	155	1.80

adjustment of 6s to 3ps + closely agrees with Fe content

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RESULTS OF SATURATION & PERMEABILITY TESTS

TABLE 1-B

Company Jackson Bros. Lease Hendrickson Well No. 3

Sample No.	Depth, Feet	Effective Porosity Percent	Percent Saturation			Oil Content Bbls. / A Ft.	Perm., Mill.	Feet of Sand		Total Oil Content	Perm. Capacity Ft. X md.
			Oil	Water	Total			Ft.	Cum. Ft.		
25	2355.1	16.6	19	54	73	245	2.0	1.0	24.7	245	2.00
26	2356.1	13.7	19	55	74	202	2.0	1.0	25.7	202	2.00
27	2357.1	15.1	13	60	73	152	7.5	1.0	26.7	152	7.50
28	2358.1	16.1	19	53	72	237	6.6	1.0	27.7	237	6.60
29	2359.1	16.8	12	56	68	156	5.9	1.0	28.7	156	5.90
30	2360.1	16.2	10	58	68	126	14.	1.0	29.7	126	14.00
31	2361.1	15.9	9	62	71	111	8.8	1.0	30.7	111	8.80
32	2362.1	15.1	11	52	63	129	2.4	1.0	31.7	129	2.40
33	2363.1	15.5	18	51	69	217	8.8	1.0	32.7	217	8.80
34	2364.1	16.8	13	53	66	169	9.3	1.0	33.7	169	9.30
35	2365.1	16.7	21	55	76	272	4.1	1.0	34.7	272	4.10
36	2366.1	15.3	18	60	78	214	6.0	1.0	35.7	214	6.00
37	2367.1	15.4	16	61	77	191	Imp.	1.0	36.7	191	0.00
38	2368.1	16.0	10	76	86	124	0.96	1.0	37.7	124	0.96
39	2369.1	16.4	17	76	93	216	3.0	1.6	39.3	346	4.80
								Total-------		7,459	

Oilfield Research Laboratories

SUMMARY OF WATER DIFFERENTIATION TESTS

TABLE VII

Company Jackson Bros. Lease Hendrickson Well No. 3

Depth Interval, Feet	Chloride Content of Brine in Sand, ppm	Average Percent Connate Water	Average Percent Drilling & Foreign Water
2327.0 - 2347.6	103,850		
2347.6 - 2370.2	101,700		
2327.0 - 2370.2	102,500		

Note: ppm — parts per million.

Oilfield Research Laboratories

SUMMARY OF LABORATORY FLOODING TESTS

TABLE V

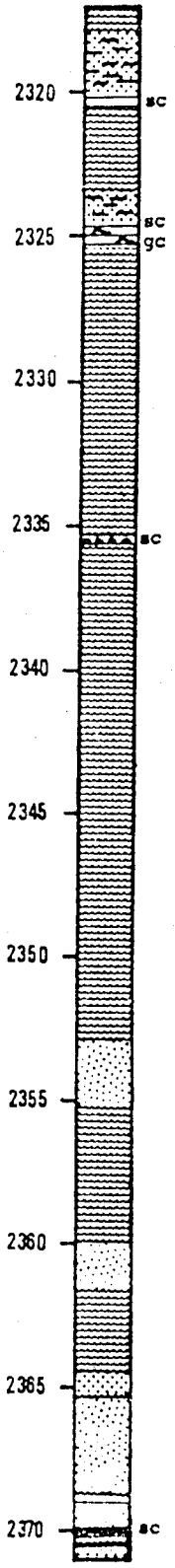
Company Jackson Bros. Lease Hendrickson Well No. 3

Depth Interval, Feet	2327.0 - 2370.2
Feet of Core Analyzed	8.0
Average Percent Porosity	15.8
Average Percent Original Oil Saturation	21.0
Average Percent Oil Recovery	3.0
Average Percent Residual Oil Saturation	18.0
Average Percent Residual Water Saturation	73.1
Average Percent Total Residual Fluid Saturation	91.1
Average Original Oil Content, Bbls./A. Ft.	257.
Average Oil Recovery, Bbls./A. Ft.	37.
Average Residual Oil Content, Bbls./A. Ft.	220.
Total Original Oil Content, Bbls./Acre	2,060.
Total Oil Recovery, Bbls./Acre	295.
Total Residual Oil Content, Bbls./Acre	1,765.
Average Effective Permeability, Millidarcys	0.225
Average Initial Fluid Production Pressure, p.s.i.	48.8

NOTE: Only those samples which recovered oil were used in calculating the above averages.

JACKSON BROS. HENDRICKSON NO.3

17-25S-9E



silty sandstone with small scale ripples

dark gray siltstone and sandstone with abundant slumping and contorted bedding

dark gray siltstone with interbedded sandstone

small scale asymmetrical unidirectional current ripples

horizontal laminations

interlaminated dark gray siltstone and sandstone with ripples

unidirectional asymmetrical current ripples

calcareous cemented zone from 2333-36

interlaminated silt and sandstone with distorted clasts

unidirectional asymmetrical current ripples

large scale inclined planar bedding with numerous climbing ripples

small scale unidirectional asymmetrical current ripples

large scale trough crossbedding

small scale asymmetrical unidirectional current ripples

massive bedding

large scale trough crossbedding

small scale asymmetrical unidirectional current ripples

massive bedding

coal; ripples overlying a dark gray siltstone

Hendrickson #3

must take picture of complete + prime core

2317

vf grained ss to ripple laminated dk gry siltstone wisps, also areas of interlaminated silt + ss wisps

2318

continuous

dk gry siltstone w contorted ss "clumps" probably reflecting mixing + hydroplastic movement. Fe concentrations also contorted ss wisps

2319

abundant contorted bedding - overcompaction + slumping? also loading of ss - burrowing when if present at all

relative amt of silt vs ss dictates flow velocity increase or decrease

sharp

2320

irregularly bedded silt stringers generally discontinuous extremely small scale - looks similar to number of little interference ripples

Lower lower sharp

2321

dk gry siltstone + interlaminated ss - very fine x-laminations then contorted bedding

ss wvf faint horizontal laminae

Slightly curved up - slight increase in flow?

ss wf small-med scale assymetrical ripples ripples are outlined better at the base w higher amts of silt + Fe coated grains

seem to be continuous

2322

higher degree of silt laminae

2323

almost graded like bedding in low + inclined lamina at base of prograding ripple zone

generally a massive sandstone

2324

wf faint horizontal laminae

- faint silt horizontal laminae look like maybe very low plane bed type deposit

vvf and abundant silt

sharp

interlaminated ss + silt displaying large scale ripples areas of Fe stained grains gradually decreasing into a fe stained silt shale w/ no visible ripple laminations all the way to very faint ripples

2325

similar to all gry interlaminated silts w/ local concentrations of Fe cement - generally rippled w/ abundant contorted bedding no evidence of burrowing - some clumps or lenticules along ripple bedding - unidirectional flow zone like an upper stage deposit of distal splay not tidal flat

2326

gradational fining up

2327

small scale assymetrical

w/ varying amts of silt only by ripple forms due to variation in flow velocity

2328

2329

2330

same type of ripples as above w/ higher degree of silt laminae. also there are numerous erosional contacts between sets 30-31 (horizontal faint)

2331

2332

calcareous zone

2333

erosional ??

also a ripple laminated zone but with a higher degree of Fe coated grains. seems to be interspersed w/ hor laminae Fe nodules

2334

2335

small scale asymmetrical prograding ripples

horizontally laminated silt & carb material w/ Fe nodules & compacted? rip up clast
also graded bedded unit right above
similar to 2346

2336

erosional ????

2337

2338

erosional ??

variations in silt may just be due to seasonal variations in flow discharge

2339

difficult to tell really if sedimentary seds fines upward not the same abundance of silt as unit below

2340

occasional clasts are present

2341

ss seems to be coarser & contains less silt also deformed erosional clasts

erosional ?? scour surface

concentration of pyrite w/ sideritic halo

2342

Small scale asymmetrical ripples from 2341-6" to 2346 contain high conc. of silt (silty ss) + interspersed graded bedded units prograding ripples

2343

2344

2345

2346

3cm horizontal or low inclined bedding // planar continuous seems slightly graded bedded units

erosional

massive s.st grades up into ss scale ~1cm

contorted laminated dk. gry siltstone w/ sand stone clasts (probably loady) / Fe concentrated in siltstone

contorted bedding due to slumping

erosional

2347

small scale ripple laminations w/ decreasing amt. of silt as depth increases prograding widen

2348

may be climbing ripple sequence

2349

fining up sequence

2350

ripple forms look smaller?

2351

2352

I believe continuous maybe erosional though

large scale low to medium & planar // inclined bedding outlined by silt wisps & Fe zones w/ smaller like ripple forms in beds

2353 X

may be part of same sequence

very well outlined larger medium & inclined beds - planar may be sandwave deposition - may represent variations in flow conditions probably not flood stage

vf subangular SS w/ Fe + carb + silt concentrated in laminae outlining bed form - may be clue to non equil.

2354

ripples on top of med & inclined bedding ?? - ripples - asymmetrical prograding - seem to be interbedded w/ larger scale forms - may represent adjustment to decrease in flow velocity from dunes to ripples

2355

erosional?

larger scale inclined bedding becomes more wavy & seems to go into a faint ripple zone as depth increases

2356

small scale asymmetrical ripples - unidirectional prograding relatively well outlined w/ silt + Fe

2357

2358

2359

but no real decrease in grain size - sedimentary structures [illegible]

may actually be smaller trough sets than 2360-61 - give appearance of ripple prograding zone numerous [illegible] scours

large scale low to medium & parallel

2360

2361

2362

2363

2364

2365

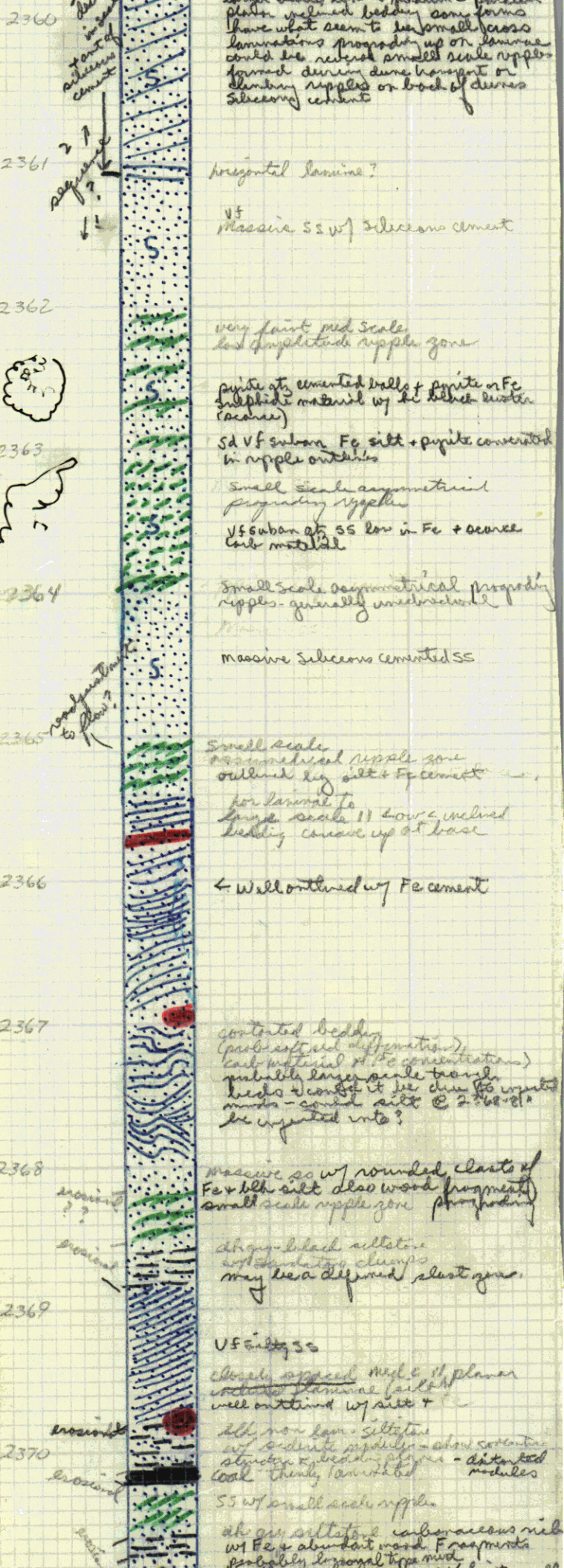
2366

2367

2368

2369

2370



2371

pyrite

Vfs silty fine sandstone very faint small scale prograding stippled

Generally the entire core seems to have varying amounts of silica cement