(10)

Oilfield Research Laboratories

GENERAL INFORMATION & SUMMARY

elevation 1325

Company Jackson Bros. Lease Perrier Well No. 6

Location NE NW SE

Section 17 Twp. 25S Rge. 8E County Greenwood State Kansas

Name of Sand	Bartlesville
Top of Core	2350.0
Bottom of Core	2382.0
Top of Sand	2351.0
Bottom of good Sand	2366.5
Total Feet of Permeable Sand	16.0
Total Feet of Floodable Sand	14.0

Distribution of Permeable Sand:

Permeability Range Millidarcys	Feet	Cum. Ft.
0 - 5	2.5	2.5
5 - 10	4.9	7.4
10 - 25	1.6	9.0
25 - 50	5.0	14.0
50 & above	2.0	16.0

Average Permeability Millidarcys	24.4
Average Percent Porosity	15.9
Average Percent Oil Saturation	28.7
Average Percent Water Saturation	41.9
Average Oil Content, Bbls./A. Ft.	353.
Total Oil Content, Bbls./Acre	5,822.
Average Percent Oil Recovery by Laboratory Flooding Tests	3.6
Average Oil Recovery by Laboratory Flooding Tests, Bbls./A. Ft.	47.
Total Oil Recovery by Laboratory Flooding Tests, Bbls./Acre	575.
Total Calculated Oil Recovery, Bbls./Acre (Primary & Secondary)	3,739.
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 Perrier Well No. 6

Depth Interval, Feet	2351.0 - 2361.6	2361.6 - 2367.5	2351.0 - 2367.5
Feet of Core Analyzed	10.1	2.0	12.1
Average Percent Porosity	16.9	14.5	16.5
Average Percent Original Oil Saturation	29.0	35.0	30.0
Average Percent Oil Recovery	3.7	3.0	3.6
Average Percent Residual Oil Saturation	25.3	32.0	26.4
Average Percent Residual Water Saturation	66.3	56.0	64.6
Average Percent Total Residual Fluid Saturation	91.6	88.0	91.1
Average Original Oil Content, Bbls./A. Ft.	380.	396.	382.
Average Oil Recovery, Bbls./A. Ft.	50.	35.	47.
Average Residual Oil Content, Bbls./A. Ft.	330.	361.	335.
Total Original Oil Content, Bbls./Acre	3,839.	793.	4,632.
Total Oil Recovery, Bbls./Acre	505.	70.	575.
Total Residual Oil Content, Bbls./Acre	3,334.	723.	4,057.
Average Effective Permeability, Millidarcys	1.32	0.30	1.15
Average Initial Fluid Production Pressure, p.s.i.	33.6	35.0	33.8

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 Perrier Well No. 6

Depth Interval, Feet	Chloride Content of Brine in Sand, ppm	Average Percent Connate Water	Average Percent Drilling & Foreign Water
2351.0 - 2361.6	37,606		
2361.6 - 2367.5	93,686		
2351.0 - 2367.5	57,659		

Note: ppm — parts per million.

A fresh water mud was used as a circulating fluid in the coring of the sand in this well. The well was drilled in a virgin area. The core was sampled and sealed in tin cans by an employee of Oilfield Research Laboratories.

FORMATION CORED

The detailed log of the formation cored is as follows:

Depth Interval, Feet	Description
2350.0 - 2351.0	Shale, containing a vertical fracture.
2351.0 - 2366.5	Light brown, slightly shaly sandstone.
2366.5 - 2367.5	Brownish gray, shaly, carbonaceous sandstone.
2367.5 - 2382.0	Sandy shale.

Coring was started at a depth of 2350.0 feet in shale and completed at 2382.0 feet in sandy shale. This core shows a total of 16.5 feet of sandstone. The pay is made up of light 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 35.2 and 5.8 millidarcys respectively; the overall average being 24.4 (See Table III). By observing the data given on the coregraph, it is noticeable that the sand has a very irregular permeability profile. The permeability of the sand varies from 0.97 to a maximum of 71. millidarcys.

PERCENT SATURATION & OIL CONTENT

The sand in this core shows a fairly low weighted average percent oil saturation, namely, 28.7. The weighted average percent oil saturation of the upper and lower sections is 29.0 and 28.3 respectively.

The weighted average percent water saturation of the upper and lower sections is 39.6 and 45.8 respectively; the overall average being 41.9 (See Table III). This gives an overall weighted average total fluid saturation of 85.4 percent.

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 considerable flushing of the sand did occur during coring as the zone of higher permeability had a much lower average chloride content.

The weighted average oil content of the upper and lower sections is 370 and 321 barrels per acre foot respectively; the overall average being 353. The total oil content, as shown by this core, is 5,822 barrels per acre (See Table III).

LABORATORY FLOODING TESTS

When taking into consideration that the sand in the core had a fairly low oil saturation, the samples responded rather well to laboratory flooding tests, as a total recovery of 575 barrels of oil per acre was obtained from 12.1 feet of sand. The weighted average percent oil saturation was reduced from 30.0 to 26.4, or represents an average recovery of 3.6 percent. The weighted average effective permeability of the samples is 1.15 millidarcys, while the average initial fluid production pressure is 33.8 pounds per square inch (See Table V).

By observing the data given in Table IV, you will note that of the 17 samples tested, 16 produced water and 13 oil. This indicates that approximately 76 percent of the sand represented by these samples is floodable pay sand.

CONCLUSION

From a study of the above data, we estimate that approximately 3,739 barrels of oil per acre or an average of 267 barrels per acre foot can be recovered from the area, represented by this core, by efficient primary and waterflood operations. Of this amount, 2,017 barrels can be expected from primary production and 1,722 from waterflooding. The following data was used in calculating the above oil recovery values:

Original formation volume factor	1.22
Irreducible water saturation, percent	29.0
Primary recovery, estimated, percent	None
Present oil saturation, percent	58.2
Average porosity, percent	16.2
Oil saturation after flooding, percent	26.4
Performance factor	0.55
Net floodable pay sand, feet	14.0

This core shows a rather clean sand section having a fairly low oil saturation, a moderate water saturation and a good permeability for its depth.

The chloride tests indicate that considerable flushing of the sand occurred during coring. This would cause the sand in the core to show a lower oil and a higher water saturation.

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SUMMARY OF PERMEABILITY & SATURATION TESTS

TABLE III

Company Jackson Bros. Lease Perrier Well No. 6

Depth Interval, Feet	Feet of Core Analyzed	Average Permeability, Millidarcys	Permeability Capacity Ft. x Md.
2351.0 - 2361.6	10.1	35.2	355.95
2361.6 - 2367.5	5.9	5.8	34.27
2351.0 - 2367.5	16.0	24.4	390.22

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
2351.0 - 2361.6	10.6	16.5	29.0	39.6	370	3,919
2361.6 - 2367.5	5.9	14.8	28.3	45.8	321	1,903
2351.0 - 2367.5	16.5	15.9	28.7	41.9	353	5,822

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RESULTS OF WATER DIFFERENTIATION TESTS

TABLE VI

Company Jackson Bros. Lease Perrier Well No. 6

Sample No.	Depth, Feet	Chloride Content of Brine in Sand ppm	Percent Water Saturation		
			Connate	Drilling & Foreign	Total
1	2351.1	60,400			
2	2352.0	85,700			
3	2353.1	21,800			
4	2354.1	63,100			
5	2355.1	11,725			
6	2356.1	18,075			
7	2357.1	89,300			
8	2358.1	23,050			
9	2359.1	17,025			
10	2360.1	21,500			
11	2361.1	54,175			
12	2362.1	95,000			
13	2363.1	89,750			
14	2364.1	105,100			
15	2365.1	98,500			
16	2366.1	85,300			
17	2367.1	87,600			

Note: ppm — parts per million

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RESULTS OF LABORATORY FLOODING TESTS

TABLE IV

Company Jackson Bros. Lease Perrier Well No. 6

Sample No.	Depth, Feet	Effective Porosity Percent	Original Oil Saturation		Oil Recovery		Residual Saturation			Volume of Water Recovered cc*	Effective Permeability Millidarcys**	Initial Fluid Production Pressure Lbs./Sq./In.
			%	Bbls./A. Ft.	%	Bbls./A. Ft.	% Oil	% Water	Bbls./A. Ft.			
1	2351.1	19.2	32	462	6	89	25	66	373	31	0.60	40
2	2352.2	16.9	28	367	2	26	26	71	341	60	1.20	30
3	2353.1	19.0	29	428	5	74	24	69	354	83	1.60	30
4	2354.1	13.7	31	330	1	11	30	53	319	9	0.10	50
5	2355.1	19.3	26	390	4	60	22	70	330	101	1.70	30
6	2356.1	16.8	27	352	3	39	24	70	313	59	1.90	30
7	2357.1	15.0	29	337	2	23	27	62	314	29	0.50	30
8	2358.1	16.9	27	354	2	26	25	69	328	31	0.50	40
9	2359.1	18.4	29	414	5	71	24	73	343	169	3.20	30
10	2360.1	16.9	29	381	5	66	24	68	315	119	2.30	30
11	2361.1	14.9	34	393	6	69	28	61	324	35	0.60	30
12	2362.1	14.6	28	318	0	0	28	59	318	15	0.20	40
13	2363.1	14.7	22	251	0	0	22	61	251	19	0.30	30
14	2364.1	13.9	32	345	1	11	31	60	334	24	0.30	30
15	2365.1	15.2	38	448	5	59	33	52	389	17	0.30	40
16	2366.1	16.5	22	282	0	0	22	68	282	15	0.20	40
17	2367.1	14.7	29	331	0	0	29	61	331	0	Imp.	-

Note: 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.

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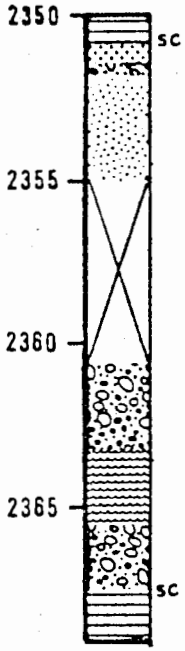
RESULTS OF SATURATION & PERMEABILITY TESTS

TABLE 1-B

Company Jackson Bros. Lease Perrier Well No. 6

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	2351.1	18.7	32	34	66	464	18 lo	0.6	0.6	278	10.80
2	2352.0	14.6	26	49	75	294	3.1 lo	0.5	1.1	147	1.55
F-2	2352.2	16.9	28	-	-	367	-	0.5	1.6	183	-
3	2353.1	18.6	29	29	58	419	62 lo	1.0	2.6	419	62.00
4	2354.1	13.4	31	44	75	322	6.6 lo?	1.0	3.6	322	6.60
5	2355.1	18.9	26	35	61	381	71.	1.0	4.6	381	71.00
6	2356.1	16.4	27	40	67	343	48.	1.0	5.6	343	48.00
7	2357.1	14.8	29	46	75	332	15.	1.0	6.6	332	15.00
8	2358.1	16.9	27	40	67	354	36. lo?	1.0	7.6	354	36.00
9	2359.1	17.9	29	36	65	402	38.	1.0	8.6	402	38.00
10	2360.1	16.4	29	45	74	368	40.	1.0	9.6	368	40.00
11	2361.1	14.8	34	41	75	390	27.	1.0	10.6	390	27.00
12	2362.1	14.4	27	42	69	302	4.3 dust	1.0	11.6	302	4.30
13	2363.1	14.3	20	51	71	222	7.0	1.0	12.6	222	7.00
14	2364.1	13.4	32	53	85	332	7.3	1.0	13.6	332	7.30
15	2365.1	15.0	38	46	84	441	7.5 ripple	1.0	14.6	441	7.50
16	2366.1	16.6	21	39	60	270	8.0	0.9	15.5	243	7.20
17	2367.1	15.1	31	43	74	363	0.97 dust	1.0	16.5	363	0.97
								Total		5,822	

JACKSON BROS. PERRIER NO. 6
17-25S-9E



dark gray laminated siltstone with pyrite and organic material
massive bedding
iron nodules

large scale trough crossbedding

missing core interval

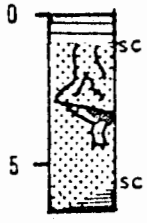
clast zone with siltstone clasts, iron nodules, carbonaceous material and calcareous nodules

medium scale unidirectional asymmetrical current ripples

clast zone as above

dark gray siltstone showing high angle cross laminations; iron claystone is at the top of the siltstone and shows distorted laminae

JACKSON BROS. HENDRICKSON NO. 7
17-25S-9E



dark gray siltstone with soft sediment deformation and slickensides

oblique non-tectonic fractures

generally a massive sandstone with medium angle inclined bedding and siliceous and/or dolomite cement; black carbonaceous rich claystone

Jackson Bros
Perrier #6

dark gray siltstone well laminated w/ closely spaced silt - carb material & mica laminae generally horizontal w/ sand starved ripples pyrite w/ subsidiary halo (beautiful fools gold)

~~Sandstone generally massive yet seemingly [illegible] [illegible] ripple forms~~ ? - siliceous cement w subordinate calcite cement

SS f to vf subangular w/ minor Fe + carbonaceous material

— Fe nodules w/ outline of ripple forms - prograding?

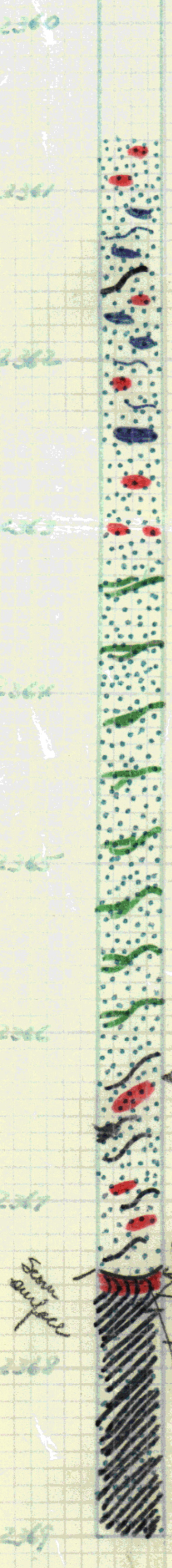
large scale med + planar // cross bedding outlined by carb material + tops of laminae no discernable grain size increase about 3.0 ϕ, subangular. Low in Fe content Carb is common

↑↑ common in this sequence of sands

← Siliceous cement?

← flattening out of inclined laminae indicates progradation of sandwave forms or dune forms

Massive SS



abundant dk gry silt or shale rip-up clasts w/ Fe clay nodules

amount of Fe in sandstone is still very low except where concentrated around Fe nodules + carbonaceous material, bedding is irregular, showing in places inclined wavy bedding or horizontal bedding

clasts are compacted yet have a somewhat rounded nature could it be a clue of downcutting into the underlying shale that was semiconsolidated

numerous calcareous clasts
siltstone clasts are black to greenish gray + pyrite has regular boundaries
all detritial from lateral greenish gray or black siltstone facies

large scale ripple bedding w/ carbonaceous material + scarce Fe clasts

generally sd is vf, subangular, moderately sorted, ~½% Mf ca Fe cement is generally scarce to common + carb material is common

Fe nodules + clasts become abundant + carbonaceous clast scale of trough like laminae is higher. May be due to slumping, I don't believe that they are channel lag in the classical sense rather perhaps slumping + erosion higher in a bank or a [illegible] zone and erosion of pre-existing silt deposit

abundance of carb material indicates reducing conditions or a rapid [illegible]

inch of Fe carbonate conc (claystone)

top laminae are deformed

black wavy to inclined planar parallel bedding, v fine sand w/ abundant carbonaceous material + silt.

may also indicate semi consolidated

similarity in diagenetic features of the two sandstones suggest a genetic relationship
also seems like the more iron more likely that carb material has metallic luster

with calcite cement present
+ siderite - what was source
of Fe + in abundance of sulfur
why did siderite appear - maybe
with channels coming through - there
was more of an oxidizing atmosphere
+ abundant plant activity allowed
for the fact that CO_2 is mostly low
present. In actuality most of the
siderite may be primary w/ later
changes in the connate H_2O cause
iron into cement like form
pyrite as w/ carbonaceous material
may be authigenic