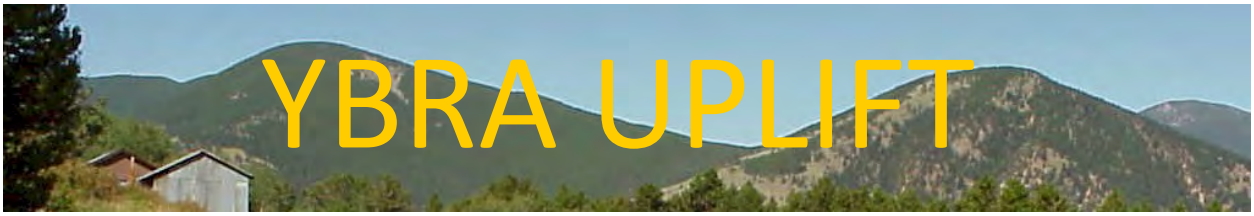

Annual Newsletter of the Yellowstone-Bighorn Research Association

Issue 20 *2014*


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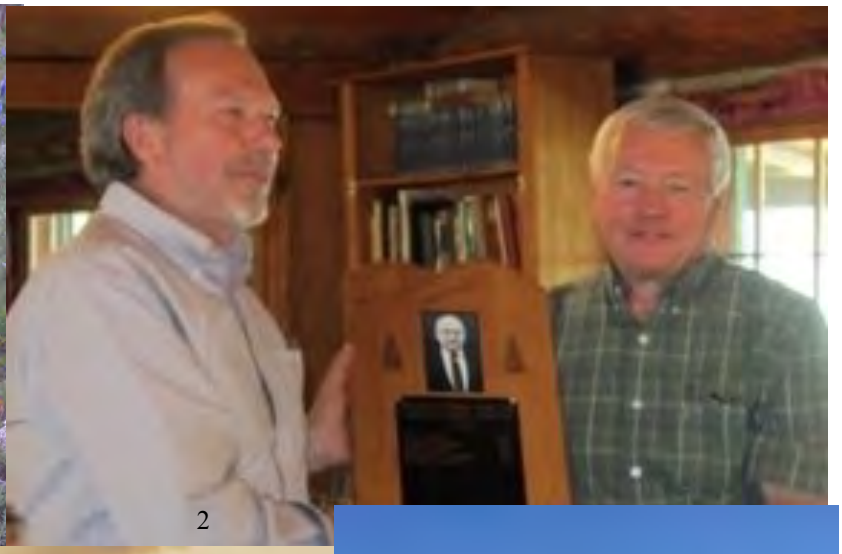
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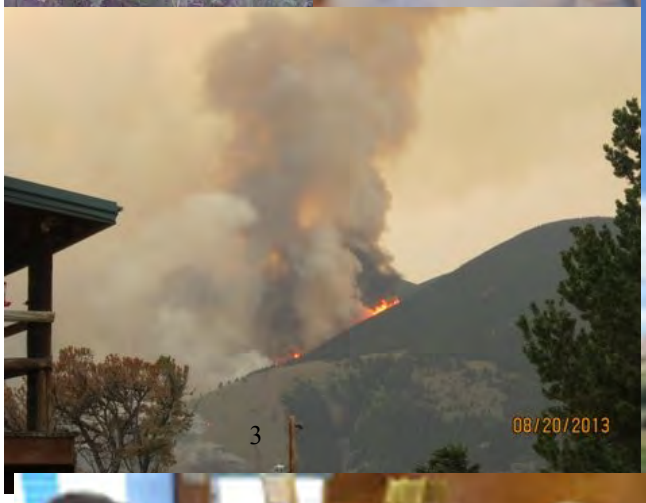

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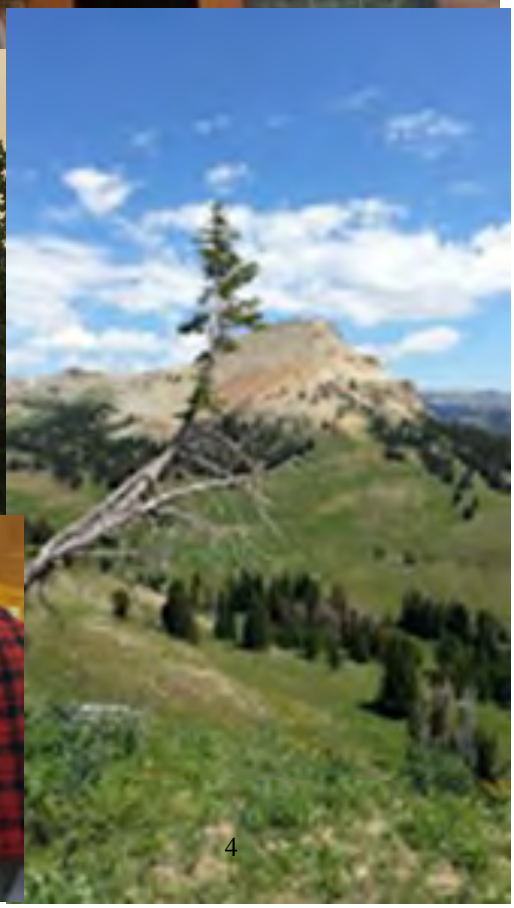
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YBRA 75th Anniversary Campaign - 2014

From the President,

Our 75th Anniversary Campaign has taken an exciting turn. **Tyler Krutzfeldt**, a native Montanan, has committed to leading our fund-raising efforts through 2017. Tyler visited YBRA during the 75th Anniversary Open House and was intrigued by our story. Officially he is a member of our advisory board who brings a great deal of business and financial experience to our efforts. Tyler is the founder and managing director of Mont Vista Capital, a leading provider of banking services to the alternative energy industries. His expertise includes agribusiness, risk management, investment analysis, and fund raising. Please read Tyler's note to members included in this Newsletter.

The fund raising committee has refocused and broadened our efforts. One major goal is to identify and reconnect with YBRA "alumni" through e-mail, social media, and a professionally redesigned website. We need to more effectively communicate with YBRA supporters and broadcast our story and mission. Another key component to our fund raising is the creation of an annual YBRA symposium where alumni and industry leaders hear prominent keynote speakers discuss current, cutting-edge business and technology themes,

This year we will take an initial step in this direction by hosting **YBRA Alumni and Industry Symposium 2014** on August 18 and 19. This event is more fully described on Page 3. Your involvement in our efforts is vital.

When you receive this Newsletter I urge you to do the following:

1) **provide your e-mail address** to me (rhfifarek@gmail.com) ,
2.) **join the YBRA Group on Linkedin**; invite other alumni/supporters to join,
and
3) mail in your proxy and, if possible, donate to one of our funds.

We greatly appreciate the past support we have received from members and with continued effort we can ensure YBRA thrives well into the future.

Regarding other matters, camp usage in 2014 continues to change. The UH-Geophysics group has decided not to use YBRA this year due to the daunting logistics of transporting a large amount of equipment and their support staff. However, we welcome to YBRA a plant biology course from Roger Williams University (RI) led by Dr. Lonnie Guralnick. About 10 students will work from camp for three weeks during late July and early August. Still, we have several soft spots in our 3 month schedule, particularly in late June and most of August. Consequently, we are searching for other field based courses or groups that might be interested in using YBRA. If you know of a potential users please have them contact me for further information.

Cover pictures

1. Wild flowers at the Camp:
2. Denny McGinnis receiving the Dutcher award from President, Rick Fifarek
3. August 2013 Forest fire looking west from the Fanshawe Lodge porch
4. Wyoming Beartooth Butte, Wyoming
5. Betsy Payne, Academy of Natural Sciences of Philadelphia (left), and David Parris, New Jersey State Museum (right), teaching the WINS girls about Big Horn Basin geology at YBRA.

YBRA Alumni and Industry Symposium 2014

We invite all YBRA members, alumni and supporters to join us at camp on August 18 and 19 for our first alumni-industry symposium. We are in the process of inviting speakers from industry and academia to make presentations on the energy resource business in the northern Rocky Mountain region. A variety of science, business and technology topics will be discussed. The purpose of the symposium is to promote the YBRA story, engage leaders from industry, and serve our educational mission. For alumni this is an opportunity to make new alliances and reconnect with YBRA and the geological and recreational areas near Red Lodge, perhaps reliving some of their field camp experiences. For industry and business representatives this is an opportunity to learn about YBRA's rich history and successful role in educating young geoscientists. We particularly hope to establish lasting sponsorships with industry representatives and companies.

The symposium format will feature keynote presentations in the afternoon of the first day with time allotted for discussion and camp tours. The second day will devoted to optional field trips and social events. Lodging will be available at camp and a lunch and cocktail hour/dinner will be provided by YBRA on the first day. If you are interested in participating in our first YBRA Alumni and Industry Symposium please contact me by e-mail to register and, if desired, reserve lodging.

Richard Fifarek…
fifarek@geo.siu.edu

Summer Schedule

Our 2014 schedule shown below may be subject to change, but most user dates have been confirmed. Groups will arrive for dinner on the first date of their respective schedule and will depart the morning after the last date. If you notice any incorrect dates, please contact fifarek@geo.siu.edu

JUNE

June 3-21: Univ. of Houston/YBRA Geology Field Camp I
June 8-14: Penn State Univ. Geology Field Camp
June 15-30: Southern Illinois Univ. Geology Field Course

JULY

July 20: YBRA council and general meetings
July 6: Univ. of Houston/YBRA Geology Field Camp I
July 1-8: Southern Illinois Univ. Geology Field Course
July 7-26: Univ. of Houston/YBRA Geology Field Camp II
July 10-27: Ohio Univ. Geology Field Course
July 11-31: New Jersey State Museum
July 27-31: Roger Williams Univ.

AUGUST

August 1-2: New Jersey State Museum
August 1-16: Roger Williams Univ.
August 9: Univ. of Houston/YBRA Geology Field Camp II
August 18-19: YBRA Alumni-Industry Symposium 2014
August 20-23: Volunteer Work Week
August 24-25: Camp Closing

Please join us for the Symposium and Work Week or visit anytime, if you can.

YBRA LinkedIn Group launches

Please join the **YBRA LinkedIn Group** on the networking site LinkedIn. Since the Group was launched in January, YBRA alumni & industry supporters have joined from five U.S. states. In addition, the professional executive search firm Hobbes & Towne has agreed to join the Group. The firm will post senior positions in the energy & minerals industry. Here's how to join the Group:

1) first, join LinkedIn as a member
2) 2) search for "YBRA Yellowstone Bighorn" under the Groups section of the LinkedIn network.
3) 3) select the "Join" button and follow the instructions.

Tyler Krutzfeldt and Sue Kaufman at The 2013 Annual Meeting at the YBRACamp

YBRA Announces 2014-2017 Capital Campaign

The primary purpose of the YBRA capital campaign is to re-engage our rich history and replace, build, or improve infrastructure at the YBRA field camp. The Board has compiled a series of high priority projects to ensure the facility is as vibrant 20 years from now as it is today! The Fundraising Committee has established the following goals:

1. Increase awareness of the fantastic YBRA history, mission, and needs by physically attracting alumni & industry leaders to YBRA near Red Lodge, Montana. We believe the **spirit of the place** and **history** speaks for itself.
2. Secure new contact information of 1,000 individual YBRA alumni by 2016. Our alumni are located in many parts of the world.
3. Finish $1.5 Million capital campaign by year end 2017.
4. Attract 20 Sustaining Industry Day institutional & industry sponsors by year end 2017. Our alumni are making great impacts within industry.

Tyler Krutzfeldt

Letter From The Camp Manager

Over the last few years we have made considerable progress in improving the camp. Thinning of the surrounding forest and replacing cedar shingle roofs have improved our fire survival chances. Last August we had a major wildfire within sight of YBRA property, which was a reminder of how much we still need to do. Thanks to a very generous donation we were able to put a met-

al roof on Dorf faculty cabin. Funds are presently not available to continue this good work. We need your help.

Road improvement will be a goal for this summer. Last summer many of the vans had tire damage. Please drive slowly whether you are climbing or descending the hill. Please be careful and watch for workers on the road.

Thank you Dr. Wang for getting the grant to install a permanent GPS station. It is to be co-located with the USGS seismic station. At present I am not sure when construction will take place but be aware of the workers involved. Projects like these only enhance the over-all quality of YBRA.

Significant YBRA People

Officers
President: Rich Fifarek, Southern Illinois University
Vice President: Peter Crowley, Amherst College
Past President: Virginia Sisson, University of Houston
Secretary: Laurel Goodell,, Princeton University
Treasurer: Betsy Campen, Billings, MT

Councilors
Tom Anderson, University of Pittsburgh
Jerry Bartholomew, University of Memphis
Eric Ferre, SIU
Robert Giegengack, University of Pennsylvania
Tom Kalakay, Rocky Mountain College
Marv Kauffman, Sunset Beach, TX
Jennifer Lindline, New Mexico Highlands University
Paul Mueller,
Mike Murphy, University of Houston
Phil Robertson, retired SIU
Jennifer Smith, Washington University
Mari Vice, University Wisconsin, Platteville
Rob Thomas, University of Montana-Western
John Weber, Grand Valley State University
Eric Kirby, Pennsylvania State University

Special Councilors (Emeritus)
Bill Bonini, Princeton University
Gerry Brophy, Amherst College
David “Duff” Gold, Pennsylvania State University

Archivist
Linda Dutcher, Carbondale, IL

Accountant and Member
Denny McGinnis, Billings, MT

Newsletter Editor
Betsy Campen
(Betsycampen@bresnan.net)

Camp Manager
Ray Raymond

Work week this year will be in August. As usual anyone helping with camp improvements will get free room and board. Also, when possible, starting this year we will supply room and board for anyone wanting to work for a few days. Be aware that camp numbers have been increasing, so availability may not always be possible.

Work continues on converting the library to a study hall. Blinds and screens for all the windows are needed. Some help in purchasing the necessary materials would help the camp immensely. We spent available funds last year on conversion of the study hall into a dorm.

The winter provided a good snow pack this winter combined with the mowing and tree clearing this summer promises a gorgeous display of wild flowers. I hope you will make an effort to visit YBRA.

Ray Raymond, YBRA Camp Manager

A Moment in Carbon County History from the YBRA Uplift 2003
by Marv Kauffman.

Production of coal (at the Beartooth Mine) declined from the mid-1920s, when much less expensive surface mining began in southeastern Montana. Throughout the 1930s, oil and gas production increasingly replaced coal for many purposes. A brief rebirth of the coal industry in the Red Lodge/Bearcreek fields during World War II was brought to a halt by the worst coal mine disaster in Montana history. The No. 3 Smith Mine of the Montana Coal and Iron Company at Washoe was the site of a tremendous explosion about 9:30 A.M. on Saturday, February 27, 1943. The resulting fires and gases claimed the lives of all but three of the workers in the mine at the time of the explosion. A sign on the Red Lodge/Bearcreek road near the town of Washoe poignantly tells the story (below). The coal mining industry never fully recovered from this tragedy, though coal continued to be removed from a few mines. In 1970, the Brophy Mine, the last underground operation, was shut down.

"*Smoke pouring from the mine entrance about 10 o'clock in the morning of February 27, 1943 was the first indication of trouble. 'There's something wrong down here! I'm getting out!' the hoist operator called up. He and two nearby miners were the last men to leave the mine alive. Rescue teams from as far away as Butte and Cascade County worked around the clock in six-hour shifts to clear debris and search for possible survivors. There were none.*

The night of March 4 the workers reached the first bodies. More followed until the toll mounted to 74. Some died as a result of a violent explosion in Number 3 vein, the remainder fell victim to the deadly methane gases released by the blast. The tragedy at Smith Mine became Montana's worst coal mine disaster, sparking investigations at the state and national level. Montana Governor Sam C. Ford visited the scene, offered state assistance, and pushed through an inquiry into the incident. Today's marker of the Smith Mine disaster follows a simpler one left by two of the miners trapped by poisonous gas they knew would come, 'Walter and Johnny. Goodbye, wives, and daughters, we died an easy death, love from us both, be good' ".

YBRA Update

Dinosaur Hunting (and so much more) with the New Jersey State Museum

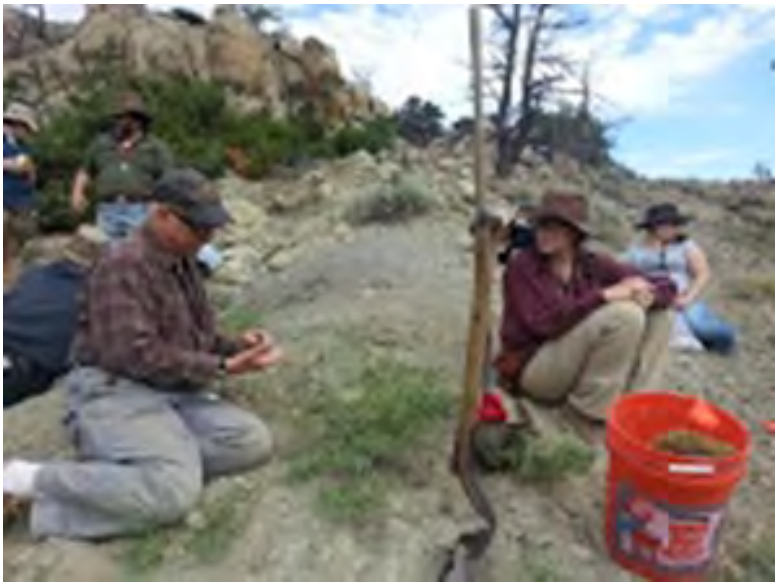
Dave Parris wears a number of hats - too many to count, really. Back East he's the Curator of Natural History at the New Jersey State Museum (NJSM), but around these parts he's better known as an unofficial YBRA historian and an honorary "local." As a graduate student at Princeton University in the 1960s, he is practically a direct "descendant" of so many distinguished geologists whose names you can now find all over YBRA's campus; Thom, Howell, and Jepsen. He even met Professors Erling Dorf and William Bonini when he first arrived at YBRA. Dave has kept his interests in the region ever since and is very happy to have the New Jersey State Museum's Field Paleontology Expeditions there every year. Over the last few seasons, though, he's been slowly handing the reins of the program over to me. I'm humbled, honored, and incredibly excited to step into this role, and I'm doing my best to continue Dave's legacy.

All of Dave's hard work over the years created a strong foundation for the future of the program, and in recent years we have been reaping the benefits. If you've been to YBRA over the past several summers, you may have noticed that the dining hall, parking lot, and the campus in general has been getting more and more crowded around late July and early August. That's in no small part due to an ever-growing contingent from the NJSM. Each season we are hosting more students, teachers, and general enthusiasts, and each year more and more want to return. Although the larger groups are harder to manage and coordinate, these minor issues are far outweighed by all of the benefits of having more eyes on the ground. Much of the great successes we've had in recent years would not have been possible without all of these enthusiastic participants. Since 2012, those new participants have included a group from the **W.I.N.S.** program. **W**omen **I**n **N**atural **S**ciences is a program at the Academy of Natural Sciences of Drexel University that encourages Philadelphia area high school-age girls from disadvantaged backgrounds to pursue a degree and career in the sciences. These young ladies have never experienced anything like the wide-open vistas and rugged beauty that makes this corner of the West what it is. Introducing them to so many new experiences - in the field, in camp, and everywhere in between (the fried pickles at The Red Boxcar are undoubtedly a highlight of the trip for them!) - has been an incredibly gratifying experience.

Most of our fieldwork in the region is a continuation of what Dave has been doing for much of his career. Primarily, we focus our efforts on the latest Cretaceous Lance and Meteetsee formations and the early Paleogene Fort Union Formation in the Bighorn Basin. Many of Dave's old sites continue to be productive, even after decades of collecting. More recently, though, we've been expanding our search zones within our traditional permitted tracts and making new discoveries in newly-acquired public lands. Our search zones now include much of the northwest corner of the Bighorn Basin primarily on the north side of Polecat Bench.

The sheer bulk of our collections has increased dramatically as well. Dave is known far and wide for his love of small fossils: no one ever got more excited about vertebrate microfossils than Dave. Rumor has it that he'd even kick dinosaur bones down into the gullies while our backs are turned just so that he wouldn't have to lug them back home. While we share his love of the little critters at the bottom of the food chain, we also have a fondness for the giants at the top - the dinosaurs - and this is where we've really seen a lot of success in the last few years. In 2011 we excavated two huge jackets that only recently-completed preparation has revealed to contain large portions of the duck-billed giant, *Edmontosaurus annectens*. Last summer we excavated an even bigger jacket that may yield an ankylosaur skull, and what must be a large portion of a *Triceratops* nose horn.

Our newest field project takes us to a very different setting in search of very different paleontological prey. In 2011, concerned that people were illegally collecting fossils from the site, the U.S. Forest Service issued us a permit and designated the NJSM as an official repository for fossils of early armored fish of the Devonian Period from Beartooth Butte. So, once or twice each field season we take a break from the beautiful, rugged, Bighorn Basin, and drive over the Beartooth Pass to what must be one of the most incredible field sites any paleontologist ever got to call home: Beartooth Butte. This would be a strenuous hike under normal conditions, but trekking over remnant snow fields and steep slopes at an elevation of over 10,000 feet, all while keeping an eye out for the resident grizzly and her cub, makes it an unforgettable adventure. Oh yeah, and the fossils there are great too.



David Parris (front, left) and other members of the 2013 expedition, excavating "Kate's Triceratops," near Bobcat Pass, Montana

Dave's "passing of the torch" isn't just about the field program. His love for YBRA, this region, its people, and its history (both natural and man-made) are obvious, and thanks to him, now shared by me. Like him, I now consider YBRA and Red Lodge to be a second home. Summer can't get here fast enough!

But enough of that! Summer is almost here and there is a lot to do. Those fossils don't find themselves, you know!

A Brief Overview of the Bakken/Three Forks in the Williston Basin

By Mark Millard
SM Energy Company

Anyone with a newspaper, internet, or TV has likely heard of the oil boom occurring in Eastern Montana and North Dakota. Some of the recent headlines include: "Bakken Oil Man Says U.S. Energy Independence," by Jay Kohn (KTVQ Billings), "Oil Boom Brings Influx of People to Eastern MT," by Amanda Venegas (KTVQ News), and "Bakken Oil boom Still Sparking growth," by Dustin Klemann (MTN News.) While most Americans are familiar with the monetary opportunities available in the Williston Basin, few understand the geological aspects that lead to such an extensive resource.

The Bakken formation is Mississippian to Devonian in age. The Bakken #1 well, for which the formation was named,was drilled in 1951 in Williams County, ND on the property of Harry, Mary, and Henry Bakken.. While drilling the exploratory well geologists encountered a succession of rocks at a depth of 9500 ft that was described from top to bottom of ~10 ft of black, organic rich shale (later known as the Upper Bakken Shale), ~10 ft of grey, silty dolomite/lime (Middle Bakken), and another ~ 10 ft of black, organic rich shale (Lower Bakken Shale). Over the next few years operators tested the Bakken with minimal success, one of the best wells only made 536 barrels before being plugged. In the early 1980's operators found success with the heavily-fractured, oil-saturated source rocks of the Upper Bakken in Billings and McKenzie Counties. This discovery, along with the advent of horizontal drilling led to continued advancement and expansion of the play throughout the early 1990s. However, due to political, geological, and economic difficulties, the play fizzled out.

Around the year 2000, a few operators ventured into Richland County, MT to test the middle member of the Bakken and found very positive results. These early tests resulted in the discovery of Elm Coulee Field. Elm Coulee is a NW-SE trending dolomitized carbonate shoal with ~600 horizontal wells spread over 450 square miles. To date it has produced ~130,220,389 Bbls oil and ~113,551,136 MCF gas. In 2007, EOG discovered the most prolific field to date, Parshall Field, in Montrail County, ND. Equipped with a new understanding of the geology of the Bakken and the development of multi-stage fracking, the play has expanded to 13 counties and a daily production rate of 914,003 Bbl/day in North Dakota as of March, 2014 (www.dmr.nd.gov).

A few key geologic factors are responsible for the Bakken Petroleum System (BPS) becoming a world-class petroleum system. First, the Middle Bakken reservoir is encased by two highly organic shales, the Upper and Lower Bakken. Both shales were deposited in highly anoxic environments which allowed for the preservation of organic matter. The shales have current day TOC (Total Organic Carbon – a measure of source rock quality) in the range of 10-15% (rates among the world's richest source rocks). In addition to their high organic content, the shales are widespread covering the entire western half of North Dakota, and extending into Montana, Saskatchewan, and Alberta. The shales have been buried sufficiently during geologic time to allow for the organic material to be converted into oil. Second, the two main reservoirs in the BPS are the Middle Bakken, a silty dolomite sandwiched between the two shales with porosities around 5-8%, and the Three Forks, which lies directly below the Lower

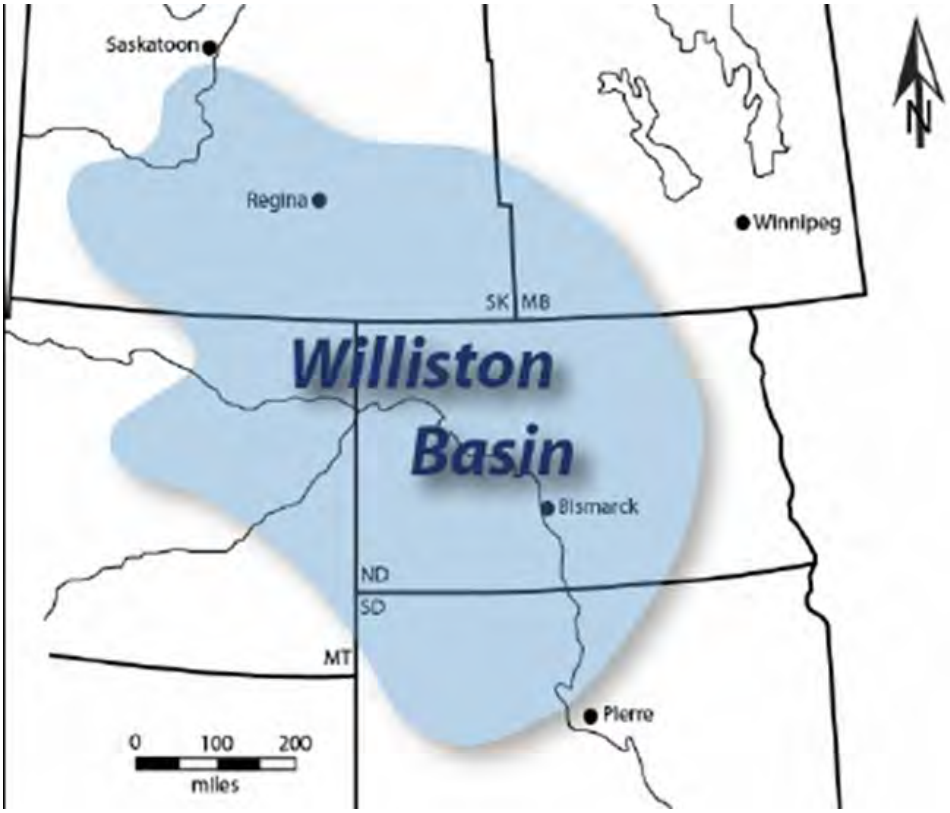
(*continued from Mallard article, page 7)*

Bakken shale. The Three Forks is an interbedded dolomite and shale package with porosities typically in the range of 5-10%. The BPS has often been referred to as a "basin centered oil accumulation." After oil generation, migration occurred vertically into the Middle Bakke and Three Forks. However, because of the poor permeability of the two reservoirs minimal lateral migration occurs, resulting in most of the basin centered kitchen being oil saturated while the updip reservoir out of the kitchen remains water saturated.

The legacy of the BPS is far from over. Currently operators are testing new concepts to capture more oil including: tighter downspacing testing of wells (see recent investor presentations from Continental Resources and Kodiak), testing lower benches of the Three Forks Formation, stimulation optimization

Techniques, and enhanced oil recovery methods. As technologies in the petroleum industry increase, we will likely see large-scale development of other resource plays similar to the BPS throughout North America, and the rest of the world.

Much of the data shared in this paper was originally given in an outstanding paper by Julie A. Lefever at the North Dakota Geological Survey titled "Geotechnical Insights of the Bakken." It, along with many other resources related to the Williston Basin, can be found at: https://www.dmr.nd.gov/ndgs/bakken/bakkenthree.asp



GETTING GEOLOGY STUDENTS INTO THE FIELD

The importance of field schools to practicing geologists is unquestionable; yet, the opportunities to experience field geology are dwindling. The Geological Society of America (GSA), in cooperation with ExxonMobil, is currently offering three programs to support and encourage field geology. This non-profit/industry collaboration has proven very successful and in 2014 over 200 geology students and professors applied for these awards.

The GSA/ExxonMobil Big Horn Basin Field Award (deadline 17 April, 2015) - a one week field seminar that offers 20 undergraduate and graduate students and 5 faculty members a chance to receive a high-quality educational experience in the spectacular Bighorn Basin of north-central Wyoming. The course is free to accepted participants, and all transportation, meals, and living expenses are covered.

The seminar focuses on multi-disciplinary integrated basin analysis and enables awardees to study exposures of individual hydrocarbon system play elements, such as source, seal, reservoir and structure, within a prolific hydrocarbon basin. For more than a century, the Bighorn Basin has been studied by academic, industry and government geoscientists, who have focused on the exceptional outcrop exposures, as well as subsurface borehole and seismic data. Our current understanding of the basin derives from both industry and academic perspectives.

This is not, however, a course on the detailed geology of the Bighorn Basin. Instead, our objectives are to introduce the concepts of integrated basin analysis, including evaluation, prediction, and assessment of play element distribution and quality, using the Bighorn Basin as a natural laboratory. Via this laboratory, we explore the concepts, methods, and the tools of petroleum geoscience that we use on a day-to-day basis in the energy industry. Our discussions on the outcrop and in the classroom focus on how we make decisions with limited data and how critical information is identified in order to evaluate risk vs. uncertainty. We also use the excellent field setting to teach fundamental geoscience skills in structure, stratigraphy, geochemistry, etc. By the end of the school, the teams will generate play element maps, play summary charts, cross-sections, and play fairway maps. The highlight of this course is the presentation of these ideas to the group and the ensuing discussions about how these ideas and play assessments could be further developed.

This seminar is team taught by several ExxonMobil professionals. These geoscientists represent years of research in integrated basin analysis, with specific skills in tectonics, geochemistry, structure, sequence stratigraphy, sedimentology, paleontology, hydrocarbon systems analysis, and integrated play analysis. GSA's role is to select awardees and to handle all logistics.

"It was one of the most invaluable experiences of my lifetime."
"That was a fantastic course. I learned so much! It was an honor to go."

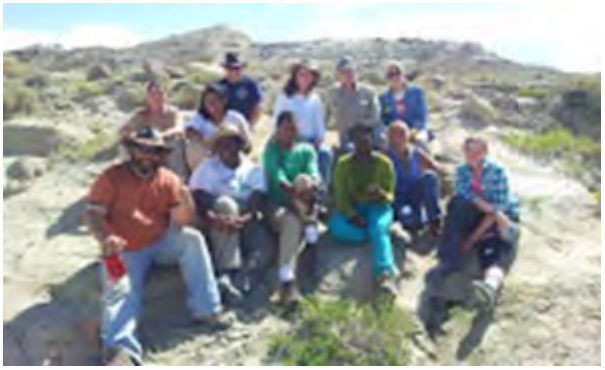
The GSA/ExxonMobil Field Camp Scholar Award (deadline 17 April, 2015) - provides 20 undergraduate students $2,000 each to attend the field camp of their choice based on diversity, economic/financial need, and merit. Funds for this award have been provided by ExxonMobil. Selections of awardees are completed by GSA.

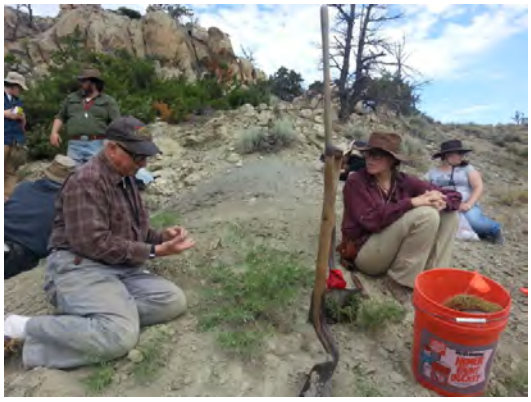
"The experience was unforgettable. The scholarship afforded me this great opportunity to strengthen my education, which I would otherwise have not been able to finance. I am truly grateful."
"For me, this was a once in a lifetime experience, and having spent an entire summer in this immersive program has laid a solid foundation as I move forward in my career as a glaciologist. Thank you for providing me the financial support in this vital step of my academic career."

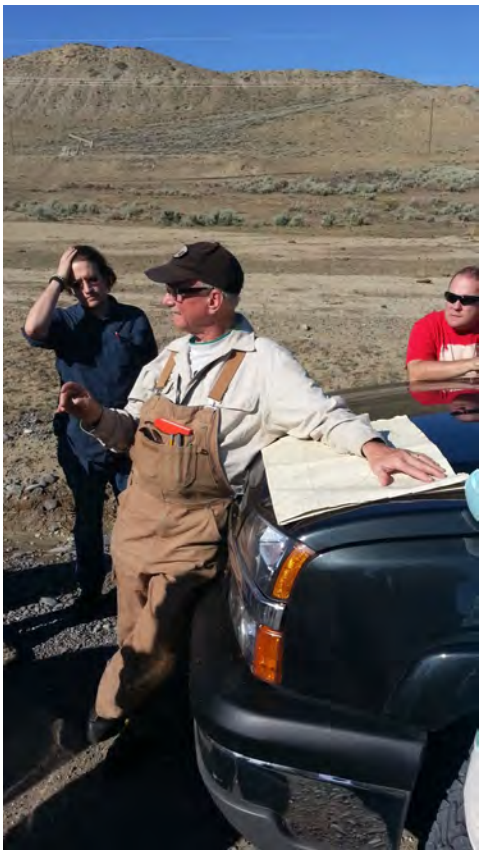
The GSA/ExxonMobil Field Camp Excellence Award (deadline 17 April, 2015) - provides one geologic field camp an award of $10,000 to assist with their summer field camp based on safety awareness, diversity, and technical excellence..

To apply for these awards, please visit https://rock.geosociety.org/ExxonMobilAward/index.asp. Students and recent graduates must submit an on-line application form, two letters of recommendation and a cover letter.

Questions? Please contact Jennifer Nocerino, jnocerino@geosociety.org, or +1-303-357-1036.







the 2012 New Jersey State Museum Field Paleontology Program near Dumb Bell Hill,

Yellowstone-Bighorn Research Association
PO Box 20598
Billings, MT 59104

ATTN: Proxy Enclosed