

The Denver Well Logging Society

Chapter of the Society of Professional Well Log Analysts

Chapter News

December 1999, Volume 12 Number 4

Determining Pore Pressure and Permeability in Low Permeability Sands using Conventional Log Data and Small Volume Diagnostic Pump-in Analysis

Mike Mulle, David Craig
Halliburton Energy Services

Abstract

The Mesa Verde Formation in the Piceance Basin of Northwestern Colorado is characterized by a 2000-3000' section of stacked lenticular sands. The basin centered gas accumulation is trapped in 20 - 40 individual sand reservoirs in the lower half of the Mesa Verde. These wells are typically completed using three to four stages of hydraulic stimulation for commercial production because of the 10 - 50 micro Darcy permeability. As the fields in the Piceance Basin have been developed, well spacing has been reduced from 160 acres to as low as 20 acres. This increases the possibility for one or more of the many reservoirs to show signs of depletion. An important aspect of designing economic completions is the ability

to be able to predict well performance and reserves using wireline log analysis. To do an effective job of this, an accurate pore pressure and permeability needs to be determined.

In the Piceance Basin, several hundred individual sand reservoirs have been tested using a small volume diagnostic pump-in test (Craig, 1999) to determine pore pressure and permeability to help predict well performance and stimulation design. These tests were conducted after the wells had casing run and used primarily to design stimulation treatments.

There still exists a need to see if there is any way to determine this information prior to running casing. Thus the results of this statistical study compares the individual measurements of pore pressure and permeability from the diagnostic pump in tests to the conventional wireline log measurement derivation of permeability and pore pressure. A novel relationship between log characteristics and pore pressure will be presented as well as a method for calibrating wireline permeability measurements with well test permeabilities.

Meeting Information

When

Tuesday, December 14, 1999
11:30 A.M. - 1:30 P.M.

Where

Wynkoop Brewing Company
1634 18th St. (18th & Wynkoop)
Mercantile Ro

Cost

\$15 per person

Reservations

Reservations must be made by noon, Monday, December 13.
Call Elice Wickham @
(303) 573-2781



President's Message

Phil Nelson

This column continues to highlight the services and materials available to the Denver well logging community. These profiles concentrate upon, but are not be limited to the DWLS membership. For this issue, we feature one company offering core analysis and two companies with software designed for well logs.

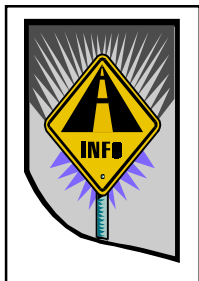
Precision Core Analysis, Inc.

Precision Core Analysis, Inc. began operations in early 1992 as a conventional core analysis laboratory serving the Rocky Mountain Region. As the larger service companies consolidated their operations, many moved from the area, leaving a void in the market place. Precision Core remains to provide core analysis services in Denver.

Founder and president Stephen H. Leeds brings 20 years of experience to the company with a wide-ranging background in the oil service industry. Mr. Leeds worked for several of the larger core analysis

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companies in a variety of capacities ranging from lab technician to regional



manager. Precision Core has established alliances with other core-related companies in order to access and offer a broad range of

core services. Complete petrographic analyses, fracture characterization, detailed reservoir description, formation damage determinations, and special core analyses are available through these associations.

Location: 1338 S. Valentia Street, Suite 140, Denver, 80231; Telephone: 303 751-9244; email:

corechaser@aol.com

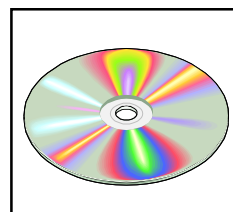
Petroleum Software Technologies

Mark Franklin and Jeff Arbogast started PST in 1997. PST currently provides two "cutting edge" software products to the oil and gas industry, Rt-Mod and>NNLAP which are designed to complement and enhance all standard log analysis programs.

Rt-Mod uses forward and inverse modeling to process resistivity logs. It simultaneously corrects for bore hole conductivity, invasion, bed shoulder effects, thin bed effects, and dipping bed effects (up to 45 degrees). It gives a more accurate representation of true formation resistivity (Rt) and the resistivity of the invaded zone (Rxo) at bed boundary resolutions of less than two feet

for most recorded resistivity measurements. Rt-Mod processes old ES logs (laterals and normals), 6ff40 Induction logs, Russian logs, Chinese logs, MWD logs, and Schlumberger's AIT log. 100 feet of 6ff40 induction log can be processed in less than 30 seconds on a Pentium II PC.

NNLAP uses neural network technology to generate synthetic wireline log and core properties from digital curve data. Neural networks learn the dependency between input curves (the curves you have abundantly available) and output curves (the curves you need) through a carefully selected set of training examples.>NNLAP has significant advantages over more



traditional deterministic and linear regression methods in solving the typically non-linear predic-

tive relationships encountered when working with digital logs.

PST, in close association with Rocky Mountain Petrophysics, provides worldwide consulting services which emphasize the collaborative use and value of these two technologies in developing complete and accurate petrophysical models for all available wells.

Location: 9400 E. Iliff Ave., #261, Denver, Colorado 80231; Website: www.pstech.net; Email: arbogast@pstech.net; Telephone: (303) 337-1785

Terrasciences Inc.

Terrasciences has been in business since 1979. Their office in the south metro area offers sales and customer support services, with other offices located in Houston and London, England. Their client base is worldwide, and they strive to provide rapid response to client needs, including additions to the software if needed. Andy Jaggar serves as president.

Terrasciences develops and sells the TerraStation II system, a PC or Unix based system for geologists and petrophysicists. The system combines mapping, well log data storage, petrophysical analysis, log display, and cross-section components. Optional modules are available for borehole image processing and analysis, as well as resistivity log modeling, and organic geochemical analysis from wireline logs.

A number of smaller products can be downloaded from the Terrasciences web site. These include a log digitizer and a automatic log tracer from scanned images. The web site also offers a free download of a units conversion program.

Location: 7800 South Elati,
Suite 330, Littleton 80120; Web
site: www.terrasciences.com;
Telephone: 303 794 5511;
Email:
sales@terrasciences.com



Note: If you would like to have your company/organization profiled in this column, send a short writeup to Phil at pnelson@usgs.gov.

Attendance Incentive!!

Attendees at the October luncheon will be rewarded by a free cdrom-of-the-month, selected by Phil Nelson.



The Denver Well Logging Society

Chapter of the Society of Professional Well Log Analysts

1999 - 2000 Application for Membership

_____ New Member

_____ Renewal

Member Name: _____

Job Title: _____

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Are you a National SPWLA member?

Yes: _____ Dues are \$5.00 (Dual Membership)

No: _____ Dues are \$10.00 (Local Member only)

Make cheque payable to the **Denver Well Logging Society** and send to:

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Attn: Steve Richards

c/o Schlumberger Oilfield Services

6090 Greenwood Plaza Blvd.

Englewood, CO 80111

Do you have any suggestions for lunch topics?

Schlumberger

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 Reservoir Management

Teamwork & innovation to create value

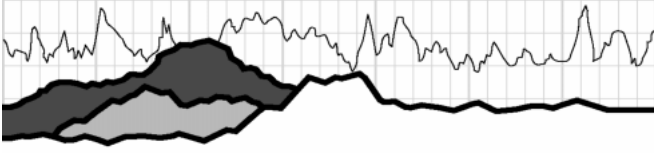
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