



# KANSAS GEOLOGICAL SOCIETY BULLETIN

Volume 79 Number 2

March—April 2004

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### THIS MONTH AT THE KGS

March 4 - William McBee

March 11- Dr. J. Edward Blott, Littleton, CO

March 25- Ted Beaumont, Tulsa

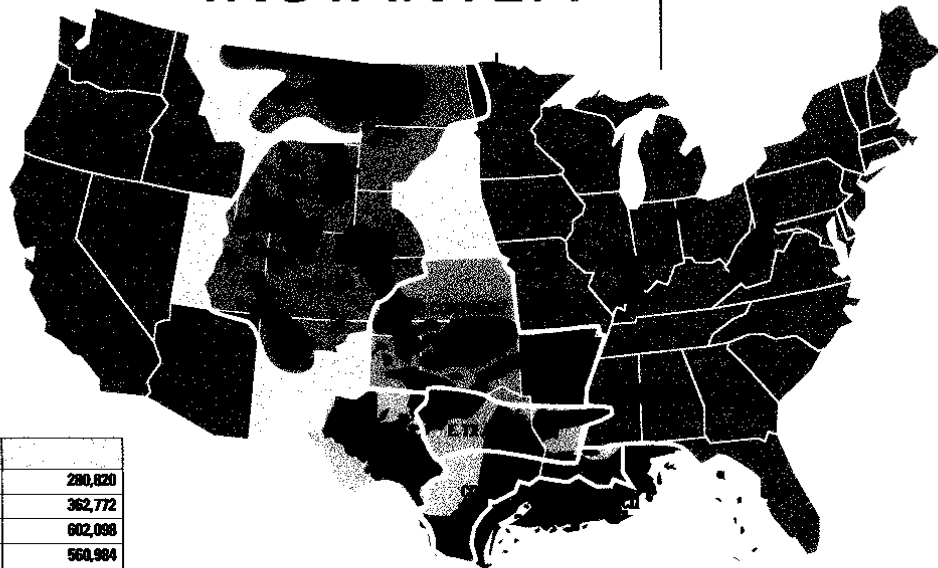
### NEXT MONTH AT THE KGS

April 1– Ray Sorenson, Anadarko Petr., Houston

April 8– Terry Donze, Denver

April 15– Christine Hansen

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# KANSAS GEOLOGICAL SOCIETY

# BULLETIN

Volume 79 Number 2

March—April 2004

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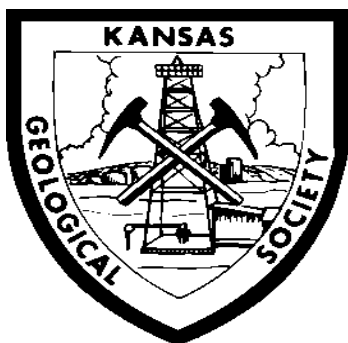
## ON THE COVER

This issue has a profile on Neil Sikes and two memorials; J. Mark Richardson and John Barwick.

Also, part two of Sal Mazzullo's scientific paper on porosity evolution in carbonate reservoirs.

There are banquet photos on page 16.

The *KGS Bulletin* is published bi-monthly by the Kansas Geological Society, with offices at 212 North Market, Wichita, Kansas 67202 Copyright ©1993, The Kansas Geological Society. The purpose of the *Bulletin* is to keep members informed of the activities of the Society and to encourage the exchange and dissemination of technical information related to the Geological profession. Subscription to the *Bulletin* is by membership in the Kansas Geological Society. Limited permission is hereby given by the KGS to photocopy any material appearing in the *KGS BULLETIN* for the non-commercial purpose of scientific or educational advancement. The KGS, a scientific society, neither adopts nor supports positions of advocacy, we provide this and other forums for the presentation of diverse opinions and positions. Opinions presented in these publications do not reflect official positions of the Society.



# KANSAS GEOLOGICAL SOCIETY

Established 1925

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# KANSAS GEOLOGICAL SOCIETY TECHNICAL PROGRAMS

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## Schedule of Programs for Spring 2004

- March 4 William McBee, “*The Nemaha Fault Zone: Strike Slip Faulting in the Mid-Continent, U.S.A.*”
- March 11 Dr. J. Edward Blott, Littleton, CO— “*3-D, 3-C Reservoir Characterization of a Morrow Valley-Fill Sandstone, Reservoir at Sorrento Field, Colorado*”  
*More To Follow*
- March-25 Ted Beaumont, Tulsa “*Application of Petrophysical Principles the “Hunt” for Overlooked Carbonate Pay*”
- April-1 Ray Sorenson, Anadarko Petroleum, Houston “*A Dynamic Model for the Permian Panhandle and Hugoton Fields, Western Anadarko Basin*”
- April-8 Terry Donze, Denver, “*New Method for SHALLOW Oil and Gas Exploration*”
- April-15 – Christine Hansen, Executive Director of the Interstate Oil & Gas Compact Commission “*Update on Federal Energy Legislation*” (see abstract on pg. 6)
- May 6 To Be Announced
- May 13 Dr. Mary Hubbard, KSU; “*Geology on a Plate Boundary: Basin Development in New Zealand*”
- May 20 To Be Announced

All technical meetings are held at 12:30 p.m. in the Bank of America Auditorium unless otherwise noted.

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.

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## EDITOR'S PAGE

---

Dear KGS members and friends,

I was between wellsite jobs thinking that I had best get cracking on the March-April issue of the *Bulletin*, only to find out that the dang project was almost finished. Seems the only thing missing was this letter and my cousin Tom's president's letter. So, I owe another big thanks to Rebecca Radford, our illustrious KGS Manager, and to Kimberly Dimmick-Wells, my able assistant editor for all their fabulous efforts on my behalf. Rebecca remarked to me that since they thought I was out on a well, she and Kimberly had considered calling Betty and asking her what we had been up to lately in an effort to fill this space.

Well, because you are all dying to know, I'll bring you up to date. We did travel to Hawaii again over Christmas and New Year's to see the kids. Betty got to eat lots of freshly dead, raw food from the sea and I had saltines. We went on a whale watching excursion where we got to see a school of dolphins and some whale tail. Nate and I played a round of golf at Ko Olina (Nate snuck me on at kama 'aina rates). For you mainlanders, that means "local" not tourist. It saved me 80 smackers. Mostly, however, we slept and ate too much, including a Chinese 9 course dinner.

My most memorable food was a request from Nate's sister-in-law for Okinawan sweet potato haupia cream pie. Okinawan sweet potatoes are purple in color. Haupia is a coconut gelatinous mixture. This concoction was covered with a cream topping with a bottom crust of crushed macadamia nuts. Good heavens was it

good! You are probably thinking that all we did was eat. Well, duh!

New Year's eve is a big deal for fireworks in Hawaii. Picture this. Various ethnic Asians, Polynesians, haoles, and Portuguese folks are igniting pyrotechnics (many of which are illegal), while in varying states of inebriation, all done on the sidewalks and streets in front of their homes. It was really cool, man.

I was going to write more, but cousin Tom rambled a bit (see below).

Bye for now, Wes

---

"What should we do in 2004 for our profession"

1. Continue or begin Mentoring Someone
2. If you have passion for a subject, write a paper or give a speech. Knowledge – PASS IT ON, as those geologists have, that have gone before us.
3. Renew a geologist to the KGS. Contact someone that has dropped their membership to the KGS and encourage them to re-up. Renew a dropped member by paying their dues
4. Join the digital library

If we don't do it, it won't get done!

John Wooden – "Success is peace of mind which is a direct result of self-satisfaction in knowing you did your best to become the best that you are capable of becoming."

If each of us will do our best each day during 2004, just think how much better off OUR profession and we ourselves will be when 2005 rolls around.

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## PRESIDENT'S LETTER

---



It is a busy time at the Kansas Geological Society & Library. Membership dues and library membership dues are rolling in every day (well maybe not everyday). Please don't forget to pay your dues, the money helps keep the doors open.

One hundred twenty-eight attended the annual banquet, which included members, wives, and a guest or two. Morris Korphage served as master of ceremony. As always, he kept everyone laughing and the program ended on time. Thanks Morris for a job well done. Larry Richardson presented the KE-STA award from the Kansas Geological Foundation to Sara Coddington. Jon Callen introduced and thanked the Bob Walter's family for their generous donation to the Walters Digital Library. Debra Fitzgerald presented 50-year membership lapel pins to William W. Hambleton, William D. Kendall, Jr., George Mueller, James W. Rockhold, Don D. Strong, Alfred W. Stude, and James Thompson. Thanks to all our 50-year members for their years of support and dedicated service to the KGS. A 75-membership plaque was presented to Mr. Jack Barwick, who was not able to attend. I am sorry to report he has since passed away. Our thoughts and prayers go out to his family. Our honorary membership this year was presented to Mr. Larry Skelton. Mr. Ernie Morrison introduced Larry to those attending. Larry honored us with a brief acceptance speech. Congratulations Larry. I want to thank Chairperson Marjorie Crane along with committee members Chellie Mazzullo and Doug Davis for a job well done. Also, thanks to Don Slottke (WSU student) who helped with tickets at the banquet.

The KGS website (<http://www.kgslibrary.com/index.html>) has been placed on a server used only by the KGS. Previously, the KGS & KGF website and the Walters Digital Library had been housed on one server. David Bayer, a contract I.T. person, has worked on the project. Please check it out and let us know what you think of it. As before, the bulletins are available online. As are the upcoming technical talks, etc. A downloadable membership application will appear in the near future. By the time you read this, it may already be online. Suggestions are welcome, as long as they aren't indecent % #\$\$@ or demeaning ;>).

The Walters Digital Library continues to gain members. Tell your geological friends of its benefits and ask them to join. Word of mouth is a good way to gain new members.

Earth Day Kansas sponsored by Boeing Wichita will be held at the Sedgwick County Zoo on April 22, 2004, from 9 a.m. to 4 p.m. Larry Skelton, Chuck Brewer, Bob Cowdery, and myself will man the booth. "Dinosaurs & Their Time" is the theme for the KGS booth this year. Larry has volunteered to assemble the fossils and other information for the KGS booth. Stop-by and visit if you attend Earth Day this year.

The AAPG Convention will be held in Dallas, Texas this year (April 18 -21). KGS will have a booth at the convention. Rebecca has indicated she could use some help at the booth. If you are willing to work the KGS booth, please contact Rebecca.

For those KGS members that didn't attend the KGS annual banquet. Here are some of my ramblings from the annual banquet. We rest on the shoulders of those who have gone before us. James Hutton (1726 - 1797) observed the Present is the Key to the Past. He formulated the principle of uniformity, which assumes that forces now operating to change the face of the Earth have worked continuously and rather uniformly through a large part of the Earth's history.

I submit to you that the Past is the Key to the present KGS as we know it. Those KGS members that have gone before us have changed the face of the KGS and made the KGS what it is today. We as geologists know that failures and successes move us forward. For those members past and present that have built the KGS to what it is today and to the future members of the KGS that will move it forward in the future, thank you.

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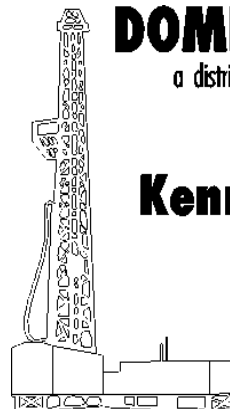
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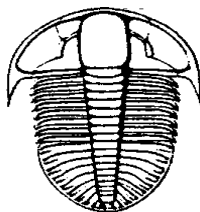
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**Bulletin committee members and PhD's in Paleontology are prohibited from entering.**



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# GEOLOGIST'S WIVES

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## OFFICERS

President—Kate Donnelly  
Vice-president—Peg Walters  
Secretary—Sue Cowdery  
Treasurer—Barbara Thompson  
Historian—Dianne DeGood

### March Meeting (With Petroleum Wives)

March 5th—6:30 PM

### Candle Club

Couples & Guests Party

### April Meeting

April 2nd

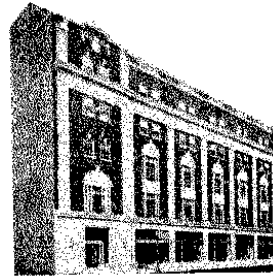
### Botanica Gardens

Lunch at 11:30 AM

Elect New Officers  
Guests Welcome

#### MEMBERSHIP REQUIREMENTS

Husband must belong to the Kansas Geological Society or be an acting geologist. Wives of deceased members are eligible to retain their membership. Officers and voting privileges shall be restricted to widows and wives of active Kansas Geological Society members.



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## MEMBER PROFILE: Neil Sikes

---



This is a very interesting story about one of our fellow geologists who has been a ‘Jack of all trades and a Master of all of them’. Neil has been a star football player, a member of a seismic crew, worked in an oil company research laboratory, managed Insurance company offices, a part of a successful independent oil company, full-time consultant, owned and operated an oil company, entrepreneur who formed a company to re-manufacture cartridges for laser printers. How many in the profession have such a varied and successful ‘track record’?

Neil’s journey thru this exciting career commences in Lubbock, Texas in 1932. His father was active in the grocery business and later in the insurance field.. Neil has an older brother, Noel, a petroleum engineer and who is retired and residing in Midland, Texas. He has a younger brother, Paul, now retired after holding a number of responsible positions with Sears. Paul now lives in Dallas.

All of Neil’s early education was in Lubbock culminating with his graduation from Lubbock High School in 1949 at the age of 16 (?). Neil then attended Coffeyville Jr.

along with his brother Noel. They both starred on the football team and have since been inducted into the Hall of Fame at Coffeyville.

Neil received his degree from Coffeyville in 1951 and in June of that year married Patricia Scott. Pat and Neil have 5 children: Melody, who manages apartment complexes in Dallas; Cynthia, a talented actress and who continues in the acting field. She is married to Bud Yorkin, a well-known producer. They reside in Los Angeles. Neil Jr., an ultrasound specialist at the Lawrence Hospital in Lawrence, Kansas; Susie, who received her Master’s degree at Wichita State, lives in Indianapolis with her husband who is a gastro-intestinal specialist; and Tad who is a truck driver and lives in Wichita. Pat and Neil have 10 grandchildren and 2 great-grandchildren.

Neil took a respite from education until the spring of 1953 when he was recruited by Jack Mitchell, who had been an assistant coach at Texas Tech in Lubbock, to play football at Wichita State. Obviously Jack Mitchell knew what he was doing as Neil was later included in the All Missouri Valley Conference team. He also coached freshman football in the fall of 1955. Although Neil had originally started in Civil Engineering he switched majors to Geology in part being influenced by his brother, Noel, who by this time had graduated as a Petroleum Engineer. Neil believes that Dr. Paul Tasch who was his instructor in Micro-paleontology probably exerted the greatest influence on him while enrolled at Wichita State. Some of his classmates were: Don Pate., Bill Nye, and J.C. Musgrove..

Following graduation in the spring of 1956, Neil joined Rayflex Exploration, a geophysical company where he worked for

6 months including a stint in Plentywood, Montana. Neil was then employed by Sinclair as a seismologist at the Research Laboratory in Tulsa. Neil left Sinclair to work for Kansas Paint and Color Company from 1958 until 1961, also in Tulsa. In 1961, he joined Southwest Life Insurance company in Tulsa, where he remained until 1963 when he departed to help form Life of America in Wichita. In 1965, he rejoined Southwest Life Insurance in Wichita and was employed there until 1967 when he was employed by Guaranty Life as District Manager and where continued until 1969.

In 1969, although he was still active in insurance he became active in the oil industry in conjunction with Sonny Watson and was with Carl Swan Drilling in the discovery of the Castor Pool in Gueda Springs. Neil continued these activities until 1972 when he became a full-time Geological Consultant. During this period he was mentored by a number of geologists including: Steve Powell, Bob Jinkins, and Harvey Gough.

While working a wellsite geologist, Neil recalls one test operated by Rains and Williamson in Southwest Kansas. Neil was on his way to the wellsite on what he terms a "cowpasture road" after several inches of rain had fallen. He came up over a hill and drove into four foot of water. He had to carry all of his equipment including a microscope over a mile into the location.

Neil formed Petro Gas Energies Inc. in 1975 and this company drilled several tests. In 1980, Neil began an association with Oil Capitol Corp. One of their most successful projects was farmout from Petroleum, Inc. of a seismic anomaly in Lane County. Petroleum, Inc had drilled dry holes on two similar anomalies in the same area. A successful development program followed the discovery. This set of circumstances provided material for a presentation by a local

geologist entitled "Mistakes I Have Made". Production developed by this company was sold in 1986 and the company was liquidated. From 1986 until 1988, Neil did some work as an independent consultant.

In 1988, Neil initiated a company, Laser Cartridge Specialties, which re-manufactured toner cartridges for printers. He sold this company in 1998 to one of the larger companies engaged in the same business. Since this sale, Neil has pursued his recreational interest of golf and travel. He continues his golfing activities, although he has endured operations on both knees and both hips.

Neil in the past has been active in on the Picnic and Golf committees of the KGS and has maintained memberships in the KGS, Shrine, Consistory and Crestview Country Club

Even though he has had careers in several fields, it is obvious that he enjoyed being a Petroleum Geologist, and he has some good advice for a young geologist entering the field. "Have patience, keep educating yourself, make use of all the technology available, and find an experienced geologist to serve as you mentor" One of his good friends to whom he would attach the label of "biggest character" now deceased KGS member Benny Singleton. Neil says he does not believe Benny ever purchased a pack of cigarettes, but managed to be a "chain smoker" by soliciting cigarettes from his many friends. Neil says that he was a lot of fun to be around.

Neil has set as a primary goal, "to live long enough to see his grandchildren grow and develop. It is sometimes hard to do justice in a short profile such as this to such an interesting individual who has had such an exciting career.

---

## MEMORIAL: J. Mark Richardson

---



With the death of Mark Richardson on February 2, 2004, the Kansas Geological Society lost one of its Past-Presidents and a valuable member. Mark had the reputation of being one of the “better oil finders” in Kansa, and one of the shrewdest traders, in the best sense of the word.

Mark’s birthplace in 1921 was Ozark, Arkansas, but when he was six his family moved to a farm near Poteau, Oklahoma. There he was raised with four siblings.

Mark, and his brother Paul, who later became a Stanolind geologist, developed an early interest in the geology of the area. Often, while hunting in the Ouachita Mountains near Poteau, they would note stains along faults. These with other geological phenomena in the area helped shape their early decisions to pursue geological careers.

It was during his early years, that he developed the trading skills that were later to serve him so very well as an independent operator. Mark recalled that when he was about eight years old, he saw a gypsy beating a donkey. After a heated exchange with the gypsy, he arranged the trade of two pet chickens for the donkey. Then, three months later, he observed a farmer beating a mare that refused to work, according to the farmer. Mark then traded the

donkey for the mare and three months later the mare gave birth to a colt.

Mark attended a country school near Poteau for his first eight grades. At school he was challenged by his sister, Jean, who enrolled in the first grade when Mark was already in the third grade. Jean was soon placed on the same level and later graduated from high school at the age of 15.

After graduating from high school at Howe, Oklahoma in 1939, Mark joined the Air Force. He trained at March Field, California, Fresno Air Base and Sioux City Iowa. He embarked from New York City for the European Theater where he served as a crewman on a B-17 flying out of England and France. Mark received his discharge at Ft. Smith Arkansas in 1945.

He then enrolled in geology at the University of Oklahoma where he graduated with a B.S. degree in 1948. He spent some time working towards a Master’s degree but did not finish the requirements. While at OU, Mark encountered Dr. Carl Moore, Head of the Department, who taught him “the value of the microscope” which he later put to good use.

In 1948, Mark married Esther Clothier, of Sylvia. They have a daughter, Kim, who in the recent past worked in Mark’s office. Mark also has two step-children.

After graduation Mark joined Mid-States Oil Company in Wichita, and in 1957 was transferred to Oklahoma City. When Mid-States was acquired by Tenneco, he was transferred back to Wichita as District Geologist. Mark’s skills as a geologist resulted in the first significant oil discovery by Tenneco after they commenced operations in Kansas.

In 1960, Mark left Tenneco to become a consulting geologist. From 1960 until 1966 when he formed his own operating company, he was the wellsite geologist for a number of companies including H. L. Hunt and Pan American.

Mark’s keen knowledge of business served him well in other areas of endeavor. Over the years he accumulated 2500 acres of irrigated

land in western Kansas. The farming operations progressed to the point that they were consuming about 50% of Mark's time in later years.

Mark served both his profession and the community. As an AAPG member he worked on sectional meetings and was a member of the House of Delegates in 1988. He served the Kansas Geological Society as Vice-President, President in 1980 and later as advisor to the Board. He was a member of the Kansas Independent Oil and Gas Association, the IPAA, and the Chamber of Commerce.

This is a memorial to a man who so ably fit Louis Sebring's (a geologist formerly in Wichita with Champlin) definition of an "oil finding geologist" – he must be a scientist and a salesman, a prospector and a promoter, a researcher and a hustler".

The family has designated the Kansas Geological Foundation as a memorial to Mark.

---

Tribute to J. Mark Richardson

By Willis D. Nigh  
As given at his funeral service  
February 7th, 2004

Mark has been a friend for nearly forty years. After I changed careers twenty-five years ago, and entered the oil and gas business, he became, in effect, a mentor to me. He gave me the encouragement I needed and helped me weather some early failures. It was never done in a direct way, but rather in a subtle or indirect way, so that I never quite realized he was actually helping me. There were no pep talks nor hot tips. In retrospect I now realize that he had this unique ability to make you feel that you were his equal, smarter, more important, or more successful than you really were.

I'll give you an example. He always greeted me, whether it was on the phone or the street or at his office, with "Hi Doctor." I always wondered why he said that. Perhaps because I had been a teacher. But now I know it was his way of making me feel important or as smart as he

was.

Another example. He would often say when we met by chance or on the phone, "Come by the office sometime, I want to pick your brain." There really wasn't much he could learn from me. But again, I now realize it was his way of making me feel confident, knowing that confidence was more important to success in this business than hot tips.

Sometimes I would stop by his office to ask him questions. But before we had talked for long, he would be asking me questions. How clever he was in making me feel good about myself, I now realize. So once again, I would leave his office upbeat, encouraged, and full of confidence, not realizing that he had actually helped me.

And he made other people feel that way too. As many of you know, most of Mark's oil and gas operations were in Kiowa County. He was well known there, admired and respected by dozens of farmers, ranchers, and townspeople, as well as the people who drilled and serviced his wells and the people who provided the equipment and supplies.

I am still fairly active in Kiowa County and when I am there, someone from the community will nearly always ask me about Mark. And anytime I mention his name among oil field workers, there is always someone in the group who knew him, or remembers him or knows of him, and it is always evident that they all hold him in high esteem.

It's clear Mark showed them that same concern and respect he always showed me. For him, that concern and respect was genuine and effective.

It still makes me proud to say that I knew him and that he was a friend.

---

*The Kansas Geological Society  
Wishes to thank the following people for  
Their generous donations to support the banquet*

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**Margaret Walters**

\* Those who donated to support a geology student's attendance

*The Following Wichita State University Geology Students would like to thank  
those who donated money towards the purchase of student tickets:*



Marjorie Crane  
Toyly Abdullayer  
Andy Haner  
Alan Heckel  
Don Slotke  
Jaci Venhaus  
Shawn Hamm  
Daryl Lederhos  
Robert Hendrix  
Mark Davis



Monica Turner-Williams





**Larry Skelton receiving his award  
as Honorary Member**

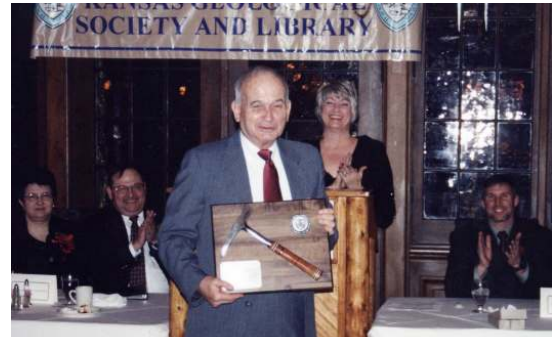


**50 Year Members**

From left: Daniel Merriam receiving for William Hambleton, Jim Thompson, George Mueller and Don Strong



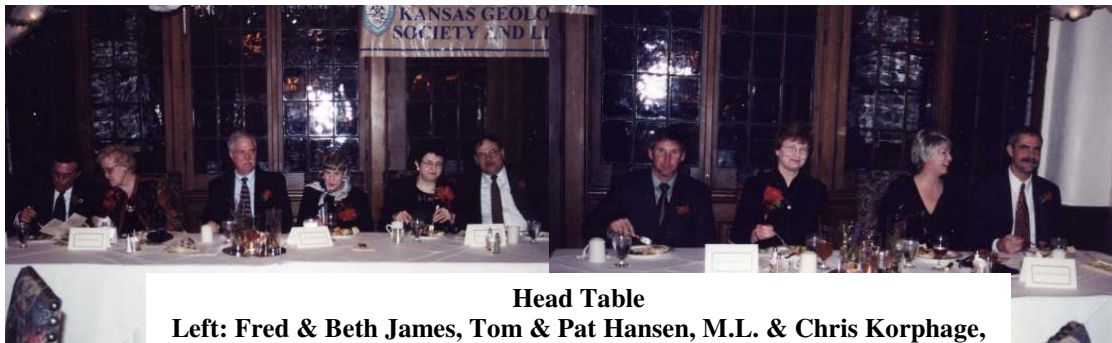
**KGS Past President**



**Bob Cowdery receiving Special Award on  
behalf of John "Jack" Barwick.  
For 75 years of membership in the KGS**



**Honorary Members and 50 Year Members**



**Head Table**

**Left: Fred & Beth James, Tom & Pat Hansen, M.L. & Chris Korphage,  
Tim & Kathy Pierce, Debra & Brian FitzGerald**

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## ABSTRACT

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**Christine A. Hansen**

Christine A. Hansen is executive director of the Interstate Oil and Gas Compact Commission (IOGCC), a position she has held since July 1993. The IOGCC is an organization of 30 oil and gas producing states which promotes conservation and efficient recovery of domestic oil and gas resources. The IOGCC is funded and supported by the member states and is supervised by the governors of those states.

Hansen is a lawyer and is a member of the National Petroleum Council, the Gas Technology Institute Advisory Board and the board of the Petroleum Technology Transfer Council. She was selected as "Woman of Achievement for 1995" by the national organization Women in Energy, and received a "1997 By-liner Award" from Women in Communication, recognizing her newsworthy achievements on behalf of the oil and gas producing states. During the 1996 Global Conference of the International Women's Forum, Hansen was recognized as a "Woman That Makes A Difference" by the IWF membership.

Prior to becoming Executive Director of the IOGCC, Hansen was in private law practice and had been a senior executive officer with two large utility companies. For seven years, she served as one of three Iowa Commerce Commissioners, regulating public utilities in that state.

Ms. Hansen has testified numerous times on energy matters before committees of the United States Senate and House of Representatives, as well as offered information to a variety of state and federal agencies. She has been involved in government relations for several organizations.

Her background also includes five years as a newspaper political reporter and five years as an agent of the Federal Bureau of Investigation.

**Ms. Hansen will speak to the KGS on Thursday, April 15, 2004, Bank of America.**

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## FROM THE MANAGER'S DESK

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Dear Members,

January and February have been outstanding months for the KGS Library. We have been very busy!

By the time you receive this Bulletin, we will be past the due date deadline for KGS dues. If you have not paid them by now, you will be dropped from our membership rolls. We are such a small staff, it is very difficult for us to keep reminding all of you to pay your dues. I know the KGS has been somewhat slack on enforcing this in the past, but if you read your by-laws, February 28th is the cut off date to have your dues in. This year you have one extra day. We have sent out one reminder letter with statements, after that, you are on your own. All of you who do get your dues paid on time, we really appreciate it and you should know that it saves your Society money to not have to send out a mailer reminding people to pay. If you are a Library member, and have not renewed by now, there will be no prorating for the year as has been in the past. When you renew, your membership for the Library will run from anniversary date to anniversary date. If you have concerns about this, please give me a call or stop by to see me.

We have an addition to our staff.

**David Bayer** is working for us part-time on a contract basis to handle all of our IT work. David has a master's degree in electrical engineering and has worked in the business of computer hardware and software for various companies. Please check out the KGS website for some of the changes that he has initiated. We are open for any suggestions of what you might like to see on the KGS website. We have some more ideas coming in the near future to incorporate.

The Walters Digital Library is up and running smoothly. We hope to be gaining more members as we progress through the year. If you haven't tried it out yet, get on the demo and give it a whirl. Those who are using it are loving it! If you want any assistance, stop by the Library or call and I'll show you how it works.

We also have another new person working for the KGS. **Don Slotke**, WSU geology major, is our new Thursday night person. Don is very adept at running the KIP machine and is helping us in many ways with his experience. Thanks Don!!

I want to give a special thank-you to **Marj Crane** for her work and dedication on making this year's banquet such a success. It was a big task for a graduate student to take on being the banquet chairperson and she did a wonderful job. Coming to her aid was **Chellie Mazzullo and Doug Davis**. Please let these people know that you appreciate them when you see them.

Upcoming events: Check out the enclosed info on the KGS Fishing Tournament coming in May. Also, AAPG Convention in Dallas, April 18-21. Please contact me if you can work the KGS-KGF booth at any time during the convention.

As I write this, I think Spring might be on it's way. Happy prospecting!

*Rebecca Radford*



## KGF TAPE REVIEWS

**Lewis and Clark – The Journey of the Corps of Discovery** 240 Minutes  
PBS Home Video  
(Two tapes)  
(This tape was donated by Elbie McNeil)

The tape tells the remarkable story of the entire Corps of Discovery—not just the two captains, but the young army, French-Canadian boatmen, Clark's Afro-American slave, and the Shoshone woman named Sacagawea.

**Montserrat's Andesite Volcano**  
52 Minutes  
Living Letters Production

This tape documents the eruption of this spectacular volcano from its beginnings in 1995. It also looks into the volcanic processes of andesite volcanoes.

### Kansas Geological Foundation Items for Sale

Several sets of geological data and publications  
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## Memorial – John S. “Jack” Barwick

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With the passing of Jack Barwick on February 4, 2004 at the age of 100, it might be said that a “legend” has departed from our ranks. He was recently honored by the Kansas Geological Society Banquet for having been a member for 75 years.

Jack was born in Guthrie, Oklahoma in 1903. The family resided in Guthrie after Jack’s father made the famous “run” in 1889 and later became a state legislator when the state capitol was located in Guthrie.

Jack graduated from high school in Guthrie at the age of 15 and received a degree in Engineering Geology from the University of Oklahoma. Over the years, Jack supported the Guthrie High School and the University of Oklahoma by providing scholarships for Guthrie High School graduates at the University.

His first employment was with Empire Oil and Gas Company, later to become Cities Service Oil Company. In 1926, he joined Skelly Oil company as the company was increasing its exploration efforts in Kansas. Also in 1926, Jack married Gladys Casey, and to this union were born two daughters, Dorothy and Betty. Gladys passed away in 1962.

In his early days in the profession, Jack had the opportunity to associate and argue with such notable figures in the geologic profession as: Sidney Powers, Fred Bush, later Chief Geologist of Sinclair, N.W. Bass, Dr. R. C. Moore and others.

In 1930, Jack made the decision to leave Skelly and become an independent, as he thought the worst of the depression was over. During the next five years, Jack had some small successes developing gas fields in Eastern Kansas.

Jack returned to Wichita in 1935, and several partners formed Ranger Oil Company at the urging of George Collins, a prominent Wichita attorney. Ranger Oil eventually fell apart, and Jack continued to assemble drilling prospects on his own. He was the wellsite geologist on a test being drilled on one of his prospects in Ness Co. on December 7, 1941.

In the Spring of 1942 when he was 38 years old he applied for a direct commission in the Army Air Corps. He received a commission as a 1<sup>st</sup> Lieutenant assigned to Photo and Combat Intelligence. After going through a six-week training session at Miami Beach, and another six-weeks at the Intelligence School in Harrisburg, he was assigned to a bomber squadron in Montana and was soon on his

way to North Africa. He served with the Ninth Air Force in North Africa, and with the 15<sup>th</sup> Air Force in Italy. He returned to Wichita after his discharge in 1945 with the rank of Major.

Once again he began assembling small blocks of acreage as drilling prospects, and as he later stated, “making a living, but not a great one”. In 1945, a former boss offered him the opportunity to work for the Chilean oil monopoly, Empresa Nacional del Petroleo. Jack signed a six month contract with that company. His stay in Chile was extended to seven years and included a period when he was chief geologist. He did find that “the Chilean politicians needed some Americans around to blame if anything went wrong.”

Jack determined that his family had been away from the United States for too long, so he returned to Wichita. At this time, he joined Musgrove Petroleum. After two years, Pierce Musgrove, who was raising money while Albert Abercrombie was running the company, decided to sell the company. The assets were sold to the Tandy Corporation and essentially the company was dissolved, thus Jack was out of a job.

For three years he operated a company with Gordon Koelling, but in 1961 he and Gordon split the assets of the company. From that time on he managed his investments, but maintained an interest in geology. Jack, at the time of his death, had been a member of the Kansas Geological Society for 75 years and had been a member of the AAPG since 1924.

In 1967, Jack married Dortha Froebe, and since then, they have resided in the Tallgrass area of Wichita. For many years Jack served Eastminister Presbyterian Church as Financial Secretary

Jack was a man of very definite opinions, and in his self-description said that he was “argumentative and outspoken”. When interviewed approximately 5 years prior to his death, he was still taking exception to the correlations of some very respected geologists.

This memorial has been an attempt to describe the very “full life” of a man who lived 100 years and for a large portion of that life pursued his profession with intensity and vigor.

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## OVERVIEW OF POROSITY EVOLUTION IN CARBONATE RESERVOIRS: Part II

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S. J. Mazzullo  
Department of Geology  
Wichita State University

### ALTERNATIVE ORIGIN OF SECONDARY POROSITY: THE MESOGENETIC MODEL

Since the late 1970s-early 1980s, geologists began to suspect that not all secondary dissolution porosity in carbonate rocks forms or formed solely beneath unconformities by freshwater dissolution in either the eogenetic or telogenetic environments (e.g., Bathurst, 1980; Scholle and Halley, 1985; Choquette and James, 1987; Moore, 1989). Rather, there was growing realization of the significance of, and processes controlling, secondary dissolution porosity formation (and porosity occlusion) in the deep-burial environment B which is what Choquette and Pray (1970) referred to as the *mesogenetic environment*. Two important points in this regard are the facts that: (1) not all porous carbonates are associated with unconformities; and (2) specifically, there are a number of examples of porous and permeable carbonate rocks deposited in deep-water settings and which later were deeply buried and never subaerially exposed. Hence, meteoric exposure at any time after deposition has been ruled out for such rocks (e.g., Mazzullo and Harris, 1991; Mazzullo, 1994). Therefore, post-depositional diagenesis and the formation of secondary dissolution porosity in such rocks must have occurred in an environment *other than* the meteoric eogenetic or telogenetic environment. Furthermore, if we are exploring for hydrocarbon reservoirs in the subsurface, then those reservoirs must have resided in the subsurface, variously shallowly or deeply buried, for long periods of time. Insofar as carbonate diagenesis never ceases, any diagenesis that occurs in the mesogenetic environment overprints earlier diagenesis, including that which may have occurred, for example, in subunconformity, meteoric eogenetic or telogenetic environments. Geologists have since come to realize that deep-burial diagenesis has significantly contributed to secondary dissolution porosity and permeability evolution in many carbonate hydrocarbon reservoirs (e.g., Mazzullo and Harris, 1992).

As discussed above, in order for dissolution of any carbonate rocks to proceed, they must be exposed to fluids that are undersaturated with respect to calcium carbonate. That is easy enough to do in the subunconformity meteoric environment because rain water, the ultimate source of near-surface freshwater, is undersaturated. In the mesogenetic environment, however, most connate fluids are brines that typically are saturated or even supersaturated with respect to calcium carbonate, which means they are not capable of dissolving carbonate rocks and creating secondary porosity. Rather, such fluids tend to precipitate carbonates in the form of calcite or dolomite cement, and in some cases, they may be capable of dolomitization. How, then, can carbonate dissolution and porosity formation proceed in the deep-burial environment? In other words, how are fluids undersaturated with respect to calcium carbonate generated in the mesogenetic environment?

Studies of porosity evolution in sandstones, combined with studies of organic matter maturation and hydrocarbon generation in source rocks (e.g., Foscolos, 1984; Surdam et al., 1984; Kharaka et al., 1986; Lundegard and Land, 1986; Meshri, 1986; Sassen and Moore,

1988), have provided answers to these questions which have been applied to carbonate reservoir rocks, both limestone and dolomite, around the world (e.g., Druckman and Moore, 1985; Heydari and Moore, 1989; Mazzullo and Harris, 1992). It is known that carbon dioxide, hydrogen sulfide, and great quantities of organic acids are generated during the maturation of organic matter to hydrocarbons in buried source rocks (Figure 11). As these gases and organic acids are expelled from the source rock, the evolved CO<sub>2</sub> combines with subsurface water to produce carbonic acid and the H<sub>2</sub>S similarly combines with water to produce sulfuric acid. Together, these acids and associated organic acids can migrate great distances laterally as well as vertically (Figure 12; e.g., Hanor, 1987) to dissolve buried carbonates just ahead of migrating hydrocarbons. Likewise, once the acids are spent, subsurface fluids can then precipitate carbonate cements, which is why many examples of such cements contain hydrocarbon inclusions (e.g., Burruss et al., 1985). In given rocks, secondary dissolution porosity formation can alternate with cementation many times to result in complex diagenetic histories of reservoirs (e.g., Moore and Druckman, 1981; Mazzullo and Harris, 1989; Moore, 1989). Because such evolved subsurface fluids can migrate great distances both laterally and vertically, they can affect carbonates that were or are not deeply buried. I have come across several wells in Ness County, for example, where there is a great concentration of pyrite and minor sphalerite at the top of the Mississippian, which is at only about 4100 feet below the surface, clearly not in the deep-burial environment (at least, not today). These minerals may have been emplaced along the pre-Penn unconformity by fluids that evolved within and subsequently migrated out of the Anadarko Basin.

Porosity formed in the mesogenetic environment is represented by the same types of pores that can form in the eogenetic and telogenetic freshwater environment (Mazzullo and Harris, 1992), including even cavernous porosity (e.g., Hall, 1990; Hill, 1992), which otherwise is generally known as Aburial karst. Therefore, an important point to remember in this regard is that the diagenetic environment in which porosity formation occurred can not be determined on the basis of the pore types present in a reservoir! How, then, does one recognize porosity formed in the mesogenetic environment? The answer to this question is *‘With careful, detailed petrographic study of thin sections, often combined with analysis of carbon and oxygen isotopic values of carbonate cements associated with suspected mesogenetic porosity.* For details, refer to the papers by Moore and Druckman (1981), Druckman and Moore (1985), Heydari and Moore (1989), Moore (1989) and Mazzullo and Harris (1991, 1992), and the many papers cited therein. There are, however, some readily visible clues to the mesogenetic origin of porosity in carbonate rocks that can be identified in cuttings and core samples. For example: (1) porosity along and associated with stylolites or which cuts across stylolites (Figure 13). As pressure-dissolution features, stylolites form most commonly in the deep-burial environment. So, if the timing of porosity formation can be determined by the law of cross-cutting relationships to be *younger* than the stylolites, and the rocks are still buried, then porosity formation must be the result of mesogenetic dissolution; (2) pores that cut across cements that contain hydrocarbon inclusions; (3) pores that cut across or which are intimately associated with fluorite, metal sulfides such as galena and sphalerite, and sometimes pyrite/marcasite, which are common Mississippian Valley-type precipitates from migrating deep-basinal fluids (e.g., Cathles and Smith, 1983; Clendenin and Duane, 1990); and (4) pores that cut across saddle dolomite (Figure 14). Saddle dolomite, otherwise known as baroque dolomite or pearl spar”, is a cement or replacive mineral that is readily identified by its characteri-

tic curved crystal faces, common opaque-white color, and relatively coarse crystal size, that commonly forms in the deep-burial environment (Radke and Mathis, 1980). Hence, if pores cut across saddle dolomite, then porosity formation must be mesogenetic if the rocks are still buried. Are there examples of mesogenetic porosity in carbonate reservoirs in Kansas? Undoubtedly, but specific published instances where mesogenetic porosity is present are not available.

### MICROPOROSITY, PINPOINT POROSITY, AND CHALKY POROSITY

The term *microporosity* refers to any very small pores that can be recognized only with the aid of a high-powered binocular microscope or thin section (Choquette and Pray, 1970; Pittman, 1971). Micropores, otherwise known as pinpoint pores, may variously represent: (1) birdseye pores in tidal flat deposits; (2) intraparticle pores within small particles; (3) intercrystalline pores between dolomite crystals or between calcite cement crystals; (4) intercrystalline pores within the nuclei or cortices of oolites; or (5) intracrystalline pores within individual dolomite or calcite cement crystals. In some cases, whereas matrix microporosity/pinpoint porosity may not be very permeable for oil, it very well may be permeable enough for natural gas (e.g., Roehl, 1985; Ruzyla and Friedman, 1985). *Chalky porosity* is a term that refers to microporosity that commonly forms in highly weathered or otherwise highly diagenetically altered carbonate rocks (Pittman, 1970; Reeckmann and Friedman, 1982) that, as a consequence of being strongly altered, are very soft. Although true chalks (i.e., those limestones of Cretaceous to Paleogene age that are composed dominantly of coccoliths) commonly contain microporosity, the presence of chalky porosity does not necessarily indicate that the rocks under consideration are chalks. In fact, tripolitic cherts commonly have microporosity, and because the rocks are relatively soft, such porosity can be referred to as chalky. I point out that microporosity, and specifically chalky porosity, can form in carbonate rocks (and cherts) beneath unconformities as well as in deeply buried rocks, and as such, their presence does not necessarily imply the existence of a stratigraphically-nearby unconformity.

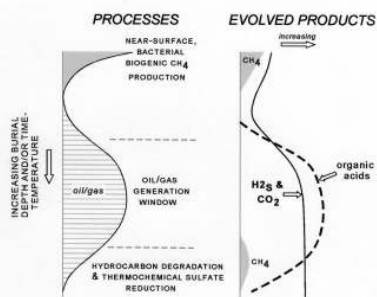


Figure 11. Processes and products of hydrocarbon generation. Relatively minor amounts of methane (CH<sub>4</sub>) are generated during shallow burial by bacterial processes. As organic matter in source rocks matures and generates oil or gas, copious amounts of hydrogen sulfide (H<sub>2</sub>S) and carbon dioxide (CO<sub>2</sub>) are generated, along with organic acids.

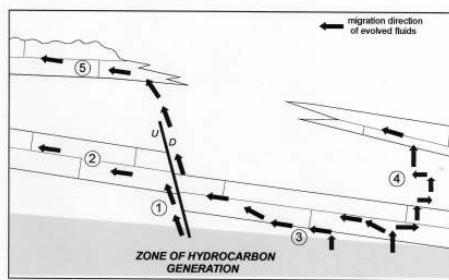


Figure 12. Carbon dioxide, hydrogen sulfide, and organic acids evolved during hydrocarbon generation mix with connate waters in the burial environment to produce acids. These acidic fluids can migrate both vertically and laterally for great distances, even affecting carbonate rocks that are not deeply buried (5). Acidic fluids can migrate along faults (1), along bedding planes or porous strata within beds (2), along formational boundaries (3), or upward along fractures through otherwise non-permeable beds ("cross-formational flow" -- 4).



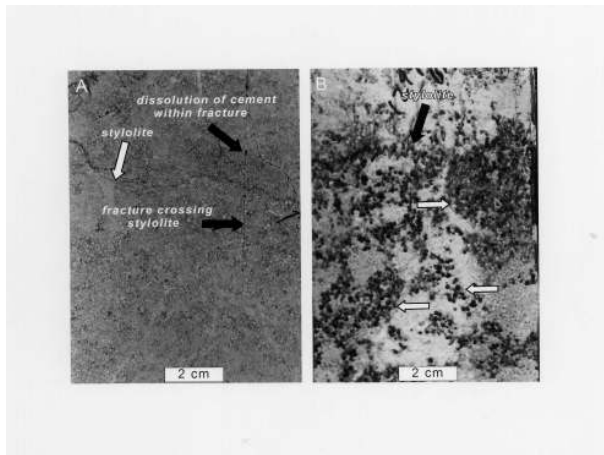


Figure 13. Mesogenetic porosity. A – Fractures, which cross and therefore post-date stylolites, with porosity from the dissolution of post-fracture cement. Adjoining this area is selective dissolution of oolites. B – Oomoldic porosity adjoining and post-dating the formation of a stylolite.

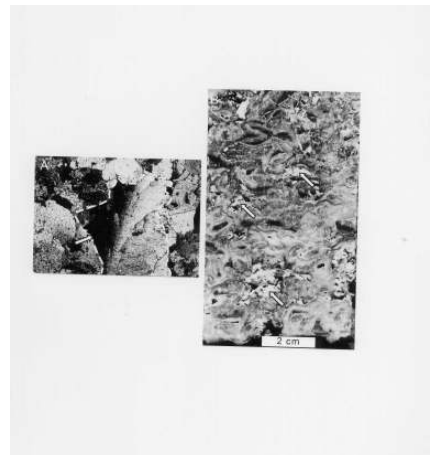


Figure 14. Mesogenetic porosity. A – Thin-section photomicrograph of curved saddle dolomite (with typical undulose extinction) filling a pore. B – Core slab showing coarse crystalline saddle dolomite that has been partially dissolved to exhume (vuggy) porosity.

## CONCLUSIONS

Secondary porosity in carbonate rocks, in both limestone and dolomite, can be formed by: (1) freshwater dissolution either in the subunconformity meteoric, eogenetic or telogenetic environment, or; (2) by dissolution by chemically aggressive subsurface fluids, generated during maturation of organic matter in source rocks, in the deep-burial (mesogenetic) environment. Although pore types formed in these environments are similar, their origin often can be determined by careful observation, thin-section petrography, and stable carbon-oxygen isotope analysis.

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## BOOK REVIEW by Robert Stozle

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### **“The Long Line Kansas Skinner” by John Hogoboom published by Butler County Printing, price \$15.00**

These two books cover an enormous span of time and circumstance and style. It is a compliment to the science and profession of geology that both could and should be of interest to the membership. The first is essentially a first person history of John Hogoboom that focuses on his youth and the earliest days of the Nemaha Anticline drilling and production. “Beyond” is a finely produced coffee table book of images from the various robotic missions to study the planets of our Solar System. I can recommend them both.

John Hogoboom grew up in and around El Dorado and Augusta and was five years old when oil was discovered three miles northwest of El Dorado on October 5, 1915. His story is roughly written and not well proofed, but it does a nice job of telling the reader what it was like to make a living with a team of working horses, both in and out of the oil fields. I imagine the work and effort required then would not be possible for most of us.

Hogoboom stayed in the oil patch and ran a successful oil field trucking and hauling business and was well known to anyone working the East ranges. His story has the ring of the “dog house” tales that all “geos” will immediately recognize and appreciate. The expertise and work with horses that he describes is, today, a lost art that required an almost psychic level of understanding between human and horse. John Hogoboom knew and loved horses and the hard, demanding and dangerous work of the oil fields; his description of moving a Star drilling rig through the Kansas mud with 20 two horse teams and the other stories in the book bring to life a part of oil field history that should not be forgotten. A personal note: John Hogoboom died August 16, 2003 at the age of 93, the first Kansas death attributed to the West Nile virus--a disease also fatal to the horses he loved.

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### **“Beyond” “Visions of the Interplanetary Probes” by Michael Benson published by Harry N. Abrams, Inc., price \$55.00**

“Beyond” is the best compilation of the images and science acquired from the various planetary missions that I have seen. The book is well produced and the author has a scientist’s attitude that honors the data and imagery. The pictures are both beautiful and scientifically accurate. There are brief introductions to and explanations of the images of each planet except Pluto (we haven’t gone there yet) as well as the Sun and Moon. As with any good science, the book leaves more questions than it answers, but it also presents what is known about the planets in a concise, very readable manner.

Most geologists are familiar with air photo stereo pairs or Landsat imagery and we all make a living finding the patterns in the chaos and understanding the earth’s systems. Planetary geologists use the same techniques to eventually understand that the sulfur volcanoes of the Jovian moon Io are driven by gravitational heating or that the arcuate cracks on Europa probably indicate liquid water below the surface ice. There are enough really strange pictures to confound the most inquisitive among us. Anyone interested in exploration or science will be moved by the stunning images and the commentary on the robots that produced them. It isn’t possible to look at this book and not think that we should be doing more of this. Or, to borrow from an 11 year old when asked “Why is the Human on Earth?”, ...“I believe the universe, with all it’s wonder and balance and logic, needs to be marveled at, and we are the only species (to our knowledge) that has the ability to do so.”

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# KANSAS GEOLOGICAL FOUNDATION

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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.

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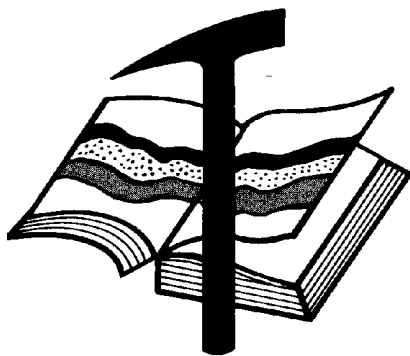
**New Slides on Energy from AAPG** - 14 slides are available from the Speaker's Bureau on energy. Please contact Bob Cowdery at 267-9030 to check out the slides.

The Kansas Geological Foundation was founded in March of 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.

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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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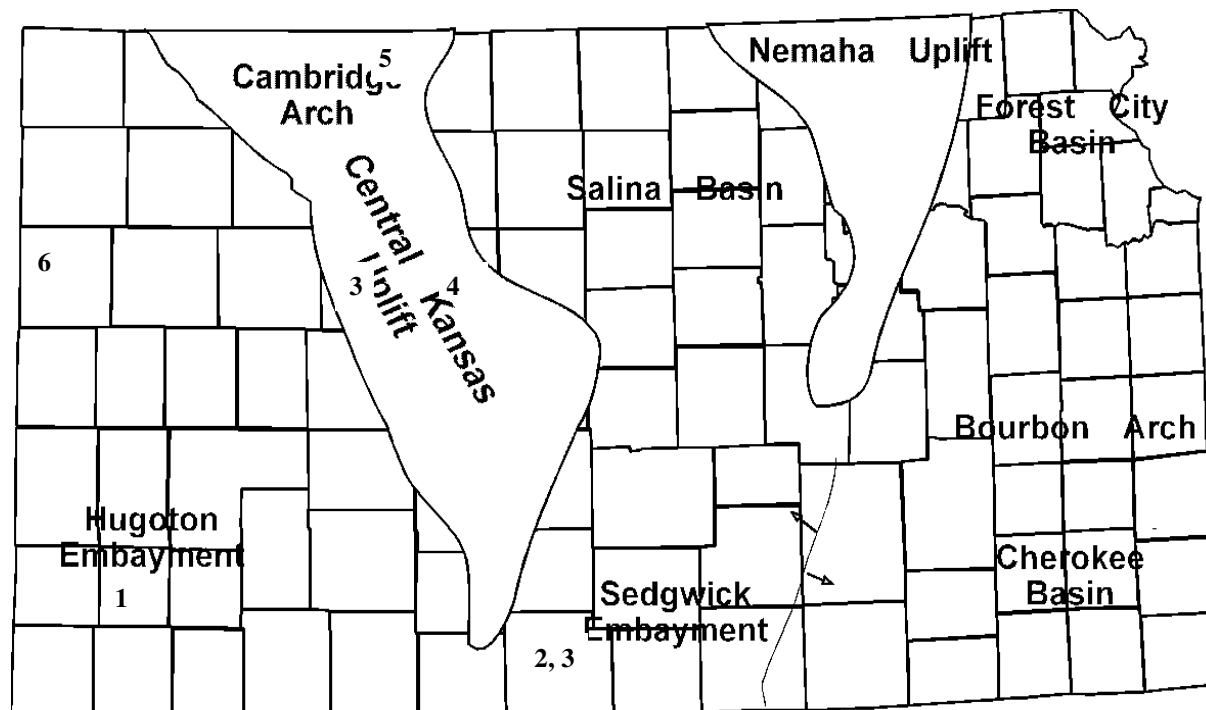
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# EXPLORATION HIGHLIGHTS

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By John H. Morrison, III  
Independent Oil and Gas Service



**(1) Anadarko Opens New Oil Field**  
(IOGsi weekly News 01/12/04) - Anadarko Petroleum Corp., of The Woodlands (TX), reports the discovery of new deep oil deposits at a wildcat site in Grant County, southwest Kansas. The Lighty 'A' #1, located 350 ft. from the south line and 660 ft. from the west line (app S/2 SW SW) in section 21-T29s-R35W, was put on pump on July 25, 2003 at an undisclosed rate. The well produced 147 barrels of oil in August, according to State records. The producing zone has not been reported, however, both the Morrow and Mississippian Chester zones were primary objectives of the 5700 ft. deep well. The Lighty 'A' well lies nearly 1-3/4 miles northwest of Anadarko's HJV Lahey 'A' #1 in section 34 which was completed as a Morrow oil producer earlier this year and established the Ryus Northwest Field. The Lahey discovery has produced over 27,000 barrels of oil thus far. Anadarko's new unnamed field is situated 3/4 mile north and 2-3/4 miles west of the town of Ryus, or 11-1/2 miles southeast of Ulysses.

**(2) R & B Oil & Gas Opens New Gas Field**  
(IOGsi weekly News 02/02/04) - R & B Oil & Gas, Attica (KS), has discovered new Shawnee (Toronto Limestone) gas reserves at the Chain Ranch #1, located 70 ft. south of C W/2 W/2 E/2 in section 31-T30s-R11W in Barber County. Operator hired Pickrell Drilling tools to drill the wildcat well to a total depth in Viola of 4739 ft. Top of the Toronto zone was logged at 3675 (-1905 KB). A drill stem test covering an interval from 3635 to 3714 ft. tested a maximum gauge of 103.7 Mcf gas daily through a one-quarter inch choke at the end of the second open period. A total of 120 ft. of gassy mud was recovered. Shut-in pressures were 1357 and 1344 psi with flow pressure building from 31 to 95 psi. After landing four and one-half inch casing at 3920 ft., the Toronto was perforated with four holes per foot from 3677.5 to 3681.5 ft. The zone was then treated with 250 gallons of FE acid with additives. Good show of gas (gauge not reported) was tested on swab down. The well is currently shut-in awaiting connection to the pipeline. Discovery site lies over one mile east of Mississippian oil production in the Amber Creek



Field, but is over four miles from closest known Shawnee pay in the vicinity. The new unnamed gas field is located 6-1/2 miles north of Medicine Lodge, Kansas.

**(3) American Energies Produces Oil at Barber Wildcat (IOGsi weekly News 02/02/04)** - New Mississippian oil reserves have been discovered in Barber County by Wichita-based American Energies Corporation. The firm's Sill 'A' #2, spotted in C W/2 W/2 NE of section 2-T32s-R13W, has been put on pump at an undisclosed production rate. The well, located 6 miles west of Medicine Lodge, Kansas, was drilled to a total depth of 4601 ft. by Pickrell Drilling tools. Mississippian production comes from around a depth of 4200 to 4300 ft. at nearby oil and gas producers in the Medicine River Southwest Field which lies two miles to the southeast. American Energies' new field remains unnamed at this time.

**(4) Hertel Oil Company, LLC Completes Discovery (IOGsi weekly News 02/02/04)** - Hertel Oil Company, LLC, Hays (KS), is pumping 35 barrels of oil per day from Arbuckle formation at the Hoffman #1-8 wildcat well in Ellis County. The well discovered an isolated feature one-half mile south of producing wells in the multipay Younger Field at site located in approximately SW NW SE in section 8-T14s-R17W. Exact pay depth is unknown, however, the nearby producing wells to the north found pay at around 3540 to 3560 ft. The Hoffman well was bottomed at 3572 ft. using Discovery Drilling rig. The unnamed field is located 2-1/4 miles north and one mile east of Munjor, Kansas.

**(5) Black Diamond Oil Reports IP on Discovery Well (IOGsi weekly News 02/02/04)** - Black Diamond Oil, Inc. of Hays, Kansas is pumping 15 barrels of oil and 80 barrels of water per day at the Vandiest #1, a recent new oil discovery made last year in Norton County. The well is spotted 180 ft. north of C NW NE NE in section 33-T4s-R22W, about 1-1/2 miles north and 3 miles west of the town of Densmore. Operator completed the well in the Lansing-Kansas City formation through perforations shot at one hole per foot from 3598 to 3600, 3610 to 3612 and 3630 to 3632 ft. All zones were acidized together with a total of 1500 gallons of mud cleanup acid. Discovery Drilling tools bottomed the well at a total depth of 3725 ft. The new discovery establishes the Hansen Estate West Field. Elsewhere in Norton County, Black Diamond has expanded production in the Hansen Estate Northwest Field and added new pay source with the successful completion of their

Sansom #4. Located 870 ft. from the north line and 370 ft. from the east line (app. SE NE NE) in section 28-T4s-R22W, the well was placed on the pump in September '03 for 15 barrels of oil and 2 barrels of water per day. Kenneth Vehige, President and well site geologist, called the log top of the Lansing-Kansas City at 3456 (-1194 KB). Single, limited-entry perforations were shot at 3600, 3622 and 3633 ft. The well lies about one-quarter mile west of Black Diamond's Sansom #1 in section 27 which was completed for 15 barrels of oil per day from Arbuckle at 3698 to 3700 ft. The #4 well ran seven feet lower on structure. Field area is located 2-1/2 miles north and 3 miles west of Densmore.

**(6) Pelican Hill Oil & Gas Completes Stepout (IOGsi weekly News 02/02/04)** - Upper Morrow Sand oil and gas production has been extended east of the Mount Sunflower Northeast Field in Wallace County by Pelican Hill Oil & Gas of San Clemente, California. The Lundblade #1-17, located 2630 ft. from the south line and 870 ft. from the east line (app. W/2 E/2 E/2) in section 17-T15s-R41W, is pumping 25 barrels of oil and 30 barrels of water per day, plus 75,000 cubic feet of gas. The well encountered the top of the second Morrow Sand zone at 4996 (-1197 KB) with pay being recovered through perforations placed at six holes per foot from 4996 to 5000 ft. Crude gravity is 38 degrees API. The well started producing in September last year and extends production in the field one-half mile to the northeast. Field area lies 8 miles south and 3-1/2 miles east of Weskan, Kansas.

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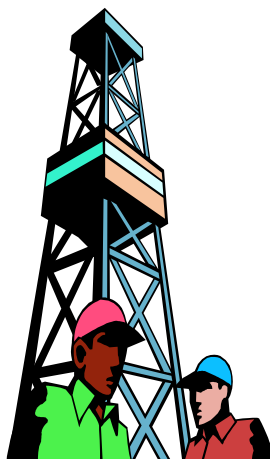
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