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ON THE COVER:

Several of the most prolific hydrocarbon reservoirs in Kansas are found beneath major unconformities along the tops of the Arbuckle, Viola, Hunton, and Mississippian. Such reservoirs (subunconformity types) variously are present in porous and permeable limestone, dolomite, chert, and in some cases spiculite.

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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 Technical Editor Dr. Sal Mazzullo at <u>salvatore.mazzullo@wichita.edu</u>, whose mailing address is Department of Geology, Wichita State University, Wichita, Kansas 67260. 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

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

KGS Tech Talks

May 8—Tuesday—Larry Skelton, "An old well in downtown Wichita"

May 14—Larson & Company, "Taxation Issues in Funding Oil & Gas Exploration & IRAs—401Ks"

May 21—Video Talk: "Geo Families"

There are no scheduled talks For the months of June, July & August. We will resume talks in September.

The fall dates will be :

Sept. 17th & 24th Oct. 15, 22, 29 Nov. 5, 12, 19 Dec. 3, 10, 17

Attention!

New Location for Technical Meetings

All KGS technical presentations are held at 12:30 p.m. at the

Wichita Bar Association, located at 225 N. Market, ground floor conference room, 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.

Dear Members,

Everything is proceeding according to plan. The golf tournament, June 11, at Hidden Lakes, is being planned, the fishing tournament will be history when you read this, the software for the Walters Digital Library is going to be installed for 'beta' users next week (April 23rd) and seminars are planned for the users, folks are buying logs, and a Geofest is planned for this fall after the AAPG Regional Convention. Kinberly Dimmick-Wells is chairing the KGS picnic committee. Date and place will be announced soon. Thanks Kimberly and all the KGS committee members for all their work this year.

Key aspects of the new software are the ability for integration with our database WinScout, the ability to get all the corrections entered and update all the cards and logs we have been unable to link. This data has been scanned and is waiting for the new "admin" program to be entered and accessible. Unlike the old software, I understand it only has to be entered once rather than four or five times. We should get this caught up fairly quickly.

Gus Messenger is working on a deal for a great addition to the library database in a private collection of core log information. Gus' tireless efforts to organize our neglected core log data have been a monumental effort. Thanks Gus.

Randy Koudelle is exploring an idea to obtain older LAS log files for our library. That would be a wonderful addition to our database for those who use computer-generated logs and cross-sections. It would be a shame to lose these older files because no one has systematically asked for them.

Those who missed the Geomorphology talk missed a fantastic one. It was full of Kansas examples. Bob Cowdey is to be complimented on the many fine talks he has brought to our society. It is amazing that Bob gets these wonderful speakers who pay their own way to give us free first class information. Many societies have to pay speakers fees, their transportation and accommodations. Our last speaker, Bob Davis with Schlumberger, marveled at our frequency for our talks and commented most societies struggle to get one talk per month.

Bob also mentioned to me that the outstanding collection of science and geology related DVD's, video's and materials as well as our speakers bureau are available for area Science teachers and educators. This is way under utilized. If anyone has connections with the local science teachers, we need to know how to get the word out that these things are available. We also have lots of items that are useful for members own education and exploration. Check it out.

We plan to do a little rock-hounding this summer. Chris has her eye on a two ton Blue River rock in Breckenridge that would look nice in our front yard. Anyone coming back this way with a flatbed truck, please call. Have fun this summer, y'all.

Philip M. Knighton





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AAPG Annual Meeting Long Beach, CA

This will be a short report of what transpired at the meeting held April 1-4

House of Delegates – The Kansas Geological Society was well represented by Alan DeGood and Ernie Morrison. The main business that transpired was a vote to allow lower rates for membership for potential members from areas of the world less prosperous than the US. After a parade of members addressing the subject (two against and approximately 20 for) the measure was overwhelmingly passed. Elected as Chairman- Elect of the H of D was George Bole of Houston and Secretary\Editor Robert Webster of Dallas. It is of some interest to note that all four of the candidates for these positions were from Texas.

At the Awards ceremony on Sunday the two highest awards of the AAPG were presented: Sidney Powers to Dr. Arnold Bouma, retired professor from LSU and the Michael T. Halbouty Award to John Amoruso of Houston.

The attendance at the meeting was over 5260 and there were 200 plus exhibitors. The KGS had an excellent position in the exhibit hall next to the Kansas Geological Survey and on an aisle very close to the large AAPG exhibit, thus there was good traffic going by the booth. It was manned by Rebecca Radford, manager, with help from others.

KGS members attending included: Ernie Morrison, Alan DeGood, Dave Barker, Dan Reynolds, Paul Gerlach, Marty Dubois, John Doveton, Lee Gerhard, Dan Merriam, Susan Nissen and Mary Hubbard.

Newest Trustee of the AAPG Foundation is William Barrett of Denver, but originally from a farm north of Topeka.

- Submitted by Bob Cowdery

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From The Manager

Dear Members,

First it's spring, then it isn't.....you can always count on crazy weather in Kansas, right?

Well, I had a good trip to Long Beach for the AAPG 2007 convention. We had good traffic at our booth as we were showing the new software for the Walters Digital Library. Some of our digital members were out there and got to see it first hand, and we had a lot of other states & companies looking at it and scratching their heads about all we have accomplished. We hope to have the software out to the digital membership sometime in May and we should be having some "show & tells" sometime in late April or early May. Anyone interested, member or



not, should plan to attend one of these special meetings so you can see just what all the hoopla is about.

The library is getting extremely busy again and I am so glad to welcome Sherri Gruenwald back into the fold. She has stepped back into the groove of things and it has made life much easier for all of us. Please join us in welcoming her back.

The Foundation has scheduled the Spring Mixer for Thursday, May 24th this year. Also, we have the KGS Annual Golf Tournament coming up June 11th (a Monday) back at Hidden Lakes course outside Derby. I have ordered up a wonderful day (remember last year?), no rain, no lightening, just lots of sun and a cool breeze. Hope to see a good turnout this year.

Respectfully submitted,

Rebecca Radford Manager



Booth at Long Beach AAPG Convention

Geo-Scenes

Editor's Note: This new section of the bulletin will periodically feature scenes of geological interest in Kansas and from anywhere else in the world, or for that matter, on other planets in our solar system. All readers are encouraged to submit such images along with short, explanatory captions as illustrated below. Send all submissions via electronic format (images as jpegs, and separately, text in Microsoft Word or WordPerfect format) to the technical editor, Sal Mazzullo, at either <u>salvatore.</u> <u>mazzullo@wichita.edu</u> or <u>dolomite@cox.net.</u>

Surficial Karst Features (Landforms) along Unconformities on Carbonate Rocks

Several of the most prolific hydrocarbon reservoirs in Kansas are found beneath major unconformities along the tops of the Arbuckle, Viola, Hunton, and Mississippian. Such reservoirs (subunconformity types) variously are present in porous and permeable limestone, dolomite, chert, and in some cases spiculite. Geologists typically map the tops of these units as structural features, knowing full well that they actually represent structurally modified paleogeographic (paleotopographic) surfaces whose paleogeomorphologic development was related mainly to processes included under the broad umbrella of karstification. Such processes are dominated by meteoric (fresh-water) dissolution of carbonate rocks, and they result in relatively smallscale features such as sinkholes, dolines, and caves and caverns along regional paleotopographic surfaces. Such surfaces may include, on a larger scale, buried hills (including karst towers) of various elevation and dimension and intervening valleys or topographically lower areas between hills. The regional geomorphologic character of such paleotopographic surfaces varies greatly, and it reflects differences in rock porosity and permeability, presence or absence of fractures (and faults), structural attitude of subcropping strata, climate, bedding thickness and specific lithology of the rocks, and other factors. Notwithstanding faults, any exploration geologist who has mapped the tops of the Arbuckle, Viola, Hunton, or Mississippian is well aware of the differences in paleotopographic relief, related to karstification, along the unconformable tops of these units.



Figure 1 - Smooth karst surface with sinkholes (black arrows) and shallow dolines (white arrow) along the top-of-Pleistocene (138,000 years old) limestone on Ambergris Caye in Belize.

In many cases in science we see that small-scale characteristics of features often mimic larger-scale features, and this coincidence is especially true along unconformities. The two photographs herein (Figures 1 and 2) are examples of such coincidence. These photos are of the top of the Pleistocene limestone on Ambergris Caye in northern Belize. The limestone is radiometrically dated at 138,000 years old. The small-scale features along the unconformity surface here are similar to those found in the subsurface of Kansas in Arbuckle, Viola, Hunton, and Mississippian rocks. Figure 1, for example, shows a relatively smooth unconformity surface comprising low, rounded hills and intervening low areas. When these low areas are relatively shallow and flat, they are referred to as dolines. Such features can be of various areal dimensions, and they typically are manifested in the subsurface as low and relatively flat "structural" areas. Scattered across this low-relief geomorphic surface are small, rounded sinkholes that commonly connect to subsurface caves and caverns. This topography resembles, for example, that along the top of the Mississippian in central Kansas (e.g., Ness County) and eastern Kansas (e.g., Butler County). In these areas hydrocarbon production commonly is from relatively low, rounded buried hills of various dimension. Many of you undoubtedly

can recall tales of drilling along the flanks of a high, or even the top of a high on the Miss, and unfortunately hitting a low spot (sinkhole) along that surface.

In contrast, Figure 2 shows a rugged topographic surface of relatively high, jagged knobs (across the middle of the photo) that pass rapidly into an almost flat geomorphic surface (in the foreground of the photo). On the small scale these knobs comprise what



Figure 2 - Rugged karst surface (a.k.a. "phytokarst") with steep, jagged pinnacles adjoining flat, smooth surface (in foreground) along the top-of-Pleistocene (138,000 years old) limestone on Ambergris Caye in Belize.

is referred to as "phytokarst", whereas on the larger scale they would comprise buried hills. Hydrocarbon production from buried hills is common throughout subsurface Kansas. If we were considering the Arbuckle, Viola, Hunton, or Miss in the subsurface, then note that: (i) one can go from a high at one drilling location (labeled #1 on the figure) to being flat and very low at an offset location (labeled #2 on the figure); and (ii) the change in the sub-regional character of the geomorphic surface along an unconformity, for example from buried hills to flat areas, can be very abrupt.

submitted by Sal Mazzullo





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Member Profile



Hal Brown



Native born Kansan and active geologist in Wichita since 1976, Hal Brown has contributed considerable to the geologic effort and exploration success in this area.

He was born January 10, 1930 in Hays, Kansas where his father was a cable tool driller. Hal's mother was a homemaker although when they lived in Winfield, she was credit manager for Montgomery Ward. Hal was one of four sons. Two brothers still living are: Larry in Wichita and Sam in Almsville, Oregon.

Hal attended grade school, Jr. High School and High School in Winfield where he graduated in 1948. He commenced college at Kansas State University, majoring in Soil Conservation, but was called into the Air Force in 1949 and was not discharged until 1953 at Forbes Field in Topeka. During his time in the Air Force, he was stationed for a period of time at Mildenhall, United Kingdom, which is near Cambridge. There he met Susan Williams, the mother of his three children: Sylvia, now residing in Denton Texas, Steven of Midwest City, Oklahoma and Stephanie, a psychiatrist in Tulsa. While in the service Hal worked as a draftsman and achieved the grade of Staff Sergeant.

After his discharge, Hal returned to Kansas State. There, after taking a course in general geology, he realized he enjoyed geology so much that he changed his major to geology. He also was influenced in part by his father's work in the "oil fields". In the summer of 1955, he worked for the USGS in Grand Junction, Colorado. The USGS was examining trees for radioactivity based on the theory that the tree's roots might extend into Uranium deposits.

Hal graduated from K-State in January 1956. Among his classmates were Gene Ratcliff, later to become Chief Geologist for Kerr-McGee and Paul Strunk, owner of American Shoreline of Corpus Christi. At K-State, Hal was greatly influenced by Dr. Claude Shenkel as were many K-State graduates.

Following graduation, Hal went to work for Pan American Production in Abilene, Texas. While working in Texas he was on an offset to a discovery in the Breedlove Field and in examining the samples discovered some very odd brown items in the samples. He had been exposed by the crew, as many geologists have been early on to walnut shells. In 1957, he worked for a period in Wichita. From 1958 until 1961, he worked in Liberal. While in Liberal Hal encountered the "biggest character", Woody Paul that he can recall. Woody in the past had his own TV show called "Backyard Cooking with Woody". He was also a big promoter, but "honest as the day is long" according to Hal. In 1961, he was transferred to Oklahoma City where he remained until 1967 when the office was closed and he was transferred to Ft. Worth.. In 1970 Hal joined Helmerich and Payne in Tulsa and worked for that company until 1973 when he was employed by Texas Oil and Gas in Oklahoma City. Hal transferred to Wichita in 1976 where he served as District Geologist and later promoted to District Exploration Manager until his retirement from that company in 1985. As an

Independent he maintained an office at American Energies until 1996.

Along the way Hal received helpful advice and mentoring from Jack Hendrickson at Pan-Am, John Mason with Amoco, and Steve Tilman at Texas Oil and Gas.

During his career, Hal has been active in professional societies. He recalls serving on the Board of the KGS. He was President of the Oklahoma City Geological Society for awhile and still maintains a member ship in that society. Hal is also a member of the AAPG.

There isn't any doubt that Hal enjoyed his career as a Petroleum Geologist and he has strong words of advice to the young geologist considering a career. "Get a Master's Degree". Hal was working on his Master's at the University of Oklahoma when he worked in Oklahoma City, but with his move to Ft. Worth, he was unable to complete his degree.

Since his retirement, he has engaged in volunteer activities, working as a driver for the Red Cross and also volunteering at the Zoo. He has always enjoyed golf, hunting, fishing and flying. He has owned several different airplanes and has accumulated well over 500 hours in the air. During his employment in Liberal, Hal and his colleagues used to hunt during the noon hour. Although currently, a physical condition has prevented him from playing golf, one of his goals is to get back on the golf course.

Hal was married to Kay Cochran for seventeen years, but is currently unmarried. Currently he enjoys his family, which includes not only the children, but the grandchildren and three great-grandchildren.

Certainly this brief description does not adequately cover what has been a rewarding and productive career of a Wichita geologist.



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Opening Session

September 9, 2007 Speaker: State Geologist Bill Harrison

All Convention Luncheon

Keynote Speaker USGS Director Mark Myers

Memorial

Eldon Frazey

With the death of Eldon Frazey on February 22nd the industry lost one of its "real gentlemen" and a true professional. Eldon was born in Halstead, Kansas in August 1922 and at that time his father was Superintendent of Schools in Moundridge. With the death of his mother when he was four years old, he went to live with an aunt in Haven. Eldon attended grade school and Haven High School graduating in 1940. He then enrolled in Hutchison Community College and was there from 1940 until 1942. He then enrolled at K-State where remained until 1944 when he was called into the service.

Eldon was in 10 different army camps before being attached to Patton's 3rd Army in Europe with the Corp of Engineers. He finished his European tour at Branau, Austria and was discharged from the service in 1946 at Ft. Leavenworth. Returning to



K-State, Eldon completed his B. S. degree in Geology in 1947. After graduation, Eldon worked a summer for the USGS in Denver. He then joined Cities Service Oil Co. in El Dorado where he remained until 1955 when he was transferred to Wichita.

While in El Dorado he met Joyce Gude and they were married in 1948 and were happily married for 56 years until her death. Joyce and Eldon had four children: Deirdre, now residing in Broken Arrow, Oklahoma, Dick of Evergreen, Colorado, Bill of Bar Nunn, Wyoming and Tom of Jackson, Wyoming.

In 1956, Eldon was transferred by CSO to Casper Wyoming and remained there until 1961 when he was sent to Bartlesville to work in the Operations Department. When the company moved its headquarters to Tulsa in 1971, he moved also and stayed in Tulsa until 1973 when the company once again transferred him to Wichita. In 1983 he retired from CSO.

With retirement, Eldon and Joyce moved to Derby where Eldon pursued his recreational interests of yard work and flowers. Also for over thirty-five years, he and Joyce took their RV to the Grand Tetons of Wyoming.

Eldon had been a member of the Kansas Geological Society for many years and was still a member of the American Association of Petroleum Geologists at the time of his death. While in college, he joined the K-State chapter of the Sigma Gamma Epsilon, geological fraternity, as a charter member.

Eldon was extremely "well liked" by all that knew him and will be missed particularly by his many co-workers at CSO. A memorial has been established with the Kansas Geological Foundation.



THREE KGS MEMBERS GIVE TALKS AT LOCAL CHURCH

Three of our local geologists are featured speakers at St. James Episcopal Church, speaking on the topic of "God and the Environment", a program running April 15—May 27.



Tom Hansen M.S.

Tom attended and majored in geology at KSU, he received a Bachelor of Science in 1967 and a Master of Science in 1969. He worked as a geologist and exploration manager for several oil companies. Since 1989, Tom has been a consulting hydrogeologist. Tom his wife Pat, and their two daughters moved to Wichita in 1980. Tom is certified as Professional Geologist with the American Association of Petroleum Geologists and the American Institute of Professional Geologists.



Kent Matson B.S.

Kent is a life long resident of Kansas and grew up in the Valley Center area. He graduated from WSU in 1991 with a BS in Geology with continued graduate studies in geology. Kent has been employed as a geologist in the environmental business for the last 14 years and currently he is a Senior Geologist and Environmental Department Manager at Geotechnical Service, Inc. (GSI). His primary focus of work over the years has been in the area of soil and groundwater contamination assessments and remediation.

Monte R. Markley B.S.



Monte R. Markley obtained a BS in Geology from Lamar University in Beaumont, Texas in 1989. He worked 15 years as an engineering geologist and hydrogeologist conducting geologic hazard evaluations and hazardous waste and water supply groundwater investigations in the central US from the Gulf Coast to Canada. In 2005 he started working for FAB Environmental of Wichita, Kansas and is a partner in that firm. He has been married to Anna for 20 years and has three teenagers.

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Exploration Highlights

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



1) New Mississippian gas production has been established nearly two miles south of the Dunlap Creek Field in Comanche County by Wichita-based Woolsey Operating Co., LLC. The #1 York D OWWO, located in the NE/4 of section 5- T32s- R16W, is flowing an undisclosed amount of natural gas effective December 21, 2006. Operator successfully re-entered the old well which was originally drilled and plugged in 1958 at a total depth of 5038 ft. A Drill Stem Test had tested a maximum gauge of 734 Mcf gas daily from a depth between 4905 to 4980 ft. The well opens the new Baker Canyon Field about seven and one-half miles southeast of Wilmore, Kansas.

2) A new oil discovery has been made in the NE/4 of section 4-T15s-R26W, Gove County, by Central Operating, Inc. of Denver, Colorado. The firm's Raymond / Parsons #1 has been completed for 35 barrels of oil per day, no water. Operator found productive zone in the Mississippian formation from 4239 to 4242 ft. First production commenced in February this year. The new field is named Noton Southeast as it lies about one and one-quarter miles to the southeast of the Noton Field. The new field is located about ten miles northwest of Utica, Kansas.

3) Coral Production Corp., of Denver, Colorado, has discovered the new Gano South oil field in Graham County about six and one-half miles east of the town of Saint Peter, Kansas. The discovery well, #13-1 V. Gano, located in the NW/4 of section 13- T10s- R24W, is producing an unknown amount of crude oil from the Lansing-Kansas City formation. The well has been successfully offset to the south with two locations drilled by Murfin Drilling Company of Wichita. The Goltl Trust Unit #1-14, SE/4 of section 14- T10s- R24W, is on pump, and the Page #2-13, SW/4 of section 13- T10s- R24W, awaits completion. They also found LKC reserves.

4) The new Quarry Hill oil field has been discovered by Vincent Oil Corp., of Wichita. Discovery was made at the Webb #1-30, located in the NE/4 of section 30- T7s- R22W, about three and one-half miles northeast of Hill City, Kansas. The well is on pump at an unknown rate. Rotary total depth was obtained by WW Drilling tools at 3900 ft. The discovery lies over threequarters mile southeast of the Fabricius Field in Graham County

5) In the SE/4 of section 33- T5s- R22W, Norton County, new Lansing-Kansas City oil production has commenced at the Minks 33AD #1, operated by Ritchie Exploration, Inc. of Wichita. The 3920 ft. deep well is producing an undisclosed amount of oil at site located nearly three-quarters mile southeast of the Kemper Northeast Field, or approximately six miles southwest of Densmore, Kansas. Plug back total depth is 3893 ft. Jeff Christian served as well site geologist.

6) Lansing-Kansas City oil is being produced at the rate of 30 barrels daily plus 120 barrels of water at the Teresa #1, located in the SW/4 of section 31- T7s- R20W in Rooks County. The wildcat well is a new oil discovery for by Black Diamond Oil, Inc., of Hays, Kansas. Discovery site is spotted nearly three-

Earl Knighton, Sr. Endowed Scholarship

quarter mile south of established production in the Nicodemus East Field. The Teresa well is producing 30 degree gravity oil from limited entry perforations in the Lansing- Kansas City limestone at 3348 ft. and 3358 ft. First production was established on January 26, 2007. The well was drilled to a total depth of 3570 ft. by WW Drilling tools. The new unnamed field lies slightly over one-half mile northeast of the town of Nicodemus.

7) Lansing-Kansas City oil deposits have been discovered by Palomino Petroleum, Inc., of Newton, Kansas, at the firm's LaBarge #1 in the NW/4 of section 20- T7s- R20W, Rooks County. Southwind Drilling rig drilled the well to a total depth of 3645 ft. Operator perforated the LKC from 3395 to 3400 ft. and 3406 to 3410 ft. and has completed the well for 25 barrels of oil and 20 barrels of water per day effective January 29, 2007. The wildcat well establishes a new unnamed field

8) Russell Oil, Inc., of Plainville, Illinois, has completed their #1-19 Zelda Ferguson 'B' for 127 barrels of oil per day, no water. The new Sheridan County pool discovery is located in the SW/4 Commingled 43 degree gravity crude is being produced from the Lansing-Kansas City limestone at 4241 to 4247 ft., as well as from the Marmaton (Pawnee) limestone at 4370 to 4374 ft. Shields Drilling rig was used to drill the well to a rotary total depth of 4650 ft. The new field started producing in November last year and has tentatively been named the Zelda Field. Closest production nearby is found over one mile to the west in the Triangle Field in Thomas County where similar reserves have been produced since 1983.





The Knighton family has provided funds for an endowed scholarship in the name of Earl Knighton, Sr.

Earl Knighton grew up in Missouri and graduated from Joplin High School. After taking several geology courses at the University of Missouri, he switched his major from business to geology. Unfortunately Earl was not able to complete his senior year because of the illness of his father

After 8 months back in Joplin he joined an acquaintance in Bartlesville. While there he interviewed with Indian Territory Illuminating Oil Company, later to become Cities Service Oil Co. After the interview, he accepted employment with ITIO in their accounting department. After three months in accounting he accepted a position in their geological department.

While employed in Bartlesville, he met and married Mary Katherine Stockard. Earl and Katie had three sons: Earl Jr. (Mac), Wichita, Phil, Wichita, and Robert, Kansas City.

In 1940 Earl was called to active duty with the Air Force. During his 5 ¹/₂ years in the service Earl was stationed in a wide variety of places including Washington D. C., Tulsa, North Carolina, Belleville, Illinois and St. Louis.

After being discharged, Earl returned to work for Cities Service. He then worked in Wichita for two years in the Land Department. Rather than return to Bartlesville, he made the decision to "go on his own". He worked with a wide variety of operators, including Ernie Moncrief and Pierce Musgrove

In the 1970's he commenced operations with Don Hellar and this successful relationship continued for many years. Earl passed away in 2001.

The Foundation certainly wants to express its gratitude for this donation, which will provide funds for some student in need.





Kansas Geological Foundation

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Abstracts of AAPG Annual Meeting Long Beach, 2007 – AAPG

Understanding Earth Systems

2006 AAPG Bulletin on CD-Rom

Petroleum Systems and Assessment of Undiscovered Oil and Gas in the Raton Basin – Sierra Grande Uplift Province, Colorado and New Mexico USGS

The Oil and Gas Resource Potential of the Artic National Wildlife Refuge 1002 Area, Alaska USGS

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Alaska, Oil and Gas Opportunities – March 2007 Alaska Department of Natural Resources – Division of Oil and Gas

Petroleum Potential of United Kingdom Department of Trade and Industry

HDS 2000 – Visual Petrophysical Tool ETECH International Ltd.

All Datapool Programs – Program Maps, Legends and Survey Plats ECHO Geophysical Corporation

SEISearch SEI – Seismic Exchange

Seismic and Well Data – Seismic Processing Services GGS Spectrum

World Data Directory – 2006 Edition Fugro Robertson, Inc.

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Norman R. Stewart	07/93	1993	Edward B. Donnelly	08/01	2001	
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