



The Rock Record – October, 2010

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Please contribute to the SGS Newsletter

The SGS Newsletter is produced by the SGS executive. Letters, announcements, notices, comments, photos, news and information about SGS members, etc. are always welcome. Call an executive member or write to us at:

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SGS e-mail address:
info@sgshome.ca

SGS Website:
www.sgshome.ca

All advertising inquiries should be directed to **Tyler Music**

In This Issue

- **Event Announcements** p. 1
- **Reports and Requests** p. 2-3
- **October 14th Luncheon talk abstract** p. 4
- **October 28th Luncheon talk abstract** p. 5
- **2010 SGS Membership Form** p. 6

Thursday, October 14, 2010

Insight in Lieu of Truth: An Approach to Probabilistic Fault Seal Analysis

Dr. Donald Medwedeff, Chevron Energy
AAPG Distinguished Lecturer
(abstract attached)

Ramada Hotel Downtown, 1818 Victoria Avenue, Regina

Lunch: 11:45 a.m.

Meeting: 12:00 – 1:00 p.m.

Members: \$10.00 and Non-members: \$15.00 for lunch

For those not having lunch the talk is free

Please contact Kate MacLachlan (katem@apegs.sk.ca) or

Gavin Jensen (gavin.jensen@gov.sk.ca)

by Tuesday, October 12th if you are planning to have lunch

Thursday, October 28, 2010

Rumblings from the Laboratory: Past, Present, and Future

Dr. Carl Sondergeld, University of Oklahoma
Society of Exploration Geophysicists Distinguished Lecturer
(abstract attached)

Location to be determined (will be included in the second notice)

Lunch: 11:45 a.m.

Meeting: 12:00 – 1:00 p.m.

Members: \$10.00 and Non-members: \$15.00 for lunch

For those not having lunch the talk is free

Please contact Kate MacLachlan (katem@apegs.sk.ca) or

Gavin Jensen (gavin.jensen@gov.sk.ca)

by Tuesday, October 26th if you are planning to have lunch

Past Events

Field Trip

The annual field trip to the Big Horn Basin, N. Wyoming was held from August 20th to 24th. Dr. Christopher Fielding of the University of Nebraska gave an excellent 1½ day tour of the Cretaceous siliciclastic sections in the Greybull area. John Lake took us to an extensive outcropping of Mississippian carbonates that included excellent karst features at the upper unconformity. We ended the trip by touring back and forth on two mountain passes through the Big Horn Mountains that exposed the complete section from the Tertiary through to the Archean Wyoming Craton core, with spectacular scenery as a bonus. There was something for everyone on this trip. Thanks are extended to our long-standing Field Trip Chair, John Lake, for again organizing a terrific field trip. A talk on the trip will be given at the AGM in January.

Golf Tournament/BBQ

The annual golf tournament/BBQ was scheduled to be held on September 10th. Unfortunately the weather did not cooperate and the tournament had to be cancelled. However the BBQ was held at the MacDougall's and was well attended despite the weather. Good food, beer, and socializing were enjoyed. Thanks to Alice and Dave MacDougall for again hosting the BBQ and to another of our long-standing Chairs, Bob Troyer, and others for organizing the event.

University of Regina: Meet & Greet

The University of Regina Don Kent Student Geology Club held their annual Meet & Greet on September 17th which the SGS subsidized and was attended by a number of SGS members. Due to an innovative approach developed by Luc Chabanole, their club President, and their liaison to the SGS, 47 geology students signed up to become SGS members. This is part of a continuing effort to develop more student involvement in the SGS.

Requests

1) Williston Basin Petroleum Conference Workshops

The SGS will be organizing two WBPC workshops to be held next May, a core workshop, and a core logging workshop that will both be held at the Subsurface Core Laboratory in Regina. We are seeking volunteers to participate on a planning committee for the events. Duties of the committee will involve organizing the workshops, producing workshop volumes, and arranging volunteers to staff the events. These workshops will be a major revenue generator for the SGS. Organizing and hosting events like these is the primary way that the SGS produces significant revenue to continue its activities. If you are interested please contact me at murray.rogers@gov.sk.ca or tel: (306)-787-1932.

2) SGS Executive for 2010-2011

This is the first call for volunteers for next year's Executive. We will have some returning Executive members but will also need some new people. The SGS has relied almost exclusively for the last few years on geologists from the Saskatchewan Geological Survey to fill the positions. As a result those resources are becoming depleted, particularly with the loss of positions over the

last couple of years. If you still want the benefits that the Society provides we need people to contribute their time. We really need some volunteers from industry and/or academia to fill some positions. If you are interested please contact me at murray.rogers@gov.sk.ca or tel.: (306)-787-1932.

3) Luncheon Talk Speakers

If anyone has any ideas for luncheon speakers please contact Gavin Jensen (Tel.: 787-2577) or Bernadette Knox (Tel.: 787-9373).

SGS Merchandise

The SGS has a variety of reasonably-priced merchandise, mainly clothing, that is posted on the website: www.sgshome.ca for viewing. This includes seasonal items such as very nice golf shirts, t-shirts, and hats. Please contact Tyler Music at (787-6984) or Tyler.Music@gov.sk.ca if you are interested in purchasing.

A reminder, if you haven't renewed your 2010 membership yet please fill out the attached form and submit it with the payment at a meeting, or mail it to the SGS postal address on the first page. Jason Berenyi at (787-2579) or Jason.Berenyi@gov.sk.ca is the contact for memberships. You can also sign up for membership on-line at http://www.sgshome.ca/sgs_membership_form.

Upcoming Talks at the University of Regina

November 3rd, Tina Maki, APEGS; Becoming a Professional Geoscientist, CW 237.1, 4:00 pm.

November 10th, Jullie; Graduate Students at the U. of Regina.

November 17th, Brian McEwan, Graduate Student; Structural Style and Regional Correlation of the Ketyet River Area.

November 24th, Rachele Boulanger, Graduate Student; Petrographic and Geochemical Characterization of the Midwest Northeast Roughrider Zone Unconformity-Type Uranium Deposit, Athabasca Basin, Saskatchewan, Canada.

Abstract

Insight in Lieu of Truth: An Approach to Probabilistic Fault Seal Analysis

Dr. Donald Arthur Medwedeff, Chevron Energy Technology Company

AAPG Distinguished Lecturer

The height of fault-supported hydrocarbon columns is dependent on a number of intrinsic and extrinsic factors. These include fault geometry, fault zone architecture, host and fault rock permeability and fabric, stratigraphic stacking pattern, and hydrocarbon densities as well as the overall trap geometry and presence or absence of a hydraulic head. Continuous variation in controlling factors can yield both continuous and discontinuous variation in the resulting trapped columns. Even more than most geologic analyses, faulted column height prediction is an under-constrained task and is thus well suited to a probabilistic approach in which the range of input uncertainty is explored.

However, probabilistic models should complement not substitute for careful analysis of the available data. Often structural analysis is key, as trap geometry is the most important factor and is typically the most constrained by data. Depth structure maps should be made on multiple horizons and the faults should be interpreted in map and section view and linked to the mapped surfaces. From these maps, throw variation can be evaluated systematically to confirm the interpretation integrity and gain insight on possible sub-resolution fault complexity. The relative importance of the other factors varies with geologic history so that factors that dominate in one basin may be insignificant in another.

Once all available data have been analyzed the remaining uncertainty can be explored in two steps. First is to identify the uncertainty ranges and estimate the impact on column height of the controlling factors. Some factors, such as fault surface and fault zone architecture, have discontinuous impacts on column and thus can only be understood in terms of specific scenarios – e.g. the presence or absence of sand-on-sand windows. Other factors, such as the fluid properties and estimated capillary properties, have a linear or at least continuous impact and can be evaluated by simple error analysis. Second, probabilistic methods can be used to quantify the residual uncertainty of the first-order factors. Second-order factors, those that do not contribute significantly to the variance in column height, should be left out of the probabilistic analysis. As Einstein is quoted, “Make everything as simple as possible, but not simpler.” To ensure meaningful results, column heights must be calculated from the geometry and underlying physics for specific deterministic scenarios. Taking care not to interpolate between distinct scenarios, the resulting column heights can then be aggregated and analyzed using standard statistical techniques.

When analyzing the results, keep in mind that, beautiful 3D visualizations notwithstanding, models are simplifications of nature and not nature itself. Do not assume the mean result is the best estimate. Rather, use the results to (1) make explicit the uncertain knowledge of controlling parameters and (2) assist in distinguishing independent and dependant parameters, and (3) determine the degree of impact of those parameters on hydrocarbon column height. In short, seek to gain insight, not truth, from the model.

Abstract

Rumblings from the Laboratory: Past, Present, and Future

Dr. Carl Sondergeld, University of Oklahoma

Society of Exploration Geophysicists Distinguished Lecturer

The complexity of rocks in nature, and its resultant imprint on rock properties, makes empirical laboratory studies necessary and relevant. Numerous efforts are underway in academia and industry to try and use theoretical models to predict petrophysical and seismic rock properties from microscale images of rocks. However, modeling can only honor the physics of the chosen model; measurements are still needed to define and calibrate the modeling physics. It is important to recognize the significant discoveries and technological advancements that are a direct consequence of careful laboratory measurement on rocks.

Historically, laboratory measurements have been used to develop an understanding of the physical response of rock and fluid systems under various conditions (frequency, temperature, stress, sample size, etc.). The resulting data were used to provide insights into the key controls governing rock behavior when filled with various fluids and buried below the surface. Early work was conducted to develop a better understanding of the correlations between compressional velocities, composition, density, porosity, and pore fluid type; this work formed early interpretations on understanding sonic logs and seismic bright spots. The ability to measure shear and polarized shear velocities in the laboratory significantly expanded the scope of issues we could explore on naturally occurring materials; this helped to establish a new understanding of seismic rock properties. Combining both P and S-wave data, along with some basic concepts of elasticity, provided the basis for lithology and fluid discrimination. Although multiple theoretical models provided an understanding of rock and fluid behavior, it was the experimental confirmation of Biot-Gassmann theory that allowed rock physics to become the workhorse of the oil and gas industry; it is now one of the most important tools for the analysis of prestack seismic data.

Future Directions

New directions in rock physics research will extend the application of rock physics by incorporating petrophysical characterization into our measurement and analysis of rocks. For example, the concepts of capillarity, wettability, and relative permeability are rarely incorporated into seismic modeling. However, all three properties exert primary control on fluid saturation and distribution. Other promising directions for future rock physics research includes laboratory measurements of production induced strain (in both reservoir and overburden rocks), detailed examination of the effects of pore microstructure on elasticity, examination of velocity behavior at temperatures and pressures equivalent to those found in deep basins, and the effects of CO₂ and time on seismic wave propagation through reservoir rocks. Simultaneous measurements of multiple properties will provide stronger constraints for computational rock physics models. Recent developments in imaging technologies make it possible to image pore microstructures at scales that have historically been impossible. Application and further development of these technologies will allow us to extract more information from smaller and smaller samples. The practical aspect of this is that it should be possible to make better use of drill cuttings as a source of geophysical information. Finally, measurements on new reservoir materials, e.g., coals, shales, hydrates, etc., will lead to new geophysical technologies.

Our history is rich with examples of how laboratory measurements have lead to innovations in field-scale technologies. In other words, if we can observe and quantify the magnitude of an effect in the laboratory, we have a basis for developing field-scale applications. This talk will highlight past accomplishments in rock physics, and more importantly will focus on future directions in rock physics and the promising and critical role that laboratory measurements will have in the development of new and innovative technologies.

