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Volume 49, Number 5 THE PROFESSIONAL GEOLOGIST SEPT/OCT 2012

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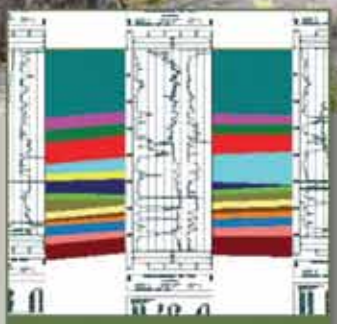

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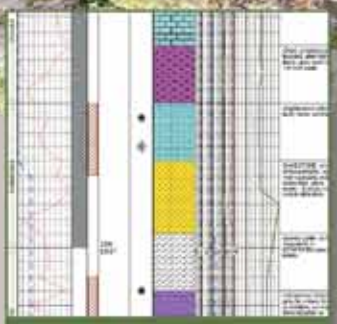

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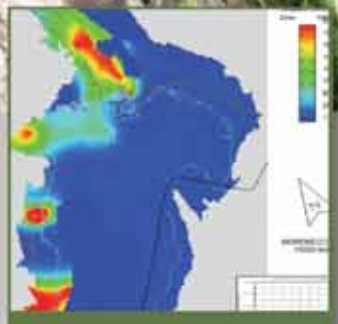

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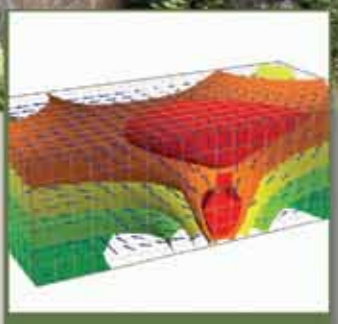

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FEATURES

The Tertiary White River Group sedimentary layers are wildly eroded in South Dakota's Badlands National Park resulting in some of the most dramatic landscapes of the American west. Photo by Dan Heidenreich, CPG-10085.

DEPARTMENTS

AIPG Publication Policy, October 4, 2010. AIPG encourages submission of articles and editorials for publication in *TPG* on topics related to the science and profession of geology. Submittals shall be of interest to the members of AIPG, other professional geologists, and others interested in the earth sciences. Articles and editorials may be noted as follows at the discretion of the Editor, "The opinions, positions and conclusions presented herein are those of the author and do not necessarily reflect the opinions, positions or conclusions of the American Institute of Professional Geologists." All materials submitted for publication, including author opinions contained therein, shall include accurate and appropriate references. The Editor has the authority to solicit, edit, accept, or reject articles and editorials and other written material for publication. The Executive Committee has the authority if it so chooses to act on any particular case to support or overrule actions of the Editor regarding the solicitation, editing, acceptance, or rejection of any particular article, editorial, or other written material for publication.

American Institute of Professional Geologists (AIPG) is the only national organization that certifies the competence and ethical conduct of geological scientists in all branches of the science. It adheres to the principles of professional responsibility and public service, and is the ombudsman for the geological profession. It was founded in 1963 to promote the profession of geology and to provide certification for geologists to establish a standard of excellence for the profession. Since then, more than 10,000 individuals have demonstrated their commitment to the highest levels of competence and ethical conduct and been certified by AIPG.

The mission of the American Institute of Professional Geologists (AIPG) is to be an effective advocate for the profession of geology and to serve its members through activities and programs that support continuing professional development and promote high standards of ethical conduct.

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Subscriptions for all Members and Adjuncts in good standing are included in annual membership dues. Subscription prices are $20.00 a year for Members' additional subscriptions and $30.00 a year for non-members for 6 issues (for postage outside of the U.S. add $10.00). Single copy price is $4.00 for Members and $6.00 for non-members. Claims for nonreceipt or for damaged copies are honored for three months.

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For AIPG news and activities go to www.aipg.org.

AIPG National Officer Election Results

2013 President-Elect (2014 President)

Raymond W. Talkington
CPG-07935
Exeter, New Hampshire
rtalkington@geospherenh.com

Statement of purpose or goals you have for AIPG: I encourage the evolving role of AIPG with support to the Sections and states in their efforts to maintain their licenses/registrations or obtain licensure. In addition, I advocate the expanding role of AIPG in reaching deeper into the academic realm and state government to demonstrate the benefits of AIPG. I also am a strong proponent of AIPG-developed and sponsored short courses, seminars, and webinars as a means to reach out to the membership and geosciences community as a whole.

2013 Vice President

James A. Jacobs
CPG-07760
Mill Valley, California
geojimj@gmail.com

Statement of purpose or goals you have for AIPG: AIPG must be relevant and provide important professional benefits to all members. If elected, I plan to evaluate several similar professional societies for possible new ideas on implementing more successful outreach to graduates, better retention of young members, improved activation rates of the general membership, and more efficient communication strategies. In addition, I would work with the AIPG Executive Committee on ongoing and current business in an efficient manner.

2013-2014 Treasurer

Lawrence M. Austin
CPG-05181
Grand Rapids, Michigan
laustin@aqua-techconsultants.com

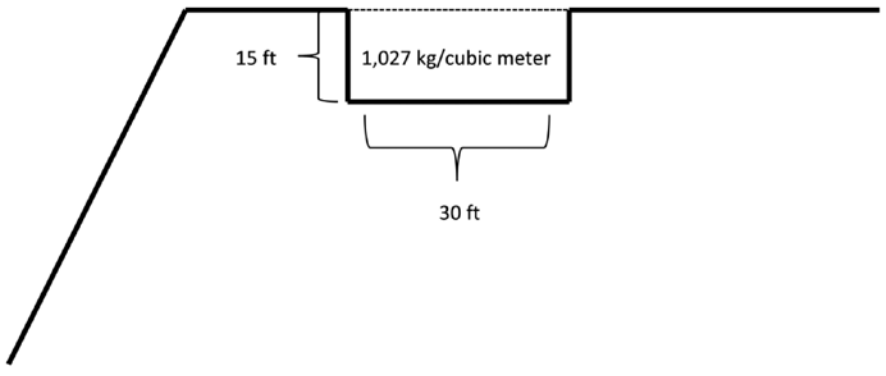
Statement of purpose or goals you have for AIPG: My goals for AIPG are to further strengthen our National level relationship with the Sections, smooth the membership and certification processes as possible while maintaining our high standards for the Certified Professional Geologist. In a larger sense I'd like to see AIPG continue to strengthen our relationships with Canada, Europe, Australia and to open discussions with professional geologists in Africa, Asia and South America as possible.

Congratulations

Please note the corrected question 4 and corresponding answer to the July-August issue of the *TPG*. The fluid's density is 1,027 "kilograms per cubic meter" and not "kilograms per cubic centimeter". Big difference indeed! Thanks to Mr. Keith Thompson, CPG-06005!

4. A rectangular storage tank is located at the ground's surface and very near the face of an exposed clay slope. The tank is 15 feet deep and 30 feet wide and is to be filled with a fluid of approximate specific weight of 1,027 kilograms per cubic meter. What is the expected force in pounds on one face of the rectangle?
   a. 50,250 lb.
   b. 216,371 lb.
   c. 405,000 lb.
   d. Dream on!

4. The answer is choice "b" or "216,371 lb." The proof follows:



Specific Weight (SW) = Weight per Unit Volume
SW = (1,027 kg/cu. m.) = (64.11 lb/cu. ft.), or ~ density of salt H2O (1)

Submerged Area (A) = Depth x Width = (15 ft) x (30 ft) = 450 sq. ft. (2)

Depth of Centroid (DC) = (15 ft)/2 = 7.5 ft. (3)

Force on face (Ff) = Specific Weight x Area x Depth of Centroid.
Ff = (SW) x (A) x (DC) (4)

From (1), (2) and (3) above, equation (4) becomes:
Ff = (64.11 lb/cu. ft.) (450 sq. ft.) (7.5 ft.) = 216,371.25 lb (5)

Equation (5) depicts the expected force on one face of the rectangle and reflects choice "b" for our question.

Editorial Oversight Policy

The American Institute of Professional Geologists' July/August issue of **The Professional Geologist** (*TPG*) included an article regarding creationism. The article was published in error; it contradicts AIPG's position statement concerning evolution and Earth history and its inclusion did not meet AIPG's editorial review standards. AIPG's management, officers, and executive committee deeply regret this mistake. We wish to state unequivocally that AIPG does not endorse these views.

Each edition of *TPG* is assembled into a galley proof by headquarters staff, which is then sent to the editor for review and final approval. The galley proof includes articles that have been subject to the peer-review process by associate editors, as well as shorter articles, news and information, regular columns, advertising, and opinion pieces. Unfortunately, this particular creationist article was overlooked during the final review of the galley proof.

AIPG has reviewed its editorial process. We are presently taking steps to ensure that the future content of *TPG* is appropriate and to confirm that the subject matter is consistent with AIPG's mission statement and relevant position statements.

We ask that you, our members, accept our apology for this regrettable circumstance with our assurance of improved editorial procedures to restore the status of *TPG* to the professional standards of AIPG.

Sincerely,

Barbara H. Murphy

Barbara H. Murphy, President

William Siok

William J. Siok, Executive Director

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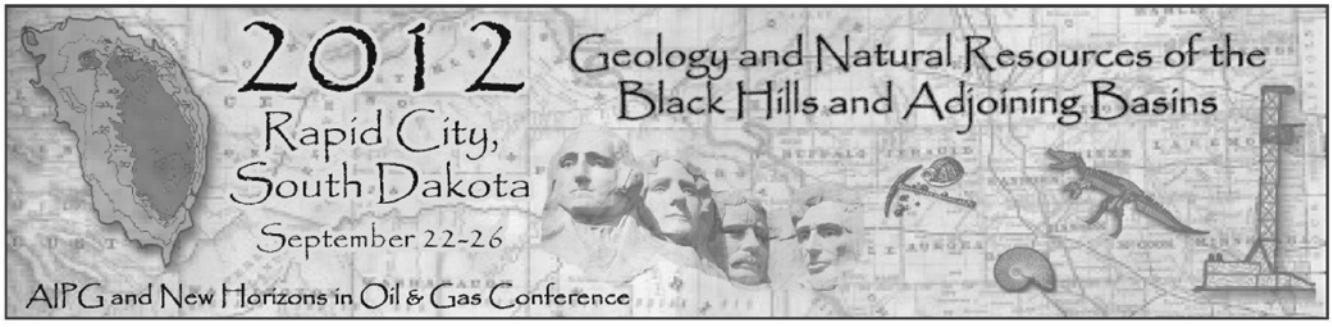
The American Association of Petroleum Geologists – Leadership Days

John L. Bognar, CPG-08341

I was given the honor of representing AIPG at the 32nd annual American Association of Petroleum Geologists (AAPG) Leadership Days symposium during the first half of August in Tulsa, OK. For those of you who may not be aware, the AAPG is a first class organization of first rate people, some 35 thousand in all. It is operated by a paid staff of approximately 80 people. I was blessed to meet many of the staff during a tour of its two headquarters buildings in downtown Tulsa. David Curtiss, AAPG's Executive Director and Ted Beaumont, AAPG's President for 2012 are doing a fantastic job of keeping the business and direction, respectively, of AAPG very healthy and moving in the right direction. AAPG cultivates leaders and fosters mentorship, technology exchange, and perhaps most important a vibrant exchange of new ideas. After all, oil and gas is found in the mind of a geologist. As a result I venture to say that without the men and women of AAPG (since 1917), our supplies of the indispensable hydrocarbon resource would be a pittance compared to what actually is the current reserve picture and our economy and strength as a nation would never have developed to the soaring heights that we have seen and will see.

During the Leadership Days symposium I learned much about how AAPG plays a role in fostering scientific breakthrough and specifically how the technical dialog is somewhat focused on getting so-called shale gas and liquids to market and improving the economics of this vast resource. While the shale gas plays are essentially in their infancy, it is great to see the optimistic, can do attitude of the oil and gas industry on the job with the aim of making more energy with less fiscally. It goes without saying that the politics of the world can be changed drastically for the better as many nations are developing these newly available resources within their own sovereign borders and it is American exceptionalism, ingenuity, and know-how leading the way.

As AIPG celebrates our 50th anniversary next year, it is appropriate to mention that the roots of our beloved AIPG are in oil and gas geologists. A group of geologists in the oil and gas industry saw a need for some geologists to be professionally certified and the rest is history. The relationship between AAPG and AIPG has been strong ever since. As such, the next time you fill your car's tank, heat your home with gas or oil, or use something made of plastic be sure to thank an AAPG member.



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FEES AND PAYMENT INFORMATION

ANNUAL MEETING REGISTRATION	Amount	~~After 8/27/12~~	Amount
Full Registration AIPG Member, New Horizons in Oil & Gas Attendee	$375.00	~~$400.00~~	$
Non-Member Full Registration	$425.00	~~$450.00~~	$
Daily Registration □Sat □Sun □Mon □Tues	$190.00	~~$215.00~~	$
Spouse/Guest Full Registration (Admission to Welcome Reception, Breakfast, Lunch, Breaks and Exhibits)	$190.00	~~$215.00~~	$
Student Full Registration	$20.00	~~$30.00~~	$
Daily Student Registration □Sat □Sun □Mon □Tues	$15.00	~~$25.00~~	$
I Would Like to Support Student Registration	$50.00	~~$50.00~~	$
FIELD TRIPS (Must be Registered for the Conference)	**Amount**	~~**After 8/27/12**~~	**Amount**
Sitting Bull Crystal Caverns Tour and Mt. Rushmore (Sat., 9/22, 9:00 am – 3:00 pm)	$95.00 (Students $30)	~~$125.00~~ ~~(Students $40)~~	$
The Journey Museum, Food, and "Journey Into Space" Presentation (Sat., 9/22, 5:00 pm – 9:00 pm)	$18.00	~~$22.00~~	$
Eocene and Oligocene Geology and Paleontology of the White River Badlands (Sun., 9/23, 8:00 am – 6:00 pm)	$95.00 (Students $30)	~~$125.00~~ ~~(Students $40)~~	$
Precambrian Geology and Mineralogy of Classic Pegmatite Localities in the Black Hills (Sun., 9/23, 8:00 am – 6:00 pm)	$95.00 (Students $30)	~~$125.00~~ ~~(Students $40)~~	$
Paleofloods & Hydrogeology of the Black Hills (Sun., 9/23, 8:00 am – 6:00 pm)	$95.00 (Students $30)	~~$125.00~~ ~~(Students $40)~~	$
Devils Tower and the Bear Lodge Mountains: Laramide Plutons and Mineralization in the Northern Black Hills Uplift, Wyoming (Sun., 9/23, 8:00 am – 6:00 pm)	$95.00 (Students $30)	~~$125.00~~ ~~(Students $40)~~	$
Homestake Mine Tour and Deadwood, SD (Sun., 9/23, 9:00 am – 5:00 pm)	$95.00 (Students $30)	~~$125.00~~ ~~(Students $40)~~	$
The 1880 Train, Keystone, SD and Mt. Rushmore (Mon., 9/24, 8:30 am - 4:30 pm)	$95.00 (Students $30)	~~$125.00~~ ~~(Students $40)~~	$
Tour of RESPEC's Materials Testing Laboratory (Mon., 9/24, 3:00 pm - 5:00 pm)	$25.00	~~$30.00~~	$
South Dakota School of Mines & Technology Paleontology Research Lab and Museum of Geology Tour (Tues., 9/25, 8:30 am - 11:30 am)	Free	Free	**Free** (circle to attend)

FIELD TRIPS (Must be Registered for the Conference)	Amount	~~After 8/27/12~~	Amount
Prairie Berry Winery Tasting (Tues., 9/25, 1:30 pm - 4:00 pm)	Free	Free	**Free (circle to attend)**
Reclamation at Active and Closed Heap Leach Gold Mines in the Black Hills: Wharf, Richmond Hill, and Gilt Edge Mines (Weds., 9/26, 7:30 am – 6:00 pm)	$95.00 (Students $30)	~~$125.00 (Students $40)~~	$
Gold Mineralization in the Black Hills (Weds., 9/26, 8:00 am - 5:30 pm)	$95.00 (Students $30)	~~$125.00 (Students $40)~~	$
Paleozoic and Mesozoic Reservoir Rocks of the Northern Black Hills Uplift (Weds., 9/26, 8:00 am – 6:00 pm)	$95.00 (Students $30)	~~$125.00 (Students $40)~~	$
Engineering Geology of the Black Hills and I-90/Hwy 79 Development Corridor (Weds., 9/26, 8:00 am – 6:00 pm)	$95.00 (Students $30)	~~$125.00 (Students $40)~~	$
SHORT COURSE/ SOCIAL EVENTS (Must be Registered for Conference)			Amount
Short Course - Natural Fractures in Hydrocarbon Reservoirs - Earn 0.6 CEU's (Sun., 9/23, 8:00 am – 4:00 pm)		$225.00	$
Welcome Reception (Sun., 9/23, 6:30 pm – 8:30 pm) (please circle if attending)		Included with Registration	
AIPG Past-Presidents Breakfast (Mon., 9/24, 7:00 am – 8:30 am)		Invitation Only (please circle if attending)	
Awards, Dinner and Entertainment (Mon., 9/24, 6:00 pm – 8:30 pm)		$35.00	$
		TOTAL AMOUNT DUE	$

Organization Meetings (see Program for Dates and Times) – Please Indicate if Attending

	Attending		Attending
AIPG National Executive Committee Meeting (9/22)	**yes / no**	**AIPG 2012-2013 Joint Executive/Business Mtg. (9/22)**	**yes / no**
AIPG 2012 Advisory Board Meeting (9/22)	**yes / no**		

Full AIPG, Oil & Gas, and Non-Member Registration Includes: Welcome Reception, Technical Sessions, Student Poster Sessions, Exhibits, Registration Materials, Continental Breakfast, Lunch, and Breaks on Saturday, Monday, and Tuesday.

I understand that by registering for the AIPG and SDSM&T New Horizons in Oil & Gas Conference 2012 Annual Conference & Exhibition, I release and agree to indemnify The American Institute of Professional Geologists (AIPG) and the SDSM&T New Horizons in Oil & Gas and their agents, officers, volunteers and employees from all liability for any loss, damage or injury sustained by me while involved in any way with the Conference and Exhibition except that AIPG and the SDSM&T New Horizons in Oil & Gas are not released from such liability to the extent the same is caused by its actual negligence or willful misconduct. I have read and understand this waiver and release.

I also understand that submission of this registration form gives AIPG and the New Horizons in Oil & Gas the authority to utilize any photograph taken of me at the conference for conference related publicity (e.g., photo gallery on CD, web site, TPG, etc.).

Hotel Information: Best Western Ramkota Hotel, 2111 N. LaCrosse Street, Rapid City, SD 57701, (605) 343-8550.

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PROGRAM

Saturday, September 22, 2012	
7:00 am–5:00 pm	Registration – Hotel Lobby
7:00 am–8:00 am	AIPG Executive Committee Breakfast (*complimentary to all registrants*)
8:00 am–12:00 noon	AIPG Executive Committee Meeting (*open to all registrants*)
9:00 am–3:00 pm	Guest Trip – Sitting Bull Crystal Caverns Tour and Mt. Rushmore
1:00 pm–4:30 pm	AIPG Advisory Board Meeting (*open to all registrants*)
4:30 pm–5:00 pm	AIPG 2012-2013 Joint Executive Committee Meeting & Business Meeting (*open to all registrants*)
5:00 pm–9:00 pm	Journey Museum, Food, and "*Journey Into Space*"
Sunday, September 23, 2012	
7:30 am–5:00 pm	Registration – Hotel Lobby
8:00 am–4:00 pm	Short Course – Natural Fractures in Hydrocarbon Reservoirs
8:00 am–6:00 pm	Field Trip – Eocene & Oligocene Geology and Paleontology of the White River Badlands
8:00 am–6:00 pm	Field Trip – Precambrian Geology and Mineralogy of Classic Pegmatite Localities in the Black Hills
8:00 am–6:00 pm	Field Trip – Paleofloods and Hydrogeology of the Black Hills:40th Anniversary of the 1972 Rapid City Flood
8:00 am–6:00 pm	Field Trip – Devils Tower & the Bear Lodge Mountains: Laramide Plutons and Mineralization in the No. Black Hills Uplift, WY
9:00 am–5:00 pm	Guest Trip – Homestake Mine Tour and Deadwood, SD
6:30 pm–8:30 pm	Welcome Reception – Exhibit Area Open (complimentary for all registrants)

Best Western Ramkota Hotel and Conference Center
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(605) 343-8550 - Room Rate $94

Monday, September 24, 2012	
7:00 am–5:00 pm	Registration – Hotel Lobby
7:00 am–8:30 am	AIPG Past President's Breakfast *(by invitation)*
8:00 am–5:00 pm	Technical Sessions
8:00 am–5:00 pm	Guest Trip – The 1880 Train, Keystone, SD and Mt. Rushmore
9:00 am–5:00 pm	Exhibits Open
12:00 noon–1:30 pm	Luncheon with Keynote Speaker (*complimentary to all registrants*)
3:00 pm–5:00 pm	Field Trip –Tour RESPEC's Materials Testing Lab
5:00 pm–6:00 pm	SD AIPG Section Meeting (*open to all registrants*)
6:00 pm–8:30 pm	AIPG Awards, Dinner and Entertainment (*AIPG members and non-members welcome with additional fee*)
Tuesday, September 25, 2012	
7:00 am–9:00 am	AIPG Foundation Meeting
7:30 am–4:00 pm	Registration – Hotel Lobby
8:00 am–5:00 pm	Technical Sessions (Includes the Screening of the Feature Length Documentary on Global Energy "SWITCH")
8:30 am–11:00 am	Guest Trip – SDSM&T Paleontology Research Lab & Museum of Geology Tour
9:00 am–4:00 pm	Exhibits Open
12:00 noon–1:30 pm	Luncheon with Keynote Speaker (complimentary to all registrants)
1:30 am–4:00 pm	Guest Trip – Prairie Berry Winery Tasting
Wednesday, September 26, 2012	
7:30 am–6:00 pm	Field Trip – Reclamation at Active & Closed Heap Leach Gold Mines in the Black Hills
8:00 am–5:30 pm	Field Trip – Gold Mineralization in the Black Hills
8:00 am–6:00 pm	Field Trip – Paleozoic and Mesozoic Reservoir Rocks of the Northern Black Hills Uplift
8:00 am–6:00 pm	Field Trip – Engineering Geology of the Black Hills and I-90/Hwy 79 Development Corridor

AIPG 2012 Annual Meeting Abstracts-Part 1

The New Jersey Site Remediation Reform Act's Licensed Site Remediation Professional's Ethics and Practice Issues

***David M. Abbott, Jr.*, American Institute of Professional Geologists Ethics Committee Chairman and Consulting Geologist Denver, Colorado**

The 2009 New Jersey Site Remediation Reform Act creates the Licensed Site Remediation Professional (LSRP) title. New Jersey's LSRP program provides an interesting example of the expansion of professional licensing and licensing's impacts on professional practice. The LSRP's "highest priority in the performance of professional services shall be the protection of public health and safety and the environment." In achieving this goal, the LSRP must notify the New Jersey Department of Environmental Protection (DEP) of all material activities on a site for which the LSRP has been retained. Effectively, the DEP becomes a co-client with the private client who hires the LSRP.

The Site Remediation Reform Act allows for the exercise of professional judgment, which is good. But what happens when professional judgments disagree? How broad is the professional judgment allowance? These disagreements/conflicts of interest can occur between the LSRP and the DEP staff, although the DEP staff has the final say in such cases. Conflicts can also arise between the LSRP and other experts, who may be LSRPs, retained by adjacent landowners, buyers or sellers, landlords or tenants, financial institutions, and in co-mingled plume disputes. Another issue is that remediation technologies and practices and contaminant detection limits evolve over time. Can a previously completed site remediation be re-opened as a result? In addition, LSRPs face some specific conflict of interest provisions, including a prohibition on employment by a firm conducting the actual remediation work.

Immediate environmental concern situations where immediate threats to the public's health and safety are perceived to exist can also be an issue. How "immediate" is "immediate"? For example, how fast is a contaminant plume moving? There can be differing opinions. SRLPB Complaint 003-2011 provides an example. In this case the complaint concerned a proposed residential development on land where lead shot from a former skeet range was present. While there was no question that lead in concentrations greater that allowed by the DEP's standards was present, there was no evidence that the lead was moving around or beyond the property and so there was no immediate environmental concern.

New Jersey's LSRP program is in the process of being fully implemented and there are no firm answers to the questions raised. As answers are provided through practice or litigation, expect significant impacts on professional site remediation practice in New Jersey and potentially in other jurisdictions as well.

Hydrothermal Alteration and Gold Mineralization in Biotite Zone Host Rocks at Homestake Mine in Lead, South Dakota

***Andrew E. Armstrong, Dr. Colin J. Paterson,* Rapid City, South Dakota**

The Homestake gold mine, until its closure in 2002, produced in excess of 40 million ounces of gold during its 125 years of mining. A petrographic and geochemical study has been undertaken in the biotite zone of the Homestake mine to discern the nature of the hydrothermal reactions that occurred between the Homestake Iron Formation and the hydrothermal fluids that permeated through it along shear zones at approximately 1.73 Ga. Samples of intensely-altered and background Homestake Formation were selected for comparison from the Sanford Underground Science and Engineering Lab core archive in Lead. Typical mineral assemblages in background Homestake Formation consists of anhedral fine-grained chlorite with blue birefringence, finer-grained carbonates, finer-grained biotite, long slender grains of grunerite and fine-grained quartz. Heavily altered samples typically have larger more euhedral matted crystals of chlorite with green birefringence, coarser carbonates, and coarser biotite as well as larger grains of quartz. Altered samples may also have a small amount of muscovite. SEM analysis of was performed to acquire chemical compositions of individual grains of minerals for use in determining possible alteration reactions. Bulk rock major and minor element analyses were also performed on the samples to constrain the chemical interactions that led to precipitation of the gold. The 51 element aqua regia analysis shows in altered samples there are significant increases of Ag, Al, As, Au, Bi, Ca, Ga, Ge, Li, P, Pb, Sb, Se, Sr, Te, V and depletions of Ba, Be, Cs, Cu, Hg, K, La, Mg, Mo, Rb, and Sn compared to background samples. The major element analysis via XRF shows increases of Al_2O_3, CaO, and Na_2O and depletions of SiO_2, and K_2O in altered samples compared to background samples.

Groundwater recharge estimates for the Powder River and Williston structural basins

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Groundwater recharge will be estimated as part of a project initiated by the U.S. Geological Survey to construct a conceptual model and water budget for the lower Tertiary and Upper Cretaceous aquifer system in the Powder River and Williston structural basins. The study area covers about 75,000 mi^2 in parts of Wyoming, Montana, and North and South Dakota. These aquifers are the shallowest and typically most accessible primary aquifers within the two structural basins. Prolific natural gas and coal production in the Powder River structural basin and oil production in the Williston structural basin will require trillions of gallons of water from this aquifer system over the next 15 years. Increasing demands for irrigation, industry, domestic, and municipal uses in this region will also affect the groundwater availability. Determining how the aquifer system will respond to these depletions is important for regional water management.

A numerical soil-water-balance (SWB) model based on a modified Thornthwaite-Mather approach is being used to estimate recharge to the aquifer system. The inputs for the SWB model include daily precipitation and temperature data, land-use classification, soil type, and surface-water flow direction. The sources and sinks of water within each grid cell are determined by the SWB model based upon the input data. Recharge is calculated as the difference between the change in soil moisture and the flow rates of sources and sinks. The model is being run on a daily time-step over a 31-year period (1980-2010). Site-specific recharge estimates, such as the water-table fluctuation method, will be used to validate the results. Monthly recharge to the aquifer system will be recorded and incorporated into a conceptual model generalizing the water budget of the aquifer system within each structural basin.

Sediment Yield and Dam Capacity in trhe Great Lakes Watershed: Field Methods, Preliminary Results of Sediment Core Dating, and Application to Contaminated Sediment Monitored Natural Attenuation (MNA) Sites

***John Barkach*, Farmington Hills, Michigan, *Dennis McCauley, Chris Turner, and Mike McCauley* Traverse City, Michigan**

The U.S. Army Corps of Engineers (USACE) is tasked with maintaining the navigability of the waters of the United States. Within the Great Lakes, there are over 100 federal harbors or federally maintained navigation channels. The USACE spends approximately $20 million to $40 million annually to remove approximately 2 to 4 million cubic yards of sediment that accumulates in Great Lakes harbors and navigation channels each year.

The USACE has observed that the sediment yield in Great Lakes watersheds has increased

by nearly an order of magnitude from the mature, closed forests in pre-European settlement to the agriculture-dominated watersheds of today. Despite this large increase in sediment production, relatively little sediment is delivered to Great Lakes harbors. This is due to the impoundment of sediment behind a network of 4,943 dams in the Great Lakes watershed.

During 2010, the USACE and Wayne State University (WSU) began a three year project to estimate the sedimentation rates in Great Lakes watershed impoundments and to calibrate a basin-wide model to estimate the remaining storage capacity behind dams that are tributary to federal-maintained harbors and channels. To collect data to support this effort, 10 impoundments were selected for study. Great Lakes Environmental Center, Inc. and WSU implemented the field work that involved: vibracore sediment sampling, a bathymetric survey of the impoundment, velocity transects of streams that feed each impoundment, as well as surface water sampling to evaluate total suspended solids. The sedimentation rates in each impoundment are being evaluated using three approaches:

1. Determination of the sedimentation rate of an impoundment by dating sediment cores using Cesium 137 (^{137}Cs) and Lead 210 (^{210}Pb).
2. Evaluation of sediment accumulation via analysis of historic bathymetric maps versus current bathymetric maps created using an M-9 RiverSurveyor.
3. Evaluation of sediment transport modeling.

Of the 110 cores that have been collected, WSU has completed dating of 40 sediment cores that were collected from 8 of the 10 impoundments. Preliminary review of the ^{210}PB and ^{137}Cs data reveals that the calculated sediment accumulation rates are typically similar. The sedimentation rates of individual impoundments will be used to fine tune the sediment transport models being developed by the USACE and WSU. In particular, the preliminary results of the ^{210}Pb and ^{137}Cs sediment core dating show wide application at contaminated sediment sites where impacted sediments will be managed in-place.

Dewey-Burdock *In-Situ* Recovery Project, Southern Flank of the Black Hills Uplift

***James A. Bonner,* Greenwood Village, Colorado**

In 1951, uranium was first discovered on the southern flank of the Black Hills Uplift in Lower Cretaceous fluvial sandstones of the Fall River and Lakota Formations (Inyan Kara Group). This resulted in a flurry of prospecting and exploration activity across southwestern South Dakota and northeastern Wyoming. By the mid 1950's, the Edgemont Mining District had been established. Uranium and vanadium ore was produced from shallow underground and surface mines and processed in a mill located at Edgemont, SD. An estimated 1.6 million pounds of uranium was mined before operations ceased in 1968.

In the mid 1970's, renewed exploration in this region began targeting deeper extensions of the previously-mined areas. The Tennessee Valley Authority (TVA) acquired a major land position and completed nearly 10 thousand exploratory drill holes in the overall region. TVA initiated mine planning for a large underground operation within the Edgemont District, but this effort stopped with the collapse of the uranium industry in the early 1980's.

Today, the district is once again active with the Dewey-Burdock In-Situ Recovery Project entering its final mine permitting stage. The geologic setting of the district is ideal for such a project. Uranium mineralization is present in typical U.S. sandstone roll- front type deposits. The deposit's uranium grades are quite favorable, as shown in the latest technical reports on the project, which identify 11.2 million pounds of Indicated and Inferred uranium resources averaging 0.20% U_3O_8. The host sandstones within the Inyan Kara Group have measured permeabilities in the 1-3 darcy range and are confined by hundreds of feet of overlying Cretaceous marine shale and by shale of the underlying Jurassic Morrison Formation. Laboratory tests on cores of the mineralization demonstrate that the deposit is amenable to leaching with a benign oxygen and carbon dioxide lixiviant. Restoration of the ground water and surface operations will leave the area essentially as it was before mining.

New Topics in Critical and Strategic Minerals

***Jim Burnell*, Denver, Colorado**

In the world of critical and strategic minerals, new developments in technology and geopolitics serve to swing the interest in new directions from year to year. While concern remains in "technology metals" such as gallium, germanium, indium and tellurium, attention has moved to a new suite of mineral commodities.

Reports from the U.S., the European Union, and Great Britain have placed the spotlight on tungsten, antimony, graphite, beryllium and fluorspar. The utility of these five, their price escalation and the perceived limitations in their upstream supply have made them topics in the commodities world.

U.S. tungsten consumption has been growing at an average of 20% per annum. To date, much of our tungsten supply has been derived from recycled scrap but demand threatens to outstrip supply. More than 80% of raw supply originates in China. Prices have increased because China has imposed a stiff export tariff and enacted a tight export quota.

The U.S. suffers an 80% import dependence on antimony. While we recover some of this metal from the recycling of lead-acid batteries, China boasts reserves far greater than the rest of the world combined. Price has increase substantially because of Chinese supply interruptions.

Graphite has been the hottest topic in the industrial minerals world. This formerly mundane product has benefited from technological developments that promise to expand the demand well beyond supply. The U.S. currently produces no graphite. In a recurring theme, China is the leading producer. The price for the most valuable forms of graphite - especially the large flake type-has increased 50% in the last year.

Beryllium is unusual in that the U.S. is a leading producer. Demand has increased in the last few years, but beryllium's uses in new technologies are predicted to expand that demand significantly in the coming years.

Fluorspar is another industrial mineral for which the U.S. was formerly a leading producer. Now most of the supply originates in China and Mexico. A disturbing feature of the fluorspar supply is that estimates of China's known reserves predict that they will be exhausted in seven years.

These five strategic minerals once again point out the importance of revitalizing mineral exploration and production efforts in the United States.

Candidate Conservation Agreements and Candidate Conservation Agreements with Assurances: Tools for Dealing With Species in Limbo

***Kenneth R. Carothers*, Austin, Texas**

Throughout the country in our quest to become energy independent, oil and gas exploration and production is at an all time high. Much of this recent success can be attributed to the exploitation and advancement of hydraulic fracturing technologies. But this enthusiasm has also brought questions and numerous concerns for the safety and wellbeing of our population and environment. The purpose of this presentation is to examine some of the environmental constraints and considerations during the permitting process of these oil and gas activities (also applicable to mining activities). Two environmental considerations in particular are the development of Candidate Conservation Agreements (CCA) and Candidate Conservations Agreements with Assurances (CCAA). CCAs and CCAAs are developed within a legal framework through which an individual landowner or an industrial entity can protect their long-term project objectives through voluntary consultation with the U.S. Fish and Wildlife Service. Development of a CCA or CCAA ultimately facilitates the conservation of proposed and candidate species (and species likely to become candidates), while allowing for project objectives to continue even after these candidate species become listed under the Endangered Species Act (ESA).

Blushing Geology

***Sarah Chadima*, Vermillion, South Dakota**

The cosmetic and beauty products manufacturing industry expects revenue to reach $54.9 billion dollars in 2012; of which $10.2 billion dollars (18.6%) is attributed to cosmetics. In 2005, the average age at which a female began using beauty products was 17; today it is 13.7. Young women ages 12-24 currently out-buy all other age groups in the cosmetic and skin care product market.

In October 2010, the Geological Survey Program, South Dakota Department of Environment and Natural Resources, began

participating in a variety of educational outreach events targeting teenage girls in eastern South Dakota. The goals of these events are to make young female students aware of the varied careers available in science, technology, engineering, and mathematics (STEM), and to encourage them to pursue math and science classes in middle school and high school. Regardless of audience size, hands-on science activities are strongly encouraged at these events.

An applied geology, booth-style program was developed and called *Minerals & Makeup – what's in your Beauty Care Products?* The girls first explore a variety of rocks and minerals placed next to products that use that particular rock or mineral. For example, a fist-sized sample of pumice is placed by a jar of foot scrub, large clear calcite rhombohedra are near a tube of natural toothpaste, and a glass jar with raw petroleum is adjacent to a vial of Vaseline®. Second, each girl has the opportunity to make powdered blush from talc, kaolinite, iron-oxides, and muscovite. These powdered rocks and minerals are mixed in Ziploc® bags, applied to the cheeks with cotton balls, and - with many giggles - the results are viewed in a hand mirror.

Time after time, girls respond with surprise to this simple activity. Make-up, and its origins, fit the motto of the Women In Mining Education Foundation, "If it isn't GROWN, it has to be MINED." Although no evaluation surveys have been completed, this hands-on activity has been well received. The number of requests for this presentation/activity has increased each year (including repeat requests). Approximately 530 students were reached during the 2010-2011 school year, and approximately 820 were reached during the 2011-12 school year. At an upcoming festival called "It's All about Science" in Sioux Falls, South Dakota, organizers plan for attendance numbers approaching 5,000 people. This festival has a much broader mission: the mission of developing and supporting a science-centric community.

This simple activity provides one more opportunity for geologists to encourage girls in STEM. This activity can easily engage girls in science during their teenage growth; a time of self-exploration and self-awareness, image and confidence building, education and socialization. Women have made tremendous progress in education and the workplace during the past 50 years, yet much can still be done to encourage girls in science. As globalization makes the world smaller, we must press on for the education of all minds for sustainable global development.

Geology and Development of the Rosemont Copper Project

***Jeff Cornoyer,* Tucson, Arizona**

Rosemont Copper Company will set a high standard for sustainable mining practices, including using solar power, consuming less than half the water as traditional mines with filtered tailings, and reclaiming the site as permanent open space by revegetating with concurrent reclamation throughout the life of the mine. Rosemont Copper has completed feasibility engineering and is in the process of final engineering and permitting leading to the development of the Rosemont copper-molybdenum-silver deposit, with final permits expected in December 2012. The deposit is located approximately 25 miles southeast of Tucson, Arizona, on the east flank of the Santa Rita Mountains. Mining in the area predates the turn of the 20th century, and in 1879, the U.S. Congress declared the area the Rosemont-Helvetia Mining District. At the time, mining was limited to high grade veins from underground workings. More recent interest has been focused on the development of lower grade, broadly distributed mineralization amenable to open pit mining. Original drilling and geologic work was conducted by Anaconda and its Anamax joint venture, with subsequent work by ASARCO. Rosemont Copper Company purchased the property in 2005 and has continued to evaluate the deposit and its potential for development. The Rosemont deposit consists of copper-molybdenum-silver mineralized skarns related to a quartz-monzonite porphyry intrusion. Host rocks to the intrusion consist of Paleozoic and Mesozoic carbonate and clastic sediments. Surrounding the intrusive contact, the carbonates and clastics were metasomatically altered to various calcsilicate skarns and hornfels. Mineralization associated with the intrusion and host rock alteration consists of broadly distributed disseminations and veinlets of sulfides, primarily bornite and chalcopyrite. Following the mineralization event, the deposit was subjected to faulting. Interestingly, the complex faulting in the deposit area has left only minor scattered remnants of the intrusive stock for a "rootless" intrusion, leading to much debate over time. Erosion has sculpted the current configuration of the deposit area, accompanied by near surface weathering and oxidization, which has resulted in a small amount of oxide mineralization in the clastic Mesozoic cover.

Rosemont Copper Company has conducted extensive resource drilling and metallurgical test work, leading up to a Feasibility Study in 2007 that demonstrated positive economic viability. Since that time further work by Rosemont was used to complete an Updated Feasibility Study in 2009. In early 2012, a drilling program was completed for an additional 2012 Feasibility Study update and expanded the Rosemont resource and reserve. The updated mineral reserve includes 266 diamond drillholes totaling 342,707 feet with 667.2 million tons of sulfide ore averaging 0.44% copper, 0.015% molybdenum, and 0.12 ounces per ton silver. Total resource contains 919.3 million tons of 0.41% copper, 0.014% molybdenum, 0.11 ounces per silver and 63.4 million tons of oxide ore averaging 0.17% copper. The project is planned as an open pit mine to provide 90,000 plus tons per day of sulfide ore to a crushing-grinding-flotation facility to produce both a copper and molybdenum concentrate, with average production of 243 plus million pounds of copper for a 21 life of mine. Rosemont Copper Company is continuing with detailed engineering and permitting of the project with an anticipated production startup in early 2013. The Rosemont mine will be a significant U.S. copper producer and will have a positive economic impact of over $19 billion dollars into the Arizona economy over the life of the mine, provide 2100 local jobs and create over $128 million per year of county, state, and federal tax revenue.

Eight Months to the Field Site: NASA Mars Science Lab

***Thomas V. Durkin*, Rapid City, South Dakota**

Curiosity stuck the landing! On August 5, 2012, after an eight-month, 352-million mile journey through space, NASA's Mars Science Laboratory (MSL) spacecraft carrying the 1,982-pound SUV-sized exploration rover named *Curiosity* landed successfully on the surface of Mars. During a nail-biting, seven-minute descent through the thin Martian atmosphere, the MSL spacecraft performed a first-ever, multi-staged, precision landing sequence that slowed the spacecraft from its entry speed of 13,200 mph to a soft, touchdown landing of almost 0 mph. The precision landing maneuvers employed bold new techniques that enabled the selection of a smaller target landing site (a 12x4 mile ellipse) and much heavier payload than were possible for any previous Mars mission.

The overarching science goal of MSL's mission is to assess whether the landing area has ever had, or still has, environmental conditions favorable to microbial life in terms of habitability and preservation in the rock record. The primary mission is scheduled to last for at least one Martian year; just under two Earth years. MSL builds on the extensive geological information collected by NASA's highly successful Mars Exploration Rover Mission that consists of two golf-cart sized rovers *Spirit* and *Opportunity*, one of which is still operating after eight years! Unlike solar-powered *Spirit* and *Opportunity*, *Curiosity* carries a radioisotope power system that generates electricity from the heat of plutonium's radioactive decay. This power source gives the mission its operating lifespan of at least one Martian year, while providing significantly greater mobility and operational flexibility, enhanced science payload capability, and exploration of a much larger range of latitudes and altitudes than was possible on previous missions. Unlike earlier rovers, *Curiosity* carries equipment to gather rock and soil samples, process them, and distribute them to onboard test chambers inside analytical instruments.

Curiosity landed at the foot of a layered mountain inside a 96-mile diameter crater (Gale Crater.) The mountain, Mt. Sharp, rises about three miles above the crater floor; higher than Mount Rainier rises above Seattle. Mt. Sharp is not simply a rebound peak from the asteroid impact that excavated Gale Crater. A rebound peak may be at its core, but the mountain displays hundreds of flat-lying geological layers indicative of a much more complex history over billions of years. Twice as tall as the sequence of colorful bands exposed in Arizona's Grand Canyon, the layered geology of Mount Sharp appears to result from changing environments of deposition and erosion. The portion of the crater floor where Curiosity landed has an alluvial fan likely formed by water-carried sediments.

Selection of Gale Crater was made after more than 100 scientists considered over 30 possible landing sites. The Gale Crater landing site is so close to the crater wall, that it would not

have been considered safe if the mission weren't using NASA's improved landing precision.

Vessigny Beach Sand Composition and Provenance Implications, Southern Trinidad

Goddard, Coreyn, Zaben, Aihab and Payen Rodrigue, **Queens NY**

Trinidad is situated on the northern edge of the South American plate, but close to the southern boundary of the Caribbean plate. Current research includes sample collection and subsequent laboratory work at York College (CUNY). Preliminary laboratory work includes grain size analysis, heavy mineral separation, and chemical analysis by XRF. Sieve analysis data indicate that the sediments are well sorted, having an average standard deviation of 0.43 phi, with a near symmetrical distribution (average skewness -0.10). The sediments are leptokurtic, predominately medium to fine-grained sand (average Mean 1.24 phi). Initial heavy mineral separation reveals that sand is composed predominately of minerals of low specific gravity, such as quartz and feldspars. These minerals comprise 91-99%, by weight, of the sand grains. Traditional heavy mineral separation shows the presence of hornblende, zircon, epidote, pyrite, tourmaline, glauconite, magnetite and garnet. Such composition might indicate that the provenance is in close proximity to a mixed igneous, metamorphic, and reworked sedimentary source. Studies of recent geological map data have shown that surficial terrain is of sedimentary origin. Based on this, one might discern that the provenance of these coastal deposits is from the South American continent via the Orinoco River. In addition, trace amounts of heavy ultrastable minerals having well-rounded shape indicating that some, if not all of the sand, was reworked from older Tertiary and Quaternary marine and barrier island sediments. Trace elements such as Zr, Cu, Ni, Ti, Cr, and Ba also suggest winnowing of sediments by hydraulic sorting and ultimate enrichment of these elements in the sand. The deposition and winnowing of sand on the barrier island is apparently in equilibrium condition.

Surface Geophysical Investigation at a Buried Drum Disposal Site

David Heidlauf, Ryan Keeler, and Art Fromm, **Chicago, Illinois**

A multi-phase surface geophysical investigation was conducted at a large, capped, buried drum disposal site. In excess of 100,000 drums of pesticide manufacturing waste were disposed of in waste disposal trenches in three general disposal areas during a 10 year period in the 1960's and 1970's. The waste disposal trenches were created using a bull dozer in generally sandy soils along ridge top areas. The waste disposal areas were formally capped in 1980 with an earthen materials consisting of a grading layer, a two-foot compacted clay cap, and a six-inch topsoil layer. The landfill caps were further upgraded in 1997 with geo-composites to conform to RCRA landfill capping standards. A discovery last year of a historical, low altitude aerial photograph from the late 1960's or early 1970's of an empty trench located outside of the known buried drum wastes / capped landfill disposal areas was the genesis to initiate site surface geophysical investigation.

A combination of EM conductivity, magnetometry, and ground penetrating radar methods were employed over 24 acres of known capped waste disposal areas and 13 acres of adjacent, uncapped areas. The objectives of the surface geophysical investigation were to identify the locations of buried drum trenches underlying, along the periphery, and outside of the landfill's current RCRA geo-composite caps. The surface geophysical investigation was conducted in an iterative fashion and totaled 40 days of in-field data collection over a ten month period. A series of test pits, test trenches, and soil borings were also conducted to confirm the lateral edge of existing landfill caps and to verify the locations of suspected buried drum trenches both underlying and outside of the site's existing RCRA geo-composite caps.

The surface geophysical investigation was successful in the identification of an approximate 105-foot long by 15-foot wide suspect buried drum trench corresponding with the location of the empty trench identified on the late 1960's to early 1970's low-altitude aerial photograph, which is located outside of the landfills' existing capped area. The presence of buried drum waste at this location was confirmed with a soil boring drilled through the suspect buried drum trench location. Future site remedial plans include construction of a RCRA composite cap over this uncapped buried waste drum trench.

The surface geophysical investigation was also successful in the identification of approximately 2,100 feet of lateral landfill cap boundaries where buried drum trenches extended outside the limits of the existing landfill caps. Future site remedial plans include constructing cap extensions for those areas where buried drum trenches extend outside the limits of the existing caps.

Finally, surface geophysical investigation was successful in mapping the locations of approximately 3.3 linear miles of buried drum trenches underlying the existing landfill caps. The location of the buried drum trenches have been used to site the locations of soil vapor extraction remediation wells for a one-acre pilot test remediation area as well as in the development of a soil vapor extraction conceptual remedial design for the remainder of the capped landfill disposal areas.

Sampling Plants for Heavy Metals on Pine Ridge Reservation, South Dakota

Armando J. Hernandez**, Brookings, South Dakota**

A student intern sampled plant tap roots from *Astragalus racemosus* (creamy poison vetch) to detect heavy metals levels near the tribal landfill on Pine Ridge Reservation in southwestern South Dakota in June 2012. The project is part of a joint service-learning class exercise between South Dakota State University (SDSU) and Oglala Lakota College (OLC), where the student has dual enrollment. Samples were subjected to microwave digestion and inductively coupled plasma optical emission spectrometry (ICP-OES) in the Water and Environmental Engineering Research Center laboratory at SDSU to estimate levels of certain heavy metals: arsenic (As), barium (Ba), selenium (Se), and uranium (U). The results are presented, including the implications of prevailing winds near the landfill and their association with ash from burning at the site. The sampling is part of the OSSPEEC project: OLC, SDSU, and SDSMT (South Dakota School of Mines and Technology) Pre-Engineering Education Consortium, partly funded by National Science Foundation grants.

Biaxial Horizontal Swelling Strains in Pennsylvanian Rocks of the Appalachian Plateau in Response to Moisture Adsorption

Monte Hieb**, Oak Hill, West Virginia**

Study of moisture-induced swelling strains in Pennsylvanian rocks of the Appalachian Plateau in West Virginia reveals a 2:1 biaxial horizontal deformation oriented NW-SE. Oriented slabs of coal mine roof rocks collected across West Virginia in the spring of 2012 were dry-sawed to size, air-dried to stability, then monitored for moisture changes and deformation in the horizontal plane for one wetting cycle, followed by one drying cycle. The primary purpose was to determine if moisture-induced biaxial horizontal strains occur in Appalachian Basin rocks, and if so could they be used as a surrogate to estimate the direction of the maximum horizontal in-situ stress, as has been reported by various researchers over the years for certain Michigan Basin rocks. Biaxial swelling strains oriented NW-SE were observed in the West Virginia rocks , however alignment agrees more closely with mapped face cleat trends in underlying coal beds than with the direction of the present maximum in-situ stress, suggesting that the mechanisms controlling moisture-induced swelling strains form early in the tectonic history of the host rocks. Shale rocks rich in clay exhibit the strongest and most rapid biaxial swelling strains, with siltstones and sandstones being generally less reactive. The testing methods used are simple and inexpensive and the results offer insight into the biaxial nature of moisture-related stress in mine roof and floor rocks, and also may have application for shale gas development as a means to better predict the biaxial orientation of swelling strains from water injection and their effects on induced fracture networks.

Sampling White River Water for Heavy Metals in Western South Dakota

Daniel A. Johns**, Brookings, South Dakota**

In a collaborative service-learning exercise between South Dakota State University (SDSU) and Oglala Lakota College (OLC), a student intern sampled White River water samples at six bridge sites from near Belvidere to Oacoma in western South Dakota in June 2012. Samples were processed in the SDSU Water and Environmental Engineering Research Center laboratory through microwave digestion and inductively coupled plasma optical emission spectrometry (ICP-OES) to detect levels of

selected heavy metals: arsenic (As), barium (Ba), selenium (Se), and uranium (U). Results are presented and compared to samples taken by another student on other segments of the river during the same month and year. The research is part of a continuing, pre-engineering education consortium (known as OSSPEEC), between OLC, SDSU, and SDSMT (South Dakota School of Mines and Technology), partially funded by grants from the National Science Foundation.

A Resource Inventory of Selected Outcrops Along the White Clay Fault in Southwestern South Dakota

***Lilly Jones, James Sanovia, Hannan LaGarry,* Rapid City, South Dakota**

The White Clay Fault, located in southwestern South Dakota, formed after the Laramide orogeny (65mya) that resulted in the uplift of the Black Hills in western South Dakota and eastern Wyoming.

Many of the outcrops along the White Clay Fault are part of the Eocene-Oligocene White River Group (37-26.9 mya), an accumulation of nonmarine sediments composed primarily of tuffaceous mudstones and silty claytones with lesser amounts of kaolinitic sandstones, lacustrine limestones and gypsum (LaGarry, 1998; LaGarry and LaGarry, 1997). These rocks also consist of volcanic ash from eruptions in the southwestern United States (Larson and Evanoff, 1998).

The White Clay Fault lies at the outer boundary of the Black Hills uplift. After the fault formed, the erosion of overlying materials exposed outcrops of Late Cretaceous Niobrara chalk that formed between 145.5-65.5 mya, at a time when this region was covered by the Western Interior Seaway. The Niobrara Formation consists of chalk and limestone interbedded with marls and shale (Locklear and Sageman, 2008).

This poster records a geological and paleontological resource inventory for two selected outcrops that are within a short walking distance of each other along the White Clay Fault. Outcrops on the downside of the fault belongs to the Peanut Peak member of the White River Group, while the outcrops on the upside of the fault belong to the Niobrara Formation; a difference of 60 million years.

Few fossils were found at the White River Group site, however, the Niobrara chalk site is very fossiliferous. We were able to record the presence of numerous invertebrates as well as marine reptiles and sharks.

Sampling Wild Roses and Soils for Heavy Metals along White River on and near Pine Ridge Reservation, South Dakota

***Joanita M. Kant*, Brookings, South Dakota**

Sampling of wild rose plants and immediately adjacent soils was conducted in 2011 and 2012 on and near Pine Ridge Reservation in southwestern South Dakota, along with one non-reservation site in northwestern Nebraska. The purpose was to evaluate the levels of heavy metals in the plants and soils and to compare the detected levels of arsenic (As), barium (Ba), selenium (Se), and uranium (U). The plants included four species of wild roses, all of which often hybridize in their natural settings: Rosa acicularis, *Rosa arkansana, Rosa blanda, and Rosa Woodsii*. The 2011 sampling included sites distributed throughout the reservation, while the 2012 sampling included sites only on the banks of the White River at major bridges on the reservation, and one site in nearby Nebraska. Plants and soils were processed using microwave digestion and inductively coupled plasma optical emission spectrometry (ICP-OES) in the Water and Environmental Engineering Research Center laboratory and the Department of Civil and Environmental Engineering at South Dakota State University in Brookings, South Dakota. The results will be presented at the 49th Annual Conference of the American Institute of Professional Geologists in Rapid City, SD, in September 2012.

The research is part of a multi-year project known as OSSPEEC. It is a collaborative venture where the letters represent Oglala Lakota College, South Dakota State University, and South Dakota School of Mines and Technology Pre-Engineering Education Consortium, sponsored in part by grants from the National Science Foundation. Future research will include continuation of comparing detected levels of heavy metals in several traditionally edible fruits, in soils, and in White River sediment and water, on and near Pine Ridge Reservation, including sites within the World War II gunnery range.

Silver Cliff Volcanic Center: New Evidence of a Violent, Unique Caldera

***Jessica C. Kinninger, Robert J. Odien,* Colorado Springs, Colorado**

The Silver Cliff Volcanic Center (20-35MA) of Custer County, Colorado is located in the Wet Mountain Valley, and is east of the Sangre de Cristo Mountains and west of the Wet Mountains and the Rosita Hills volcanic area. Previous studies designate the Wet Mountain Valley as a tectonic basin related to the Rio Grande Rift System. This tectonic action gave rise to the Tertiary felsic volcanic activity at Silver Cliff, that transects the surrounding Precambrian metamorphics. In the late 1800's, silver deposits that resulted from hydrothermal mineralization due to the volcanic activity produced numerous economically profitable mining ventures and gave the area its name.

Prior structural evidence and current field work give credence to a hypothesis concerning the violence of the volcanic sequences in Silver Cliff and the presence of a uniquely weathered obsidian dome. Although the extant features of the caldera are heavily eroded, geomorphologic studies indicate the area to be consistent in structure and associated rock types with those of a caldera. A complex system of ring faults, in addition to the presence of mineralization, vents, and abundant breccia pipes are indicative of a caldera encompassing an area of eight square miles. Evidence of the violent nature of the Silver Cliff Volcanic Center was noted in previous studies that describe more than a thousand feet of pyroclastic debris and ash. This tephra is preserved in the two grabens that bound the rim to the west (trending southwest) and south (trending southeast). Based upon preceding geologic investigations, the conclusion can be reached that these down-dropped areas were caused by subsidence and then subsequently filled with material that resulted from either a flank collapse, phreatic (gas driven, as opposed to magmatic driven) eruptive sequence, or most likely, both. Late stage rhyolitic domes suggestive of potential magmatic resurgence are prominent in the White Hills area near the northern boundary of the caldera. Not previously noted, however, is the existence of a centrally located obsidian dome containing a multitude of extraordinary megaspherulites (ranging from 1 to 3 meters in diameter) that demonstrates a weathering process not present on this scale anywhere else in Colorado. Due to the high viscosity of obsidian prior to cooling, this dome would denote the source to underlie the extant structure. The result of this study coupled with previous investigations leads to the proposal that the Silver Cliff Volcanic Center be renamed as the Silver Cliff Caldera.

Take This Out of the Ballpark - Geology and Environmental Remediation of the New Twins Ballpark Site

***Kate Kleiter*, St. Paul, Minnesota**

The new Twins Ballpark Site was formerly a parking lot covering over 20 feet of urban fill polluted with petroleum, heavy metals and polynuclear aromatic hydrocarbons (PAHs)--a classic inner city "Brownfields Site". The pollution resulted from the historical industrial activities that occurred on the properties. Detailed environmental and geotechnical assessments were conducted prior to "breaking ground" to characterize the environmental and geological site stratigraphy. These activities were performed by a variety of consultants hired by Hennepin County. Over 250,000 cubic yards of polluted urban fill soils were remediated for disposal at local landfills during building of the new home for the Twins. This talk will focus on the steps taken to ensure that the stadium was built safely on clean land.

Hydrostatic Tank Testing in a Drought: A Battle for Water Rights

***Todd Knause*, Coalville, Iowa**

When applying for an Industrial Groundwater Transfer permit, Nebraska Administrative Code requires completion of a Hydrologic Evaluation Report to assist the Nebraska Department of Natural Resources (DNR) in evaluating potential impacts on the surrounding groundwater aquifer and surface water bodies. The Hydrologic Evaluation requires a feasibility study of all possible sources of water. Possible options are to be evaluated for their applicability, either individually or in combination, to the specific site conditions and surrounding settings with respect to effectiveness, implementability, and cost. Applicable or Relevant and Appropriate Requirement (ARARs) to local, state or federal statutes that pertain to the protection of human

health, life, and the environment are also to be considered as part of the evaluation process.

In 1955, a 10 million gallon above ground storage tank (AST) was constructed at a facility near Greenwood, Nebraska. At that time, a permit application was approved to pump approximately 500 gallons per minute of groundwater for 14 days from a nearby well to test the tank. Since then, cracks developed in the AST and the well has collapsed leaving both inoperable. The cracks have been repaired and the tank is ready for tightness testing. However, a water source is not readily available and hydrostatic testing is the only practical way to test the integrity of an AST of this size. Approximately 7 million gallons of water are needed to conduct a hydrostatic test on the AST at a time when the region is in an ongoing drought which has resulted in a moratorium on new well permits and restrictions on surface water appropriation.

Abstract for the Successful Implementation of Adaptive Management for the Restoration of a Watershed in Southeastern Tennessee Impacted by Copper Mining

Tom McComb, David Winter,
Nashville, Tennessee

Adaptive Management is defined as a structured, iterative process of decision making in the face of uncertainty, with an aim to reduce uncertainty over time via system monitoring. In lieu of the CERCLA RI/FS process, adaptive management presented a path forward at a complex site using incremental steps to speed up the remediation process. The site, the North Potato Creek Watershed located in the Copper Basin, Polk County, Tennessee, was the location of mining and mineral processing between 1850s and 1980s. Open roasting of sulfide ore during the late 1800s devegetated the basin allowing for massive soil erosion. Subsequent mining operations resulted in acid mine drainage, impacted benthic-macroinvertebrate communities, and braided stream channels.

OXY USA (Glenn Springs Holdings, Inc.), EPA, and the Tennessee Department of Environment and Conservation agreed in 2001 to use adaptive management to determine the extent and scope of removal actions to be performed for the restoration of the North Potato Creek watershed. The agreement required restoration of the biological integrity of North Potato Creek; however, it did not prescribe a specific remedy or an explicit timetable for completion. The remedial actions have not included the removal of all potential contaminant sources, but focused on the remediation of high impact source areas. A key component of the adaptive management was comprehensive base-flow and storm-flow surface-water monitoring and biological performance monitoring. The monitoring activities have documented the reduction in loading of base-flow and storm-flow acidity and metals, a reduction in the magnitude of the first flush during storm-water events, and improvements in the benthic-macroinvertebrate communities. Different phases of the project had unique intermediate goals: 1) **Initial Actions** – Elimination of potential human health exposures, 2) **Secondary Actions** – Removal actions in acid generating source areas, 3) **Tertiary Actions** – Removal of secondary sources of acid generation and metals and the reconstruction of impacted stream reaches, 4) Final Actions (Ongoing) - Improvement of stream and stream bank habitats and the remediation of small sources of acid generation and metals.

Using adaptive management, the removal actions were initiated earlier than possible if the project had been conducted using the typical CERCLA RI/FS model. With the CERCLA RI/FS model all the site data would have been collected during a lengthy remedial investigation and all the remedial actions would have been determined during a feasibility study and selected during the ROD. With adaptive management, the initial actions and secondary actions did not require significant data collection or planning prior to their implementation. Additionally, the process of monitoring the impact of the initial remedial phases to select and design subsequent removal actions led to better scoping of removal actions and to a reduction in time required for the completion of restoration activities.

Rare Earth Elements (REE) Deposits In New Mexico

Virginia T. McLemore, **Socorro, New Mexico**

Our society is currently demanding more environmental-friendly technologies like solar panels and wind turbines for electricity, batteries, and electric cars. Other technologies are being developed like water purification, desalination, carbon capture and storage, and even better light bulbs and they all require non-traditional minerals and elements in their manufacture. Elements such as cerium, samarium, neodymium, ytterbium, and 13 others are known collectively as rare-earth elements (REE) and are required in many of these technologies as well as other products, such as magnets used to drive many of our motors, cell phones, televisions, and computers.

Deposits of rare earth elements (REE) are found in New Mexico, but they have not been important exploration targets in past years because demand has been met elsewhere. However, with the projected increase in demand and potential lack of available REE production from China, the New Mexico deposits are being re-examined for their potential.

REE-Th-U veins are found in the Gallinas, Caballo, Capitan, and Cornudas Mountains and Laughlin Peak-Chico Hills. A small amount of bastnaesite, a REE mineral, was recovered during processing for fluorite from the Gallinas Mountains. Four types of deposits are found in the Gallinas Mountains: epithermal REE-F veins, Cu-REE-F veins, REE-F breccia pipes and iron skarn deposits; all are associated with Tertiary alkaline to alkalic-calcic igneous rocks. Alteration includes brecciation, silicification, chloritization, and fenitization. District zonation is defined by Cu-REE-F (±Pb, Zn, Ag) veins that form center of the district, surrounded by REE-F veins. Carbonatites are inferred at depth by the presence of fenitization, carbonatization of the breccias, presence of REE and similarity of the intrusive rocks and mineralization to areas with known carbonatites. Resources amount to at least 537,000 short tons of 2.95% total REE (not NI-43-101 compliant; Schreiner, 1993). Drilling is required to identify a better resource estimate.

The Cornudas Mountains consist of ten larger sills, plugs, and laccoliths and smaller dikes and plugs of phonolite, syenite, and other alkaline igneous rock that intrude relatively flat-lying limestones and other sedimentary rocks of the Hueco Limestone and Bone Spring Limestone (Permian). The abundant rare mineralogy in the Cornudas Mountains suggests that the area has potential for undiscovered deposits of rare earth elements, niobium, and zirconium. U.S. Borax sampled and drilled in the Chess Draw area (up to 0.06% total rare-earth oxides, 10-1400 ppm Nb, 10-3000 ppm Zr, 230-13,000 ppm F). An analysis of a dike contained 1235 ppm Ce, 700 ppm La, 270 ppm Nd, and 242 ppm Y. Additional geophysical and geochemical studies followed by drilling are required to properly assess the resource potential.

Other types of REE deposits are found in New Mexico. Carbonatites are found in the Lemitar and Chupadera Mountains, Laughlin Peak-Chico Hills, Lobo Hill, and Monte Largo (Sandia Mountains). Disseminated Y-Zr deposits in syenite are found at Pajarito Mountain, Mescalero Apache Indian Reservation near Ruidoso. In 1990, Molycorp, Inc. reported historic resources of 2.7 million short tons grading 0.18% Y_2O_3 and 1.2% ZrO_2 as disseminated eudialyte. Two additional deposit types have potential for REE in New Mexico: Cretaceous heavy mineral, beach-placer sandstone deposits and pegmatites. Exploration is ongoing in the Lemitar, Gallinas, and Cornudas Mountains.

Many challenges face these industries in supplying REE elements. REE have to be mined and they have environmental issues that will be identified and addressed. Most REE deposits are associated with radioactive waste material, which will require special handling. Are there enough REE in the pipeline to meet the demand for these technologies and other uses? Future development of these green technologies will be challenging and demand more research in many fields.

Part 2 of the 2012 Annual Meeting Abstracts will be printed in the Nov/Dec *TPG*.

Have you given a presentation at a seminar, or annual meeting?

If yes, then we are interested in you submitting your paper for publication.

Please contact AIPG Headquarters at ***aipg@aipg.org,*** if you are interested in having your paper being published in *TPG*.

Arizona Section

AIPG Arizona Section Field Trip to Chihuahua, Mexico-Our plans for the field trip to Chihuahua April 5 to April 11, 2013, are set. Our trip will start at the capital of the state, Chihuahua City, with the first travel day on Friday, April 5, 2013. The trip itinerary is as follows in Table 1:

Day	Description of Activities
Day 1 (Friday, April 5)	Participants travel to Chihuahua and check into hotel.
Day 2 (Saturday, April 6)	Day trip to Naica Mine and tour the Cave of Giant Crystals; Evening dinner in conjunction with local geologists (AIMMGM).
Day 3 (Sunday, April 7)	Visit to nearby historic mining district Santa Eulalia. Excursion to historic district of Chihuahua City and local museums.
Day 4 (Monday, April 8)	Check out of hotel in Chihuahua City and travel to Nuevo Casas Grandes with stop at exploration project. Check into hotel at Nuevo Casas Grandes/ have lunch. Travel to Mata Ortiz to see pottery-making with visits to artists' studios and watching a firing of pottery.
Day 5 (Tuesday, April 9)	Drive to scenic outlook along flank of the Basin and Range to view regional geology. Tour of museum and archeological ruins at Paquimé. Visit the Mormon settlement of Colonia Juarez.
Day 6 (Wednesday, April 10)	Check out of hotel in Nuevo Casas Grandes and return to Chihuahua City. Group dinner at restaurant with regional specialty menu.
Day 7 (Thursday, April 11)	Return to USA or start optional excursion to Copper Canyon (the optional trip would be with a local tour company).

This month we are highlighting the two portions of the trip: the geology of the *Naica Mine* and the formation of the Crystal Cave and the visit to *Mata Ortiz*, world-renown for pottery.

Naica Mine and the Selenite Crystals-The Naica Mine is a poly-metallic mine operated by Industrias Peñoles since 1951. The purpose of our visit won't be to look at core, though. We will be visiting the Cave of the Crystals, which has been described as "Superman's home" and "the Sistine Chapel of crystals", because it contains some of the largest natural crystals ever found. These selenite crystals were formed during a period of about 500,000 years when the cave was filled with a mineral-rich hot water. It was discovered in 2000 when a new tunnel was being excavated. As photos were passed around the internet, thoughts of "photo-shopped" were in the minds of many geologists who saw photos of people dwarfed by the crystals that are up to almost 40 feet in length. Now there have been researchers who have studied the cave and determined that the key to the mineral growth was a very narrow, stable temperature range that allowed for the crystal growth over a long period. The cave is along a fault that is a conduit for groundwater. The volcanic processes created a geologic formation that was rich in anhydrite, which is stable above 136 degrees Fahrenheit. The temperatures dropped as the magma cooled. The anhydrite dissolved as it became unstable, and then selenite crystals started forming (anhydrite is the anhydrous form of gypsum). The long period at just the right temperature allowed the crystals to grow and grow. We'll see it all ourselves when we travel into the mine and step into the cave.

Mata Ortiz-Located on the west bank of the Palangas River in northwestern Chihuahua, the small village of Mata Ortiz is the artistic center for the world-class, modern pottery that is sold in fine galleries and museum shops in the U.S., Europe, and Japan. Over 100 highly talented ceramic artists produce hand-formed vessels that are painted with mineral pigments from the local soil. Inspired by the ancient pottery of the pre-Columbian city of Paquimé, these beautifully constructed and intricately decorated pieces are fired in the traditional method using local wood. Visiting the village provides the opportunity to meet the artists and see how the pots are made and fired.

Want to join us?-If you are interested in the field trip and would like to have your name added to the list, please contact **Dawn Garcia** (trip coordinator) at *dgarcia@srk.com* or via cell 520-471-9387. Dawn is the President-Elect for the Arizona section, and has extensive travel experience in Mexico. The trip leader for the area of Nuevo Casas Grandes will be **John Bezy**, retired geologist and co-author of the book "The Artistry and History of Mata Ortiz". John has been traveling in Mexico for decades and has a wealth of knowledge not only on the geologic but on the culture and history of Chihuahua.

Cueva de los Cristales.

Special Acknowledgement -Arizona Section member Bill van der Wall, CPG-11426, will be traveling to Zurich in July to receive the 2011 Nyrstar STAR of Excellence Award for his department's outstanding production and safety record for 2011. The competition considers all of Nyrstar's operations, which includes five continents. Nyrstar is the largest producer of refined zinc in the world, and Bill works at El Mochito mine in Honduras.

Bill, the geology manager at El Mochito Mine, received the Nystar 2011 Excellence award for "innovative and creative thinking". Grupo Nystar, the mine owner, awards an annual prize throughout its global operations. In 2011 Bill and his team (the geology and diamond drill departments at El Mochito) were awarded the top honor when they focused on 3 aspects to improve the diamond drill operations: 1. Improve the existing diamond drilling program. 2. Reconstruct two drilling platforms using the internal mechanics department to achieve a cost of less than $100,000 each. 3. Initiate a preventative maintenance program that resulted in an equipment availability increase of more than 80 percent. As a result of the departments' effort, they were able to increase the mine reserves based on 1.2 million metric tons of new proven and probable minerals. ***Congratulations, Bill, on this achievement!***

David Palmer, CPG-09960
Section Secretary

Ohio Section

Ohio Section Mentors Students at GSA, Dayton Ohio. The Ohio Section of AIPG combined efforts with National AIPG to reach out to literally hundreds of geology students at the North-Central GSA Section Meeting held at the Convention Center in downtown Dayton on April 23 and 24, 2012. Ohio-Section member volunteers Robin Roth, CPG-09264, Curt Coe, CPG-06240, and Brent Huntsman, CPG-04620, were lead by Tom, CPG- 08208, and Betty Berg (true veteran conference and meeting marketers) in providing students from Midwestern colleges and universities various handouts and advice. Most of the material discussed concerned general geology, the geology of Ohio, the practice of professional geology, and what is

Past President Tom Berg, CPG-08208, officiates one of the numerous AIPG sponsored raffle drawings for useful geologicorientated accessories conducted for new student members at the North-Central GSA in Dayton, OH.

required to become a Student Member of AIPG. During the two day event, nearly a hundred students submitted applications to become AIPG members. Ohio-Section members also contributed to the overall success of the meeting through oral and poster technical presentations as well as participating in student mentoring programs.

A more detailed assessment of AIPG-Ohio Section efforts and there effectiveness in promoting the practice of professional geology at student-dominated meetings such as GSA is forthcoming in a *TPG* article by Tom Berg.

Ted DeBrosse, CPG-00082, Ohio Section Extends Farewell Tribute to Founding Member. Past President Theodore "Ted" DeBrosse, founding member, and loyal friend, passed away May 21, 2012 at the age of 81. Ted DeBrosse was one of AIPG's first Certified Professional Geologists, as indicted by his registration number, 82. In 1965, his vision and dedication to the geological profession led him and a small handful of fellow CPGs to found the Ohio Section of AIPG. Once formed, Ted served on the Section's first screening board in 1966, then on the executive committee in 1967, as Secretary-Treasurer in 1969 and 1970, and then as President in 1971. Ted remained committed to the Section and retained his membership all these years. He was also a charter member of the Ohio Geological Society, and an active member of the American Association of Petroleum Geologists. Ted was retired from the State of Ohio Division of Oil and Gas, where he served as assistant chief. We are grateful to Ted, and we extend our condolences to his wife and family.

Ted Debrosse, CPG-00082, a Recollection, by William. E. Shafer, CPG-01620. Ted worked in the Oil & Gas Section of the Ohio Department of Natural Resources and then with the new Ohio Oil & Gas Division of the ODNR. He actively promoted the registration of professional geologists in the State of Ohio. To achieve that end he became a charter member of the Ohio Section of AIPG.

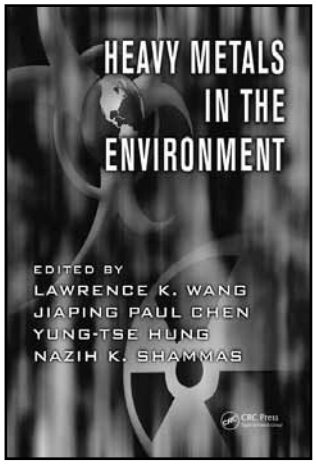
Ted weathered the dramatic and tumultuous events of the "1960's Morrow County Ohio Oil & Gas Boom" under the direction of "Bernie" Bernhagen and then "Buzz" Collins, sequential division chiefs. He retained considerable presence of mind and a growing accumulation of field-stories and data files to fascinate the daily line of Geological Survey patrons and sight-seers overflowing and pressing through the Survey's office each day. When the Ohio Division of Oil & Gas was created in 1965 with implementation of the new oil & gas laws, Ted was logically assigned to this new division under Don Norling, the new chief. Ted's service remained faithful to the cause. He kept the data flow in good order, and his oil field story narrations were as rich as ever. When well permits could no longer be "walked through" the Geological Survey [preempting the earlier applications received by mail] Ted took the unpleasant and unjustified brunt of some of the more egotistical lease and well operators' irritation over this "new rule." Ted remained "Assistant to The Chief", as the division expanded many times during the several subsequent political administrations. The chiefs changed with the installation of each new political administration. Ted never lost his zest, sharing oil field stories to enrich his audiences, time permitting. Ted was a man of the hour. Of course, as with all of us, he shall be missed.

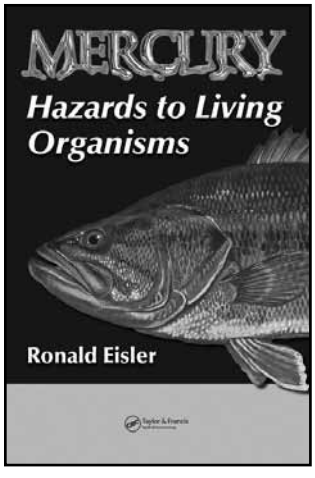
Editor's note: Bill Shafer served on the executive committee with then President Ted DeBrosse in 1971.

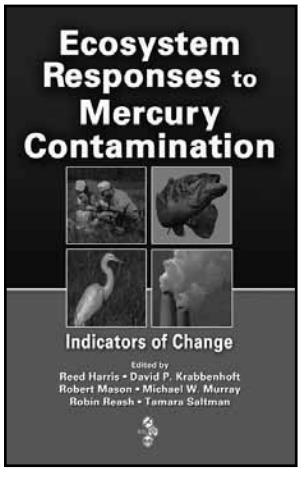
Matt Justice, CPG-10485
Section Editor

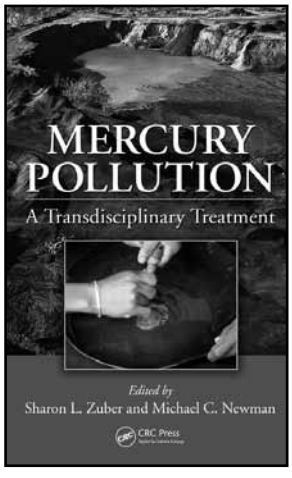
A Review of Four Books on Mercury

James A. Jacobs, CPG-07760









Although mercury is a naturally occurring metal, most of the concerns relate to anthropogenic mercury exposure associated with industrial processes, power generation or gold mining. Mercury is not only one of the most toxic metals on Earth, but the only metal found as a liquid at room temperature. This silvery element, due to its heavy molecular weight, was used for centuries to extract one of Earth' most valuable and precious metals: gold. This association with gold has created a toxic legacy stored in the bottom sediments of streams, rivers and lakes in gold mining areas. Power generation from coal produces vast quantities of toxic air emissions, including mercury vapors. Industrial production may use mercury in processes or generate mercury as a waste product which may enter the biosphere through improper metals treatment or disposal practices. Due to these anthropogenic activities and others, mercury enters the environment where the highly toxic characteristics of the element have been noted and documented in the environmental science and epidemiology literature for decades.

Mercury exposure pathways are highly complex in the biosphere, and the prevention of mercury exposure to humans and the environment requires a basic understanding of air pollution control, industrial water pollution practices, soil conservation, site soil and water remediation, groundwater protection, public health management and communication, solid waste disposal, and combined industrial-municipal mercury waste management. Despite some improvements in storage and handling procedures over the years, mercury is still an extremely dangerous heavy metal when released into the environment. Although each book reviewed has a slightly different focus, the following article is an evaluation of some of the available mercury-related books. These books were reviewed to determine whether the books provide a useful compilation of information for a researcher to rapidly obtain a reasonable understanding of the complex interaction of mercury in the biosphere and the associated environmental issues and solutions.

The first book reviewed about mercury in the environment is ***Heavy Metals in the Environment,*** which contains 15 chapters written by a wide variety of experts and edited by Lawrence K. Wang, Jiaping Paul Chen, Yung-Tse Hung, and Nazih K. Shammas. The editors are well respected researchers or professors in the environmental science and engineering field. The usefulness of this book is that it captures a variety of valuable information in one volume, including the sources, occurrence, toxicity, assessment, management, treatment and recycling of metals such as mercury as well as lead, chromium, cadmium, zinc, copper, arsenic, nickel, and iron.

Although this book describes several metals other than mercury, through natural occurrence or through industrial processes, mercury is sometimes concentrated or associated with other metals. It is instructive to review the concise compilation of physical and chemical characteristics of the other heavy metals which differ from the unusual properties of mercury. Of particular interest in mercury remediation is the chapter on management and treatment of heavy metals from contaminated soils. Along with descriptions of numerous products containing a variety of heavy metals, including mercury, a chapter is focused on the current methods of recycling and disposal of hazardous solid wastes containing heavy metals and other toxic substances. Some current products containing mercury include electrical switches and light bulbs.

There is information on proper handling, storage and disposal of these industrial and consumer products. Toxicology issues include toxicity, acute and chronic exposure, and health effects of a vari-

ety of metals, including mercury. The authors describe various technologies for metals treatment and management, and metal contaminated wastewaters and solid wastes and metals control is an important part of the focus of the book. The book describes the treatment processes and mechanisms for metals control and removal, the environmental behavior and effects of engineered metal and metal oxide nanoparticles, nano-technology applications in metal ion adsorption, biosorption of metals, and heavy metal removal by specialized microbes. ***Heavy Metals in the Environment*** is a concise compilation of important and current information about mercury and other heavy metals which should be useful to wastewater treatment plant operators, regulators, industrial facility managers and environmental consultants.

Another book reviewed about mercury and the environment is ***Mercury: Hazards to Living Organisms***. The volume is important for those working in toxicology or with marine organisms. Although this book was published a few years ago, the information on the toxicity and exposure pathways of mercury is still relevant today. The other three books reviewed are a collection of chapters written by various experts. This book is the only volume reviewed that is written by one author, Ronald Eisler, Ph.D. A scientist with chemistry and biology degrees, Eisler is a highly published early researcher and expert in the toxicological effects of mercury on marine organisms, and chemical risk assessment to wildlife. He had a distinguished 45-year career with several American federal government agencies, including the US EPA and US Department of the Interior.

The author describes mercury concentrations in abiotic materials, plants, invertebrates, amphibians, reptiles, fishes, and birds, as well as humans and other mammals. The historical and current uses and sources of mercury are described along with the physical, chemical, biological, and biochemical properties of this unique and highly toxic metal. The well known tragic history of the Japanese mercury poisoning by the consumption of mercury tainted fish, now referred to as Minamata Disease, is included in this book. Other case studies describe mercury poisonings in Japan, China, Faroe Islands, the Republic of Seychelles, New Zealand and Ontario, Canada. The significant mercury hazards from gold mining are also documented in case studies about Brazil, Columbia, Peru, Ecuador, Surinam and Venezuela, Africa, China, Philippines, Siberia, Canada and in the United States. Eisler summarizes mercury sources, properties, poisoning and treatment as well as mercury transport and the mercury speciation processes. The analytical chemistry techniques for mercury measurement are also described. The details of mercury toxicology, risk assessment, exposure pathway analysis leads Eisler to explain in clear prose the high toxicity of mercury to wildlife, domestic animals, and humans including the potential resulting cancers, birth defects, and chromosomal aberrations related to mercury exposure.

Eisler makes several key points in his book: 1) Some forms of the element have relatively low toxicity which can be transformed to high toxicity through biological or other processes. 2) The uptake of mercury directly from seawater or through biomagnifications in marine food chains returns mercury directly to humans in concentrated forms. 3) The uptake of mercury may result in genetic changes. 4) Naturally elevated levels of mercury in some marine organisms, including fish, such as tuna, swordfish and marlin, emphasize the complexity of natural mercury cycles and anthropogenic impact on those cycles. 5) The human use of mercury in products or processes needs to be curtailed due to the small difference between the tolerable natural background levels of the element and extremely toxic effects of mercury to humans and other organisms. Based on the well researched case studies in the book, Eisler makes the strong argument that mercury is extremely dangerous in products and the environment, and the use of the element should be stopped.

Although a few years old, ***Mercury: Hazards to Living Organisms*** is well written from the toxicology-risk assessment view point. It should be required reading for toxicologists, chemists, wildlife biologists, chemical risk assessors, environmental consultants, regulators and others who are working with the effects of mercury in the environment.

A third book, ***Ecosystem Responses to Mercury Contamination: Indicators of Change,*** features six chapters written by forty experts in the environmental field. The book is edited by R. Harris, D.P. Krabbenhoft, R. Mason, M.W. Murray, R. Reash, and T. Saltman. The book was prepared based on the Society of Environmental Toxicology and Chemistry (SETAC) North America Workshop on Mercury Monitoring and Assessment, 14-17 September 2003, Pensacola, Florida, USA.

Rising levels of mercury in the environment pose an increasing threat of toxicity to humans and wildlife. Over the past several years, several laws have called for industries to reduce mercury emissions at the source. ***Ecosystem Responses to Mercury Contamination: Indicators of Change*** provides a summary of the infrastructure and methods needed to measure, monitor, and regulate the impact and concentration of mercury present in the ecosystem. The book contains the practical instructions needed to design a large-scale monitoring program for mercury in the environment. The book also shows how to use the mercury concentration data to create, enforce, and evaluate the progress of initiatives aimed at reducing mercury emissions.

Based on the collaborative efforts of many scientists, the Society of Environmental Toxicology and Chemistry (SETAC) provides an outline of a national-scale framework for monitoring the effects of releases of mercury into the environment impacting biota through a variety of exposure pathways including air, water, soil, rock and sediment. Bioaccumulation and biomagnification of mercury in living tissues through the ingestion of mercury-tainted aquatic organisms and wildlife creates another exposure pathway for animals and humans higher on the food chain.

From the experience of the authors, the book has identified the most useful biological indicators showing the environmental changes associated with mercury contamination. The indicators are broken into four main exposure pathways, also called compartments of the environment: 1) airsheds and water sheds, 2) water and sediment, 3) aquatic organisms with emphasis on freshwater ecosystems, and 4) wildlife that live in freshwater, terrestrial, and/or coastal environments.

The book starts with an introduction of mercury emissions and deposition, sampling strategy and monitoring data and modeling. Mercury in airsheds and watersheds is described as well as the importance of selecting local mercury monitoring sites and the global and regional influences associated with monitoring and analytical methods. To evaluate the health of an ecosystem, one needs the tools to understand monitoring

and evaluation methodologies to identify trends in sediment and water indicators. The authors propose a set of biological indicators to use as a measure of changing mercury concentrations in the environment. A recommended mercury monitoring strategy is provided as well as guidance for determining the systematic changes in mercury concentration in the environment. Additional mercury monitoring strategies are presented to relate observed changes in mercury concentration to regulatory controls on mercury emissions.

Due to the importance of methylmercury accumulation in aquatic biota, an entire chapter is focused on the criteria to select aquatic biological indicators, including fish, benthic invertebrates, zooplankton, phytoplankton and periphyton. Wildlife indicators are examined in detail regarding host factors, indicators of exposure and indicators of effect. Candidate bio-indicator species include mammals (mink, river otter, raccoon, bats and marine mammals) and birds (bald eagle, osprey, common loon, common merganser seabirds, insectivorous birds, albatrosses and hawks), reptiles and amphibians. The collection of tissue samples from hair, feathers, eggs, and organs is explained. The final chapter in the book is focused on an integrated framework for ecological mercury assessments which includes the design of the monitoring network, criteria for the selection of indicator species, and considerations for sampling (scale, location, frequency, duration of monitoring program, trends and integration of monitoring with modeling capabilities.

Ecosystem Responses to Mercury Contamination: Indicators of Change is comprehensive in scope and provides a compilation of important applied information by practicing experts written for wildlife biologists, ecologists, environmental scientists, regulators, and others. The author understands the essentials of monitoring, sampling and analytical methods that are needed to confirm the environmental impact of mercury in the ecosystem.

The fourth and final book reviewed is ***Mercury Pollution: A Transdisciplinary Treatment***. This volume is unlike the other three in several aspects. It provides many historic case studies and describes the socio-economic issues from the wider human experience. The tragedy of mercury exposure in the biosphere can be described in the scientific literature as to concentrations of mercury found in tissues or the data from clinical evaluations. This is useful information for the specialized practitioners in the field. Sometimes however, scientific data by itself falls short of describing the health problems or communicating the dangers of particular toxins in the environment, such as mercury. This is the tragedy of science done in a vacuum, without the benefit of adequate media exposure. This book helps to provide proper communication of the hazards of mercury and highlights the importance of the scientific results and interpretations. In the process ***Mercury Pollution: A Transdisciplinary Treatment*** shares that information with the technical experts, environmental policy makers and the general public.

This volume features eleven chapters written by about a dozen different authors, The book is edited by Sharon L. Zuber, a well respected documentary film maker and co-director of the Mercury Global Inquiry Group and Michael C. Newman a marine science professor at the College of William and Mary's School of Marine Science. Newman is an expert in quantitative ecotoxicology, environmental statistics, risk assessment, population effects of contaminants, metal chemistry, and bioaccumulation and biomagnifications modeling.

The book is written in easy-to-understand prose and contains a socio-economic approach to the mercury poisonings. Although the information contained in the book is fully documented with technical references, the tone of the book is more conversational. It is not written in the language of the standard scientific technical paper, and consequently is more accessible. ***Mercury Pollution: A Transdisciplinary*** Treatment is focused on communicating the hazards and issues of mercury exposure and poisoning to policy makers, the general public and media outlets. Although medial and epidemiological statistics about the mercury poison victims are available in data tables, the authors of this book are trying to tell a story about the human experience of mercury exposure. It is the purely scientific research paper that misses the human tragedy of mercury pollution. This book includes important historic black and white photographs of the victims of Minamata, Japan taken by W. Eugene Smith and Aileen M. Smith. The historic photos and the current text provides a retrospective understanding of the unmistakable human anguish, confusion, and painful deaths that are the direct consequence of human exposure to mercury pollution. The chapters in this volume has titles such as; "When the Scientific Vantage is Not Enough," "Dangerous Attractions: Mercury in Human History," "Mercury by the Numbers," "Is the Tuna Safe?" and "Writing as Environmental Stewardship." The book includes the history of the uses and dangers of mercury, and mercury-related environmental regulations and international treaties.

This powerful book includes an interdisciplinary approach that presents a more complete human picture of the painful effects of mercury pollution and provides insights into environmental activism, regulation and environmental vision that is needed to protect the biosphere from mercury exposure. The book is recommended for environmental regulators, environmental policy makers, environmental activists, and others trying to communicate to the public and to the media about the significant dangers of mercury and the importance of minimizing and regulating mercury exposure in the biosphere.

There will always be new and updated scientific articles published in the environmental science literature regarding mercury exposure. However, the existing knowledge base on toxicology, human exposure and mercury in the environment is significantly large. Comprehensive collections of articles such as these books are an important time saving research tool for environmental professionals. There are many technical articles of various levels of quality available on the internet on the subject of mercury environmental hazards. However, tracking down accurate and generally accepted information about mercury is time consuming and not always productive. Each of the four books reviewed provide an organized (and indexed) compilation of specific mercury-related information that is needed for those serious about mercury related issues.

James A. Jacobs is a professional hydrogeologist with Environmental Bio-Systems. He is a Fulbright Scholar and co-authored the Chromium(VI) Handbook and several articles about metal remediation methods. Contact information: *geojimj@gmail.com*

AIPG's National Executive Committee – New Blood is Beneficial

John L. Bognar, CPG-08341

During my years in AIPG I have always marveled at the large number of people donating their time, ideas and brainpower for AIPG betterment. But we can always do better with more of the same. In my 20 years or so as a member, I venture to say that I have met literally hundreds of members and heard an equally large number of great ideas to serve the members and make AIPG stronger. Members have always been alerted to volunteer opportunities, but as in most organizations regardless of its nature and business, it seems there are only a few percentage wise, that carry the lion's share of the burden. Personally I believe that may be true, but in AIPG's case not for reasons of apathy on the part of those not greatly involved. Rather in part, I believe would-be participation as opposed to actual participation may be due to what could be perceive by members as a lack of welcoming. In fewer words, members who may think of themselves somewhat as outsiders may ask themselves "Do I have a realistic chance to participate in AIPG's National Executive Committee?"

As Past President of AIPG, I would like to answer that question. Yes! Our cherished institute was built by a long succession of new comers bringing their new blood and new ideas to the Executive Committee. Personally I believe it is this constant revitalization of the Executive Committee that keeps it fresh and keeps it looking forward. Those of us who have had our opportunities to serve and offer fresh and new ideas during our tenures are thankful; for without exception the returns of such volunteerism are much greater than the expenditure. There has always been a custom it seems, that I particularly admire by the women and men of AIPG who have served on Executive Committees. Once their period of participation is over, they have always stepped aside thus creating opportunity for new-comers and accomplishing the goal of letting the new blood refresh and make fertile the incoming Executive Committees. My hero, George Washington told John Adams while passing the baton, that one of the most important duties of a President is to stay out of the fray as Past President.

Because AIPG embraces the culture of refreshment, there are always several openings each and every year to serve at the national level Executive Committee level. Perhaps the best way to get started is to run for one of the four Advisory Board member positions. This September help keep AIPG going into a bright future; bring your new blood to the Executive Committee.

Is Your Profile Correct?

It is important to keep your address, phone numbers, and e-mail information up to date in our records. Please take the time to go to the AIPG National Website, ***www.aipg.org,*** login to the member portion of the site and make sure your information is correct. You can edit your record online. If you do not know your login and password you can e-mail National Headquarters at *aipg@aipg.org* or call (303) 412-6205.

Invitation from AIPG to Submit Articles

You are invited to submit an article, paper, or guest column based upon your geological experiences or activities to the American Institute of Professional Geologists to be included in "The Professional Geologist" (*TPG*) bi-monthly journal. The article can address a professional subject, be technical in nature, or comment on a state or national issue affecting the profession of geology.

Article submissions for *TPG* should be 800 to 3200 words in length (Word format). Photos, figures, tables, etc. are always welcome! Author instructions are available on the AIPG website at *www.aipg.org*.

Please contact AIPG headquarters if you have any questions. AIPG email is *aipg@aipg.org* or phone (303) 412-6205.

Communication In Today's Electronic World

Virginia T. McLemore, CPG-07438
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In today's fast-paced electronic-based world communication is simple and easy—right? Well maybe… There are certainly many modes of communication available and, most often, they provide instant results. But there are some drawbacks we must keep in mind.

Communication is the sharing of information, including thoughts, messages, articles, etc. and, requires a sender (person sending the information) and a receiver (person accepting the information). The art of communicating and getting your message through to the receiver isn't always easy, even with all the technology available today. One reason is that the receiver may not always be aware that communication is occurring or that the message is clear and understood—that is the hard part of communication.

Electronic communication has replaced, or at least supplemented, traditional forms of communication, like face-to-face meetings, letters, even traditional publications like the *TPG*. Many newspapers and magazines are re-evaluating if hard copies of their publications makes business sense. Colleges and universities are moving towards books on computer instead of hard copies. Many scientific articles are available in electronic form.

Some problems can occur. Much of our day-to-day e-mails have many advantages, but beware of messages that are not well written. Misunderstandings can occur if the e-mail is not well written. Social networking sites, such as Facebook, MySpace, LinkedIn, blogs, widgets, etc. are another way many people communicate today, especially the younger generations. Facebook, Myspace may actually improve communication *(http://www.collegian.psu.edu/archive/2008/08/06/study_facebook_improves_commun.aspx, accessed 8/20/12)*. Once again, be careful how you write and what you write. Many of these forms are available to the public!

There are other drawbacks. Not everyone has access to the internet; and some are still intimidated by electronic technology. The technology doesn't always work. Hackers have broken into some of our important sites (like banks, Department of Defense, etc.) and everyone must constantly upgrade their systems—this results in communications downtime, new servers, and new passwords. And as geologists, how many times are you in remote areas where the cell phones and computers do not work?

Almost all conflicts today are still a result of communication problems and assumptions, especially because we depend upon electronic communication so much. Message overload (too many messages) is a problem—we spend too much time trying to prioritize our e-mail and other communications, instead of face-to-face meetings. Message complexity and message clarity is becoming more problematic. Listen—many problems occur because we do not listen. We do not always read the messages as they were intended!

Some suggestions to improve our communication are:

- Write simple, to the point, clear messages.
- Be professional. One of the consequences of our fast-paced, electronic world is that we are too casual too quickly.
- Be enthusiastic. When you discuss ideas face to face, your body language conveys enthusiasm to the listeners. People can't see or hear your enthusiasm in written forms of communication. Once again in our electronic world, we must specifically use phrases to convey our excitement, like "I'm excited about this" or "I can't wait to start".
- Be accurate and specific. Include timelines (deadlines) if appropriate.
- Be responsive. Address the needs of the listener.
- Be respectful and consistent.
- Communications must be well-organized, short, and to the point.

And remember, if you do not get the results with electronic communication, then give that party a phone call or better yet a personal face-to-face visit. In many times, you will find that there was an underlying problem in communicating electronically or each of you had different assumptions or expectations.

Wanted—Your Photos Of Past AIPG Annual Meetings and Field Trips

Next year will be our 50th anniversary and we have several events planned to celebrate it. We also would like to highlight past AIPG activities, but we need your photos to accomplish that. We would like to use these photos on our cover issues of *TPG* next year. If you have any other ideas for next year's celebration please forward them to me or AIPG headquarters at a*ipg@aipg.org*.

Answers on Page 26

Robert G. Font, CPG-03953

1. In magmatic crystallization as described in "Bowen's Reaction Series", which of these constitutes the "continuous" branch?
   a. Ferromagnesian.
   b. Plagioclase feldspar.
   c. What?

2. Which of the following types of asbestos does not belong to the amphibole class?
   a. White.
   b. Blue.
   c. Brown.

3. Consider a fault that strikes N30E and dips at 42 degrees to the SE. The strike-slip component is negligible and the dip slip = 1,000 meters. What is the "heave" of this fault?
   a. 743 meters.
   b. 819 meters.
   c. 656 meters.

4. As you are doing field work, you find specimens of "*Exogyra arietina*" in a shale. Where do you find yourself in the geologic time scale?
   a. Ordovician.
   b. Devonian.
   c. Cretaceous.

Should I become a CPG?

Have a you been thinking about upgrading your membership to CPG? If the answer is yes, What are your waiting for? To find out if you have the qualifications go to Article 2.3.1 of the AIPG Bylaws. The AIPG Bylaws can be found on the AIPG website or the directory.

The CPG application can be found on the website under 'Membership'. Just follow the instructions. The basic paperwork includes the application, application fee, transcripts, geological experience verification and sponsors.

If you have any questions, you may contact Vickie Hill, Manager of Membership Services at aipg@aipg.org or call headquarters at 303-412-6205.

www.aipg.org

The Digital World

Barbara H. Murphy, CPG-06203
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As I write this message, I am thinking about the AIPG annual conference, looking forward to meeting with members at the business meetings, attending the technical sessions, going on several field trips, and seeing colleagues and friends at the social functions. The annual conferences have developed into a great forum for discovering and learning about the geology of various parts of the country through talks and field trips, and the sharing of technical knowledge and updates through presentations and workshops. Over the years, in AIPG's planning for the meetings, there has been more of an emphasis in offering a variety of field trips and in getting out seeing the geology and discussing it in the field. Many of our conferences are held in partnership with other professional organizations, as is this year's meeting, and this has been very beneficial from the sharing of ideas and networking opportunities.

As I was making travel arrangements and looking for other information, I logged onto my computer and started looking at interactive aerial photos of the conference location, zooming in to the front of the hotel and then with a 360 degree street view of the area, looking at travel routes to the area, looking at geology maps – all of this within a matter of a few minutes. As many of us know from having worked in geology for many years, the way in which we now get our information has changed so dramatically. I know for me, so much data is available on-line through various information sources. From a quick search, one can often find all sorts of scientific maps and data, reports, current and historical aerial photographs, and similar. This is so different from many years ago when I first started working as a geologist.

When I began my professional career, at the beginning of a project, I would often visit an agency, review files and maps, and hand write notes, mark up a topographic map when in the field or with other data, and get photocopies of maps and other information. It could take several weeks or months to gather the information. Then I would typically have the need for a draftsman to transfer the information and make a map and other graphics for me. Photographs would be taped into a report. I would hand write a report that was then to be typed by a secretary. I remember making changes to a typed document was a big deal, trying to rewrite a paragraph that was of the same length as the original so the whole report did not have to be retyped. We would write reports in sections, starting with new pages to allow for edits without having to redo a whole report. Today, so much research is available on the internet, through numerous web sites. Now I typically type my own report, format how I would like it to look, add graphics, insert digital photos, download topographic base maps, make geologic/hydrogeologic and other maps and data tables, and generate graphs and figures from the data tables. It really is rather satisfying to be able to do so much – it also allows me to be creative with the graphics. And, needless to say, making a change to the text or graphics is typically quick and easy. And, of course, we can now conduct so much work remotely, transmitting data and reports via e-mail or web sites. The digital world has certainly allowed huge changes in how and where we conduct our work!

From some of the conferences and professional society meetings I have attended over the past few years, I have become even more aware of several important data source networks and the need for these networks so that digital data are readily accessible and truly useful. The United States Geosciences Information Network (USGIN) is the initiative of the Association of American State Geologists (AASG) and the United States Geological Survey (USGS). USGIN was created to facilitate discovery of, and access (with free open-source software) to geoscience information from the state and federal geological surveys of the United States. USGIN has established a data-sharing network with standards, procedures, and protocols that makes accessing and using the data much more functional. OneGeology is an international collaborative project initiated in the International Year of Planet Earth (IYPE) in 2007 to make public and Internet-accessible geological map data available worldwide to better address the needs of society. The priority of OneGeology is to make the best information available that is interoperable, Internet-accessible, and scientifically-attributed data. The United Nations Educational, Scientific and Cultural Organization (UNESCO) with an International Consortium of Geological Surveys manage the program which now includes 117 countries and other geoscience organizations participating in the OneGeology program. Geological surveys and organizations are encouraged to work together to develop and implement the required interchange standard to make their data interoperable. The project web portal was officially launched in August 2008 at the 33rd International Geological Congress in Oslo, Norway.

The USGIN and OneGeology programs are some of the key sources of worldwide geosciences mapping and data information. So much other local and regional data is also available through other web sites. The digital age has certainly changed how much more information is readily available to us and how we geoscientists conduct our work.

Education, Professionalism, and Civility

William J. Siok, CPG-04773

University preparation for a career in geology (or geosciences as the broad category is now called) may culminate with a Bachelor of Science degree or carry through to a post-Doctoral credential. Whatever level of formal education one attains, the achievement of the final degree is only the very beginning of career preparation.

Upon completion of formal education, one's career begins in earnest with the first full-time employment. The sectors where opportunities are to be found are myriad in the modern day, as compared to the years immediately following publication of William Smith's seminal map (*A Geological Map of England and Wales and Part of Scotland*. Initially published in 1815).

At the risk of appearing coy, allow me to list a few sectors in which geoscientists are presently employed. Energy, mineral resources, education, law, finance, insurance, banking, hydrology, planning, law enforcement, IT, management, construction.

Each category listed, and a handful of others, represent fields of endeavor in which geoscientist play a critical role. Geoscientists are able to apply the geological sciences to their chosen fields to either a larger extent or to a lesser extent, but apply it they do. Each and every one is, by virtue of formal education, experience, and continuing education, a professional.

If a one is employed in the banking sector is he less a professional than the geologist who is engaged in finding and developing oil plays? If one is employed in IT is he any less a professional than the hydrogeologist engaged in managing groundwater? Perhaps the answers to a comparative analysis of this sort depend upon the sector in which one is engaged for livelihood.

The geoscience community in the United States is very small compared to professional colleagues in engineering and law. Some fields of endeavor in the geosciences are regulated by statute (licensure), some are not. Some colleagues are of the opinion that all fields of practice should be regulated, others are of the opinion that regulation is a form of restraint.

This brings me to the point of this article. The issue of licensure remains controversial in some sectors of the profession. At times, the debate about the efficacy and appropriateness of government regulation of the profession flares up anew.

This debate is healthy and should be instructive and constructive. Too often it elicits commentary which borders on the unprofessional and personal. The community must not permit this debate to degenerate into a denigration of the non-licensed practitioner. Valid perspectives are held by those who promote licensure and those who feel it is not necessary. The geoscientist community is much too small to allow its credibility and cohesiveness to be fractured by incivility within its ranks.

START AN AIPG STUDENT CHAPTER TODAY!

The AIPG Student Chapter Manual is available on the AIPG National Website at **www.aipg.org** or contact National Headquarters at (303) 412-6205.

Annual Meeting Exhibitors

WDI Systems, Inc.
www.wdisystems.com

RESPEC
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Intertech Environmental & Engineering, LLC
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www.cambridge.org

Old Dead Things, LLC
www.olddeadthings.com

American Geosciences Institute (AGI)
www.agiweb.org

South Dakota School of Mines
http://graded.sdsmt.edu

Association of Women Geoscientists
www.awg.org

Answers:

1. The answer is choice "b" or "plagioclase feldspar".

As the magma cools in the "continuous" (plagioclase feldspar) branch, the sequence passes from the crystallization of "anorthite" ($CaAl_2Si_2O_8$) to less calcium-rich and more sodium-rich feldspars until "albite" ($NaAlSi_3O_8$) forms.

In the "discontinuous" (ferromagnesian) branch, olivine $(Mg,Fe)_2SiO_4$ forms first. As the magma cools "olivine" reacts with the melt to form "pyroxene" ("augite"). Similarly, as the temperature continues to drop "pyroxene" reacts with the magma to produce "amphibole" ("hornblende") and the latter is eventually replaced by "biotite".

Crystallization of ferromagnesian minerals and plagioclase feldspars occurs simultaneously as the magma cools.

Upon further cooling, eventually the residual melt may generate potassium feldspar ("orthoclase" or $KAlSi_3O_8$), "muscovite" and "quartz" (SiO_2).

2. The answer is choice "a" or "white" asbestos.

Asbestos is the term which describes a group of six fibrous minerals which occur naturally associated with metamorphic rocks. Asbestos minerals are hydrous silicates. Six types are recognized, including "tremolite", "actinolite", "anthophyllite", "chrysotile", "amosite" and "crocidolite". Asbestos is chemically inert and fire resistant. It is commonly used as an insulator, since it does not conduct heat or electricity. Asbestos has been used in shipyards, buildings, automobiles and in many household products.

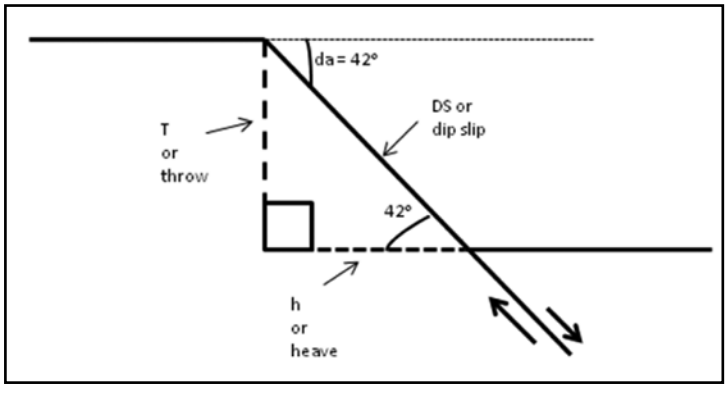
Asbestos may be divided into two basic groups; the serpentine class ("chrysotile") and amphibole varieties ("tremolite", "actinolite", "anthophyllite", "amosite" and "crocidolite").

Chrysotile or white asbestos has a serpentine, curled-fiber fabric. It is magnesium-rich and is less friable and less likely to be inhaled than other types of asbestos.

Amphibole asbestos consists of straight, needle-like fibers that are more likely to be inhaled. Amosite or brown asbestos is iron-rich, whereas crocidolite or blue asbestos has sodium and iron in its chemical formula.

3. The answer is choice "a" or "743 meters." The proof follows:

Let da = the fault's dip angle, DS = dip slip, T = throw and h = heave. Then:



$\cos(da) = h/DS$ (1)

$h = \{(DS) * [\cos(da)]\}$ (2)

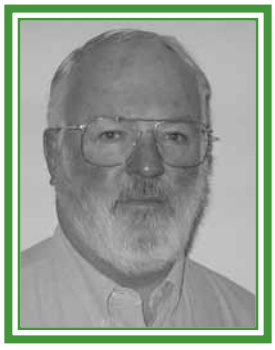
In our example:
DS = 1,000 meters
da = 42 degrees

$h = (1{,}000\ m) * (\cos 42^{o})$

$h = 743.15$ meters (3)

Equation (3) gives us the magnitude of the heave, coinciding with our choice "a".

4. The answer is choice "c" or "Cretaceous". The genus *Exogyra* describes a pelecypod, specifically an ostracean dysodont distinguished by a large spirally-twisted left valve and a small flat right valve. *Exogyra arietina* was described by Roemer within the Lower Cretaceous Washita Group in Texas. Other oysters present in Cretaceous strata include *Gryphaea* and *Alectryonia*.



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Field Safety and Personal Protection Equipment

This topic was prompted by the end of the description of the Gold Mineralization in the Black Hills field trip in conjunction with the 2012 AIPG Annual Meeting in Rapid City, SD. The trip description ends, "Steel-toed boots, hard hats, glasses, and orange safety vest will be required for the mine tour. Some moderately strenuous hiking is planned for one of the stops." The use of such personal protection equipment is now required on tours of active mines and quarries due to MSHA requirements. Because I frequently visit mines, I have all this equipment but I realized that Sue, my wife, who likes going on such field trips, needed a reflective vest; she has the other items. This got me thinking about safety requirements in general and how things have changed over the years.

Hard hats have been part of the gear for mines, construction sites, etc. for years. But I sometimes wonder about their required use in some places. Flag people on road construction come to mind. I remember the flag lady one summer on a highway in the Colorado mountains at the entrance to a sand and gravel operation. Since loaded trucks entered the highway only periodically, she spent most of her time in a lawn chair by the side of the road knitting winter sweaters. There she sat in short shorts, a halter top, and a hard hat. As far as I could tell, the only thing the hard hat protected her from was hail. While I'm not against appropriate safety equipment requirements, I wonder about the overzealous requirements that occur in some places. Do these requirements lead to a blasé attitude towards safety requirements that are really needed?

Steel-toed boots and shoes have become more widely required over the years. Even the office personnel in manufacturing facilities apparently are increasingly required to wear steel-toes based on the offerings for what look like normal office attire shoes from the steel-toe footwear manufactures. Reflective vests are more recent addition to the required list in many places.

This brings me to geoscientists in the field and on field trips. Do all of us wear safety glasses when out hammering in the field? How about hard hats or reflective vests? The common answer is no. Yet there are those who believe that such equipment should be worn at all times. I was once criticized for publishing a photo of a field trip stop beside a cliff because the participants were not wearing hard hats. As Howard J. Gordon observed in this article, S*o Who is Responsible for Field Safety?* (*TPG*, May/June '08), "[C]onsider the hazards associated with the little bottle of HCl used to identify limestones or dolomites in the field or in the laboratory? What are proper gloves to wear while collecting samples of volcanic glasses or what are the proper types of shoes to wear when working around old abandoned mines and their tailing dumps? During my summer field camp, conducted by a State-run college, none of us in my five-person mapping team received training in first aid, or had a first aid kit, or were made aware of the various signs of heat stress before conducting field mapping exercises in a remote section of the Inyo Range of California during the summer."

Taking appropriate safety precautions is something we should all take seriously. What are the risks? How likely is their occurrence? How severe are the consequences of occurrence? These are factors most of us take into account as a matter of routine when going into the field. But do we do enough?

That's Quite a Water Table

William Stone's Hydrothink column, "That's Quite a Water Table," column in the July/August '12 *TPG* is an excellent continuation of his theme in his "What Are You Really Measuring?" column in the March/April '12 *TPG*. To me, Stone's overall discussion is a question of quality control/quality assurance in hydrologic sampling. Until you are sure that you have good, accurate, repeatable data of the same type, presentation of that data in statistical or graphical form (including maps) yields erroneous and misleading results. I've addressed this issue in several columns including 112, 114. 121, and 125 (see the *pe&pindex.xls at http://aipg.org/About/ethics.htm* for details). I'm glad Stone has provided hydrologic examples. The problem arises in other

Topical Index-Table of Contents to the Professional Ethics and Practices Columns

A topically based Index-Table of Contents, "pe&p index.xls" covering columns, articles, and letters to the editor that have been referred to in the PE&P columns in Excel format is on the AIPG web site in the Ethics section. This Index-Table of Contents is updated as each issue of the TPG is published. You can use it to find those items addressing a particular area of concern. Suggestions for improvements should be sent to David Abbott, dmageol@msn.com

areas. Recall that for years the skull used in Apatosaurus (Brontosaurus—the more familiar but later name for the same animal) mounts belonged to a different animal.

Occam's Razor and Tides

Occam's Razor, is usually cited as something like, "It is futile to do with more things that which can be done with fewer."[1] It is a principle of parsimony. Wikipedia's entry states, "The principle is often incorrectly summarized as 'other things being equal, a simpler explanation is better than a more complex one.' In practice, the application of the principle often shifts the burden of proof in a discussion. The razor asserts that one should proceed to simpler theories until simplicity can be traded for greater explanatory power. The simplest available theory need not be most accurate." I recently learned that tides are an excellent example of the complex being far more accurate than the simple.

As a Coloradan, tides are not high on my list of things I need to know about. I've been to various oceans and noted the variations in tidal ranges and accepted the commonplace explanation that tides are caused by the gravitational effect of the Moon. However, I had a chance this summer to leaf through a cousin's copy of James G. McCully's *Beyond the Moon: a conversational guide to understanding the tides* (2006). McCully points out that while the east coast of Florida has the common semi-diurnal tides, the west coast has only one tidal cycle per day. What? Only one high and low tide per day? Yes. This is apparently true for the Gulf of Mexico.

As for the Moon's gravitational attraction, this might explain high tides on the side of the Earth facing the Moon, but what about the high tide that occurs on the opposite side of the Earth? That can't be gravitational. It turns out centripetal force helps out here. But why do tidal ranges vary so much from place to place? McCully notes that the Moon's gravitational attraction accounts for only about 12″ of tidal range and the Sun can account for another 6″ or so. So what about the Bay of Fundy and other places with notably high tidal ranges, or places like the Bahamas, which have a fairly low tidal range? Assorted hydraulic parameters; basinal roughness, depth, and shape; and a host of other factors numbering almost 400 affect the local tidal ranges and frequencies. *Beyond the Moon* does not contain the detailed mathematics that some purists might wish. Instead it provides clear narrative explanations of the various factors and their effects. For those particularly interested in tides, read this book.

The lack of a simple answer to how the tides work prompted memories of a term paper I wrote for my paleontology course and the section on mass extinctions. I read various papers advocating one or another particular cause. Extraterrestrial causes were proposed but seemed like special pleading in those days prior to the discovery of the iridium layer at the Cretaceous-Tertiary (K-T) boundary and the Chixalub impact site and an increasing number of impact sites around the world. I came away with the conclusion that the cause of mass extinctions would result from the interplay of a number of causes rather than a single cause. I did discover that the Permo-Triassic boundary was notable because there were few, if any, well-studied sites (at the time, 1971) where uppermost Permian strata were immediately overlain by lowermost Triassic rocks. That there was a dramatic break in the fossil suites between known Permo-Triassic sequences was an unsurprising result of missing strata. While a great deal more is known about mass extinctions now (41 years later), even the Chixalub impact is not the sole cause of the K-T boundary changes. Why did crocodiles and birds survive when the rest of their dinosaurian relatives did not? It is clear that a number of factors coincided for the K-T extinction event, although the details are still being investigated.

The foregoing makes me wonder about climate change. The summer of 2012 in the US is the hottest since the Dust Bowl.[2] Is it all due to increased atmospheric CO_2 or are there a lot more factors at work? My sense is that there are many factors involved just as is true of the tides, factors whose effects are not thoroughly understood. Computer modeling is all well and good, but cannot provide the final answers or even conclu-

1. Wikipedia's entry for "Occam's Razor" notes that William of Occam (or Ockham), a 14th-century English theologian, never precisely wrote the principle attributed to him. This is like the fact that Mark Twain never wrote, "A mine is a hole in the ground owned by a liar." It sounds like Twain, but Google the sentence if you want to check it out.
2. I'm writing this is in early August but the forecast is for more of what has occurred in June and July.

sive answers. The area I see this most is in mine modeling. The ability of computer programs to form 3D shapes that can be easily rotated around and which produce great graphics is wonderful. But their accuracy depends on the density of accurate data points on which the models are based along with correct boundary delineations of rock types, faults, shear zones, alteration effects, etc. I'm always amused at the increasing complexity of mine and oil field maps, sections, and models as more holes are drilled over time. William Stone's Hydrothink column, "That's Quite a Water Table," column discussed above, is another good example.

Women in the Geosciences and AIPG

I was interested in the female enrollment graph compiled by Christopher M. Keane of AGI on page 51 of the July/August '12 *TPG*. The graph starts in 1975, which was the year I received my MS and started my professional career. There were a number of female geology majors, both graduate and undergraduate at the Colorado School of Mines and there had even been a couple of junior year-exchange women at Dartmouth during my senior year (Dartmouth was still all male at the time, although that soon changed). As shown on the AGI graph, women accounted for slightly more than 20% of the undergraduate majors, slightly more than 15% of the MS students, and 10% of the doctoral students in 1975. Women were just starting to enter a number of professions in significant numbers in the 1970s. However, a few women had been in geosciences for years before then.

I was curious about how many women were AIPG members in its beginning and consulted Richard Proctor's *A History of AIPG 1963–2003*. On the last 4 pages are the sign-in sheets for the founding convention in November 1963 (incorrectly labeled 1968). Margaret Fuller Boos was among the attendees. Several women were Charter Members of AIPG, CPGs 1 through 741. They are Margaret Fuller Boos, CPG-711; Daisy C. Hansen, CPG-218; Louise Jordan, CPG-617; Edith M. McKee, CPG-737; Ruth A.M. Schmidt, CPG-352; and Suzanne Takken, CPG-563. There may have been some others whose names are either not immediately recognizable as female or who went by their initials. Suzanne Takken was the first female member of the National Executive Committee in 1973 and she was Secretary/Treasurer in 1978. Susan M. Landon, CPG-4591, was Vice President in 1985 and President in 1990.[3] Women, like men, served as officers in Sections prior to being elected to National office and many were active in AIPG in many other ways.

Curiosity, the Geologic Robot

The new Mars rover, Curiosity, has justly received lots of attention and accolades for having successfully landed and for beginning years of exploration. It has also brought out some good fun. One of the first pictures taken was shown with Marvin the Martian peeking into the picture. Curiosity has been described as a robotic geologist, but does it have an adequate supply of beer? If not, how can it be a geologist? I don't think those of us Earth-bound geologists have to worry about losing our jobs anytime soon. I doubt Curiosity could handle most of the field conditions most of us encounter. Mars has no vegetation or bogs.

AIPG Section Websites

AIPG Section Website links are on the AIPG National Website at www.aipg.org. Click on the top right drop down menu and click on Section Websites. If your section does not have a website contact AIPG Headquarters to get one setup (*wjd@aipg.org*). AIPG Headquarters will maintain a website for your section. Several sections (AZ, CA, CO, FL, GA, HI, IL Chapter, MI, MO, NM, OK, PA, and TN) are examples of websites hosted by AIPG National.

3. It should be remembered that at the time, one needed 5 years of experience prior to being Certified, the only membership category then. Therefore a 1975 graduate could not become a CPG until 1980, unless 1 year of experience credit was received for an MS or 2 years for a PhD.

NGWA Participates In Federal Briefing On Importance Of Monitoring Groundwater

(Westerville, OH — August 1, 2012) A congressional briefing led by the U.S. Geological Survey has spotlighted the importance of monitoring the nation's groundwater quantity and quality. Representing USGS at the July 27 briefing was Bill Cunningham, acting chief of the USGS Office of Groundwater.

Groundwater is often referred to as an out-of-sight, out-of-mind resource, yet 78 percent of community water systems, nearly all America's private household wells, and 42 percent of agricultural irrigation water are supplied by groundwater.

There is no systematic nationwide monitoring of the nation's groundwater levels or quality to assist in planning for and minimizing impacts from shortages or supply disruptions. This lack of systematic groundwater monitoring affects the country's ability to address food, energy, economic, and drinking water security issues.

"If we think of an aquifer [groundwater] as a bank account holding a precious resource, aquifer assessments combined with water level measurements allow us to understand how much water is in our account [aquifer], and how our account balance is changing over time," Cunningham said.

"Water level measurements are the most basic element for knowing our account balance. Repeated measurements over a long time period can be used to produce a 'hydrograph' of these water levels over time," he said. U.S. Representative Betty McCollum (D-Minnesota) echoed the need to monitor the nation's groundwater resources.

"Every day, millions of Americans rely on groundwater sources for their drinking water, including nearly 80 percent of Minnesotans. The National Ground Water Monitoring Network is a critical resource," she said. "Congress must continue to do everything possible to ensure our nation's drinking water remains a safe and plentiful resource."

In 2009, Congress authorized a national groundwater monitoring program. In 2010, six states tested concepts for the National Ground Water Monitoring Network. An expansion of this effort would provide consistent, comparable nationwide groundwater level and quality data through a Web portal for federal, state, local government, and private-sector users.

American Institute of Professional Geologists (Kentucky Section)

Professional Development Conference presents

An Overview of Environmental Geophysics

Thomas Brackman, Geology Professor, Northern Kentucky University

Friday, October 12, 2012
7:30 a.m. to 5:00 p.m.

Kentucky Geological Survey, Well Sample and Core Library
2500 Research Park Drive
Lexington, Kentucky 40511

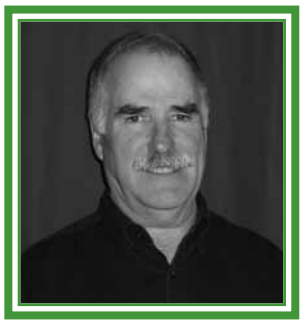
This course is suited for persons who have little or no geophysical exploration experience with practical information on the strengths and limitations of the five most used geophysical techniques. Introduction to electrical resistivity, seismic, magnetics, electromagnetics, and ground penetrating radar methods for site characterization and waste locations. There will be site demonstrations for magnetics, electromagnetics, and ground penetrating radar.

Registration: Standard—$100, AIPG Members—$75, Students—$20, Student AIPG Members Free

After October 1, 2012: Standard registration fee: $125; AIPG members $100.

☆ **Eight professional development hours will be awarded.**

Detailed information and registration form can be obtained at the KY-AIPG Web site, ky.aipg.org/Announcements.htm



So, You Made A Seepage Run

William J. Stone, MEM-2164

To determine which reaches of a stream are gaining water from or losing water to ground water, a seepage run is normally made. This involves measuring surface-water discharge at a series of channel transects (often at regular intervals) along the watercourse. The transects, together with gaining and losing reaches, can be marked on a suitable base map. If seepage runs are repeated at the same series of transects at regular time intervals, a separate map for each date may be prepared. But other than such general maps, how can you show the results? How can you quantify the presentation of results?

A concern at an open-pit gold mine where I once worked was how operations had impacted the flow of local streams and springs. In the case of the most significant stream, we decided monthly seepage runs would be a good first look. The U.S. Geological Survey, a cooperator on hydrologic oversight at the mine, made the runs. They presented the raw data for discharge at each transect for each month in the form of a table.

A more visual presentation seemed better for inclusion in a report, but I could find no standard means of illustrating such results. So, I designed my own by plotting the data on graph-like figures. Change in discharge (+ or –) relative to the last transect was assigned to the Y axis and transect numbers to the X axis (distance downstream from the first transect could also be used). More specifically, change in discharge was shown relative to a horizontal baseline, that represented no change in discharge, drawn perpendicular to the Y axis. Plus values were plotted above this baseline and minus values were plotted below it. The result was a jagged line tracing a path above the baseline in gaining reaches and below it in losing reaches. Such plots for successive months could easily be compared and gave a very visual record of the change in the stream flow with respect to the position and extent of gaining and losing reaches through time (p. 85 in my book). Tip: If there is no standard means of illustrating your data, invent one that seems to work. By the way, the USGS collaborators admitted there is no standard Survey plot for seepage runs and like mine.

Dr. Stone has more than 30 years of experience in hydroscience and is the author of numerous professional papers as well as the book, *Hydrogeology in Practice – a Guide to Characterizing Ground-Water Systems* (Prentice Hall). Feel free to argue or agree with him via email at *wstone04@gmail.com*.

AGI News

AGI Joins the Science, Technology and Innovation Expert Partnership

Alexandria, VA – As a part of Secretary of State Hillary Clinton's 2012 Global Diaspora Forum, the American Geosciences Institute (AGI), other top scientific organizations, and the U.S. Department of State have signed a mutual memorandum of understanding establishing the Science, Technology and Innovation (STI) Expert Partnership.

The STI Expert Partnership seeks to promote economic prosperity, democratic governance, and social development through increased scientific and technological diplomacy worldwide. With the support of U.S. embassies and international networks, the Partnership will exponentially expand the reach of U.S. scientific experts traveling abroad through identification of new and existing diplomacy opportunities worldwide. The initiative aims to highlight the global challenges facing the international scientific community, and hopes to collaboratively solve these critical issues moving forward.

Cooperating partners for the STI Expert Partnership include the American Association for the Advancement of Science (AAAS), the American Chemical Society (ACS), the American Society of Microbiology (ASM), the American Institute of Physics (AIP), the American Society of Tropical Medicine and Hygiene (ASTMH), the Association of American Engineering Societies (AAES), the American Society of Civil Engineers (ASCE), the National Academy of Sciences, the Smithsonian Institution, and the Department of State.

"The American Geosciences Institute is thrilled to be a member of this distinguished group," said Dr. P. Patrick Leahy, Executive Director for the American Geosciences Institute. "With our diverse member societies and access to over 250,000 geoscientists, AGI is uniquely positioned to help tackle the global challenges facing the geoscience community. We look forward to engaging with new and foreign publics and strengthening the foundation for expanded international geoscientific cooperation."

Young Professional and Student Involvement in AIPG

Stephanie Jarvis, SA-1495,
sjarvis@siu.edu

In June, I attended the AIPG Executive Committee meeting in Denver to give my thoughts on the issue of young professional involvement in organizations such as AIPG. Sitting in on this meeting was a lot more interesting than I expected—I really had no idea what to expect, actually, but certainly not that much laughing.

A 'young professional' is, according to AIPG membership categories, someone who has earned their bachelors degree within the past 3 years. This group of professionals is important to the organization because they are the future of the profession—a profession of which most members are nearing retirement age. As AIPG is *the* organization serving the needs and interests of professional geologists, and a large portion of professional geologists will soon fall into this 'young professional' category, it is obviously important that AIPG be in touch with young professionals.

When I was first asked to come talk about this issue, I reflected on the path that led me to be in such a position. My first thought when I read AIPG Executive Director Bill Siok's e-mail inviting me out was: 'Sure! But I'm not a professional..." Then I realized I had the exact same thought when I first looked at the membership form. Truthfully, I had no intention of being as involved as I am when I first signed up. The name, for one, was rather intimidating. Besides my own reflection that I wasn't a 'professional' and wasn't exactly sure what it meant to be one, when I asked a professor that I have a huge amount of respect and admiration for to write a reference letter for the scholarship he quipped that *professional* geologists probably didn't care what an *academic* like him would have to say, but he would of course write me a letter. This left me feeling very naive about the politics and social dynamics of geologists. But there was scholarship money to be had, so I sent my $20 (there was a fee for students then) in with my application. My only feeling about it at the time was that it seemed like I was paying for a chance at money for school, but it has definitely paid off!

Because 'young professionals' are not far removed from students, and students are easy to target, I feel that attracting students is the first step to involving young professionals. This means we need to be aware of how this organization is viewed (or *if* this organization is viewed…) by students. My first impressions, as I said, were focused on the name, which put me off a little. I was in a position that the only geologists I knew at the time were in academia, and to hear from one I highly respected that there was such a divide between academic and professional geologists was disheartening. Luckily, I was of the idealistic mind-set that I could work to bridge that gap (coal companies and environmentalists, pro- and anti-frackers, geologists and engineers...) apparently, But not all students are of this mind-set, and this attitude of professional vs. academic is something we need to be mindful of and work to counter. For me, much of the intimidation surrounding this perception was cured when I met my first "professional" geologists at an Ohio Section banquet. Out of my academia comfort zone, I was quite nervous about walking into a room full of "professionals". However, on my way back to campus that night I called my mom because I was so excited about how cool geologists were and just had to tell somebody. I concluded that the perception of my advisor was isolated. Though I later learned it wasn't from an angry e-mail about one of my columns, it is certainly not the rule.

My most recent impression of AIPG is that of community. At that first Ohio Section banquet I went to when I received the scholarship a few years ago, it was apparent that this was a meeting of friends more than anything. I got the same sense at the National meeting in Chicago last September and, when I returned to Ohio for a section meeting this past November, I realized that AIPG functions have now become that for me—a chance to reconnect with people I would never have known otherwise. Young people are generally a social bunch, and this community aspect is what needs to be made apparent to students.

Since my perspective is not that of everybody's, I decided to ask around about what 'young professionals' look for in their professional organization. I sent this query out to my department at SIU via e-mail and to my friends via, of course, Facebook. I got a few responses from a mix of people—a geology major fresh out of her undergrad, one of the younger professors in my department at SIU, a PhD student who focuses on aquatic biology, and one of my many chemistry friends who is currently working as a researcher. The fresh geology grad wants job searching and training advice. She wants help formatting her resume from people actually in her field, mentors she could go to with questions, and job and grad school postings. The chemistry grad wants his organization to be less expensive and cites networking opportunities and job postings for multiple levels as necessary functions of a professional organization. The PhD student suggests reduced conference fees, travels grants, and student competitions as good ways to attract students but points out that, to retain those student members once they graduate, organizations need to have reduced 'young professional'

fees (which AIPG does!). The professor is a member of multiple organizations and gets different things out of each: there's AGU and GSA where he presents research and networks with colleges, and then there's Sigma Xi which he views as having more of an informational role. For myself, I see GSA as my research and academic networking organization, AIPG as a professional networking and informational organization, and AGU as academic informational.

From these responses and my own observations, I think students and young professionals' interest in professional organizations comes down to one thing: a job. This isn't surprising, and it isn't as simple as hosting a job board. (Recent discussions in *TPG* have focused on whether or not to include classifieds. My opinion: Please!!! If I don't look at anything else in the many AGU Eos Newsletters and GSAToday's that pile up on my desk, I at least flip through the classifieds!) AIPG offers lots of services to its members, including certification, continuing education, and topical conferences. These services are vital to the betterment of the profession, but they don't mean much to somebody who has yet to get their feet on the ground with a job and the beginnings of a career. That person needs help navigating though all those contradicting resume tips and formats, figuring out where to look for job postings that match their interests and skills, and lining up internships. They also love field trips (that's why we're geologists, after all), though they're often on a pretty tight budget and locally restricted, and they (believe it or not) like to hear people other than their professors talk.

There has been a recent push to sign student members up, which is great. What I think needs to really happen, though, is to *engage* those student members so that they see the value of AIPG in their professional lives once they become professionals. Students, of course, live in academia and look to their professors for direction, and if professors can direct them to resources provided by AIPG, students are much more likely to recognize AIPG as an organization they need to be a part of. I think efforts to encourage professors to renew their memberships, as the Ohio AIPG section did in conjunction with the recent GSA section meeting in Ohio, and the new Educator's Page column in TPG, are great steps in the right direction to reaching out to the academic realm of things. To directly reach the students, however, the Sections need to step up to the plate. A few members of a section assigned to serve the student members of a nearby school by leading field trips, giving talks, and providing career mentoring would go a long way in making students really feel like part of this organization. The Georgia Section is doing a great job with this, as attested to in the Section News in the May/June 2012 issue.

Something to keep in mind, also, is that membership is contagious among my peers—the more people see AIPG stickers on water bottles or AIPG "likes" on Facebook (I never thought I'd be recommending Facebook to *anybody*, but it's true), or hear about sweet field trips and good professional relationships developed over wine tasting and long bus rides, the more they will want to know what it's all about. So, in conclusion, my suggestions for attracting young professionals to this organization are:

- Connect with Academia, and get the professors on your side—that's where the students, who will become young professionals, are and where they are looking for direction.
- Engage student members—Seminars, field trips, job fairs, and mentoring are all things students will see the value in, and will introduce them to the community that is AIPG. I think this will be most effectively done at the Section level.
- Be easily accessible and visible—Up-to-date websites and active facebook pages are vital. And stickers are really cool!

At the Executive Committee meeting there were lots of observations about what was working and what wasn't to attract students, from scholarship amounts to good raffle prizes (a chrome rock hammer? Heck yea!). Shortly after getting back from Colorado I had an e-mail from one of the sections asking for my thoughts on this very subject. Sections have had a lot more experience than I do attracting students and it would be beneficial to all if they were sharing what they've learned. This column space is the perfect spot for that, so please send me your experiences, thoughts, ideas, and questions. This is a discussion that is essential to the future of AIPG.

Field Geology: Memories that Last a Lifetime

Michael J. Urban, MEM-1910

Actually *doing* geology in the field is one of the most rewarding aspects of taking a geology class or pursuing it as a career. Few upper division or graduate courses in geology would be complete without some sort of field experience, and the notion of field work in these courses is often regarded as obligatory. After all, who can envision a course in structural geology, glacial geology, sedimentology and stratigraphy, or mineralogy/petrology without an accompanying day-long, week or two week long, field trip? There is probably no arguing this point. How about then, the undergraduate introductory geology course? How critical is a field experience here? Some would argue that field experiences are just as essential – or maybe even more so – to the introductory geology course. Ask any non-geologist who took an introductory geology class with a field trip about his or her most memorable experiences from the class and you will likely hear something about either the positive or negative aspect of the field experience. They are, more often than not, responsible for the strongest, and even fondest, memories in any class.

My Experience as both Student and Instructor

I distinctly remember as an undergraduate student taking a couple of geology field trips: one was to a local stream near the university to take measurements and calculate water volume/velocity in a geomorphology class, and the second was to examine rocks/formations along the shore of Lake Superior in a basic mineralogy/petrology class. Both of these field trips obviously left an impression on me and probably helped sway me eventually in the direction of the earth sciences. So too may it be for many other students. I do not recall taking a field trip in my introductory geology course, but it is possible it was *optional*. At this point in my undergraduate career, I was not yet all that into geology – what a wasted opportunity for me, especially if I declined to participate in an optional field trip!

As a graduate student, though, I participated in *several* field trips to many geologically exquisite locales: Guadalupe Mountains, White Sands, Carlsbad Caverns, Rocky Mountains, etc. These were some of the greatest experiences in my life! Simultaneously, as a graduate teaching assistant, I led several trips into Rocky Mountain National Park for our introductory geology course laboratory sections (two 12-passenger vans full of excited and nervous undergrads). I did not think much about it at the time, but these experiences ultimately translated into extremely valuable learning opportunities for me, as an eventual secondary earth science teacher and college/university geoscience instructor; they also resulted in livelier subsequent class meetings. Many impromptu conversations about geology topics and potential careers evolved out of such excursions. The benefits to these students, for a variety of reasons, are too often overlooked, so all geoscience instructors should pause for a moment to reflect on some of them.

Field Trip Logistics and Impediments

There are, of course, potential logistical problems with scheduling vans, securing or training drivers, finding additional guides, divvying up classes to dedicate to field trips, requiring or making trips optional, and obtaining administrative support, especially for large introductory geology classes. However, as we stop and consider our own field experiences in geology, we will inevitably arrive at the conclusion that *trying* to build in class field trips is definitely worth it (to our students). It is true that on field trips there is occasionally some complaining and griping – usually resulting from early morning scheduling, outdoor conditions (e.g., heat, precipitation, etc.), or just anxiety related to preconceptions about what a field trip may be like. That said, though, the end of the trip usually boasts more student enthusiasm and unprecedented interest in geology!

As we observe continued increases in introductory class sizes and more courses go online, we must remind ourselves of the reasons we (should) include field experiences in the introductory geology curriculum: learn and practice field rock/formation/structure identification and mapping skills, hone observation and note-taking skills, foster an appreciation for nature and the scope of geology, and also to motivate, promote scientific interest, and build camaraderie. Field experiences are useful in any and all earth/geoscience courses, not just general geology.

Nothing can truly replace traditional field trips or activities, but in the absence of such opportunities, digital equivalents (or facsimiles) – referred to as *virtual field trips* – may be the next best thing. Some instructors like them and others despise them. We could certainly debate the merits of "virtual" field trips and online geology classes, but the simple fact is that virtual field trips provide opportunities for students taking online classes to learn more about geology than they would otherwise learn through simply reading a textbook. [This issue's *Featured Resource* below provides an example of where to find reputable virtual geology field trips and additional discussion.]

In the end, individual instructors must use their best judgment and discre-

tion to determine whether field trips will be included in their introductory geology courses. Speaking from both a student's and instructor's perspective, I highly encourage all introductory geoscience instructors to carefully consider the benefits of including field experiences as we begin this next academic year.

Featured Resource:

Virtual Field Trip Guides: United States and Canada from the Walter Geology Library out of the University of Texas at Austin, accessible at *http://www.lib.utexas.edu/geo/onlineguides.html/*

The website provides an excellent starting place to locate and identify suitable *virtual field trips* in geology. The trip guides are organized by region or location, and the web site also includes additional "Miscellaneous" links to other valuable sites. Many useful guides and virtual field trips are included related to topics like fossils, glaciers, mountains, canyons, minerals, caverns, and national parks.

In addition to the virtual field trips identified here, your state geological survey is another potentially excellent resource.

Plate Tectonics Creed

I believe in the tectonic theory, Maker of the face of the Earth, and of all things geological thereon. And in the lithospheric plate, which was conceived 'neath the midst of the waters, born of the oceanic ridge, suffered to receive the magnetic stripes, was buckled, bent, and subducted. It descended into the mantle. The third hundred-million-year period it rose again, according to the learned journals, and sitteth upon the bed of the ocean. From whence it shall come to smite those that live on its edges. I believe in this hyper-thesis, its wholly catholic application, the community of geoscientists, the resurrection of Wegener, and the Theory Everlasting.

Alastair C. McKay, Letter to the Editor: *Geotimes,* March 1975, p. 12-13.

IN MEMORY

Steven J. Bergath
CPG-07840
Member Since 1990
April 9, 2012
Huffman, Texas

Theodore A. DeBrosse
CPG-00082
Charter/Emeritus Member
Member Since 1964
May 21, 2012
Columbus, Ohio

This service is open to AIPG Members as well as non-members. The Professional Services Directory is a one year listing offering experience and expertise in all phases of geology. Prepayment required. Advertising rates are based on a 3 3/8" x 1 3/4" space

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As defined by the American Geological Institute, a geological science is any of the subdisciplinary specialties that are part of the science of geology, e.g., geophysics, geochemistry, paleontology, petrology, etc.

STUDENT APPLICATION FORM

American Institute of Professional Geologists
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12000 Washington Street, Suite 285, Thornton, CO 80241 – (303) 412-6205 - aipg@aipg.org

Last Name: First Name: MI: Suffix:

School Name: Undergraduate ☐ Graduate ☐ Doctoral Candidate ☐

Preferred Mailing Address: ☐ Home ☐ School

Anticipated Graduation Date: Male ☐ Female ☐ Birth Year:

Street:

City: State: Zip: Country:

School Ph: Home Ph: Cell:

Email:

ATTESTATION: I attest that I meet the requirements for AIPG Student Adjunct (currently enrolled in a geological science degree program) and agree to abide by AIPG Bylaws and Code of Ethics.

Applicant Signature: Date:

HEADQUARTERS USE ONLY Rcvd: Mbr #:

Applicants for certification must meet AIPG's standards as set forth in its Bylaws on education, experience, competence, and personal integrity. If any Member or board has any factual information as to any applicant's qualifications in regard to these standards, whether that information might be positive or negative, please mail that information to Headquarters within thirty (30) days. This information will be circulated only so far as necessary to process and make decisions on the applications. Negative information regarding an applicant's qualifications must be specific and supportable; persons who provide information that leads to an application's rejection may be called as a witness in any resulting appeal action.

Applicants for Certified Professional Geologists

AK	John Odden
CO	Scott Gaffri
CO	Walter Hunt
CT	David D'Onofrio
FL	Leon Carrero
MI	Terry Tackett
MT	Jonathan Ferree
MT	Peter Ellsworth
VA	Stephen Hall
VA	A. Trent Fisher

Applicants Upgrading to CPG

AK	Eric Cannon	MEM-0920
AL	William McCroskey	MEM-1625
AZ	Rodrigo Calles-Montijo	MEM-2256
CO	Jan Tomanek	MEM-2266
FL	Anne Murray	MEM-2025
KY	Sabry Hanna	MEM-2178

New Certified Professional Geologist

AK	Mary Azelton	CPG-11531
AZ	William Langer	CPG-11528
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ID	Richard Moses	CPG-11534
MI	Stephen Zayko	CPG-11527
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MN	John Wilson	CPG-11525
MT	Blane Mortensen	CPG-11526
NV	Glen Carter	CPG-11524
NV	Lora Chiehowsku	CPG-11532
OH	Nicholas Petruzzi	CPG-11529
WA	Stanton Dodd	CPG-11533
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AZ	Rodrigo CallesMontijo	MEM-2256
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CO	Matthew Reed	SA-3663
CO	Marisa Boraas	SA-3653
FL	Justin Lashley	SA-3649
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IL	Anthony Tomaras	SA-3669
IL	Carl Peters	SA-3691
IL	Lindsey Yeider	SA-3692
IN	Maxwell Dahlquist	SA-3689
IN	Ryan Voegerl	SA-3690
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SD	Carol Woods	SA-3651
SD	Adam Schimelfening	SA-3650
TN	Jeremy Tiegs	SA-3665
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TX	Jadon Sanders	SA-3674
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AIPG/AGI Summer Interns Beat the Heat in Washington, DC

Wilson Bonner
AGI Geoscience Policy Associate

The AIPG/AGI summer 2012 interns bulled through a sweltering summer in Washington, DC as temperatures broke record highs in June and July ended up as D.C.'s all-time second hottest month on record. The temperatures were so high on some days, the railcars on the Metrorail system had to reduce speeds to avoid "heat kinks" caused by thermal expansion in the rails. Even though these railcars had to slow down, our interns operated at full speed! For twelve weeks, they managed busy schedules as they learned about Congress, the administration, and geoscience-related issues the federal government deals with every day. Throughout the summer, they visited federal agencies, attended conferences, talked with local geoscientists, met with their senators and representatives, went to many congressional hearings, and in their spare time, caught the sights and sounds of the Washington, DC area.

Our interns had not even spent a full day in the office before they headed to Capitol Hill to attend the Coalition for National Science Funding Exhibition, an annual science fair for Congress that AGI helps organize. Three teams of geoscientists were present to explain their findings to members of Congress and the administration. Catching the "policy bug," they quickly became experts on Earth science policy related to energy, the environment, natural hazards, water, space, STEM education, and innovation. Their articles reflect specific interests they developed while at AGI.

The American Geosciences Institute and the three interns are very grateful to the Foundation of the American Institute of Professional Geologists for providing financial support for the internships. Below are brief biographies of the three AIPG/AGI summer interns:

Krista Rybacki, SA-3633, graduated from Missouri University of Science and Technology in Rolla with a Bachelor of Science degree in Geology and Geophysics with an emphasis in Geochemistry in May 2012. As part of her undergraduate studies, Krista participated in research studying the flood sediment deposits in the scour valley from the Taum Sauk Reservoir failure. She was active in the department and community as a member of C.L. Dake Geological Society/AAPG, Society of Exploration Geophysicists (SEG), Phi Kappa Phi Honor Society, and Sigma Gamma Epsilon Honor Society. In spring of 2012, Krista was inducted into Missouri S&T's Mines and Metallurgy Academy and graduated with highest honors. Her interests include climate studies, geochemistry research, and science education. She is originally from Nashville, IL.

Nell (Beth) Hoagland, SA-3634, is a rising junior at Washington University in St. Louis where she is working on a Bachelor of Arts in Environmental Earth Sciences. Her research focuses on reconstructing the geochemical history of Mars through isotopic analyses of sulfate evaporites. Beth is passionate about community service and is involved in many service-oriented activities including preparation of meals for local homeless shelters, tutoring, and involvement in a community service honor society. She is originally from Louisville, KY.

Stephen Ginley, SA-3632, is a rising senior at the University of Maryland, College Park studying geology. His main research interests are high temperature geochemistry and mineralogy and he will be conducting a thesis project on the origin of Albanian ophiolites with Dr. Richard Walker in the 2012-2013 academic year. He is a member of the Alpha Lambda Delta and Phi Eta Sigma Honors Societies and is the social chair of the Alpha Rho chapter of Alpha Chi Sigma, the professional chemistry fraternity. He is originally from East Rockaway, NY.

Powering Our Future: Can Geothermal Take the Heat?

By Krista Rybacki

The future of power generation in the United States is a hotly debated topic across the country and among policy makers. The conundrum is how to power the nation in an economically viable and environmentally friendly way. Tapping the Earth's natural heat source, geothermal is considered a renewable energy that can serve as a reliable baseload. A key concern is whether geothermal can supplant fossil fuels for a large percentage of electricity generation. In 2010, according to an Energy Information Administration (EIA) report, coal-fired power plants generated about 45 percent and natural gas-fired power plants contributed about 24 percent of total electricity. A recent bill proposed in the U.S. Senate, the Clean Energy Standard Act of 2012 (CES, S. 2146), supports increasing the percentage of energy generation that have low- to zero-carbon emissions, like geothermal. The question is can geothermal and other renewables like solar, wind, and hydropower supplant fossil fuels.

According to the Geothermal Energy Association's latest report in 2012, the U.S. has 3187 megawatts (MW) of geothermal capacity. This makes the U.S. the leading geothermal capacity country in the world. According to the Energy Information Administration's (EIA) analysis, with no CES in place, geothermal is projected to generate 31 billion kilowatt hours (kWh) and 47 billion kWh in 2025 and 2035, respectively. Both of these figures are less than one percent of expected total

Krista Rybacki and her representative Congressman John Shimkus. (L-R)

generation. With legislation promoting clean energy production, geothermal is projected to generate 37 billion kWh and 53 billion kWh for the years 2025 and 2035, respectively. This sets geothermal to rise slightly above the one percent contribution to total generation by 2035.

EIA lists five factors that can limit geothermal use. First, technology costs for enhanced geothermal systems are more expensive compared to conventional geothermal plants and other renewable sources. Second, geothermal sources are sometimes far from transmission lines. Third, geothermal has the slowest construction times of renewable energy resources with completion rates from four to eight years. Fourth, exploration and production may have higher risks and costs. Fifth, some geothermal methods require the use of underground water reservoirs to gather the steam and heat necessary for electrical generation. The Association of American State Geologists (AASG) is coordinating the National Geothermal Data System (NGDS). The NGDS will provide data on where viable geothermal resources may be located throughout the U.S. and make "geothermal-relevant" data available publicly via a web site.

Geothermal has advantages. According to the Department of Energy (DOE), geothermal fields produce about one-sixth of the amount of carbon dioxide that clean natural gas-fired power plants produce. This is in addition to little to no nitrous oxide or sulfur-bearing gas emission, common in coal-fired generation. Geothermal is always available, with availability rates of 90 percent or higher, in comparison to coal plants, which are available 75 percent of the time.

President Obama has accounted for the future of clean energy and the need for geothermal technology development. In fiscal year (FY) 2012, the DOE received $102 million for geothermal research and development, while the Department of the Interior (DOI) received $73 million for reviewing and permitting of renewable projects on federal land. In his proposed FY 2013 budget, the DOE, the DOI and the National Science Foundation (NSF) would receive funds for geothermal development. Of the DOI's $11.4 billion budget, $86 million would be allotted to review and permit new renewable energy projects on federal lands and waters. In NSF's $7.4 billion budget, $355 million is requested for research on clean energy technologies. Of the DOE's $27.2 billion budget, $2.3 billion is requested for the Office of Energy Efficiency and Renewable Energy (EERE). $65 million of EERE budget is dedicated to geothermal energy and enhanced geothermal systems. The Geothermal Technologies Program, a partnership between industry, universities and national laboratories, works to develop geothermal energy, especially to expand EGS to places where natural heat sources are not available. The other four areas of research include: hydrothermal and resource confirmation, low-temperature resources, systems analysis, and technology validation.

Even though geothermal supplies a small fraction of electricity generation, its use is growing. My institution, Missouri University of Science and Technology, broke ground on a geothermal energy project. This project is expected to cut energy use by 50 percent and eliminate carbon dioxide emissions by 25,000 tons a year, while providing energy to 15 campus buildings. The project will replace the power plant built on the campus in 1945 and is projected to save $3 million annually in the future. Following my institution's lead, many more improvements can be made to make geothermal into an affordable option and to help alleviate use of fossil fuels. Although geothermal may not be the number one contributor to the country's electricity generation any time soon in the future, geoscientists are going to be vital in developments that will make it an option in achieving a clean energy environment.

National Groundwater Monitoring: Prioritizing Unseen Resources

By Nell Hoagland

Stretching across 174,000 square miles of the Midwest, reaching a saturated thickness of up to 1,000 feet, and holding 978 trillion gallons of water, is the unconfined High Plains Aquifer of the Ogallala formation. As one of 69 principal aquifers in the nation, the vast expanse of the High Plains Aquifer makes it appear as if the United States is favored with an infinite water supply. Unfortunately, this is not the case. In certain regions of the Ogallala, stress placed on groundwater levels due to over-pumping has caused water level decline of more than 100 feet, and reduction of the saturated thickness by more than half. Although projections for the rate of depletion vary, many geologists estimate it may require merely 25-30 years under current consumption trends to completely exhaust the Ogallala Aquifer. Factors such as climate change, the rising population, and excessive consumption have positioned the U.S. on a worrisome trajectory toward groundwater scarcity, particularly in the West. Recognizing the nation's unsustainable level of water consumption and the importance of groundwater resources, the federal government is beginning to concentrate natural resource policy on improved groundwater management. The President's fiscal year (FY) 2013 budget request calls for a $34.5 million increase to U.S. Geological Survey (USGS) science programs, $21 million of

Nell Hoagland visiting with Senate Minority Leader Mitch McConnell and staff.

which would be allocated to water resource priorities. One of the main water resource objectives, outlined by Congress in the 2009 Secure Water Act, is the implementation of a National Ground Water Monitoring Network (NGWMN). The President's proposed increase would support the creation of the NGWMN by providing $2.5 million and funding for an additional ten full-time employees.

The Secure Water subtitle in the Omnibus Public Lands Management Act of 2009 (Public Law 111-11) establishes a comprehensive, national water policy to ensure adequate and safe water supplies, support water research and development (R&D), and reduce uncertainties pertaining to climate change and water availability. In addition to budget responsibilities, Congress has the authority to initiate groundwater R&D projects, legislate responsible resource use through integration and coordination of federal agencies, promote public education programs on water conservation, and assure the availability of reliable information through the USGS.

The U.S. relies on groundwater for a myriad of economic and resource needs, including irrigation, public drinking water supply, livestock, self-supplied domestic water, mining, and industry. Irrigation practices consume the most groundwater, accounting for two-thirds of withdrawals in 2005. According to the USGS, the rate of total water use has remained steady while groundwater consumption has increased. Unlike water delivery contracts used for interstate allocation of river water, compacts for aquifer sharing between states have not been established. Decreasing aquifer levels and a lack of groundwater compacts have led to tense relations over disparities in Ogallala water consumption between states such as Texas, where unlimited water withdrawals are permitted, and New Mexico, where withdrawals are limited.

A coordinated, national monitoring program would advance quantity and quality assessments of groundwater and facilitate informed management decisions that transcend state borders. Current groundwater monitoring is operated on a local level, making it difficult to monitor water availability, rates of use, and sustainability on a regional or national scale. Because assessments are managed following state-specific protocols and under varying state objectives, they disproportionately evaluate transboundary aquifer systems. According to the 2007 Advisory Committee on Water Information (ACWI) State and Regional Monitoring Networks Survey, thirteen states lack a statewide groundwater-level monitoring network, eight have no network in place, five rely on intrastate networks, and only 33 have groundwater quality programs. Although certain needs contrast from state to state, consistent national funding, expansion of the existing well registry, and assimilation of USGS and independent groundwater datasets are crucial to preserve aquifer resources for future generations.

Operating under the authority of the Department of the Interior, the ACWI Subcommittee on Groundwater (SOGW) conducted a national 'water census,' as well as pilot projects in Illinois-Indiana, Minnesota, Montana, New Jersey, and Texas to assess the benefits of a NGWMN. Results from the studies proved a NGWMN would open up lines of communication between states, update field and data-management procedures, improve collaboration via information technologies, and provide data to effectively guide the management of groundwater resources. A transition from the pilot-scale projects to full implementation will begin in 2013 contingent on funding allocation.

To address public concern and the SOGW recommendations, the USGS and Bureau of Reclamation have allocated $21 million to WaterSMART (Sustain and Manage America's Resources for Tomorrow), an interagency program focused on understanding the interconnectivity of water quantity and quality, the environment, and society. In addition to implementing the NGWMN, the WaterSMART program will evaluate the influence of water quality on water availability and conduct water supply assessments in the Colorado River Basin, the Delaware River Basin, and the Apalachicola-Chattahoochee-Flint Basin.

Existing USGS-operated networks include the Active Groundwater Level Network with yearly records from 20,000 observation wells, the Climate Response Network with 130 wells, and several regional networks, including the High Plains Aquifer Monitoring Network with 9,000 wells. Archived groundwater records source from about 850,000 total well sites, of which 1,400 are continuous, real-time groundwater level monitoring wells and 1,900 are continuous, groundwater quality monitoring wells. The new NGWMN will expand on the existing network infrastructure to reach each climate division, cover each principal aquifer in the U.S., provide insight into groundwater and surface water interactions, and measure groundwater storage capacity, recharge, and discharge rates. Data collected from the new NGWMN will help assess the impacts of climate on groundwater recharge.

In conjunction with a NGWMN, the Secure Water Act establishes a Climate Change and Water Intragovernmental Panel and a Reclamation Climate Change and Water Program to research the potential for water shortages or conflicts resulting from climate change at a watershed and aquifer system-scale, and to implement appropriate management strategies. After evaluation of water research practices, knowledge gaps in monitoring networks, data integration, and modeling capacity, the Climate Change and Water Intragovernmental Panel issued a Congressional report in 2009 suggesting the federal government take action to strengthen water research systems. The recommendations include funding for a core network of stream gages and groundwater wells, development of a monitoring plan to track, predict, and adapt to climate change effects on groundwater recharge and availability, creation of a standardized water data portal, modeling of groundwater-surface water interactions, and groundwater models for selected

hydrogeologic settings. The increase in the President's FY 2013 budget request for overall USGS R&D programs and approval under the House Interior-Environment Appropriations bill (H.R. 6091) for the requested NGWMN funding, reflect a shifting, bipartisan acknowledgement of climate change-induced effects on water resources and the need to prioritize projects to address the panel's recommendations.

The value of maintaining healthy freshwater aquifer systems is all-encompassing. As emphasized by the NGWA, "one cannot adequately address the nation's food, energy, economic, and drinking water security without understanding the extent, availability, and sustainability of the critical commodity-groundwater." Prioritizing hydrogeologic research and groundwater management will not only serve as a critical natural resource policy, but an economic, environmental, social, and security policy. Hydrologists and geologists will be as critical a resource to the nation as groundwater itself. By monitoring groundwater, exploring innovative water management solutions, and informing Congress of effective water policies, geoscientists can help ensure a safe and sustainable supply of groundwater for future generations.

Krista Rybacki, Nell Hoagland, and Stephen Ginley (L-R) at the entrance to the U.S. Geological Survey's headquarters in Reston, Virginia.

The Deep Seabed: Harboring Critical Minerals

By Stephen Ginley

Critical mineral resources are available in the deep seabed, the abyssal plain lying under international waters. The National Oceanic and Atmospheric Administration (NOAA) and the U.S. Geological Survey (USGS) have been assessing marine mineral deposits like sulfides and ferromanganese crusts and nodules since 1975. These deposits contain metals like cobalt, copper and rare earth elements that are used in electrical wiring, superalloys for jet engines and superconductive magnets in computers and electric generators. The technology for profitably mining the deep seabed exists and environmental protection procedures are being developed but one obstacle to deep seabed mining by U.S. companies is ratification of the Law of the Sea.

The United Nations Law of the Sea Convention allows countries to claim land on the abyssal plain for mining through the International Seabed Authority (ISA). ISA manages matters relating to deep seabed mining according to the treaty. Originally, Article XI of the LOS mandated transfer of deep seabed mining technology to developing countries. President Ronald Reagan rejected the convention in 1982 because he objected to any technology transfer requirements. He did require federal agencies to follow the other provisions of LOS. In 1994, the objectionable technology transfer obligation was removed and the U.S. was offered a permanent seat on the ISA Council once the treaty was ratified. The council sets the agenda for the full ISA assembly, with representatives from all nations who are a party to LOS, by consensus. The permanent seat would essentially give the U.S. a permanent veto power. Regardless of party affiliation, every president, including Ronald Reagan has supported ratification of LOS with the 1994 modification. Fortune 500 corporations, environmental advocacy groups and military officials all support accession to the convention.

In 2004, ratification of LOS unanimously passed the Senate Committee on Foreign Relations but a small group of senators threatened a filibuster to prevent it from being debated on the Senate floor. Unfortunately, a similar situation is emerging in 2012. Support of two-thirds of the Senate is required to ratify a treaty and a group of 34 senators including Senate Majority Leader Mitch McConnell (R-KY) have spoken out against the treaty.

Central to the opposition's argument is the claim that the UN is attempting to usurp U.S. sovereignty. This claim does not hold much water considering the convention would expand the U.S. continental shelf by over 1 million square kilometers of international waters. A portion of profits from deep seabed mining would be distributed by the ISA to land-locked and developing countries. Dissenters believe these funds will be distributed to hostile nations like Sudan, but accession to the convention will ensure a U.S. delegate can prevent this, as the ISA Council recommends nations to receive the funds.

Today companies sponsored by a nation that is party to LOS have begun to apply for claims through the ISA to mine the deep seabed in the South Pacific and Indian Oceans. Deep seabed mining of nodules is possible today because of advancements in remotely operated vehicles and dredging equipment. Further research is needed to build drilling equipment that can function at the high pressures present on the seafloor. These drills would be necessary to mine ferromanganese crusts and sulfide deposits. Much of this research has been compiled by the International Society of Offshore and Polar Engineers (ISOPE). ISOPE's research on deep seabed minerals has been extremely valuable in compiling and evaluating breakthroughs in mining and environmental engineering.

Deep seabed mining companies must submit environmental assessments before and after mining as per ISA guidelines. The same hydrothermal environments that harbor sulfide deposits are also oases of life on the seafloor. Heat from black smokers supports diverse ecosystems in the otherwise barren benthic zone. Mining has the potential to damage these unique communities. Benthic worms are known to live on some ferromanganese nodules as well. Releasing sediment

can form plumes which will negatively impact marine life. Trace metal enrichment in water and burial of benthic organisms are some consequences of sediment plumes. To avoid releasing sediment discharge from the controlling surface vessel, engineers have suggested in situ processing techniques like leaching. Leaching separates trace metals through a series of chemical reactions, usually with solutions containing cyanide or sulfuric acid. These chemicals would do more harm than good on the abyssal plain but an executive from the deep sea exploration company SeaMinR believes this problem can be "engineered out." Research by Corby Anderson at the Colorado School of Mines suggests nitrogen solutions as a less harmful alternative, making leaching a possibility on the deep seabed.

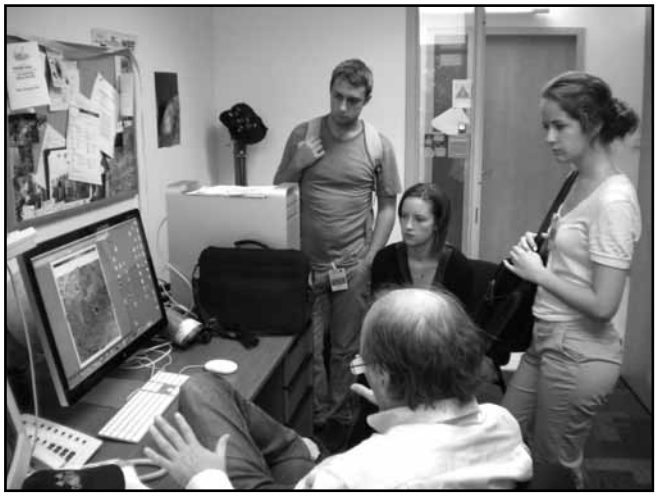
To prepare for possible deep seabed mining, the U.S. should ratify LOS to provide international recognition of rights and protections for the deep seabed. Until then, some legislators have taken preliminary steps to set up a deep seabed mining industry. Delegate Eni Faleomavaega (D-AS) introduced a bill (H.R.2803) to direct the USGS to explore deep seabed hydrothermal environments within the U.S. Extended Economic Zone (EEZ) and extended continental shelf for mineral deposits containing important metals. This bill and laws like the Deep Seabed Hard Mineral Resources Act (P.L. 101-178) are important to starting a profitable and intelligent seabed mining industry, but the U.S. does not have legal authority to mine outside its continental shelf.

If a U.S. company like Lockheed Martin wants to mine deep seabed deposits, which it does, it would have to be sponsored by a nation which has ratified LOS. Until the U.S. ratifies the convention, American miners are left adrift. Lockheed Martin would not be able to prevent a company like Nautilus Minerals from exploiting their claim and could even face legal action from the ISA.

The importance and increasingly limited supply of metals critical to industry and defense cannot be ignored. A further delay in the accession to LOS puts U.S. mining companies at a disadvantage in securing claims to areas of interest for deep seabed mining. Mining engineers have worked to improve equipment functionality and environmental sustainability to prepare for LOS ratification. To maintain its status as a world industrial power, the U.S. must take advantage of this opportunity to secure a domestic supply of critical minerals while displaying its technological prowess. The prospecting, engineering and planning have all been done- all that is left is to provide international legal security for companies, freedom of research for economic geologists and environmental protection through the Law of the Sea Convention. The bountiful abyss will not wait long.

Nell Hoagland, Krista Rybacki, and Stephen Ginley (L-R).

Stephen Ginley, Nell Hoagland, and Krista Rybacki (L-R) in the meteorite lab of the Smithsonian Institution's National Museum of Natural History.



Stephen Ginley, Krista Rybacki, and Nell Hoagland (L-R) visiting with a geoscientist at NASA's Goddard Space Flight Center.

Hurricane Irene (2011) - A Hydrological Catastrophe in the Northeast U.S.

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Abstract

Hurricane Irene (2011) had a very large wind field and a high moisture content. Although it had decreased to a tropical storm intensity by the Northeast, damage was far greater than expected. When the moisture-laden winds were lifted over the hills and mountains of the Northeast, rapid condensation resulted in very heavy rainfall. Regional flash flooding occurred because of the heavy rainfall and steep slopes, as well as the low infiltration rate into the predominantly bedrock surface of the region. Antecedent rainfall had saturated and softened the soil. Consequently, the subsequent tropical storm winds caused a great number of trees to topple over, resulting in massive power losses in the region. High convective centers in the outer rain bands of this massive storm initiated rainfall long before the front eye wall entered the region. The extensive paved surfaces in urban coastal and inland regions created short stream lag times. Runoff flowed rapidly into low areas and flooded basements, streets, and arterial highways.

Storm surge levels were just short of the elevation needed to flood the subsurface transport and communications facilities in New York City. Although Irene was only a tropical storm when it reached New York City, it did damage equal to historic Category 1 and 2 hurricanes that made a landfall here in 1821 (Coch, 1999) and 1893 (Coch and Jarvinen, 2000). Once again, we saw the significant damage *amplification* that occurs in the landfall of a northern hurricane.

Figure 1. Satellite view of Irene in the Bahamas. The storm had an immense wind field and a very high moisture content.

Introduction

Hurricane Irene was a Category 3 hurricane with a very large wind field (Figure 1) and a heavy moisture content (NOAA) in the Bahamas. The storm was predicted to skirt the east Coast into the Northeast. Many in New York City feared it would be the long feared "Big One" to hit the NY-NJ Metropolitan area.

The Northeast U.S. is no stranger to hurricanes. Major storms have hit here since colonial times (Coch, 2002). However, very few have had the regional impact of Hurricane Irene. Irene followed a track similar to Hurricane Floyd (1999) as well as the 1821 "Norfolk-Long Island" Hurricane of 1821 (Figure 2). Both of these hurricanes had a high moisture content and traveled partially over land and water into the northeast. The 1821 Hurricane had a major impact in a far less developed New York City (Coch, 1999). Hurricane Floyd was only a tropical storm in the New York Metropolitan Region, but it resulted in very heavy flooding, especially in New Jersey (Coch, 1999).

An intrusion of dry air in Georgia (Figure 3) reduced storm intensity and it was only a Tropical Storm as it entered New York City. Moderate wind damage and widespread street and cellar flooding occurred in New York City. However, the flooding between New York City and Canada was far greater and, in some areas, reached historical levels. Most streams overflowed their banks, mass movements were common and many trees were uprooted leading to widespread power loss.

How could a decaying hurricane moving overland into New England create such historic water damage? The answer is the unique meteorological characteristics of Hurricane Irene plus the unique topographical and geological character of the region where it made its final landfall. These are the subjects of this paper.

Figure 2. Tracks of Irene, the 1821 Hurricane and Hurricane Floyd (1999). These "wet" hurricanes had similar tracks, traveled extensively over land without great loss in intensity and caused major flooding in the New York Metropolitan Region.

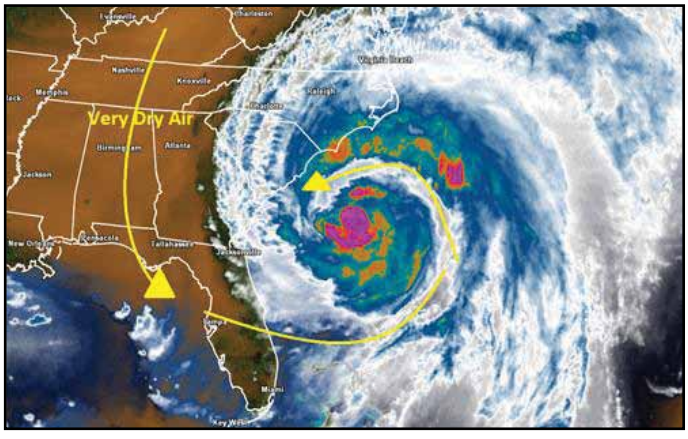


Figure 3. Satellite view of dry air intrusion into Irene in the SE U.S. The dry air decreased the intensity of the storm as it moved northward along the coast.

Figure 4. Satellite view of Irene when the eye was at Atlantic City. Note that the high convective centers on the rain bands were causing flooding far north of the storm.

Meteorology and Character of Hurricane Irene

Hurricane Irene had an immense wind field (Figure 1) of 1000 km in the Bahamas, which decreased only to 750 km by landfall in the SE. Remote sensing by NOAA indicated the storm had a high moisture content. Frictional effects plus intrusion of dry air (Figure 3) decreased storm intensity as it moved northward along the Atlantic Coast. It decreased in intensity steadily northward. In New York City it was only of tropical storm intensity.

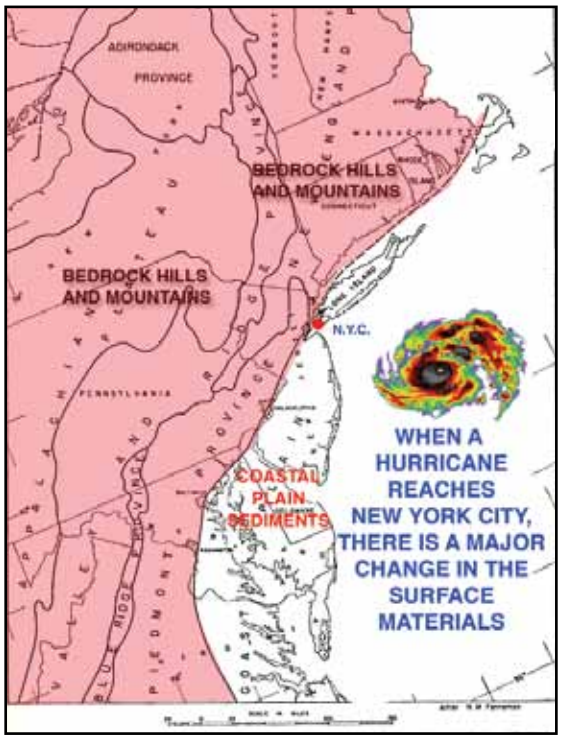
It is important to understand that *in such a large hurricane, heavy rainfall can precede the landfall of the eye by hours*. For example, while the eye was centered in Atlantic City, NJ (Figure 4) convective centers on the outer rain bands were flooding areas from New York City into Northern New England. The rate of rainfall in New England would only increase as the front eye wall approached the area.

Geology and Topography

The damage caused by a hurricane is not only a function of the characteristics of the storm (moisture, translational velocity, vortex velocity, adjacent air masses etc.) *but also the geological, topographical and demographic characteristics of the area it moves over*. Hurricanes from Texas to New Jersey make landfall on wide, gently sloping sandy coastal plains. This enables rainfall to sink slowly into the permeable surface layer and feed streams at a gradual rate.

However, once a hurricane makes a landfall north of southern New Jersey, it encounters far different surface conditions (Figure 5). Northeastern states are underlain in places by thin glacial deposits that overlie *bedrock*. In some places, the bedrock is sedimentary with some permeability. However, in most cases, the bedrock is igneous or metamorphic rock with limited permeability exclusive of fractures (joints). This limited surface permeability, plus the steep slopes of the hills and mountains of New England, served to decrease stream lag time.

Another major factor in the deluge from Irene is the hilly and mountainous topography of New England as well as the morainal topography of Long Island. As moisture-laden winds are driven upward over topography, orographic rainfall is created (Figure 6). This effect is well documented in the meteorological literature. We normally associate this orographic precipitation with mountains, but a recent study shows it works on hills (up to 100m) as well. Long Island features elongate east-west trending morainal ridges from the Wisconsonian Glaciation. Recent research shows a significant increase in rainfall occurs as storm winds encounter such glacial hills only several hundred meters high. Cole and Yuter (2007) analyzed radar patterns to study precipitation as a tropical storm passed over the glacial hills on Long Island. Their conclusion was that the precipitation increased by 30-40% as a result of passing over the glacial hills. Benimoff (2012, personal communication) stated that the rainfall was higher over the hills on Staten Island. National Weather Service data show that actual rainfall during Irene could have been higher over the moraine on Long island. A map of the rainfall distribution (Figure 7) suggests lower values south of the morainal hills, higher values over the moraine and a decrease northward across Long Island Sound. However, the number of data points, and the variety of sources, is insufficient to support a solid relationship at this time.



Firuge 5. Map showing areas of bedrock and coastal plain deposits in the northeastern U.S. Note that bedrock hills appear at the shoreline only in the New York Metropolitan Region.

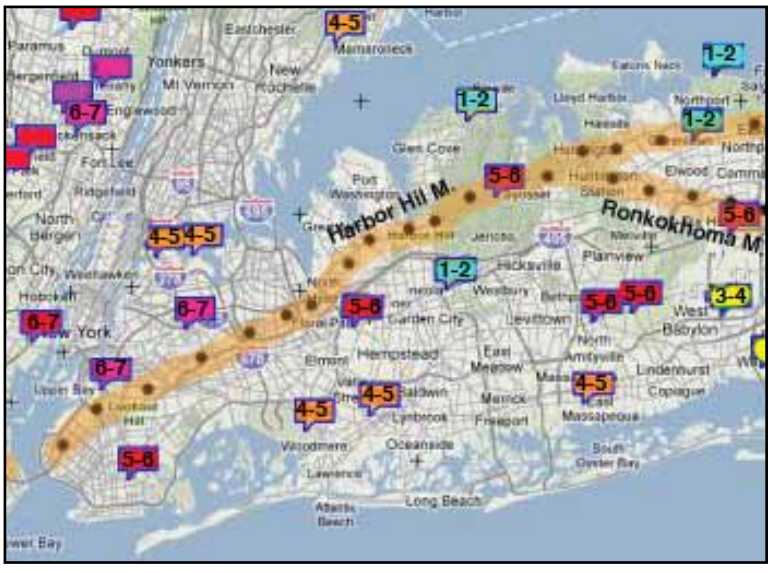


Figure 7. Map showing Irene rainfall rates and topographic features on Long Island. This compilation of rainfall data suggests that the 100m high morainal hills of western Long Island increased rainfall.

Surprisingly it would not be New York City, but the high areas to the north, that would be subject to dramatic devastation from the rains of Irene. Rainfall rates increased even more as the storm moved northward from the glacial hills of Long Island to the Catskills and Adirondacks in New York and the Green (Vermont) and White Mountains (New Hampshire) of New England (Figure 6). The heavy antecedent rainfall loosened the soil and made tree uprooting possible once the main storm winds arrived. The downed trees pulled down power lines and created massive power outages. The steep mountain slopes and relatively impermeable massive igneous and metamorphic rocks decreased lag time and huge stream discharges were reached before the front eye wall of the storm reached the area.

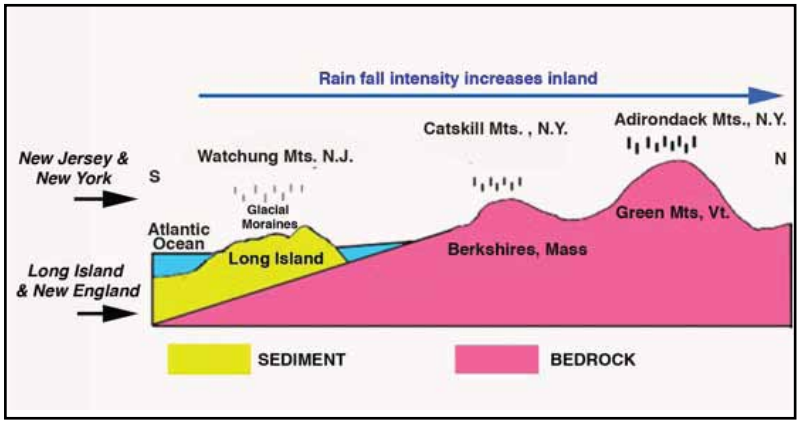


Figure 6. Diagrammatic South-North cross section from the Atlantic Ocean to Canada showing the topographic features in the northeast. Rainfall increased northward as Irene encountered higher topography.

A number of recent studies have documented the marked changes in landscapes, hydrology, soil erosion and groundwater changes caused by Hurricane Irene in the Northeast. River levels reached historic proportions. Buraas (2010) reported that the floods of August 28-30 exceeded the largest measured discharge at U.S.G.S. stream gauges in several New England watersheds. MacBroom (2012) described the major landscape alterations in New England that resulted from mass movements and channel widening. He reported that in central Vermont, precipitation in some cases, exceeded the 200 year event and in some places, the 500 year event. Mango (2012) reported that on August 28th, 11 inches of rain fell in 24 hours. This level of precipitation in Vermont drove streams out of their channels to cause massive flood damage. Five hundred miles of roads were destroyed, 200 bridges were washed away and countless structures were destroyed.

Sediment erosion was high due to channel enlargement and overland flow. Satellite photos from NASA showed large sediment plumes exiting from the mouths of the Connecticut River into Long Island Sound and into New York Bay from the Hudson River. Newton (2012) measured the suspended sediment concentration in Avery Brook , a principal tributary for the city of Northampton, Mass. During the storm 155mmm of rain fell in the watershed. Base flow went from 0.05 cms to a peak flow of 24cms in 24 hours. Suspended sediment concentration in Avery Creek went from 5mg/l to 1,500 mg/l at peak flow. Kratz (2012) found that sediment concentration reached 1,000 mg/l at the mouth of the Connecticut River.

In summary, the massive flooding was a function of the high moisture in Irene, its wide wind field and the numerous outer convection bands triggering rainfall before the front eye wall of the storm arrived.

Irene's Damage

The massive flooding from Irene caused a variety of damage. Roads were washed out, trees were uprooted, and debris flows covered transportation

routes. In the Catskill Mountains of New York, whole towns, like Prattsville, were destroyed. Some of the types of destruction observed in the Northeast are illustrated in Figure 8.

New York City is highly vulnerable to storm flooding (Cole et al, 2008). During Irene, it was a close call for New York City. Water levels rose close to the entrance grates of the subways at The Battery in lower Manhattan. For the first time in history, New York City's extensive subway system was closed down prior to storm landfall. Low areas and numerous cellars were flooded. New York City's hurricane evacuation plans were used for the first time during the storm. Of the three evacuation zones("A-C"), evacuation was mandatory only in zone "A".

Figure 8. Montage of damage of Hurricane Irene in the Northeast. A-Mud flow across Metro North railroad tracks. B-Flooding of Hudson Line railroad tracks. C-Road washout in Vermont. D-Massive flooding in Vermont.

While Irene did not cause massive damage in New York City, the costs to the city were considerable. The *preliminary* cost to the city (overtime, supplies, damage to city buildings, sidewalks and trees) was $55 million (New York Times, 2012). This is only a fraction of the total cost. The total cost will include insured property damage, repairs to non-insured property, and the economic cost of closing down Manhattan (payroll, business loss, loss of tourism etc.).

These figures point out an important lesson. *Although hurricane strikes on New York City may be infrequent, their consequences can be catastrophic.*

The Lessons of Hurricane Irene

Irene has many of the characteristics that make Northern (Georgia-Canada) hurricanes more dangerous, Saffir-Simpson category by category, than those that make landfall in to the South (Coch, 1984). Northern Hurricanes have enlarged wind fields and have a greater transitional (forward) velocity that enables them to penetrate far inland. They cause proportionally greater damage because they pass over numerous coastal population centers.

Northern hurricanes have greater hydrologic effects. Their wide wind fields enable high convective centers on their outer rain bands to initiate precipitation long before arrival of the front eye wall (Figure 4). Rainfall rates increase markedly inland because of the hilly and mountainous topography of New England. The steep slopes and impermeable bedrock limits precipitation infiltration and decreases stream lag time. This leads to peak steam discharge soon after initiation of rainfall. Lower infiltration rates result in greater soil saturation and the triggering of mass movements on slopes (Figure 7).

There is another important lesson to learn from Hurricane Irene. Emergency managers in coastal cities emphasize storm surge (salt water) destruction when a hurricane landfall is imminent. However, Irene showed that the first hydrologic reaction in urban areas is overland (fresh water) flooding. Urbanized areas are largely paved over (streets, buildings, filled in former waterways) and initial rainfall moves to the lowest point in the topography. This can cause cellar and street flooding as well as "choke points" across major evacuation routes. Examples of hurricane-induced freshwater urban flooding are shown in Figure 9.

Summary and Conclusions

Hurricane Irene has provided a worst-case scenario for the *hydrological* effects of a massive, moisture-laden hurricane landfall in the Northeast. All states in the Northeast were subject to massive flooding (Figure 10).

Once again, the inhabitants of the Northeast U.S. were lucky. Irene was only a tropical storm in the Northeast. What if Irene had *entered* the Northeast as a *hurricane*? The damage would have been so great that it would be difficult to put interstate aid plans into effect. Our oceans are getting warmer (NOAA) and many tropical meteorologists feel that a major hurricane is inevitable in the Northeast in the coming decades. Up to now, we have concentrated on the coastal effects of hurricane landfalls. However, Tropical Storm Irene showed us that we must consider the potential *inland flooding* effects as well.

References

Benimof, A., 2012 Hurricane history, extra tropical storms, Nor'easters and flooding for Staten island, N,Y, : A review, hydrologic response and further GIS studies, Geol. Soc. Of Amer., Abstracts with programs, V. 44, No. 2, P. 61.

Buraas, E.M., 2012, Assessing the geomorphic impact of Hurricane Irene flooding on unregulated Gravel-bed Rivers in New England, Geol. Soc. Of Amer., Abstracts with programs, V. 44, No. 2, P. 39.

Coch, N.K., 1994, Hurricane Hazards in the Northeastern United States, in Jour. Coastal Research Spec. Issue No.12,

Figure 9. Examples of urban flooding in Irene. A. East side, lower Manhattan. B. Rockaway Beach, Queens.

Coastal Hazards- Perception and Susceptibility, C. Finkl (Ed.), Chapter 9 (pp. 115-147).

Coch, N.K., 1999, The 1821 Hurricane in the Northeastern U.S. - A seminal event in tropical meteorology: Geol. Soc. Amer. Abstracts with programs, V 31, No. 2, P. A-10.

Coch, N.K., 1999, Hurricane Hazards in New Jersey, pp. 65-98 in New Jersey Beaches and Coastal Processes from a Geological and Environmental Perspective, J. Puffer (Ed.)., Geological Society of New Jersey Annual Proceedings, V. 16. 158 pp.

Coch, N.K., 2002, America's First Natural Disaster- The Hurricane of 1635: Implications for New England, Geol. Soc. Amer. Abstracts with programs, V. 34, No. 1 p.

Coch, N.K., 2012, Hurricane Irene - Lessons for the Northeast, Geol. Soc. of Amer., Abstracts with programs, V. 44, No. 2, P. 61.

Coch, N.K., and Jarvinen, B., 2000, Reconstruction of the 1893 New York City Hurricane from meteorological and archeological records - Implications for the future. Abstracts with programs, 24th Annual conference on Hurricanes and Tropical Meteorology, Amer. Meteorol. Soc. Mtg., Ft. Lauderdale Fla., Paper AM 16C.3.

Cole, B.A., Buonaiuto,F., Bowman, M.J., Wilson, R.E., Flood, R., Hunter, R., Mintz, A. and Hill, D., 2008, New York City's vulnerability to coastal flooding- storm surge modeling of past cyclones, *Bulletin of the American Meteorological Society*, June, pp. 829-841.

Cole, B.A. and Yuter, S.E., 2007, The impact of coastal boundaries and smallhills on the precipitation distribution across southern Connecticut and Long Island, New York, *Monthly Weather Review*, March, pp. 933-954

Kratz, L.N. 2012, Resultant sedimentation from Tropical Storm Irene in the Lower Connecticut River, Geol. Soc. Amer. Abstracts with program, V. 44, No. 2, p.40.

MacBroom, J.G., 2012, River channel adjustments during and after Hurricane Irene, Geol. Soc. Of Amer., Abstracts with programs, V. 44, No. 2, P. 40.

Mango, H., 2012, Estimating discharge of flooding of the Castleton River, Vermont resulting from Tropical Storm Irene, Geol. Soc. Of Amer., Abstracts with programs, V. 44, No. 2, P. 85.

New York Times, 2012, Tropical storm cost city $55 Million, September 21, p. A25.

Newton, R.M., 2012, Impact of tropical storm Irene on the hydrology and chemistry of Avery Brook, East Whately, Mass.

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Nicholas K. Coch received his Ph.D. in 1965 from Yale University with a specialization in sedimentology and coastal geology. In 1967, he joined the faculty at Queens College and the CUNY Doctoral Faculty in Earth and Environmental Sciences. He is now a Professor of Geology in the School of Earth and Environmental Sciences at Queens College of C.U.N.Y. He has co-authored two college geology textbooks (*Physical Geology*) and is the author of *Geohazards* (Prentice Hall). In 2008 he received the Presidents Award for Teaching Excellence at Queens College. and the John Moss Award For Excellence in College Teaching from the National Association of Geology Teachers. His research studies since 1967 have included sedimentation on the Moon, as a Principal Investigator in NASA's Lunar Sample Study Program, and shipboard studies of continental shelf, coastal and estuarine areas, as well as ground and aerial studies of the effects of hurricanes on coasts and urban centers. His recent research deals with the effects of hurricanes on coasts and inland areas and in categorizing hurricane damage patterns. He has carried out ground and aerial studies of most recent hurricanes as well as forensic studies of older (16th-20th century) hurricanes. He is a Fellow of the GSA, and a Member of The American Meteorological Society, SEPM, NAGT, AAPG and is CPG-6419. Dr. Coch is an expert on Northern Hurricanes and has been a consultant to the N.Y. City Emergency Management Organization and the N.Y.S. Office of Emergency Management. Programs discussing his research have aired on the Weather, Discovery, History and National Geographic Channels.

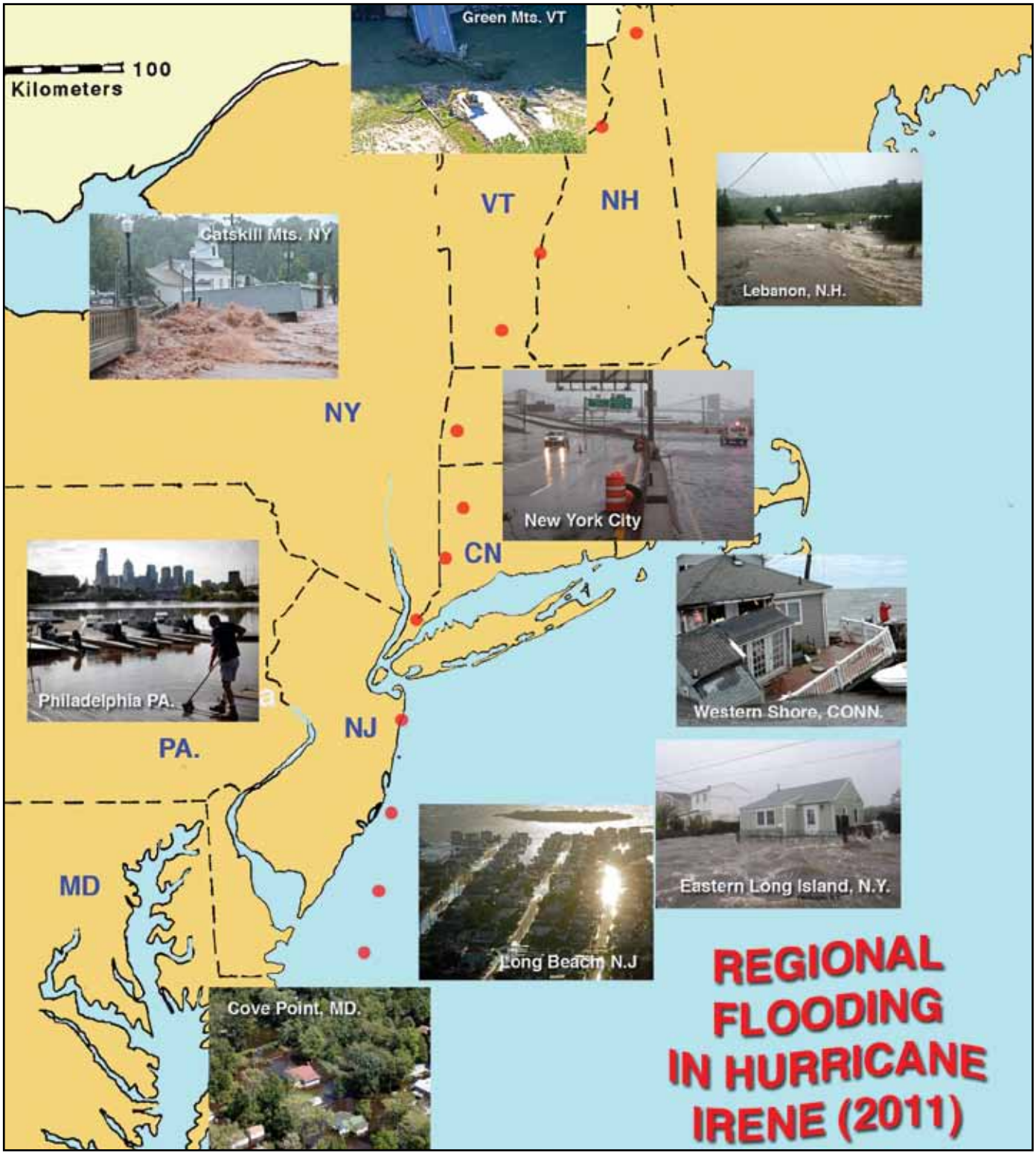

Figure 10. Photo montage of Irene flooding in each of the states in the Northeast. (Various sources)

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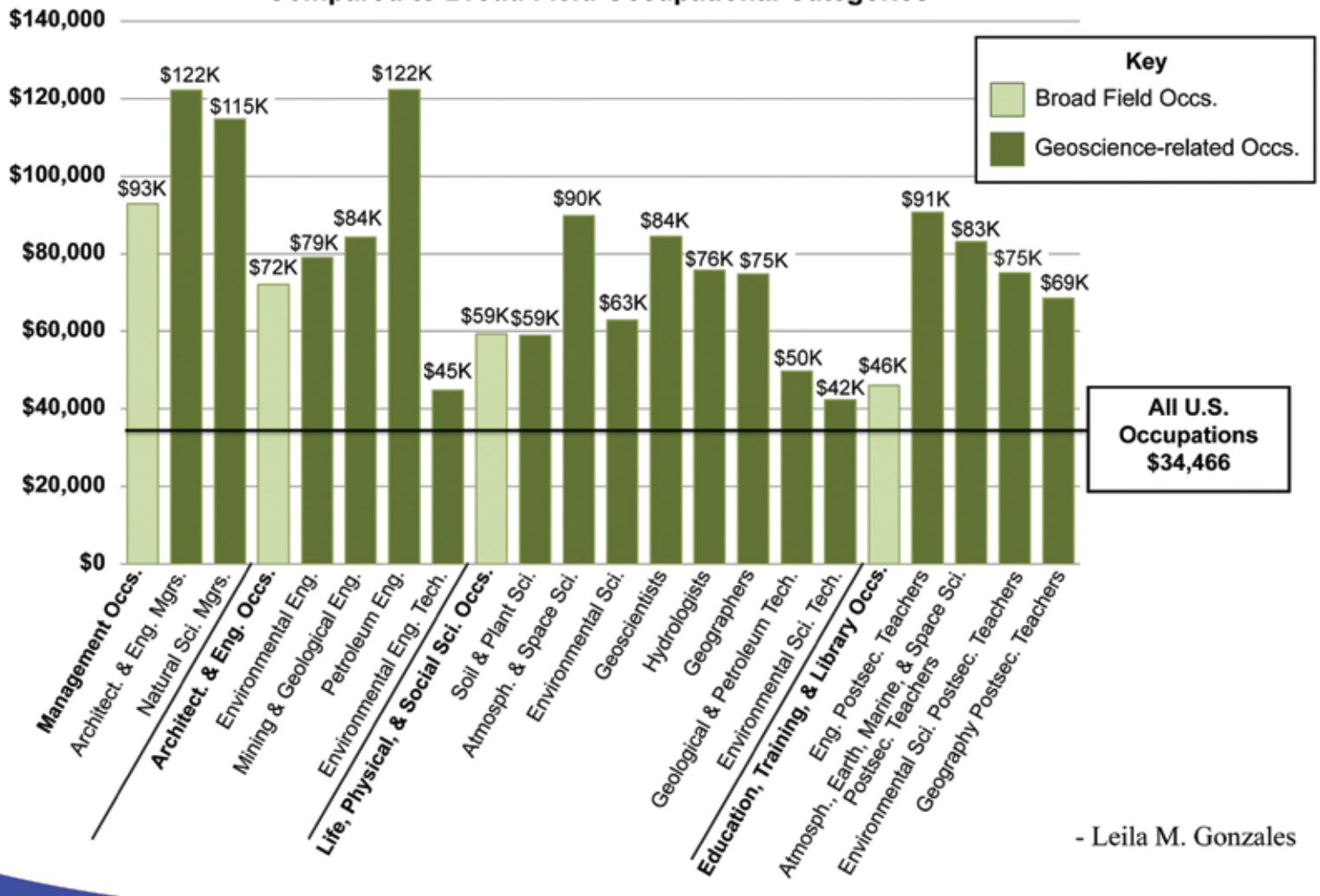
2011 Median* Salaries for Geoscience-related Occupations

Median salaries for non-technician, geoscience-related occupations outpaced broad occupational category salaries in 2011. Salaries for geoscience-related management occupations were 24-32% higher than salaries for all management occupations, while geoscience-related engineering occupations outpaced salaries for all architecture and engineering occupations by 10-70%. Geoscience-related scientific disciplines outpaced salaries for all Life, Physical, and Social Science salaries by 6% (Environmental Scientists) to 51% (Atmospheric and Space Scientists). In addition, geoscience-related postsecondary teacher salaries outpaced Education, Training and Library occupations by 49-97%. Although the majority of median salaries for geoscience-related occupations decreased by less than 3% between 2010-2011, over the past five-years (2007-2011), the majority of median salaries of geoscience-related occupations increased between 1-9%, with Petroleum Engineering salaries seeing the largest growth over the period, and Environmental Engineering salaries seeing the smallest growth.

*The 2011 median salaries for geoscience-related occupations are on average 7% (+/- 4%) lower than the corresponding mean salary. We use median salaries because salary data are often asymmetrically distributed, and thus the median values give better estimates of centrality or a "typical" salary of an occupation.

To view this data interactively, and explore median salary changes for 2010-2011 and 2007-2011, visit:
http://public.tableausoftware.com/views/2011_Geoscience_Salaries/2011GeoscienceSalaries

2011 Median Annual Salaries for Geoscience-related Occupations Compared to Broad Field Occupational Categories



- Leila M. Gonzales

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