BENSON-MONTIN-GREER DRILLING CORP.
EXHIBITS IN CASE NOS. 8946 & 8950
BEFORE THE OIL CONSERVATION DIVISION OF THE
NEW MEXICO DEPARTMENT OF ENERGY AND MINERALS

AUGUST 7, 1986

NMOCC/NMOCD Case No. 8950
Hearing Date 8/21/86
Benson-Montin-Greer

Exhibit No. 8

Geologic Analysis of Naturally Fractured Reservoirs

Ronald A. Nelson

Effect of Variation in Fracture Spacing

Variation in fracture spacing can have a dramatic effect on both fracture porosity and permeability (Figures 1-55 and 1-56). The combined effect of both fracture width and spacing on these reservoir parameters is shown in Figures 1-55 and 1-56. A good qualitative feeling for the effect of outcrop or core observations of fracture spacing at an assumed fracture width, or vice versa, can be derived from these diagrams.

Techniques for Calculating Fracture Spacing

In simple fracture networks of regular, closely spaced fractures, fracture spacing is easily calculated in core or outcrop provided the sampling area or volume is large with respect to fracture spacing. This is accomplished by counting the number of fractures encountered along a line of some given length perpendicular to the fracture set of interest, for each of the fracture sets present and dividing the length of measurement line.

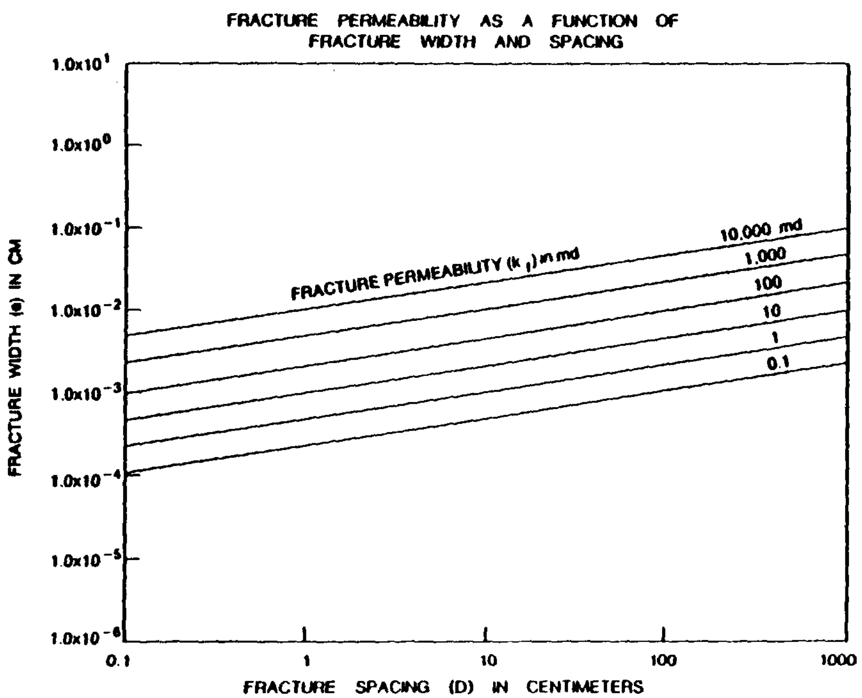


Figure 1-55. Fracture permeability as a function of fracture width and fracture spacing.

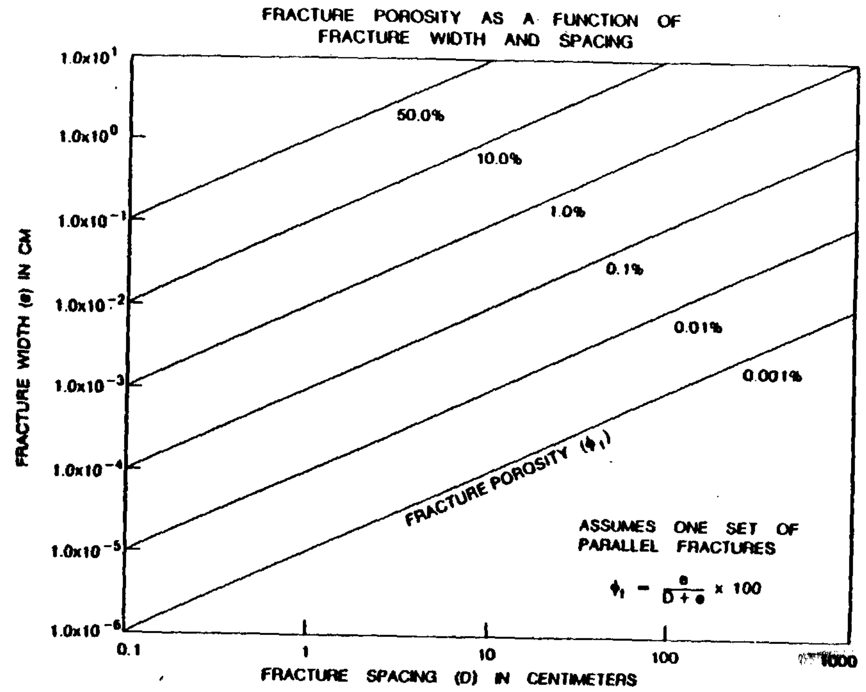


Figure 1-56. Fracture porosity as a function of fracture width and fracture spacing.

In more complex fracture systems, workers have gone to similar determinations along lines in specific directions. This author has often used two perpendicular measurement directions with one parallel to bedding strike and one parallel to bedding dip. Others have tried to reconstruct the entire vector/spacing distribution (at least in a plane) by measuring along three specific directions (120° apart) and statistically manipulating the data into a full 360° distribution. Hudson and Priest (1983) present an excellent statistical technique for determining the entire 2-D array of spacing vectors present in a rock. Narr and Lerche (1984) present a statistical/geometric method for accurately depicting fracture spacing from core data.

Utilization of Laboratory Data

Laboratory data can be quite useful in quantifying reservoir properties in fractured reservoirs. However, the extrapolation of these data to sub-

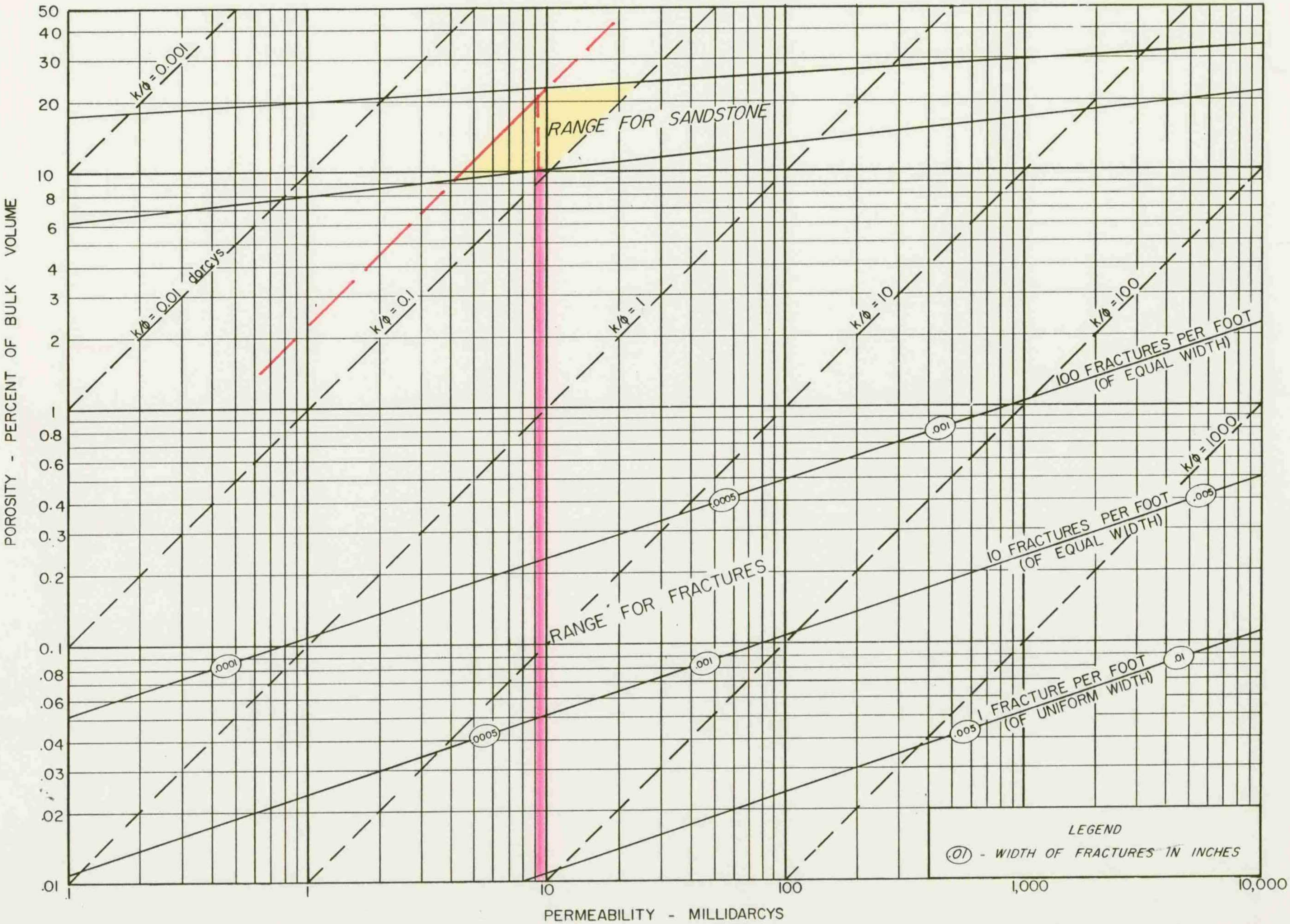
METHODS OF INTERPRETATION OF PRESSURE BEHAVIOR IN THE OIL PRODUCING FRACTURED SHALE RESERVOIRS OF THE PUERTO CHIQUITO POOL RIO ARRIBA COUNTY, NEW MEXICO

November 1, 1966

EXHIBIT NO. 1
NMOCD CASE NO. 3455
November 16, 1966

VALUES OF K/φ FOR SANDSTONE RESERVOIRS AND FOR FLOW SYSTEMS OF FRACTURES IN AN IMPERMEABLE MATRIX

FRACTURES PARALLEL TO DIRECTION OF FLOW



APPENDIX III FIGURE NO. III-3

VALUE OF DIFFUSIVITY CONSTANT AS FUNCTION OF K/ϕ VS. Cμ

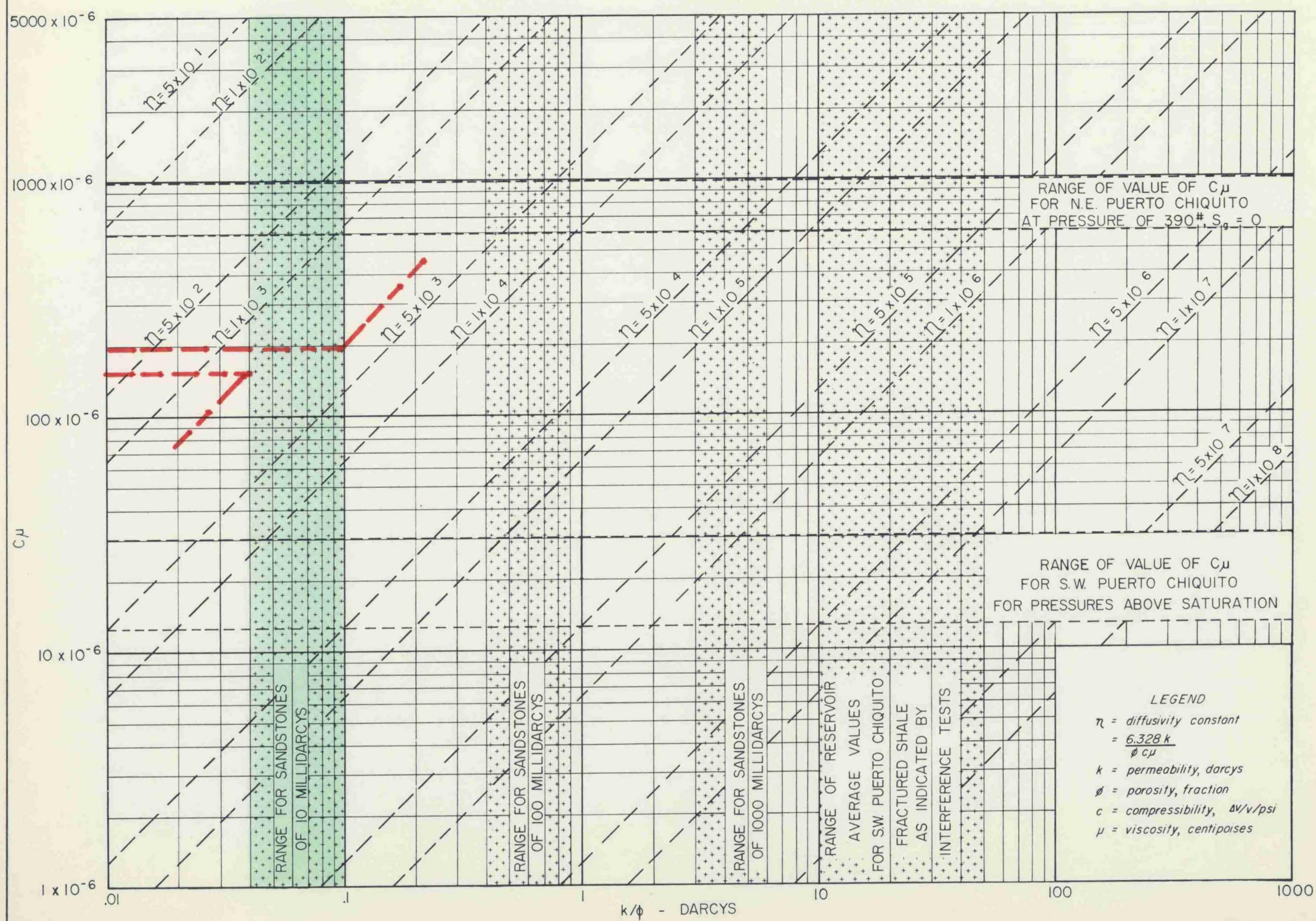
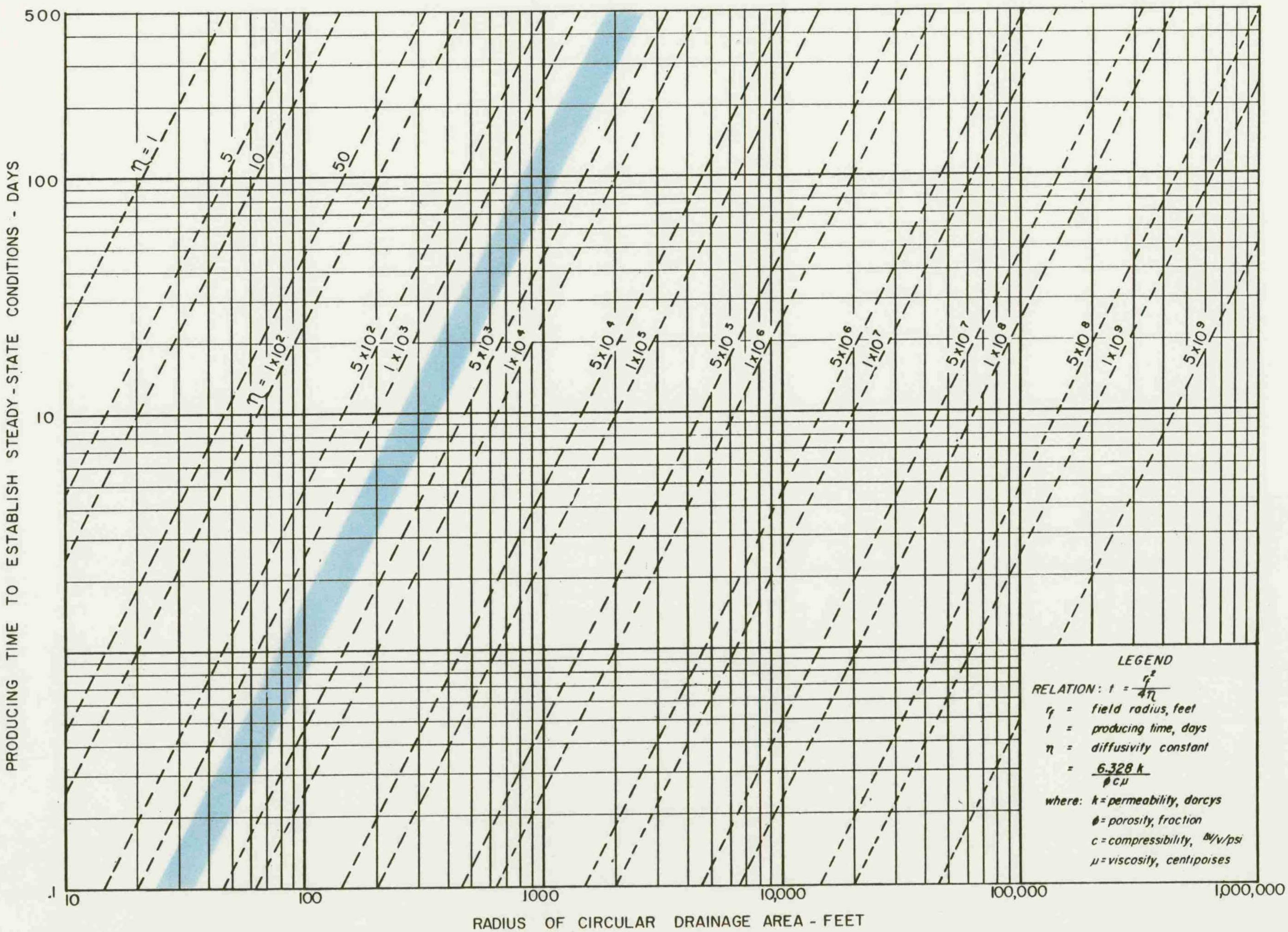


FIGURE NO 10

TIME REQUIRED TO ESTABLISH STEADY-STATE CONDITIONS FOR CIRCULAR DRAINAGE AREAS OF UNIFORM PROPERTIES



The Behavior of Naturally Fractured Reservoirs

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P. J. ROOT
MEMBERS AIME

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PITTSBURGH, PA.

ABSTRACT

An idealized model has been developed for the purpose of studying the characteristic behavior of a permeable medium which contains regions which contribute significantly to the pore volume of the system but contribute negligibly to the flow capacity; e.g., a naturally fractured or vugular reservoir. Unsteady-state flow in this model reservoir has been investigated analytically. The pressure build-up performance has been examined in some detail; and, a technique for analyzing the build-up data to evaluate the desired parameters has been suggested. The use of this approach in the interpretation of field data has been discussed.

As a result of this study, the following general conclusions can be drawn:

1. Two parameters are sufficient to characterize the deviation of the behavior of a medium with "double porosity" from that of a homogeneously porous medium.

2. These parameters can be evaluated by the proper analysis of pressure build-up data obtained from adequately designed tests.

3. Since the build-up curve associated with this type of porous system is similar to that obtained from a stratified reservoir, an unambiguous interpretation is not possible without additional information.

4. Differencing methods which utilize pressure data from the final stages of a build-up test should be used with extreme caution.

INTRODUCTION

In order to plan a sound exploitation program or a successful secondary-recovery project, sufficient reliable information concerning the nature of the reservoir-fluid system must be available. Since it is evident that an adequate description of the reservoir rock is necessary if this condition is to be fulfilled, the present investigation was undertaken for the purpose of improving the fluid-flow characterization, based on normally available data, of a particular porous medium.

DISCUSSION OF THE PROBLEM

For many years it was widely assumed that, for the purpose of making engineering studies, two parameters were sufficient to describe the single-phase flow properties of a producing formation, i.e., the absolute permeability and the effective porosity. It later became evident that the concept of directional permeability was of more than academic interest; consequently, the degree of permeability anisotropy and the orientation of the principal axes of permeability were accepted as basic parameters governing reservoir performance.[1,2] More recently,[3-6] it was recognized that at least one additional parameter was required to depict the behavior of a porous system containing regions which contributed significantly to the pore volume but contributed negligibly to the flow capacity. Microscopically, these regions could be "dead-end" or "storage" pores or, macroscopically, they could be discrete volumes of low-permeability matrix rock combined with natural fissures in a reservoir. It is obvious that some provision for the inclusion of all the indicated parameters, as well as their spatial variations, must be made if a truly useful, conceptual model of a reservoir is to be developed.

A dichotomy of the internal voids of reservoir rocks has been suggested.[7,8] These two classes of porosity can be described as follows:

a. *Primary porosity* is intergranular and controlled by deposition and lithification. It is highly interconnected and usually can be correlated with permeability since it is largely dependent on the geometry, size distribution and spatial distribution of the grains. The void systems of sands, sandstones and oolitic limestones are typical of this type.

b. *Secondary porosity* is foramenular and is controlled by fracturing, jointing and/or solution in circulating water although it may be modified by infilling as a result of precipitation. It is not highly interconnected and usually cannot be correlated with permeability. Solution channels or vugular voids developed during weathering or burial in sedimentary basins are indigenous to carbonate rocks such as limestones or dolomites. Joints or fissures which occur in massive, extensive formations composed of shale, siltstone, schist, limestone or dolomite are generally vertical, and they are ascribed to tensional failure during mechanical deformation (the permeability associated with this type of void system is often anisotropic). Shrinkage cracks are the result

Original manuscript received in Society of Petroleum Engineers office Aug. 17, 1962. Revised manuscript received March 21, 1963. Paper presented at the Fall Meeting of the Society of Petroleum Engineers in Los Angeles on Oct. 7-10, 1962.

[1] References given at end of paper.

4

Formation Evaluation By Well Testing

Various theories have evolved regarding pressure behavior in naturally fractured reservoirs. Since all naturally fractured reservoirs are not the same, the following techniques may vary in their application.

Pollard—Pirson Methods

One of the early papers on pressure buildup analysis of fractured reservoirs was published by Pollard in 1959. Pollard considered that the reservoir consisted of three regions: one around the wellbore, one in the fractured system, and one in the matrix. Consequently, he broke the pressure differential into three components: (1) pressure differential across "skin" near the wall of the hole, (2) pressure differential due to flow resistance in the coarse communicating fissures, and (3) pressure differential between the fine voids and the coarse fissures.

Pollard's method

Pollard's method assumes that during a late stage of buildup the flow rate (q_b) from the matrix into the fractures can be described by the equation:

$$q_b = - V_b \, c_b \frac{dp_b}{d\theta} = A_1 (p_b - p_f) \qquad (4\text{-}1)$$

where: q_b = *rate of flow from matrix into fractures*
V_b = *pore volume of the matrix*
c_b = *compressibility factor of fluids in the matrix*

(Aguilera)

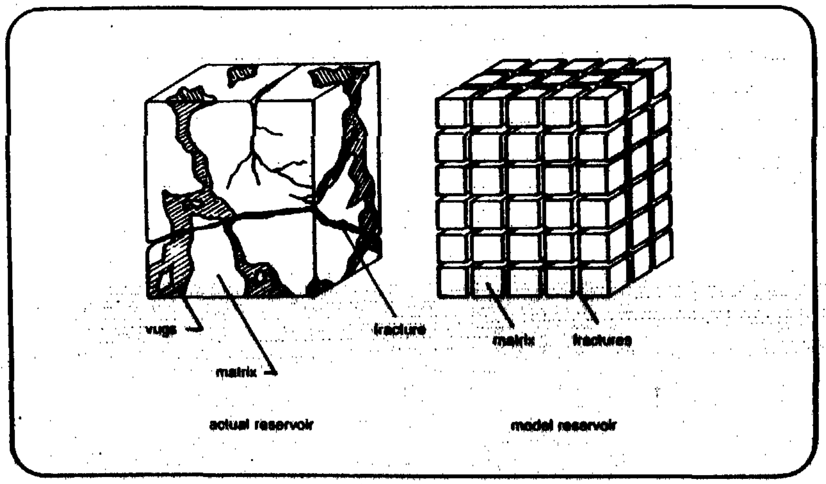

Fig. 4-10 Idealization of the heterogeneous porous medium. (After Warren & Root)

Warren and Root—Kazemi—De Swaan

Warren and Root

They presented a model composed of rectangular parallelopipeds where the blocks represented the matrix and the space in between the fractures (Fig. 4-10).

They evaluated this heterogeneous double-porosity model using as a base the following general assumptions:

1. The primary porosity (matrix) is homogeneous and isotropic, and is made up of identical rectangular parallelopipeds (Fig. 4-10).
2. The secondary porosity is contained within an orthogonal system of continuous, uniform fractures. A different fracture spacing or a different width may exist along each of the axis to simulate the proper degree of anisotropy.
3. Flow can occur between the primary and secondary porosities, but flow to the well can occur only through fractures. Flow through the primary-porosity elements cannot occur.

Warren and Root made an analytical investigation of the unsteady-state of flow in this model. The pressure buildup was analyzed in detail

(Aguilera)

and they found that a conventional buildup plot could result in two parallel straight lines. The vertical separation of the two lines was related to the storage capacity of the fractures.

They concluded that two parameters were enough to characterize the behavior of the double-porosity system. One parameter (ω) represented a measure of the fluid capacitance and the other parameter (λ) was related to the degree of heterogeneity of the system. Mathematically, λ and ω can be written as:

$$\lambda = \frac{\alpha k_1 r_w^2}{\bar{k}_2} \qquad (4\text{-}23)$$

and

$$\omega = \frac{\phi_2 c_2}{\phi_1 c_1 + \phi_2 c_2} \qquad (4\text{-}24)$$

where: α = *geometric parameter for hetrogeneous region*, $1/L^2$
k_1 = *matrix permeability*
r_w = *well bore radius*
$\bar{k}_2 = \sqrt{k_{2x} k_{2y}}$, *effective permeability of anisotropic medium*, L^2
ϕ_2 = *secondary porosity*
ϕ_1 = *primary porosity*

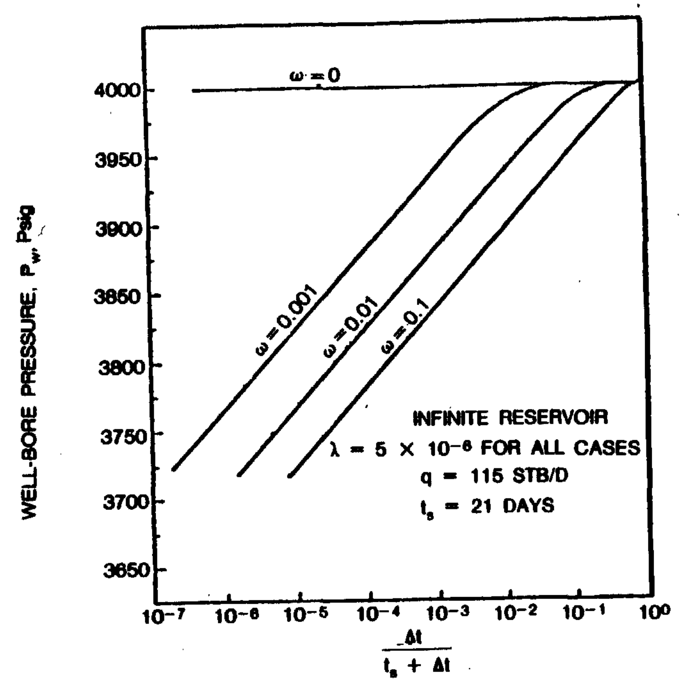

Fig. 4-11 Theoretical buildup curves. (After Warren & Root)

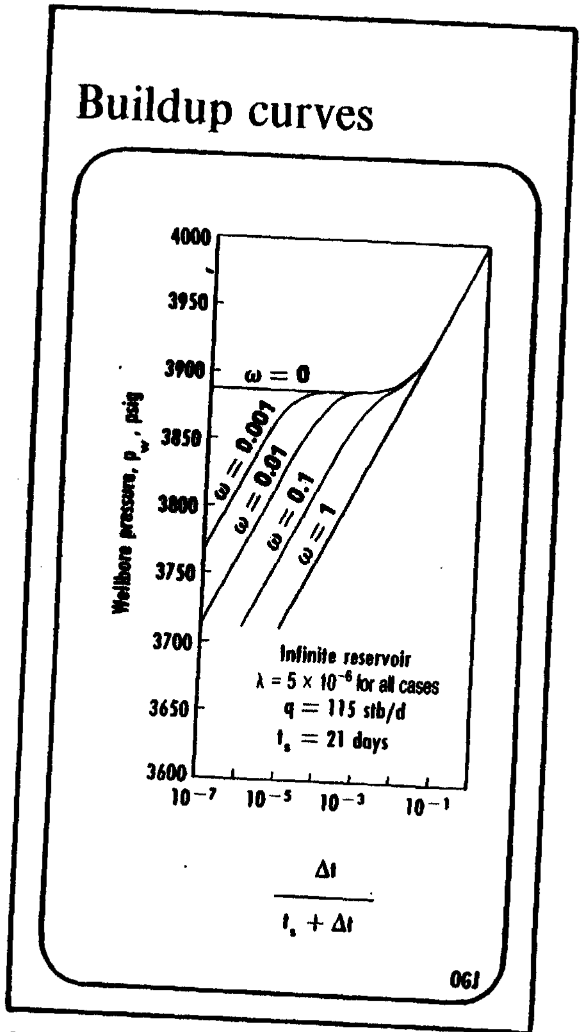

Fig. 4-12 Theoretical buildup curves. (After Warren & Root)

c_2 = *total compressibility in secondary system*
c_1 = *total compressibility in primary system*

Theoretical pressure buildup curves for an infinite reservoir and various combinations of λ and ω are shown in Figs. 4-11 and 12. Notice that when there is only primary porosity, ω = 0, the buildup occurs almost instantaneously if λ is very small.

The behavior in Fig. 4-11, where the value of λ is assumed at 5 × 10^{-6}, implies a reservoir with a closed boundary. Note also that, if only

the early portion of the curve were recorded, the pressure p determined by extrapolations to $\Delta t/(t_s + \Delta t)$ would be in error by an amount equal to m log (1/ω), and the skin resistance (s_d) would be high by an amount equal to 1.15 log (1/ω).

This may lead to error in the interpretation; Warren and Root point out that this is one of the weaknesses of the Pollard method. It is possible to analyze the transitional curve between the initial linear portion and the asymptote just as if the reservoir actually had a finite drainage radius. Fig. 4-12, where the value of λ is assumed at 5 × 10^{-6}, shows the double-slope buildup performance.

Although Warren and Root's method is mathematically more rigorous, Matthews and Russel in SPE Monograph Vol. I indicate that the type of buildup displayed by Pollard and Pirson seems much more common than the one suggested by Warren and Root.

Kazemi

Kazemi studied the transient pressure behavior of naturally fractured reservoirs by means of a model which consisted of a finite circular reservoir with a well located in the center and two distinct porous regions, referred to as matrix and fractures (Fig. 4-13).

Fig. 4-14 depicts a representative section of the Kazemi model, which used as a basis the following assumptions:

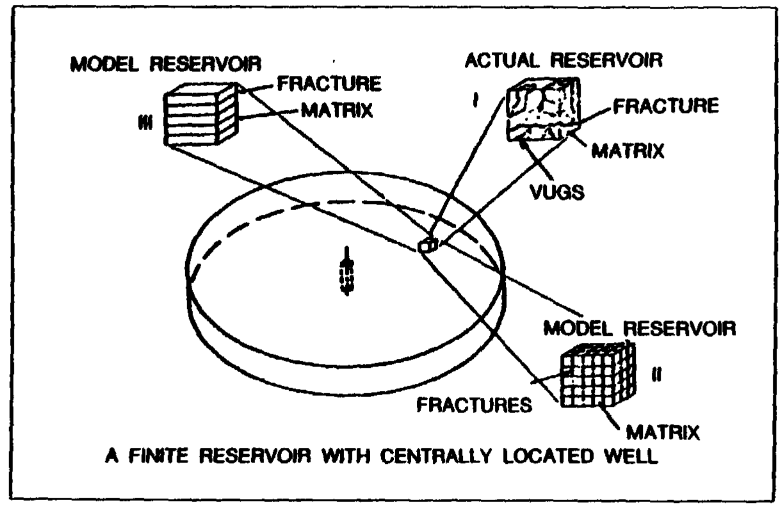

Fig. 4-13 Idealization of naturally fractured porous medium. II, Warren-Root model; III, Kazemi model. (After Kazemi)

(Aguilera)

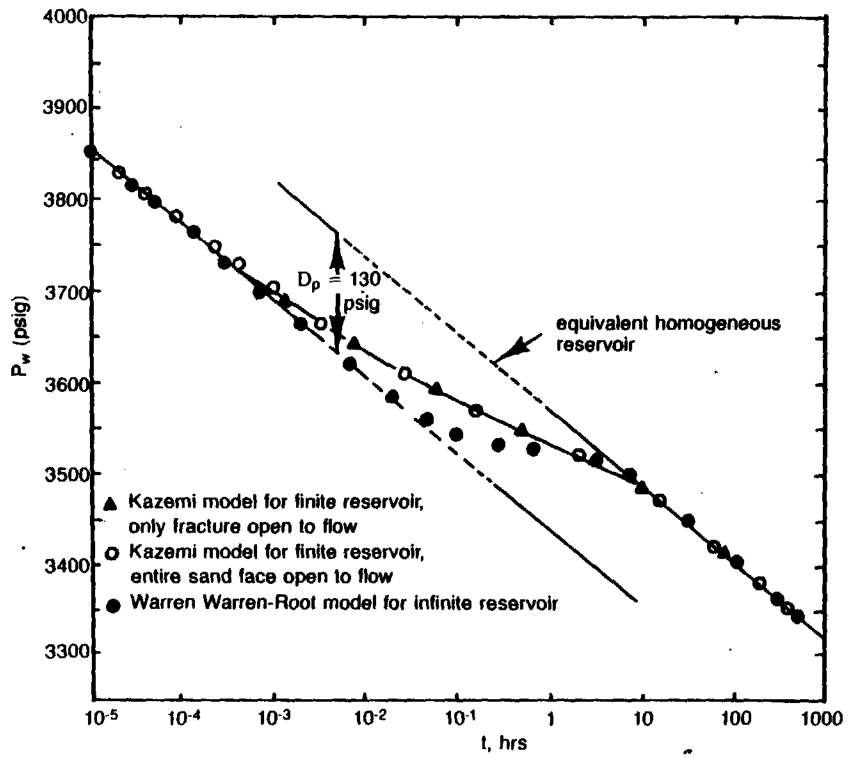

Fig. 4-15 Pressure drawdown for case 1. (After Kazemi)

was uniform, and the contrasts between fracture and matrix flow were large. When this contrast was small, only one straight line was noticeable.

De Swaan

De Swaan presented an excellent analytical approach to the evaluation of naturally fractured reservoirs from pressure drawdown data. His theory is based on the following assumptions:

1. At early times, flow occurs only in the fractures and is described by the approximate solution of the radial infinite reservoir as applied to fracture media:

$$\Delta p_f = \frac{q\mu}{4\pi\, h_f k_f} \ln\left(\frac{4\,\eta_f\, t}{\gamma' r_w^2}\right) \qquad (4\text{-}31)$$

(Aguilera).

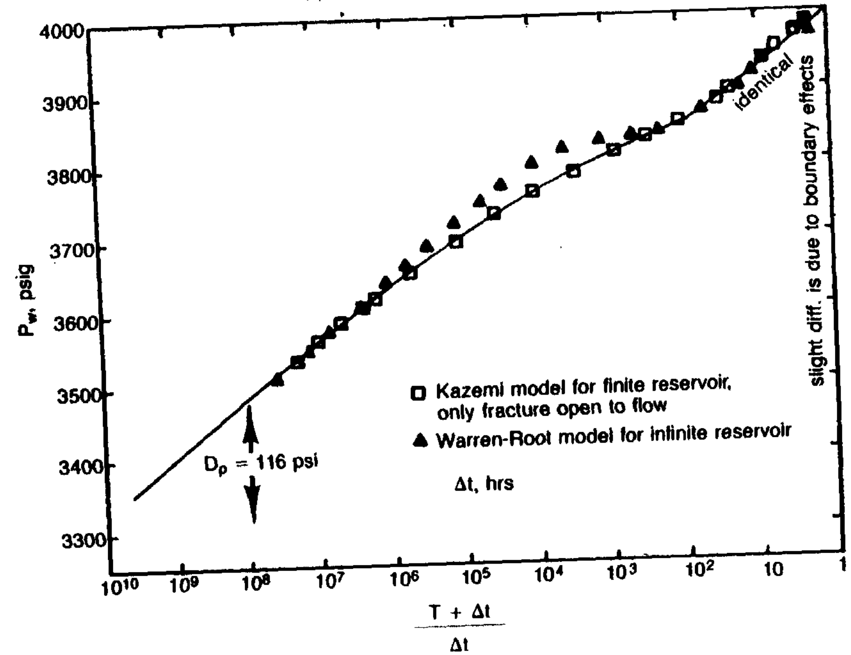

Fig. 4-16 Pressure buildup for case 1. (After Kazemi)

where:
$p_f = p_i - p$ = *incremental pressure, atm*
q = *flow rate, cc/sec*
μ = *viscosity, cp*
k_f = *fracture permeability, darcys*
h_f = *fracture thickness, cm*
η_f = *fracture hydraulic diffusivity—sq cm/sec*
γ' = 1.78
r_w = *well bore radius, cm*
t = *time, seconds*

2. The matrix blocks represent a source uniformly distributed in the fracture system. Due to the matrix low permeability, the response of the matrix blocks is slower than the fracture media response.
3. Solutions of heat flow problems in solids are applicable to the case in which shape of the matrix block is approximated by regular solids. These solutions are given for solids with unitary pressure (temperature) loss at their surfaces as a boundary condition.
4. The outflow from the blocks is described through a convolution:

CORE DESCRIPTION AND PETROGRAPHIC ANALYSIS OF THE GALLUP FORMATION IN THE NUMBER 1-11 HOWARD FEDERAL WELL

for

MALLON OIL COMPANY
Denver, Colorado

Petrographic Services

DISCUSSION (Continued)

interval. From 7300 to 7280 feet the unit is dark gray in color and exhibits undisturbed, horizontal planar laminations. Silt laminae are very rare. Calcareous stringers, silty laminae, and fossil debris are in low abundance in this unit.

Fractures occur throughout the cored interval. They are oriented vertically to approximately 30 degrees from vertical, and spaced at intervals greater than four inches, these fractures are generally mineralized with calcite and pyrite. Fracture sets intersect at angles of ten to fifteen degrees, and commonly terminate one another. The dark gray units typically contain one dominant fracture two to three feet in length, with closely spaced (approx. 1/2 inch) subordinate fractures parallel to it. The gray-black, siltier unit contains a somewhat higher frequency of shorter (six to twelve inch long) fractures.

Thin Section Description

A thin section cut normal to bedding in a silty interval (7322.8 feet) revealed slightly compacted, moderately sorted, wavy laminated, burrowed units of coarse silt within a wavy laminated, silty shale matrix (plate 2A). The silt component is comprised principally of quartz grains, with a lower abundance of feldspar grains, volcanic rock fragments, and mica. Traces of zircon, glauconite, and detrital dolomite are also present. A significant component of both the silty and shaly units is calcareous foraminifer debris. This debris, plus the large bivalve shells, account for the calcareous nature of the entire interval. Carbonaceous matter is abundant in the shaly laminae.

Pyrite is the most abundant authigenic mineral. It has formed in close association with foraminifer tests, and as scattered framboids in both silty and shaly laminae. Calcite is abundant as sparry to poikilotopic, intergranular cement in the silty laminae; very minor dolomite cement has also formed in these units. No porosity is evident in thin section.

Wireline Log Analysis

Figure 1 is a compilation of all wireline log curves plus the measured percent shale curve generated in this study. No log except density porosity exhibits behavior parallel to the percent shale curve. This is a deception, however, as the density porosity reading in the silty zone (log depth 7294 to 7300 feet) indicates high porosity (sandstone matrix), whereas the core analysis from this zone reports porosities around 1 %. The measured grain density of the shale is 2.63 g/cc, which is very close to the assumed matrix

MALLON OIL COMPANY
No. 1-11 Howard Federal Well

File No. PD-85057

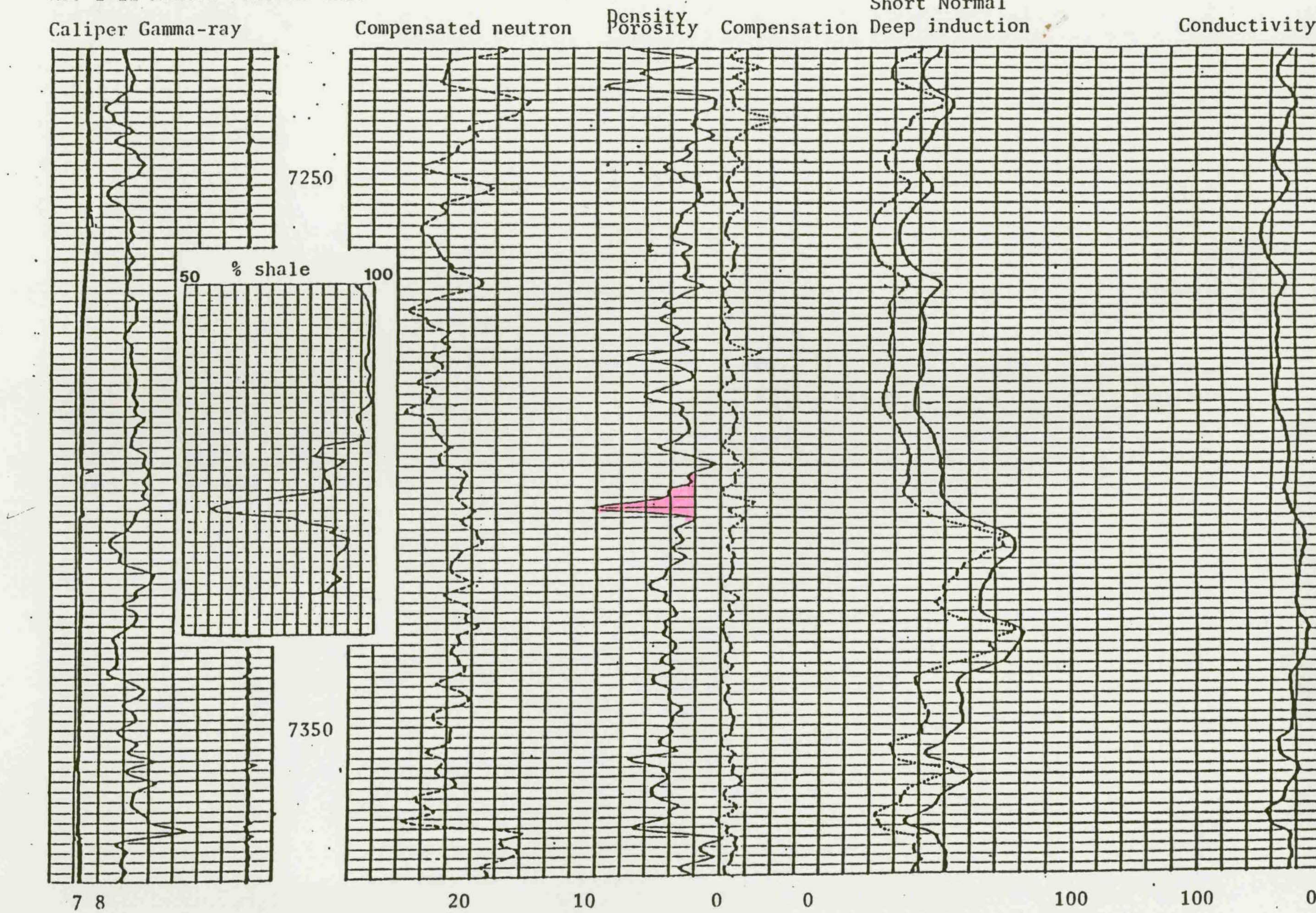

FIGURE 1

[illegible]
Petroleum Reservoir Engineering
DALLAS, TEXAS

MOBIL PRODUCING TX & NM INC.
LINDRITH B UNIT # 38
GAVILAN MANCOS
RIO ARRIBA, N.M.
API # 30-039-70228-85

DATE : 10-DEC-1985
FORMATION : GALLUP
DRLG. FLUID: WBM
LOCATION : NE,SW SEC. 4-T24N-R2W

FILE NO : 38030-3424
ANALYSTS : DS;EV
ELEVATION: 7180 GL

No coring pressure

CONVENTIONAL ANALYSIS-BOYLE'S LAW POROSITY

SAMPLE NUMBER	DEPTH	PERM. TO AIR (MD) MAXIMUM	PERM. TO AIR (MD) 90 DEG	POR. He	FLUID SATS. OIL	FLUID SATS. WTR	GRAIN DEN	DESCRIPTION	
	GALLUP FORMATION CORE # 1 6660-6681								
1	6660.0-61.0	0.01		2.5	39.0	39.0	2.66	SD GRY VFGRN SHY SL/CALC	
2	6661.0-62.0	0.02		2.0	34.6	40.3	2.66	SD GRY VFGRN SHY SL/CALC	
3	6662.0-63.0	<0.01		1.0	39.6	35.2	2.69	SD GRY VFGRN SHY CALC PYR	
4	6663.0-64.0	0.42		0.9	49.5	22.0	2.67	SD GRY VFGRN SHY CALC	**
5	6664.0-65.0	<0.01		0.6	49.8	16.6	2.64	SD GRY VFGRN SHY CALC	
6	6665.0-66.0	<0.01		1.0	52.4	22.1	2.70	SD GRY VFGRN SHY CALC PYR	
7	6666.0-67.0	<0.01		0.9	41.2	34.3	2.63	SD GRY VFGRN SHY CALC	
8	6667.0-68.0	0.02		0.7	45.6	32.9	2.66	SD GRY VFGRN SHY SL/CALC	
9	6668.0-69.0	<0.01		0.5	42.3	35.2	2.65	SD GRY VFGRN SHY SL/CALC	
10	6669.0-70.0	0.02		1.1	38.6	33.1	2.65	SD GRY VFGRN SHY SL/CALC	
11	6670.0-71.0	0.10		0.5	38.8	32.4	2.63	SLTST DRKGRY VFGRN SHY CALC	
12	6671.0-72.0	<0.01		1.7	34.2	34.2	2.69	SD GRY VFGRN SHY CALC PYR	
	6672.0-77.0							SHALE -- NO ANALYSIS	
13	6677.0-78.0	0.02		2.7	24.9	33.1	2.67	SD GRY VFGRN SHY CALC	
14	6678.0-79.0	0.01		2.9	22.5	50.0	2.67	SD GRY VFGRN SHY CALC	
15	6679.0-80.0	0.01		3.5	31.9	31.9	2.66	SD GRY VF-FNGRN SHY CALC	
16	6680.0-81.0	0.01		3.1	30.5	30.5	2.67	SD GRY VF-FNGRN SHY CALC	
	GALLUP FORMATION CORE # 2 6681-6714								
17	6681.0-82.0	0.03		2.3	28.8	38.4	2.67	SD GRY VF-FNGRN SHY SL/CALC	
18	6682.0-83.0	0.14		2.5	19.6	39.2	2.68	SD GRY VF-FNGRN SHY CALC	
19	6683.0-84.0	0.07		2.8	32.0	42.7	2.67	SD GRY VF-FNGRN SHY CALC	
20	6684.0-85.0	0.02		2.2	17.5	60.0	2.68	SD GRY VF-FNGRN SHY PYR	
21	6685.0-86.0	0.16		2.1	24.5	59.9	2.66	SD GRY VF-FNGRN SHY CALC	

MOBIL PRODUCING TX & NM INC.
LINDRITH B UNIT # 38

DATE : 10-DEC-1985
FORMATION : GALLUP

FILE NO : 38030-3424
ANALYSTS : DS;EV

CONVENTIONAL ANALYSIS-BOYLE'S LAW POROSITY

SAMPLE NUMBER	DEPTH	PERM. TO AIR (MD) MAXIMUM	PERM. TO AIR (MD) 90 DEG	POR. He	FLUID SATS. OIL	FLUID SATS. WTR	GRAIN DEN	DESCRIPTION
22	6686.0-87.0	0.06		1.6	21.1	61.0	2.66	SD GRY VF-FNGRN SHY CALC
23	6687.0-88.0	0.12		1.5	16.6	56.8	2.67	SD GRY VFGRN SHY PYR SL/CALC **
24	6688.0-89.0	2.85		2.0	22.3	50.9	2.68	SD GRY VFGRN SHY PYR SL/CALC **
25	6689.0-90.0	11.		2.2	0.0	56.4	2.68	SD DRKGRY VFGRN SHY CALC PYR
26	6690.0-91.0	0.06		2.6	20.1	57.5	2.67	SD DRKGRY VFGRN SHY CALC PYR
27	6691.0-92.0	0.01		1.8	18.6	47.9	2.67	SD DRKGRY VFGRN SHY CALC PYR
28	6692.0-93.0	0.03		1.9	32.4	36.0	2.67	SD DRKGRY VFGRN SHY CALC PYR
29	6693.0-94.0	0.03		2.4	18.3	52.4	2.67	SD DRKGRY VFGRN SHY CALC PYR
30	6694.0-95.0	0.79		2.0	20.4	52.5	2.66	SD DRKGRY VFGRN SHY CALC **
31	6695.0-96.0	0.02		1.5	23.9	47.9	2.65	SD DRKGRY VFGRN SHY CALC
32	6696.0-97.0	<0.01		1.8	22.5	36.0	2.67	SD DRKGRY VFGRN SHY CALC
33	6697.0-98.0	<0.01		2.5	34.7	30.8	2.67	SD DRKGRY VFGRN SHY CALC
34	6698.0-99.0	0.06		1.5	24.6	49.1	2.65	SD DRKGRY VFGRN SHY CALC
35	6699.0-00.0	0.02		2.2	30.2	51.7	2.68	SD DRKGRY VFGRN SHY CALC PYR
	6700.0-05.0							SHALE SL/SD -- NO ANALYSIS
36	6705.0-06.0	0.36		2.6	21.8	48.5	2.69	SD DRKGRY VFGRN SHY CALC PYR
37	6706.0-07.0	0.01		2.5	26.2	29.9	2.71	SD DRKGRY VFGRN SHY CALC PYR
38	6707.0-08.0	<0.01		2.6	43.6	31.1	2.69	SD DRKGRY VFGRN SHY CALC PYR
39	6708.0-09.0	0.01		2.8	39.3	32.8	2.69	SD DRKGRY VFGRN SHY CALC PYR
40	6709.0-10.0	0.01		2.2	38.5	33.0	2.68	SD DRKGRY VFGRN SHY CALC PYR
41	6710.0-11.0	<0.01		1.3	40.0	26.7	2.66	SD DRKGRY VFGRN SHY CALC
42	6711.0-12.0	<0.01		2.1	39.3	26.2	2.67	SD DRKGRY VFGRN SHY CALC
43	6712.0-13.0	<0.01		1.3	39.1	22.4	2.62	SLTST DRKGRY VFGRN SHY SL/CALC
44	6713.0-14.0	<0.01		1.0	42.8	28.6	2.61	SD GRY VFGRN SHY SL/CALC
	GALLUP FORMATION CORE # 3 6714-6720							
45	6714.0-15.0	<0.01		1.3	50.6	25.3	2.61	SD GRY VFGRN SHY SL/CALC
	6715.0-16.0							SHALE -- NO ANALYSIS
46	6716.0-17.0	0.01		2.4	36.2	24.1	2.63	SD GRY VFGRN SHY CALC

CC E BC AT IE II

Petroleum Reservoir Engineering

DALLAS, TEXAS

MOBIL PRODUCING TX & NM INC.
LINDRITH B UNIT # 38

DATE : 10-DEC-1985
FORMATION : GALLUP

FILE NO : 38030-3424
ANALYSTS : DS;EV

CONVENTIONAL ANALYSIS-BOYLE'S LAW POROSITY

SAMPLE NUMBER	DEPTH	PERM. TO AIR (MD) MAXIMUM	PERM. TO AIR (MD) 90 DEG	POR. He	FLUID SATS. OIL	FLUID SATS. WTR	GRAIN DEN	DESCRIPTION
	6717.0-18.0							SHALE -- NO ANALYSIS
47	6718.0-19.0	0.01		2.4	41.7	34.7	2.68	SD GRY VFGRN SHY CALC PYR
48	6719.0-20.0	0.01		2.0	44.7	31.9	2.68	SD GRY VFGRN SHY CALC PYR
	GALLUP FORMATION	CORE # 4 6720-6736						
49	6720.0-21.0	0.01		2.2	35.5	31.6	2.67	SD GRY VFGRN SHY CALC PYR
50	6721.0-22.0	0.01		1.5	26.7	30.6	2.69	SD GRY VFGRN SHY CALC PYR
51	6722.0-23.0	0.32		2.2	32.8	32.8	2.66	SD GRY VFGRN SHY CALC
52	6723.0-24.0	<0.01		1.0	10.6	42.4	2.70	SD GRY VFGRN SHY CALC PYR
53	6724.0-25.0	0.02		1.5	27.1	30.9	2.67	SD GRY VFGRN SHY CALC PYR
54	6725.0-26.0	<0.01		1.1	30.3	34.6	2.69	SD GRY VFGRN SHY CALC PYR
55	6726.0-27.0	0.05		1.3	36.2	32.2	2.66	SD GRY VFGRN SHY CALC
56	6727.0-28.0	0.09		1.8	10.6	42.5	2.64	SD GRY VFGRN SHY CALC
57	6728.0-29.0	0.01		1.7	44.6	29.8	2.66	SD GRY VFGRN SHY CALC
	6729.0-31.0							SHALE -- NO ANALYSIS
58	6731.0-32.0	0.01		1.2	25.8	29.5	2.64	SD GRY VFGRN SHY CALC
59	6732.0-33.0	0.05		0.8	0.0	35.2	2.64	SD GRY VFGRN SHY CALC
60	6733.0-34.0	0.08		0.5	30.4	27.1	2.64	SD DRKGRY VFGRN SHY CALC
61	6734.0-35.0	0.03		0.8	26.0	23.1	2.67	SD GRY VFGRN SHY CALC PYR
62	6735.0-36.0	0.06		1.0	37.8	31.5	2.65	SD GRY VFGRN SHY CALC
	GALLUP FORMATION	CORE # 5 6736-6743						
63	6736.0-37.0	0.16		0.8	39.8	33.2	2.61	SD GRY VFGRN SHY CALC **
	6737.0-39.0							SHALE -- NO ANALYSIS
64	6739.0-40.0	0.01		0.6	48.8	24.4	2.66	SD GRY VFGRN SHY CALC
	6740.0-41.0							SHALE -- NO ANALYSIS
	6741.0-43.0							CORE LOSS
	GALLUP FORMATION	CORE # 6 6743-6756						

MOBIL PRODUCING TX & NM INC. DATE : 10-DEC-1985 FILE NO : 38030-3424
LINDRITH B UNIT # 38 FORMATION : GALLUP ANALYSTS : DS;EV

CONVENTIONAL ANALYSIS-BOYLE'S LAW POROSITY

SAMPLE NUMBER	DEPTH	PERM. TO AIR (MD) MAXIMUM	PERM. TO AIR (MD) 90 DEG	POR. He	FLUID SATS. OIL	FLUID SATS. WTR	GRAIN DEN	DESCRIPTION	
	6743.0-50.0							SHALE -- NO ANALYSIS	
65	6750.0-51.0	0.21		1.6	40.4	26.9	2.64	SD GRY VFGRN SHY CALC	
66	6751.0-52.0	0.01		1.0	42.3	30.2	2.61	SD GRY VFGRN SHY SL/CALC	
	6752.0-56.0							SHALE -- NO ANALYSIS	
	GALLUP FORMATION	CORE # 7 6756-6770							
67	6756.0-57.0	<0.01		0.8	36.3	40.8	2.67	SD GRY VF-FNGRN SHY CALC PYR	
68	6757.0-58.0	0.01		1.0	43.3	37.9	2.65	SD GRY VFGRN SHY SL/CALC	
	6758.0-59.0							SHALE -- NO ANALYSIS	
69	6759.0-60.0	0.01		1.2	32.4	21.6	2.59	SH BLK VFGRN SL/CALC	
	6760.0-70.0							SHALE -- NO ANALYSIS	
	GALLUP FORMATION	CORE # 8 6770-6809							
70	6770.0-71.0	4.16		1.0	37.9	52.1	2.59	SH BLK VFGRN SL/CALC	
	6771.0-85.0							SHALE -- NO ANALYSIS	
71	6785.0-86.0	0.65		1.1	28.4	52.1	2.64	SD DRKGRY VFGRN SHY SL/CALC	**
	6786.0-88.0							SHALE -- NO ANALYSIS	
72	6788.0-89.0	0.01		1.0	50.6	40.5	2.60	SH BLK VFGRN SL/CALC	
73	6789.0-90.0	0.81		1.1	38.2	38.2	2.70	SD GRY VFGRN SHY CALC PYR	**
	6790.0-91.0							SHALE -- NO ANALYSIS	
74	6791.0-92.0	0.01		0.8	45.3	30.2	2.65	SD GRY VFGRN SHY SL/CALC	
75	6792.0-93.0	0.03		1.0	35.1	40.2	2.63	SD GRY VFGRN SHY SL/CALC	
	6793.0-94.0							SHALE -- NO ANALYSIS	
76	6794.0-95.0	0.01		0.8	48.4	27.6	2.63	SD GRY VFGRN SHY CALC	
	6795.0-98.0							SHALE -- NO ANALYSIS	
77	6798.0-99.0	0.01		1.1	35.0	40.0	2.68	SD GRY VFGRN SHY CALC	
78	6799.0-00.0	0.01		0.4	32.3	35.9	2.64	SD GRY VFGRN SHY CALC	
79	6800.0-01.0	1.21		1.2	46.6	39.3	2.63	SD GRY VFGRN SHY CALC	**

CORE LABORATORIES, INC.
Petroleum Reservoir Engineering
DALLAS, TEXAS

MOBIL PRODUCING TX & NM INC.
LINDRITH B UNIT # 38

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FILE NO : 38030-3424
ANALYSTS : DS;EV

CONVENTIONAL ANALYSIS-BOYLE'S LAW POROSITY

SAMPLE NUMBER	DEPTH	PERM. TO AIR (MD) MAXIMUM	PERM. TO AIR (MD) 90 DEG	POR. He	FLUID SATS. OIL	FLUID SATS. WTR	GRAIN DEN	DESCRIPTION
80	6801.0-02.0	0.01	51	0.8	58.6	27.9	2.57	SH BLK VFGRN SL/CALC
81	6802.0-03.0	0.01		1.0	41.7	37.1	2.67	SD GRY VFGRN SHY CALC
	6803.0-09.0							CORE LOSS
	GALLUP FORMATION CORE # 9 6809-6843							
	6809.0-43.0							SHALE -- NO ANALYSIS

** DENOTES FRACTURE PERMEABILITY

INTERPRETATION OF FLUID SATURATIONS
ASSUMING
10% FLUSH AND 20% RECOVERY OF OIL-IN-PLACE
AFTER FLUSH
(FINAL PRESSURE ATMOSPHERIC)

	LABORATORY				CALCULATED SATURATIONS FOR GIVEN CONDITIONS				
Sample Number	Perm (md) (1)	Porosity (2)	Saturations Oil (3)	Saturations Water (4)	Initial Reservoir Oil-in-Place (5)	Less 10% Flush (6)	Less 20% "Production" to Atmospheric Pressure (7)	Stock Tank Volume Remaining (8)	Column 8 Minus Column 3 (9)
1	0.01	2.5	39.0	39.0	61.0	54.9	43.9	31.8	(7.2)
2	0.02	2.0	34.6	40.3	59.7	53.7	43.0	31.1	(3.5)
3	<0.01	1.0	39.6	35.2	64.8	58.3	46.7	33.8	(5.8)
4	0.42	0.9	49.5	22.0	78.0	70.2	56.2	40.7	(8.8)
5	<0.01	0.6	49.8	16.6	83.4	75.1	60.0	43.5	(6.3)
6	<0.01	1.0	52.4	22.1	77.9	70.1	56.1	40.6	(11.8)
7	<0.01	0.9	41.2	34.3	65.7	59.1	47.3	34.3	(6.9)
8	0.02	0.7	45.6	32.9	67.1	60.4	48.3	35.0	(10.6)
9	<0.01	0.5	42.3	35.2	64.8	58.3	46.7	33.8	(8.5)
10	0.02	1.1	38.6	33.1	66.9	60.2	48.2	34.9	(3.7)
11	0.10	0.5	38.8	32.4	67.6	60.8	48.7	35.3	(3.5)
12	<0.01	1.7	34.2	34.2	65.8	59.2	47.4	34.3	0.1
13	0.02	2.7	24.9	33.1	66.9	60.2	48.2	34.9	10.0
14	0.01	2.9	22.5	50.0	50.0	45.0	36.0	26.1	3.6
15	0.01	3.5	31.9	31.9	68.1	61.3	49.0	35.5	3.6
16	0.01	3.1	30.5	30.5	69.5	62.6	50.0	36.3	5.8
17	0.03	2.3	28.8	38.4	61.6	55.4	44.4	32.1	3.3
18	0.14	2.5	19.6	39.2	60.8	54.7	43.8	31.7	12.1
19	0.07	2.8	32.0	42.7	57.3	51.6	41.3	29.9	(2.1)
20	0.02	2.2	17.5	60.0	40.0	36.0	28.8	20.9	3.4
21	0.16	2.1	24.5	59.9	40.1	36.1	28.9	20.9	(3.6)
22	0.06	1.6	21.1	61.0	39.0	35.1	28.1	20.3	(0.8)
23	0.12	1.5	16.6	56.8	43.2	30.9	31.1	22.5	5.9
24	2.85	2.0	22.3	50.9	49.1	44.2	35.4	25.6	3.3
25	11.00	2.2	0.0	56.4	43.6	39.2	31.4	22.7	22.7
26	0.06	2.6	20.1	57.5	42.5	38.3	30.6	22.2	2.1
27	0.01	1.8	18.6	47.9	52.1	46.9	37.5	27.2	8.6
28	0.03	1.9	32.4	36.0	64.0	57.6	46.1	33.4	1.0
29	0.03	2.4	18.3	52.4	47.6	42.8	34.3	24.8	6.5
30	0.79	2.0	20.4	52.5	47.5	42.8	34.2	24.8	4.4
31	0.02	1.5	23.9	47.9	52.1	46.9	37.5	27.2	3.3
32	<0.01	1.8	22.5	36.0	64.0	57.6	46.1	33.4	10.9
33	<0.01	2.5	34.7	30.8	69.2	62.3	49.8	36.1	1.4
34	0.06	1.5	24.6	49.1	50.9	45.8	36.6	26.6	2.0
35	0.02	2.2	30.2	51.7	48.3	43.5	34.8	25.2	(5.0)
36	0.36	2.6	21.8	48.5	51.5	46.4	37.1	26.9	5.1
37	0.01	2.5	26.2	29.9	70.1	63.1	50.5	36.6	10.4
38	<0.01	2.6	43.6	31.1	68.9	62.0	49.6	35.9	(7.7)
39	0.01	2.8	39.3	32.8	67.2	60.5	48.4	35.1	(4.2)
40	0.01	2.2	38.5	33.0	67.0	60.3	48.2	35.0	(3.5)
41	<0.01	1.3	40.0	26.7	73.3	66.0	52.8	38.2	(1.8)
42	<0.01	2.1	39.3	26.2	73.8	66.4	53.1	38.5	(0.8)
43	<0.01	1.3	39.1	22.4	77.6	69.8	55.9	40.5	1.4
44	<0.01	1.0	42.8	28.6	71.4	64.3	51.4	37.3	(5.5)
45	<0.01	1.3	50.6	25.3	74.7	67.2	53.8	39.0	(11.6)

INTERPRETATION OF FLUID SATURATIONS
ASSUMING
10% FLUSH AND 20% RECOVERY OF OIL-IN-PLACE
AFTER FLUSH
(FINAL PRESSURE ATMOSPHERIC)

LABORATORY					CALCULATED SATURATIONS FOR GIVEN CONDITIONS				
Sample Number	Perm (md)	Porosity	Saturations Oil	Saturations Water	Initial Reservoir Oil-in-Place	Less 10% Flush	Less 20% "Production" to Atmospheric Pressure	Stock Tank Volume Remaining	Column 8 Minus Column 3
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
46	0.01	2.4	36.2	24.1	75.9	68.3	54.6	39.6	3.4
47	0.01	2.4	41.7	34.7	65.3	58.8	47.0	34.1	(7.6)
48	0.01	2.0	44.7	31.9	68.1	61.3	49.0	35.5	(9.2)
49	0.01	2.2	35.5	31.6	68.4	61.6	49.2	35.7	0.2
50	0.01	1.5	26.7	30.6	69.4	62.5	50.0	36.2	9.5
51	0.32	2.2	32.8	32.8	67.2	60.5	48.4	35.1	2.3
52	<0.01	1.0	10.6	42.4	57.6	51.8	41.5	30.1	19.5
53	0.02	1.5	27.1	30.9	69.1	62.2	49.8	36.1	9.0
54	<0.01	1.1	30.3	34.6	65.4	58.9	47.1	34.1	3.8
55	0.05	1.3	36.2	32.2	67.8	61.0	48.8	35.4	(0.8)
56	0.09	1.8	10.6	42.5	57.5	51.8	41.4	30.0	19.4
57	0.01	1.7	44.6	29.8	70.2	63.2	50.5	36.6	(8.0)
58	0.01	1.2	25.8	29.5	70.5	63.5	50.8	36.8	11.0
59	0.05	0.8	0.0	35.2	64.8	58.3	46.7	33.8	33.8
60	0.08	0.5	30.4	27.1	72.9	65.6	52.5	38.0	7.6
61	0.03	0.8	26.0	23.1	76.9	69.2	55.4	40.1	14.1
62	0.06	1.0	37.8	31.5	68.5	61.7	49.3	35.7	(2.1)
63	0.16	0.8	39.8	33.2	66.8	60.1	48.1	34.9	(4.9)
64	0.01	0.6	48.8	24.4	75.6	68.0	54.4	39.4	(9.4)
65	0.21	1.6	40.4	26.9	73.1	65.8	52.6	38.1	(2.3)
66	0.01	1.0	42.3	30.2	69.8	62.8	50.3	36.4	(5.9)
67	<0.01	0.8	36.3	40.8	59.2	53.3	42.6	30.9	(5.4)
68	0.01	1.0	43.3	37.9	62.1	55.9	44.7	32.4	(10.9)
69	0.01	1.2	32.4	21.6	78.4	70.6	56.4	40.9	8.5
70	4.16	1.0	37.9	52.1	47.9	43.1	34.5	25.0	(12.9)
71	0.65	1.1	28.4	52.1	47.9	43.1	34.5	25.0	(3.4)
72	0.01	1.0	50.6	40.5	59.5	53.6	42.8	31.0	(19.6)
73	0.81	1.1	38.2	38.2	61.8	55.6	44.5	32.2	(6.0)
74	0.01	0.8	45.3	30.2	69.8	62.8	50.3	36.4	(8.9)
75	0.03	1.0	35.1	40.2	59.8	53.8	43.1	31.2	(3.9)
76	0.01	0.8	48.4	27.6	72.4	65.2	52.1	37.8	(10.6)
77	0.01	1.1	35.0	40.0	60.0	54.0	43.2	31.3	(3.7)
78	0.01	0.4	32.3	35.9	64.1	57.7	46.2	33.4	1.1
79	1.21	1.2	46.6	39.3	60.7	54.6	43.7	31.7	(14.9)
80	0.01	0.8	58.6	27.9	72.1	64.9	51.9	37.6	(21.0)
81	0.01	1.0	41.7	37.1	62.9	56.6	45.3	32.8	(8.9)

Column 1: Permeability, millidarcies.
Column 2: Percent of bulk volume.
Column 3: Percent of pore space.
Column 4: Percent of pore space.
Column 5: Initial oil-in-place, percent of pore space at initial reservoir pressure. 100 minus Column 4.
Column 6: Column 5 x .9 (reservoir volume after flushing, percent of pore space).
Column 7: Column 6 x .8 (reservoir volume after "production" of 20% of oil-in-place after flushing).
Column 8: Stock tank volume remaining in reservoir after "production" and expulsion of flushing water: Column 7 divided by FVF of 1.38.
Column 9: Column 8 minus Column 3, theoretical saturation less laboratory saturation. (Negative figure means sample is suspect - or flushing of less than 10% occurred).

INTERPRETATION OF FLUID SATURATIONS ASSUMING 0% FLUSH AND 20% RECOVERY OF OIL-IN-PLACE (FINAL PRESSURE ATMOSPHERIC)

	LABORATORY				CALCULATED SATURATIONS FOR GIVEN CONDITIONS				
Sample Number	Perm (md) (1)	Porosity (2)	Saturations Oil (3)	Saturations Water (4)	Initial Reservoir Oil-in-Place (5)	Less 0% Flush (6)	Less 20% "Production" to Atmospheric Pressure (7)	Stock Tank Volume Remaining (8)	Column 8 Minus Column 3 (9)
1	0.01	2.5	39.0	39.0	61.0	61.0	48.8	35.4	(3.6)
2	0.02	2.0	34.6	40.3	59.7	59.7	47.8	34.6	0.0
3	<0.01	1.0	39.6	35.2	64.8	64.8	51.8	37.6	(2.0)
4	0.42	0.9	49.5	22.0	78.0	78.0	62.4	45.2	(4.3)
5	<0.01	0.6	49.8	16.6	83.4	83.4	66.7	48.3	(1.5)
6	<0.01	1.0	52.4	22.1	77.9	77.9	62.3	45.2	(7.2)
7	<0.01	0.9	41.2	34.3	65.7	65.7	52.6	38.1	(3.1)
8	0.02	0.7	45.6	32.9	67.1	67.1	53.7	38.9	(6.7)
9	<0.01	0.5	42.3	35.2	64.8	64.8	51.8	37.6	(4.7)
10	0.02	1.1	38.6	33.1	66.9	66.9	53.5	38.8	0.2
11	0.10	0.5	38.8	32.4	67.6	67.6	54.1	39.2	0.4
12	<0.01	1.7	34.2	34.2	65.8	65.8	52.6	38.1	3.9
13	0.02	2.7	24.9	33.1	66.9	66.9	53.5	38.8	13.9
14	0.01	2.9	22.5	50.0	50.0	50.0	40.0	29.0	6.5
15	0.01	3.5	31.9	31.9	68.1	68.1	54.5	39.5	7.6
16	0.01	3.1	30.5	30.5	69.5	69.5	55.6	40.3	9.8
17	0.03	2.3	28.8	38.4	61.6	61.6	49.3	35.7	6.9
18	0.14	2.5	19.6	39.2	60.8	60.8	48.6	35.2	15.6
19	0.07	2.8	32.0	42.7	57.3	57.3	45.8	33.2	1.2
20	0.02	2.2	17.5	60.0	40.0	40.0	32.0	23.2	5.7
21	0.16	2.1	24.5	59.9	40.1	40.1	32.1	23.2	(1.3)
22	0.06	1.6	21.1	61.0	39.0	39.0	31.2	22.6	1.5
23	0.12	1.5	16.6	56.8	43.2	43.2	34.6	25.0	8.4
24	2.85	2.0	22.3	50.9	49.1	49.1	39.3	28.5	6.2
25	11.00	2.2	0.0	56.4	43.6	43.6	34.9	25.3	25.3
26	0.06	2.6	20.1	57.5	42.5	42.5	34.0	24.6	4.5
27	0.01	1.8	18.6	47.9	52.1	52.1	41.7	30.2	11.6
28	0.03	1.9	32.4	36.0	64.0	64.0	51.2	37.1	4.7
29	0.03	2.4	18.3	52.4	47.6	47.6	38.1	27.6	9.3
30	0.79	2.0	20.4	52.5	47.5	47.5	38.0	27.5	7.1
31	0.02	1.5	23.9	47.9	52.1	52.1	41.7	30.2	6.3
32	<0.01	1.8	22.5	36.0	64.0	64.0	51.2	37.1	14.6
33	<0.01	2.5	34.7	30.8	69.2	69.2	55.4	40.1	5.4
34	0.06	1.5	24.6	49.1	50.9	50.9	40.7	29.5	4.9
35	0.02	2.2	30.2	51.7	48.3	48.3	38.6	28.0	(2.2)
36	0.36	2.6	21.8	48.5	51.5	51.5	41.2	29.9	8.1
37	0.01	2.5	26.2	29.9	70.1	70.1	56.1	40.6	14.4
38	<0.01	2.6	43.6	31.1	68.9	68.9	55.1	39.9	(3.7)
39	0.01	2.8	39.3	32.8	67.2	67.2	53.8	39.0	(0.3)
40	0.01	2.2	38.5	33.0	67.0	67.0	53.6	38.8	0.3
41	<0.01	1.3	40.0	26.7	73.3	73.3	58.6	42.5	2.5
42	<0.01	2.1	39.3	26.2	73.8	73.8	59.0	42.8	3.5
43	<0.01	1.3	39.1	22.4	77.6	77.6	62.1	45.0	5.9
44	<0.01	1.0	42.8	28.6	71.4	71.4	57.1	41.4	(1.4)
45	<0.01	1.3	50.6	25.3	74.7	74.7	59.8	43.3	(7.3)

INTERPRETATION OF FLUID SATURATIONS
ASSUMING
0% FLUSH AND 20% RECOVERY OF OIL-IN-PLACE
(FINAL PRESSURE ATMOSPHERIC)

	LABORATORY				CALCULATED SATURATIONS FOR GIVEN CONDITIONS				
Sample Number	Perm (md)	Porosity	Saturations Oil	Saturations Water	Initial Reservoir Oil-in-Place	Less 0% Flush	Less 20% "Production" to Atmospheric Pressure	Stock Tank Volume Remaining	Column 8 Minus Column 3
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
46	0.01	2.4	36.2	24.1	75.9	75.9	60.7	44.0	7.8
47	0.01	2.4	41.7	34.7	65.3	65.3	52.2	37.9	(3.8)
48	0.01	2.0	44.7	31.9	68.1	68.1	54.5	39.5	(5.2)
49	0.01	2.2	35.5	31.6	68.4	68.4	54.7	39.7	4.2
50	0.01	1.5	26.7	30.6	69.4	69.4	55.5	40.2	13.5
51	0.32	2.2	32.8	32.8	67.2	67.2	53.8	39.0	6.2
52	<0.01	1.0	10.6	42.4	57.6	57.6	46.1	33.4	22.8
53	0.02	1.5	27.1	30.9	69.1	69.1	55.3	40.1	13.0
54	<0.01	1.1	30.3	34.6	65.4	65.4	52.3	37.9	7.6
55	0.05	1.3	36.2	32.2	67.8	67.8	54.2	39.3	3.1
56	0.09	1.8	10.6	42.5	57.5	57.5	46.0	33.3	22.7
57	0.01	1.7	44.6	29.8	70.2	70.2	56.2	40.7	(3.9)
58	0.01	1.2	25.8	29.5	70.5	70.5	56.4	40.9	15.1
59	0.05	0.8	0.0	35.2	64.8	64.8	51.8	37.6	37.6
60	0.08	0.5	30.4	27.1	72.9	72.9	58.3	42.3	11.9
61	0.03	0.8	26.0	23.1	76.9	76.9	61.5	44.6	18.6
62	0.06	1.0	37.8	31.5	68.5	68.5	54.8	39.7	1.9
63	0.16	0.8	39.8	33.2	66.8	66.8	53.4	38.7	(1.1)
64	0.01	0.6	48.8	24.4	75.6	75.6	60.5	43.8	(5.0)
65	0.21	1.6	40.4	26.9	73.1	73.1	58.5	42.4	2.0
66	0.01	1.0	42.3	30.2	69.8	69.8	55.8	40.5	(1.8)
67	<0.01	0.8	36.3	40.8	59.2	59.2	47.4	34.3	(2.0)
68	0.01	1.0	43.3	37.9	62.1	62.1	49.7	36.0	(7.3)
69	0.01	1.2	32.4	21.6	78.4	78.4	62.7	45.4	13.0
70	4.16	1.0	37.9	52.1	47.9	47.9	38.3	27.8	(10.1)
71	0.65	1.1	28.4	52.1	47.9	47.9	38.3	27.8	(0.6)
72	0.01	1.0	50.6	40.5	59.5	59.5	47.6	34.5	(16.1)
73	0.81	1.1	38.2	38.2	61.8	61.8	49.4	35.8	(2.4)
74	0.01	0.8	45.3	30.2	69.8	69.8	55.8	40.5	(4.8)
75	0.03	1.0	35.1	40.2	59.8	59.8	47.8	34.7	(0.4)
76	0.01	0.8	48.4	27.6	72.4	72.4	57.9	42.0	(6.4)
77	0.01	1.1	35.0	40.0	60.0	60.0	48.0	34.8	(0.2)
78	0.01	0.4	32.3	35.9	64.1	64.1	51.3	37.2	4.9
79	1.21	1.2	46.6	39.3	60.7	60.7	48.6	35.2	(11.4)
80	0.01	0.8	58.6	27.9	72.1	72.1	57.7	41.8	(16.8)
81	0.01	1.0	41.7	37.1	62.9	62.9	50.3	36.5	(5.2)

Column 1: Permeability, millidarcies.
Column 2: Percent of bulk volume.
Column 3: Percent of pore space.
Column 4: Percent of pore space.
Column 5: Initial oil-in-place, percent of pore space at initial reservoir pressure. 100 Minus Column 4.
Column 6: Same as Column 5 (assumes 0% flush of core by circulating fluid).
Column 7: Column 6 x .8 (reservoir volume after "production" of 20% of oil-in-place).
Column 8: Stock tank volume remaining in reservoir after "production": Column 7 divided by FVF of 1.38.
Column 9: Column 8 minus Column 3, theoretical saturation less laboratory saturation. (Negative figure means sample is suspect.)

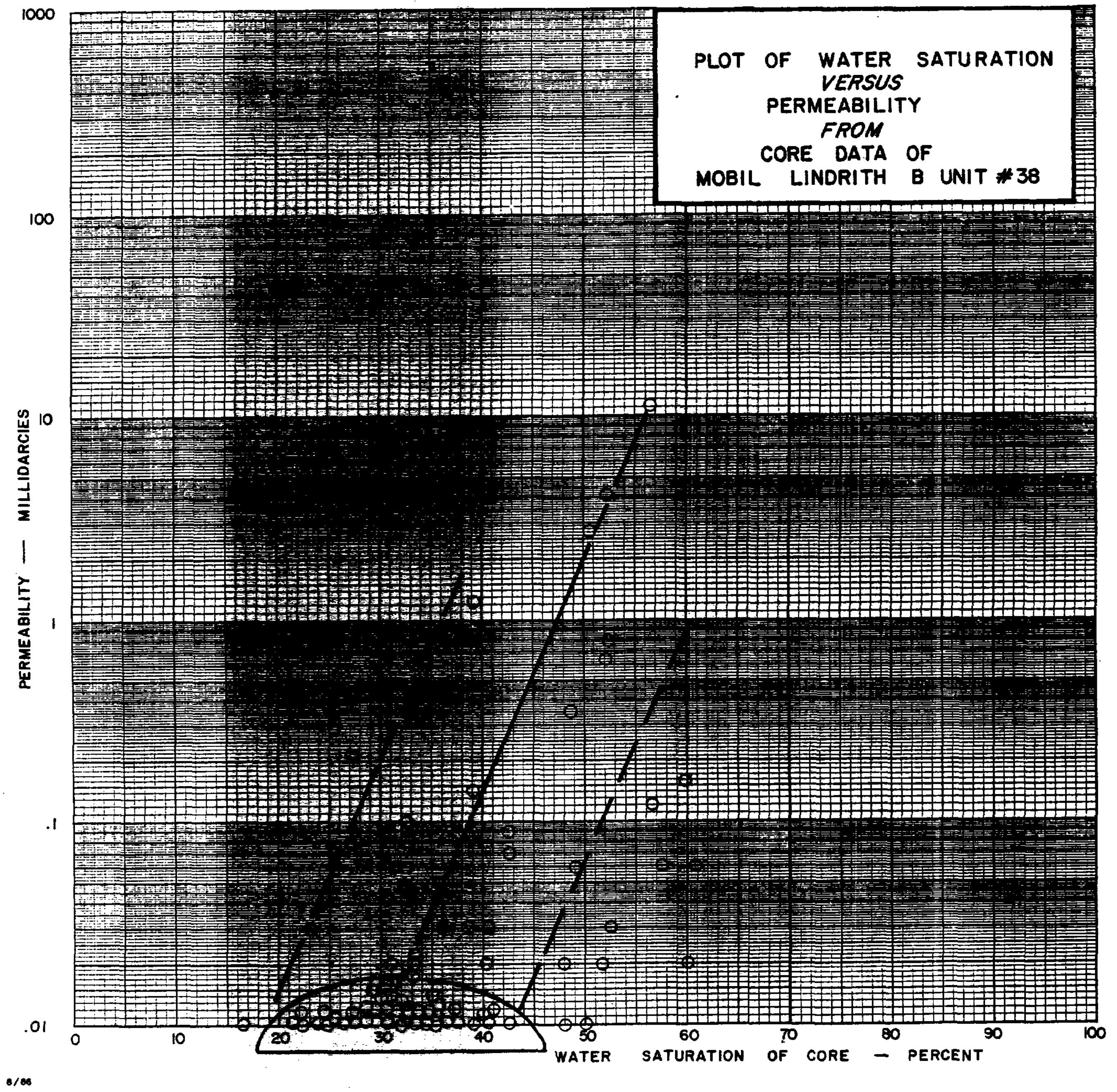
INTERPRETATION OF FLUID SATURATIONS
ASSUMING
0% FLUSH AND "PRODUCTION" REPRESENTED BY DIFFERENCE OF STOCK TANK VOLUMES

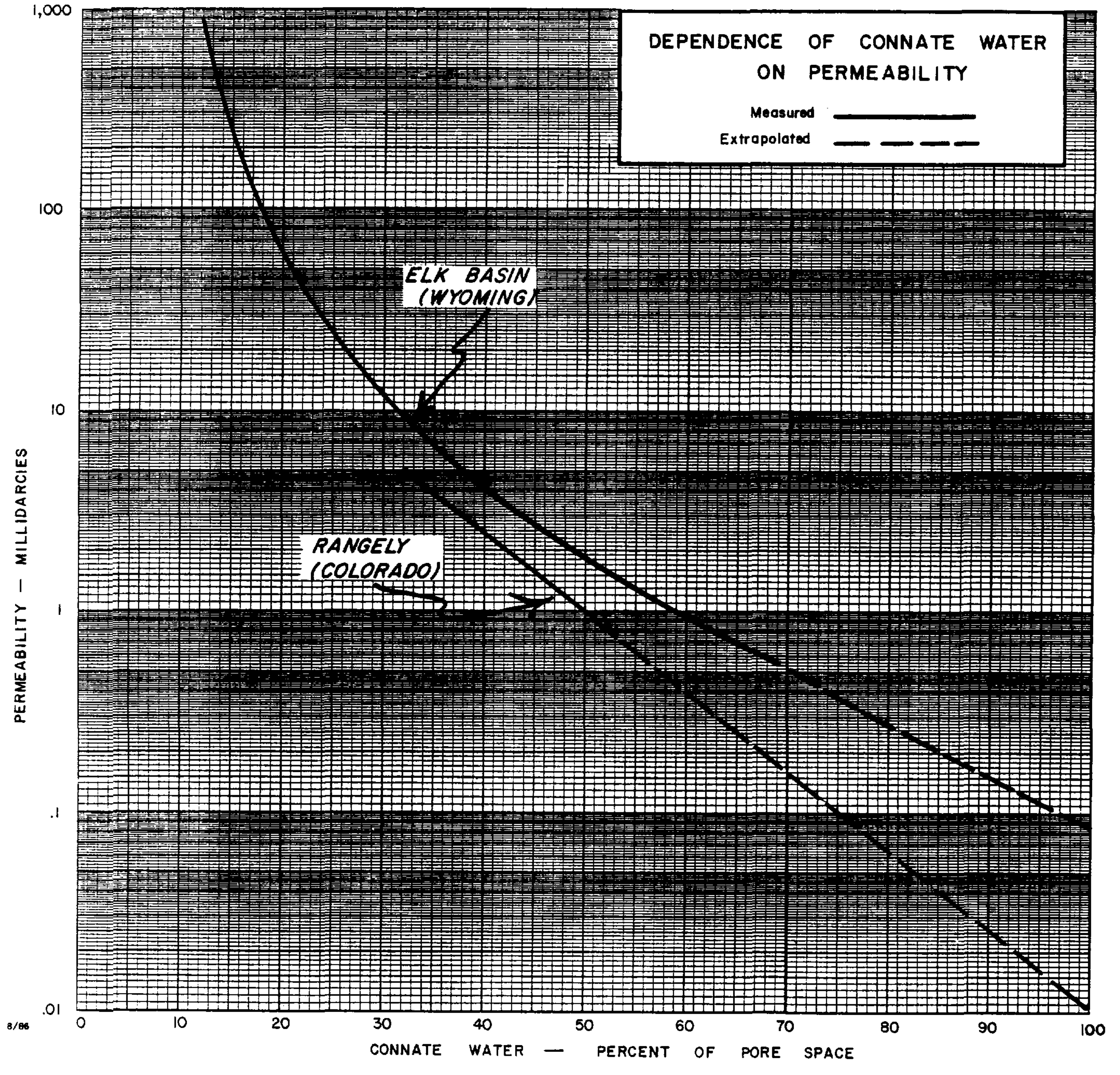
LABORATORY					Initial Oil-in-Place		"Production" to 0# (gauge) Reservoir Pressure (Stock Tank Volumes)	
Sample Number	Perm (md)	Porosity	Saturations Oil	Saturations Water	Reservoir Volume	Stock Tank Volume	"Production" Percent of Pore Space	"Production" Percent of Oil-in-Place
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
1	0.01	2.5	39.0	39.0	61.0	44.2	5.2	11.8
2	0.02	2.0	34.6	40.3	59.7	43.3	8.7	20.0
3	<0.01	1.0	39.6	35.2	64.8	47.0	7.4	15.7
4	0.42	0.9	49.5	22.0	78.0	56.5	7.0	12.4
5	<0.01	0.6	49.8	16.6	83.4	60.4	10.6	17.6
6	<0.01	1.0	52.4	22.1	77.9	56.4	4.0	7.2
7	<0.01	0.9	41.2	34.3	65.7	47.6	6.4	13.5
8	0.02	0.7	45.6	32.9	67.1	48.6	3.0	6.2
9	<0.01	0.5	42.3	35.2	64.8	47.0	4.7	9.9
10	0.02	1.1	38.6	33.1	66.9	48.5	9.9	20.4
11	0.10	0.5	38.8	32.4	67.6	49.0	10.2	20.8
12	<0.01	1.7	34.2	34.2	65.8	47.7	13.5	28.3
13	0.02	2.7	24.9	33.1	66.9	48.5	23.6	48.6
14	0.01	2.9	22.5	50.0	50.0	36.2	13.7	37.9
15	0.01	3.5	31.9	31.9	68.1	49.3	17.4	35.4
16	0.01	3.1	30.5	30.5	69.5	50.4	19.9	39.4
17	0.03	2.3	28.8	38.4	61.6	44.6	15.8	35.5
18	0.14	2.5	19.6	39.2	60.8	44.1	24.5	55.5
19	0.07	2.8	32.0	42.7	57.3	41.5	9.5	22.9
20	0.02	2.2	17.5	60.0	40.0	29.0	11.5	39.6
21	0.16	2.1	24.5	59.9	40.1	29.1	4.6	15.7
22	0.06	1.6	21.1	61.0	39.0	28.3	7.2	25.3
23	0.12	1.5	16.6	56.8	43.2	31.3	14.7	47.0
24	2.85	2.0	22.3	50.9	49.1	35.6	13.3	37.3
25	11.00	2.2	0.0	56.4	43.6	31.6	31.6	100.0
26	0.06	2.6	20.1	57.5	42.5	30.8	10.7	34.7
27	0.01	1.8	18.6	47.9	52.1	37.8	19.2	50.7
28	0.03	1.9	32.4	36.0	64.0	46.4	14.0	30.1
29	0.03	2.4	18.3	52.4	47.6	34.5	16.2	46.9
30	0.79	2.0	20.4	52.5	47.5	34.4	14.0	40.7
31	0.02	1.5	23.9	47.9	52.1	37.8	13.9	36.7
32	<0.01	1.8	22.5	36.0	64.0	46.4	23.9	51.5
33	<0.01	2.5	34.7	30.8	69.2	50.1	15.4	30.8
34	0.06	1.5	24.6	49.1	50.9	36.9	12.3	33.3
35	0.02	2.2	30.2	51.7	48.3	35.0	4.8	13.7
36	0.36	2.6	21.8	48.5	51.5	37.3	15.5	41.6
37	0.01	2.5	26.2	29.9	70.1	50.8	24.6	48.4
38	<0.01	2.6	43.6	31.1	68.9	49.9	6.3	12.7
39	0.01	2.8	39.3	32.8	67.2	48.7	9.4	19.3
40	0.01	2.2	38.5	33.0	67.0	48.6	10.1	20.7
41	<0.01	1.3	40.0	26.7	73.3	53.1	13.1	24.7
42	<0.01	2.1	39.3	26.2	73.8	53.5	14.2	26.5
43	<0.01	1.3	39.1	22.4	77.6	56.2	17.1	30.5
44	<0.01	1.0	42.8	28.6	71.4	51.7	8.9	17.3
45	<0.01	1.3	50.6	25.3	74.7	54.1	3.5	6.5

INTERPRETATION OF FLUID SATURATIONS
ASSUMING
0% FLUSH AND "PRODUCTION" REPRESENTED BY DIFFERENCE OF STOCK TANK VOLUMES

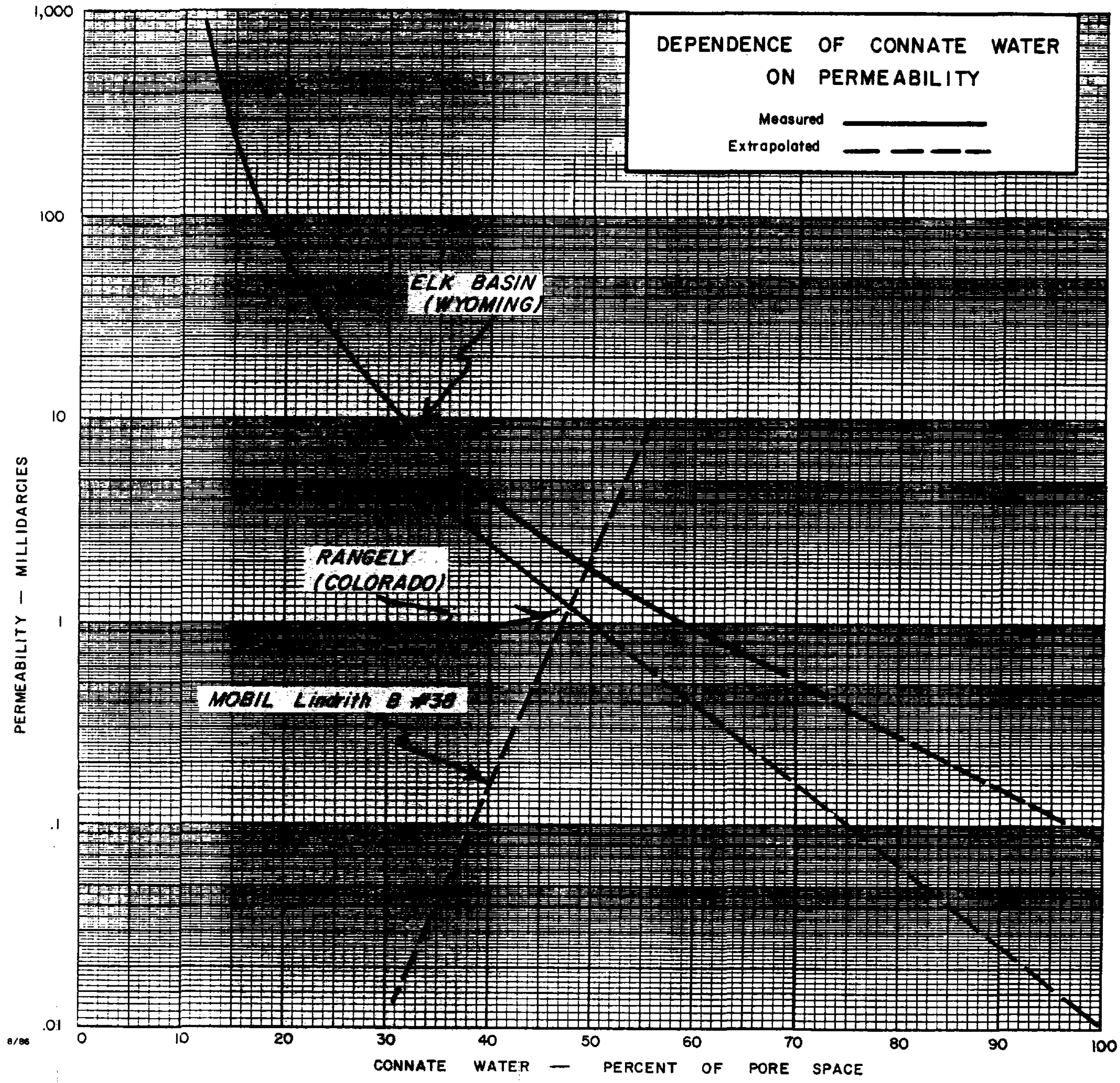
LABORATORY					Initial Oil-in-Place		"Production" to 0# (gauge) Reservoir Pressure (Stock Tank Volumes)	
Sample Number	Perm (md) (1)	Porosity (2)	Saturations Oil (3)	Saturations Water (4)	Reservoir Volume (5)	Stock Tank Volume (6)	"Production" Percent of Pore Space (7)	"Production" Percent of Oil-in-Place (8)
46	0.01	2.4	36.2	24.1	75.9	55.0	18.8	34.2
47	0.01	2.4	41.7	34.7	65.3	47.3	5.6	11.9
48	0.01	2.0	44.7	31.9	68.1	49.3	4.6	9.4
49	0.01	2.2	35.5	31.6	68.4	49.6	14.1	28.4
50	0.01	1.5	26.7	30.6	69.4	50.3	23.6	46.9
51	0.32	2.2	32.8	32.8	67.2	48.7	15.9	32.6
52	<0.01	1.0	10.6	42.4	57.6	41.7	31.1	74.6
53	0.02	1.5	27.1	30.9	69.1	50.1	23.0	45.9
54	<0.01	1.1	30.3	34.6	65.4	47.4	17.1	36.1
55	0.05	1.3	36.2	32.2	67.8	49.1	12.9	26.3
56	0.09	1.8	10.6	42.5	57.5	41.7	31.1	74.6
57	0.01	1.7	44.6	29.8	70.2	50.9	6.3	12.3
58	0.01	1.2	25.8	29.5	70.5	51.1	25.3	49.5
59	0.05	0.8	0.0	35.2	64.8	47.0	47.0	100.0
60	0.08	0.5	30.4	27.1	72.9	52.8	22.4	42.5
61	0.03	0.8	26.0	23.1	76.9	55.7	29.7	53.3
62	0.06	1.0	37.8	31.5	68.5	49.6	11.8	23.8
63	0.16	0.8	39.8	33.2	66.8	48.4	8.6	17.8
64	0.01	0.6	48.8	24.4	75.6	54.8	6.0	10.9
65	0.21	1.6	40.4	26.9	73.1	53.0	12.6	23.7
66	0.01	1.0	42.3	30.2	69.8	50.6	8.3	16.4
67	<0.01	0.8	36.3	40.8	59.2	42.9	6.6	15.4
68	0.01	1.0	43.3	37.9	62.1	45.0	1.7	3.8
69	0.01	1.2	32.4	21.6	78.4	56.8	24.4	43.0
70	4.16	1.0	37.9	52.1	47.9	34.7	(3.2)	(9.2)
71	0.65	1.1	28.4	52.1	47.9	34.7	6.3	18.2
72	0.01	1.0	50.6	40.5	59.5	43.1	(7.5)	(17.4)
73	0.81	1.1	38.2	38.2	61.8	44.8	6.6	14.7
74	0.01	0.8	45.3	30.2	69.8	50.6	5.3	10.4
75	0.03	1.0	35.1	40.2	59.8	43.3	8.2	19.0
76	0.01	0.8	48.4	27.6	72.4	52.5	4.1	7.7
77	0.01	1.1	35.0	40.0	60.0	43.5	8.5	19.5
78	0.01	0.4	32.3	35.9	64.1	46.4	14.1	30.5
79	1.21	1.2	46.6	39.3	60.7	44.0	(2.6)	(5.9)
80	0.01	0.8	58.6	27.9	72.1	52.2	(6.4)	(12.2)
81	0.01	1.0	41.7	37.1	62.9	45.6	3.9	8.5

Column 1: Permeability, millidarcies.
Column 2: Percent of bulk volume.
Column 3: Percent of pore space.
Column 4: Percent of pore space.
Column 5: Initial oil-in-place, percent of pore space at initial reservoir pressure. 100 minus Column 4.
Column 6: Initial stock tank volume of oil-in-place: reservoir volume divided by FVF.
Column 7: Stock tank volume "production" to 0# (gauge) reservoir pressure, percent of pore space (Column 6 minus Column 3).
Column 8: Stock tank volume "production" to 0# (gauge) reservoir pressure, percent of oil-in-place (Column 7 divided by Column 6 x 100). Low (less than 15 to 20%) means sample is suspect. High (30 to 40% or more) suggests substantial flushing or gas zone or sample is suspect.


PLOT OF WATER SATURATION
VERSUS
PERMEABILITY
FROM
CORE DATA OF
MOBIL LINDRITH B UNIT #38
PERMEABILITY — MILLIDARCIES
1000
100
10
1
.1
.01
0
10
20
30
40
50
60
70
80
90
100
WATER SATURATION OF CORE — PERCENT
8/86



DEPENDENCE OF CONNATE WATER ON PERMEABILITY
Measured
Extrapolated
ELK BASIN (WYOMING)
RANGELY (COLORADO)
PERMEABILITY — MILLIDARCIES
1,000
100
10
1
.1
.01
0
10
20
30
40
50
60
70
80
90
100
CONNATE WATER — PERCENT OF PORE SPACE
8/86


DEPENDENCE OF CONNATE WATER ON PERMEABILITY
Measured
Extrapolated
ELK BASIN (WYOMING)
RANGELY (COLORADO)
MOBIL Lindrith B #38
PERMEABILITY — MILLIDARCIES
1,000
100
10
1
.1
.01
0
10
20
30
40
50
60
70
80
90
100
CONNATE WATER — PERCENT OF PORE SPACE

CA-20

CORE LABORATORIES, INC.
Petroleum Reservoir Engineering
DALLAS, TEXAS

CORE ANALYSIS RESULTS

Company BENSON-MONTIN-GREER Formation GALLUP File RP-3-2318
Well LA PLATA MANCOS UNIT NO. 3(G-32) Core Type DIAMOND 3.5" Date Report 9-30-68
Field LA PLATA (GALLUP) Drilling Fluid CRUDE OIL Analysts GALLOP
County SAN JUAN State NEW MEX. Elev. 5988'GL Location 1650'FN&EL SEC 32-T32N-R13W

Lithological Abbreviations

SAND-SD	DOLOMITE-DOL	ANHYDRITE-ANHY	SANDY-SDY	FINE-FN	CRYSTALLINE-XLN	BROWN-BRN	FRACTURED-FRAC	SLIGHTLY-SL/
SHALE-SH	CHERT-CH	CONGLOMERATE-CONG	SHALY-SHY	MEDIUM-MED	GRAIN-GRN	GRAY-GY	LAMINATION-LAM	VERY-V/
LIME-LM	GYPSUM-GYP	FOSSILIFEROUS-FOSS	LIMY-LMY	COARSE-CSE	GRANULAR-GRNL	VUGGY-VGY	STYLOLITIC-STY	WITH-W/

NOTE: DEDUCT 20' FROM BELOW LISTED DEPTHS TO CORRELATE WITH SCHLUM. IES LOG RUN 10-2-68

(CONVENTIONAL ANALYSIS)

SAMPLE NUMBER	DEPTH FEET	PERMEABILITY MILLIDARCYS KA	POROSITY PER CENT	RESIDUAL SATURATION PER CENT PORE: OIL	RESIDUAL SATURATION PER CENT PORE: TOTAL WATER	SAMPLE DESCRIPTION AND REMARKS
1	5075.0-76.0	0.03	5.8	12.1	75.8	Sh, Bl, V/Fn Grn, W/Lmy Slt Strks, Frac
2	77.0-78.0	0.30	5.4	13.0	64.9	Sh, Bl, V/Fn Grn, W/Lmy Slt Strks, Frac
3	79.0-80.0	0.38	5.9	8.5	67.8	Sh, Bl, V/Fn Grn, W/Lmy Slt Strks, Frac
4	81.0-82.0	0.66	4.5	11.1	75.5	Sh, Bl, V/Fn Grn, Slty, Frac
5	83.0-84.0	0.17	5.6	8.9	71.5	Sh, Bl, V/Fn Grn, W/Lmy Slt Strks, Frac
6	85.0-86.0	0.01	5.3	3.8	75.5	Sh, Bl, V/Fn Grn, W/Lmy Slt Strks, Frac
7	87.0-88.0	0.17	5.5	3.6	80.0	Sh, Bl, V/Fn Grn, W/Lmy Slt Strks, Frac
8	89.0-90.0	0.02	4.8	4.2	83.4	Sh, Bl, V/Fn Grn, Slty, Frac
9	91.0-92.0	0.01	5.1	9.8	68.6	Sh, Bl, V/Fn Grn, Slty, Frac
10	93.0-94.0	0.01	5.3	13.2	71.7	Sh, Bl, V/Fn Grn, Slty, Frac
11	95.0-96.0	0.04	5.7	8.8	70.7	Sh, Bl, V/Fn Grn, Slty, Frac
12	97.0-98.0	0.02	7.2	29.8	59.7	Sh, Bl, V/Fn Grn, W/Lmy Slt Strks, Frac
13	5099.0-00.0	1.12	6.6	39.4	46.9	Sh, Bl, V/Fn Grn, W/Lmy Slt Strks, Frac
14	5101.0-02.0	0.09	6.2	46.7	43.5	Sh, Bl, V/Fn Grn, W/Lmy Slt Strks, Frac
15	03.0-04.0	0.02	6.9	43.5	37.7	Sh, Bl, V/Fn Grn, W/Lmy Slt Strks, Frac
16	05.0-06.0	0.01	7.3	46.5	41.0	Sh, Bl, V/Fn Grn, W/Lmy Slt Strks, Frac
17	07.0-08.0	0.03	6.7	41.8	44.7	Sh, Bl, V/Fn Grn, Slty, Frac
18	09.0-10.0	0.03	7.8	51.2	35.9	Sh, Bl, V/Fn Grn, Slty, Frac
19	11.0-12.0	0.17	6.7	49.2	40.3	Sh, Bl, V/Fn Grn, Slty, Frac
20	13.0-14.0	0.01	7.5	41.3	44.0	Sh, Bl, V/Fn Grn, W/Lmy Slt Strks, Frac
21	15.0-16.0	0.03	6.6	53.0	30.3	Sh, Bl, V/Fn Grn, Slty, Frac
22	17.0-18.0	0.03	6.6	48.5	36.4	Sh, Bl, V/Fn Grn, Slty, Frac
23	19.0-20.0	0.24	6.7	49.2	37.3	Sh, Bl, V/Fn Grn, Slty, Frac
24	21.0-22.0	0.22	5.2	40.3	46.2	Sh, Bl, V/Fn Grn, Slty, Frac
25	23.0-24.0	0.27	5.9	28.8	55.9	Sh, Bl, V/Fn Grn, Slty, Frac
26	25.0-26.0	0.50	4.5	20.0	59.9	Sh, Bl, V/Fn Grn, Slty, Frac
27	27.0-28.0	0.03	6.1	27.8	57.3	Sh, Bl, V/Fn Grn, Slty, Frac
28	29.0-30.0	0.66	6.7	32.8	49.2	Sh, Bl, V/Fn Grn, Slty, Frac
29	31.0-32.0	0.03	6.8	27.9	57.3	Sh, Bl, V/Fn Grn, W/Lmy Slt Strks, Frac
30	33.0-34.0	0.04	6.2	27.4	56.5	Sh, Bl, V/Fn Grn, W/Lmy Slt Strks, Frac
31	35.0-36.0	0.17	5.2	32.7	44.2	Sh, Bl, V/Fn Grn, W/Lmy Slt Strks, Frac
32	37.0-38.0	0.17	5.5	25.5	56.3	Sh, Bl, V/Fn Grn, Slty, Frac
33	39.0-40.0	0.17	5.9	27.1	64.3	Sh, Bl, V/Fn Grn, Slty, Frac
34	41.0-42.0	0.13	5.4	38.9	48.1	Sh, Bl, V/Fn Grn, W/Lmy Slt Strks, Frac
35	43.0-44.0	0.09	5.6	35.7	44.6	Sh, Bl, V/Fn Grn, Slty, Frac
36	45.0-46.0	0.02	5.3	39.6	51.0	Sh, Bl, V/Fn Grn, Slty, Frac

(Service #1-A)

CA-20

CORE LABORATORIES, INC.
Petroleum Reservoir Engineering
DALLAS, TEXAS

CORE ANALYSIS RESULTS

Company BENSON-MONTIN-GREER Formation GALLUP File RP-3-2318
Well LA PLATA MANCOS UNIT NO.3(G-32) Core Type DIAMOND 3.5" Date Report 9-30-68
Field LA PLATA (GALLUP) Drilling Fluid CRUDE OIL Analysts GALLOP
County SAN JUAN State NEW MEX. Elev. 5988'GL Location 1650'FN&EL SEC 32-T32N-R13W

Lithological Abbreviations

SAND-SD, SHALE-SH, LIME-LM, DOLOMITE-DOL, CHERT-CH, GYPSUM-GYP, ANHYDRITE-ANHY, CONGLOMERATE-CONG, FOSSILIFEROUS-FOSS, SANDY-SDY, SHALY-SHY, LIMY-LMY, FINE-FN, MEDIUM-MED, COARSE-CSE, CRYSTALLINE-XLN, GRAIN-GRN, GRANULAR-GRNL, BROWN-BRN, GRAY-GY, VUGGY-VGY, FRACTURED-FRAC, LAMINATION-LAM, STYLOLITIC-STY, SLIGHTLY-SL/, VERY-V/, WITH-W/

(CONVENTIONAL ANALYSIS)

SAMPLE NUMBER	DEPTH FEET	PERMEABILITY MILLIDARCYS KA	POROSITY PER CENT	RESIDUAL SATURATION PER CENT PORE: OIL	RESIDUAL SATURATION PER CENT PORE: TOTAL WATER	SAMPLE DESCRIPTION AND REMARKS
37	5147.0-48.0	2.80	6.3	33.3	50.7	Sh, Bl, V/Fn Grn, W/Lmy Slt Strks, Frac
38	49.0-50.0	0.04	6.2	45.1	35.5	Sh, Bl, V/Fn Grn, W/Lmy Slt Strks, Frac
39	51.0-52.0	0.02	6.3	46.0	34.9	Sh, Bl, V/Fn Grn, Slty, Frac
40	53.0-54.0	0.10	5.6	33.9	48.2	Sh, Bl, V/Fn Grn, W/Lmy Slt Strks, Frac
41	55.0-56.0	0.30	6.9	50.7	39.1	Sh, Bl, V/Fn Grn, W/Lmy Slt Strks, Frac
42	57.0-58.0	1.30	5.9	42.4	40.7	Sh, Bl, V/Fn Grn, Slty, Frac
43	59.0-60.0	0.33	6.3	39.7	42.8	Sh, Bl, V/Fn Grn, Slty, Frac
44	61.0-62.0	2.60	6.6	43.9	40.8	Sh, Bl, V/Fn Grn, Slty, Frac
45	63.0-64.0	0.09	5.6	46.1	37.5	Sh, Bl, V/Fn Grn, Slty, Frac
46	65.0-66.0	1.30	6.2	50.0	40.3	Sh, Bl, V/Fn Grn, Slty, Frac
47	67.0-68.0	0.33	6.3	46.0	39.7	Sh, Bl, V/Fn Grn, Slty, Frac
48	69.0-70.0	0.50	4.7	34.0	38.3	Sh, Bl, V/Fn Grn, Slty, Frac
49	71.0-72.0	0.04	6.0	46.7	40.0	Sh, Bl, V/Fn Grn, Slty, Frac
50	73.0-74.0	0.17	7.6	40.8	40.8	Sh, Bl, V/Fn Grn, W/Lmy Slt Strks, Frac
51	75.0-76.0	0.19	5.3	13.2	71.7	Sh, Bl, V/Fn Grn, W/Lmy Slt Strks, Frac
52	77.0-78.0	0.31	5.7	15.8	73.6	Sh, Bl, V/Fn Grn, W/Lmy Slt Strks, Frac
53	5180.0-81.0	0.21	5.9	15.2	67.8	Sh, Bl, V/Fn Grn, W/Lmy Slt Strks, Frac
54	85.0-86.0	0.02	6.4	14.1	71.9	Sh, Bl, V/Fn Grn, Slty, Frac
55	90.0-91.0	0.01	6.2	14.5	74.2	Sh, Bl, Fn Grn, Slty, Frac
56	95.0-96.0	0.01	5.2	3.8	80.8	Sh, Bl, Fn Grn, Slty, Frac
57	5200.0-01.0	0.01	4.7	4.3	74.4	Sh, Bl, V/Fn Grn, Slty, Frac
58	05.0-06.0	0.02	5.2	3.8	77.0	Sh, Bl, V/Fn Grn, Slty, Frac
59	10.0-11.0	0.01	4.0	5.0	75.0	Sh, Bl, V/Fn Grn, Slty, Frac
60	15.0-16.0	0.04	4.8	10.4	68.8	Sh, Bl, V/Fn Grn, Slty, Frac
61	20.0-21.0	0.32	4.8	10.4	73.0	Sh, Bl, V/Fn Grn, Slty, Frac
62	25.0-26.0	0.09	4.4	11.4	77.2	Sh, Bl, V/Fn Grn, Slty, Frac
63	30.0-31.0	0.01	4.2	11.9	76.2	Sh, Bl, V/Fn Grn, Slty, Frac
64	35.0-36.0	0.01	5.7	3.5	87.8	Sh, Bl, V/Fn Grn, Slty, Frac

CORE LABORATORIES, INC.
Petroleum Reservoir Engineering
DALLAS, TEXAS

CORE ANALYSIS RESULTS

Company BENSON-MONTIN-GREER Formation GALLUP File RP-3-2326
Well LA PLATA MANCOS UNIT NO. 4(N-31) Core Type DIAMOND 3.5" Date Report 10-25-68
Field LA PLATA (GALLUP) Drilling Fluid CRUDE OIL Analysts GALLOP
County SAN JUAN State NEW MEX. Elev. 6113'GL Location 756'FSL 1208'FWL SEC 31-T32N-R13W

Lithological Abbreviations

SAND-SD	DOLOMITE-DOL	ANHYDRITE-ANHY	SANDY-SDY	FINE-FN	CRYSTALLINE-XLN	BROWN-BRN	FRACTURED-FRAC	SLIGHTLY-SL/
SHALE-SH	CHERT-CH	CONGLOMERATE-CONG	SHALY-SHY	MEDIUM-MED	GRAIN-GRN	GRAY-GY	LAMINATION-LAM	VERY-V/
LIME-LM	GYPSUM-GYP	FOSSILIFEROUS-FOSS	LIMY-LMY	COARSE-CSE	GRANULAR-GRNL	VUGGY-VGY	STYLOLITIC-STY	WITH-W/

NOTE: SEE DEPTH CORRELATIONS IN NOTATION ON PAGE 2

(CONVENTIONAL ANALYSIS)

SAMPLE NUMBER	DEPTH FEET	PERMEABILITY MILLIDARCYS KA	POROSITY PER CENT	RESIDUAL SATURATION PER CENT PORE OIL	TOTAL WATER	SAMPLE DESCRIPTION AND REMARKS
1	2220.0-21.0	0.20	6.5	44.6	50.8	Sh, Bl, V/Fn Grn, W/Lmy Slt Strks, Frac
2	22.0-23.0	0.41	8.3	39.7	56.6	Sh, Bl, V/Fn Grn, W/Lmy Slt Strks, Frac
3	24.0-25.0	0.20	7.8	41.1	53.8	Sh, Bl, V/Fn Grn, Slty, Frac
4	26.0-27.0	0.20	8.4	48.8	46.4	Sh, Bl, V/Fn Grn, W/Lmy Slt Strks, Frac
5	28.0-29.0	0.31	8.8	49.8	45.5	Sh, Bl, V/Fn Grn, W/Lmy Slt Strks, Frac
6	30.0-31.0	0.08	9.6	45.8	50.0	Sh, Bl, V/Fn Grn, W/Lmy Slt Strks, Frac
7	32.0-33.0	0.20	6.8	51.4	42.7	Sh, Bl, V/Fn Grn, W/Lmy Slt Strks, Frac
8	34.0-35.0	0.10	8.6	47.7	50.0	Sh, Bl, V/Fn Grn, W/Lmy Slt Strks, Frac
9	36.0-37.0	0.01	8.3	54.2	42.2	Sh, Bl, V/Fn Grn, Slty, Frac
10	38.0-39.0	0.02	8.3	49.4	47.0	Sh, Bl, V/Fn Grn, Slty, Frac
11	40.0-41.0	0.05	7.0	47.1	47.1	Sh, Bl, V/Fn Grn, Slty, Frac
12	42.0-43.0	0.01	8.1	50.7	43.1	Sh, Bl, V/Fn Grn, Slty, Frac
13	44.0-45.0	0.01	8.9	43.9	50.5	Sh, Bl, V/Fn Grn, Slty, Frac
14	46.0-47.0	0.02	8.4	34.5	58.5	Sh, Bl, V/Fn Grn, Slty, Frac
15	48.0-49.0	0.01	8.3	45.7	45.7	Sh, Bl, V/Fn Grn, W/Lmy Slt Strks, Frac
16	50.0-51.0	0.20	8.9	50.6	41.6	Sh, Bl, V/Fn Grn, Slty, Frac
17	52.0-53.0	0.01	8.1	54.3	35.8	Sh, Bl, V/Fn Grn, W/Lmy Slt Strks, Frac
18	54.0-55.0	0.01	7.8	42.3	47.5	Sh, Bl, V/Fn Grn, W/Lmy Slt Strks, Frac
19	56.0-57.0	0.04	7.7	45.3	48.0	Sh, Bl, V/Fn Grn, W/Lmy Slt Strks, Frac
20	58.0-59.0	0.01	8.2	42.7	47.6	Sh, Bl, V/Fn Grn, W/Lmy Slt Strks, Frac
21	60.0-61.0	0.62	9.6	40.5	51.0	Sh, Bl, V/Fn Grn, Slty, Frac
22	62.0-63.0	1.20	9.6	41.7	50.0	Sh, Bl, V/Fn Grn, Slty, Frac
23	64.0-65.0	0.04	7.8	37.2	56.4	Sh, Bl, V/Fn Grn, Slty, Frac
24	66.0-67.0	0.08	7.8	37.2	53.8	Sh, Bl, V/Fn Grn, Slty, Frac
25	67.0-68.0	2.10	8.8	29.8	47.7	Sd, Gy, V/Fn Grn, Lmy, W/Shale Strks, Frac
26	68.0-69.0	0.03	4.8	41.6	48.0	Sd, Gy, V/Fn Grn, Lmy, W/Sh Strks, Frac
27	69.0-70.0	0.36	7.7	29.0	41.6	Sd, Gy, V/Fn Grn, Lmy, W/Sh Strks, Frac
28	70.0-71.0	1.60	9.6	44.8	42.8	Sh, Bl, V/Fn Grn, W/Lmy Slt Strks, Frac
29	2272.0-73.0	0.17	9.2	48.8	40.2	Sh, Bl, V/Fn Grn, W/Lmy Slt Strks, Frac
30	74.0-75.0	0.08	10.3	63.1	32.0	Sh, Bl, V/Fn Grn, Slty, Frac

Service #1-A

CA-20

CORE LABORATORIES, INC.

Petroleum Reservoir Engineering

DALLAS, TEXAS

CORE ANALYSIS RESULTS

Company	BENSON-MONTIN-GREER	Formation	GALLUP	File	RP-3-2326
Well	LA PLATA MANCOS UNIT NO. 4	Core Type	DIAMOND 3.5"	Date Report	10-25-68
Field	LA PLATA (GALLUP) (N-31)	Drilling Fluid	CRUDE OIL	Analysts	GALLOP
County	SAN JUAN State NEW MEX.	Elev.	6113'GL	Location	756'FSL 1208'FWL SEC 31-T32N-R13W

Lithological Abbreviations

SAND-SD, SHALE-SH, LIME-LM, DOLOMITE-DOL, CHERT-CH, GYPSUM-GYP, ANHYDRITE-ANHY, CONGLOMERATE-CONG, FOSSILIFEROUS-FOSS, SANDY-SDY, SHALY-SHY, LIMY-LMY, FINE-FN, MEDIUM-MED, COARSE-CSE, CRYSTALLINE-XLN, GRAIN-GRN, GRANULAR-GRNL, BROWN-BRN, GRAY-GY, VUGGY-VGY, FRACTURED-FRAC, LAMINATION-LAM, STYLOLITIC-STY, SLIGHTLY-SL/, VERY-V/, WITH-W/

SAMPLE NUMBER	DEPTH FEET	PERMEABILITY MILLIDARCYS KA	POROSITY PER CENT	RESIDUAL SATURATION PER CENT PORE: OIL	RESIDUAL SATURATION PER CENT PORE: TOTAL WATER	SAMPLE DESCRIPTION AND REMARKS
31	2276.0-77.0	0.60	8.9	50.5	37.1	Sh, Bl, V/Fn Grn, Slty, Frac
32	78.0-79.0	0.07	9.2	56.5	36.9	Sh, Bl, V/Fn Grn, Slty, Frac
33	80.0-81.0	0.02	8.5	52.8	41.1	Sh, Bl, V/Fn Grn, Slty, Frac
34	82.0-83.0	0.03	8.4	44.1	46.4	Sh, Bl, V/Fn Grn, Slty, Frac
35	84.0-85.0	0.57	7.2	18.1	69.5	Sh, Bl, V/Fn Grn, Slty, Frac
36	86.0-87.0	0.14	7.3	9.6	75.3	Sh, Bl, V/Fn Grn, W/Lmy Slt Strks
37	88.0-89.0	0.01	5.8	8.6	74.1	Sh, Bl, V/Fn Grn, W/Lmy Slt Strks
38	90.0-91.0	0.02	7.4	6.7	81.0	Sh, Bl, V/Fn Grn, W/Lmy Slt Strks
39	92.0-93.0	0.03	6.8	3.0	77.8	Sh, Bl, V/Fn Grn, W/Lmy Slt Strks
40	94.0-95.0	0.11	6.1	3.3	78.7	Sh, Bl, V/Fn Grn, Slty
41	96.0-97.0	0.08	5.7	3.5	82.4	Sh, Bl, V/Fn Grn, Slty

Note: To correspond with Schlumberger log depths:
Add 9' to interval 2220 to 2245 feet
Add 8' to interval 2245 to 2270 feet
Add 7' to interval 2270 to 2297 feet

CA-20

CORE LABORATORIES, INC.

Petroleum Reservoir Engineering

DALLAS, TEXAS

CORE ANALYSIS RESULTS

Company BENSON-MONTIN-GREER Formation GALLUP File RP-3-2312

Well LA PLATA MANCOS UNIT "I" NO. 6 Core Type DIAMOND 3.5" Date Report 8-24-68

Field LA PLATA (GALLUP) Drilling Fluid CRUDE OIL Analysts GALLOP

County SAN JUAN State NEW MEX. Elev. 6015'KB Location SEC 6-T32N-R13W

Lithological Abbreviations

SAND-SD	DOLOMITE-DOL	ANHYDRITE-ANHY	SANDY-SDY	FINE-FN	CRYSTALLINE-XLN	BROWN-BRN	FRACTURED-FRAC	SLIGHTLY-SL/
SHALE-SH	CHERT-CH	CONGLOMERATE-CONG	SHALY-SHY	MEDIUM-MED	GRAIN-GRN	GRAY-GY	LAMINATION-LAM	VERY-V/
LIME-LM	GYPSUM-GYP	FOSSILIFEROUS-FOSS	LIMY-LMY	COARSE-CSE	GRANULAR-GRNL	VUGGY-VGY	STYLOLITIC-STY	WITH-W/

(Note: Add 9' to below listed core depths to correspond to depths on Schlumberger log run 8-29-68.)

(CONVENTIONAL ANALYSIS)

SAMPLE NUMBER	DEPTH FEET	PERMEABILITY MILLIDARCYS K_A	POROSITY PER CENT	RESIDUAL SATURATION PER CENT PORE: OIL	RESIDUAL SATURATION PER CENT PORE: TOTAL WATER	SAMPLE DESCRIPTION AND REMARKS
1	3995.0-96.0	0.29	8.3	42.2	46.9	Sh, Bl, V/Fn Grn, W/Lmy Slt Strks, Frac
2	97.0-98.0	0.11	9.0	41.1	42.2	Sh, Bl, Slty, V/Fn Grn, Frac
3	99.0-00.0	0.10	9.6	38.5	48.9	Sh, Bl, V/Fn Grn, W/Lmy Slt Strks, Frac
4	4001.0-02.0	0.32	8.7	41.3	43.7	Sh, Bl, V/Fn Grn, W/Lmy Slt Strks, Frac
5	03.0-04.0	0.22	9.2	38.0	46.7	Sh, Bl, V/Fn Grn, Slty, Frac
6	05.0-06.0	0.07	8.6	39.5	51.2	Sh, Bl, V/Fn Grn, Slty, Frac
7	07.0-08.0	0.16	9.1	37.4	50.6	Sh, Bl, V/Fn Grn, Slty, Frac
8	09.0-10.0	0.06	9.1	39.5	52.7	Sh, Bl, V/Fn Grn, Slty, Frac
9	11.0-12.0	0.32	9.4	42.6	48.9	Sh, Bl, V/Fn Grn, Slty, Frac
10	13.0-14.0	0.99	8.5	37.7	54.1	Sh, Bl, V/Fn Grn, Slty, Frac
11	15.0-16.0	0.02	8.0	48.7	41.2	Sh, Bl, V/Fn Grn, W/Lmy Slt Strks, Frac
12	17.0-18.0	0.02	7.5	52.0	36.0	Sh, Bl, V/Fn Grn, W/Lmy Slt Strks, Frac
13	19.0-20.0	0.06	7.5	41.3	49.3	Sh, Bl, V/Fn Grn, W/Lmy Slt Strks, Frac
14	21.0-22.0	0.19	7.7	48.2	41.2	Sh, Bl, V/Fn Grn, W/Lmy Slt Strks, Frac
15	23.0-24.0	0.11	7.9	44.2	44.2	Sh, Bl, V/Fn Grn, W/Lmy Slt Strks, Frac
16	25.0-26.0	0.08	7.5	38.6	49.3	Sh, Bl, V/Fn Grn, W/Lmy Slt Strks, Frac
17	27.0-28.0	0.02	7.9	37.9	50.6	Sh, Bl, V/Fn Grn, W/Lmy Slt Strks, Frac
18	29.0-30.0	0.11	8.6	33.7	54.6	Sh, Bl, V/Fn Grn, W/Lmy Slt Strks, Frac
19	31.0-32.0	1.70	8.9	39.3	52.7	Sh, Bl, V/Fn Grn, Slty, Frac
20	33.0-34.0	0.07	7.9	36.7	57.0	Sh, Bl, V/Fn Grn, Slty, Frac
21	35.0-36.0	0.14	6.6	49.3	37.7	Sh, Bl, V/Fn Grn, W/Lmy Slt Strks, Frac
22	37.0-38.0	0.10	7.9	51.8	39.2	Sh, Bl, V/Fn Grn, Slty, Frac
23	39.0-40.0	0.07	7.0	44.3	47.2	Sh, Bl, V/Fn Grn, Slty, Frac
24	41.0-42.0	0.06	7.4	41.8	52.7	Sh, Bl, V/Fn Grn, W/Lmy Slt Strks, Frac
25	43.0-44.0	0.01	7.3	39.7	50.7	Sh, Bl, V/Fn Grn, W/Lmy Slt Strks, Frac
26	45.0-46.0	0.13	7.0	44.2	47.2	Sh, Bl, V/Fn Grn, Slty, Frac
27	47.0-48.0	0.02	7.0	40.0	45.7	Sh, Bl, V/Fn Grn, Slty, Frac
28	49.0-50.0	0.03	7.0	41.4	47.1	Sh, Bl, V/Fn Grn, W/Lmy Slt Strks, Frac
29	51.0-52.0	0.01	7.4	40.6	51.3	Sh, Bl, V/Fn Grn, Slty, Frac
30	53.0-54.0	0.03	8.1	38.3	35.8	Sh, Bl, V/Fn Grn, W/Lmy Slt Strks, Frac
31	55.0-56.0	0.06	6.8	30.9	61.7	Sh, Bl, V/Fn Grn, W/Lmy Slt Strks, Frac
32	57.0-58.0	0.09	6.3	31.8	55.6	Sh, Bl, V/Fn Grn, Slty, Frac
33	59.0-60.0	0.01	6.5	27.2	61.5	Sh, Bl, V/Fn Grn, Slty, Frac
34	61.0-62.0	2.0	7.2	40.2	48.5	Sh, Bl, V/Fn Grn, Slty, Frac
35	63.0-64.0	4.8	6.7	31.3	61.2	Sh, Bl, V/Fn Grn, W/Lmy Slt Strks, Frac
36	65.0-66.0	0.83	7.2	27.7	63.8	Sh, Bl, V/Fn Grn, Slty, Frac

Service #1-A

CORE LABORATORIES, INC.
Petroleum Reservoir Engineering
DALLAS, TEXAS

CORE ANALYSIS RESULTS

Company BENSON-MONTIN-GREER Formation GALLUP File RP-3-2312
Well LA PLATA MANCOS UNIT "I" NO. 6 Core Type DIAMOND 3.5" Date Report 8-24-68
Field LA PLATA (GALLUP) Drilling Fluid CRUDE OIL Analysts GALLOP
County SAN JUAN State NEW MEX. Elev. 6015'KB Location SEC 6-T32N-R13W

Lithological Abbreviations

SAND-SD	DOLOMITE-DOL	ANHYDRITE-ANHY	SANDY-SDY	FINE-FN	CRYSTALLINE-XLN	BROWN-BRN	FRACTURED-FRAC	SLIGHTLY-SL/
SHALE-SH	CHERT-CH	CONGLOMERATE-CONG	SHALY-SHY	MEDIUM-MED	GRAIN-GRN	GRAY-GY	LAMINATION-LAM	VERY-V/
LIME-LM	GYPSUM-GYP	FOSSILIFEROUS-FOSS	LIMY-LMY	COARSE-CSE	GRANULAR-GRNL	VUGGY-VGY	STYLOLITIC-STY	WITH-W/

SAMPLE NUMBER	DEPTH FEET	PERMEABILITY MILLIDARCYS KA	POROSITY PER CENT	RESIDUAL SATURATION PER CENT PORE OIL	RESIDUAL SATURATION PER CENT PORE TOTAL WATER	SAMPLE DESCRIPTION AND REMARKS
		(CONVENTIONAL ANALYSIS)				
37	4067.0-68.0	0.13	6.0	36.6	48.3	Sh, Bl, V/Fn Grn, W/Lmy Slt Strks, Frac
38	69.0-70.0	0.37	4.8	41.7	43.7	Sh, Bl, V/Fn Grn, W/Lmy Slt Strks, Frac
39	71.0-72.0	0.10	5.1	43.1	45.1	Sh, Bl, V/Fn Grn, W/Lmy Slt Strks, Frac
40	73.0-74.0	0.66	6.1	42.6	40.9	Sh, Bl, V/Fn Grn, W/Lmy Slt Strks, Frac
41	75.0-76.0	0.07	7.1	39.4	45.1	Sh, Bl, V/Fn Grn, W/Lmy Slt Strks, Frac
42	77.0-78.0	0.40	7.2	40.2	48.6	Sh, Bl, V/Fn Grn, Slty, Frac
43	79.0-80.0	0.13	7.6	32.9	56.5	Sh, Bl, V/Fn Grn, Slty, Frac
44	4150.0-51.0	0.83	5.5	25.4	63.6	Sh, Bl, V/Fn Grn, W/Lmy Slty Strks, Frac
45	52.0-53.0	1.30	5.0	30.0	58.0	Sh, Bl, V/Fn Grn, W/Lmy Slt Strks, Frac
46	54.0-55.0	0.83	5.8	27.5	56.8	Sh, Bl, V/Fn Grn, W/Lmy Slt Strks, Frac
47	56.0-57.0	5.3	5.1	33.4	52.9	Sh, Bl, V/Fn Grn, S/Lmy Slt Strks, Frac
48	58.0-59.0	0.06	5.7	29.0	54.3	Sh, Bl, V/Fn Grn, S/Lmy Slt Strks, Frac
49	60.0-61.0	<0.01	4.7	25.5	57.4	Sh, Bl, V/Fn Grn, W/Lmy Slt Strks, Frac
50	62.0-63.0	0.21	5.9	27.2	57.6	Sh, Bl, V/Fn Grn, Slty, Frac
51	64.0-65.0	0.06	5.8	32.8	56.9	Sh, Bl, V/Fn Grn, W/Lmy Slt Strks, Frac
52	66.0-67.0	0.83	6.1	41.0	49.2	Sh, Bl, V/Fn Grn, W/Lmy Slt Strks, Frac
53	68.0-69.0	0.04	6.7	38.8	49.3	Sh, Bl, V/Fn Grn, Slty, Frac
54	70.0-71.0	0.03	6.5	32.3	58.5	Sh, Bl, V/Fn Grn, Slty, Frac
55	72.0-73.0	0.02	6.6	30.3	57.5	Sh, Bl, V/Fn Grn, Slty, Frac
56	74.0-75.0	0.11	6.5	44.6	41.6	Sh, Bl, V/Fn Grn, W/Lmy Slt Strks, Frac
57	76.0-77.0	0.01	5.9	35.6	52.5	Sh, Bl, V/Fn Grn, Slty, Frac
58	78.0-79.0	5.5	5.9	37.3	42.3	Sh, Bl, V/Fn Grn, W/Lmy Slt Strks, Frac
59	80.0-81.0	1.50	7.3	38.3	52.0	Sh, Bl, V/Fn Grn, W/Lmy Slty Strks, Frac
60	82.0-83.0	0.06	8.1	42.0	46.8	Sh, Bl, V/Fn Grn, Slty, Frac
61	84.0-85.0	2.2	7.9	39.2	54.4	Sh, Bl, V/Fn Grn, Slty, Frac
62	86.0-87.0	1.50	5.4	53.6	33.4	Sh, Bl, V/Fn Grn, W/Lm Slty, Strks, Frac
63	88.0-89.0	0.03	7.0	42.8	40.0	Sh, Bl, V/Fn Grn, Slty, Frac
64	90.0-91.0	1.12	5.8	56.9	34.5	Sh, Bl, V/Fn Grn, Slty, Frac
65	92.0-93.0	0.33	6.7	52.2	40.3	Sh, Bl, V/Fn Grn, Slty, Frac
66	94.0-95.0	0.04	7.5	44.0	46.7	Sh, Bl, V/Fn Grn, W/Lmy Slt Strks, Frac
67	96.0-97.0	0.33	6.7	49.1	40.3	Sh, Bl, V/Fn Grn, Slty, Frac
68	98.0-99.0	0.83	7.3	43.8	46.5	Sh, Bl, V/Fn Grn, W/Lmy Slty Strks, Frac
69	4200.0-01.0	0.09	6.9	50.7	42.0	Sh, Bl, V/Fn Grn, W/Lmy Slt Strks, Frac
70	02.0-03.0	0.50	9.4	41.4	52.0	Sh, Bl, V/Fn Grn, Slty, Frac
71	04.0-05.0	0.08	8.5	43.5	43.5	Sh, Bl, V/Fn Grn, Slty, Frac
72	06.0-07.0	1.30	7.5	49.2	44.0	Sh, Bl, V/Fn Grn, W/Lmy Slt Strks, Frac
73	08.0-09.0	0.01	8.2	51.2	34.2	Sh, Bl, V/Fn Grn, W/Lmy Slt Strks, Frac

CA-20

CORE LABORATORIES, INC.
Petroleum Reservoir Engineering
DALLAS, TEXAS

CORE ANALYSIS RESULTS

Company BENSON-MONTIN-GREER Formation GALLUP File RP-3-2312
Well LA PLATA MANCOS UNIT "I" NO. 6 Core Type DIAMOND 3.5" Date Report 8-24-68
Field LA PLATA (GALLUP) Drilling Fluid CRUDE OIL Analysts GALLOP
County SAN JUAN State NEW MEX. Elev. 6015'KB Location SEC 6-T32N-R13W

Lithological Abbreviations

SAND-SD	DOLOMITE-DOL	ANHYDRITE-ANHY	SANDY-SDY	FINE-FN	CRYSTALLINE-XLN	BROWN-BRN	FRACTURED-FRAC	SLIGHTLY-SL/
SHALE-SH	CHERT-CH	CONGLOMERATE-CONG	SHALY-SHY	MEDIUM-MED	GRAIN-GRN	GRAY-GY	LAMINATION-LAM	VERY-V/
LIME-LM	GYPSUM-GYP	FOSSILIFEROUS-FOSS	LIMY-LMY	COARSE-CSE	GRANULAR-GRNL	VUGGY-VGY	STYLOLITIC-STY	WITH-W/

SAMPLE NUMBER	DEPTH FEET	PERMEABILITY MILLIDARCYS KA	POROSITY PER CENT	RESIDUAL SATURATION PER CENT PORE OIL	TOTAL WATER	SAMPLE DESCRIPTION AND REMARKS
	(CONVENTIONAL ANALYSIS)					
74	4210.0-11.0	0.09	8.5	48.2	41.2	Sh, Bl, V/Fn Grn, W/Lmy Slt Strks, Frac
75	12.0-13.0	<0.01	6.9	50.7	42.0	Sh, Bl, V/Fn Grn, W/Lmy Slt Strks, Frac
76	14.0-15.0	0.06	8.1	40.7	48.0	Sh, Bl, V/Fn Grn, Slty, Frac
77	16.0-17.0	0.02	8.3	45.7	45.7	Sh, Bl, V/Fn Grn, Slty, Frac
78	18.0-19.0	2.5	7.9	39.2	44.3	Sh, Bl, V/Fn Grn, W/Lmy Slt Strks, Frac
79	20.0-21.0	1.80	8.0	41.3	51.2	Sh, Bl, V/Fn Grn, W/Lmy Slt Strks, Frac
80	22.0-23.0	0.17	7.3	46.6	41.1	Sh, Bl, V/Fn Grn, W/Lmy Slt Strks, Frac
81	24.0-25.0	0.10	6.5	49.1	40.0	Sh, Bl, V/Fn Grn, Slty, Frac
82	26.0-27.0	0.10	7.0	55.8	31.4	Sh, Bl, V/Fn Grn, Slty, Frac
83	28.0-29.0	0.02	7.5	50.7	37.3	Sh, Bl, V/Fn Grn, W/Lmy Slt Strks, Frac
84	30.0-31.0	8.3	6.6	45.4	39.4	Sh, Bl, V/Fn Grn, W/Lmy Slt Strks, Frac
85	32.0-33.0	0.37	6.5	47.7	41.6	Sh, Bl, V/Fn Grn, W/Lmy Slt Strks, Frac
86	34.0-35.0	0.10	7.3	35.6	45.2	Sh, Bl, V/Fn Grn, W/Lmy Slt Strks, Frac
87	36.0-37.0	0.06	6.3	33.3	49.2	Sh, Bl, V/Fn Grn, W/Lmy Slt Strks, Frac
88	38.0-39.0	0.02	6.0	35.0-	45.0	Sh, Bl, V/Fn Grn, W/Lmy Slt Strks, Frac
89	40.0-41.0	0.02	7.9	35.4	42.9	Sh, Bl, V/Fn Grn, W/Lmy Slt Strks, Frac
90	42.0-43.0	0.04	7.0	40.0	48.6	Sh, Bl, V/Fn Grn, Slty, Frac
91	44.0-45.0	<0.01	6.8	17.6	66.2	Sh, Bl, V/Fn Grn, Slty, Frac
92	46.0-47.0	0.83	8.2	36.5	46.3	Sh, Bl, V/Fn Grn, W/Lmy Slt Strks, Frac
93	48.0-49.0	0.19	6.2	33.8	48.3	Sh, Bl, V/Fn Grn, Slty, Frac
94	50.0-51.0	0.02	6.6	42.3	39.4	Sh, Bl, V/Fn Grn, Slty, Frac
95	52.0-53.0	0.20	6.2	50.0	35.5	Sh, Bl, V/Fn Grn, W/Lmy Slt Strks, Frac
96	54.0-55.0	0.06	7.1	43.6	43.6	Sh, Bl, V/Fn Grn, W/Lmy Slt Strks, Frac
97	56.0-57.0	0.33	7.0	41.4	41.4	Sh, Bl, V/Fn Grn, W/Lmy Slt Strks, Frac
98	58.0-59.0	0.17	6.7	43.3	40.2	Sh, Bl, V/Fn Grn, W/Lmy Slt Strks, Frac
99	60.0-61.0	0.01	7.6	38.2	40.7	Sh, Bl, V/Fn Grn, W/Lmy Slt Strks, Frac
100	62.0-63.0	0.01	6.7	49.2	32.8	Sh, Bl, V/Fn Grn, Slty, Frac
101	64.0-65.0	2.3	5.7	49.1	35.1	Sh, Bl, V/Fn Grn, W/Lmy Slt Strks, Frac
102	66.0-67.0	0.17	7.4	44.6	44.6	Sh, Bl, V/Fn Grn, W/Lmy Slt Strks, Frac
103	68.0-69.0	0.07	6.2	50.0	35.5	Sh, Bl, V/Fn Grn, W/Lmy Slt Strks, Frac
104	70.0-71.0	0.19	6.3	52.3	34.9	Sh, Bl, V/Fn Grn, W/Lmy Slt Strks, Frac
105	72.0-73.0	12	6.6	45.4	42.4	Sh, Bl, V/Fn Grn, Slty, Frac
106	74.0-75.0	0.21	6.0	49.3	36.7	Sh, Bl, V/Fn Grn, Slty, Frac
107	76.0-77.0	0.14	6.1	50.8	39.3	Sh, Bl, V/Fn Grn, W/Lmy Slt Strks, Frac
108	78.0-79.0	0.66	5.8	46.5	37.9	Sh, Bl, V/Fn Grn, W/Lmy Slt Strks, Frac
109	80.0-81.0	0.01	7.0	57.1	31.4	Sh, Bl, V/Fn Grn, Slty, Frac
110	82.0-83.0	<0.01	5.6	39.2	48.2	Sh, Bl, V/Fn Grn, W/Lmy Slt Strks, Frac
111	84.0-85.0	3.0	6.3	39.7	46.0	Sh, Bl, V/Fn Grn, W/Lmy Slt Strks, Frac

CORE ANALYSIS RESULTS

Company BENSON-MONTIN-GREER — Formation GALLUP — File RP-3-2312

Well LA PLATA MANCOS UNIT "I" NO. 6 — Core Type DIAMOND 3.5" — Date Report 8-24-68

Field LA PLATA (GALLUP) — Drilling Fluid CRUDE OIL — Analysts GALLOP

County SAN JUAN — State NEW MEX. — Elev. 6015'KB — Location SEC 6-T32N-R13W

Lithological Abbreviations

SAND-SD, SHALE-SH, LIME-LM, DOLOMITE-DOL, CHERT-CH, GYPSUM-GYP, ANHYDRITE-ANHY, CONGLOMERATE-CONG, FOSSILIFEROUS-FOSS, SANDY-SDY, SHALY-SHY, LIMY-LMY, FINE-FN, MEDIUM-MED, COARSE-CSE, CRYSTALLINE-XLN, GRAIN-GRN, GRANULAR-GRNL, BROWN-BRN, GRAY-GY, VUGGY-VGY, FRACTURED-FRAC, LAMINATION-LAM, STYLOLITIC-STY, SLIGHTLY-SL/, VERY-V/, WITH-W/

SAMPLE NUMBER	DEPTH FEET	PERMEABILITY MILLIDARCYS K_A	POROSITY PER CENT	RESIDUAL SATURATION PER CENT PORE: OIL	RESIDUAL SATURATION PER CENT PORE: TOTAL WATER	SAMPLE DESCRIPTION AND REMARKS
	(CONVENTIONAL ANALYSIS)					
112	4286.0-87.0	0.02	6.6	43.9	46.9	Sh, Bl, V/Fn Grn, Slty, Frac
113	88.0-89.0	0.33	6.9	45.9	47.8	Sh, Bl, V/Fn Grn, Slty, Frac
114	90.0-91.0	<0.01	8.2	40.2	47.5	Sh, Bl, V/Fn Grn, Slty, Frac
115	92.0-93.0	<0.01	8.3	42.2	47.0	Sh, Bl, V/Fn Grn, W/Lmy Slt Strks, Frac
116	94.0-95.0	0.50	5.1	17.6	68.5	Sh, Bl, V/Fn Grn, V/Slty
117	96.0-97.0	3.3	5.2	13.5	76.8	Sh, Bl, V/Fn Grn, V/Slty
118	98.0-99.0	0.02	7.2	6.9	79.2	Sh, Bl, V/Fn Grn, V/Slty
119	4300.0-01.0	0.01	5.2	13.4	69.2	sh, Bl, V/Fn Grn, V/Slty
120	02.0-03.0	<0.01	4.2	16.6	76.2	Sh, Bl, V/Fn Grn, V/Slty, W/Lmy Slt Strks
121	04.0-05.0	0.50	5.0	10.0	84.0	Sh, Bl, V/Fn Grn, V/Slty, W/Lmy Slt Strks
122	06.0-07.0	<0.01	5.0	10.0	76.0	Sh, Bl, V/Fn Grn, V/Slty, W/Lmy Slt Strks
123	08.0-09.0	0.22	5.4	9.2	77.8	Sh, Bl, V/Fn Grn, V/Slty, W/Lmy Slt Strks
124	10.0-11.0	0.09	6.0	8.3	73.3	Sh, Bl, V/Fn Grn, V/Slty, W/Lmy Slt Strks
125	12.0-13.0	3.0	6.3	7.9	76.2	Sh, Bl, V/Fn Grn, V/Slty, W/Lmy Slt Strks
126	14.0-15.0	<0.01	5.4	9.3	81.5	Sh, Bl, V/Fn Grn, V/Slty, W/Lmy Slt Strks
127	16.0-17.0	0.05	6.0	8.3	76.6	Sh, Bl, V/Fn Grn, V/Slty, W/Lmy Slt Strks
128	18.0-19.0	0.01	6.3	7.9	69.9	Sh, Bl, V/Fn Grn, V/Slty
129	20.0-21.0	0.07	5.4	9.3	74.0	Sh, Bl, V/Fn Grn, V/Slty, W/Lmy Slt Strks
130	22.0-23.0	0.18	5.7	8.7	70.1	Sh, Bl, V/Fn Grn, V/Slty, W/Lmy Slt Strks
131	24.0-25.0	<0.01	4.6	10.9	71.7	Sh, Bl, V/Fn Grn, V/Slty, W/Lmy Slt Strks
132	26.0-27.0	0.08	5.8	8.6	74.1	Sh, Bl, V/Fn Grn, V/Slty, W/Lmy Slt Strks
133	28.0-29.0	0.09	6.2	8.1	77.3	Sh, Bl, V/Fn Grn, V/Slty, W/Lmy Slt Strks
134	30.0-31.0	0.07	6.8	7.3	82.4	Sh, Bl, V/Fn Grn, V/Slty

CA-20

CORE LABORATORIES, INC.
Petroleum Reservoir Engineering
DALLAS, TEXAS

CORE ANALYSIS RESULTS

Company BENSON-MONTIN-GREER Formation GALLUP File RP-3-2312
Well LA PLATA MANCOS UNIT "I" NO. 6 Core Type DIAMOND 3.5" Date Report 8-24-68
Field LA PLATA (GALLUP) Drilling Fluid CRUDE OIL Analysts GALLOP
County SAN JUAN State NEW MEX. Elev. 6015'KB Location SEC 6-T32N-R13W

Lithological Abbreviations

SAND-SD, SHALE-SH, LIME-LM, DOLOMITE-DOL, CHERT-CH, GYPSUM-GYP, ANHYDRITE-ANHY, CONGLOMERATE-CONG, FOSSILIFEROUS-FOSS, SANDY-SDY, SHALY-SHY, LIMY-LMY, FINE-FN, MEDIUM-MED, COARSE-CSE, CRYSTALLINE-XLN, GRAIN-GRN, GRANULAR-GRNL, BROWN-BRN, GRAY-GY, VUGGY-VGY, FRACTURED-FRAC, LAMINATION-LAM, STYLOLITIC-STY, SLIGHTLY-SL/, VERY-V/, WITH-W/

(WHOLE-CORE ANALYSIS)

SAMPLE NUMBER	DEPTH FEET	PERMEABILITY MILLIDARCYS K_A	POROSITY PER CENT	RESIDUAL SATURATION PER CENT PORE: OIL	RESIDUAL SATURATION PER CENT PORE: TOTAL WATER	SAMPLE DESCRIPTION AND REMARKS
1	4000.0-01.0	**	6.7	19.8	60.3	Sh, Bl, V/Fn Grn, Slty, Frac
2	04.0-05.0	**	6.6	19.4	59.7	Sh, Bl, V/Fn Grn, Slty, Frac
3	10.0-11.0	**	8.3	15.3	66.9	Sh, Bl, V/Fn Grn, Slty, Frac
4	14.0-15.0	*1.12	5.6	22.0	54.5	Sh, Bl, V/Fn Grn, W/Lmy Slt Strks, Frac
5	20.0-21.0	**	6.0	19.8	66.5	Sh, Bl, V/Fn Grn, W/Lmy Slt Strks, Frac
6	24.0-25.0	**	7.0	17.2	62.2	Sh, Bl, V/Fn Grn, W/Lmy Slt Strks, Frac
7	30.0-31.0	**	6.9	20.6	57.5	Sh, Bl, V/Fn Grn, Slty, Frac
8	34.0-35.0	**	6.5	13.6	63.3	Sh, Bl, V/Fn Grn, Slty, Frac
9	40.0-41.0	**	5.0	19.4	62.6	Sh, Bl, V/Fn Grn, Slty, Frac
10	44.0-45.0	**	7.0	12.9	71.3	Sh, Bl, V/Fn Grn, Slty, Frac
11	50.0-51.0	*0.01	6.2	21.7	62.2	Sh, Bl, V/Fn Grn, Slty, Frac
12	54.0-55.0	**	8.2	17.8	66.8	Sh, Bl, V/Fn Grn, Slty, Frac
13	60.0-61.0	*0.07	5.9	15.3	62.5	Sh, Bl, V/Fn Grn, W/Lmy Slt Strks, Frac
14	64.0-65.0	**	7.0	12.6	72.7	Sh, Bl, V/Fn Grn, Slty, Frac
15	70.0-71.0	*0.99	5.3	20.2	59.4	Sh, Bl, V/Fn Grn, W/Lmy Slt Strks, Frac
16	74.0-75.0	*0.03	4.4	21.4	55.9	Sh, Bl, V/Fn Grn, W/Lmy Slt Strks, Frac
17	4155.0-56.0	**	4.7	12.0	78.3	Sh, Bl, V/Fn Grn, Slty, Frac
18	59.0-60.0	*1.8	3.5	12.1	73.5	Sh, Bl, V/Fn Grn, Slty, Frac
19	65.0-66.0	*<0.01	6.0	16.2	62.8	Sh, Bl, V/Fn Grn, W/Lmy Slt Strks, Frac
20	69.0-70.0	**	5.1	16.6	74.6	Sh, Bl, V/Fn Grn, W/Lmy Slt Strks, Frac
21	75.0-76.0	**	5.4	23.9	62.7	Sh, Bl, V/Fn Grn, W/Lmy Slt Strks, Frac
22	79.0-80.0	**	5.5	22.0	69.8	Sh, Bl, V/Fn Grn, W/Lmy Slt Strks, Frac
23	85.0-86.0	**	5.6	20.7	68.3	Sh, Bl, V/Fn Grn, W/Lmy Slt Strks, Frac
24	89.0-90.0	**	5.3	26.5	63.3	Sh, Bl, V/Fn Grn, W/Lmy Slt Strks, Frac
25	95.0-96.0	*<0.01	5.5	25.7	68.2	Sh, Bl, V/Fn Grn, Slty, Frac
26	4201.0-02.0	*<0.01	5.3	17.7	69.8	Sh, Bl, V/Fn Grn, W/Lmy Slt Strks, Frac
27	05.0-06.0	**	5.3	26.9	59.6	Sh, Bl, V/Fn Grn, Slty, Frac
28	09.0-10.0	*<0.01	5.9	25.0	66.6	Sh, Bl, V/Fn Grn, Slty, Frac
29	15.0-16.0	*<0.01	6.3	23.1	66.0	Sh, Bl, V/Fn Grn, Slty, Frac
30	19.0-20.0	*0.01	6.2	22.9	68.3	Sh, Bl, V/Fn Grn, W/Lmy Slt Strks, Frac
31	25.0-26.0	**	7.3	23.7	56.3	Sh, Bl, V/Fn Grn, W/Lmy Slt Strks, Frac
32	29.0-30.0	**	4.3	22.6	56.4	Sh, Bl, V/Fn Grn, W/Lmy Slt Strks, Frac
33	35.0-36.0	**	5.1	26.4	54.1	Sh, Bl, V/Fn Grn, W/Lmy Slt Strks, Frac

*Indicates Plug Permeability
**Indicates Sample Unsuitable for Permeability Measurement

(Service #5-B)

CA-20

CORE LABORATORIES, INC.
Petroleum Reservoir Engineering
DALLAS, TEXAS

CORE ANALYSIS RESULTS

Company BENSON-MONTIN-GREER Formation GALLUP File RP-3-2312
Well LA PLATA MANCOS UNIT "I" NO. 6 Core Type DIAMOND 3.5" Date Report 6-24-68
Field LA PLATA (GALLUP) Drilling Fluid CRUDE OIL Analysts GALLOP
County SAN JUAN State NEW MEX. Elev. 6015'KB Location SEC 6-T32N-R13W

Lithological Abbreviations

SAND - SD, SHALE - SH, LIME - LM, DOLOMITE - DOL, CHERT - CH, GYPSUM - GYP, ANHYDRITE - ANHY, CONGLOMERATE - CONG, FOSSILIFEROUS - FOSS, SANDY - SDY, SHALY - SHY, LIMY - LMY, FINE - FN, MEDIUM - MED, COARSE - CSE, CRYSTALLINE - XLN, GRAIN - GRN, GRANULAR - GRNL, BROWN - BRN, GRAY - GY, VUGGY - VGY, FRACTURED - FRAC, LAMINATION - LAM, STYLOLITIC - STY, SLIGHTLY - SL/, VERY - V/, WITH - W/

(WHOLE-CORE ANALYSIS)

SAMPLE NUMBER	DEPTH FEET	PERMEABILITY MILLIDARCYS K_A	POROSITY PER CENT	RESIDUAL SATURATION PER CENT PORE OIL	RESIDUAL SATURATION PER CENT PORE TOTAL WATER	SAMPLE DESCRIPTION AND REMARKS
34	4239.0-40.0	*0.02	4.9	20.0	61.4	Sh, Bl, V/Fn Grn, W/Lmy Slt Strks, Frac
35	45.0-46.0	**	5.2	22.3	60.3	Sh, Bl, V/Fn Grn, W/Lmy Slt Strks, Frac
36	49.0-50.0	**	3.7	18.5	55.1	Sh, Bl, V/Fn Grn, W/Lmy Slt Strks, Frac
37	55.0-56.0	*0.01	5.6	18.9	62.0	Sh, Bl, V/Fn Grn, W/Lmy Slt Strks, Frac
38	59.0-60.0	*0.01	5.9	19.4	57.8	Sh, Bl, V/Fn Grn, W/Lmy Slt Strks, Frac
39	65.0-66.0	*0.02	5.1	23.6	59.8	Sh, Bl, V/Fn Grn, W/Lmy Slt Strks, Frac
40	69.0-70.0	**	4.1	13.0	52.8	Sh, Bl, V/Fn Grn, W/Lmy Slt Strks, Frac
41	75.0-76.0	**	6.9	16.0	62.0	Sh, Bl, V/Fn Grn, Slty, Frac
42	79.0-80.0	*<0.01	5.2	14.9	61.5	Sh, Bl, V/Fn Grn, Slty, Frac
43	85.0-86.0	*<0.01	5.4	22.0	55.8	Sh, Bl, V/Fn Grn, W/Lmy Slt Strks, Frac
44	89.0-90.0	*0.01	4.7	21.5	61.5	Sh, Bl, V/Fn Grn, W/Lmy Slt Strks, Frac
45	95.0-96.0	*0.01	5.5	4.7	73.0	Sh, Bl, V/Fn Grn, Slty
46	4299.0-00.0	*0.01	4.7	1.5	67.2	Sh, Bl, V/Fn Grn, V/Slty
47	4305.0-06.0	*< 0.01	5.8	1.2	77.7	Sh, Bl, V/Fn Grn, V/Slty
48	09.0-10.0	*< 0.01	5.7	0.9	77.0	Sh, Bl, V/Fn Grn, V/Slty
49	15.0-16.0	*0.01	7.2	1.3	70.5	Sh, Bl, V/Fn Grn, V/Slty
50	19.0-20.0	*<0.01	6.3	1.3	70.2	Sh, Bl, V/Fn Grn, V/Slty
51	25.0-26.0	*0.70	6.9	1.4	73.8	Sh, Bl, V/Fn Grn, V/Slty
52	29.0-30.0	*0.03	7.7	0.9	71.8	Sh, Bl, V/Fn Grn, V/Slty

*Indicates Plug Permeability
**Indicates Sample Unsuitable for Permeability Measurement

LA PLATA MANCOS UNIT I-6

CORE DESCRIPTION

CORE NO. 1 Cored 3995' to 4055'. Cored 60', recovered 60'. Average penetration rate 10 minutes/foot. Bedding plane partings and hairline fractures throughout entire core.

DEPTH	DESCRIPTION	INDICATED VERTICAL FRACTURES	OBSERVED HAIRLINE FRACTURE PATTERN
3995 - 4008'	Black shale		Fair
4008 - 4009'	Black shale	Vertical fracture	Fair
4009 - 4012'	Black shale		Fair
4012 - 4028'	Black shale with limey siltstone laminations		Fair
4028 - 4031'	Black shale with limey siltstone laminations	Vertical fracture	Fair
4031 - 4043'	Black shale with limey siltstone laminations		Poor
4043 - 4046'	Black shale	Vertical fracture	Fair to good
4046 - 4055'	Black shale	Fracture vertical to bedding planes	Good

CORE NO. 2 Cored 4055' to 4080'. Cored 25', recovered 25'. Average penetration rate 9.6 minutes/foot. Bedding plane partings and hairline fractures throughout entire core.

DEPTH	DESCRIPTION	INDICATED VERTICAL FRACTURES	OBSERVED HAIRLINE FRACTURE PATTERN
4055 - 4067'	Black shale		Fair
4067 - 4077'	Black shale with limey siltstone laminations		No good
4077 - 4080'	Black shale		Poor to fair

LA PLATA MANCOS UNIT I-[illegible]

CORE DESCRIPTION

CORE NO. 3: Cored 4150' to 4210'. Cored 60', recovered 60'. Average penetration rate 12.2 minutes/foot. Bedding plane partings and hairline fractures throughout entire core. Occasionally throughout core bedding planes are offset.

DEPTH	DESCRIPTION	INDICATED VERTICAL FRACTURES	OBSERVED HAIRLINE FRACTURE PATTERN
4150-4153'	Black shale with limey siltstone laminations		Fair
4154-4155'	" " "	Vertical fracture	Fair
4155-4159'	" " "		Fair to poor
4160-4179'	" " "	Fracture not on bedding plane	Poor to absent
4180-4185'	" " "		Fair to poor
4185-4188'	" " "	Healed fractures at angles to bedding planes	Absent
4189-4191'	" " "		Poor to absent
4192-4197'	" " "		Poor to fair
4197-4200'	" " "		Fair
4201-4203'	" " "	Vertical fracture	Fair
4204-4210'	" " "	Large healed vertical fracture 4005-06'	Good to fair

NOTE: General fracture pattern indicates larger fractures than in La Plata Mancos Unit No. P-31 well for comparative depth interval.

LA PLATA MANCOS UNIT I-6

CORE DESCRIPTION

CORE NO. 4: Cored 4210' to 4265'. Cored 55', recovered 55'. Average penetration rate 13.5 minutes/foot. Bedding plane partings and hairline fractures throughout entire core. Occasionally throughout core bedding planes are offset.

DEPTH	DESCRIPTION	INDICATED VERTICAL FRACTURES	OBSERVED HAIRLINE FRACTURE PATTERN
4210-4212'	Black shale with limey siltstone laminations		Fair
4212-4216'	Black shale with limey siltstone laminations	Vertical fracture	Good
4216-4220'	Black shale		Fair to good
4220-4230'	Black shale with limey siltstone laminations		Good to fair
4230-4238'	Black shale with limey siltstone laminations	All directions	Fair
4238-4242'	Black shale with limey siltstone laminations		Good
4242-4246'	Black shale with limey siltstone laminations		Fair
4246-4249'	Black shale with limey siltstone laminations	Vertical fracture	Fair
4249-4263'	Black shale with limey siltstone laminations		Fair
4263-4265'	Black shale with limey siltstone laminations	Vertical fracture	Fair

NOTE: General fracture pattern indicates larger fractures than in La Plata Mancos Unit No. P-31 well for comparative depth interval.

LA PLATA MANCOS UNIT I-6

CORE DESCRIPTION

CORE NO. 5: Cored 4265' to 4294'. Cored 29', recovered 29'. Average penetration rate 16 minutes/foot. Bedding plane partings and hairline fractures throughout entire core.

DEPTH	DESCRIPTION	INDICATED VERTICAL FRACTURES	OBSERVED HAIRLINE FRACTURE PATTERN
4265-4269'	Black shale with limey siltstone laminations		Fair to good
4269-	Approximately 2" section of slickenside		
4269-4278'	Black shale with limey siltstone laminations		Fair
4278-4281'	Black shale with limey siltstone laminations	Vertical fracture	Good
4281-4288'	Black shale with limey siltstone laminations		Fair
4288-4289'	Black shale with limey siltstone laminations	Vertical fracture	Poor to fair
4289-4292'	Black shale with limey siltstone laminations		Poor
4292-4294'	Black shale with limey siltstone laminations	Vertical fracture	Poor

NOTE: General fracture pattern indicates larger fractures than in La Plata Mancos Unit No. P-31 well for comparative depth interval.

LA PLATA MANCOS UNIT I-6

CORE DESCRIPTION

CORE NO. 6: Cored 4294' to 4334'. Cored 40', recovered 37'. Occasional bedding plane partings and infrequent hairline fractures in part of core as described below. As compared to previous cores, the limey siltstone laminations are more infrequent and thinner.

DEPTH	DESCRIPTION	INDICATED VERTICAL FRACTURES	OBSERVED HAIRLINE FRACTURE PATTERN
4294-4296'	Black shale with limey siltstone laminations	None	Fair
4296-4303'	" "	"	Poor
4303-4305'	" "	"	Fair
4305-4325'	" "	"	Poor to absent
4325-4331'	" "	"	Poor to fair

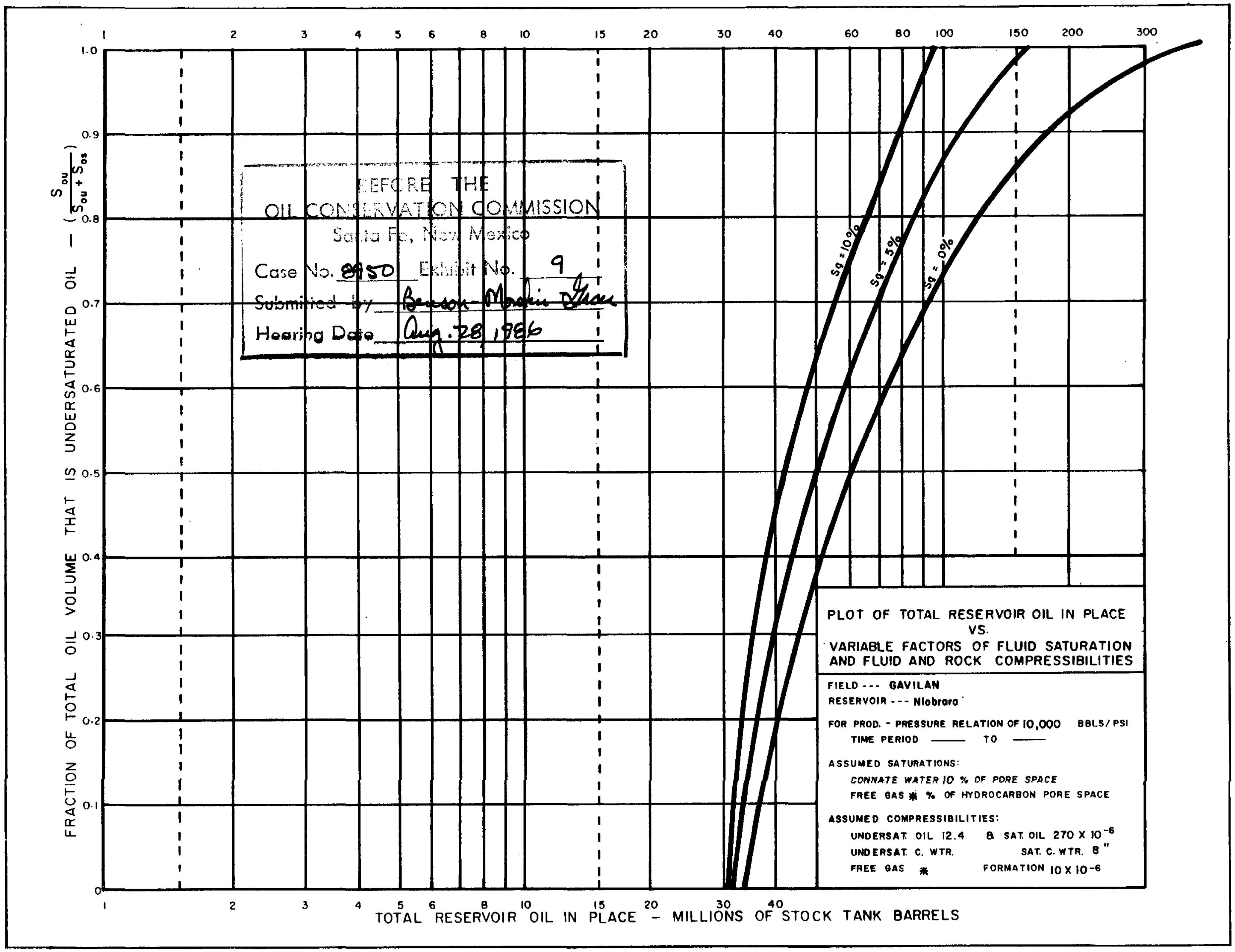
NOTE: Compared to Cores 3, 4 and 5, this core contains less frequent connections of bedding plane partings with hairline fractures at an angle to the bedding planes.

9-25-68 (cont'd) Pressured up on annulus between tubing on top of packer with tubing open. Pressure held. Did not get any returns through tubing. Swabbed back 12 barrels acid displacement oil.

9-26-68 Fraced with 6 Dowell Allisons at 625 HHP (total 3750 HHP), 3 Dowell Turbines at 825 HHP (total 2475 HHP) and 1 Dowell Turbine Experimental at 1000 HHP. Total HHP on location 7225. HHP delivered during frac job 6334. Treated with 200,000# 20/40 sand plus estimated 26,000# 10/20 sand, mixed with 3,400 barrels crude oil. Total sand volume 226 barrels. Average overall injection rate 86 BPM. No apparent breakdown pressure. Minimum TP 2900#, maximum 4500#, average 3100#. Well sanded off at 4800#.

1:18 PM Shut pumpers down at 4800# pressure.

Date	Time	Dowell Gauge	B-M-G Gauge
	1:19 PM	3000#	
	1:20 PM	2300#	
	1:22 PM	1900#	
	1:24 PM	1500#	
	1:26 PM	1300#	
	1:29 PM	1250#	1440#
	1:30 PM		1420#
	1:33 PM		1410#
	1:45 PM		1380#
	2:00 PM		1260#
	2:15 PM		1340#
	2:30 PM		1380#
	2:45 PM		1450#
	3:00 PM		1440#
	3:15 PM		1440#
	3:30 PM		1440#
	3:45 PM		1430#
	4:00 PM		1420#
	4:15 PM		1415#
	4:30 PM		1410#
	4:45 PM		1405#
	5:00 PM		1400#
	5:15 PM		1400#
	5:30 PM		1385#
	5:45 PM		1380#
	6:00 PM		1375#
	6:15 PM		1370#
	6:30 PM		1365#
	6:45 PM		1365#
	7:00 PM		1360#
	7:15 PM		1350#
	7:30 PM		1345#
	7:45 PM		1340#
	8:00 PM		1340#
	9:00 PM		1325#
	10:00 PM		1320#
	11:00 PM		1300#
	Midnight		1290#
9-27-68	1:00 AM		1280#
	2:00 AM		1280#
	3:00 AM		1300#
	4:00 AM		1300#
	5:00 AM		1280#
	6:00 AM		1260#
	7:00 AM		1260#
	8:00 AM		1240#
	9:00 AM		1240#


FRACTION OF TOTAL OIL VOLUME THAT IS UNDERSATURATED OIL — ($\frac{S_{ou}}{S_{ou} + S_{os}}$)
TOTAL RESERVOIR OIL IN PLACE - MILLIONS OF STOCK TANK BARRELS
Sg = 10%
Sg = 5%
Sg = 0%
BEFORE THE
OIL CONSERVATION COMMISSION
Santa Fe, New Mexico
Case No. 8950 Exhibit No. 9
Submitted by Benson-Montin-Greer
Hearing Date Aug. 28, 1986
PLOT OF TOTAL RESERVOIR OIL IN PLACE
VS.
VARIABLE FACTORS OF FLUID SATURATION
AND FLUID AND ROCK COMPRESSIBILITIES
FIELD --- GAVILAN
RESERVOIR --- Niobrara
FOR PROD. - PRESSURE RELATION OF 10,000 BBLS/PSI
TIME PERIOD ——— TO ———
ASSUMED SATURATIONS:
CONNATE WATER 10 % OF PORE SPACE
FREE GAS * % OF HYDROCARBON PORE SPACE
ASSUMED COMPRESSIBILITIES:
UNDERSAT. OIL 12.4 & SAT. OIL 270 X 10⁻⁶
UNDERSAT. C. WTR. SAT. C. WTR. 8 "
FREE GAS * FORMATION 10 X 10⁻⁶