



MONTANA GEOLOGICAL SOCIETY NEWSLETTER

Vol. 61 No. 9

June 2017

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P2 / PRESIDENT'S LETTER

Our President discusses his latest hiking adventure and the critters he encountered.



P5 / RMS-AAPG

Get registered now for the 2017 RMS-AAPG Section Meeting, taking place in Billings during June 25-28.



P8 / LUNCHEON

Read the summary for the upcoming talk given by Chantel Lines, of SM Energy.



P11 / MBMG

Review the list of publications recently released by the Montana Bureau of Mines and Geology.

Upcoming Events:

June 22 - MGS Luncheon with Chantel Lines

June 25 - Opening Ceremonies for the 2017 RMS-AAPG Section Meeting

**DON'T MISS OUT -
REGISTER TODAY!**



Contact Us:

mtgeo.org / montanageologicalsociety@gmail.com

Add our email address to your contacts so your Newsletters & Luncheon announcements don't end up in Spam!

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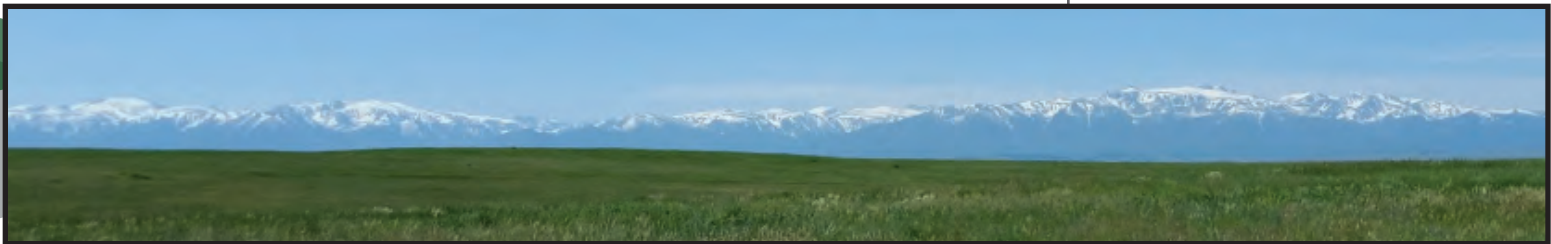
President's Letter

Dear Membership,

Somehow spring slipped into summer, and I missed it. The leaves unfolded, flowers bloomed, and the good reasons not to do field work have just vanished. Now I'm torn between the things I need to do, and the things I want to do. Fortunately for me, I have planners in my family, who pencil events into my schedule, and once listed, the events become "must do" items. This last weekend, my time was slated for a backpack trip into the Beartooths with my kids. The plan sounded great in early May when it was drafted, but as the date drew closer it became obvious our options were limited by the weather. Last year we were able to camp at 9,000 feet without much snow. The streams were small and the temperatures were in the 70's. Obviously the upper elevation destinations this year would be winter camping and stream crossings would be difficult. We decided to head up the Stillwater trail to a destination 5 miles above Lake Sioux Charley.

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The area is usually very busy, but the trail was all ours as we ventured out on Friday afternoon. The river was lapping onto the trail in the canyon and low black clouds up canyon were adding more water. Five miles up, the only fresh tracks on the trail were from a bear heading the same direction. Much of the trail was under water from the many springs and small streams draining the south facing talus slopes. The river flooded the meadows area, leaving only a couple high spots to camp.





It started to rain as we set up camp. After a night of rain, fishing was tough to say the least. We instead spent our time hiking and looking at rocks, wildlife, and flowers. There were some great intrusions above our camp, some weathered out and others formed interesting patterns on the rock faces.

On our first hike, we encountered Mr. Bear. Like us, he was out for a morning stroll. We were glad his stroll was on the other side of the river, and it would have been a cold swim over to our location.



We also found that we were not the only creatures that like rocks. The rockslide by our campsite started to slither when I rolled a rock off the trail. The many Garter snakes were enjoying the few moments when the sun broke through. We had never seen so many in one spot! I think there are at least five in this picture.

This place seemed to be teeming with all the things people despise! We found plenty of ticks trying to get at our blood, and a few mosquitoes. We were pleased with the total lack of people.

I hope your adventures are going as well as mine, and that you have time to join us at the upcoming MGS events,



Kevin Chandler
MGS President

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Na...

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for more information.

Rocky Mountain Section Annual Meeting

REGISTRATION NOW OPEN

RMS-AAPG

2017 JUNE 25-28
BILLINGS MONTANA



Early registration ends May 25

<http://rmsaapg2017.com/>

For more information contact:

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covecreekresources@msn.com

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Steve Van Delinder

svandelinder@ballardpetroleum.com

Mark Millard

mmillard@sm-energy.com





The RMS-AAPG Section Meeting is just around the corner....

Don't Miss Out!

Sunday, June 25

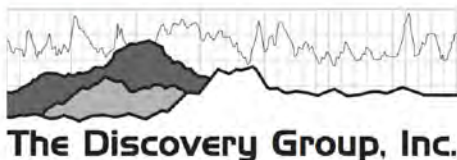
4:30 pm – 5:30 pm — Opening Session: Welcome and Awards Ceremony (Double Tree – Ballroom C, 3rd floor)

5:30 pm – 7:30 pm — Icebreaker and Opening of the Exhibit Hall (Double Tree – Ballrooms A & B, 3rd floor)

See <http://rmsaapg2017.com/> for more information.

You are Invited to The Leeds Group Casual NETWORKING Evening

Hosted by



Tuesday, June 27th • 6 to 9 pm

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MGS Luncheon Meeting

Thursday, June 22nd

11:45 am – Billings Petroleum Club

Please join us for lunch (\$14) and the talk (no charge)

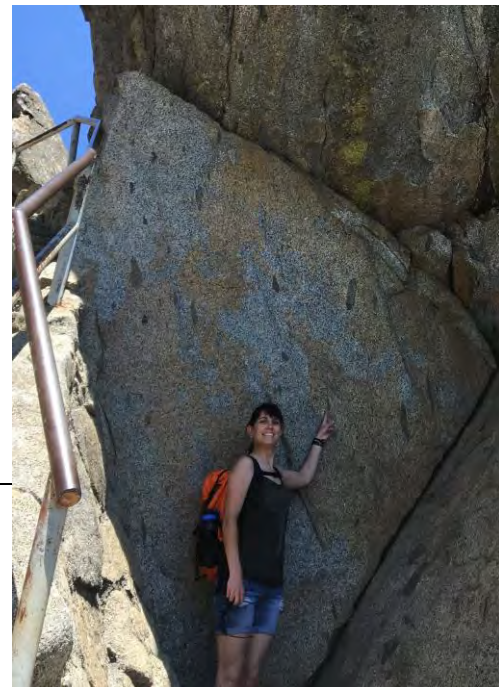
RSVP – montanageologicalsociety@gmail.com

An email reminder will be sent 3 days prior to the talk

CHANTEL LINES

OPERATIONS GEOLOGIST

SM ENERGY, PERMIAN BASIN



Characterization of complex lateral heterogeneity using MWD, XRF and Seismic inversion (C. Lines, S. Fluckiger, S. Mogensen)

Capturing lateral heterogeneity is challenging, particularly when only Measurement While Drilling (MWD) data are available and gamma ray (GR) character alone does not reflect the variability inherent in the zone of interest. Using Logging While Drilling (LWD) technologies is the preferred method of capturing and characterizing heterogeneity along the length of a lateral, but LWD technologies can be cost prohibitive. This paper presents two separate case studies where X-ray diffraction (XRF) was run on cuttings taken at regular intervals along the lateral length and used to correlate to core-calibrated regional geologic facies models at both the log and seismic scale. The results of these case studies demonstrate the viability of this technique to accurately predict lateral heterogeneity in a complex geologic system using relatively low cost measurements. The laterals presented in both case studies were located near key vertical cored wells where XRF analyses were run at 1' resolution over the entire zone of interest. The full regional calibration dataset consisted of 10 cored vertical wells where this high vertical resolution XRF analysis was conducted.

In the first case study cuttings were collected at 100' intervals along the full length of the ~10,000' lateral and sent for analysis. A Standard Operating Procedure (SOP) was prepared and imposed to ensure high quality sample collection and increase confidence in the data. The resultant elemental concentrations received from the XRF analysis were linked back to a regional core calibrated log (Quad Combo) e-facies model using a technique employing Linear Discriminant Analysis (LDA) to link the XRF properties measured on the cuttings to the regional geologic model. This process was validated by using the XRF data measured at high resolution on the vertical cored wells to predict e-facies which were then compared back to the results of the log based e-facies model with a high degree of accuracy. This lent confidence to the prediction of e-facies along the length of the lateral using the cuttings XRF which was further corroborated by additional measurements such as MWD GR, rate of penetration (ROP) and total gas.

In the second case study the SOP was followed for collecting the cuttings along the length of the ~10,000' lateral, however in this case samples were collected at 50' increments in order to increase the resolution of the analysis. Additionally, this well location was chosen within the bounds of a 3D seismic volume where a detailed reservoir characterization employed stochastic and Bayesian methods to invert the reflection data into a detailed lithofacies model. The seismic lithofacies were tied to the log and core facies through a rigorous upscaling process. The inverted seismic models were converted to depth and then used to build a

detailed geomodel. The 3D geomodel provided a predictive seismic facies model correlative to the e-facies model at high spatial detail away from well control. The resultant correlation between the two independent techniques, XRF and the seismic lithofacies model, for identifying e-facies along the lateral length had an 86% match. This relationship verified the results of both techniques and provided further confidence in our ability to effectively capture geologic complexity in the zone of interest.

The results of these two case studies demonstrates the viability of utilizing XRF from cuttings from an economic standpoint as well as being a technically valid means of capturing heterogeneity in complex geologic environments. While the case studies presented here are specific to the Williston Basin, the same methodology can be applied to other resources plays.

Biography

Chantel's love of rocks and fossils as a child led to a Geology major at Stephen F. Austin State University in Nacogdoches, Texas. She graduated with her Bachelor's degree in Geology in 2007 then entered the master's program at Stephen F. Austin, where her thesis focused on Pennsylvanian fossil communities and depositional environments west of Fort Worth, Texas. After graduating with a Master's in Geology in late 2009, she began a career in oil and gas in 2010 with Sunburst Consulting as a wellsite geologist. In 2014, she hired on with SM Energy in Billings as an Operations Geologist working the Williston Basin, until 2017 when she transferred to the Permian Basin.



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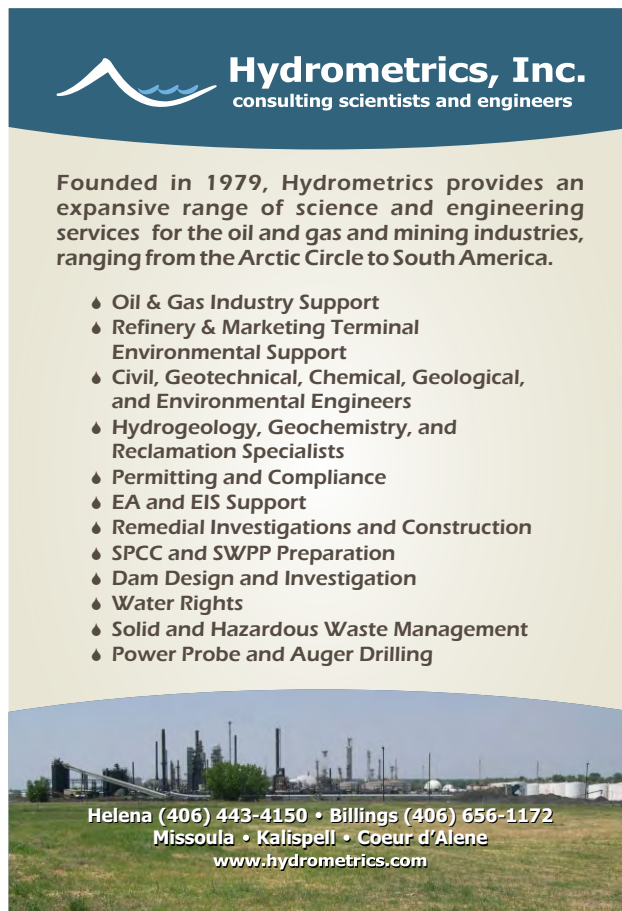
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The MGS Membership would like to extend our condolences to the family, friends, and colleagues of MGS Member Vince Larsen, who passed in March. We are grateful for his contributions to the geological community.

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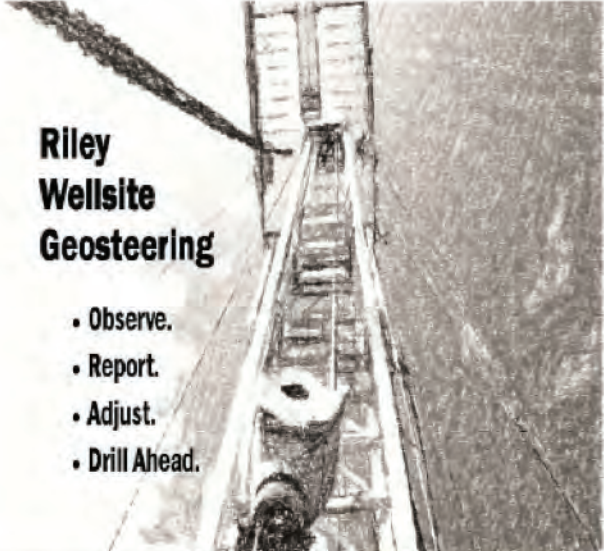


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The MBMG release the following publications during April/May. To view any of these publications, please visit their website: <http://mbmg.mtech.edu/>

Information Pamphlet 11, Groundwater Quality in the Shields River Basin of South-Central Montana: Assessment of Oil and Gas Drilling Impacts and Baseline Conditions, by Daniel D. Blyth

MBMG Open-File Report 688, Hydrogeologic Investigation of the Boulder Valley, Groundwater Modeling Report, by Julie A. Butler and Andrew L. Bobst

MBMG Open-File Report 689, Geologic Map of the Helena Valley, West-Central Montana, by Michael C. Stickney and Susan M. Vuke

MBMG Open-File Report 690, Geologic Map of Part of the Lick Creek 7.5' Quadrangle, Southwest Montana, by Jeffrey D. Lonn

MBMG Open-File Report 691, Geologic Map of the Wilborn 7.5' Quadrangle, West-Central Montana, by Martin L. Bregman

MBMG Open-File Report 692, Geologic Map of the Lima Peaks 7.5' Quadrangle, Beaverhead County, Montana, by Betty A. Skipp, William J. Perry, Jr., and Susanne U. Janecke

ROAD TRIP!

Where are you headed this summer?
If your summer vacation includes Montana geology, we'd love to see it!

To submit your photos for inclusion in the MGS Newsletter & MGS Facebook page, please submit your high-resolution photograph(s), caption(s) and full name to montanageologicalsociety@gmail.com

Wyoming Geological Association

Geology & Energy Resources of Northern Wyoming

September 8-11, 2017

**NEW
DATE!**



Conference to be
held in beautiful
Casper, Wyoming

More details to
come!

This year's conference will focus on all general (energy AND non-energy-related) geologic topics in the northern half of Wyoming.

Call for Papers

You are invited to submit a technical paper relating to this year's theme. Collected papers will undergo peer review and will be released in an upcoming WGA Guidebook. Submit papers to info@wyogeo.org by **JUNE 5, 2017**

Call for Speakers

In addition to papers, we are inviting people to present at a one-day technical session on topics related to this year's theme.

FOR MORE INFORMATION ON PAPER GUIDELINES OR SPEAKING, CONTACT:

Mike Mellin: 307-702-0813
mike.mellin@ur-energy.com

Jesse Self: 307-315-1891
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2006 AAPG Datapages - MGS Publications DVD		\$180.00	
2006 AAPG Datapages - MGS Publications DVD (MGS Member price)		\$150.00	
2000 50th Anniversary Symposium		\$125.00	
1998 8th Int'l Williston Basin Symposium		\$55.00	
1998 8th Int'l Williston Basin Symposium Core Workshop		\$30.00	
1997 Big Horn Basin Symposium		\$50.00	
1997 MGS-TRGS: The Edge of the Crazies		\$25.00	
1997 AAPG - Rocky Mtn. Section Meeting / Abstract Volume		\$16.00	
1995 7th International Williston Basin Symposium - Core Workshop		\$30.00	
1995 7th International Williston Basin Symposium		\$100.00	
1995 Big Horn Basin Symposium		\$40.00	
1996 AAPG - Rocky Mtn. Section Meeting / Abstract Volume		\$25.00	
1993 Energy and Mineral Resources of Montana		\$54.00	
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1991 Geology & Horizontal Drilling of the Bakken		\$50.00	
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1991 Sequence Stratigraphy of Eagle Sandstone		\$7.50	
1990 Bakken Workshop Short Course Study Notes #1		\$12.00	
1989 Geologic Resources of Montana		\$80.00	
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