

# Oklahoma Geological Survey

## 2010 Annual Summary

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### **Introduction**

One could literally say that things were shaking at the Oklahoma Geological Survey in 2010. On Friday, January 15, two earthquakes of magnitude 3.7 and 3.8 struck Jones, a small town east of Oklahoma City, and seemed to be felt by almost everyone in the area. A flurry of calls from citizens and town officials, media calls, television crews filming interviews, and other requests for information continued throughout the day. After a quiet nine days on the job, new seismologist Austin Holland decided that his fears of not having enough data to study in Oklahoma probably were unfounded.

On October 13 of 2010, a magnitude 4.7 earthquake occurred 6 miles southeast of Norman and was felt over a wide area. The OU campus got a series of tremors that alarmed many of the students, faculty and staff as buildings shook and rumbled when the waves passed through. Those in the basements and taller buildings especially felt the jolts. This was the second largest earthquake recorded in the state; the largest being a 5.5 near El Reno, west of Oklahoma City, in 1953.

Although earthquakes dominated the news and public service activities for 2010, oil and gas exploration and production also continued to be in the spotlight because horizontal drilling made more plays economical in the state.

Among other issues for study in 2010 were CO<sub>2</sub> sequestration, oil and gas data storage and archiving, and the continuing STATEMAP program.

### **Seismic Studies**

With the addition of Dr. Keller in 2007 and Austin Holland in 2010, the Survey has been fortunate to add two seismologists just when they were needed the most. Swarms of small earthquakes began showing up in 2007 near Jones and in the surrounding area. As more and more people began to feel the quakes, the local news media descended on the Survey for answers. An average year in Oklahoma before 2009 would have had about 50 measurable events, with only a few of these strong enough to be felt. In 2009, 43 felt earthquakes made an exceptional year for seismic activity. In 2010, the trend continued as about 500 quakes were recorded in Oklahoma County alone and more than 200 others occurred throughout the rest of the state.

Swarms of earthquakes are not unknown here, but the duration and frequency of these swarms certainly sets the activity apart from previously recorded events. The fact that the quakes occurred in a populated area also made them more newsworthy.

During this time frame, the EarthScope project of the National Science Foundation began placing seismometers throughout Oklahoma with cooperation from the OGS. The Survey also sited 10 strong-motion accelerograph stations on loan from the USGS in the Jones area.

During 2010, upgrades were made to the Geophysical Observatory in Leonard, Oklahoma, near Tulsa, in equipment, software, and connectivity to the main offices in Norman.

In addition to the data collected for study from these earthquakes, the OGS acknowledges its commitment to the citizens of Oklahoma by spending a great deal of time and effort to answer questions from media outlets and the public. The relationship with them is good, and it is one of the Survey's most important areas of public service.

### **Oil, Gas, Coalbed Methane and Coal**

Requests for information occupy a sizeable amount of time for the OGS staff members who work with oil, gas and coal. Clientele include industry professionals, educators and the public, both in-state and out. The most requested information includes drilling activity, hydrocarbon potential and production volumes, stratigraphic nomenclature, well data, reservoir characterization, and general geological information. Many citizens who have inherited mineral rights also contact the Survey for guidance in finding out what they have acquired. While the geologists do not supply specific answers about individual properties economic potential, they do point them toward information that is available from the state and other sources.

Geologists also teach classes for the Conoco-Phillips School of Geology and Geophysics, give presentations at OGS workshops and other gatherings, attend meetings and lead field trips for industry, academia and the public.

In addition to basic research, collecting and analyzing data on Oklahoma's oil and gas industry takes a lot of time and attention. Publications include an annual report on drilling highlights and in 2010 a new publication on *Production Decline Curves and Payout Thresholds of Horizontal Woodford Wells in the Arkoma Basin, Oklahoma*.

Data collection and archiving always is important at the OGS, but recent years have seen the activity stepped up with publications and maps that are available to users at no cost on the internet. Gas shales well-completion maps and a database are updated frequently, as are a coal database and maps. The OGS also is cooperating with Energy Libraries Online in putting hundreds of cross sections covering the northeastern quadrant of Oklahoma online and making them available for use. The life work and hobby of an Oklahoma geologist named Glenn Cole, the material consists of 506 cross sections and more than 21,000 individual log images.

### **Oklahoma Petroleum Information Center**

OPIC was a busy place in 2010 as new features were added and some areas were upgraded. There also was a 15 % increase in visitors that kept the staff busy.

- Core usage increased 91% over 2009.
- A higher resolution camera was added to the core photography equipment.
- Lighting was increased above all of the lay-out tables, giving users ample illumination to view materials.
- A lab was repurposed as office area for private viewing by adding lay-out tables and lighting that included both white and UV lamps. Other offices were converted to a small conference room and a large lab.

- Viewing and lab areas are booked for the next 5 years.
- A spectral gamma logger was added and is up and running.
- The cuttings from 2,032 wells were added to the collection.
- Work tables with microscopes, acid and other items are now available for use when viewing core.
- New viewing cubicles are equipped for customers to use when examining the cuttings.

### **Geological Studies**

Basic studies at the OGS include the National Geothermal Data System (NGDS) Geothermal study, which is a 3-year project. The OGS statement of work had been approved by the lead organization (Arizona Geological Survey) and the Survey currently is building a large database incorporating reservoir attributes, core availability, well-log image files, and other various geological data relevant to the Hunton and Arbuckle Groups in Oklahoma.

The U.S. Geological Survey National Geological CO<sub>2</sub> sequestration assessment in Oklahoma involves a one-year project time period. Data collection and analysis is ongoing.

Work is also underway for a planned 2011 field symposium on igneous rocks in the Arbuckle Mountains and Ardmore Basin areas.

### **Mapping and Cartography**

OGS Geologists Thomas M. Stanley and Julie Chang continue to spend lots of time in the field and in the office completing maps for STATEMAP. Their efforts are processed by the OGS cartography department and published on the OGS website for free download. In the last two years, nine digital geologic STATEMAP quadrangle sheets have been completed. The goal of the OGS is to make all final mapping available to the public via the internet.

The following maps were made available on the website in 2010:

OGQ-77A. Preliminary geologic map of the Watonga 30' X 60' quadrangle, scale 1:100,000.

OGQ-78A. Preliminary geologic map of the Foss Reservoir 30' X 60' quadrangle, scale 1:100,000.

OGQ-79. Geologic map of the Sand Springs 7.5' quadrangle, scale 1:24,000.

OGQ-80. Geologic map of the Wekiwa 7.5' quadrangle, scale 1:24,000.

OGQ-81. Geologic map of the Pauls Valley 30' X 60' quadrangle, scale 1:100,000.

In addition to working with STATEMAP, the OGS cartography section takes data and information and produces the required maps, illustrations, and posters for print publication, live presentations, and downloads from the OGS Web site.

### **Meetings and Outreach**

During this reporting time, the Survey's successful series of workshops and other meetings continued to give those in academia and industry a venue to meet and share ideas. Workshops were often filled and sometimes had waiting lists. They remain a valuable asset to the research community and industry in Oklahoma.

Another major outreach effort was undertaken with two 16-page publications that were aimed at Oklahoma school student in grades 7 through 12. The first edition appeared in April and was titled simply ***Oklahoma Rocks!*** It began with an overview of Oklahoma geology then went on to examine mapping, oil and natural gas, earthquakes, rocks and minerals, fossils and dinosaurs, and lastly water and aquifers.

The second supplement appeared in October in conjunction with Earth Sciences Week, and was titled ***Oklahoma Rocks! ENERGY***. The supplement began with a look at the energy challenge, and then had a discussion of the past and future for energy use in the U.S. From there, the pros and cons of various energy sources were outlined, along with the economic and environmental benefits and pitfalls. Topics were: Oklahoma oil and natural gas, coalbed methane, coal, hydroelectric power, nuclear energy and wind energy. Text and graphics were included to focus on jobs available in the energy field now and in the future, with the hope that some of the students will realize what a wide variety of Earth sciences skills and talents are needed to provide energy for the nation.

Each classroom teacher who signed up for the free program received 25 printed copies, a teacher's guide and supplemental material online, and a series of 6 quarter-page newspaper lessons that appeared weekly in the newspaper and were delivered by e-mail to the classrooms. Lesson plans and activities were included in the material. The program is part of the *Daily Oklahoman's* Newspapers in Education project, and goes to hundreds of classrooms throughout Oklahoma. The plans are to produce a supplement each October in conjunction with Earth Science Week.

OGS outreach activities always include: answering public and industry requests for information; conducting field trips; assisting scout troops with merit badge requirements; judging earth science events; GIS, Water and Aggregates Days at the Capitol; booths at conventions; information for rock hounds; mailing rocks to students and teachers; Oklahoma Academy of Science activities; basic information for general public use; and attendance at and sponsorship of many professional and society workshops and meetings. The geological staff contributes articles to publications on the state and national scale, and serve as officers and committee members for many organizations and agencies on a state and national basis.

Publications:

**Bulletin 150** *Conodonts and Conodont Biostratigraphy of the Joins and Oil Creek Formations, Arbuckle South-Central Oklahoma*, by Jeffrey A. Bauer.

**Guidebook 36.** Stratigraphic Analysis of the Permian Chase Group in Northern Oklahoma—Outcrop Analogs of Reservoir Rocks in the Hugoton Embayment of Northwestern Oklahoma and Southwestern Kansas, by James R. Chaplin.

**Information Series 14.** Petrified Wood in Oklahoma, by Neil H. Suneson.

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