

CALIFORNIA RESEARCH CORPORATION
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RESERVOIR FLUID STUDY
DALY WELL 6-10

PROJECT 8211

H. S. Yaplee
September 11, 1953

CALIFORNIA RESEARCH CORPORATION
La Habra, California

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File 568.22
Project 8211
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This report presents the results of a reservoir fluid study made on a bottom-hole fluid sample from Daly Well 6-10. The study was requested in Mr. C. D. Mims' letter of June 11, 1953, to Mr. E. G. Gaylord.

Data were determined for the following information:

1. Pressure-volume relations at a reservoir temperature of 79°F
2. Differential gas liberation data at 79°F
3. Single-stage flash vaporization data at separator conditions of 0 psig and 45°F
4. Viscosity of liquid phase at reservoir temperature.

These data are presented in the attached tables and figures.

A considerable quantity of wax or asphalt precipitation with a melting point of approximately 115°F was found in the samples. Because of this, it was necessary to measure the liquid phase viscosities at 120°F and 150°F and then obtain the liquid viscosities at reservoir temperature by extrapolating the data to 79°F. Only undersaturated liquid viscosities could be obtained. These are given in Table 7.

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Tables 1 through 7
Figures 1 through 3 (LE-6517-19)



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TABLE 1

SUMMARY OF GENERAL DATA

Bubble Point Pressure: 436 psia at 79°F

Coefficient of compressibility at reservoir
temperature of 79°F, $-\frac{1}{V} \left[\frac{\partial V}{\partial P} \right]_T$:

<u>Pressure, psia</u>	<u>Coefficient, vol per vol per psi</u>
Bubble point	6.3 (10 ⁻⁶)
1600	6.3

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TABLE 2

PRESSURE-VOLUME RELATIONSHIP AT 79°F - EXPERIMENTAL DATA

Bubble Point Pressure: 436 psia

Pressure psia	Relative Volume Factor Bubble Point Volume = 1.0 Gas + Liquid	$\frac{Y}{\left[\frac{P_s - P}{P} \right] \left[\frac{1}{\frac{V}{V_s} - 1} \right]}$		Per Cent Liquid
2008	0.9907			
1652	0.9919			
1308	0.9944			
961	0.9970			
604	0.9991			
420	1.0060	6.3420		
413	1.0075	7.3958		
369	1.0207	8.7729		
323	1.0486	7.2020		
298	1.0672	6.8903		
233	1.1288	6.7640	88.07	
149	1.3692	5.2172	72.26	
100	1.7960	4.2211	54.89	
78	2.3379	3.4305	41.93	
55	3.2666	3.0562	29.89	

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TABLE 3

PRESSURE-VOLUME RELATIONSHIP AT 79°F - SMOOTHED DATA*

Bubble Point Pressure: 436 psia

Pressure psia	Relative Volume Factor, Bubble Point Volume = 1.0	
	<u>Gas + Liquid</u>	<u>Liquid</u>
1600		0.9926
1400		0.9939
1200		0.9952
1000		0.9964
800		0.9977
600		0.9989
400	1.0122	0.999
350	1.0338	0.998
300	1.0636	0.997
250	1.1080	0.995
200	1.1858	0.993
150	1.3636	0.990
100	1.8215	0.984
50	3.6294	0.975

*By application of "Y" curve:
$$Y = \left[\frac{P_s - P}{P} \right] \left[\frac{1}{\frac{V}{V_s} - 1} \right]$$

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TABLE 4

DIFFERENTIAL GAS LIBERATION AT 79°F - EXPERIMENTAL DATA

Bubble Point Pressure: 436 psia at 79°F
Relative Volume: 1.0746 bbl per bbl*

Pressure Range psia	Volume cfb*	Liberated Gas		Relative Volume of Saturated Oil at Lower Pressure bbl per bbl*
		Specific Gravity (Air=1.0)	Compressibility Factor at Lower Pressure $Z = PV/NRT$	
436-334	6	0.966	0.892	1.0737
334-248	7	0.982	0.910	1.0727
248-123	17	1.025	0.945	1.0650
123-63	20	1.130	0.969	1.0511
63-14.7	72	1.475	-	1.0083

*Basis: Residual oil volume at 14.7 psia and 60°F = 1.0

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TABLE 5

SUMMARY OF DIFFERENTIAL GAS LIBERATION TEST AT 79°F

Bubble point pressure, psia	436
Volume of gas liberated between saturation and atmospheric pressure, cu ft per bbl residual oil at 14.7 psia and 60°F	122
Relative volume of residual oil at 60°F, bbl per bbl saturated oil at 436 psia and 79°F	0.9306
Gravity of residual oil, °API	30.5
Density of saturated oil at 436 psia and 79°F, gm per cc	0.845
Average specific gravity of all gas liberated (Air = 1.0)	1.300

RESERVOIR FLUID ANALYSIS

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TABLE 6

SINGLE-STAGE SEPARATOR TEST AT 45°F

Tank Pressure: 0 psig

Total Gas-Tank Oil Ratio, cfb	137
Gas Gravity (Air = 1.0)	1.315
Tank Oil Gravity, °API	27.5
Formation Volume Factor bbl reservoir oil per bbl tank oil at 14.7 psia and 60°F	1.100

RESERVOIR FLUID STUDY

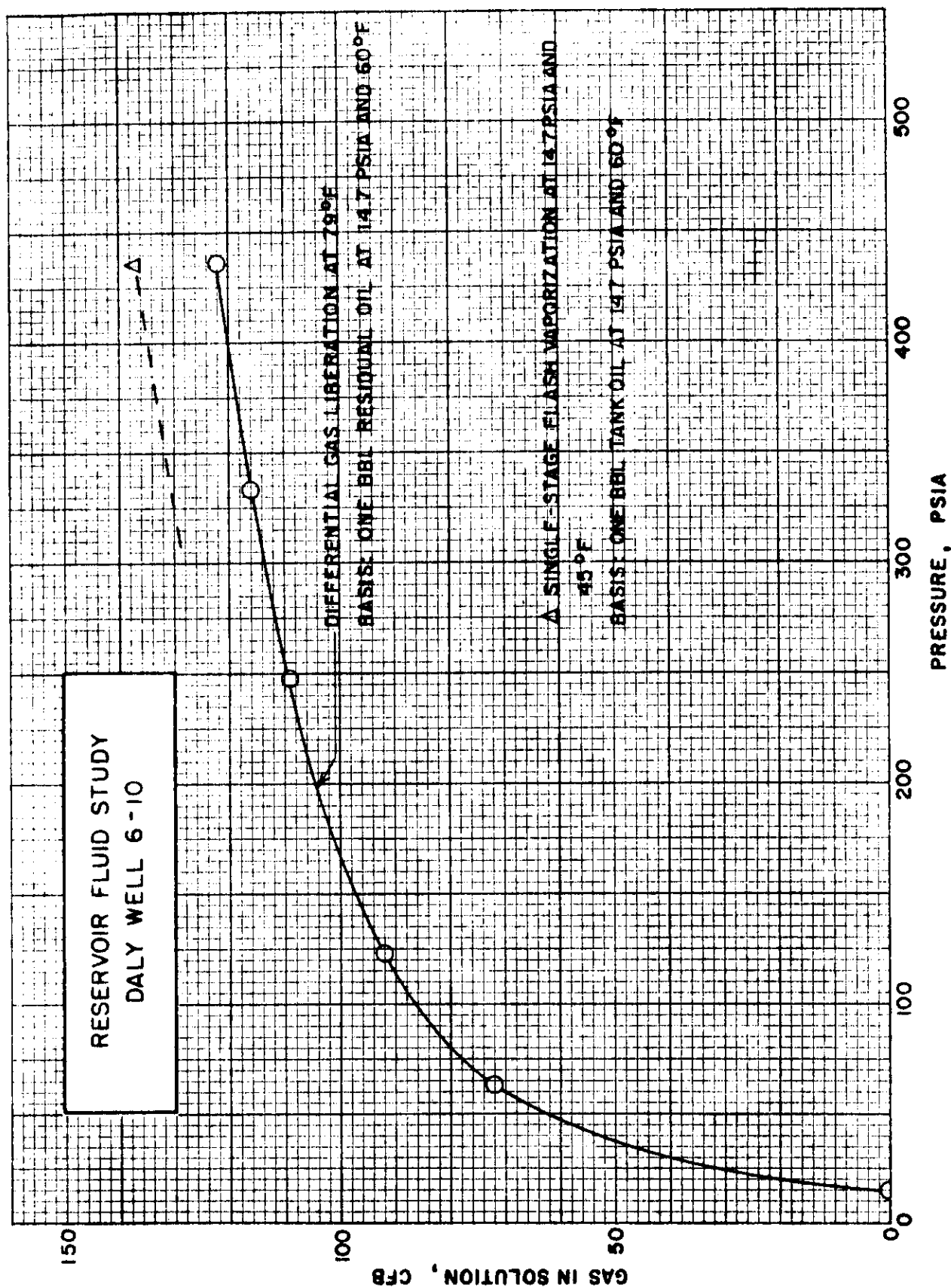
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TABLE 7

VISCOSITY OF LIQUID PHASE AS FUNCTION OF PRESSURE

Temperature: 79°F

<u>Pressure</u> <u>psia</u>	<u>Viscosity</u> <u>cp</u>
1600	3.75
1400	3.68
1200	3.61
1000	3.54
800	3.47
600	3.40
500	3.36
Bubble Point Pressure	3.34



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FIGURE 1
GAS IN SOLUTION VS PRESSURE

