

Oilfield Research Laboratories

GENERAL INFORMATION & SUMMARY

10

Company Jackson Bros. Lease G.K. Jackson Heirs Well No. 11

Location NW NW SW

Section 23 Twp. 25S Rge. 8E County Greenwood State Kansas

Name of Sand - - - - - Bartlesville

Top of Core - - - - - 2450.0

Bottom of Core - - - - - 2479.0

Top of Sand - - - - - (Analyzed) 2450.0

Bottom of Sand - - - - - 2474.0

Total Feet of Permeable Sand - - - - - 18.2

Total Feet of Floodable Sand - - - - - 12.4

Distribution of Permeable Sand:
Permeability Range
Millidarcys

Feet

Cum. Ft.

0 - 5	5.8	5.8
5 - 10	5.0	10.8
10 - 20	3.0	13.8
20 - 35	3.4	17.2
35 & above	1.0	18.2

Average Permeability Millidarcys - - - - - 17.0

Average Percent Porosity - - - - - 16.5

Average Percent Oil Saturation - - - - - 28.6

Average Percent Water Saturation - - - - - 48.5

Average Oil Content, Bbls./A. Ft. - - - - - 365.

Total Oil Content, Bbls./Acre - - - - - 7,195.

Average Percent Oil Recovery by Laboratory Flooding Tests - - - - - 9.2

Average Oil Recovery by Laboratory Flooding Tests, Bbls./A. Ft. - - - - - 122.

Total Oil Recovery by Laboratory Flooding Tests, Bbls./Acre - - - - - 1,513.

Total Calculated Oil Recovery, Bbls./Acre - (Primary & Secondary) - - - - - 3,600.

Packer Setting, Feet - - - - -

Viscosity, Centipoises @ - - - - -

A. P. I. Gravity, degrees @ 60 °F - - - - -

Elevation, Feet - - - - -

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SUMMARY OF LABORATORY FLOODING TESTS

TABLE V

Company	Jackson Bros.	Lease	G.K. Jackson Heirs	Well No.	11
Depth Interval, Feet	2450.0 - 2464.6 - 2464.6 - 2474.0 - 2450.0 - 2474.0				
Feet of Core Analyzed	4.0	8.4	12.4		
Average Percent Porosity	15.9	17.7	17.2		
Average Percent Original Oil Saturation	32.4	27.5	29.1		
Average Percent Oil Recovery	7.2	10.0	9.2		
Average Percent Residual Oil Saturation	25.2	17.5	19.9		
Average Percent Residual Water Saturation	64.1	74.0	70.8		
Average Percent Total Residual Fluid Saturation	89.3	91.5	90.7		
Average Original Oil Content, Bbls./A. Ft.	392.	378.	382.		
Average Oil Recovery, Bbls./A. Ft.	86.	139.	122.		
Average Residual Oil Content, Bbls./A. Ft.	306.	239.	260.		
Total Original Oil Content, Bbls./Acre	1,574.	3,171.	4,745.		
Total Oil Recovery, Bbls./Acre	346.	1,167.	1,513.		
Total Residual Oil Content, Bbls./Acre	1,228.	2,004.	3,232.		
Average Effective Permeability, Millidarcys	0.413	3.62	2.58		
Average Initial Fluid Production Pressure, p.s.i.	45.0	23.8	30.8		

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

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SUMMARY OF WATER DIFFERENTIATION TESTS

TABLE VII

Company Jackson Bros. Lease G.K. Jackson Heirs Well No. 11

Depth Interval, Feet	Chloride Content of Brine in Sand, ppm	Average Percent Connate Water	Average Percent Drilling & Foreign Water
2450.0 - 2464.6	97,600		
2464.6 - 2474.0	73,500		
2450.0 - 2474.0	86,000		

Note: ppm — parts per million.

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:

<u>Depth Interval, Feet</u>	<u>Description</u>
2450.0 - 2452.8	Brown, laminated, shaly sandstone.
2452.8 - 2453.3	Shale.
2453.3 - 2453.8	Brown, laminated, shaly sandstone.
2453.8 - 2457.6	Shale.
2457.6 - 2459.6	Light brown, laminated, shaly sandstone.
2459.6 - 2474.0	Brown, slightly shaly sandstone.
2474.0 - 2479.0	Shale.

Coring was started at a depth of 2450.0 feet in shaly sandstone and completed at 2479.0 feet in shale. For the most part, the pay is made up of brown, slightly 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 4.0 and 29.2 millidarcys respectively; the overall average being 17.0 (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 141. millidarcys.

PERCENT SATURATION & OIL CONTENT

The sand in this core shows a good weighted average percent oil

saturation, namely, 28.6. The weighted average percent oil saturation of the upper and lower sections is 30.9 and 26.2 respectively. The weighted average percent water saturation of the upper and lower sections is 48.5 and 48.5 respectively; the overall average being 48.5 (See Table III). This gives an overall weighted average total fluid saturation of 77.1 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 appears that some flushing did occur. In general, the zones of lower permeability have the higher chloride content.

The weighted average oil content of the upper and lower sections is 374 and 356 barrels per acre foot respectively; the overall average being 365. The total oil content, as shown by this core, is 7,195 barrels per acre of which 4,745 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 1,513 barrels of oil per acre was obtained from 12.4 feet of sand. The weighted average percent oil saturation was reduced from 29.1 to 19.9, or represents an average recovery of 9.2 percent. The weighted average effective permeability of the samples is 2.58 millidarcys, while the average initial fluid production pressure is 30.8 pounds per square inch (See Table V).

By observing the data given in Table IV, you will note that of the 20 samples tested, 14 produced water and 12 oil. This indicates that

approximately 60 percent of the sand represented by these samples is floodable pay sand. The tests also show that the sand has a wide variation in 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 1,620 and 1,980 barrels of oil per acre respectively. These are average recoveries of 131 and 160 barrels per acre foot. These recovery values were calculated using the following data and assumptions:

Original formation volume factor	1.22
Reservoir water saturation, percent	36.0
Expected primary recovery, estimated, percent	12.0
Average porosity, percent	17.2
Oil saturation after flooding, percent	19.9
Performance factor, percent	50.0
Net floodable pay sand, feet	12.4

This core shows a pay sand section having a good oil saturation, a moderate water saturation and a wide variation in effective permeability to water.

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SUMMARY OF PERMEABILITY & SATURATION TESTS

TABLE III

Company		Lease		G.K. Jackson Heirs		Well No.	
Jackson Bros.						11	
Depth Interval, Feet	Feet of Core Analyzed	Average Permeability, Millidarcys	Permeability Capacity Ft. x Md.				
2450.0 - 2464.6	8.8	4.0	35.54				
2464.6 - 2474.0	9.4	29.2	273.90				
2450.0 - 2474.0	18.2	17.0	309.44				

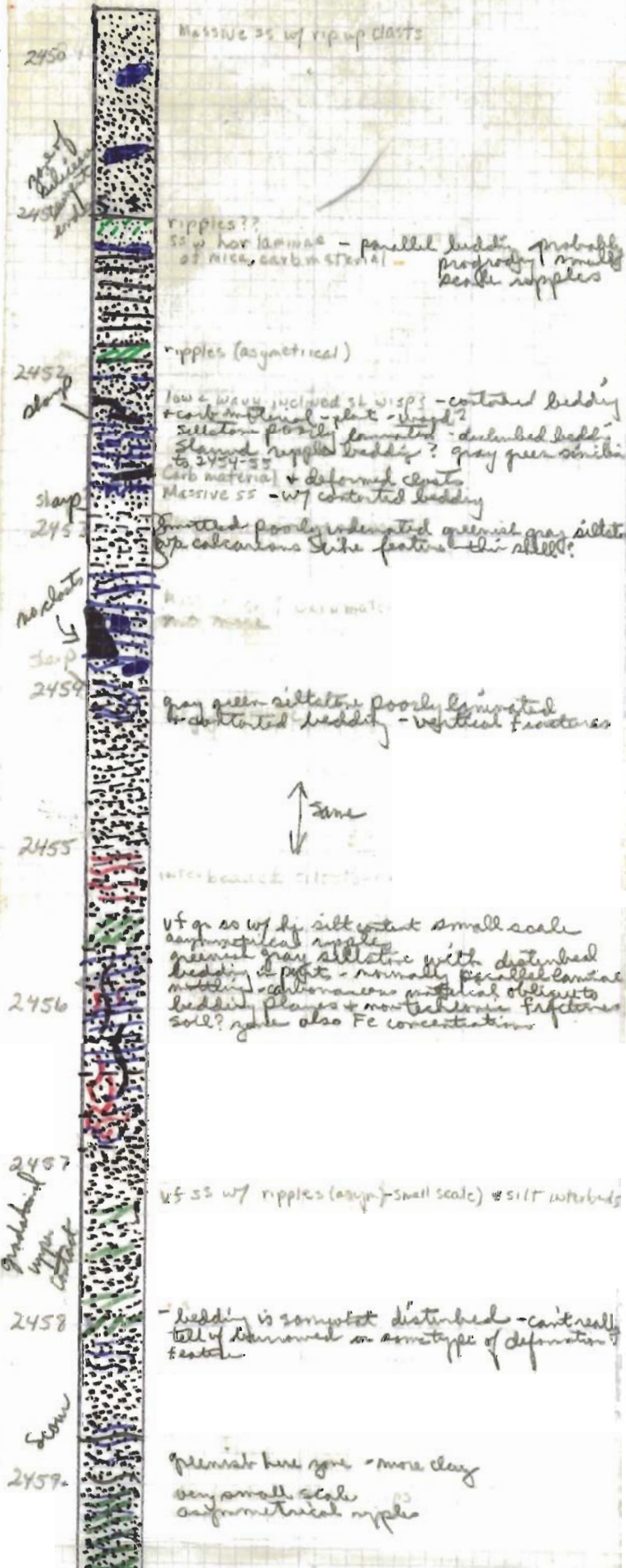
Depth Interval, Feet	Feet of Core Analyzed	Average Percent Porosity	Average Percent Oil Saturation	Average Percent Water Saturation	Average Oil Content Bbl./A. Ft.	Total Oil Content Bbls./Acre
2450.0 - 2464.6	10.3	15.6	30.9	48.5	374	3,846
2464.6 - 2474.0	9.4	17.5	26.2	48.5	356	3,349
2450.0 - 2474.0	19.7	16.5	28.6	48.5	365	7,195

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RESULTS OF WATER DIFFERENTIATION TESTS
TABLE VI

Company Jackson Bros. Lease G.K. Jackson Heirs Well No. 11

Sample No.	Depth, Feet	Chloride Content of Brine in Sand ppm	Percent Water Saturation	
			Connate	Drilling & Foreign
1	2450.1	30,200		
2	2451.1	73,500		
3	2452.1	110,700		
4	2453.7	124,000		
5	2458.1	117,200		
6	2459.1	97,600		
7	2460.1	102,300		
8	2461.1	82,700		
9	2462.1	99,600		
10	2463.1	107,500		
11	2464.1	111,700		
12	2465.1	101,700		
13	2466.1	101,100		
14	2467.1	112,300		
15	2468.1	105,700		
16	2469.1	36,300		
17	2470.1	50,750		
18	2471.1	81,200		
19	2472.1	78,800		
20	2473.1	15,810		

Note: ppm — parts per million



2458

- bedding is somewhat disturbed - can't really tell if laminated or some type of deformation texture

down

2459

greenish here zone - more clay
very small scale
asymmetrical ripples

2460

461

low - inclined, d.s. sh wisps not as large scale as lower sediments grading up into shell scale ripple zone - definitely forming upward

2462

Massive ss

2463

2464

gradual decrease in siliceous cement

Massive ss

generally med & inclined bedding but somewhat disturbed

2465

low inclined, // planar laminae

2466

Massive ss - again back into strongly siliceous zone

almost contact between siliceous zone & non siliceous zone

2467

Fe has been abundant in the last couple of supposed sequences actually from 2464-92

2468

- back again to strong siliceous cement
- more ripple laminated than large scale x bedding - little siliceous cement



2465

low inclined, 11, planar laminae

2466

Massive SS - again back into strongly siliceous zone

abrupt contact between siliceous zone & non siliceous zone

2467

Fe has been abundant in the last couple of supposed sequences actually from 2464-92

2468

- back again to strong siliceous cement
- more ripple laminated than large scale & probably a little siliceous cement

2469

- Siliceous cement abundant

Massive SS - between 2469-70 not as much siliceous cement another sequence to change if flow w/ to 1st laminae inclined, 11, planar laminae siliceous cement

2470

laminae become easier to see

2471

med - inclined planar laminae outlined by (Fe + cement) pyrite present Fe locally more abundant than below

2472

SS massive w/ siliceous cement

finer very fine subangular SS w/ carb material common. Also w/ Fe siliceous cement (Fe is present though)

2473

SS massive, with lesser silica cement also of pyrite cemented balls

2474

black carbonaceous sh. shale w/ concretion features

again
siliceous

good candidate for x-rays