# ALABAMA GEOLOGICAL SOCIETY NEWS

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## NOTES FROM THE PRESIDENT

Hello all! I hope that everyone has had a relaxing summer. The weather (to me anyway) has been great with only a few weeks of really hot temperatures. Now that we have all had (or hopefully had) a "battery recharging" vacation, it is now time to start looking at what's ahead for this upcoming year.

First of all I would like to congratulate this year's Newton and Winefordner scholarship winners. Billie Jean Palmer of Auburn University is this year's winner of the John S. Winefordner Scholarship. Billie is studying the characteristics of the karst system near Spring Villa, Alabama and the problems that relate to the sinkholes that are developing in the area. The winner of the John G. Newton Scholarship is James Thomka, of Auburn University, who is conducting research on a crinoid Lagerstätten in the Barnsdall Formation in northeastern Oklahoma. Both scholarship winners have graciously provided brief descriptions of their research projects which are presented later in this newsletter. I would also like to take this opportunity to thank Philip Dinterman and Stuart McGregor for recounting their travels in Eastern Europe at the Annual Slideshow/ Awards banquet this past Spring. Both slideshows were very informative and I know enjoyed by all in attendence.

Also, in this issue of the AGS newsletter, Dan O'Donnell,of our southwestern section, presents an article entitled "A Water Survey; What Does the Data Show". Dan's article talks about water level surveys, how to measure them, and what they really mean. We would like to see more geoscience-oriented articles from our members. Please submit them to Philip Dinterman. Thank-you Dan for your article.

There are several upcoming events around the southeast that may be of interest to our members:

The Alabama Mining Institute is presenting a professional development conference at the University of Alabama's Bryant Conference Center on September 29-30th. Technical sessions will include presentations on mining, geology, mineral processing, and environmental issues. See information flyer for more details or contact Donna Keene (dkeene@ccs.us.edu) or (205) 348-6513.

The Gulf Coast Association of Geological Societies (GCAGS)—of which we are a member society—is having their $59^{th}$ annual convention on September, $27^{th}$ -$29^{th}$ at the Shreveport Convention Center in Shreveport Louisiana. For more information go to www.GCAGS2009.com.

The Rocket City Geospatial Conference will be on November $17^{th}$ and $18^{th}$ in Huntsville, Alabama at the Huntsville Marriott. Presentations on GIS issues, geospatial technologies, and spatial data infrastructure and management will be given. For more information go to the conference website: www.rocketcitygeospatial.com

And looking just a bit further ahead, the $57^{th}$ Annual meeting for Southeast GSA will be in Baltimore, MD on March $13^{th}$ through $16^{th}$. Information on the $58^{th}$ annual meeting can be found at www.geosociety.org/sectdiv/sections.htm.

Make sure to mark your calendars for these upcoming opportunities to attend some informational great meetings.

We are well into the planning stages for the next Alabama Geological Society fieldtrip. It is tentatively planned for Friday and Saturday, December $4^{th}$ and $5^{th}$. The field trip "Tectonic controls of gold deposits in Alabama" will be run from Alexander City, Alabama. Fieldtrip leaders and contributors include Greg Guthrie, Bob Cook, Mark Steltenpohl, and Tony Neathery. A separate email will be sent out to all members with a more in-depth description and registration form at a later date. However, with initial interest shown for this trip I would encourage all members that would like to attend to register early.

The future of the Alabama Geological Society is sound with membership growing and a variety of activities (workshops, seminars, and fieldtrips) being planned. As always, if you have any questions or comments please let us know. Also, if you have any contributions for the newsletter or announcements that you would like to make, please feel free to contact our newsletter editor, Phillip Dinterman (pdinterman@gsa.state.al.us or (205)-247-3559).

G. Daniel Irvin

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The *Alabama Geological Society News* is published quarterly in February, May, August, and November. Manuscripts, news, and notes should be directed to the Newsletter Editor. The AGS also welcomes announcements of meetings, conferences, lectures, field trips, short courses, personnel changes, and social events of geological importance. The deadline for copy is three weeks prior to the month of publication. Submit copy by e-mail or diskette.


## ALABAMA GEOLOGICAL SOCIETY NEW MEMBERS

**May 09 to July 09**

**Professional**

Jeffrey S. Richardson
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## ADVERTISING RATES FOR THE ALABAMA GEOLOGICAL SOCIETY NEWSLETTER

The *Alabama Geological Society News* is published four times per year. The format for a full page is 8.5 x 11 inches less a 0.5 inch border on four sides, or 7.5 x 10 inches. A free subscription to the Newsletter is provided to advertisers who purchase a full page ad for a year. Advertising rates are as follows:

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Thank you for your consideration and support of our Society!

Alabama Geological Society

# Annual Awards Banquet and Slide Show

May 8, 2009

The 2009 Banquet and Slide Show once again highlighted the ability of the Alabama Geological Society to assist student research through two scholarships and for a room full of geologists to have a good time.  This year the two Society scholarships were given to two students at Auburn University. Billie Jean Palmer received the John S. Winefordner scholarship and James Thomka received the John G. Newton scholarship.

The two talks this year were presented by Stuart McGregor and Philip Dinterman. Stuart entertained us, for the second year in a row, with his stories from "*An Innocent Abroad: Stuart's Travels in  Western Europe, 2007*". Philip talked about a trip to Germany with his recently retired father in *"A Look Back, Germany 2008"*. Thank you to all who attended and special thanks are extended to Glenda Rheams for organizing the tasty food and to Vice President Larry Rheams for organizing the event as well as standing in for Dan Irvin for the welcome and scholarship presentations. Descriptions of the scholarship recipient's research can be found on the following pages.




# GENESIS OF A CRINOID LAGERSTÄTTE IN THE BARNSDALL FORMATION (UPPER PENNSYLVANIAN, MISSOURIAN) OF NORTHEASTERN OKLAHOMA, USA

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Conservation Lagerstätten are deposits characterized by exceptional fossil preservation; as such, they provide unique windows into ancient ecologies and physiologies that are normally absent from the fossil record and are therefore worthy of special attention from paleontologists (Seilacher, 1970; Seilacher et al., 1985). Although the preservation of non-mineralized soft tissue is the most spectacular of features associated with Lagerstätten, an equally important criterion is the preservation of articulated multi-element skeletons which would be found as disarticulated, isolated skeletal components under normal taphonomic conditions. Crinoids, characterized by very rapid disarticulation into individual ossicles without rapid burial or conditions prohibitive to biologic disturbance, provide excellent examples of such taphonomically volatile organisms (see reviews by Lewis, 1980; Donovan, 1991; Brett et al., 1997). While the fossil record of crinoids is hearty, deposits featuring articulated, complete or nearly complete crinoids can be classified as Conservation Lagerstätten (Brett and Seilacher, 1991).


A thin mudstone interval in the Upper Pennsylvanian Barnsdall Formation bearing an exceptionally diverse, abundant, and well-preserved crinoid fauna crops out near the small town of Copan in Washington County, northeastern Oklahoma. With 44 genera and 51 crinoid species represented, the Copan deposit is the most diverse Pennsylvanian crinoid Lagerstätte described in North America (see Hess et al., 1999); furthermore, it represents one of only two recognized Pennsylvanian crinoid Lagerstätten, the other being the LaSalle Limestone of Illinois (Strimple and Moore, 1971). Restricted both stratigraphically and geographically, previous research on the crinoid colony has focused on systematics (Pabian et al., 1995), biotic interactions (Pabian et al., 1997) and taphonomy (Lewis et al., 1998), with minor references to the deposit occurring in studies focused on crinoid paleoecology within midcontinent cyclothemic sequences (Holterhoff, 1996; 1997).

To date, no major research initiatives have been undertaken to determine the specific mechanism or mechanisms responsible for the occurrence and preservation of such a remarkable crinoid fauna. Therefore, the goals of the ongoing study are to utilize the paleoecology, sedimentology, stratigraphic setting, taphonomy, and geochemistry of the Copan crinoid Lagerstätte in order to determine 1) the nature of the interactions between physical, biological, and chemical factors that led to the genesis of the Lagerstätte; 2) the taphonomic history of the crinoid fauna and any new taphonomic patterns or processes that can be recognized by the occurrence of such a paleoecologically and biostratigraphically distinct assemblage; and 3) any unique sedimentologic or paleogeographic conditions that may lead to the discovery of genetically similar Lagerstätten in comparable strata.

With funding from the Alabama Geological Society's John G. Newton Scholarship, travel to the University of Nebraka State Museum in Lincoln, Nebraska was made possible, allowing taphonomic assessment of over 1100 crinoid cups and crowns recovered from the Copan deposit. In addition, funding for petrographic thin sections of sediment and siderite nodules associated with the crinoid fossils, carbon isotope analysis of siderite nodules, and scanning electron microscopy of sediment and crinoid fossils was made possible. The project is currently on schedule for completion by the spring of 2010; preliminary results concerning crinoid taphonomy will be presented at the 2009 national meeting of the Geological Society of America in Portland, Oregon (with the AGS graciously acknowledged, of course).

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## Billie Jean Palmer

My research project is centered in Spring Villa, Alabama, a small community just southeast of Opelika, Alabama. The research area, in a field north of Lee Road 148, is approximately 1.2 miles northeast of an operational aggregate quarry. Heavily concentrated sinkholes have developed in this small area, Little Uchee Creek has become essentially dry, and the spring of Spring Villa is no longer discharging. These features are all indicative of a significant activation of the karst system in the Chewacla Marble and a drop in the water table. This is possibly due to dewatering from the operations of the nearby aggregate quarry, and therefore, the company has agreed to assist the City of Opelika in excavating many of the karst features and repairing the ground stability.


My study addresses the characteristics of this karst terrain by utilizing both geophysical and hydrological methods. Conduits of karst aquifers allow the rapid transport of groundwater and contaminants. By correlating spring hydrographs and precipitation data, I will be able to characterize these conduits based on response time. Special interest is placed on using the ground-truth from excavation to compare with analyses of the geophysical anomalies. At the site, ground conductivity surveys and electrical resistivity tomography have already been used to identify the voids within the subsurface. Excavations are now beginning, and I will map the orientation of fractures in the bedrock and see the nature of the conduits. By comparing the geophysical survey results to the ground-truth from excavation, I plan to improve techniques of imaging and interpretation.

The people of the small community of Spring Villa have had their lives dramatically disrupted by the development of the sinkholes. Roads have been closed, and some residents have even been forced to evacuate their homes. The study plays an important role in improving methods to identify and understand these subsurface features. With a better understanding of the subsurface geology provided from this project, perhaps we can prevent similar situations from occurring in the future.

# A water level survey; what does the data show?

By Daniel J. O'Donnell, PG[1]

One of the most critical and basic parts of any groundwater investigation is the water level survey. Yet, as this paper will show, the water level survey may be one of the least technically sound parts of the investigation. This paper illustrates that variations in data collection and interpretation from a basic water level survey do occur even when carried out by professionals.

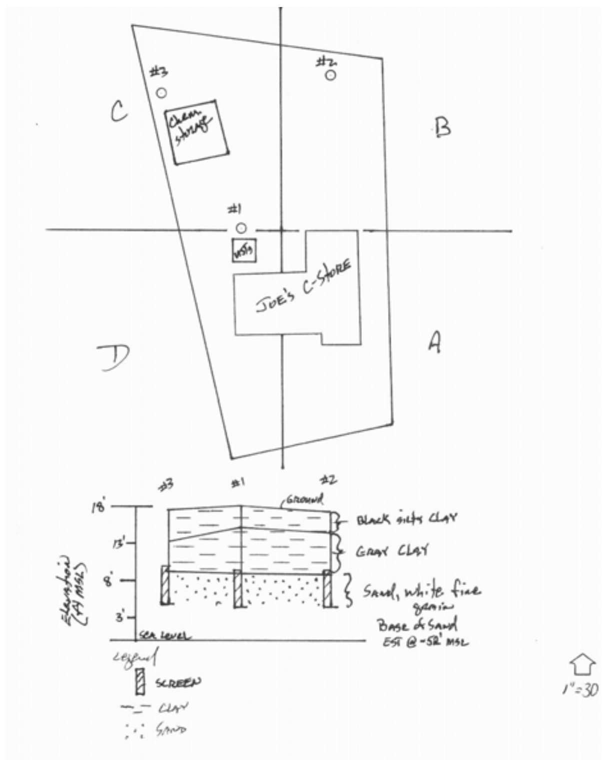
On May 20, 2008, O'Donnell & Associates, Inc. (OAI) presented a field method mini-camp to members of the Southwest Section of the Geological Survey of Alabama and other interested geologists (i.e. the "students"). The purpose of the mini-camp was to brush up on the basics of completing a water level survey. The goals of the camp were:

- to practice vertical surveying in wells (well surveying)
- to practice completing a water level survey, and
- to practice preparation of a potentiometric surface map of a shallow aquifer using the data obtained.

When combined, the data resulting from these three activities are used to make decisions on how best define and ultimately address groundwater contamination. Each student was issued an information package that provided the following background of the site under investigation, a scope of work and a scaled site map marked Exhibit 1.

**Exhibit 1**

**Site Map and Hydrogeology**




## Site Background

Joe's C-store was built in 1993 and consists of the c-store, a fuel dispensing area (USTs) and a chemical storage area. In late 2007, inventory reconciliation indicated a loss of 750 gallons of unleaded gasoline from the UST area. Subsequent testing indicated a failed UST caused the release. Preliminary work consisted of setting three groundwater monitoring wells in a triangular pattern to the north of the UST area between the site and Eslava Creek, which is located 750 feet to the north of the site. The subsurface geology indicates clay underlies the entire site to a depth of about nine feet followed by fine-grained sand to about 68 feet. Each of the wells, MW-1, MW-2 and MW-3, is constructed with 2-inch PVC casing and screen. MW-1 is at groundlevel and MW-2 and MW-3 have risers. Each well has a 5-foot long screened section. The site layout and a cross section showing the subsurface geology and well configuration are shown on Exhibit 1.

Shortly after the initial investigative work was completed, the consultant was struck dead while grilling out when a piece of space debris rained down on him. The sausage he was grilling was deemed a total loss but the balance of his environmental contract was awarded to you. Using your specific skills and training, you must complete the scope of work with all the diligence of a duly licensed PG. Mistakes may find you in court! Good luck…

## Scope of Work

- Complete a vertical survey to determine ground level and top of casing elevation at each monitoring well. Record on the data sheet your results of the survey in terms of elevation at each point. Note: Ground level adjacent to MW-1 at the "X" is 18 feet with respect to mean sea level (MSL). (You will need to pair up for this task, but record your own measurements!)

- Complete a water level survey of the three monitoring wells recording time, depth to water and presence of any odors emanating from the wells. Using the well survey data and the depth to water data complete the data sheet to determine groundwater elevation at each well.
- Using the upper portion of Exhibit 1 and the calculated groundwater elevations posted on the data sheet, prepare a potentiometric surface map of the surficial aquifer at this site. Using three-point methodology, establish the direction of horizontal flow in the surficial aquifer and draw an arrow showing flow direction on Exhibit 1. Where requested on the data sheet, indicate which quadrant the flow direction is towards (quadrants are marked on the upper portion of Exhibit 1 as A (southeast), B (northeast), C (northwest) and D (southwest)).

**Control**

A control survey was completed with each well's casing surveyed in by a professional land surveyor to the north side of the well casing with a score completed at the surveyed point. Well #1 and #2 had relatively flat casings while Well #3 was intentionally cut with a 0.05-foot slant at the top of the casing. Also, a control depth to water level survey was completed at each well to the surveyed point approximately 45 minutes prior to the student's arrival on site. This control data was used to develop a local potentiometric surface map of the surficial aquifer. The control data indicated groundwater flow was to the southwest on the day of the mini-camp.

Using this background information, the scope of work and the scaled map of the site, the students were provided with a transit and rod and allowed to begin collecting their well survey data. All were informed that assistance was available to them for the asking and then turned loose to complete the work. None of the students asked for assistance with the well surveying.

**Results of the Students' Vertical Well Survey**

The student obtained data for the elevation of the wells' TOC elevations varied, Table 1. The top of casing elevations for MW #1 varied from a low of 17.72 feet MSL to as high as 17.77 feet MSL, a difference of 0.05 feet. The averaged TOC elevation for MW #1 was 17.74 feet MSL. The control survey elevation was 17.72 feet MSL.

Top of casing elevations for MW #2 obtained by the students varied from a low of 19.77 feet MSL to as high as 19.84 feet MSL, a difference of 0.07 feet. The averaged TOC elevation for MW #1 was 19.79 feet MSL. The control survey elevation was 19.77 feet MSL.

Top of casing elevations for MW #3 varied from a low of 19.80 feet MSL to as high as 19.86 feet MSL, a difference of 0.06 feet. The averaged TOC elevation for MW #1 was 19.82 feet MSL. The control survey elevation was 19.80 MSL.

There are a number of factors that can lead to the variations in the students reported TOC elevations:

- TOC elevation depends on where on the well's casing the survey was made, particularly for Well #3 at this site with the intentionally cut slanted casing. ( Note: four of nine students documented where the vertical survey was made on the well's casing.)
- the student's proficiency with the setting up and using the transit and reading the rod (Note: none of the students were professional land surveyors)

| Student # | Well #1 GL | Well #1 TOC | Well #2 GL | Well #2 TOC | Well #3 GL | Well #3 TOC |
|---|---|---|---|---|---|---|
| Control | **18.00** | **17.72** | **17.21** | **19.77** | **17.75** | **19.80** |
| #1 | 18.00 | 17.72 | 17.24 | 19.77 | 17.73 | 19.81 |
| #3 | 18.00 | 17.72 | 17.21 | 19.78 | 17.61 | 19.82 |
| #4 | 18.00 | 17.75 | 17.64 | 19.84 | 17.24 | 19.81 |
| #5 | 18.00 | 17.73 | 17.25 | 19.78 | 17.55 | 19.81 |
| #6 | 18.00 | 17.77 | 17.21 | 19.78 | 17.61 | 19.82 |
| #7 | 18.00 | 17.73 | 17.25 | 19.78 | 17.56 | 19.82 |
| #8 | 18.00 | 17.72 | 17.29 | 19.78 | 17.76 | 19.86 |
| #9 | 18.00 | 17.74 | 17.24 | 19.78 | 17.66 | 19.86 |
| #11 | 18.00 | 17.75 | 17.64 | 19.84 | 17.24 | 19.81 |

- introduction of error in the calculation of elevations from the surveyed data

**Table 1**

**Casing Elevation Data (ft MSL)**

**Water Level Survey**

Upon completing the well survey, the students were provided with water level meters and allowed to begin collecting their water level survey data. All were informed that assistance was available for the asking and then turned loose. None of the students asked for assistance.

The student calculated groundwater elevations resulting from the depth to water measurements varied, Table 2. The groundwater elevations at MW #1 varied from 8.33 feet to 8.58 feet MSL, a difference of 0.25 feet. The averaged groundwater elevation at MW #1 was 8.45 feet MSL. The control groundwater elevation was 8.32 feet MSL

The student calculated groundwater elevations at MW #2 varied from 8.55 feet to 8.87 feet MSL, a difference of 0.32 feet. The averaged groundwater elevation at MW #2 was 8.72 feet MSL. The control groundwater elevation was 8.58 feet MSL.

The student calculated groundwater elevations at MW #3 varied from 8.30 feet to 8.53 feet, a difference of 0.23 feet. The averaged groundwater elevation at MW #1 was 8.41 feet. The control groundwater elevation was 8.31 feet.

Again, there are a number of potential factors that led to the variations in groundwater elevations reported for this event.

- depth to water depends on where on the well's casing the depth to water was measured- the well casings cannot be assumed to be cut "level" and Well #3's casing was intentionally cut crooked by 0.05 feet. (Note: Only two students indicated where the depth to water was measured from on the well casings)
- introduction of error due to the measuring equipment itself- several types were used, some possibly set with different sensitivities than others (Note: sensitivity settings were not documented on the data sheets)
- proficiency with the measuring equipment used and misreading the tape. (Note: none of the data sheets indicated the students measured each well twice for accuracy)
- introduction of error in the calculation of elevations from the surveyed data (see Groundwater Flow Section below)

**Table 2**
**Groundwater Elevation and Flow Data**

| Data Sheet # | Well #1 (ft MSL) | Well #2 (ft MSL) | Well #3 (ft MSL) | Flow Direction | Hydraulic Gradient |
|---|---|---|---|---|---|
| Control | **8.32** | **8.58** | **8.31** | **241.5** | **0.004279** |
| #3 | 8.54 | 8.82 | 8.53 | 241.3 | 0.004601 |
| #4 | 8.56 | 8.87 | 8.52 | 246.1 | 0.005383 |
| #5 | 8.35 | 8.55 | 8.31 | 249.5 | 0.003629 |
| #6 | 8.54 | 8.83 | 8.53 | 241.3 | 0.004763 |
| #7 | 8.34 | 8.60 | 8.26 | 254 | 0.005053 |
| #8 | 8.33 | 8.60 | 8.31 | 243.4 | 0.004536 |
| #9 | 8.35 | 8.59 | 8.30 | 249.8 | 0.004378 |
| #11 | 8.58 | 8.87 | 8.52 | 249.8 | 0.005285 |
| Averages | **8.45** | **8.72** | **8.41** | **246.9** | **0.004704** |

*Note; Of interest from a cross contamination perspective, three students began their water level surveys at Well #1, the well closest to the point of gasoline release even though the well was labeled with the notation "strong gasoline odor from this well" on its well cap. Three students did not record times, as directed, so the well they surveyed depth to water in first could not be established. Based on background information provided, the correct sampling order should have been Well #3, Well #2 and then Well #1 even with proper decontamination proceedures.*

**Groundwater Flow**

Using field data from their well and water level surveys along with their scaled site maps, the students prepared potentiometric surface maps with the horizontal direction of flow established for each data set. These hand calculated potentiometric surface maps showed that flow direction ranged southwest to northeast with one map showing flow in two different directions. The map with the northeast flow had groundwater flowing up-gradient.

As a check on the hand generated potentiometric surface maps, groundwater elevation data sets for each student along with well location data was input into the EPA's Hydraulic Gradient Calculator (one of the EPA's On-line Tools for Site Assessment Calculation with thanks to Jim Weaver). The hydraulic gradient calculator showed all flow, from both the student's data and the control data sets, was to the southwest. The angle of flow ranged from a low of 241.3 degrees clockwise from north to a high of 254 degrees, a shift of 12.7 degrees with an average flow direction of 246.9 degrees, Table 2. The control data had flow at 241.5 degrees.

Hydraulic gradients calculated from the EPA tool ranged from a low of 0.003629 to a high of 0.005383, a range of .0017 with an average hydraulic gradient of 0.004704, Table 2. The control hydraulic gradient was 0.004279.

*Note: The potentiometric surface maps generated from the field data using the calculator show that all flows were in the opposite direction one would expect to find based on the site's location adjacent to Eslava Creek. Previous research, see http://www.oaiwater.com/page/1fh6z/Research.html, at this site shows that groundwater flow in the surficial aquifer at this site is reversed after a substantial precipitation event with flow eventually returning to the northeast after a period of weeks. Water level data collected during this event were made 3 days after the site received 1.06 inches of rain with the direction of flow still being away from the creek.*

Conclusions

The purpose of this field methods mini-camp was to provide an opportunity for students, those being professional geologists, to brush up on basic tasks used in all groundwater investigations. The data showed that even seasoned professionals generate varying data when completing basic yet critical tasks common to a groundwater project. Sampling protocol and field documentation practices raised additional concerns beyond the fundamentals of obtaining and using basic groundwater data.

Further, without the hindsight of the historic data, analysis of ***this day's data*** begs the question: "***A*** water level survey; what does the data show?"

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# The Alabama Geological Society Engineering and Environmental Geology Seminar

On Monday April 27, 2009 the Alabama Geological Society hosted a one-day seminar on engineering and environmental geology. About 35 people were in attendance. The day began at 8:00 AM at Bevil Building on the University of Alabama Campus. Morning talks were given from various speakers working on many environmental issues throughout the State. After lunch several vendors gave demonstrations of equipment and sampling wares and provided much needed information about these products.

All in all, it was a day well spent. Thanks to all of the speakers for the informative talks and special thanks goes out to Larry Rheams for putting together the workshop and Dr. Rona Donahoe for all of the help with the seminar logistics and for the very informative talk regarding on-going research that she and her students are doing.



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| 5b | Geology of the Coastal Plain of Alabama; Geo. Soc. Am. Annual Meeting Field trip, Nov. 1967 | | $4.00 | |
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