

Oklahoma Geology Notes

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A NEWSLETTER OF THE OKLAHOMA GEOLOGICAL SURVEY

The University of Oklahoma MEWBOURNE COLLEGE OF EARTH & ENERGY

THE OKLAHOMA GEOLOGICAL SURVEY — A STATE AGENCY FOCUSED ON RESEARCH AND PUBLIC SERVICE...

G. Randy Keller, Oklahoma State Geologist

THE OKLAHOMA GEOLOGICAL SURVEY in the University of Oklahoma Mewbourne College of Earth and Energy is a state agency focused on research and public service. Chartered in the Oklahoma Constitution in 1907, it is the only geological survey written into the constitution of a new state. Its creation was signed into law on May 29, 1908.

The OGS is charged with investigating the state's land, water, mineral and energy resources and disseminating the results of those investigations to promote the wise use of Oklahoma's natural resources consistent with sound environmental practices. It operates a 200,000-square-foot warehouse facil-

ity located off-campus, the Oklahoma Petroleum Information Center, that is dedicated to the preservation of cores, samples, logs and completion reports that date back to pre-statehood and a geophysical observatory south of Tulsa.

Programs and projects of the OGS include Earth Science education, earthquake monitoring, data preservation, fossil fuel-related research, geologic mapping, industrial minerals research, organizing workshops on a variety of geoscience topics, geologic hazards studies, and projects in cooperation with state and federal agencies.

Notable recent activities include installing an array of about 10 portable

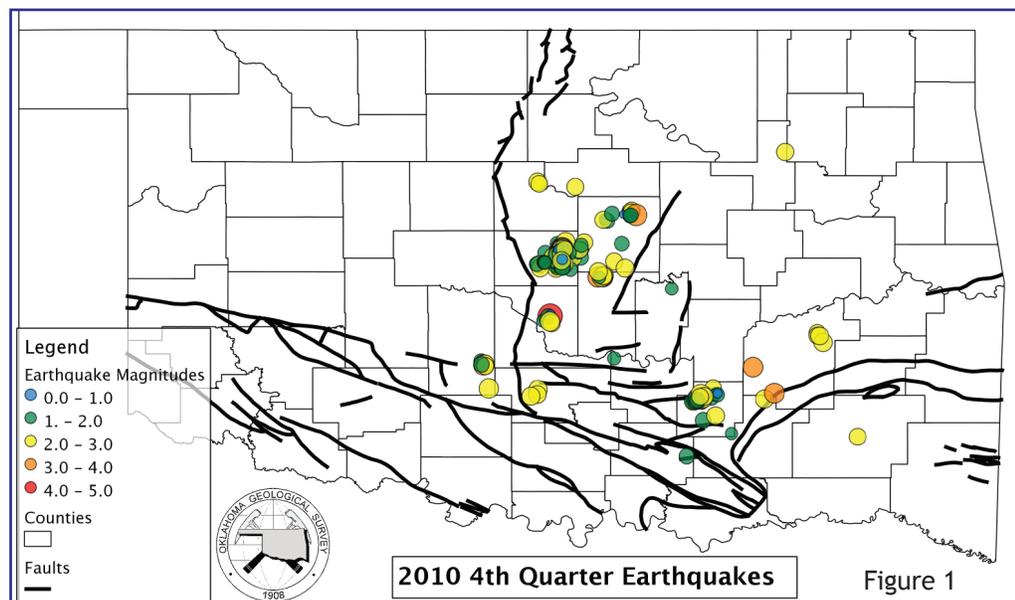
seismographs east of Oklahoma City to monitor the swarm of small earthquakes that has created a lot of public interest. The new seismologist at the OGS, Austin Holland, has been extremely busy on this effort, as has Amie Gibson at Leonard (see article below).

Providing digital records of and or about the vast data holdings of the OGS is a major emphasis that has been aided by a grant from the U.S. Geological Survey. Two other grants for data compilation and database construction have been approved for funding. The OGS also is helping the effort to create the Energy Libraries Online that is being led by the petroleum information libraries of the Oklahoma City, Tulsa and Ardmore Geological Societies (article on page two).

OGS Quarterly Earthquake Report 2010 4th Quarter

*Austin Holland, OGS Research Seismologist;
Amie Gibson, OGS Research Scientist II*

There were 338 earthquakes in the fourth quarter of 2010 (Figure 1). The majority of these earthquakes occurred in Oklahoma, Coal and Lincoln counties with 204, 59, and 28 earthquakes respectively for each county. Earthquakes in Oklahoma and Coal counties are part of ongoing earthquake swarms that occurred throughout most of 2010. There were 16 different counties which had earthquakes located within their boundaries.



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The Oklahoma Geology Notes Keeping up with the Times

G. Randy Keller, Oklahoma State Geologist

For those of you who are new to the *Notes*, welcome. For those readers who are familiar with the larger, glossier, scientific journal version of the *Notes*, we welcome you as well, and explain here why these changes have come about!

The *Notes* have changed form several times over the years. This publication series began as the “*The Hopper*” with Volume 1 in 1941. In 1956, the name of Volume 16 was changed to *Oklahoma Geology Notes*. Over the subsequent years, the physical format of the *Notes* changed and evolved into the large, colorful, and expensive format of recent years. As you know, the state budget is very tight, and we simply cannot afford to continue to publish the *Notes* in its former format.

This issue is the first in the new format as we follow many other state geological surveys and switch to a newsletter format that we will publish quarterly. This way, we can be timely in our publication while keeping costs down.

We have several other long-established publication outlets for the scientific content that has appeared in the *Notes* over the years, which include Oklahoma Geological Survey Bulletins, Guidebooks, Circulars and Special Publications, as well as the Shale Shaker published by the Oklahoma City Geological Society. We are also putting more publications on our expanding website where they can be downloaded at no charge.

We want to emphasize timely and high quality publication of scientific articles on the geology of Oklahoma and adjacent areas, and will work with the Oklahoma City Geological Society to achieve this goal. At the same time, we want to get information about geologic developments, events, and activity in Oklahoma out in a timely manner and will use the *Notes* and our website to achieve this goal.

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Energy Libraries Online Program Continues to Grow

Dan Boyd, OGS Geologist

Oklahoma’s historically hands-off attitude towards oil and gas data has created a situation in which service companies and geologic society libraries have become the main repositories for these data. Society library data is only available in hard copy and service company data is incomplete. A program called Energy Libraries Online Inc. (ELO), founded by the Oklahoma City Geological Society and The Oklahoma Well Log Library, and now joined by the Oklahoma Geological Survey and the Ardmore Geological Library is



an effort to address this problem. This non-profit, online reference library will eventually contain scanned images of virtually all of the hard-copy data now housed in all four of these libraries.

Even the best organized and maintained hard-copy collections cannot compare to digital databases. In addition to their ability to archive irreplaceable documents, they bring together the many, disparate data elements that earth scientists need to evaluate oil and gas in the subsurface. The ELO database will put in one place scout cards, completion data, well logs (including strip, electrical, and mud), and production data. It is important to organize and archive all subsurface data in one place, but one of the most important benefits the ELO system will bring to operators are the data necessary to identify underperforming oil reservoirs, which Oklahoma has in abundance. These data, which include early production, scout cards and strip logs are now difficult to impossible to access. Major collections already online include the Survey’s strip log collection of 127,000 images and 8,600 core analyses.

In addition to raw data, ELO is also dedicated to making available donated geological interpretations. The State of Oklahoma and its geological community had the very



An employee of GET Imaging prepares a strip log for scanning at the Oklahoma Petroleum Information Center on the OU campus in Norman, Oklahoma.

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OGS Quarterly Earthquake Report 2010 4th Quarter

(cont. from p. 1)

There were sixteen felt earthquakes in Oklahoma for the fourth quarter of 2010 (Table 1). The most notable of these was a magnitude 4.7 earthquake that occurred near Noble, Oklahoma. The earthquake occurred at 9:06 AM local time. This earthquake was the second largest earthquake instrumentally recorded in the state. This earthquake did not occur on a mapped fault. Seismic station recordings helped us determine that the fault is a strike slip fault. No surface expression from this earthquake has been identified or is expected. The earthquake was felt quite strongly in Noble and Norman, Okla., with a Modified Mercalli Intensity of VI. No significant damage has been reported from this earthquake. The earthquake was felt over a significant portion of the mid-continent with reports received from Oklahoma, Kansas, Arkansas, Missouri, and Texas.

The OGS earthquake monitoring program has had a busy year in 2010. We recorded and analyzed more than 1000 earthquakes in Oklahoma. Prior to 2010 the largest number of earthquakes recorded in a single year was 167. Local residents felt more than 100 earthquakes in 2010. The OGS received more than 6200 felt reports through our web-reporting facility. We incorporated into our earthquake monitoring system an additional 39 seismic stations operated by the NSF Earthscope USArray program. Initial indications suggest that adding these stations to our routine monitoring system may have increased the number of earthquakes we observed in Oklahoma by as many as 225. We also deployed 10 seismic

Origin Time (UTC)	Longitude	Latitude	Depth (km)	Magnitude		Modified Mercalli Intensity	County
					Type		
10/6/10 2:04	-97.2569	35.6163	2.7	2.8	Mc	III	Oklahoma
10/13/10 14:06	-97.3178	35.1854	11	4.7	mbLg	VI	Cleveland
10/19/10 17:53	-97.3201	35.1511	4	3	mbLg	III	Cleveland
10/25/10 20:53	-97.7412	34.8741	5	3.2	mbLg	III	Grady
10/28/10 9:52	-97.2339	35.5908	5	2.5	Mc	II	Oklahoma
10/29/10 4:18	-97.2381	35.59	1.3	2.7	Mc	II	Oklahoma
11/12/10 16:21	-97.1701	35.5561	4.6	2.1	Mc	II	Oklahoma
11/24/10 22:48	-97.2461	35.6123	5	4	mbLg	IV	Oklahoma
11/24/10 23:45	-97.2403	35.6141	6.2	3.1	mbLg	IV	Oklahoma
11/25/10 16:09	-97.2405	35.6212	5.5	2.5	Mc	III	Oklahoma
11/28/10 2:46	-97.2454	35.6128	2.3	3.2	mbLg	IV	Oklahoma
11/28/10 3:26	-97.2203	35.6547	5	2.9	mbLg	III	Oklahoma
11/28/10 3:28	-97.2422	35.6118	2.5	3.2	mbLg	III	Oklahoma
12/19/10 5:05	-96.7716	35.827	5	3.6	mbLg	IV	Lincoln
12/28/10 1:49	-95.8935	34.6961	5	3.1	Mc	III	Pittsburg
12/29/10 4:47	-97.44	34.6762	5	2.6	Mc	III	Garvin

mic recording instruments on loan from the USGS in eastern Oklahoma County in response to the Jones earthquake swarm. More than 670 earthquakes occurred in Oklahoma County in 2010. We are actively conducting research on this unique data set. We have also redesigned the OGS earthquake monitoring web page with interactive maps of past

and current seismicity.

Download 2010 4th Quarter Earthquake File (CSV): http://www.okgeosurvey1.gov/media/quarterlies/2010_qt4.csv
 Fact Sheet: October 13, 2010, Magnitude 4.7 Earthquake, Noble, Oklahoma: http://www.okgeosurvey1.gov/media/Oct13-2010-FactSheet_Revision2.pdf

OGS Geologists Teach University Course in Petroleum Subsurface Methods

Neil Suneson, OGS Geologist

For the fourth year, OGS geologists Rick Andrews, Dan Boyd, and Neil Suneson are teaching a senior undergraduate/graduate level course Subsurface Methods for the University of Oklahoma ConocoPhillips School of Geology and Geophysics. The primary goal of the course is to provide students with the skills necessary to be

a practicing petroleum geologist. The format of the course includes lectures and labs with a strong emphasis on the latter. The labs include real-world examples of what the young geologist can expect to encounter when he/she embarks on a career in the petroleum industry.



Shown l to r, OGS Geologists Dan Boyd, Rick Andrews, and Neil Suneson.

Osage Minerals Council Oil & Gas Summit and Prospect Expo A Huge Success!

Joyce Whitewing

The Osage Oil & Gas Summit & Prospect Expo was held on October 27, 28, 29, 2010, at the Crowne Plaza Hotel in downtown Tulsa. It was the tenth year for the summit, and it was the largest attendance they've had with over 285 present. Individuals from as far away as California, Houston, and Colorado attended. A record 30 vendors also participated. Producers, geologists, exhibitors, and a host of others attended the meetings and had a great learning experience as well as a great time.

Breakout sessions included information on gas contracts, Energy Libraries Online, Directional Well Modules, and Regional Setting and Deep Structure of the Osage County area.



Osage Chief John D. Red Eagle.
(Photo courtesy of Dawn Haney.)

Keynote Speakers were Harold Hamm, Founder, Chairman of the Board and Chief Executive Officer of Continental Resources, Inc.; and Rick Fritz, Executive Director, American Association of Petroleum Geologists.

The summit was kicked off with an oil and gas lease sale that was conducted by the Bureau of Indian Affairs and the Osage Minerals Council. The lease sale brought in over \$860,000.00, which is the largest sale they've had in years.

The producers who have oil and/or gas production in Osage County very generously sponsored the summit, just as they have in the past, and there was something for everyone in attendance: great food, meetings, technical papers, CEUs, and great exhibitors. All were enjoyed and found to be very worthwhile.



Opening ceremonies were conducted by the Osage Tribal Members with the drums and singing. An Osage Elder, Mongrain Lookout, was the featured Osage speaker and everyone enjoyed his rendition of growing up in Osage County.

The next summit will be held on **November 9th and 10th, 2011**. Be sure to put this date on your calendar. There will be several quality technical papers with excellent speakers, with free registrations available for the first 30 students who register. For further information, call Joyce Whitewing at (918) 885-2433.



Keynote Speaker Harold Hamm (Founder, Chairman of the Board and Chief Executive Officer of Continental Resources, Inc.) receives honorary Osage blanket from Dudley Whitehorn, Chair of the Osage Minerals Council. (Photo courtesy of Dawn Haney.)

OGS WORKSHOP – SAVE THE DATE – MAY 18TH, 2011 THE MISSISSIPPIAN

The Mississippian Osage of northern Oklahoma has long been an important producing horizon. This zone has been one of the primary reservoirs almost from the beginning of the Petroleum Industry in Oklahoma. However, in its development, geologists were often confronted by many problems when attempting to correlate and develop this reservoir. The early operators learned that the major part of the production seemed to generally occur at the top of the reservoir, in a residual or detrital chert facies, while the bulk of the reservoir appeared to consist of alternating porous and impermeable strata that was often barren, erratic, and random. This set of assumptions lead to a general misunderstanding of the reservoir's potential which has lead to bypassed reserves. In the 1960's the Mississippian Osage became the major focus for exploration with the discovery of commercial production in north-central Oklahoma. With this development came the discovery that major reserves could be obtained from almost any stratigraphic interval within the Mississippian Osage. But the problems that faced the early explorationist were also encountered by these operators. Correlation of the strata seemed to suggest a random and erratic depositional pattern, and a lack of understanding of the depositional geometry can lead directly to bypassed reserves. Today, operators have brought a new life into this reservoir's development. Horizontal drilling has demonstrated the ability to produce prolific reserves. However, these wells are expensive and the need to understand the targeted reservoirs depositional and producing characteristics couldn't be more important.

The Oklahoma Geological Survey recognizes the need to understand the various complexities inherent with the exploration, development and production of the Mississippian Osage. One of the Survey's primary responsibilities is to disseminate the information needed to assist operators who wish to successfully exploit this reservoir. To do this, the Oklahoma Geological Survey will be conducting a workshop on the Mississippian on May 18th, 2011. This workshop will consist of subjects that operators should find necessary in their search for reserves from this reservoir. These subjects will include papers on the stratigraphy and depositional environments of the Mississippian Osage, exploration concepts for discovering its reservoirs, electric log evaluation, horizontal drilling techniques, and completion procedures. Field studies will be devoted to understanding the various types of porosities within the Mississippian Osage and to the importance of understanding fracturing, reservoir drainage and in-fill drilling potential. Cores of the Mississippian Osage will be available that have been chosen to provide lithologic examples for many of the concepts presented by the papers.

Energy Libraries Online Program Continues to Grow (cont. from p. 2)

good fortune of being home to J. Glenn Cole, an eminent petroleum geologist. Shortly after he died in March of 2008, Glenn's family offered all of his geologic files and background data to the Tulsa Geological Society. He had always been recognized as an expert stratigrapher, but what was discovered when Glenn's office contents were reviewed was that in the course of his career he had amassed a monumental collection of over 500 meticulously correlated stratigraphic cross sections. These cover the entire northeastern quadrant of Oklahoma, extending from Kansas through the northern Arkoma Basin and from the Nemaha fault zone almost to Arkansas. The Tulsa Geological Society, specifically Glenn's friends on the TGS Stratigraphic Committee, in collaboration with the Oklahoma Geological Survey, have made his cross section and stratigraphic work accessible to all interested geologists. These are now available at no charge from the Energy Libraries Online (ELO) website at: <http://energylibrariesonline.com/>.

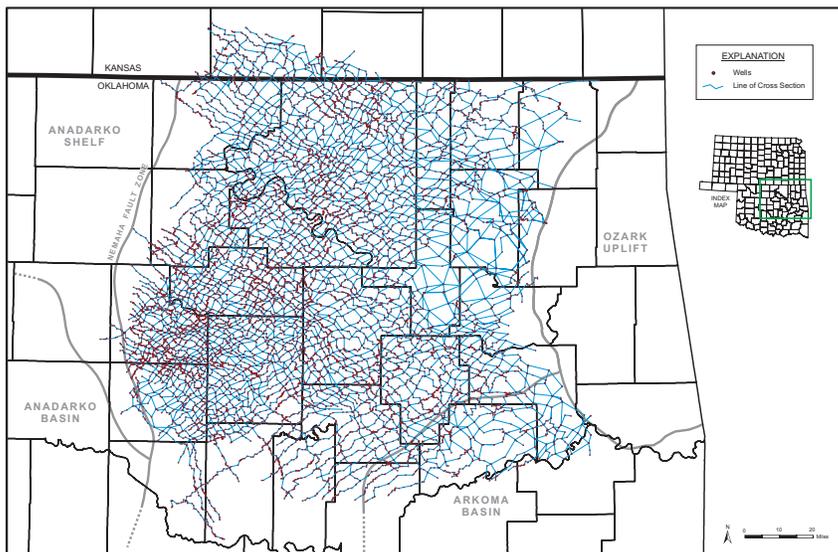
Energy Libraries Online requires financial support for this important work to be carried out, so this report would not be complete without a recommendation, directed at anyone that can see the value of this effort, to make a contribution. With such persuasive evidence that recovery factors in a significant percentage of the State's oil fields are substandard, little more needs to be done than to give the industry the tools it needs to find it. If these data increase oil-targeted drilling and production activity, every facet of the State economy will receive a boost. However, the benefits of a fully functioning online library extend well beyond the oil and gas industry. The ELO effort will also assist Oklahoma scientists in other areas of vital research, such as the study of groundwater resources and environmental quality.

Oklahoma Geological Survey Participates in National Geothermal Data System (NGDS)

Rick Andrews, OGS Geologist

In the fall of 2010, the Oklahoma Geological Survey began participation in a national geothermal data system project aimed at acquiring information that is useful for geothermal exploration, resource evaluation, and development. All is intended to be easily accessible online once the project is complete in three years. The acquired information can be of the public and/or private domain including on-going research. Each state will contribute data that is relevant to their own geographic area. Upon deciding this, a statement of work was formulated and submitted for approval to Dr. Lee Allison, director of the lead agency (Arizona Geological Survey).

Oklahoma decided to pursue acquisition of data regarding the Arbuckle Group since it is capable of delivering large volumes of hot water from the deep subsurface. Specific responsibilities include the creation of a large database of wells that penetrate this formation. From this, subsurface geologic maps will be constructed including structure and thickness maps. Additionally, the availability of core and core analyses will be completed. Analytical core data will be captured as digital files of existing reports. Representative well logs will also be acquired, scanned, and incorporated into digital deliveries to the NGDS. This project is managed by Rick Andrews of the OGS who is assisted by two graduate students. Currently, the project is completing the primary data base, has begun scanning well logs, and is acquiring the necessary supporting well data (meta-data). Funding for this effort is from the U.S. Department of Energy.



Base map showing the location of the Regional Grid (R-series) of the Cole cross section collection.

Created by the Oklahoma Territorial Legislature in 1890, the University of Oklahoma is a doctoral degree-granting research university serving the educational, cultural, economic and health-care needs of the state, region and nation. The Norman campus serves as home to all of the university's academic programs except health-related fields. The OU Health Sciences Center, which is located in Oklahoma City, is one of only four comprehensive academic health centers in the nation with seven professional colleges. Both the Norman and Health Sciences Center colleges offer programs at the Schusterman Center, the site of OU-Tulsa. OU enrolls more than 30,000 students, has more than 2,400 full-time faculty members, and has 20 colleges offering 163 majors at the baccalaureate level, 166 majors at the master's level, 81 majors at the doctoral level, 27 majors at the doctoral professional level, and 26 graduate certificates. The university's annual operating budget is \$1.5 billion. The University of Oklahoma is an equal opportunity institution.

CAMBRIAN VOLCANIC ROCKS OF THE SOUTHERN OKLAHOMA AULACOGEN— A FIELD TRIP REPORT

Neil Suneson, OGS Geologist

The Cambrian volcanic rocks in the Wichita and Arbuckle Mountains of southern Oklahoma have been studied sporadically over the last several decades, but to date, a comprehensive history of this bimodal suite has yet to be published. Charles Gilbert (University of Oklahoma) and his colleagues are responsible for many detailed studies of the Cambrian plutonic rocks (mostly gabbro and granite) in the Wichita Mountains, and Richard Hanson (Texas Christian University) and his students have published a number of studies on various aspects of the Carlton Rhyolite (Wichita Mountains) and Colbert Rhyolite Porphyry (Arbuckle Mountains). More recently Bob Puckett, a former mudlogger in the petroleum industry, published a paper on a thick sequence of basalts in the Arbuckle Mountains. His work, and that of Gilbert and Hanson, has rekindled interest in the Cambrian volcanic rocks of the Southern Oklahoma Aulacogen (SOA). In an effort to further research on these little-studied rocks and introduce new (and old) southern-midcontinent igneous petrologists to each other, I organized a “working” field trip to some key outcrops in the Arbuckle Mountains; I did this with strong encouragement from and the able assistance of Gilbert, Hanson, and Puckett.

After many emails were sent in an attempt to establish a date and a list of who to alert, Friday, December 3, 2010 was selected. The email list of possibly interested individuals evolved constantly, and I expect it will continue to change (hopefully increase). The field-trip participants included (from north to south), Matt Brueseke and Casey Bulen (KSU); Andreas Möller and Jeff Oalman (KU); Jeff Byrnes and Natalie Gentry (OSU); Bob Puckett (OKC); Randy Keller, Rick Andrews, Charles Gilbert, and me (OU and OGS); Bob Neman (ECU), Jonathan Price (Midwestern State); and Richard Hanson and Amy Eschberger (TCU), plus some

wives and significant others. We met at Braum’s in Sulphur over coffee and, in some cases, breakfast. We introduced ourselves, completed name tags, signed a waiver for one of the quarries we were scheduled to visit, and distributed handouts. The handouts included:

“Field guide to the basement rocks of the Southern Oklahoma Aulacogen” by Jon Price, John Hogan, Charles Gilbert, and Tim Denison, prepared for the 1998 South-Central Section meeting of the Geological Society of America, held at the University of Oklahoma in Norman.

A preprint of “A thick sequence of rift-related basalts in the Arbuckle Mountains, Oklahoma, as revealed by deep drilling” by Bob Puckett, to be published in the Jan./Feb. 2011 issue of the *Shale Shaker*.

A bibliography of reference on the volcanic rocks of the SOA was prepared by Bob Puckett.

“Large igneous province: Cambrian diabase dikes, eastern Arbuckle Mountains, Oklahoma – geochemical overview” by Ed Lidiak, Tim Denison,

and Bob Stern, prepared for an SOA Arbuckle Mountains field trip held in December 2010.

Our first stop was the Martin-Marietta Mill Creek quarry south of Mill Creek on the west side of Hwy. 7. We were welcomed by Mr. Dan Persyn, quarry superintendent, who gave us a brief introduction to the plant and had us sign waivers. We consolidated into as few vehicles as possible and drove into the quarry, which consists of a swarm of Cambrian basalt/diabase dikes intruded into the 1.4-billion-year-old Troy Granite (Figure 1). Some of the dikes exposed in the quarry, however, are Proterozoic. An excellent description of the dike swarm and its implications are in the handout by Lidiak et al.

The second stop of the morning was the Hanson Aggregates Davis quarry well west of I-35 on the north flank of the Arbuckle Mountains. Tim Nichols, plant manager, met us and guided us into the quarry. The contact between the volcanic rocks and overlying Reagan Sandstone is well-exposed on the east side of the quarry (Figure 2),

Figure 1. Mostly near-vertical mafic dikes intruding Proterozoic granite at Martin-Marietta’s Mill Creek quarry. Some dikes are less steeply dipping than others, and some (e.g., dike in upper left part of photograph) are subhorizontal. (Photograph by Rick Andrews, OGS.)



and pieces of a very complex breccias containing a variety of volcanic rocks types (microgranites, basalts, etc.) (Figure 3) are scattered around and were closely examined and collected by our group. Dikes are exposed in the quarry walls, but the details of the relations of the various rock units require further study. Price et al. (handout) speculated that these breccias represent a vent complex and/or a flow close to a vent. In addition to detailed work in the quarry, detailed mapping south and southeast of the quarry in the area shown on existing maps simply as "Colbert Rhyolite Porphyry" would clearly assist in our understanding of the volcanic suite.

After lunch, we drove to near the intersection of exit 47 on I-35 where we met Mr. Fred Chapman who owns the very large Chapman Ranch. Mr. Chapman graciously permitted us to examine the geology on his property, specifically, along a gully on the northeast side of Signal Mountain. Part of our group drove to look at the volcanic rocks near Turner Falls; I took a number and we hiked up the section. (The Colbert Rhyolite Porphyry underlies Signal Mountain and dips about 30° to the southwest; walking up the gully on the northeast side, therefore, allowed us to

Figure 3. Example of one of the rock types that is mapped as Carlton Rhyolite Porphyry. This breccia contains a variety of mafic and felsic rock types. (Photograph by Rick Andrews, OGS.)



examine as much of the volcanic section as possible.) The lower part of the rhyolite section was dominantly aphyric flow-banded rhyolite (Figure 4) and the upper part the more typical porphyritic (alkali feldspar) rhyolite. A thin section of sedimentary rocks (volcaniclastic?) separates the two units. We met the other group at the top of Signal Mountain, drove down to the bottom, and regrouped at the gate to Mr. Chapman's ranch. We thanked Mr. Chapman for his courtesy, said our goodbyes, and headed back to our respective states.

Post-field-trip emails indicated that the trip went well and suggested there is a lot of interest in the Cambrian volcanic rocks of the SOA. Whether or not this trip and the discussions amongst the various participants result in any research remains to be seen. Regardless, having a field symposium designed to bring together all of those working on the igneous rocks of the SOA in a year or two seems appropriate and several of us will work towards that.



Figure 2. Nonconformity (arrow) between what has been mapped as Carlton Rhyolite Porphyry below and Reagan Sandstone (Cambrian) above. (Photograph by Rick Andrews, OGS.)



Figure 4. Flow-banded, aphyric rhyolite typical of lower part of Colbert Rhyolite Porphyry section on northeast side of Signal Mountain. (Photograph by Matt Brueseke, KSU.)

Calendar: Workshops, Meetings, Conferences, and Field Trips

March 28-29 Geological Society of America South-Central Section Meeting

New Orleans, Louisiana
Website: <http://www.geosociety.org>

March 29-30 Woodford Summit

University of Oklahoma Mewbourne College of Earth & Energy
Norman, Oklahoma
Contact: Yoana De Walschap at 405/325-4753
E-mail: ywalschap@ou.edu
Website: <http://www.ou.edu/mcee>
Registration: <http://www.woodfordsummit.com>

The Woodford Shale Summit will allow a variety of stakeholders and experts in the field of shale gas production to meet and discuss key issues. The Summit will provide a unique opportunity to educate the public and address any potential concerns over the Woodford development. Host a vendor/exhibit booth to network, or plan to sign up as an attendee to listen to technical papers and network.

May 18 Mid-Continent Mississippian Play Workshop

Sponsored by University of Oklahoma Mewbourne College of Earth and Energy Oklahoma Geological Survey
Moore Norman Technology Center
Norman, Oklahoma
Contact: Michelle Summers at 405/325-7313 or 800/330-3996
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