



01220550

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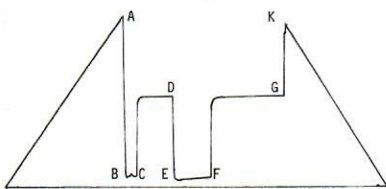
Test-A-Log Co.

Kimball, Nebraska

DRILL STEM TEST SERVICE REPORT

GUIDE TO INTERPRETATION AND IDENTIFICATION OF DST CHARTS

In making any interpretation, our employees will give Customer the benefit of their best judgment as to the correct interpretation. Nevertheless, since all interpretations are opinions based on inferences from electrical, mechanical or other measurements, we cannot, and do not, guarantee the accuracy or correctness of any interpretations, and we shall not be liable or responsible, except in the case of gross or wilful negligence on our part, for any loss, costs, damages or expenses incurred or sustained by Customer resulting from any interpretation made by any of our agents or employees.



- A - Initial Hydrostatic
- B - First Initial Flow
- C - First Final Flow
- D - Initial Shut-in
- E - Second Initial Flow
- F - Second Final Flow
- G - Second Shut-in
- H - Third Initial Flow
- I - Third Final Flow
- J - Third Shut-in
- K - Final Hydrostatic

NOMENCLATURE

Symbol	Definition	DST Unit
k	permeability	millidarcys (md)
h	pay thickness	feet (ft.)
u	viscosity	centipoise
T	reservoir temperature	°Rankin (°R)
Z	gas compressibility factor at average condition	—
q _{sc}	gas production rate	MCF/d
M	Horner slope for liquid analysis	PSI/Cycle
Mg	Horner slope for (P ²) gas analysis	PSI ² /Cycle
P _i	initial static reservoir pressure	PSI
P _{wf}	flowing bottom hole pressure	PSI
Ø	porosity	(fraction)
r _w	well bore radius	ft.
S	skin factor	—
AOF	absolute open flow	MCF/d
D. R.	damage ratio	—
r _e	external drainage radius	ft.
ISIP	initial shut-in pressure	PSI
FSIP	final shut-in pressure	PSI
b	approx. radius of investigation	ft.
t	flowing time	hrs.
B	formation volume factor	—
q	liquid production rate	bbls/day
c	gas compressibility	1/PSI
c	liquid compressibility	1/PSI

Build-Up Analysis Equations

Pressure Analysis

$$kh = \frac{162.6 Q \mu \beta}{M}$$

$$S = 1.151 \left[\frac{P_{1hr} - P_{wf}}{M} - \log \left(\frac{k}{\phi \mu c_t^2 w} \right) + 3.23 \right]$$

$$\frac{\Delta P}{Skin} = \frac{141.2 Q \mu \beta S}{kh}$$

$$L = \sqrt{\frac{0.000148 k \Delta t_x}{\phi \mu c_t}}$$

$$Efficiency = \frac{P - P_{wf} - \Delta P_{Skin}}{P - P_{wf}}$$

Type Curve P Method

$$kh = 141.2 Q \mu \beta \frac{P_{wo}}{\Delta P}$$

$$S = \frac{1}{2} \ln \left[\frac{C_D e^{2s}}{2.637 \times 10^{-4} k \Delta t} \frac{\phi \mu c_t^2 w}{t_0 / C_D} \right]$$

$$\frac{\Delta P}{Skin} = \frac{141.2 Q \mu \beta S}{kh}$$

$$Efficiency = \frac{P - P_{wf} - \Delta P_{Skin}}{P - P_{wf}}$$

Pseudo-Pressure Analysis

$$kh = \frac{1.632 \times 10^7 Q_g T}{M}$$

$$S = 1.151 \left[\frac{\psi_{1hr} - \psi_{wf}}{M} - \log \left(\frac{k}{\phi \mu c_t^2 w} \right) + 3.23 \right]$$

$$\frac{\Delta \psi}{Skin} = \frac{1422 Q_g T S}{kh}$$

$$L = \sqrt{\frac{0.000148 k \Delta t_x}{\phi \mu c_t}}$$

$$Efficiency = \frac{P - P_{wf} - \Delta P_{Skin}}{P - P_{wf}}$$

Type Curve P² Method

$$kh = 141.2 Q \mu \beta \frac{P_{wo}}{\Delta t \Delta P}$$

$$S = \frac{1}{2} \ln \left[\frac{C_D e^{2s}}{2.637 \times 10^{-4} k \Delta t} \frac{\phi \mu c_t^2 w}{t_0 / C_D} \right]$$

$$\frac{\Delta P}{Skin} = \frac{141.2 Q \mu \beta S}{kh}$$

$$Efficiency = \frac{P - P_{wf} - \Delta P_{Skin}}{P - P_{wf}}$$

Fall-Off Analysis Equations

Semi-Log Analysis

$$Eq. (3.9) \quad kh = \frac{162.6 Q \mu \beta}{M}$$

$$S = 1.151 \left[\frac{P_{1hr} - P_{wf}}{M} - \log \left(\frac{k}{\phi \mu c_t^2 w} \right) + 3.23 \right]$$

Eq. (3.10)

Log-Log Analysis

$$Eq. (4.4) \quad kh = 141.2 Q \mu \beta \frac{P_{wo}}{\Delta P}$$

$$S = \frac{1}{2} \ln \left[\frac{C_D e^{2s}}{2.637 \times 10^{-4} k \Delta t} \frac{\phi \mu c_t^2 w}{t_0 / C_D} \right]$$

Pressure drop due to skin

$$Eq. (2.9) \quad \frac{\Delta P}{Skin} = \frac{141.2 Q \mu \beta S}{kh}$$

Flow Efficiency

$$Eq. (2.12) \quad FE = \frac{P - P_{wf} - \Delta P_{Skin}}{P - P_{wf}}$$

investigation radius =

$$Eq. (2.41) \quad 0.029 \sqrt{\frac{k \Delta t}{\phi \mu c_t}}$$

Skin due to Partial Perforations

$$Eq. (2.20) \quad S_p = \left(\frac{h_t}{h_p} - 1 \right) \left[\ln \left(\frac{h_t}{h_p} \sqrt{\frac{k_H}{k_V}} \right) - 2 \right]$$

Advances in Well Test Analysis
Robert C. Earlougher Jr.
Monograph Volume 5 of
the Henry L. Doherty Series

* Well Testing
John Lee
SPE Textbook Series Vol 1

Drill-Stem-Test Reporting By:

Michael Hudson
DATA REPORTING SERVICES

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Test-A-Log Co.

Technical Services
(928) 505-8389



COMPANY: EDWARD MIKE DAVIS, LLC.
LEASE NAME & NO: B. YOUNG #31-11
INTERVAL TESTED: 3863'- 3868'

COUNTY: WASHINGTON
STATE: COLORADO
FORMATION: J SAND

DATE: 07-07-2003
TICKET #: 2508
TEST #: 1

Contractor	Excell Drilling	Surface Choke	1"	Mud Type	Chemical/Gel
Rig No.	10	Bottom Choke	5/8"	Weight	9.2
Spot	SW/NW/NE	Hole Size	7 7/8"	Viscosity	88
Sec	11	Core Hole Size		Water Loss	6.8
Twp	3 S	DP Size & Wt	4" 14.00	Filter Cake	1/32
Rng	50 W	Wt Pipe		RW	2.2 @ 80 Deg F
Field	Wildcat	ID of DC	2 1/4"		2,222 Ppm
County	Washington	Length of DC	365'	B.H.T.	142.4 Deg F
State	Colorado	Total Depth	3868' (driller)	Co. Rep.	Matt Goolsby
Elevation	4484' GL	Type of Test	Conventional	Tester	Roger Seeman
Formation	J Sand	Interval	3863'- 3868'		

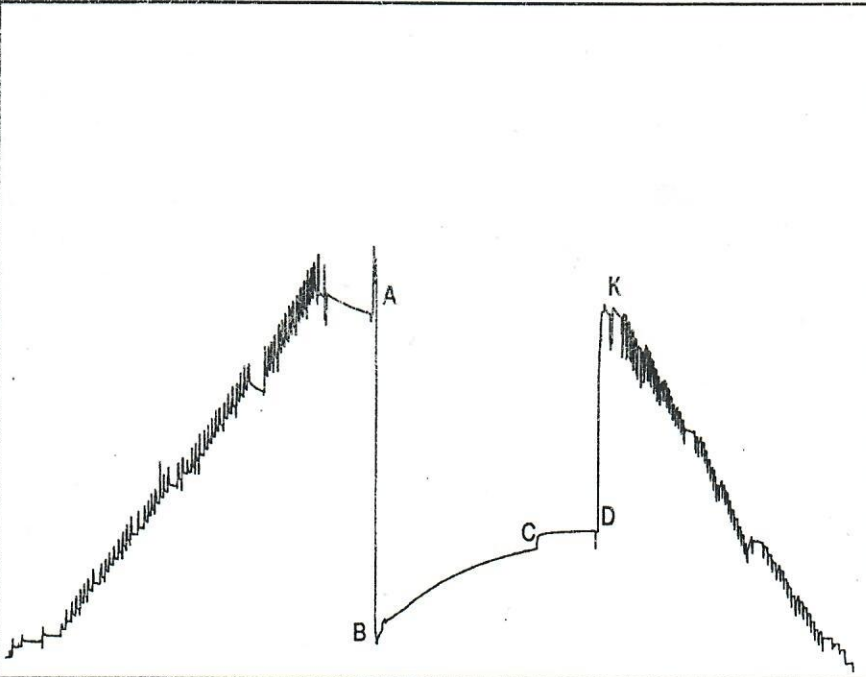
Pipe recovery:
1430' Total fluid = 13.29 bbl., consisting of:
60' Muddy water = 0.65 bbl.
1370' Water = 12.64 bbl.

Top rw: 2.8 @ 80 deg f/1,724 ppm NaCl.
Middle rw: 3.0 @ 80 deg f/1,603 ppm NaCl.
Bottom rw: 3.0 @ 80 deg f/1,603 ppm NaCl.

Surface Blow
Began with a 1/2" blow, increased to a good blow with 7.0 oz in 5 minutes; began to decrease after 30 minutes to 2.0 oz at end of flow period.

Pressure in Sampler	0	psig
Volume of Sampler	2000	cc
Volume of Sample	2000	cc
Oil:	0	cc
Water:	2000	cc
Mud:	0	cc
Gas:	0	cu ft
Other:	0	
Rw:	3.0 @ 80 deg f/1.75 @ res temp/ 1,603 ppm NaCl., 975 ppm Cl.	
Gas/Oil Ratio		
Gravity	API @ 60 Deg F	

Gauge Type	Sunada Electronic	
No.	30043	Cap 5000 psi
Depth	3846	ft.
Inside	X	Outside



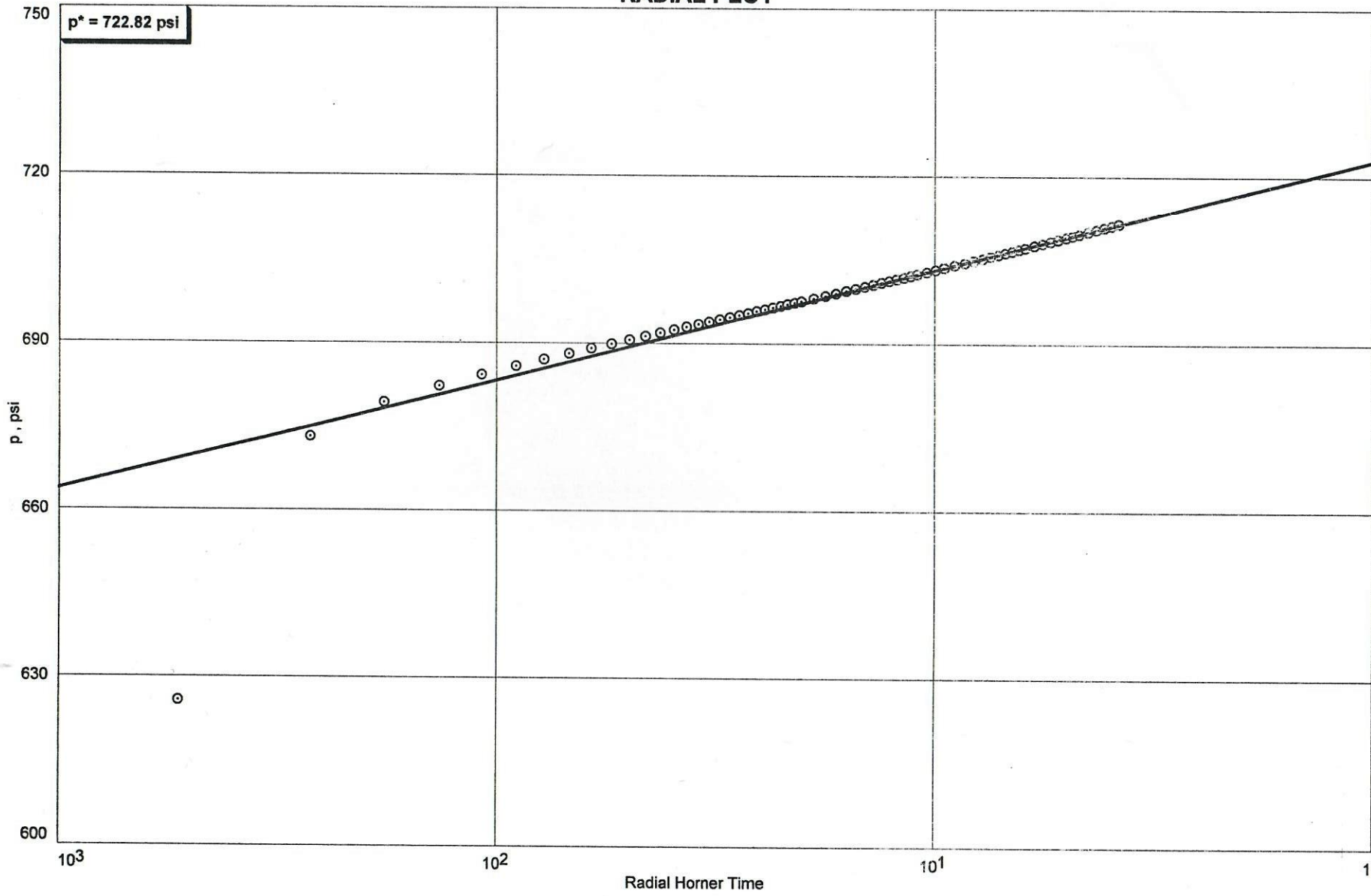
Initial Hydrostatic	[A]	1766
Final Hydrostatic	[K]	1770
Initial Flow 1	[B]	158
Final Flow 1	[C]	624
Initial Flow 2	[E]	
Final Flow 2	[F]	
Initial Flow 3	[H]	
Final Flow 3	[I]	
Shut-in 1	[D]	711
Shut-in 2	[G]	
Shut-in 3	[J]	

Opened Tool @	08:30 hrs on 07-07-03		
	Reported	Corrected	
Flow 1	90	89	min
Shut-in 1	30	32	min
Flow 2			min
Shut-in 2			min
Flow 3			min
Shut-in 3			min



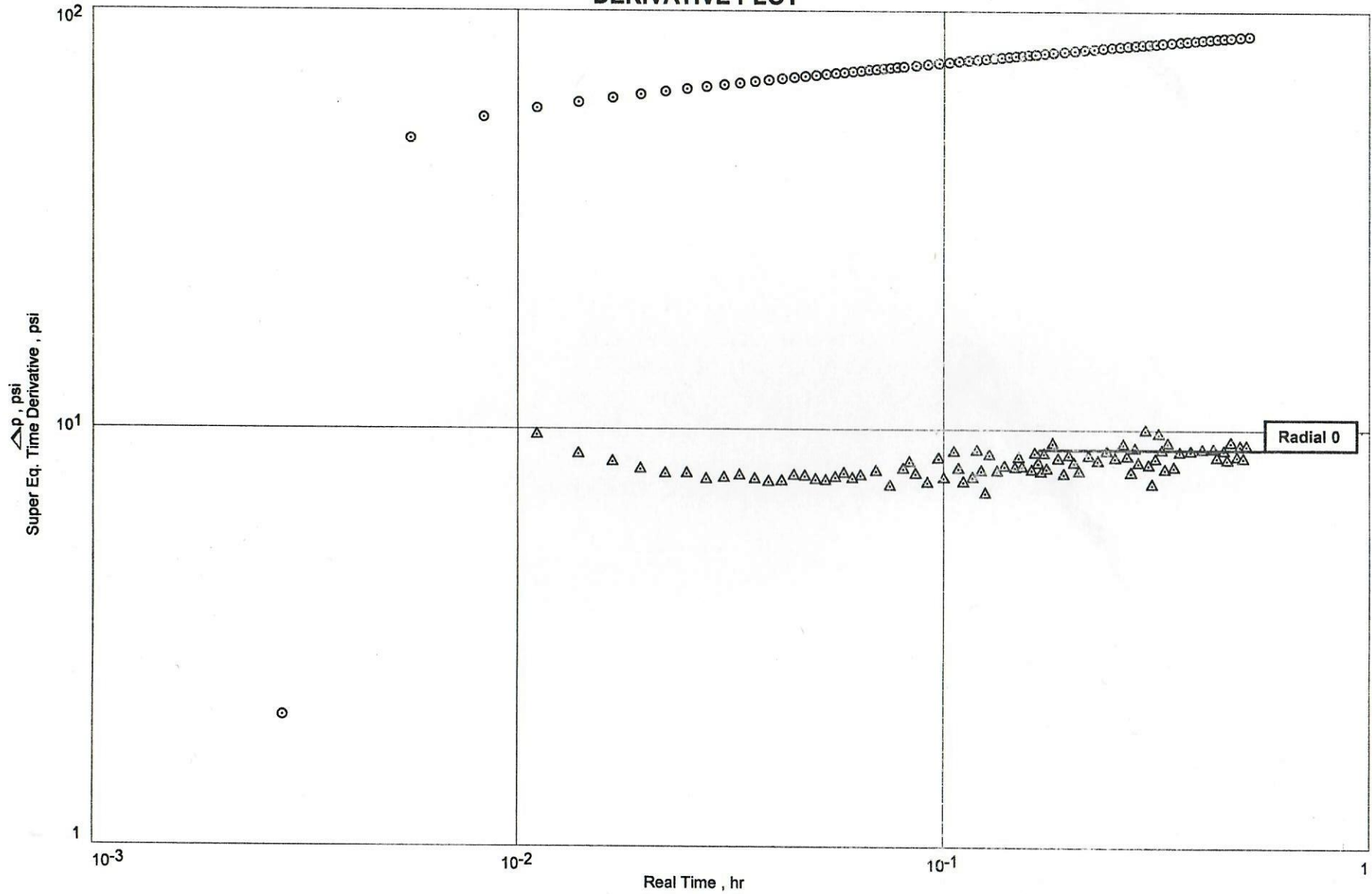
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B Young 31-11, Dst 1
Gauge 30043

RADIAL PLOT

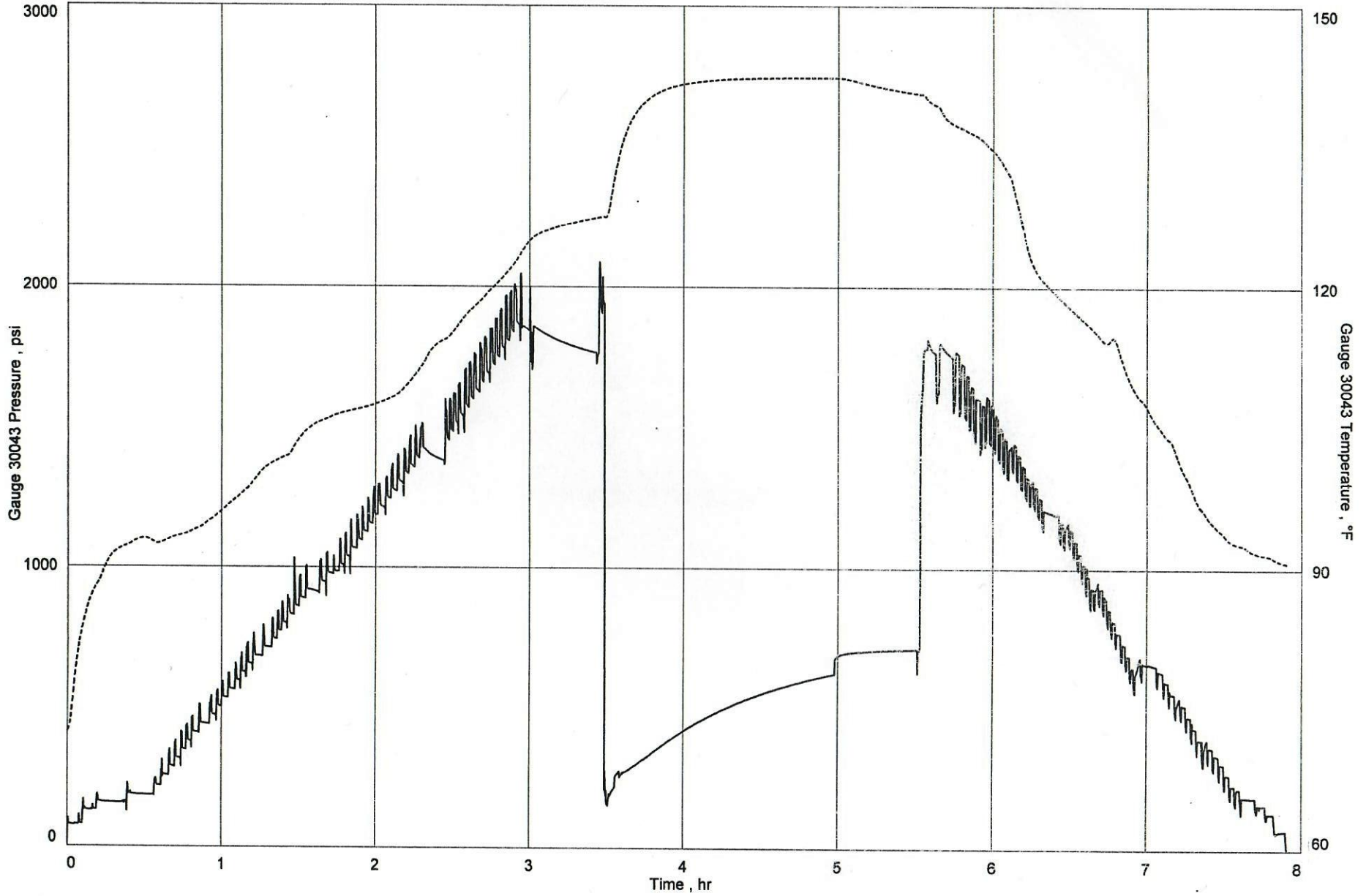


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B Young 31-11, Dst 1
Gauge 30043

DERIVATIVE PLOT



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B Young 31-11, Dst 1



Edward Mike Davis, LLC.
B. Young #31-11

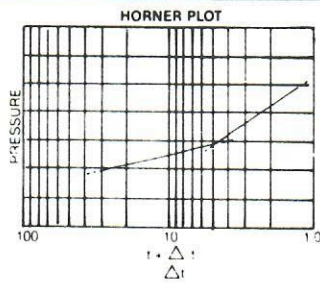
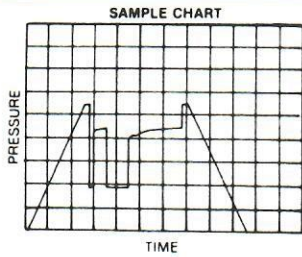
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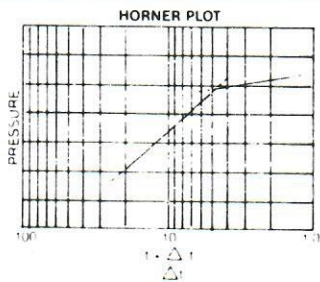
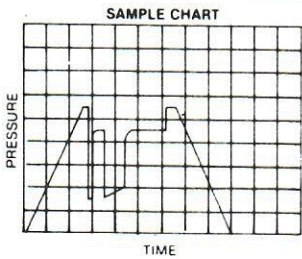
GUIDE TO DETECTION OF GEOLOGICAL ANOMALIES



Horner Plot Slope Breaks Upward

Possible Causes

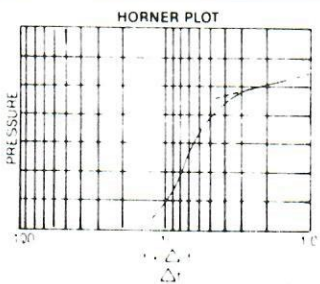
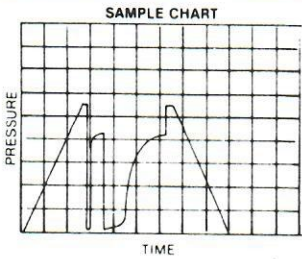
- (1) decrease in pay thickness away from the wellbore
- (2) decrease in permeability away from the wellbore
- (3) increase in viscosity of reservoir fluid (fluid contact)
- (4) barrier within the radius of investigation



Horner Plot Slope Breaks Downward

Possible Causes

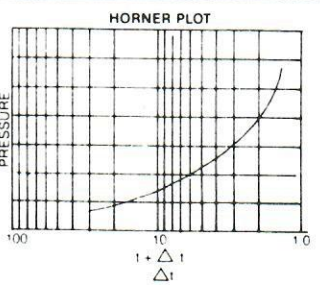
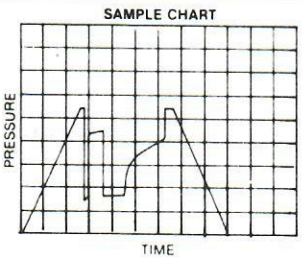
- (1) increase in pay thickness away from the wellbore
- (2) increase in permeability away from the wellbore
- (3) decrease in viscosity away from the wellbore



Early Time Deviation of Horner Plot

Possible Causes

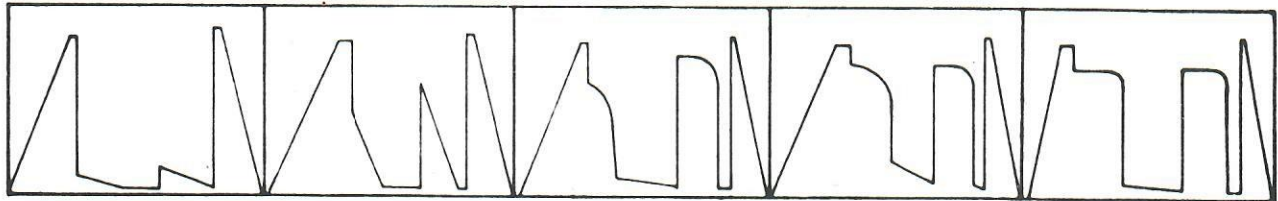
- (1) wellbore damage due to filtrate invasion, drilling solids, etc.
- (2) partial penetration of pay zone
- (3) plugging or choking of perforations (casing test only)
- (4) wellbore storage effects (low permeability gas wells)



Horner Plot Slope Continually Increasing

Possible Causes

- (1) well between two parallel boundaries (channel sand)
- (2) induced hydraulic fractures



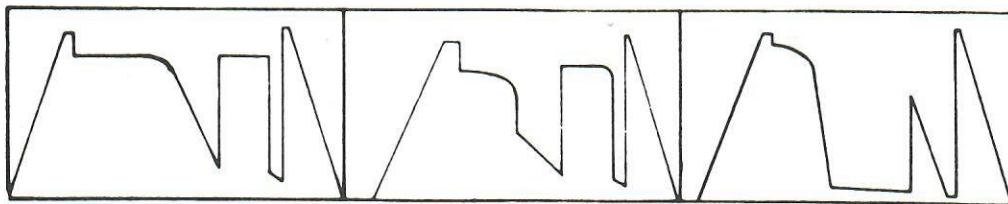
Very low permeability. Usually only mud recovered from interval tested. Virtually no permeability.

Slightly higher permeability. Again usually mud recovered.

Slightly higher permeability. Small recovery, less than 200 ft).

Average permeability. Final and initial shut-ins differ by 50 psi.

Average permeability. Strong damage effect. High shut-in pressure, low flow pressure.



Excellent permeability where final flow final shut-in pressure.

High permeability where ISIP and FSIP are within 10 psi.

Deep well bore invasion or damage. Final shut-in higher than the initial shut-in.