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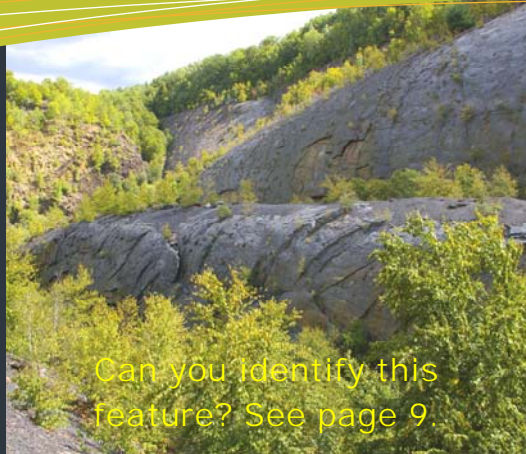
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Can you identify this feature? See page 9.

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Message from the President

The Changing Face of Geology and Environmental Science

Fellow members, I hope that your businesses are doing well in these challenging economic times. During a recent moment of retrospection, some long-time members of PCPG and I were discussing how things have changed since "The Good Ol' Days". After some fond reminiscing, it dawned on us that the professional landscape for geologists and environmental scientists has evolved dramatically since PCPG was first chartered in 1989.

Perhaps this revelation should have occurred to us a bit sooner...the more we thought about it, the more we realized that PCPG as an organization has been operating on Geologic Time while the rest of the world is twittering (or is that tweeting?). Hence the question: *"Can an old school organization embrace these changing times, or do we continue with 'business as usual'?"*

Although this may be a new paradigm, PCPG has decided to embrace the future and is looking for the younger generation of geologists and scientists to help lead the way. To show that we're serious, we've established a PCPG Facebook page. I thought that this would be enough and that we didn't want to get too crazy, but some of the younger generation have informed me that starting a Facebook page (five years after everyone else) does not place you at the forefront of new world thinking.

So, PCPG is reaching out to its younger membership with the following questions:

- How can PCPG be of help to young geologists and environmental scientists?
- And, how would you like to be of help to PCPG?

We are eager for your ideas, your knowledge, your energy, and your participation. Please send your thoughts to [me](#) or to our Executive Director [Rhonda Hakundy-Jones](#). We value your insights.

David B. Farrington, P.G.
President



Newly-Formed PCPG Young Geologists Subcommittee Offers Commentary Climate Change or Mass Extinction: Geologic Education in Pennsylvania?

- Steve Treschow, P.G.

As part of PCPG's Education Committee and a fairly young Professional Geologist, my perspective on undergraduate geology education and the practice of geology in the Commonwealth of Pennsylvania is relatively new. For this reason, PCPG asked me to help form the Young Geologist Subcommittee, which is intended to meet the needs of young and prospective geologists. One of the reasons for the creation of the Subcommittee is that anecdotal information indicates Geologists, both young and old, are concerned that traditional college geology programs are struggling.

One particular educational trend which has been prevalent in recent years is the transition of traditional geology programs to environmental science or geoscience programs. This transition typically occurs when core geology courses are cut from the curriculum and replaced by broad-based science classes or when more traditional geology courses are offered only as electives. The restructuring of these programs may result in quality science-based education, but the study and understanding of geology as a discipline loses its significance and focus. Additionally, once core geology classes are cut, students may not have the minimum educational requirements to apply for licensure as Professional Geologists in Pennsylvania.

Nearly all of the articles I have read recently concerning job growth in the geosciences indicate significantly larger and faster growth than most industries. However, with fewer and fewer individuals qualified to be licensed and practicing in the Commonwealth, a shortage of Professional Geologists could become a reality. Therefore, the survival and curriculum content of geology programs have a direct bearing on the geoscience job market and the practice of geology in Pennsylvania.

Our Subcommittee's first goal is to obtain information from as many geology departments as possible and determine whether they are struggling to maintain traditional programs. Collectively, members of PCPG have likely attended a significant number of Pennsylvania colleges and universities offering geology curriculums. We would like at least one alumnus from each college or university to contact the Department Chair or a Professor at each and gather relevant information about each program. Once more concise information is available to PCPG regarding Pennsylvania's college and university geology programs, we will be in a better position to determine if or how PCPG could assist these programs.

In summary, PCPG is looking for volunteers to contact their alma maters and gather information about the status of each program, determine what the issues are for struggling programs, and solicit input from those struggling programs on what PCPG may do to help. Those persons interested in volunteering can contact either Steve Treschow at streschow@chambersenvironmental.com or Rhonda Hakundy-Jones, at execdir@pcpg.org.

For additional reading on this topic or other activities that the Young Geologist's Subcommittee is becoming involved in, please refer to PCPG's Website at:

www.pcp.org/young.asp

Note from the Editor

The American Geologic Institute (AGI) has compiled a wealth of data about geoscience education programs and careers. We encourage our readers to review this information on AGI's website, and also stress that the term geosciences is very broad and includes many fields such as meteorology, soil science, geography, and environmental science.

<http://www.agiweb.org/workforce/>

Additionally, Leila Gonzales, PhD, Workforce Analyst for AGI shared information with PCPG in an e-mail regarding geosciences education programs:

"Of all the departments listed in AGI's Directory of Geoscience Departments, there are 108 geoscience departments at 4-year institutions that are listed as "environmental" departments. Of these, 44 have changed their name to include "Environmental" within the past 10 years. Additionally, four new departments that include "Environmental Science" or "Environmental Studies" in their name have been added to the directory within the last 10 years."



PCPG Holds UECA Seminar

-- Rhonda Hakundy-Jones, P.G.

PCPG's UECA (Uniform Environmental Covenants Act) Seminar, held July 22, 2009 at the Inn at Chester Springs, was well received. There were over 50 environmental consultants, hydrogeologists, and attorneys in attendance, and opportunities to ask questions and provide feedback abounded. Matt Sullivan, Esq. of Manko, Katcher, Gold & Fox provided a presentation on the overall concepts of the UECA Program. Then Troy Conrad, Director of PADEP's Land Recycling Program discussed efforts to develop UECA regulations and guidance. Andy Hartzell, Esq. Regional Supervising Counsel in the Southeast Regional Office of PADEP provided comments based on his experience with the UECA Program in the Southeast Office. Philip Hinerman, Esq., of Fox Rothschild, LLP and David Garrison, Esq., of Gawthrop Greenwood also shared their experiences with UECA. The session ended with a question and answer period where our presenters responded to questions and comments from the attendees.

UECA is a developing program; consequently, questions remain. However, hearing Conrad and Hartzell's views on the driving factors that will control continued implementation of UECA and their hopes for the program provided valuable insights. Up to date information on the UECA program can be found at: www.dep.state.pa.us Keyword: UECA. PCPG will continue to coordinate events like this with PADEP and will strive to keep our members updated through our electronic e-mail updates and website. Don't forget to visit www.pcpg.org frequently for information about upcoming educational opportunities and regulatory changes.



Photo Insert Above: Matt Sullivan, Esq., Manko, Gold, Katcher & Fox, presenter and Troy Conrad, Director of the PADEP Land Recycling Program discussing UECA concepts following Matt's presentation at PCPG's UECA Seminar.

DON'T FORGET!

2009 Field Conference of PA Geologists
Oct. 8 - 10 in Titusville, PA
Event Details at: <http://fcopg.org>

PCPG Goes Live with e-Commerce Website

-- Rhonda Hakundy-Jones, P.G.

PCPG has activated its on-line membership and course registration system. PCPG members will be receiving an activation e-mail which provides each member with a unique username and password. Please READ this e-mail carefully and save your username and password in a secure manner. To receive member discounts on PCPG continuing education courses, you must logon to the e-commerce side of the website with your username and password.

The same username and password will also be needed to sign into the PCPG "Members Only" page.

We have spent considerable time programming and debugging this system. However, it will take time for everyone to get used to it and additional tweaking may be necessary. Please be patient. We believe that in the long run, this will make your registration experience much easier and faster.



PCPG to Offer Hydrogeology Short Course

-- Louis F. Vittorio, Jr. P.G.

PCPG has teamed with Thomas A. Earl, Ph. D., P.G., founder and former President of Meiser & Earl, Inc., to provide its members and the scientific community with a short course titled: "Basic and Advanced Principles of Groundwater Hydrogeology," to be offered November 5 and 6, 2009. The course was developed to address the practical needs of our constituents and to address forthcoming requirements for PGs to obtain continuing education credits. The latter is expected during the current renewal cycle. The current course is viewed as the first in a series of related offerings to be provided by PCPG's education committee.



The course is designed for the practicing geologist who has had basic hydrogeological training and wishes to brush up on their foundational skills and then take their understanding of hydrogeology to the next level. As such, the course is set in a two-day format that can be enrolled in separately or concurrently. The first day will cover the hydrologic cycle, the occurrence and movement of subsurface waters and the development of groundwater flows systems. Topics such as Darcy's law, aquifer anisotropy, heterogeneity, fracture flow, and development of monitoring systems will be covered. The second day will focus on application and use of the basic concepts for advanced problem solving. Topics will include aquifer and well hydraulics, pumping test solutions, use of software, aquifer characterization and data interpretation, surface water interaction and investigation design.

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UPCOMING EVENTS

September 10, 2009
3rd Quarter

PCPG Board Meeting
Lancaster, PA

October 8, 9 & 10, 2009

**Field Conference of
Pennsylvania Geologists**

Titusville, PA

<http://fcopg.org/>

October 15, 2009

Hands-On

Groundwater Sampling
Stroud Water Research Center
Chester County, PA

October 29 & 30, 2009

**Rock Slope Stability
Analysis & Design**

Back by Popular Demand!
Harrisburg, PA

November 5 & 6, 2009

**Hydrogeology Refresher:
Basic and Advanced
Principles of Groundwater
Hydrogeology**
Grantville, PA

December 3, 2009

4th Quarter

PCPG Board Meeting
Exton, PA

January 28 & 29, 2010

PGWA Winter Conference
Grantville, PA

<http://www.pgwa.org/>

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

<http://www.pcp.org>

Fingerprint Analysis of Petroleum Hydrocarbons

-Johnny A. Mitchell, TestAmerica Laboratories, Inc

While the use of fingerprint analysis has become a standard environmental tool for the evaluation of sites impacted by petroleum hydrocarbon contamination, the actual terminology "fingerprinting" has evolved and taken on several different meanings depending on the intended use of the data. In its most basic application, fingerprint analysis is used routinely to determine the basic class of petroleum product(s) present at a site. Questions related to the distribution of aliphatic, aromatic or poly-aromatic hydrocarbons, their age, the presence or absence of product-specific markers or additives, or the likely source of the product are also important considerations and introduce a different dimension to the art of fingerprint analysis. Often, these characteristics are extremely important for the determination of environmental risk factors associated with contamination and can also be helpful in defining legal liability that may result from a release. The following paragraphs provide a general overview of fingerprinting analyses and the information that can be obtained through these applications.

Petroleum hydrocarbon fingerprint analyses are generally performed using capillary column Gas Chromatography with Flame Ionization Detection (GC-FID). Flame Ionization Detection is capable of identifying the presence of any compound that will burn, and is a general technique useful for the identification of hydrocarbon classes. More specific techniques, such as capillary column gas chromatography with Photo Ionization Detectors (GC-PID) or Mass Spectroscopy (GC-MS) may also be employed to provide more specific information relative to the chemical composition of the contaminant present. Standard EPA methodology used for the determination of total petroleum hydrocarbons such as SW846 method 8015C, are generally performed using FID and can determine the presence of most contaminants with a carbon range between C4 – C40. Included in this range are petroleum products like gasoline, kerosene, mineral spirits, diesel, fuel oils, light lubricants and motor oils. These various products can be identified (fingerprinted) using GC-FID analysis by comparing the primary carbon range pattern identified in the sample to that of a neat product standard.

Identification or fingerprinting of petroleum products is often made more difficult in environmental samples due to the effects of weathering. Weathering is generally a result of three primary actions -- evaporation, water washing, or biodegradation. Through evaporation, light end components of the hydrocarbon will volatilize under general exposure to the air, causing the hydrocarbon pattern to differ from the pattern generated from analysis of a pure product. This process results in a reduction of the abundance of the lighter components relative to the heavier components, altering the resulting fingerprint.

(Continued on Page 6)



Fingerprint Analysis of Petroleum Hydrocarbons

(CONTINUED FROM PAGE 5)

Water washing, or the exposure of the product to the movement of water in the environment, can cause the specific loss of water-soluble components. In gasoline, oxygenate compounds such as MTBE, which is often used as a product specific marker, may be partially lost through this process, altering the interpretation of the resulting chromatographic data. Compounds less soluble than the oxygenate components, like benzene and toluene, may also be lost through the effects of water washing. Biodegradation can result in the selective removal of specific hydrocarbons caused by the activity of the naturally present bacteria. These organisms often prefer the smaller paraffins, consuming these compounds through natural metabolic processes.

Hydrocarbon fingerprinting techniques are also used to determine the age and source of contamination. Through the analysis of products of varied but known ages, specific ratios of individual compounds can be calculated. These standard fingerprints can then be compared to that of an environmental sample to provide the relative time frame when a release may have occurred. Also, by identifying product-specific markers present in different petroleum product formulations such as gasoline, it may be possible to identify the source of contamination from a population of multiple possibilities, or to determine if a secondary contaminant is comingled with a known release.

The hydrocarbon fingerprint analysis, whether it be used for the general identification of a petroleum class or used to distinguish multiple potential sources through aging analyses or specific marker compound identification, is now a standard tool used by environmental professionals. A better understanding of the types of analytical tools available as well as the effects of time or weathering conditions is essential in evaluating chromatographic data generated through the fingerprinting process. The evolution of new analytical applications continues in this area, including the use of separation techniques that allow for selective determination of aliphatic or aromatic hydrocarbons. Many state environmental regulatory agencies have adopted these improved analytical methods as a means to improve risk and remediation assessments under their jurisdiction. With the known complexities associated with accurate hydrocarbon fingerprinting, it is always good practice to explore analytical alternatives with the laboratory prior to project execution to ensure that resulting data will be suitable to address questions pertinent to the investigation.

References:

Hydrocarbon Fingerprinting: Benefits and Uses, 2007 Torkelson Geochemistry, Inc.

Zhendi Want, M. Fingas, M Ladriault, L. Sigouin, Bill Castle, and David Hostetter, 1999. *Development of Fingerprinting Analysis of Petroleum Hydrocarbons*, #461. *Proceedings of the International Oil Spill Conference*. that resulting data will be suitable to address questions pertinent to the investigation.



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News of the Pennsylvania Geological Survey

- John Harper, P.G., Pennsylvania Topographic and Geologic Survey



Carbon Sequestration – DCNR, with the Survey in the lead, completed a comprehensive report on sequestration opportunities in Pennsylvania and transmitted it to the Governor and legislature by May 1, 2009 as required by Act 129. The study focused on four primary targets in western Pennsylvania, the Upper Devonian Venango Group sandstones in southwestern Pennsylvania, the Lower Devonian Oriskany Sandstone and the Middle Silurian Salina Group bedded salt both located in western and north-central Pennsylvania, and the Lower Silurian Medina Group and Tuscarora Sandstone. The report also includes “next steps” (including a business plan, risk assessment, outreach, etc.). The full report can be found at <http://www.dcnr.state.pa.us/info/carbon/mastercstareport.pdf>. For further information, contact Kristin Carter.

ARRA Site Assessment – As part of American Recovery and Reinvestment Act of 2009 (ARRA 2009 - the Federal economic stimulus package), the U.S. Department of Energy, in a competitive funding opportunity announcement, will fund ten projects nationwide to assess sites where regionally extensive formations are believed to be able to sequester at least 30 million metric tons of CO₂. DCNR submitted a proposal to evaluate a site in southwestern PA. The Survey would be responsible for analyzing and mapping reservoir data, geophysical data (seismic, gravity, and aeromagnetic), groundwater, jointing, and other field data, as well as drilling, logging, coring, and analyzing downhole data. The Survey proposes to evaluate a multitude of formations, with the assumption that multi-tiered reservoirs could sequester a larger amount of carbon dioxide than a single formation. As part of this general effort, the Survey has already funded two small detailed aeromagnetic surveys and a detailed gravity survey in the region. If funded, the project will include partners from Penn State, Pitt, and WVU, as well as geographIT and Dr. James Drahozal, a geologist from Kentucky familiar with deep Appalachian seismic data. For more information, contact John Harper.

The 2009 Field Conference of Pennsylvania Geologists – this year, the Field Conference will be held October 8-10 in Titusville, PA. The theme of this year’s Field Conference will be celebration of the 150th anniversary of the founding of the modern petroleum industry by the Drake Well. Stops will include the history and geology of oil along Oil Creek, as well as outcrops of Mississippian and Devonian rocks in Erie and Crawford County. We will also be looking at a marvelous Ice Age feature in Butler County that includes an esker and kame delta. Accommodations will be provided by the Cross Creek Resort on PA Rt. 8 just outside of Titusville. Look for the announcement on the FCOPG website at <http://fcopg.org/>, or contact Jaime Kostelnik for more details.

Seismic Monitoring: In an attempt to provide a statewide network of seismic monitoring stations, the Survey has provided new seismic monitoring stations in Brandywine, Middletown, and Pittsburgh, and has plans for three more in the near future. The data are being stored and are visible through IRIS <http://www.iris.washington.edu/hq/>. For further information, contact Jay Parrish.

Mapping Update: The Survey has contracted with NASA for UAVSAR data. This form of infra-red remote sensing assists with landform details. Used in conjunction with lidar data, it can help detect the smallest changes in topography and elevation. The path of the airplane doing the sensing begins in Greene County in the southwest corner of the state and travels to Clearfield County in the northern part of the state. This path will allow DCNR to assess the Ryerson Station State Park for continued movement of the dam there, as well as assist with the proposed assessment of the Indiana County site project described above. For further information, contact Jay Parrish.



Seismic Reflection Surveys to Characterize Subsurface Reservoirs for Possible Carbon Sequestration Evaluation

- Jeffrey Leberfinger, P.G., Stephen King and Finn Michelson

The Pennsylvania Department of Conservation and Natural Resources (DCNR), Bureau of Topographical and Geologic Survey (Geologic Survey) has begun coordinating Seismic Reflection Surveys across the Commonwealth, through the team of ARM Geophysics and AOA Geophysics (the Team). The Team will be utilizing a combination of source technologies; the AXIS, a nitrogen gas-charged Accelerated Impact Energy Source (shown in Photo) capable of delivering over 1 million foot pounds of impact force and standard Vibroseis sources. The AXIS system is used to acquire seismic data where other conventional energy source systems cannot be used, or are not practical. It is a high-powered, environmentally-friendly impact seismic source that can be used with almost any type of modern seismograph system, and has been utilized in a variety of 2D and 3D seismic programs. The AXIS source can work in many areas where explosive and vibratory seismic sources cannot, either because of regulations, or because of the risk of damage to underground pipes, utility lines, surface structures, and wildlife habitats.



Photo Insert Above: The AXIS in Action

The seismic survey project is part of an innovative program that was formally established by Act 129 (2008) of the Pennsylvania Legislature to establish Pennsylvania as an international leader in reducing the amount of climate-changing greenhouse gases that reach the atmosphere. As conceived, the ultimate program would effectively collect carbon dioxide gas (CO₂) produced by coal-fired electricity generating plants and other sources, and then inject the gas into deep geologic “reservoirs” that have sufficient capacity to permanently sequester the gas.

The DCNR’s proposed CO₂ Storage and Sequestration Project requires the availability of an areally-extensive and deep (> ½ mile) geologic target with adequate capacity to store large quantities of gaseous CO₂ within Pennsylvania. The stratigraphic and structural features of relatively deep geologic strata with relatively large areal extent (multiple tens of square miles), with the potential to serve as CO₂ gas reservoirs, must be identified and evaluated with respect to their potential storage characteristics. Major geologic features that are favorable targets include sedimentary horizons of considerable vertical and lateral extent, such as existing but depleted oil and natural gas reservoirs. Features which are detrimental or unfavorable to CO₂ storage include open faults and permeable fractures, thin or non-uniform caprock, low porosity horizons, deep folds or faults that limit lateral reservoir continuity, and borehole penetrations - features that may jeopardize public safety and the long-term stability and sustainability of the designated CO₂ storage area. These geologic features are most readily located by means of a combination of methods including seismic investigations and surface photographic interpretation.

High resolution two-dimensional (2D) reconnaissance seismic surveys are the most cost-effective approach for identifying and characterizing potential subsurface CO₂ containment storage zones (reservoirs) over large areas.

Continued on Page 9



Seismic Reflection Surveys...

(CONTINUED FROM PAGE 8)

The Team will perform 2D reflection surveys in multiple counties across the state, imaging the subsurface from several thousand feet to thirty thousand feet below grade, and then process and interpret the collected data. This project will also involve reprocessing and interpreting over 300 miles of existing seismic data from areas that have the potential for deep geologic features suitable for CO₂ sequestration.

As the areas of investigation are screened and probable geologic targets (possible subsurface “containment zones”) are identified, comprehensive integrated seismic survey and site characterization programs such as 3D/4D seismic surveys and core drilling can be designed for full geologic and environmental characterization. Also, later-stage investigations, as required by Act 129 of 2008, will appropriately include integrated geologic modeling and interpretation, and other considerations such as site-specific assessment, risk evaluation, and cost feasibility analysis.

For more information visit the DCNR Website at www.dcnr.state.pa.us/info/carbon/index.aspx

Were you able to guess the image on Page 1 of the newsletter? It's the “whaleback,” an anticlinal structure located near Shamokin, PA. Photo used with permission of Callan Bentley. You can see more photos of this feature and others on the NOVA Geoblog which can be linked to from Mr. Bentley's website: www.nvcc.edu/home/cbentley/.

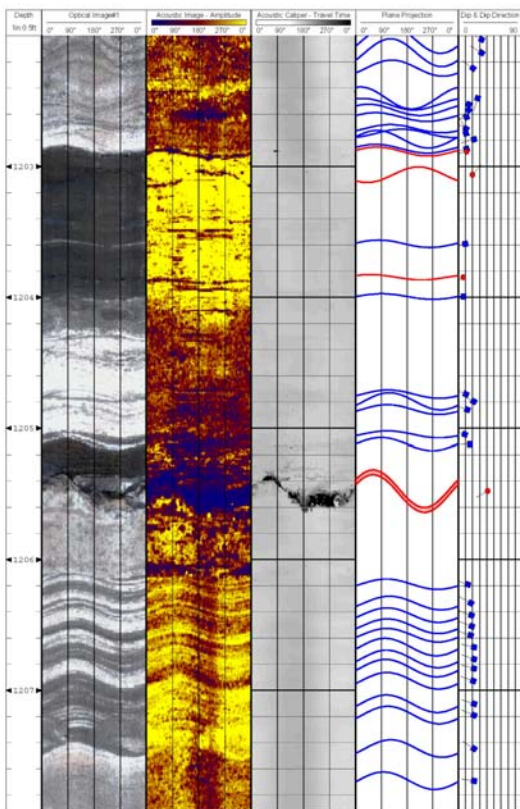


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Science Fair '09 Recap - A BIGGER ISSUE LOOMS

-- W. M. Leis, P.G.

In February and March of 2009, PCPG once again provided cash awards to "The Best Earth Science related project" at several county science fairs. This year, at the Lancaster Science and Engineering Fair, held on March 24-27, PCPG awarded two projects this title. These two, the judges felt, embodied the goal of excellence in earth sciences. Surprisingly, these projects were presented in the Junior High Division.

One project, researched by an 8th grader, involved the development of a simple geophysical tool that would locate shallow objects by using a technique that causes a harmonic frequency to be created by a variable frequency generator. Despite certain minor errors in the engineering, the topic was developed and researched by the student who, as a student of piano, was given the entire idea by noticing that, at specific key frequencies emitted by the piano, a string instrument hanging on the wall began to vibrate. This led to a harmonic frequency detector that was studied "In Concept". The student, the daughter of a geologist, plans to continue her studies for the application of this technique to the detection of land mines.

The other "Best of..." project involved a 9th grade student who measured atmospheric chemical erosion and acid deposition through recent history. The student measured rounding and obliteration of dates and lettering on limestone and marble tombstones found in cemeteries in Lancaster County and from another cemetery in New Hampshire. It was a year-long study that resulted in a series of graphs and self derived equations showing that acid deposition can be mathematically extrapolated from such environmental measurements.

An important note was made from PCPG's Science Fair participation. The various PCPG auxiliary judges have all commented on a serious decline in the quality of Earth Science projects in the Senior High division, and in recent years several judges have even declined making any awards for the Senior High division. The Junior High divisions have been the major source for almost all of the new Earth Science ideas and research. The reason for the decline in Senior High division Earth Science projects recently became obvious (one of those "Duh, oh yeah" moments for this judge). Earth Sciences are not taught in the Senior High grades; they are simply not available, either in standard science curriculum or as an elective. The Pennsylvania Board of Education (BOE) has, in its 2001 curriculum changes, placed all Earth Science courses as offerings for the Junior High grades only. Many of our members provided advice to the Pennsylvania BOE during its deliberation of the science curriculum standards back in 2001. Did we miss the boat by allowing Earth Sciences to disappear as electives in the Commonwealth's public schools?

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The Geologic Community Mourns the Loss of Carlyle Gray

-- Rhonda Hakundy-Jones, P.G.

PCPG recently learned that former State Geologist Carlyle Gray passed away on August 14, 2009. Mr. Gray served as the State Geologist from 1953 to 1961 and later founded the consulting firm Carlyle Gray Associates, from which he retired. According to Jay Parrish, current State Geologist and Director of the Pennsylvania Bureau of Topographic and Geologic Survey, Mr. Gray's contributions to Pennsylvania geology during his tenure as State Geologist include extensive geologic mapping at 1:24,000 scale, primarily in the Great Valley and Valley and Ridge, with continued work in the bituminous coal regions, studies of the Cornwall iron deposit, creation of the 1960 wall-size geologic map of Pennsylvania (by having staff perform reconnaissance mapping on a 15-minute base) and publication of two best-sellers, *Mineral Collecting in Pennsylvania* and *Fossil Collecting in Pennsylvania*. Mr. Gray retired to California in 1990, where he lived at the time of his passing. He leaves behind a wife, three children, two stepchildren and five grandchildren.



Photo Insert Above: Carlyle Gray, third director and State Geologist for the Fourth Geological Survey of Pennsylvania.

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