PCPG Newsletter

Communicating Key Information & Concerns to Geologists and Environmental Professionals

Issue 2 / 2014

Inside this issue...

Message from the President

Hello! The celebration of PCPG's 25th Anniversary has continued through our Spring Board Meeting, professional development field seminar ("Rifting, Geology, and the Importance of Terrain on the Battle of Gettysburg"), and 25th Anniversary Picnic, all held in Gettysburg in late May.

As far as Pennsylvania tourist attractions go, Gettysburg National Military Park ranks in PA's Top Ten. Annually, over 3 million people visit the park to take in the rich history of the area, and many would argue that the Battle of Gettysburg was one of the most famous battles of the American Civil War. However, fewer people realize the influence the geology of the region had on the military decisions that were made and ultimately on the outcome of the Battle of Gettysburg. For example, the Catoctin rift (~570 Ma) formed the Catoctin Mountains, which were utilized by General Robert E. Lee to screen the movements of the Confederate troops from the Union Army. Triassic sediments deposited in the Gettysburg Basin provided lower elevation terrain for armies to traverse. Triassic red shales and siltstones in the battlefield area were crosscut by intrusive sheets of York Haven Diabase, a relatively resistant formation which provided advantageous defensive positions for the Union troops at Big Roundtop, Little Roundtop, Cemetery Hill, Cemetery Ridge, and Culp's Hill during the battle.

So when you are out with family and friends this summer, taking in the great scenery and history that Pennsylvania has to offer, do a little extra research ahead of time on the geology of the area you are visiting. You might be surprised at what you learn.

Please feel free to email questions and comments at joreilly@gesonline.com, and check out our website for more information at www.pcpg.org.

Very Truly Yours,

Jennifer L. O'Reilly, P.G.
PCPG President

BOARD OF DIRECTORS

PCPG's Colleges Outreach: Allegheny College, Meadville, PA

William Gough, P.G., Moody & Associates, Inc.

Over the past year, PCPG has launched a renewed outreach effort to geology departments throughout Pennsylvania and adjoining states. As part of PCPG's new emphasis and continuing efforts to reach out to geology departments, students and faculty, PCPG Board Member Bill Gough, P.G. visited the Geology Department at Allegheny College on April 10th. Allegheny College is a liberal arts college located in Meadville, PA that will celebrate their 200th Anniversary in 2015. Allegheny College has had a strong academic tradition in geology for many decades. Bill Gough's presentation was arranged and coordinated with Dr. Ron Cole. Ron has been a supporter of PCPG and has previously presented at PCPG's Review Course for the Practicing Geologist & ASBOG Exam Candidate. Twenty-five geology students attended the luncheon presentation. Bill distributed PCPG's new brochure (April 2014) that includes information on college course work required for admittance to the ASBOG exam and also the process to become a Geologist-in-Training (GIT) and a Professional Geologist. Bill's presentation also included examples of the wide variety of career paths available to geologists. PCPG plans to continue outreach efforts in the 2014-2015 academic year.

Spring 2014 Pennsylvania Science Fairs

The PCPG supported three science fairs in Spring 2014, providing judges and awarding prizes to outstanding projects. The science fairs and winners of PCPG's awards were as follows:

Delaware Valley Science Fair, Oaks PA

PCPG Judges: Grover Emrich, Ph.D., P.G., (Emrich & Associates), Gary Kribbs, P.G. (AEON Geoscience)
$500 award winner Colleen Cochran, Marine Academy of Tech/Environmental 1st Science
Project Title: *"Effective Dune Fencing Methods on Long Beach Island, NJ"*

North Museum Science & Engineering Fair, Lancaster County

Judge: Jay Parrish, Ph.D., P.G.
Senior Division Winner - $250 - Kat Lakehart, Warwick High School
Project Title: *The effects of the New Street Ecological Restoration Project on the water quality of the Santo Domingo Stream*
Junior Division Winner - $250 - Benjamin Crabtree, Hempfield Middle School
Project Title: *Shapes of Meteor Craters*

Pittsburgh Regional Science and Engineering Fair

Judge: Stephen McGuire (Chester Engineers)
Emma Holtz and Leah Flick - $100 each
Project Title: *Rock, Acid, Water, Shoot!*
Dylan Grindle $200
Project Title: *Sisyphean Drilling Part II*
Miheer Lele $100
Project Title: *Can Aquatic Plants Be Used To Remove Heavy Metals From Fly Ash Contaminated Water?*

Congratulations to these successful young scientists!

Historic Rivals to Modern Shale Gas Well Depths

Amy Randolph, P.G. – Senior Geologic Scientist, PA Department of Conservation and Natural Resources, Bureau of Forestry – Minerals Division

However primitive by today's standards, lateral well drilling techniques have been around since at least 1873 (National Oil Journal, Pittsburgh, PA, April 1873). Advances in horizontal drilling technology have been an instrumental factor in the successful recovery of "unconventional" petroleum sources.

Over the last few years, Marcellus shale gas drillers have been steadily increasing the lengths of the lateral portions of these wells. Earlier in the development of this play, total measured depths (the combined vertical and horizontal portions) of these wells were in the range of 10,000-12,000 feet. More recent wells are reaching lengths of up to 15,000 feet or longer.

While these shale gas drill stem lengths are impressive compared to most historically drilled natural gas wells in Pennsylvania, they aren't without precedent. A review of information included in yearly Oil and Gas Progress Reports published by the Pennsylvania Geological Survey between 1950 and 1991 reveals several other interesting deep wells which have been drilled within the state. A few of these wells are highlighted below. The reader should keep in mind that all of the following are vertical, and not horizontal, wells.

Progress Report 139 (for 1951) – The Arthur Bennett No. 1 (API#37-113-90000) in Davidson Township, Sullivan County was drilled with rotary tools to a depth of 12,343 feet where it terminated in the Upper Ordovician Juniata Formation, making it the deepest well in the Pennsylvania portion of the Appalachian basin at the time. Although the well was dry, its drilling log (available through the Survey's PA*IRIS/WIS System) reported slight traces of gas in the dark shale section corresponding to the Marcellus.

Progress Report 155 (for 1958) - The Joseph Kardosh No. 1 (API #37-039-20007) in Summerhill Township, Crawford County was completed as a dry hole at 8,031 feet, but had the distinction of being the state's first Precambrian basement test.

As an interesting side note, this report also indicated that nearly all deep wells in Pennsylvania were hydraulically fractured as part of their completion, and commented that gas production from the easily fractured Onondaga chert was greatly enhanced by this technique.

Progress Report 160 (for 1961) – A York County well, the Harry Leib No. 1 (API #37-133-20001), was drilled to 8,631 feet to the Lower Cambrian Chickies Quartzite.

Progress Report 161 (for 1962) – The Charles Blemle No. 1 (API #37-015-20001) in Wilmot Township, Bradford County set a new depth record of 12,843 feet to the Upper Ordovician Juniata Formation. Its drilling log noted pockets of gas in the Middle Devonian Hamilton Formation, most likely from the Marcellus shale.

Progress Report 168 (for 1964) – The J. Franklin Long No. 1 (API #37-027-20001) in Centre County was completed at a depth of 15,663 feet before being plugged and abandoned. This well terminated in the Upper Ordovician Loysburg Formation.

The Fayette County Leo F. Heyn #1 well (API #37-051-20041) had originally been drilled in the mid- to late 1930s and was deepened through the Upper Silurian Salina Group in the early 1940s. During 1963 and 1964, this well was drilled deeper through the Lower Silurian Tuscarora Formation, terminating at 11,571 feet.

Progress Report 188 (for 1975) – The C.B. Smith Trust Estate No. 2 (API #37-20131-20131) in Wharton Township, Fayette County reached the Upper Ordovician Juniata Formation at 11,335 feet before being abandoned.

The Henry Dewey No. 1 (API #37-117-20057) in Gaines Township, Tioga County was abandoned in the Cambrian Gatesburg Formation, at a depth of 15,097 feet.

These two deep wells were impressive enough, but were eclipsed by the Somerset County No. 1 Leonard Svetz well (API #37-111-20045), completed to a depth of 21,460 feet in Ore Hill Member of the Cambrian Gatesburg Formation. This completion set a new record for the deepest well drilled in the Appalachian basin, and still holds the record as the deepest well in the Pennsylvania portion of the Appalachian basin (K. Carter, Pennsylvania Geological Survey – Pittsburgh office, personal communication, 2014).

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HISTORIC *Continued from Page 3*

Progress Report 197 (for 1984) – A new depth production record of 13,030 feet was set by a well completed in December 1982. The Texaco USA No. 1 (API #37-035-20276) penetrated the Cambrian Waynesboro Formation at a depth of 19,365 feet, although production was established in the shallower Upper Ordovician Bald Eagle Formation. This well was recently plugged in late 2013.

This is just a short summary of the many interesting oil and gas development facts and figures in Pennsylvania that can be found by accessing electronic copies of these Progress Reports, available on the Survey's website at http://www.dcnr.state.pa.us/topogeo/publications/pgspub/progress/index.htm.

Additional information on the Survey's Pennsylvania Internet Record Imaging System/Wells Information System (PA*IRIS/WIS) can be accessed at http://www.dcnr.state.pa.us/topogeo/econresource/oilandgas/pa_iris_home/index.htm.

The author would like to thank Kristin Carter, Assistant State Geologist, with the Survey's Pittsburgh office for her contribution to the above. *Please note - If readers note differences between information published in the cited Progress Reports and that written above, it is the result of more recent interpretations of available completion reports, geophysical logs, and/or other sample logs that post-date publication of the Progress Reports.*

PCPG's Position Regarding Soil Scientist Licensing in PA

The Commonwealth of Pennsylvania licenses a myriad of professions, including engineers, surveyors, and geologists, but has not yet applied a licensing requirement to the practice of soil science. Over a dozen states currently require licensing of soil scientists. Today, there are parallel bills in the state House of Representatives and the state Senate that would provide for licensing of Soil Scientists in Pennsylvania: House Bill 997 (introduced March 14, 2013) and Senate Bill 1173 (introduced November 15, 2013). These bills are the result of nearly 40 years of efforts by the Pennsylvania Association of Professional Soil Scientists (PAPSS) working in conjunction with the Soil Science Society of America.

In July 2013, representatives of PCPG and PAPSS met to discuss the scope of HB 997 and PCPG's concerns that, as written, HB 997 would limit the services currently provided by Professional Geologists. PCPG's concerns were heard and more favorable revised language was incorporated into SB 1173.

On May 7, 2014, PCPG Directors Jim LaRegina, P.G. and Mark Ioos, P.G. participated in a public hearing on HB 997 with the House of Representatives Committee on Professional Licensure. PCPG testified in support of the soil scientists' desire to seek professional licensure and registration, but voiced concerns regarding the scope and breadth of the definition of the "practice of soil science" as defined in the language of HB 997. That definition includes a list of specific soil science services historically provided by Professional Geologists (soil remediation, bioremediation and volatilization to name a few) that could potentially be interpreted as requiring a Professional Soil Scientist to the exclusion of a Professional Geologist. Also of concern is the absence of an "incidental practice" provision in HB 997. Currently the Engineer, Land Surveyor and Geologist Registration Law (Registration Law) allows engineers and surveyors to practice geology without a license for geologic work incidental to engineering or surveying. HB 997 allows for soil scientists to practice incidental geology without a license but no clause to allow geologists to practice incidental soils work. PCPG's position is that it cannot support and strenuously objects to any amendment of the Registration Law that would have the effect of reducing or limiting the types of services traditionally within the scope of the practice of geology.

The wording of SB 1173 provides a broader but comprehensive definition of the practice of soil science but does not incorporate a list of specific soil science services. The definition also states "Nothing in this definition shall be construed to preclude the practice of soil science by other scientific disciplines, where such practice is regulated by separate rules, certifications or licensure". PCPG will push to see SB 1173 further amended to incorporate a specific incidental work provision for geologists practicing soil science. PCPG's testimony to the House Committee on HB 997 included a statement that PCPG supports PAPSS's licensure effort and that the SB 1173 wording is more acceptable to PCPG than the House version of the bill.

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LICENSING *Continued from page 5*

In summary, PCPG is supportive of PAPSS's licensure effort; however, PCPG cannot support, and strenuously objects to, any amendment of the Registration Law that would have the effect of reducing or limiting the types of services traditionally within the scope of the practice of geology. PCPG members are urged to review HB 997 and SB1173 and provide input on the Bills to any Board member. The Bills are found at the following links:

House Bill 997:

http://www.legis.state.pa.us/cfdocs/billinfo/billinfo.cfm?syear=2013&sind=0&body=H&type=B&BN=0997

Senate Bill 1173:

http://www.legis.state.pa.us/cfdocs/billInfo/billInfo.cfm?sYear=2013&sInd=0&body=s&type=b&bn=1173

PCPG Hosts Booth at the 2014 Northeastern GSA Meeting

Martin F. Helmke, PhD, PG, West Chester University of Pennsylvania

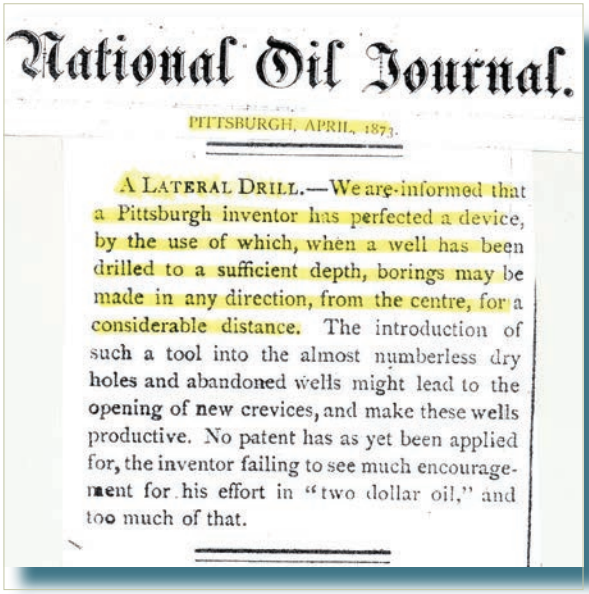
PCPG hosted a booth at the Northeastern Geological Society of America meeting held in Lancaster March 22 through 25, 2014. PCPG members Craig Ebersole, Martin Helmke, Tracy Jeremias, Kelly Kinkaid, and Gary Kribbs served as hosts during the four-day conference. This was one of the most successful NEGSA conferences to date, with 1,317 attendees. Over 100 (mostly students) registered for the PCPG newsletter and expressed interest in membership. PCPG promoted GIT certification, PG licensure, upcoming PCPG course opportunities, and provided career advice to students. We wish to thank our volunteers along with Rose Jeffries, who registered the booth and provided 25th Anniversary mugs, illuminating bottle openers, pens, book bags, flyers, and USB drives to hand out during the meeting.

Gary Kribbs, Kelly Kinkaid, and Tracy Jeremias host the PCPG booth at NEGSA.

PCPG member Craig Ebersole meets with a student, a professor, and a regulator at the NEGSA meeting.

Directional Drilling in Pennsylvania ….. or, "Everything Old is New Again"

By Dan Billman, P.G., and Valerie Holliday, P.G.



National Oil Journal.

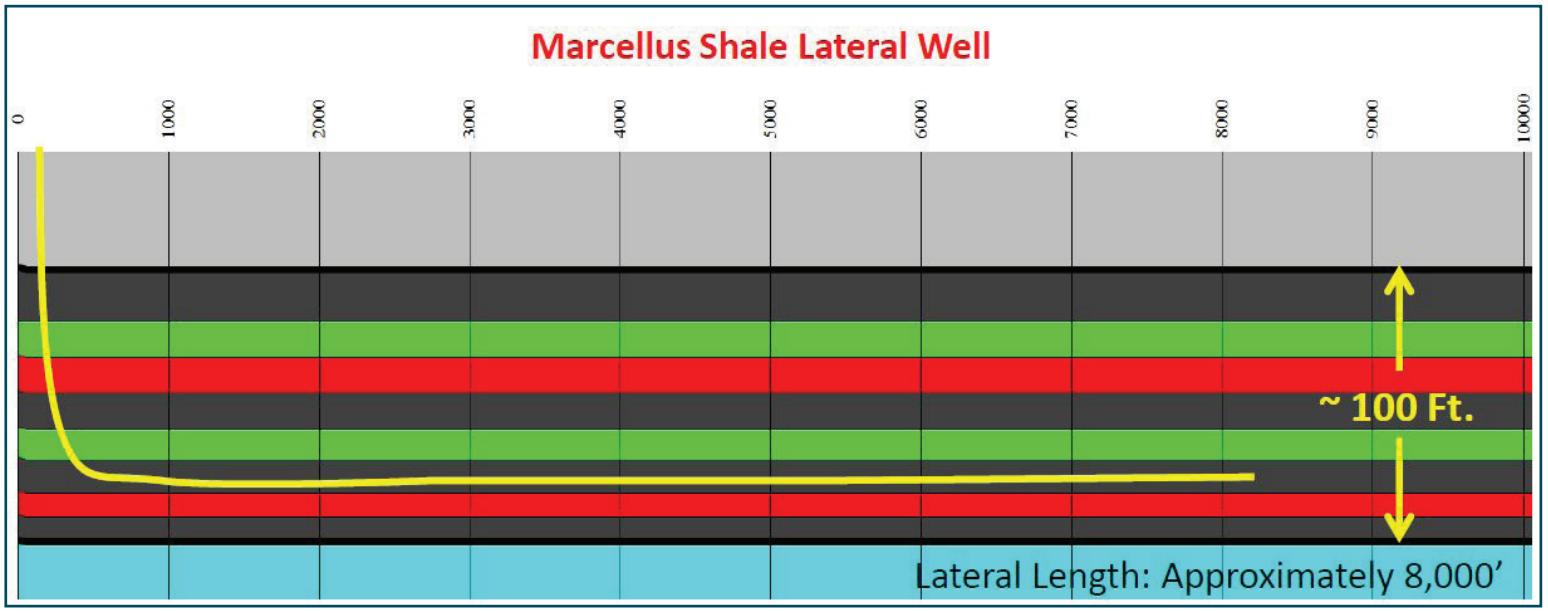
PITTSBURGH, APRIL, 1873.

A Lateral Drill.—We are informed that a Pittsburgh inventor has perfected a device, by the use of which, when a well has been drilled to a sufficient depth, borings may be made in any direction, from the centre, for a considerable distance. The introduction of such a tool into the almost numberless dry holes and abandoned wells might lead to the opening of new crevices, and make these wells productive. No patent has as yet been applied for, the inventor failing to see much encouragement for his effort in "two dollar oil," and too much of that.

If you spend much time reading the papers or watching television (especially in western and northeastern parts of the state), you might think horizontal fracture treatments (frac'ing) and horizontal or directional drilling were new technologies, developed in the 21st century. Of course, as many already know, this could not be further from the truth. Hydraulic fracture treatments have been utilized by the oil and natural gas exploration and production industry since the 1950s and directional drilling even longer. But how much longer?

Take a look at an article (see photo) from the "National Oil Journal" entitled "A Lateral Drill", with a byline of "Pittsburgh, April, 1873". Yes, that was 1873 … roughly 15 years after the Drake well discovery. The article states, "…that a Pittsburgh inventor has perfected a device, by the use of which, when a well has been drilled to a sufficient depth, borings may be made in any direction, from the centre, for a considerable distance." Sounds like horizontal drilling. The inventor suggests that use of the "… tool into the almost numberless dry holes and abandoned wells might lead to the opening of new crevices, and make these wells productive." Sound familiar? The theory of modern unconventional reservoir drilling and completion is that formations, often shales, which contain significant hydrocarbons, can be made economic through use of "new" technologies.

The use of directional drilling didn't lie dormant from the late 19th century until today. The earliest application of directional drilling was probably to sidetrack around an obstruction at the bottom of a hole. The first recorded instance of a well being deliberately deviated to reach its objective was at Huntingdon Beach, California, in the early 1930s, where a drill rig located on land used directional drilling to drill a slanted hole out from land to offshore (Inglis, 1987). It has been reported that in 1934 a deviated relief well was drilled to end a blow-out in the Conroe oil field of east Texas (Inglis, 1987).



Hypothetical Marcellus Shale lateral well

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Upcoming Events

July 17-18, 2014
Introduction to Inorganic and Organic Groundwater Geochemistry
8:00 - 5:00
Comfort Inn East
699 Rodi Road, Monroeville, PA

July 21-22, 2014
Introduction to Inorganic and Organic Groundwater Geochemistry
8:00-5:00
PSU Great Valley
30 E. Swedesford Rd.
Malvern, PA

August 7-8, 2014
Rock Slope Stability Two Day Short Course
8:00 - 5:00
Comfort Inn East
699 Rodi Road, Monroeville, PA

August 21, 2014
Basic Tools for Shale Exploration
8:00 - 5:00
Four Points by Sheraton
Pittsburgh North
Mars, PA

September 17, 2014
Act 2 Toolkit: Vapor Intrusion
PSU Great Valley
Malvern, PA

Don't forget to check the "Courses & Events" link on PCPG's home page frequently for up to date information on upcoming educational opportunities.

DRILLING *Continued from Page 6*

In Pennsylvania during the late 1980's and early 1990's, prior to the shale plays that are common today, numerous "conventional" wells were drilled in Centre and Clinton Counties using directional drilling technologies. The wells were drilled directionally so that the surface locations could be placed away from excessive topography and ecologically sensitive areas, such as bogs and swamps. The wells were often spotted a few hundred feet from the non-ideal surface location and drilled to a bottom-hole location under the surface feature that inhibited building a surface location. Those wells were just a few of the hundreds of wells drilled, in the two-county area, to extract natural gas from the Upper Devonian, Elk and Bradford Group sandstones.

Prior to the modern shale plays, the unconventional natural gas reservoir of choice was often coal. Coal Bed Methane (CBM) wells were often drilled horizontally, and in some cases, in a "pinnate" pattern (the well bores through the coal look a bit like the veins in a leaf). Horizontal wells are often utilized in natural gas storage reservoirs to better allow for the needed deliverability of natural gas during times of great natural gas demand.

Today, thousands of lateral Middle Devonian Marcellus Shale wells have been drilled in Pennsylvania and surrounding states. Shallower and deeper units, the Upper Devonian Geneseo/Burket Shale and the Ordovician Utica Shale, respectively, are also being directionally drilled.

The "inventor" of the lateral drill from 1873 could not have imagined where the oil and gas industry would be 140 years later. The 1873 article does not state the length of the lateral the inventor could achieve. Maybe only a few feet … maybe tens of feet at most. Here in the 21st century, lateral Marcellus Shale wells are drilled to lengths of 7,000 to 9,000 feet on a regular basis. Often the wells are targeting a specific objective within the Marcellus Shale and that 7,000 foot lateral can be located completely within a targeted 20 foot section of Marcellus Shale. Whether you are an inventor from 1873 or have been working in the oil and gas industry for the last 25 years, you have to marvel at the technological advances of today's horizontal drilling and completion industry.

(Inglis, T.A., 1987. Petroleum Engineering and Development Studies, Vol. 2 Directional Drilling. Graham & Trotman)

Student Corner

Martin F. Helmke, PhD, P.G., West Chester University of Pennsylvania

Welcome to the *Student Corner*, a forum for information exchange between students and geologic professionals across the Commonwealth.

Many entry-level geologist positions require 1 to 2 years of work experience. Educational institutions provide robust curricula that prepare students for careers as geoscientists. However, employers are seeking evidence of successful work experience in addition to the requisite scientific skillset. How do you gain work experience if experience is a prerequisite for work? The answer is simple: develop experience while you are a student by taking advantage of one (or more!) of the following opportunities:

1. Internship. Internships are temporary employment positions designed to allow students to "test the waters" as science professionals without the long-term commitment of the employer. These are often competitive, so apply early and reapply if unsuccessful. Most large firms, government agencies (National Park Service, USGS, EPA, PA DEP), and professional organizations (NSF, GSA, AGI/AAPG) have well-established internship programs.

2. Research. Conducting research demonstrates project management and communication skills in addition to excellent command of the subject matter. Present your research at a scientific meeting or publish in a peer-reviewed journal. At a minimum, keep a copy of your research paper to demonstrate your writing skills during job interviews.

3. Service-Learning. Application of geology as a class exercise to benefit the community is considered service-learning. High-quality service-learning demonstrates your ability to produce a professional work product. Service-learning also helps you appreciate how your geologic work benefits society.

4. Employment. All employment experience, even if it doesn't involve geology directly, is still valuable. Future employers want to know that you can show up for work, meet deadlines, interact professionally, and generally contribute to your organization. Think outside the box: summer employment as a cave tour guide, driller's assistant, or geologist park ranger would be great professional development and a lot of fun!

5. Travel. Domestic and international travel shows your commitment to learning about the broader world. Moreover, dealing with the logistics of travel demonstrates your ability to manage resources at remote locations, which is a coveted job skill for the field geologist.

6. Volunteer. Work experience does not necessitate remuneration. Volunteering is more than altruistic; volunteering may allow you to work on projects that would otherwise be inaccessible to you. Museums, government agencies, educational institutions, and professional organizations all rely on volunteers. Put your skills to work and support a worthy cause.

Make sure your record includes more than just a college transcript when you graduate. Take advantage of the numerous opportunities to gain professional experience inside and outside the classroom. And once you land your dream job, give back to your field by providing these opportunities to the next generation of geoscientists.

Please submit suggestions or questions regarding students and geology to Dr. Helmke at mhelmke@wcupa.edu.

Member Spotlight: GES

For 30 years, Groundwater & Environmental Services, Inc. (more commonly known as GES) has provided environmental consulting, engineering, and technical field services related to assessment, remediation, and compliance for all environmental media.

Since its start in 1985 in eastern PA, GES has become a national firm while retaining its roots in the Commonwealth. GES has 35 offices nationwide with 600 employees.

GES has extensive experience in the PA oil industry working at gas stations, refineries, terminals and pipeline facilities. This firm has worked with many companies in the manufacturing, transportation, and utility sectors. In recent years, GES has supported the PA oil and gas development industry, helping industry and communities across the state to develop and benefit from new energy sources. They also serve the Commonwealth through the statewide GTAC program, providing assessment and design support for the agency's land recycling, hazardous sites cleanup, federal superfund, storage tank, and other related programs.

GES balances their clients' business needs with their environmental objectives. An efficient service delivery model integrates program leadership with operations and engineering to ensure quality, consistency, and safe performance across their client's environmental portfolios. This best-value approach pairs specialized industry expertise with the appropriate technical and regulatory knowledge to match the right resources to each project. Their PA staff includes geologists, remediation specialists, environmental engineers, and a diverse staff of equipment operators and environmental technicians. GES has become well-known for its patented, aggressive Max-Ox remediation technologies, including in-situ chemical oxidation and chemical reduction technologies to treat petroleum and industrial contaminants in soil and groundwater. GES innovations also include DAPL (data acquisition and processing laboratory), an enhanced remediation feasibility testing and injection platform designed to optimize remedial strategy and design.

Above all, GES is focused on achieving their clients' goals, safely – with a commitment to health, safety, security, and environment (HSSE) and the use of their licensed LPS (Loss Prevention System) behavioral management system. They achieved no lost-time injuries in 2013 and earned 0.15 OSHA TRIR.

GES' staff use their regulatory knowledge and professional judgment to help their clients reduce the costs of managing their environmental liabilities – and to obtain closure on their toughest sites.

PRACTICAL SOLUTIONS.
SUSTAINABLE RESULTS.
solving environmental challenges for PA companies, organizations, and agencies since 1985

For more information, please contact:
Jennifer L. O'Reilly, PG
joreilly@gesonline.com
800-426-9871 x3059

PCPG Celebrates History at Gettysburg National Military Park, May 23, 2014

On a picture-perfect day in May, more than 40 geologists and friends celebrated the 25th Anniversary of PCPG and enjoyed the PCPG-sponsored field trip, "Rifting, Geology and the Importance of Terrain on the Battle of Gettysburg, July 1-3, 1863", led by Robert C. Smith, II, P.G. and Richard C. Keen. At each of eight field stops, Rick provided historical perspective and insight into the three-day battle and Bob explained the role of the unique geology of the Gettysburg Basin.

The town of Gettysburg lies toward the southern end of the Mesozoic rift basin. The battlefield landscape of 1863 owed its configuration to a complex series of geological events, from Late Triassic-Early Jurassic continental sedimentation and diabase plutonism, through Early Jurassic structural deformation and erosion during the later Mesozoic and Cenozoic (Smith and Keen, 2014). The sedimentary rocks in the basin consist of the New Oxford and Gettysburg Formations. A complex network of diabase sheets and dikes of Early Jurassic age intruded throughout the Gettysburg Basin.

Much of the first day of battle was fought over ground underlain by the Heidlersburg Member of the Gettysburg Formation, a cyclic shale, argillite and siltstone unit with numerous beds of hard white sandstone that created a terrain of alternating narrow low ridges and swampy valleys (Smith and Keen, 2014). McPherson's Ridge, where the Union forces initially placed a main line of resistance, is formed by sandy beds of the undivided lower Gettysburg Formation (Ibid).

Bob Smith describing the geology at McPherson's Ridge, with statue of General Buford in the background.

The middle and western railroad cuts on the CSX line into Gettysburg provide excellent exposures of the uppermost part of the undivided Gettysburg Formation that lies below the mapped Heidlersburg Member. The cuts are excavated in McPherson's Ridge, with both exposing thick, gray to red, argillite-bearing sequences that indicate gradation into the Heidlersburg Member (Smith & Keen 2014). The rail cuts were utilized as cover during the battle (the rail cuts were created prior to the battle, although the rail had not yet been laid down), but were too deep to be an effective firing position and turned out to be a deadly trap for soldiers.

The main diabase body in the southern part of the basin, pertinent to the battle, is a sill of York Haven Diabase, of early Jurassic age (Smith & Keen, 2014). The diabase is typically medium dark gray to dark gray and is composed primarily of calcic plagioclase and clinopyroxene (Ibid). At Devil's Den, the York Haven Diabase exhibits distinctive weathering phenomena,

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Outcrop of the Gettysburg Formation, at the railroad cut

Enjoying the picnic lunch stop – from left: Chris Kern, Betsy Schamberger, and Gary Kribbs

GETTYSBURG *Continued from Page 10*

an extensive open fracture network that divides the rock mass into huge blocks, and massive exfoliation. Little Round Top, Big Round Top, Devil's Den, Culp's Hill and Cemetery Hill were all Union line "high ground" positions, and all are underlain by the York Haven Diabase. Culp's Hill anchored the right flank of the Union line and was hotly contested on July 2 and 3, 1863. Culp's Hill was as strategically important as the ground defended on Little Round Top by Joshua Lawrence Chamberlain and the 20th Maine. If the Union line was turned back and Culp's Hill had been taken, Major General George Meade would likely have been forced to abandon his position (Smith & Keen, 2014).

The view from the Eternal Peace Light field stop, looking towards the south at the Mummasburg Road and the Union lines position

Examining boulders of York Haven Diabase at Devil's Den

The PCPG group as seen from Culps Hill Tower, with York Haven diabase outcrop.

The celebration of the 25th Anniversary of PCPG ended with a picnic dinner at the Wyndham Gettysburg Hotel. All attending had an incredible day of geology, history, networking, a beautiful weather day in the field and an overall good time.

For more information on the geology of the Gettysburg Battlefield, Vol. 34 No.3 of the DCNR's *Pennsylvania Geology* publication contains an article entitled "Regional Rifts and the Battle of Gettysburg", authored by Robert C. Smith II, and Richard C. Keen, and is found at the following link: http://www.dcnr.state.pa.us/cs/groups/public/documents/document/dcnr_006836.pdf.

DEADLINE FOR OUR NEXT NEWSLETTER IS AUGUST 18, 2014

For more information, contact our PCPG Newsletter Editor and Communications Committee Chairperson - Valerie Holliday, P.G., by **Email** or telephone at 610-517-7898.

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Through PA GEOPAC, the official political action committee (PAC) of PCPG, you have an effective way to lend financial support to candidates and legislators who support the legislative goals of our organization, or who are willing to lend an ear to our members. More than 200 trade and professional organizations in the state have formed PACs including doctors, dentists, lawyers, bankers, and builders.

Your donation will help to strengthen our voice when and where it is needed most...right now at the state Capitol, where decisions are being made regarding many topics that affect the business of geology in Pennsylvania.

Mail your check made payable to GEOPAC:
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