

BULLETIN

Volume 89 Number 3

May-June 2014

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Kris Kennedy

KGS Golf Tournament Registration Flyer Inside



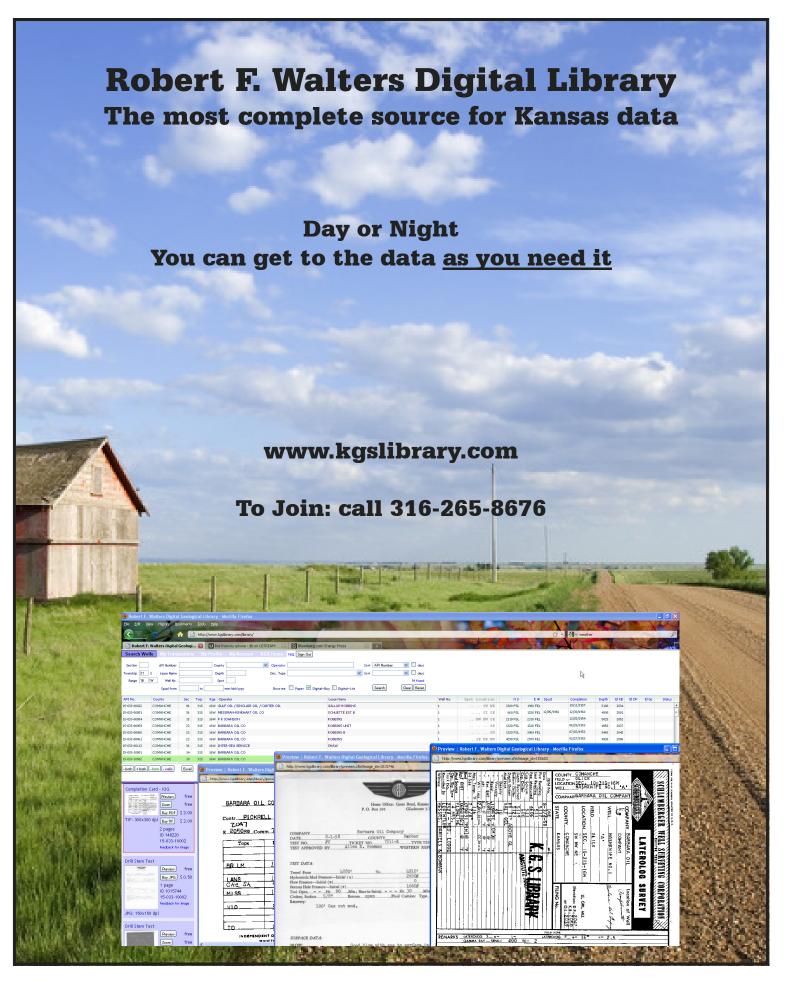


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ON THE COVER:

A group of Wichita State Geology students on their spring break field trip to the Guadalupe Mountains of New Mexico. The trip covered White Sands, Carlsbad Caverens and lots of outcrops.

CALL FOR PAPERS

The Kansas Geological Society Bulletin, which is published bimonthly both in hard-copy and electronic format, seeks short papers dealing with any aspect of Kansas geology, including petroleum geology, studies of producing oil or gas fields, and outcrop or conceptual studies. Maximum printed length of papers is 5 pages as they appear in the Bulletin, including text, references, figures and/or tables, and figure/table captions. Inquiries regarding manuscripts should be sent to Rebecca Radford, manager@kgslibrary.com or mailed to 212 N. Market, Ste. 100, Wichita, KS 67202. Specific guidelines for manuscript submission appear in each issue of the Bulletin, which can also be accessed on-line at the Kansas Geological Society web site at http://www.kgslibrary.com

SOCIETY Technical Meetings

2014 Technical Talks - NEW LOCATION!!!

May 27—Larry Richardson's WSU Class presentations of field studies

For More Information or suggestions of speakers Please contact Dave Clothier: dave@mccoypetroleum.com

No More Talks Until September

NOTICE!!

NEW Location for Technical Meetings

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All KGS technical presentations are held at 12:30 p.m. at the Landmark Square Building, located at 212 N. Market. We have a new meeting room on the 4th floor, up the stairs and at the end of the hallway in the Wisdom Center.

Note: For those geologists who need 30 points to renew their licenses, there will be a sign-in sheet at each presentation and also a certificate of attendance.

Please remember to check the website For the most up to date information on Technical Talks

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(For the most information, go to the Tech Talks tab)

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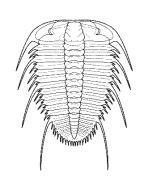


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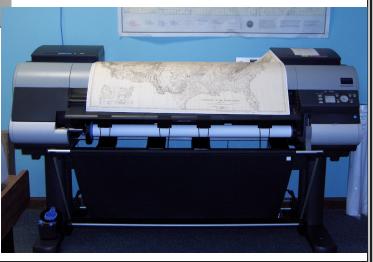
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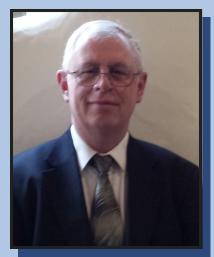


President's Letter

Dear Friends and Colleagues,

Earlier this month my wife Elaine and I attended the 2014 Annual AAPG Convention and Exhibition (ACE) in Houston, attendance was over 9,000 attendees which included geologists, students and engineers from all over the world. ACE 2014 offered more than 800 oral and poster presentations that covered 11 different themes with a large Exhibit Hall filled with vendors and exhibitors. The papers were varied and interesting. I have to admit for the oral presentations I sometimes had to walk quickly during intermission to be present for the start of the next talk. Overall I enjoyed attending the AAPG meeting and representing our society as your president.

We are now nearing the end of our spring series of speakers and we will resume again this fall. I want to thank again our committee: Dave Clothier, Sonja McDanel and Hi Lewis for keeping us supplied with a varied and inter-



esting slate of speakers. If anyone has any suggestions for speakers, please contact the committee and they will work to get them on the schedule. So far the fall lineup is wide open. Elaine and I also enjoyed attending the Kansas Geological Foundation talk and mixer last week – Mike Smith is always an interesting and entertaining speaker for our Society and Foundation.

Some Society news - we are carefully looking into strategies to reinvest some of our savings to achieve a higher yield rather than day to day interest. Recently Dave Clothier, Chuck Brewer, Hi Lewis, Lynn Watney with other members and stakeholders attended an invitation only program: "Induced Seismicity State Tasks Force Meeting" that was recently held on April 16th. One the findings presented was a graph illustrating the number of measurable seismic events in 2014 has now exceeded the number of events in all of 2013. After the presentations, we meet in smaller work groups and offered comments to a moderator. I requested that the Kansas State Geological Survey take the lead on this issue, acquire equipment, conduct research, present findings and if needed - make recommendations to the Kansas Corporation Commission. Hopefully any new resulting regulations will allow Kansas oil and gas operators to continue with normal cost effective operations and will not hinder oil and gas exploration in any way for Kansas. Also a new potentially impacting issue to the oil business: "New regulations for the protection of the habit of the Lesser Prairie Chicken". These will have a substantial impact on all types of Kansas business. Also please note I will be having another past presidents meeting in late May. Look for an announcement on the KGS website.

Don't forget the upcoming KGS Golf, Fishing Tournaments and the Fall Picnic. Best of luck in all of your exploration efforts.

Respectfully Submitted, Brian Fisher KGS President 2014



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From The Manager

Dear Members,

Spring is here with summer coming soon and Kansas remains a busy place in the oil industry. Even though not too many people come into the library to work for the day, we are filling lots of orders and new people keep joining the Society. We are nearly 800 strong now in our Society membership and the digital membership has reached an all time high of 306 members.

We keep adding more data to the digital archive and library. The donated data that the Foundation owns is providing approximately 23% new data going into our files. This is usually the older data, one-of-a-kind, and we are thrilled as that is very unique data that you most likely will not find anywhere but here.

The **Foundation** board has been going through old donated maps that have been in the basement for years. We have boxes of maps that are being put out on the library floor for free as well as a few boxes of \$1.00 maps and \$5.00 maps. We have sold some and given some of the free maps to visiting geology students but want everyone to be aware that you Society members can come in and browse through these and see if there is anything that you might use. We also have retained a great number of maps that we will eventually scan (for archiving) and be able to print copies from. If you do not support the Foundation presently, please consider joining. \$50.00 is the minimum membership and that is completely tax deductible. Not only are we getting the best collection of data by their efforts but we also help several geology students in the state by awarding scholarships each semester. If you are having some good fortune out there in the oil field, maybe it's time to give a little back.

We are pleased to announce that one of our staff, Bonnie Funk, gave birth to a beautiful little boy, Dominic, on April 18th. Our congratulations go out to her and her husband!

*Please note that the library will be closed for Memorial Day, May 26th.

Respectfully submitted,
Rebecca Radford

Manager



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Kansas Geological Society Board Minutes

The monthly meeting of the Board of Directors of the Kansas Geological Society was held on February 11, 2014. President Brian Fisher called the meeting to order at 11:37 AM

PRESIDENT'S STATEMENT – Mr. Fisher welcomed board members and gave summary of upcoming KGS events and activities.

APPROVAL OF MINUTES - The January 14, 2014 minutes were reviewed. Motion was made to approve minutes as written by Frank Mize, seconded by Dave Clothier. Motion passed by unanimous vote.

FINANCIAL REPORT/MANAGERS REPORT

- A. <u>Treasurer's Report</u> Paul Ramondetta presented the Treasurer's report for January 2014. He reported interest accrued from CD's at \$465.81 for the month of January and YTD total for 2014. He brought up discussion that KGS Funds are currently in CD's and cash, and some of these monies should be re-allocated to secure investments with a higher rate of return. Frank Mize moved to accept the Treasurer's Report, Tim Hellman seconded, and the vote carried unanimously.
- **B.** Manager's Report- Mrs. Rebecca Radford presented the Manager's Report for January, 2014. Total income for the month was \$66,993.07, with expenditures of \$56,603.17, thus generating a net gain of \$10,389.90. The year to date gain is, therefore, \$10,389.90. The Walters Digital Library report shows current membership of 257 members. The Digital Library had a net income of \$23,421.14 after expenses in January, with year to date income being the same. Manager's report was approved unanimously.

OLD BUSINESS

- **A. Investment Policy** Discussion led by Brian Fisher regarding Investment Policy adopted in 2004 determined that no changes are needed and it will serve as suitable guideline for upcoming investment recommendations.
- **B.** Formation of Investment Committee Paul Ramondetta will serve as Chair. Additional members: Tim Hellman, Tom Hansen, Brian Fisher, Leah Kasten and Rebecca Radford. Committee will meet with 3 or more financial advisors and make investment recommendations to the board.

NEW BUSINESS

- A. Review Library policy regarding new paper logs Rebecca Radford reviewed the policy on printing paper logs that are new to the collection (from KCC, Survey). Currently, prints are made only when requested by members due to high costs of printing and limited file storage space. (She projected \$165,000 in paper costs alone for the 46,000 new logs now in digital form) Board discussion resulted in no changes to policy. It was suggested, however, to add signage in the library stating that the paper log collection may not be complete and paper copies will be made available for library use upon request for no charge. Announcement will be made at Tech Talks and in the KGS Bulletin. All new geological reports are printed and placed in paper file collection.
- **B.** Use of Wisdom Center Rebecca Radford discussed use of Wisdom Center by WSU Geology Club on 2/21. She suggested bringing in cable television during the month of March so members could watch March Madness as a social activity. Additionally, chairs are coming in, but still waiting on microphone. Equipment in the room has been added to insurance policy.
- **C. Fire Monitoring Equipment in the Library -** Rebecca Radford concerned about the lack of fire monitoring as it was disabled when phone lines were cut. It can be re-established, but will cost \$400 for new equipment. She has not gotten any response from building manager to remedy the situation. Board supported her in contacting the landlord to get rectified immediately as this is a critical issue for the safe keeping of the Library assets.
- **D.** Suggestions for Investment committee Board members brought forward suggestions regarding the upcoming financial investment changes. Dave Clothier emphasized having enough cash on hand for operations. (Rebecca Radford recommended a minimum of \$150,000 for operating expenses, although some could be in the form of savings) He also recommended that accounts be set up with enough liquidity such that when our lease is up in three years, there would be adequate funds available to lay ground work for a new building location. Tim Hellman suggested initially using \$200,000 from current cash accounts for investment. Paul Ramondetta discussed setting up staggered CDs of 1 to 5 years, which could be turned over as they came due annually, which could increase yield of a current secure investment practice.
- **E. GeoGraphix Presentation** Dave Clothier mentioned this event will occur Mar 25th, and input from membership for useful content would be appreciated.

- **F.** Tech Talk with older members Discussion ensued regarding an event to give older KGS members an opportunity to share experience. Suggestions included hosting an evening dinner or informal discussion group at the library. This would serve as a social rather than technical event, and perhaps a service company could sponsor. Event should be set up by Tech Talk committee, or a separate committee established for these events.
- **G.** Changes to WDL membership process & Fees- Reviewed current policy and fees. No changes recommended. It was suggested to monitor for possible "data dump" or other conspicuous activity to keep data from being downloaded by data vendors. It was recommended that we increase staff to get data gaps (East Ranges, etc) scanned as soon as possible. This could increase profits by improving services.
- **H.** Field Trip Board in agreement that a significant field trip would benefit membership and be a great tradition to establish. No further action taken at this time.
- I. Contribution to WSU AAPG (Conducted via email on 2/11/2014) Rebecca Radford (on behalf of Peter Weiland, Pres of WSU AAPG Student Chapter) asked that a \$50 donation be made to WSU AAPG Student Chapter so they could have start-up money for new shirts. Shirt orders will be made available to KGS members at the Library. Board unanimously agreed to the contribution.

VIII. ADJOURNMENT

Motion to adjourn made by Tim Hellman and seconded by Frank Mize. Meeting adjourned by Brian Fisher at 1:20 PM.

Respectfully submitted, Leah A. Kasten, Secretary

The monthly meeting of the Board of Directors of the Kansas Geological Society was held on March 11, 2014 at the Wichita Petroleum Club.

Brian Fisher called the meeting to order at 11:39 AM

PRESIDENT'S STATEMENT – Mr. Fisher welcomed board members/advisors and gave summary of upcoming KGS events and activities.

APPROVAL OF MINUTES - The February 11, 2014 minutes were reviewed. Motion was made to approve minutes as written by D. Clothier, 2nd by F. Mize. Motion passed by unanimous vote

FINANCIAL REPORT/MANAGERS REPORT

- A. <u>Treasurer's Report</u> P. Ramondetta presented the Treasurer's report for February. He reported interest accrued from CD's at \$462.74 for the month of February, presenting YTD total of \$931.62 for 2014. Discussion regarding investment committee ensued. (See Old Business Items) Dave Clothier moved to accept the Treasurer's Report, Frank Mize seconded, and the vote carried unanimously.
- **B.** Manager's Report- R. Radford presented the Manager's Report for February, 2014. Total income for the month was \$55,358.09, with expenditures of \$68,950.10, thus generating a net loss of \$13,592.01. The year to date loss is, therefore, \$3,202.11. The Walters Digital Library report shows current membership of 262 members. The WDL had a net income of \$10,416.08 after expenses in January, with year to date income of \$33,847.22. Note that approx. \$9,100.00 from WDL was used for audio equipment expenses for Wisdom Ctr.

OLD BUSINESS

A. Investment Committee – Reviewed first meeting with financial advisor, Alan Taylor, w/ Edward Jones

Several options were discussed. Board should stay away from any investments that could risk principle. Consider cash investment in KGS (e.g., scanning, acquiring data,) to improve services, therefore improving income, (re-invest in organization rather than outside investing.) Time frame actually much less than 3 years because of need to evaluate potential move to new location well in advance of lease expiration. Cash monies we are evaluating originally came from sale of building, so that should still be considered as a possible goal for KGS. Will need to determine how aggressively KGS will pursue new location options before final decision made for investments – longer term (higher return) vs. shorter term (liquidity) Investment committee will meet with 3 more advisors and bring most suitable recommendations before the Board.

B. Landlord Response to Fire sensors & Lease copy: R. Radford concerned about making any capital investment (specifically fire sensor equipment) in this building due to poor communication by landlord. D. Clothier will contact landlord, if no response, it was suggested to deduct costs from rent payment.

C. Cable & Internet Install in Wisdom Center: R. Radford reported cable will be installed Mar 31. Chair delivery slower than expected, but supplier working with us and may adjust price.

NEW BUSINESS

- **A.** Nomenclature Committee Change R. Radford reviewed change in distribution of Kansas field nomenclature data sets from current card system to using an excel spread sheet. D. Clothier moved to approve new format, T. Hellman seconded. After clarification of current system, number of users, and impact of change for users, vote passed unanimously.
- **B.** Support for Mike Smith B. Fisher discussed providing financial support to the KGF Spring Mixer ,specifically to offset cost of speaker (Mike Smith speaking on weather near Earth Day). F. Mize moved to provide \$500 to KGF for speaker, T. Hellman seconded. Discussion ensued regarding final amount and potential outreach of mixer. Motion carried unanimously.

ADJOURNMENT

Motion to adjourn made by D, Clothier and seconded by F. Mize. Meeting adjourned by B. Fisher at 1:30 p.m.

Respectfully submitted, Leah A. Kasten, Secretary







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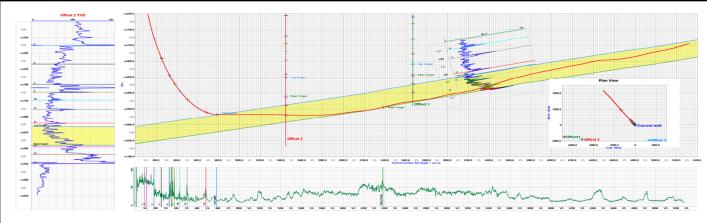
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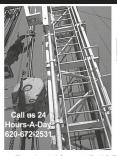
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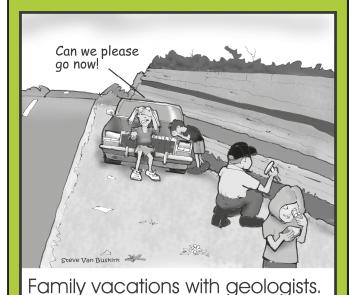
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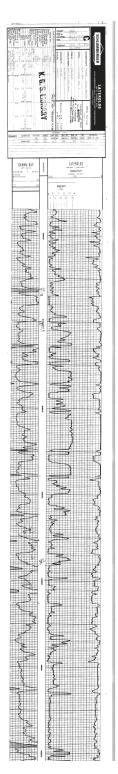
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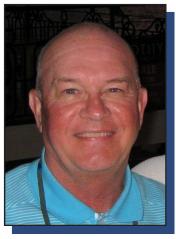
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Memorial - Kris Kennedy



KRIS KENNEDY died April 2, 2014, after a long bout with ALS. Kris was born in Lawrence Kansas April 11, 1953 to Max and Jackie Kennedy. After graduating in geology from Kansas University in 1977, he took a position in Wichita with Ritchie Exploration 1978 to 1980 working with Judd Hipps, and moved to Gear Exploration 1980-85 with fellow geologists Dan Bowles, Ken LeBlanc, Kent Crisler and Tom Hansen. He was an Independent from 1985-2002, and a co-founder of Max-Henry with Jeff Zoller. In 2010, Kris started Valhalla Exploration where he enjoyed working with his geologist son Adam, a 2006 WSU graduate, also with Derek Patterson and Adam Nighswonger. Kris was a long time member of the Kansas Geological Society and

served as the chairman of the golf tournament.

He is survived by his mother Jackie, wife Jamie, brother Rick, sons Adam [Wichita] and Sean [Kansas City] and granddaughters Sarah and Olivia. It is with great sadness that we say goodbye to one of our geologists.



NOTICE!!!!

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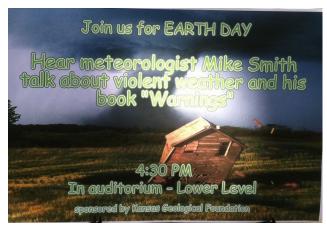
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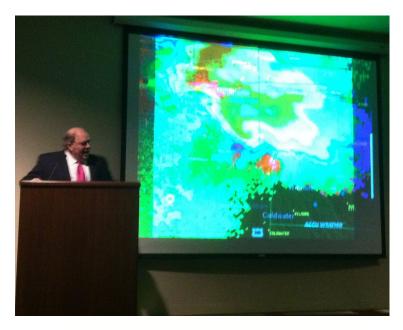
Kansas Geological Foundation Celebrates Earth Day



In celebration of Earth Day on April 22, 2014, the Kansas Geological Foundation sponsored a special evening with Meteorologist Mike Smith giving a presentation on violent weather patterns and his new book *Warnings*. The talk was well attended and Mike gave us a very interesting presentation.

We then convened at the Petroleum Club for the 19th Annual Spring Mixer, enjoying great food and drink.

Mike's book *Warnings* is an account of how the warning systems we have today have saved hundreds of lives. He



showed an illustration comparing the two tornadoes; Udall in 1955 and Greensburg in 2007. The two were unusually similar in how they formed, size, and the fact that they both wiped out those towns. The difference was in the number of lives saved in 2007 due to the warning sirens and the ability of meteorologists to track storms with some pretty amazing technology. If you missed this evening, you missed a very interesting talk.





Kansas Geological Foundation

Web Site: www.kgfoundation.org

212 North Market Wichita, Kansas 67202

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Kansas Geological Foundation Services

The Kansas Geological Foundation provides the following services as a part of the organization's commitment to educate the public regarding earth science.

Speaker's Bureau

A list of speakers available to talk about various aspects of geology may be obtained by contacting Janice Bright at the KGS Library, 265-8676. This service is free to the public.

DVD/Videotape Library

The KGF maintains a DVD & videotape library focused primarily on the various fields of earth science. These tapes may be checked out without charge by the public. To obtain a list of tapes, please contact the KGS Library, 212 N. Market, Ste. 100, Wichita, KS 67202, or call Janice Bright at 265-8676.

The Kansas Geological Foundation was founded in March, 1989 as a not-for-profit corporation under the guidelines of section 501(c)(3) of the tax code to provide individuals and corporations the opportunity to further the science of geology. It is dedicated to providing charitable, scientific, literary and educational opportunities in the field of geology for the professional geologist as well as the general public.

KGF can receive in-kind donations through which the donor may receive a tax deduction. Of equal importance, the KGF provides the financial resources to sort, process and file this data at the KGS library. If you have a donation to make, please contact the KGF at 265-8676.

Your tax-deductible membership donation helps to defray the cost of processing donations and to support public education programs about the science of geology. Annual membership begins at \$50.00 per year. Donations of \$100.00 or more are encouraged through the following clubs:

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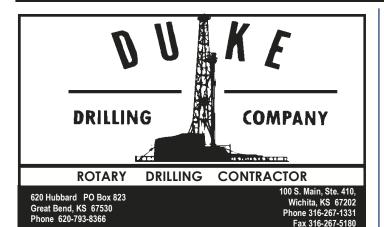
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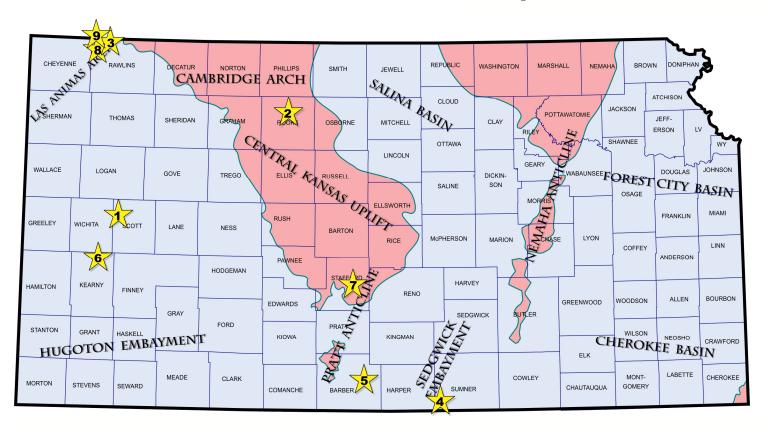
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Exploration Highlights

By John H. Morrison, III Independent Oil & Gas



- 1 Eagle Creek Corporation, Wichita (KS), has discovered Marmaton oil reserves at a wildcat wellsite in Scott County. The 1-20 Decker (API 15-171-21018), spotted in the NE NW SE of section 20- T17s- R34W. The Beaver Lodge Northeast pool opener was drilled to a logger's total depth of 4954 ft. Wellsite is located one mile south of the Beaver Cliff East field in the NE/4 of section 17. Landmark Resources, Inc. of Houston (TX) established the Beaver Cliff East field in June last year. Landmark and Eagle Creek are both participants in the development of the field which has produced nearly 48,000 barrels of oil from the Marmaton limestones since its discovery. Eagle Creek's latest discovery on the Decker lease is located about five miles north of Modoc, Kansas.
- **2 Coral Production Corporation**, Denver (CO), is producing an undisclosed amount of oil at their 16-1 Keiswetter Trust (API 15-163-24176), located in the SW SE NW of section 16- T7s- R18W, in **Rooks** County. The wildcat well found oil deposits in the Lansing Kansas City formation about one and one-half miles northeast of the Axelson Northeast field a field Coral Production also discovered in August, 2012 which has produced over 15,000 barrels of oil from the LKC zones. Maverick Drilling rig bottomed the Keiswetter well at a depth of 3380 ft. No well details have been released. The new Keiswetter oil field lies three miles west of Stockton, Kansas.
- **3 Murfin Drilling Company**, Wichita (KS), has established the Darkwing oil field (Lansing Kansas City oil) in **Rawlins** County with the successful completion of the 1-19 Downing A (API 15-153-20962). The wildcat well was drilled to a total depth of 4700 ft at site located in the SE NE NW of section 19- T1s- R35W. The new reserves are situated one and one-quarter miles southwest of the Wilkinson North field (est. 1979) which produced a little over 2000 barrels of oil from the LKC formation over a 7-year span. However, the well lies about three miles southeast of Murfin's prolific Scoda

pool discovery in section 1- T1s- R36W, on the Nebraska state line, that has yielded 366,000 barrels of oil from the LKC zones since July last year. The Downing A lease is located about nine and one-half miles north and three miles west of Beardsley, Kansas.

- **4 SandRidge Exploration & Production, Inc.**, Oklahoma City (OK), has completed a horizontal wildcat well one and one quarter miles west of the Eden Road West field (Mississippian oil) a field they established in April, 2013. The 1-19H Misak 3404 (API 15-191-22711) has been completed for an unknown potential at site located in the N/2 N/2 N2 NE of section 30- T34s- R4W, in **Sumner** County. Horizontal lateral extends in a northerly direction for nearly a mile into section 19- T34s- R4W. True measured depth of the lateral was 9755 ft. The Mississippian oil pool opener is located one and one-half miles north and nine miles west of Caldwell, Kansas. The new field is named Gerberding South.
- **5 Iuka Carmi Development LLC**, Pratt (KS), is producing an unknown amount of crude oil from the Mississippian formation at their 1-5 Jones (API 15-007-24117), NW SE NE of section 5- T32s-R11W. The **Barber** County wildcat well found new reserves at site nearly one and one quarter miles west of the Whelan Southeast field (est. 1982, Douglas gas, Lansing Kansas City oil), or about two miles east of Medicine Lodge, Kansas. Operator hired Ninnescah Drilling to drill the well to a total depth of 4900 ft. The new field is named Whelan South.
- **6 Hartman Oil Company, Inc.**, Wichita (KS), has a new Marmaton oil discovery in **Kearny** County, southwest Kansas. Operator drilled the 11-2 Kuhlman (API 15-093-21896) in the SW SW SW of section 11- T21s- R36W. Total depth was ceased at 5122 ft. Oil deposits were discovered in the Fort Scott limestone formation. No completion details have been released. The new Kuhlman field is

situated over three miles from closest known production in the Beymer Northwest field, which has produced over 236,000 barrels of oil from the Marmaton formations from two wells since its founding in 1966. Well site is located about twenty miles north of Lakin, Kansas.

Murfin Drilling Company, Inc., Wichita (KS), has successfully completed a new oil discovery in Stafford County, as well as, a second discovery in Rawlins County, and the completion of a third well, a wash-down of a 1980 dry "show-hole, that has resulted in a daily production rate of 200 barrels of oil per day, also in Rawlins County.

- First, in **Stafford** County, Murfin Drilling's 1-2 Rank OWWO (API 15-185-22964), spotted in the west-half of NW NW in section 2-T23s-R12W, found new isolated Viola oil deposits about three-quarter mile west of the 49 year old Pleasant Grove South oil field (Lansing Kansas City and Arbuckle oil). Operator re-entered the well, originally drilled to the Simpson formation by Coronado Oil & Gas in June, 1994, and cleaned it out to total depth of 3741 ft. Hole was then deepened to 3900 ft into the Arbuckle with no significant shows and was plugged back to a depth of 3838 ft. Completion details in the Viola remains confidential. Top of the Viola was logged at 3652 (-1814 kb). The new Mike's Meteor field lies one mile south and two miles east of Hudson, Kansas.
- 8 In Rawlins County, Murfin Drilling has a new oil discovery at the 1-14 Burke Trust B (API 15-153-20959), located in the west-half of NE NW NE in section 14- T1s- R36W, about thirteen miles north-northwest of the town of McDonald, Kansas. The wildcat well and new Golden Cascade pool opener is producing an undisclosed amount of crude from the Lansing Kansas City formation. Company-owned Rig 8 drilled the well to a total depth of 4800 ft. Completion details are not available. Well site is located one and one-quarter miles northeast of closest established production in the East Fork field. The field was discovered by Wichita-based BEREXCO, Inc. late last year. BEREXCO, Inc. and Murfin Drilling have since developed the East Fork field and have produced over 24,000 barrels of oil from the Shawnee (Oread) and Lansing Kansas City formations. Murfin's new field has not been named.
- 9 In conclusion, Murfin Drilling has completed their 1-1 Walter A OWWO (API 15-153-20404) for 200 barrels of oil and 16 barrels of water per day with pay coming from the Lansing Kansas City formation. The well was originally drilled by PETX Petroleum Corporation in 1980 in the west-half of NW SE in section 1- T1s- R36W. The "show-hole" was drilled to a total depth of 4940 ft, or 90 ft into the Mississippian formation. Top of the Lansing was logged at 4182 (-962 kb). The well is a part of the recently established Scoda field which Murfin Drilling discovered in August last year near the Nebraska border. Drilling in Kansas was an extension to an extensive oil play across the state line. The Scoda field in Kansas has produced nearly 223,000 barrels of oil since it began in August, 2013. Murfin Drilling has completed ten producers and are in various stages of completion on another twelve development wells. Field area lies twelve miles north and three and one-half miles west of Beardsley, Kansas.

WSU Spring Break Field Trip to New Mexico

The first day of the trip we looked at road outcrops in Albuquerque, NM. At the first outcrop we saw the Tensill Formation, a Permian aged back reef of dolomitized limestone. We stopped at an outcrop to examine the Yates Formation. It consisted of different layers of limestone with gypsum and sandstone. We stopped at the Seven Rivers Formation where we could see evidence of 7 ancient rivers, hence the name. At the next outcrop we saw the Queen Formation which was an unusually thick sandstone.

Day 2 we stopped and hiked through Carlsbad caverns. Day 3 we looked at the Castille Formation. A varv formation of layering limestone and gypsum where each coupling shows one year of time. Afterwards we hiked the Permian Reef Trail in the Guadalupe Mountains and saw Permian reef formations and fossils.

Day 4 we went to White Sands National Monument, New Mexico and did a 5 mile barefoot trek through the dunes. After white sands we traveled to Carrizozo, New Mexico and saw Quaternary aged basalt lava flows. So over they trip we saw a Permian fore-reef, back-reef and reef, massive caverns, hundreds of thousands of years represented in vary, gypsum sand dunes and 10,000 year old lava flows.

- Nate Lara, WSU geology student



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