CANADIAN WELL LOGGING SOCIETY

in site

CWLS Newsletter
APRIL 2002

Message from the President.

With the beginning of the 2002-2003 session and a new executive, I believe a few words on our current organization, direction and activities are important to keep our membership informed.

Current Organization

Firstly, I would again like to thank our past executive for their perseverance and commitment in serving our society. Under the guidance of last year's president, Max Howard, the executive continued on a path of technical excellence. A lot of hard work goes on behind the scenes to ensure a smoothly running organization by both the executive and membership.

John Harder, our past-president, must be congratulated in putting together an impressive slate of candidates for this year's executive. This is certainly not an easy job, but John assembled a group of top-notch people for the election process. Each candidate, successful in the balloting or not, demonstrated a can-do attitude and a commitment to the society. For this, I thank and congratulate you.

I warmly welcome both the returning and our new executive members. The 2002-2003 executive is a strong team of players who will help lead our society in the positive direction we are currently on.

One other team I would like to recognize is one we see little of, but play a key role in our society function. They are the ladies of the CWLS office who handle our luncheon call-ins, tickets and many other important jobs.

Susan Durksen	Patricia Huyhn
Marie Locke	Elizabeth Muir

I would also like to thank our monthly luncheon advertisers and Annual General Meeting sponsors. This year's AGM sponsors include:

Talisman Energy Inc.	Hef Petrophysical
Baker Atlas	Plains Perforating
Schlumberger	Reeves Wireline
Computalog	Tucker Wireline

Your support for the Annual is very much appreciated. Without your support, our non-profit society could not exist.

Finally, I would like to thank a key individual in our organization who has shown exemplary dedication and commitment. An individual who helped build the very heart of our society in 2000-2001 with excellent technical luncheon talks; an individual who demonstrated leadership and guidance this past year as President, Max Howard.

Direction

As a technical society, I believe we need to pursue involvement with the technical community. The life-blood of this involvement is the participation in technical luncheons, work shops and symposiums. Our technical luncheons will continue, this year under the guidance of Dave Shorey - V.P.

The executive is also currently pursuing commitments for upcoming symposiums. With preparation time typically two years, Spring 2004 is the next appropriate time for symposium activities. I have contacted the CSPG to do a joint symposium in 2004 and they are quite eager. A chairperson will be required for this event. The Society welcomes volunteers, with several individuals already committed to assist. We also have contacted the SPLWA for the Spring 2005 symposium. With 2005 being Alberta's centennial, this timing would be quite suitable. Dave Shorey - VP and I will continue to actively chase this opportunity.

Since our last symposium was in 2000 and our next likely opportunity is 2004, I would still like to see our society technically participate in the shorter term. One avenue is through two work shop sessions, Fall 2002 and Spring 2003. Taras Dziuba has generously offered to chair the Fall 2002 work shop, integrating Log and Special Core Analysis. The CSPG is also quite interested in including this session with their symposium Spring 2003. These two work shops provide a hands on approach to capitalizing on the excellent work done by Taras Dziuba and the Special Core Analysis committee.

If you have any questions or concerns, please do not hesitate to contact me or any executive member. As we look forward to the next year , we have a strong team in place to take on the challenges of improving our society.

Thank you.

John Kovacs
CWLS President

Formation Resistivity Logged Through Casing

A breakthrough in formation evaluation in cased wells

Alan Salsman – Schlumberger Wireline, Calgary

A new wireline logging tool has been developed for measuring formation resistivity in cased holes. Applications of this new measurement include reservoir monitoring and the identification of by-passed hydrocarbons in old wells, formation evaluation in new wells when unstable well conditions have prevented the acquisition of openhole logs or when logging is preferred in the more benign cased hole environment.

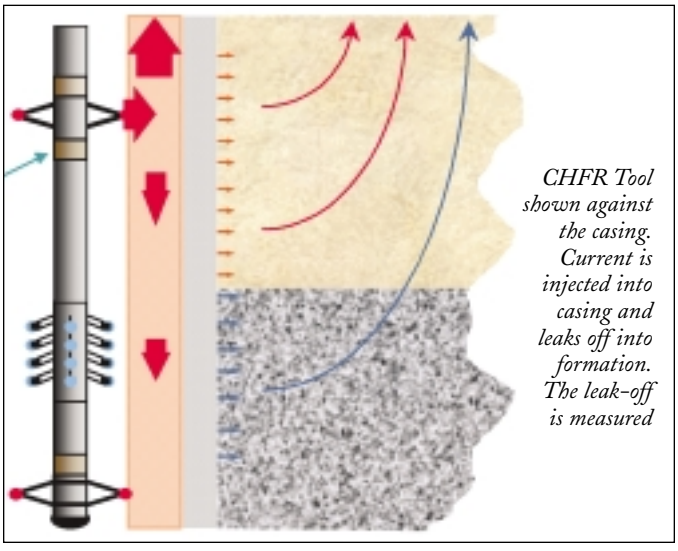
The tool has been run in many different conditions in Canada and the data has been verified against openhole resistivity logs. The field logs demonstrate that the measurement is repeatable and directly comparable to formation resistivity. The cased-hole resistivity logs have received wide acceptance in Western Canada.

Almost at the same time the first resistivity log was acquired by the Schlumberger brothers in 1927, the need for a measurement of the formation resistivity in a cased hole appeared. The first patents for cased hole resistivity were filed in the 1930's (Alpin, 1939) but it was very clear to the inventors that although the principle can be very simple, the technologies required for the measurement were such that it would be a formidable task to achieve.

Other patents from 1956, 1959 and 1972 got into details on how to make the measurement but were still facing difficulties in measuring voltages in the nanovolt range accurately in a well. The subject was revisited in the late Eighties by Kaufman (1989, 1990), Vail (1989) and Schenkel (1991). The first field data was published by Vail in 1993 and 1995. Recent advances with field examples have been presented at the SPWLA 41st Annual Logging Symposium, June 4-7,2000, Paper CC, in SPE paper 68081 presented in Bahrain March 2001 and at local Canadian meetings and symposiums.

Principal of operation

Measurements are taken while the tool is stationary. The CHFR* measures formation resistivity by injecting current into the casing through a centralizer at the top of the tool that returns to surface. Slight variations in the current loss through the casing are related to current leaking into the formation and may be calibrated to formation resistivity. The voltages investigated by the tool are in the Nano-Volt range, which requires exceptionally stable and low noise electronics down hole. Frequency of operation is limited to around 1 Hz; to avoid polarization associated with a DC-measurement and skin effects



CHFR Tool shown against the casing. Current is injected into casing and leaks off into formation. The leak-off is measured

Message from the Publication-Chair

It has been a while in coming, but we are very pleased to have the first electronic issue of In-Site. We would like to thank Rob Badry, our out-going Publications Co-chair for providing the bulk of the information in this issue and for all his work over the last two years.

Looking forward we would like to provide a more consistent flow of information about the CWLS in the form of a more "newsletter" like In-Site. At the same time we would like the membership to provide us with their own "InSights" about the art of formation evaluation. For this purpose you don't have to go to all the effort of a full scale paper. Instead you can interact with others through the newsletter.

If you have an idea or observation that you would like to convey to the membership please contact either of the publications co-chairs and we would be pleased to assist you in getting your ideas in print.

Andrew Logan
CWLS Publications Co-Chair

Steve Burnie
CWLS Publications Co-Chair

caused by a higher frequency. Casing current loss is measured through 4 rings of 3 electrodes attached to caliper-like arms that open up and establish contact with the steel casing at each station. Good electrical contact is essential; a possible problem in wells with scale or corrosion products on the inside of the casing. In double casing the CHFR will only read the resistivity of the cement between casings. Downhole tool calibration is achieved by comparing the cased hole measurements to open hole logs in the well being logged or a nearby well.

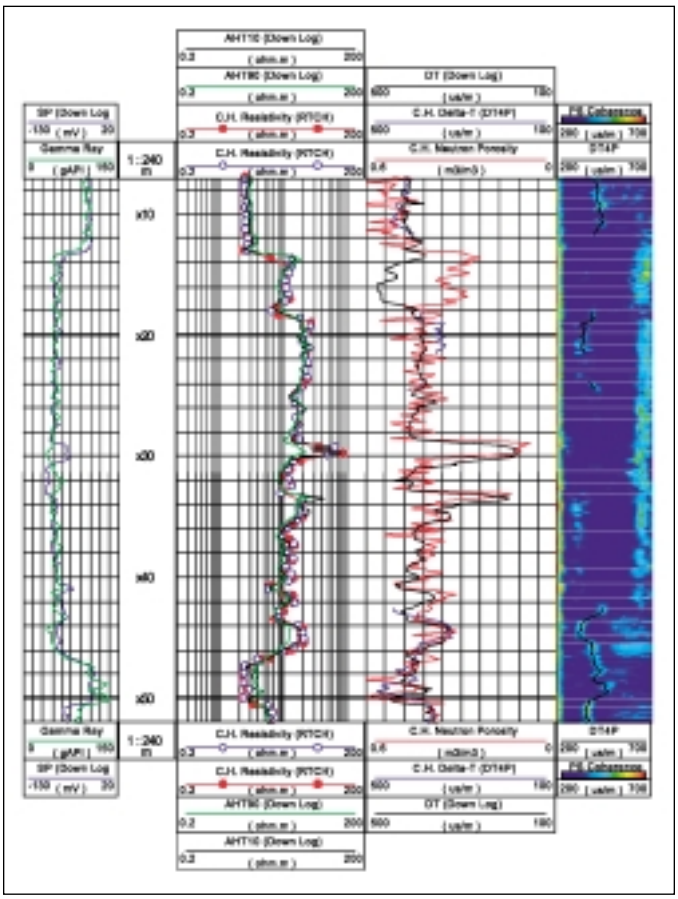
Tool Specifications

Length	13.1m (43 ft)
Measure point to bottom	4.6m (15 ft)
Tool OD	85.7mm (3 3/8 in.)
Casing range	114 – 244.5mm (4 1/2 - 9 5/8 in.)
Temperature	150°C (300°F)
Pressure	103.4MPa (15,000 psi)
Deviation	No limit providing tool is run with correct stand offs
Bore hole fluid	Water / oil / gas
Resistivity Range	1 to 300 ohm-m (still to be finally established)
Station Time	2 min typical (longer at higher resistivities)
Logging speed	36.6 m/hr (120 ft/hr with 2 minute stations)
Vertical Resolution	1.2m (4 ft)
Depth of investigation	1.5m – 9m (5 ft to 30 ft) (dependant on bed thickness, boundaries and RT to RXO and R-annulus ratios)
Combinability:	Bottom only tool; run with Gamma Ray and CCL for depth control.

Examples

The following examples are all from Alberta.

The first example shown on the right is from a well where open hole logs were obtained from a down pass only. Adverse well condition prevented the completion of the open hole logging program. The Cased Hole Formation Resistivity tool was run twice over this interval highlighting the repeatability of the measurement versus the openhole logs and also the cased hole measurement repeatability. Other cased hole logs presented are the Compensated Neutron Log for Neutron porosity, the Dipole Sonic Imager for a through casing formation delta

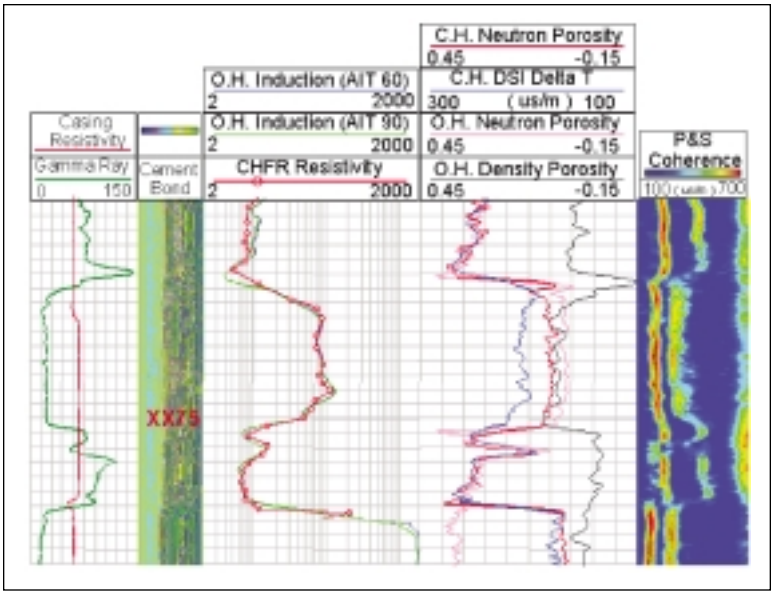


Example # 1

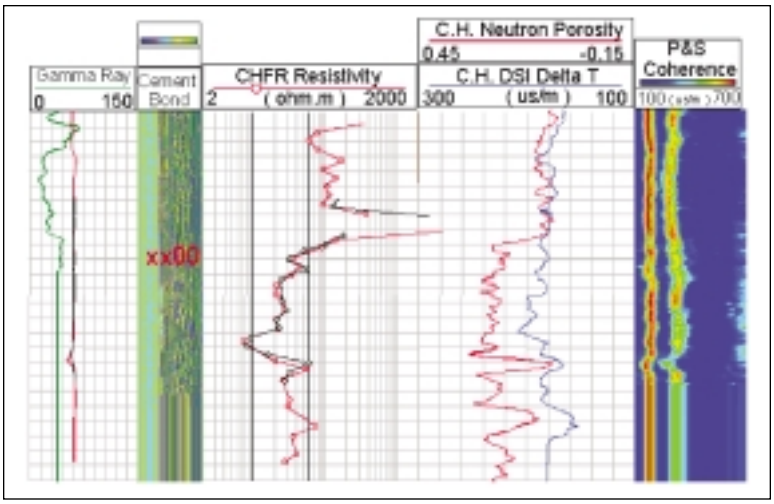
A high resolution copy of the latest newsletter is posted on the CWLS web site at www.cwls.org. For this and other information about the CWLS visit the web site on a regular basis.

If you do not wish to receive this newsletter via e-mail, please send an e-mail message to the CWLS secretary, jim.earley@encana.ca, with the Subject heading REMOVE NEWSLETTER, or contact the CWLS office at 403-269-9366.

Please forward this newsletter to any potentially interested co-workers. We would appreciate any feed back on anything you've read in the In-Site and any suggestions on how this newsletter can better serve the interests of the formation evaluation community. Feel free to contact anyone on the CWLS executive with your comments.

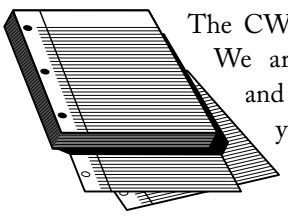


Example # 2 - CHFR and other cased hole logs run over zone to confirm the cased hole log response and determine the CHFR "K" factor



Example # 2 - CHFR and other cased hole logs run over zone to confirm the cased hole log response and determine the CHFR "K" factor

Call for Papers



The CWLS is always seeking materials for publication. We are seeking both full papers for the Journal and short articles for the Newsletter. Please share your knowledge and observations with the rest of the geoscience community. Please contact publications co-chairs, Andrew Logan (andrew.logan@bakeratlas.com) at 537-3503 or Steve Burnie (steve@rpcl.com) at 264-4466.

You provide the material and we will provide the soap box!

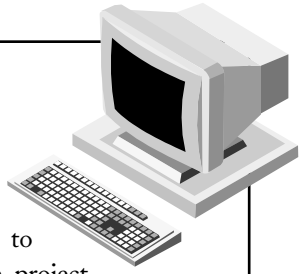
T compressional and the Gamma Ray. The cased hole delta T compressional measurement through part of the interval is not available due to the incompletely cemented casing.

The next example (#2) comes from a well where it was not possible to get open logs run to bottom due to hole instability. Open hole logs were run down to approximately XX80m.

A full suite of cased hole logs was run over the interval logged open hole to confirm the response of the cased hole measurements and determine the CHFR K factor, which is 1.75 for this example.

The logs were then run over the lower section to evaluate the zone of interest which is just below XX80m. In this case the CHFR resistivity and the cased hole porosity measurements were used to decide not to evaluate this zone further.

Special Core Project



We hope that everyone has had the opportunity to check out the special core project web site. This database is the result of a great deal of work on the part of Taras Dziuba and LogTech. LogTech has provided an interface which can be accessed from the CWLS web site at http://www.cwls.org/tech_links.htm.

CWLS members have free access to this information. To get your own password simply go to the web site and request a username and password from sales@logtechcan.com. Remember to mention your membership in the CWLS and they will send you a user name and password by e-mail.

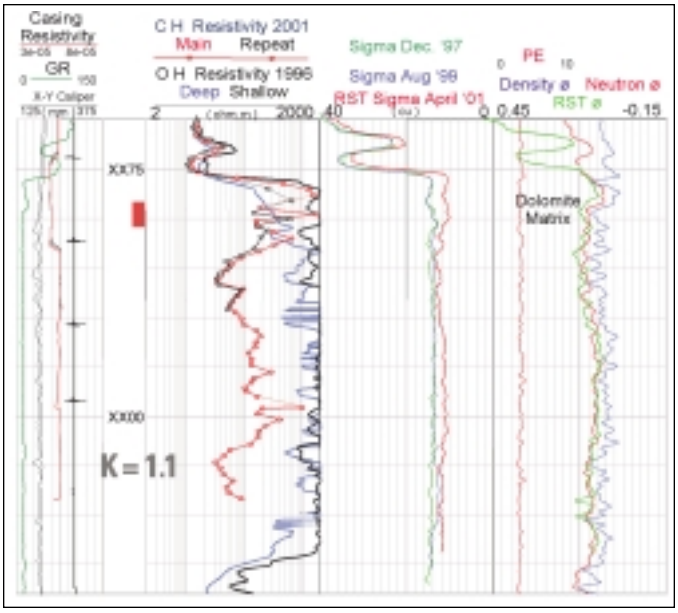
Look at the information and then participate in the Log-Core integration workshop in the Fall to get the most out of this useful database.

In the next example (#3) the well was drilled and logged open hole in 1996. The open hole logs indicated a hydrocarbon zone which was subsequently completed.

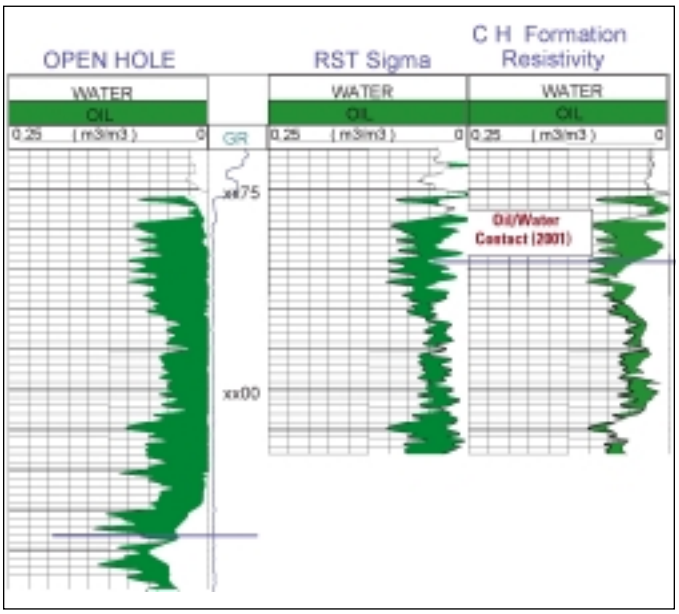
Pulsed neutron Sigma logs were run in 1997, 1999 and again at the same time as the CHFR in 2001. The purpose of the sigma runs was to track the movement of the oil water contact. Due to the low porosities and relatively fresh formation waters it was difficult in this case to use sigma to determine the movement of the water oil contact.

It is evident from the logs on the right that the CHFR provided a clear indication of the fluid contact as of April 2001.

The CHFR and sigma data was also used to create the Elemental Analysis (ELAN) comparisons seen below. Note the clearly identified fluid contact found with the CHFR.



Example #3 - Well logged open hole in 1996. Sigma logs run 1997, 1999 & 2001. CHFR logged 2001.



Example #3 - ELAN comparisons – openhole in 1996 to Sigma and CHFR in 2001 showing water contact movement and determination.

Cased Hole Formation Resistivity – Summary

Six decades after its first description, the measurement of formation resistivity through casing has finally been achieved. Cased-hole formation resistivity logs have been run successfully in numerous wells in different environments around the world, including many jobs in Canada.

Field tests were concluded in early 2001.

- Analytical and modeling work was used to derive resistivity logs from raw measurements. The field tests also showed that environmental effects are very limited in typical oil field conditions.
- Advances in electronics design have allowed the proper conditioning of very high currents and the accurate measurement of very small voltages required to accurately measure formation resistivity behind casing.
- An advanced electrode design has worked very well to reliably establish a good electrical contact with the casing at four measurement levels. The field tests have shown good overall data quality except for some specific instances of poor contact caused by corrosion or scale buildup.
- In Canada, in one well, we have seen the effects of a very fresh mud filtrate, creating a resistive invaded zone which prevented an actual RT measurement. This effect is now predictable with the application of a pre job planning tool software.

The CHFR is now commercially available for all applications in Canada.

Applications of this new measurement include

In Old Wells:

- Reservoir monitoring
  - Also successful in low porosity or low salinity formations where pulsed neutron measurements can falter
- Searching for bypassed pay opportunities.

In New Wells:

- Where unstable well conditions prevent the acquisition of open hole logs.
- In development type wells where it is preferred to acquire logging data in the more benign cased hole environment.

References

SPE 68081 Cased Hole Formation Resistivity Tool Trial - prepared for presentation at the 2001 SPE Middle East Oil Show held in Bahrain, 17–20 March 2001. Asbjorn Gyllensten, SPE, Abu Dhabi Company for Onshore Oil Operation; Austin Boyd, SPE, Schlumberger-Doll Research.

SPWLA 41 st Annual Logging Symposium, June 4-7,2000, Paper *CC RECENT PROGRESS ON FORMATION RESISTIVITY MEASUREMENT THROUGH CASING* P. Béguin, D. Benimeli, A. Boyd, I. Dubourg, A. Ferreira, A. McDougall, G. Rouault, P. van der Wal - Schlumberger.

UPCOMING EVENTS:

April 16, 2002 CWLS Technical Luncheon at the Palliser Hotel: Integration of Core Analysis and Wireline Logs for Enhanced Reservoir Description. Speaker Chris Pan, Ph.D.,Core Laboratories Canada Ltd.

May 15, 2002 CWLS Technical Luncheon at the Palliser Hotel: Tom Bradtrud of Delta-P Test Corporation.

June 19, 2002 CWLS Technical Luncheon at the Palliser Hotel: John Nieto of Anadarko Petroleum Corporation.

Reservations for the Technical luncheons can be made by calling the CWLS office at 269-9366 by noon on the Friday before the lunch.

Payment may be made either at the door or at the CWLS office. The CWLS office now accepts payment by VISA for your convenience. VISA payments will not be accepted at the Technical Luncheon.

There are a limited number of tickets available at the door so please reserve to avoid disappointment

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