It’s amazing what a little “Global Warming” can do to peach trees in Georgia and other blooming trees and plants in Wichita, and so on. I shall not digress here, but I have taken the liberty of placing a few fast facts in the hands of the reader who may be interested in this subject, in a newly added section, “Letters to the Editor.” We welcome constructive discourse on virtually any subject of interest to geoscience from any and all in the future.

As we wind down the spring season, it’s my distinct pleasure to introduce to our readers and supporters the GSKS Officers who will be taking their places on June 1, 2007:

- President: Rick Saenger
- Vice-President: Mike Crouch
- Treasurer: Susan Nissen
- Secretary: Bob Francis
- Editor: Rick Miller
- Councilor: Jim Womble

Susan Nissen and Rick Miller graciously agreed to continue in their current roles in order to assist the Society into the future and we deeply appreciate this commitment. Rick Miller has just done an outstanding job and I encourage you to see the fruits of some of his recent oversight—please take a look at our upgraded website at www.gsks.seg.org.

Rick Saenger has continuously organized and invited very high quality speakers in for our monthly Technical Meetings; Mike Crouch has served us all very well in his role as Secretary and we look forward to what he will bring us in his role as Technical Program Chairman. Bob Francis has served as Councilor and we welcome him in as Secretary. Kirk Rundle also served as a

Continued on p. 6
Program Chairman’s Column—cont’d

The **AAPG Mid-Continent** meeting will be held in Wichita on Sept. 9-11. We will have the opportunity to hear some very prominent speakers at this meeting, including Dr. Bob Hardage (Texas Bureau of Economic Geology), Dr. Tom Davis (Colorado School of Mines), Dr. Steve Roche (Veritas), C. Ed Helsing (ExxonMobil), and Dr. Don Steeples (2007 SEG Distinguished lecture).

Jim Bogardus (PGS – Onshore) will host a short course, Geophysics for Geologists, that will cover aspects of acquisition, processing, and interpretation.

There will also be some excellent student papers that will be competing for scholarships. For additional information regarding these events, please contact emorrison@mulldrlg.com.

The **Kansas Geological Society** has scheduled the following talks for May:

- **May 3** Dr. Kurt Marfurt, *Attribute-Assisted Illumination of Natural Fractures*. Abstract and biography below.
- **May 8** Larry Skelton, *An Old Well in Downtown Wichita*
- **May 14** Tom Varanda and Stephanie Williams, Larson & Co., *Taxation Issues on the Funding of Oil and Gas Exploration and IRA’s–401K’s*
- **May 21** GeoFamilies–DVD, Stories from seven families of geologists to characterize the excitement and challenge that draws people into the field.

For additional information, please contact KGS Program Chairman Bob Cowdery at sbc@southwind.net.

If you have any recommendations for papers next fall or would care to provide feedback, please email to me at rsaenger@mulldrlg.com.

Please continue to support our professional societies with your attendance and appreciation!

Rick Saenger

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Technical Program Abstract

**“Attribute-Assisted Illumination of Natural Fractures”**

*Kurt J. Marfurt, Gabriel Perez, Hao Guo, and Susan E. Nissen*

*Center for Applied Geosciences and Energy, University of Houston*

Whether a rock fractures or not under stress is a function of folding, faulting, lithology, thickness, and stress direction. Seismic attributes that are sensitive to these geologic parameters and thus can be used in predicting fractures include curvature, coherence, acoustic and elastic impedance, spectral components, and velocity anisotropy analysis. Volumetric curvature is a relatively new attribute that has proven to be quite effective in mapping subtle faults and fractures as well as karst in the Fort Worth Basin of Texas, Canada, Russia, the Middle East, and the mid-continent of the United States. Interestingly, while production data validates curvature lineaments as being faults and fractures, we do not clearly understand why we see them on seismic data—are these features due to vertical discontinuities, stress release, porosity preservation, shale infill, or diagenetic alteration?

Conventional seismic processing flows are usually focused on obtaining the best vertical resolution of seismic horizons of interest. We find that such surveys often have sub-optimal lateral resolution and may also be contaminated by acquisition footprint.

In this presentation we will begin by defining curvature and show how it delineates features of geologic interest in conventional 3D seismic surveys. We will then through attribute-driven processing flows, show...
Note from the Editor

As Dennis points out in his President’s Message, new GSKS officers will be coming on-line June 1. With this changing of the guard comes the end of Dennis’s term as the first GSKS president. His leadership, insights, and seemingly tireless efforts to promote geophysics and the interests of the membership will be sorely missed. As Dennis points out, we will be in good hands with his replacement on the board, Rick Saenger. Fifty years down the road, the geophysical community of Kansas will owe an even greater debt of gratitude to Dennis than we do now for taking the helm and providing solid direction and organizational mission during start up, the roughest period for any new organization.

As indicated in the last newsletter, we are starting another new series this month titled Exploration Challenges. Dr. Susan Nissan has contributed an excellent inaugural article demonstrating new seismic attributes that are particularly sensitive to fracture trends and applying those attributes in a study of the Dickman Field in Ness County. This is a truly fascinating work demonstrating how curvature attributes have revealed two main lineament orientations in this field that, if exploited, could dramatically improve the efficiency of infill drilling and/or horizontal drilling as well as enhance effectiveness of recovery practices. Clearly this is a tool that could be used to guide production schemes and significantly enhance production in mature midcontinent fields.

This month we have a treat, our first Letter to the Editor. Clearly Dennis has ‘held his pen’ now for as long as he can and feels this is the time to present his opinion on global warming. It is my personal hope that Dennis’ letter on global warming and all the background he provides will stimulate contributions to our Letters to the Editor series on this topic as well as others that you, the membership, might want to air out to your peers. Please take advantage of this venue!

Rick Miller

2006-07 Council

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Students are encouraged to participate in this meeting to get feedback on their research, publish some facet of their work, and meet potential employers.
President’s Message—cont’d

Councilor and we appreciate his past participation, and insightful contributions. We welcome Jim Womble on as Councilor, a role I will be sharing with him as your Past President (has been).

It was nearly two years ago that a handful of us sat down to determine that we wanted to make a run at putting this organization together. We now have about 50 members in our registry and it is very encouraging to see the numbers of students growing along with us.

A special note of pleasure along this line—member Bill Schorger of Sterling Seismic Services, Denver, was so encouraged by the opportunity to assist these aspiring geoscientists that he made a personal and significant directed gift toward our future scholarship support. This is the first of its kind to the Society and we deeply appreciate this gesture. It has caused us to consider the best means available to members who wish to follow this lead, a subject directly related to our non-profit organizational goals.

I close by extending my deepest appreciation to our loyal sponsors who made it possible to generously support students in our first ever grant and scholarship awards, and to the Council members who have unselfishly and very faithfully participated in the startup years of this Society. My hope is to see continuity and steady growth in our membership, coupled with an advancing exposure to subjects of technical merit in a variety of areas of interest.

Thanks for allowing me to serve and all the best to you in your continuing endeavors.

Dennis Hedke

Letters to the Editor

Global Warming – the 21st Century Realities

Our country is about to approach, some would say has already gone through, a significant crossroads event. The world, more specifically the Intergovernmental Panel on Climate Change (IPCC) would have us all believe that the earth is irreversibly entering into a disastrous and problematic environmental scenario related to “Global Warming.” The IPCC would like to impose on the rest of the world that the USA is largely responsible for the disaster.

The single goal of this editorial is to provide factual information which can be considered in light of these charges, and hopefully educate the reader as to some of the fundamental issues at hand. A thorough discourse on just the fundamentals would greatly exceed the limited space available for this brief introduction.

“The earth is warming up.” That statement is true for temperatures measured at the surface, which is of course where most of us spend our lives. It is patently untrue for temperatures measured in the upper reaches of the atmosphere, which is also where we measure the content of that greenhouse gas known as carbon dioxide (CO₂). Since the late 19th century, global temperatures have increased about 1 degree Fahrenheit. That’s one degree over more than 120 years.

CO₂ is not a pollutant, but try to tell that to the US Supreme Court, which has recently ruled that it is. In fact, without it there would be no trees or plants of any kind. And, no trees or plants are complaining about the “elevated levels of CO₂” in the atmosphere. Over the course of the past 40 or so years, the amount of CO₂ in the upper atmosphere has increased from about 320 parts per million (ppm) to about 380 ppm, an increase of about 18.75%, or about 0.3% per year over that period. That is not an insignificant increase, but just exactly who or what is causing the increase? That is the crux of the matter. The IPCC would have you believe that it is exclusively caused by human intervention via cars, trucks, planes, factories, etc. However, significant evidence speaks loudly and clearly against this notion, but you are not hearing about this evidence. This evidence is being gathered and studied by some of the pre-eminent scientists of our day.

Dr. Richard Lindzen, Alfred P. Sloan Professor of Atmospheric Science at MIT states “…there are the peculiar standards in place in scientific journals for articles submitted by those who raise questions about accepted climate wisdom. At Science and Nature, such papers are commonly refused without review as being without interest.”

Professor Tim Ball, Department of Climatology, University of Winnipeg adds this perspective: “Global warming alarmists tell us that if the atmospheric levels of CO₂ increase, the temperature will go up. But, the ice core record shows just the opposite. The most fundamental assumption of the whole theory of climate change due to humans is shown to be wrong.”

Professor Nir Shaviv, Institute of Physics, University of Jerusalem acknowledges after long assuming the media reporting was accurate, “The is no direct evidence which links 20th century global warming to anthropogenic greenhouse gases (human activity).”

The earth’s climate is always changing. It has always changed, with or without human intervention. A review of temperatures over approximately the past 1000 years shows us the following:

♦ During the “Medieval Warm Period (~1200), temperatures were much warmer than at any time in the past thousand years.
♦ At around 1650 temperatures were significantly colder than they are today. That occurred in what has been historically termed the “Little Ice Age”.
♦ Temperatures have been gradually increasing since that time, except for a leveling off period around 1725-1850, after which the warming trend continued to where we are today.

What you see in the media is the “Hockey Stick” temperature graph, via Dr. Michael Mann of the University of Virginia, which emphasizes the past hundred years or so, with a dramatic increase in the past 30 years. In the context of the past 1000 years, this uptick is deemed insignificant. Other periods of heating and cooling have exceeded this local rate. Expect the earth’s temperature to fluctuate wildly, with or without man’s influence.

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**Exploration Challenges**

**Using New 3-D Seismic Attributes to Identify Subtle Fracture Trends in Mid-Continent Mississippian Carbonate Reservoirs**

Susan E. Nissen,1 Timothy R. Carr,2 and Kurt J. Marfurt3
1Consultant, McLouth, Kansas; 2Kansas Geological Survey, The University of Kansas, Lawrence, Kansas; 3Allied Geophysical Laboratories, University of Houston, Houston, Texas

Introduction

Mid-Continent Mississippian reservoirs are primarily naturally fractured, solution-enhanced, multi-layered shallow shelf carbonates with strong bottom water drives. Oil production in these reservoirs is strongly influenced by fracturing. The fractures can either be open, permitting water channeling from the underlying aquifer, or shale-filled, providing compartmentalization of the reservoir. New 3-D seismic volumetric reflector curvature attributes (Al-Dossary and Marfurt, 2006) have the potential to reveal subtle lineaments that may be related to fractures in these reservoirs. Volumetric curvature attributes are calculated directly from a seismic data volume, with no prior interpretation required, and have been shown to be useful in delineating faults, fractures, flexures, and folds in various geological settings (e.g., Serrano et al., 2004; Blumentritt et al., 2006; Sullivan et al., 2006).

Dickman Field, in Ness County, KS (Figure 1), is a typical Mid-Continent Mississippian reservoir. The reservoir is composed of Meramecian shallow-shelf carbonates subjacent to a regional pre-Pennsylvanian unconformity and karst surface. Since its discovery in 1962, Dickman Field has produced nearly 1.7 million barrels of oil, with a high water cut (greater than 94%). Volumetric curvature attributes were applied to a 3-D seismic survey over Dickman Field in an attempt to more effectively locate fractures influencing fluid flow in this reservoir.

Data Analysis

Lineaments, which cannot be seen using conventional 3-D seismic attributes, have been interpreted on a most negative curvature map extracted along a continuous, high amplitude seismic reflection approximately 25 ms below the Mississippian unconformity on the Dickman seismic survey (Figure 2A). Rose diagrams of the interpreted lineaments (Figures 2B and 2C) show two main orientations—northeast and northwest. These orientations are similar to regional structural trends for Ness County, KS. Although the number of lineaments interpreted with northeasterly and northwesterly trends is approximately equal (Figure 2B), the northeast-trending lineaments have greater length and continuity than the northwesterly trending lineaments (Figure 2C). The northeasterly lineament trend parallels a down-to-the-north fault at the northwest corner of the seismic survey (Figure 2A). Interpreted lineaments were compared to geologic and production data to determine if a correlation can be found between the lineaments and shale-filled fractures, which could be barriers to fluid flow, or open fractures, which could serve as conduits for water from the aquifer below the reservoir.

Shale-filled fractures have been interpreted at the top of the Mississippian in a horizontal well from central Ness County, KS, approximately 8 miles (13 km) from the Dickman Field study area (Carr et al., 2000). In this well, numerous near-vertical shale intervals were identified along the lateral length of the well. These intervals were interpreted as solution-enhanced fractures extending down from the karst surface at the top of Mississippian that were subsequently filled by Pennsylvanian shale of the Cherokee Formation (Carr et al., 2000). Since there are no horizontal wells in Dickman Field, indirect evidence was used here to infer the presence of shale-filled fractures. In general, fractures that were solution-enhanced by post-Mississippian karst are likely to have been filled by a combination of Pennsylvanian shale and weathered Mississippian debris, reflecting accumulation of collapsed rubble from the sides of fissures, as well as deposition of Pennsylvanian sediment. Therefore, it is assumed that wells penetrating large solution-enhanced fractures will show evidence of a thicker section of weathered Mississippian material at the base of the Pennsylvian (subsequently referred to as the “karst zone”) than surrounding wells. For the purposes of this study, the karst zone in a well is defined as the interval between the highest occurrence of the basal chert conglomerate in the Pennsylvanian section (chert weathered from the Mississippian) and the top of the un-weathered Mississippian, as identified from cuttings and core.

Figure 1. Location map showing Dickman Field (dashed black outline) and the Dickman 3-D seismic survey (solid black outline). Contours of depth (subsea) to the Mississippian unconformity surface derived from 3-D seismic interpretations are shown. C.I. = 10 ft. The gray shaded overlay indicates areas where the Mississippian unconformity lies beneath the oil-water contact.

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In order to determine whether either of the two dominant lineament trends seen in the volumetric curvature data relate to filled solution-enhanced fractures, crossplots were created of the thickness of the karst zone versus the distance to the nearest northeast- and northwest-trending lineaments (Figure 3). These crossplots show that there is no apparent relation between the thickness of the karst zone and the northwest-trending lineaments; however, there is an increase in the thickness of the karst zone closer to the northeast-trending lineaments. The correlation between the thickness of the karst zone and distance to the northeast-trending lineament suggests that these lineaments are likely to represent fractures preferentially solution-enhanced during karst formation and subsequently filled with shale and other debris. Since some of the northeast trending lineaments have interpreted lengths in excess of 0.5 mile (0.8 km), they may provide significant barriers to fluid flow in the northwest-southeast direction.

The relation between the interpreted lineaments and fluid flow also was investigated by examining the spatial variability of fluid production from the wells in Dickman Field in relation to lineament proximity. In order to evaluate whether there is a link between oil production and lineament orientation, oil production was crossplotted against the distance to the nearest northeast- and northwest-trending lineaments (Figure 4). The crossplots indicate that there is no identifiable relation between oil production and the northwest-trending lineaments, but there does appear to be an overall increase in oil production away from the northeast-trending lineaments. This suggests that oil production is inhibited in proximity to the northeast-trending lineaments where there may be a higher concentration of shale-filled fractures.

Water production from the wells in Dickman Field may be related to open fractures that extend into the underlying Mississippian aquifer. In order to evaluate whether open fractures are preferentially linked to lineament orientation, water production was crossplotted against the distance to the nearest northeast- and northwest-trending lineaments (Figures 5). The crossplots indicate that there is no relation between water production and the northeast-trending lineaments but there is increased water production with closer proximity the northwest-trending lineaments. A power law function
provides a good fit to this relationship. These results suggest that the northwest-trending lineaments represent fractures, which serve as conduits to the aquifer.

Conclusions

3-D seismic volumetric curvature attributes highlight subtle fracture-related lineaments that cannot be identified by other methods. In Dickman Field, 3-D seismic volumetric curvature attributes reveal two main lineament orientations, northeast and northwest, which reflect regional structural trends. Integration of attribute and well information allows the nature of the fractures (fluid conduits vs. fluid barriers) to be inferred. Northeast-trending lineaments appear to be barriers to fluid flow, and may represent shale-filled fractures. Northwest-trending lineaments appear to represent open fractures, which serve as conduits into the aquifer. Understanding the orientations of open and filled fractures in mature Mid-Continent Mississippian reservoirs is an important prerequisite for effectively using techniques such as targeted infill drilling, horizontal drilling, and gel polymer treatments to enhance production.

References


Acknowledgements

The authors would like to thank Grand Mesa Operating Company for providing seismic and well data and Seismic Micro-Technology, Inc., Hampson-Russell Limited Partnership, and IHS-GeoPLUS Corporation for access to software. Rose diagrams were constructed with GEOrient software, courtesy of Dr. R. J. Holcombe, Holcombe Coughlin & Associates Australia (www.holcombe.net.au/software). Funding for this work was provided by the U.S. Department of Energy under contracts DE-FG26-03NT15438, DE-FG26-04NT15504, and DE-FG26-06NT42734.
Technical Program Abstract—cont’d

that we can significantly improve our lateral resolution of faults and fractures. We conclude by discussing how the most popular attribute-driven reservoir characterization workflows need to be modified for predicting the presence of open fractures using attribute and production data.

Biography

Kurt Marfurt began his geophysical career as an assistant professor teaching mining geophysics at Columbia University’s Henry Krumb School of Mines in New York. After five years, he joined Amoco at what was then called its Tulsa Research Center. Through successive reorganizations at Amoco, Marfurt has obtained diverse experience—though not necessarily expertise—in seismic modeling, migration, signal analysis, basin analysis, seismic attribute analysis, reflection tomography, seismic inversion, and multi-component data analysis. Through Amoco, he won five patents, two in seismic coherence technology. He is the author of several dozen articles and coeditor of two books published by the SEG and has received both the SEG Best Presentation award for work on seismic modeling (1989) and SEG Best Paper award for work on seismic coherence (1999). In 2006 he had the honor of serving as the SEG/EAGE Distinguished Short Course Instructor presenting a subset of the material presented in this paper. Marfurt joined the University of Houston in 1999 as a professor in the Department of Geosciences and as director of the Center for Applied Geosciences and Energy (CAGE), where his primary emphasis is on the development and calibration of new seismic attribute technology. He is a member of GSH, SEG, EAGE, AAPG, and AGU, and has served 16 years as an associate or assistant editor for geophysics.

Letters to the Editor—cont’d

Remember that 1 degree warming since the late 19th century?

Dr. Patrick Michaels, also from the University of Virginia, states “Anyone who ... says that CO₂ is responsible for most of the warming of the 20th century hasn’t looked at the basic numbers.”

The truth is that most of it occurred before 1940. From 1940-1975, during the “Postwar Economic Boom,” when plenty of industry was developing and cars were increasing in numbers, worldwide temperatures dropped noticeably. Search for and look at the numbers yourself if you don’t believe me.

Dr. Carl Wunsch, MIT: “There is a bias, a very powerful bias, within the media and within the scientific community itself, toward results which are dramatizable.”

Nigel Calder, former editor, The New Scientist: “The thing that has amazed me, as a lifelong journalist, is how the most elementary principles of journalism seem to have been abandoned on this subject.”

The question is not whether the earth is warming up—clearly it is at the present time. The question is—what is causing it? Is it the production of CO₂ as a result of modern civilization? Let’s take a closer look at the evidence as to what the sources of CO₂ actually are.

♦ Volcanoes produce more CO₂ on a continuous basis than the combined sources of humans, factories, cars and planes.

♦ Animals and bacteria produce 150 gigatons of CO₂ per year, humans 6.5.

♦ Far and away the biggest producer of CO₂ released into the atmosphere comes from none other than the oceans.

In the global scheme, when the oceans heat up, CO₂ is released, and when they cool down, CO₂ is absorbed. We are now learning that the oceans take hundreds of years to either warm up or cool down, in concert with certain other phenomena. It turns out that CO₂ content can also be gauged via ice core data, which is available in the great current ice sheets on Greenland, Antarctica, etc. An Inconvenient Truth referred to ice core data, but failed to mention a very important fact about the relationship between CO₂ and temperature. Ice cores taken from numerous localities demonstrate unequivocally that temperature increases occur before CO₂ increases, which is exactly the opposite relationship that the media and this Al Gore production suggest. In fact, the time lag from temperature maxima to CO₂ maxima is shown to be about 800 years. So, the fact is that oceans, above all other earthly factors, drive the CO₂ content we register in the atmosphere.

So, where are we headed with this discussion? What’s behind the temperatures we observe in the oceans? The answer is fundamental, and the data is astoundingly accurate: The sun.

Dr. Piers Corbyn, Climate Forecaster of Weather Action: “The sun is driving climate change, CO₂ is irrelevant.” His hypotheses are echoed by Professor Phillip Scott, Department of Biogeography, University of London, Dr. Ian Clark, Department of Earth Sciences, University of Ottawa, and many others.

Since the invention of the telescope, mankind has observed and recorded data related to sunspot activity. The above named scientists have merged data from sunspots and temperature and have identified a clear, irrefutable correlation between these measured phenomena, over hundreds of years. Quite simply, the sun emits cosmic rays, which interact with clouds. When sunspot activity is heightened, the intensity of cosmic rays increases and bombards the cloud cover in the atmosphere, reducing the protection to the earth’s atmosphere. Conversely, when sunspot activity is decreased the temperature decreases. The oceans act as great heat sinks, or heat releasing regulators over great periods of time.

To conclude a fundamental fact for the moment, Al Gore’s argument that “where there is more CO₂, the temperature rises” is patently false. Furthermore, the models of climate change which make this assumption are entirely faulty.

Am I saying that there is no value in attempting to reduce emissions of pollutants in our atmosphere? Absolutely not. But, let’s be clear as to exactly what a pollutant is, and CO₂ is not one of them. Most vehicles, factories, other machines all emit true pollutants such as sulfur dioxide (SO₂), and a host of other problematic gases into our atmosphere. We have good reasons to act in ways that will inhibit these true pollutants.

Continued on p. 16
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The crossroad we are coming to is one which will define whether society seeks the facts necessary to actually work on problems we have an opportunity to control. If society takes the path of believing we can or should attempt to control CO₂ via carbon credits and other “innovative” legislative constructs, you can bet we will have fallen prey to a monster which I am certain we have absolutely no chance of defeating. Indeed, the worldwide socio-economic impact of the scenario wherein we attempt to legislate and control these enormous natural forces would very likely be devastating.

Dennis Hedke
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New Members
The Geophysical Society of Kansas extends a warm welcome to the following new members:

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<td>Lee Hakim</td>
<td>Sterling Seismic, Littleton, CO</td>
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<tr>
<td>Jim Craft</td>
<td>TGC Industries, Oklahoma City, OK</td>
<td>Associate</td>
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<tr>
<td>Randy Koudele</td>
<td>Berexco, Inc., Wichita, KS</td>
<td>Associate</td>
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<tr>
<td>Samantha Reid</td>
<td>Geotrace Technologies, Oklahoma City, OK</td>
<td>Associate</td>
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<tr>
<td>Steven Sloan</td>
<td>University of Kansas</td>
<td>Student – PhD Candidate</td>
</tr>
<tr>
<td>Habib Diop</td>
<td>Kansas State University</td>
<td>Student – PhD Candidate</td>
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<tr>
<td>Lindsay Mayer</td>
<td>University of Kansas</td>
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<tr>
<td>Michael McGlashan</td>
<td>University of Kansas</td>
<td>Student – MS Candidate</td>
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<tr>
<td>Joscelyn Nittler</td>
<td>Wichita State University</td>
<td>Student – MS Candidate</td>
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<tr>
<td>Spencer Musgrove</td>
<td>Emporia State University</td>
<td>Student – Sr Undergrad</td>
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To provide our members a quality venue for disseminating geophysically focused information pertinent to Kansas and surrounding regions.

We also seek to advance the geosciences by providing members opportunities to increase the understanding of geophysical principles and practice.

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