

- 2 Evaluation of the debolt formation of N.E. British Columbia. 5 Case study of a foothills gas well. 6 The year in review. A look back at some of the highlights of 1996. 7 What's coming up. A look at the agenda for 1997.

President's Remarks

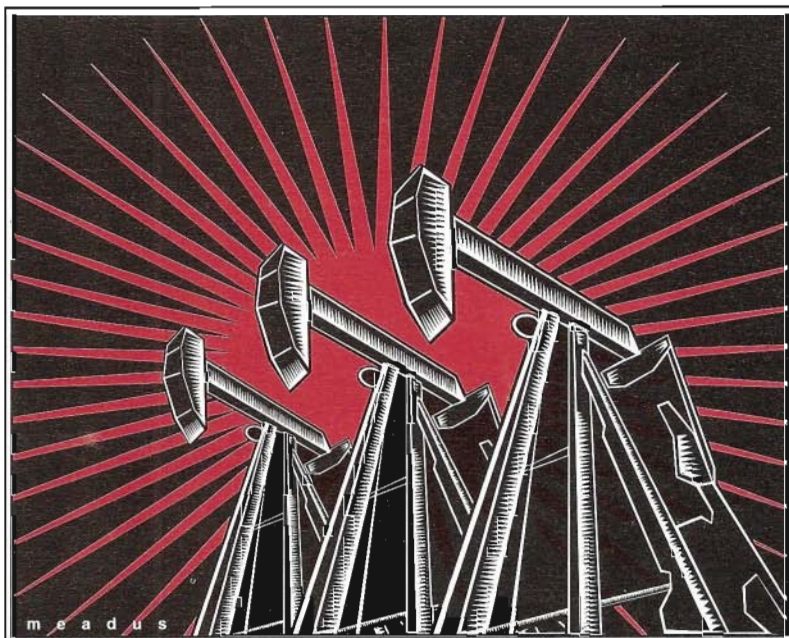


On behalf of the CWLS, I would like to welcome you to our inaugural newsletter. We are quite proud of our achievements over the past year. Following our 40th anniversary celebration last fall, we published a special edition Journal which sold out. A very successful AGM in February with Ron McLean, and a joint workshop in April with the CSPG have kept us busy. Now, the CWLS has embarked on a new service that we feel will benefit all our members, the quarterly newsletter.

The idea for the newsletter came about one day over coffee when Jane McTaggart suggested that the membership needed more than just the Journal to keep them informed. I thought it was an excellent idea. Brian Humphrey helped us in the early conceptual stages. Since then, Ian Smith and Jane have worked hard with Tom Short of Idea Machine to deliver you this product.

Lastly, I would like to sincerely thank our 1995 Journal advertisers :

AGAT Laboratories
LWT Instruments Inc.
Bears paw Logging Services Ltd.
Norjet Geotechnologies
BPB Wireline Services
Numar
Continental Laboratories
Plains Perforating Ltd.
Computalog
QC Data Petroleum Services Ltd.



Core Laboratories
Rahkit Petroleum Consulting Ltd.
Crocker Data Processing
Spectrum 2000 Mindware Ltd.
Gilbert Lausten Jung Associates Ltd.
Schlumberger of Canada
Idea Machine Inc.
Tucker Wirline Services
Lee Tool
Western Atlas Wireline Services

I would also like to thank the authors that contributed their technical summaries. To the membership, I encourage you to let us know what you think. We need your feedback so that we can continue to improve your newsletter.

Taras Dziuba

Evaluation of the Debolt Formation of N.E. British Columbia

D.V. Allan, D.G. Tivey, A.K. LaFlamme and D.R. Clenchy

The study was initiated to resolve a difference between material balance reserve estimates and the volumetric reserves calculated from log analysis.

Husky Oil recently undertook an extensive study of Foothills gas reservoirs of the Mississippian Debolt Formation in the Sikanni/Grassy area of N.E. British Columbia. The reservoirs are dolomitized, heavily fractured and have low average porosity. This study was initiated to resolve a difference between material balance reserve estimates and the volumetric reserves calculated from log analysis. Refinement of the petrophysical evaluation was achieved by utilizing data from special core analysis and from the study of drill cuttings from these wells and similar data from the surrounding area.

Five wells were chosen for special core analysis. The measurements were made at ambient and reservoir conditions. These reservoir conditions included temperature and net over burden pressure. Porosity measured at ambient conditions remained effectively unchanged at

reservoir conditions, while permeability values were dramatically reduced by a factor of 10 to 1,000. Values of m and n , of Archie's equation, were derived and yielded an average n of 0.94 and m of 1.47. Capillary pressure data, obtained with saturated brine, showed that the gas/water transition zone averaged 150 metres in height and 52% water saturation. Furthermore, irreducible water saturation ranged between 25% and 30% for reser-

voirs with 1-5% porosity. This data was then compared to a more extensive capillary pressure database which includes the Debolt, Pardonet/Baldonnel and Nahanni/Arnica formations. Petrographic studies showed that porosity in the Debolt Formation is associated with the presence of fractured dolomite and is comprised of intercrystalline and moldic type porosity. Limestone sections are mostly tight but also locally fractured.

Refinement of the petrophysical evaluation was achieved by utilizing data from special core analysis.



The insights gained from this study were then used to refine the petrophysical analysis in the a-63-H/94-G-3 well. A net pay of 40 metres, with an average porosity of 3.5% and an average water saturation of 27%, would yield a volumetric reserve that best fits the material balance reserve estimate.

The original analysis of the a-63-H well was generated using a deterministic, crossplot driven method which yielded 82 metres of net pay, using a 2% porosity cutoff. A net pay of 38 metres was achieved by applying a volume of dolomite cutoff. This cutoff was justified since the petrographic studies showed that the reservoir was associated with the dolomitized matrix. Although the net pay is fairly close to the desired value, the average porosity was slightly low. Therefore, a more comprehensive analysis technique was utilized. This approach used an inverse matrix type solution, which simultaneously solves for the mineral volumes and pore space fluids, and gives a more accurate matrix corrected effective porosity. A net pay of 39 metres and an average porosity of 3.4% was obtained with this technique.

Water saturation was calculated using a variable m technique, which compares the flushed zone water satura-

tion, from an EPT measurement, to that calculated from the MSFL. This variable m technique resulted in a more desirable average water saturation of 27.5%. The saturation exponent n was set to 2 because of the questionable nature of the core analysis. Core measurements of n are generally less accurate than measurements of m, since n is dependent on fluid properties and reservoir conditions which can be difficult to simulate.

The correlation between images obtained from the Formation Micro Scanner and the evaluation log, were excellent. Pervasively fractured intervals had m values less than 2, while zones with vugs had m values greater than 2.


In conclusion, special core analysis, combined with petrographic studies, improved the petrophysical interpretation by

providing calibration points and helping in the selection of the appropriate lithology and porosity cutoffs. In addition, this study clearly highlights the advantages of utilizing the variable m interpretation technique.

**Special core analysis,
combined with petrographic
studies, improved
the petrophysical
interpretation.**

1 Husky Oil Operations Ltd.

2 Alberta Energy Company



**Happy Holidays
and Best Wishes for
the New Year from
your Friends at
CWLS.**

Case Study of a Foothills Gas Well

Allan Pickel, Numac Energy Inc.

Good looking logs with thick pay zones are not a guarantee of success.

Production from tight fractures reservoirs can be a problem. Good looking logs with thick pay zones are not a guarantee of success. Grassy a-70-C/94-G-7, drilled by Numac Energy in 1994, is a good example of a disappointing foothills well. Initial production from the Debolt formation was at rates of 9-12 mmcf/d with less than 20% drawdown, yet it produced less than 1BCF before watering out.

The displayed logs are from the second wellbore into the structure. The first wellbore penetrated the gas/water contact, then

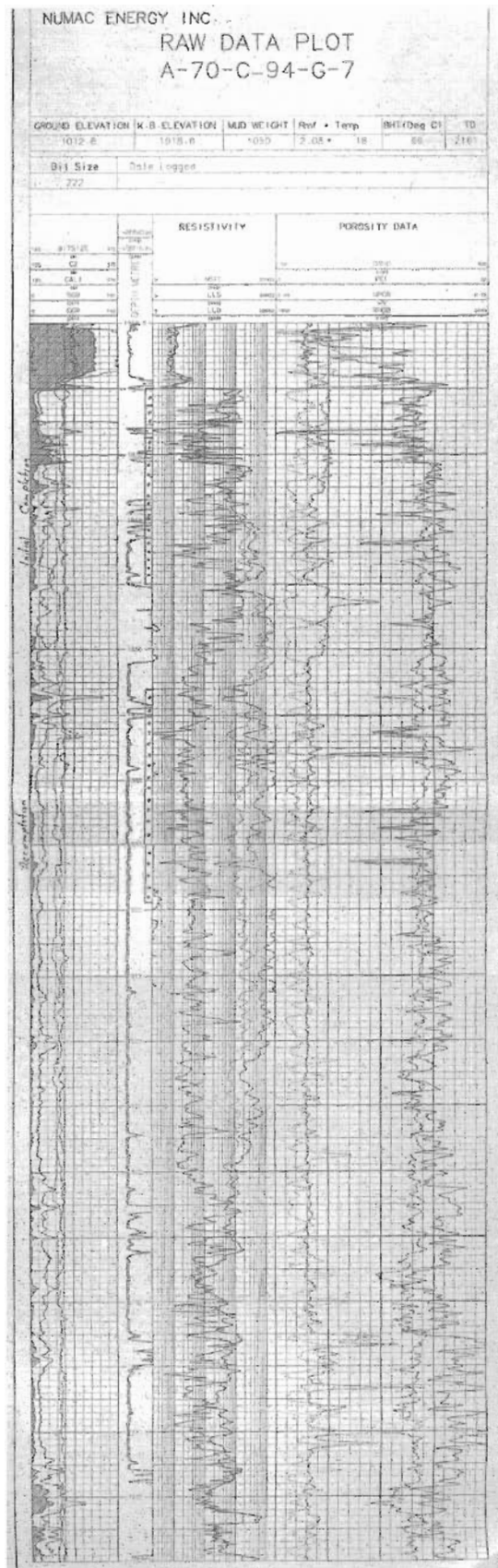
Resistivities less than
1000 ohm-m are usually wet
as formation water is very
fresh due to surface recharge
from the west.

had to be abandoned after the drillstring parted and fishing attempts were unsuccessful. The whipstock well was drilled, logged and then cased without testing. Note the good overall reservoir quality over the interval 1862-1986, with good microlog response and continuous porous dolomite. Note also the lower resistivities in the wet zone below 1939 metres. Resistivities less than 1,000 ohm-m are usually wet as formation water is very fresh due to surface recharge from the west. It is difficult to pinpoint the top of the transition zone as capillary pressure data from other wells indicate a very long transition. The FMI data showed extensive fracturing throughout the formation.

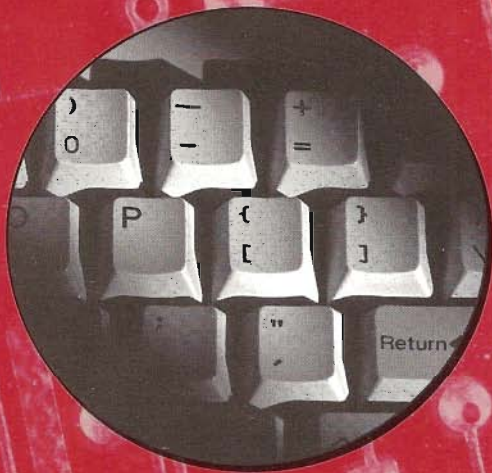
The well initially completed in the upper section from 1820-1850 metres and produced for a few months before pressures declined rapidly. The production strategy was to limit drawdown to 20% to avoid premature water coning which would necessitate a decrease in production rates. Both the pressure and rates continued to decline until the well was no longer capable of commercial rates. The well was then recompleted over the interval 1866-1899 metres on the assumption that the upper perforations were not draining the main reservoir section. The recompletion was a failure as the well now produced water with minor amounts of gas. Explanations for the water production include:

1. The original wellbore provided a pipeline to the water and is directly connected to the producing well through fractures.
2. Water is travelling up through the fractures and bypassing gas in the matrix.
3. A poor cement job.

The Grassy well is currently suspended.



Powerful, user friendly, PC based software



- Reservoir Characterization
- Log Analysis & Data Management Services
- Software Sales & Support
- International & Domestic Experience

CROCKER
DATA PROCESSING
PETROLOG

Petrometrics Ltd.

Dominion Building
Suite 505, 665 - 8th Street S.W.
Calgary, Alberta, T2P 3K7
Phone: (403) 265-5077
Fax: (403) 265-0073



BEARSPAW
LOGGING SERVICES LTD.

MANNVILLE TOP . . .

2205

2210

2215

Sand

"What's Working For You?"

2220

Full manned mud logging & portable gas detection.

Sand

2225

#12, 2135 - 32 Avenue N.E., Calgary, Alberta, Canada
Tel: (403) 291-3396 • Fax: (403) 291-0563

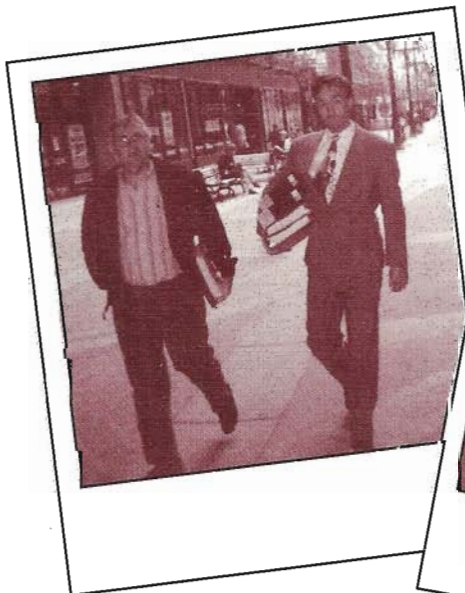
2230

1996 Technical Luncheons

- | | |
|-----------|--|
| January | Dealing with Uncertainties of Log Analysis, Peter Kubica, Petro-Canada |
| February | Logging Night in Canada, Annual General Meeting, Ron McLean, Hockey Night in Canada |
| March | Formation Evaluation in Horizontal Wells/Some Recent Examples from Shell Canada Wells, Paul Jackson, Shell Canada |
| April | Resistivity Anomalies/Opportunities in Slant Wells, Gordon Uswak, PanCanadian Petroleum Ltd. |
| May | Modernization and Use of Older Log Data, Bernie Cossette, Teknica Overseas Ltd. |
| June | Reservoir Characterization: Integration of Rocks and Well Logs, Dennis Woon, Woon Petrophysical Services, Howie King, Howie King and Associates |
| September | Improved Permeability Prediction in Carbonates, Taraz Dziuba, Canadian Hunter |
| October | Borehole Imaging, Paul Heffernan, HEF Petrophysical Consulting Inc. |
| November | An Engineer and Geologist Compare Notes on Petrophysical Parameters in Clastics, Doug Hilchie, Howie King, Howie King and Associates |
| December | Productivity Predictions from Well Logs in Variable Grain Size Reservoirs: The Cretaceous Qishn Formation, Republic of Yeman, Michael Cheng, Canadian Resources International Ltd. |



1996 Synergy Workshop



Committee Members

Publisher: Venture Publications
 Layout and Design: iDEA MACHiNE iNC.
 Chairman/Editor: Ian F. Smith,
 Jane MacTaggart
 Advertising Manager: Taras Dziuba

Advertising inquiries should be directed to the Advertising Manager or the Publications Chairman care of the CWLS office.

Volume 1, December 1996

Published by the Canadian Well Logging Society
 1600, 734 - 7th Ave S.W., Calgary, Alberta T2P 3P5

Chairman's Remarks

Welcome to the first issue of the CWLS newsletter. The newsletter is dedicated to providing a forum to its members for the sharing of information related to the many aspects of formation evaluation. The newsletter will publish abstracts that provide current and comprehensive analysis of issues that effect explorationists in their day-to-day work. Articles or brief monographs covering the formation evaluation field are most welcome, but are subject to acceptance by the Editorial Committee.

The newsletter will be published quarterly in March, June, September, and December and goes out to all the membership. At the present time, we have yet to determine a newsletter name. Members are asked to join in and help with the naming. As I see it, a contest is the only way to go! So join in, let's come up with something unique! Stay tuned for this one.

CWLS Annual General Meeting, February 19

Presents

Mr. John Dunn: Tracking Baffin Island by Foot, Ski and Kayak

Mr. Dunn will present through slides and discussion a look at his tracking of Baffin Island, N.W.T.

Mr. Dunn's work has recently been articleed in National Geographic

Cocktails: 5:00

Doors Open: 6:00


Dinner: 6:30

Presentation: 8:00

for information on tickets, call the CWLS office at 269-9366

1997 Calendar of Events

SPWLA	Topical Conference "Improved Reservoir Evaluation with Log Modeling" South Padre Is., Texas	April 20-24
CSPG/SEPM	Joint Convention Calgary, Alberta	June 1-6
SPWLA	Annual Symposium Galveston, Texas	June 21-26
SEG	International Exposition and 66th Annual Meeting Denver, Colorado	November 10-15
SEG	Horizontal Well Technology Trade Show Calgary, Alberta	November 17-19



Word of mouth is still the
best form of advertising.

Locations
and services
throughout
Western
Canada.



Tucker Wireline Services'
data quality and price
always add value to
our programs.

Lee Anderson, Torrington

Tucker Wireline Services and their
data meet all our expectations.

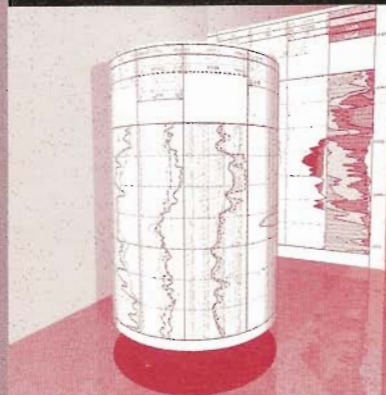
John Nurkowski, Canadian Hunter

Tucker Wireline Open
Hole Services has been a
key part of our team,
assisting us in efficiently
achieving our goals.

Rick Mikitka, Archer Resources



602, 734 - 7th Ave. S.W.
Calgary, Alberta T2P 3P8
Phone. 403.264.7040
Fax. 403.264.2118



 **Tucker**
WIRELINE SERVICES

We've always been there.