Not Just Software... RockWare. For Over 27 Years.

**RockWorks®**
Downhole Data Management, Analysis and Visualization
- Streamlined well manager includes:
  - Deviated survey data
  - Lithology
  - Stratigraphy
  - Permeability, porosity, etc.
  - Oriented fractures
  - and more
- Interactively pick formation tops from raster e-logs
- Generate well logs, cross-sections, fence diagrams and stratigraphy models
- 2D (e.g. structure, isopachs) and 3D (porosity/permeability) contouring and volumetrics
- Includes RockWorks Utilities

Free trial available at [www.rockware.com](http://www.rockware.com)

$2,499

**LogPlot®**
Powerful, Flexible, Easy-to-Use Borehole Log Software
- Dozens of templates available or design your own in the drawing-style log designer window
- Tabbed data sheets
- Import/Export data from LAS, Excel, RockWorks
- Paginated and continuous logs at any vertical scale
- Export to a variety of formats
- Free viewer can be distributed to clients

Free trial available at [www.rockware.com](http://www.rockware.com)

$699

**RockWare GIS Link 2®**
Connecting RockWorks14 and ArcMap
- Load RockWorks well locations as an ArcMap layer
- Pick profile, section, and fence diagram locations in ArcMap, generate the diagrams automatically in RockWorks
- Create contour maps of formation tops and isopachs, surface elevation
- Generate strip logs

Free trial available at [www.rockware.com](http://www.rockware.com)

$349

**RockWorks Utilities®**
An Indispensable Collection of Modeling, Analysis, and Display Tools
- Point maps
- Contour maps
- 3D surfaces
- Gridding tools
- Solid models
- Volumetrics
- Piper/Stiff plots
- Rose & Stereonet diagrams

Free trial available at [www.rockware.com](http://www.rockware.com)

$599

---

RockWare®
Since 1983

303.278.3534 • 800.775.6745
RockWare.com
Inside This Issue

FEATURES
AIPG National Officer Election Results 3
AIPG Foundation Report 4
Celebrate Earth Science Week 6
Ethics Training
George T. FitzGerald, CPG-06582 8
AIPG Annual Meeting Supporters 11/25
AIPG Annual Meeting Program 12
AIPG Annual Meeting Registration Form 13

PEER REVIEW
Illinois Sulfate Pilot Test to Enhance Anaerobic Degradation of Hydrocarbons 16
Lyle G. Bruce, CPG-07714, Hernando Albarracin, Mike Lowder Michael Teeling, CPG-10498, John Puckett and Arati Kolhatkar
Drilling: The Most Cost Effective Technique for Mineral Resource Evaluation 26
Barton G. Stone, CPG-11114
Ordinary Soot Key to Saving Arctic Sea Ice 35
Michigan’s Mythical Mines
Franklin G. Pardee 50
Geoscience NSF Graduate Fellowships Quadrupled in 2009 60

ON THE COVER -Florida’s Everglades encompasses a sheet of water 60 miles wide and over 100 miles long that slowly moves across shallow limestone bedrock from Lake Okeechobee to Florida Bay. Photo by Daniel R. Heidenreich, CPG-10085.
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.

DEPARTMENTS

11 Student Chapters
15 Editor’s Corner
33 Test Your Knowledge
34 President’s Message
36 Test Your Knowledge Answers
37 Executive Director’s Column
38 Professional Ethics and Practices
42 Hydrothink
43 Student’s Voice
44 In Memory
46 Professional Services Directory
47 AIPG Membership Application
48 AIPG Student Application
49 New Applicants and Members
55 Section News
58 Members in the News
58 Student News
59 AIPG President Travels
61 AIPG Store

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.
2011 President-Elect (2012 President)

Barbara H. Murphy
CPG-06203
Glendale, Arizona

Statement of purpose or goals you have for AIPG:
To continue to strengthen AIPG in its advocacy role for geologists and the geologic profession at state and national levels, to encourage more active participation and volunteering at the section and national levels, to further develop web site services for our members, to focus on increasing membership, and to offer assistance to the sections in providing those programs and services that are important to our members.

2011 Vice President

J. Foster Sawyer
CPG-10000
Rapid City, South Dakota

Statement of purpose or goals you have for AIPG:
To increase student participation in AIPG through student memberships and chapters, student participation in meetings and field trips, and increased interaction between AIPG and geological departments across the nation. To stimulate growth and development within struggling and nonexistent local sections. To promote the role of geologists as decision makers and public educators regarding our natural resources.

2011-2012 Treasurer

Robert W. Gaddis
CPG-07848
Tulsa, Oklahoma

Statement of purpose or goals you have for AIPG:
I would work to uphold the high standards set by other AIPG Treasurers. We need a national effort to attract mineral geologists into, or back into, the AIPG. Promote our ethics, our professionalism.

2011 Editor

Robert A. Stewart
CPG-08332
Avon, Connecticut

Statement of purpose or goals you have for AIPG:
Promote membership participation in TPG: Encourage student participation, solicit articles from the membership, work on innovations to advance the status of AIPG and TPG.

FREE RESUME POSTING
POST AND VIEW RESUMES FOR FREE ON THE AIPG NATIONAL WEB SITE VIEW JOB LISTINGS FOR FREE
www.aipg.org Click on Job Target.

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

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.
Each year, the AIPG Foundation presents a summary report to the AIPG members on the activities and grants it has funded in the past year. The Foundation continues to focus on additional sources of income and donations and on providing financial support to grant requests that meet the goals and requirements of the Foundation.

The Foundation was first organized in 1981 by the Founders of the Foundation. The early period of the Foundation focused on establishing funds to form the endowment of the Foundation. A brief history of the Foundation is included in *A History of AIPG: 1963-2003* by AIPG member Richard Proctor.

Since 1996, the Foundation has disbursed more than $230,000 in matching grants requested from AIPG, various AIPG Sections, and individual requests. The Foundation has also supported intern programs sponsored by the American Geological Institute (AGI), the Geological Society of America (GSA), a number of colleges and universities, and state geological societies. The focus of giving has always been concentrated on the education of the public with geologic information through outreach to students—not just at the college level, but also those in the K-12 programs.

The Foundation provides matching grants of up to $3,000 per year to AIPG sections that submit worthwhile projects. To date, more than $30,000 has been provided to AIPG sections for programs. This money is available and the Foundation encourages applications to provide matching grants (50% funding) for educational and geological programs. Examples of funded programs include funds for K-12 field trip materials, educational supplies, assistance with science fairs, and student scholarships.

AIPG Sections have benefited from grants from the Foundation as well. This year, the Foundation provided matching grants to the California, Minnesota and Nevada sections totaling $3,300. The grants to all three sections focused on K-12 programs. The Foundation is providing $8,000 to AIPG for intern and scholarship efforts.

The Foundation has participated in the AGI-sponsored student intern program since 1996. Originally, the Foundation sponsored two interns, but the program proved so popular that it quickly moved to sponsor three interns. The Foundation's 50% share of the program this year is $7,500. The AGI funds the balance, allowing each student to receive $5,000 for expenses during their three-month stay in D.C.

Interns are placed in either Senatorial or Congressional offices. Each intern is very appreciative of the Foundation's support and the opportunity to gain such a worthwhile experience, and has submitted an article to *TPG* about their experience.

Through the auspices of the GSA, the Foundation has supported a GeoCorps of America intern serving the US Forest Service in its educational outreach programs. This GSA program was suggested by former AIPG President and Foundation Board Member Susan Landon.
Founders

Special thanks to the following Founders of the Foundation, the first twenty-five members to donate $1,000:

David M. Abbott, Jr., CO, CPG-04570  Ernest K. Lehmann, MN, CPG-00583
Kelvin J. Buchanan, NV, CPG-06058  Charles H. Mankin, OK, CPG-01415
Russell R. Dutcher, IL, CPG-01644  Floyd H. Miller, CO, CPG-00074
Joseph P. Fritz, MS, CPG-00203  Grover E. Murray, TX, CPG-00094
Richard E. Faggioli, CA, CPG-00808  William A. Newton, CO, CPG-00008
John T. Galey, Sr., PA, CPG-0511  William H. Park, CA, CPG-00584
James A. Gibbs, TX, CPG-01783  Edward E. Rue, IL, CPG-00012
Wilson G. Harris, IL, CPG-00286  A. O. Saterdal, CO, CPG-00351
John D. Haun, CO, CPG-00136  Russell G. Slayback, CT, CPG-02305
Adolf U. Honkala, VA, CPG-00007  Paul M. Strunk, TX, CPG-02036
Roy M. Huffington, TX, CPG-01113  M. O. Turner, TX, CPG-01046
Travis H. Hughes, AL, CPG-03529  Charles Weiner, TX, CPG-03218
Susan Landon, CO, CPG-04591

Initial Major Donors

**Platinum Medallion Level: $25,000**

Adolf U. Honkala  Suzanne Takken

**Gold Medallion Level: $10,000**

Kelvin J. Buchanan  Ernest K. Lehmann  John D. Haun  Russell G. Slayback

**Silver Medallion Level: $5,000**

Travis H. Hughes  Susan M. Landon  Roy M. Huffington  Charles H. Mankin
Grover E. Murray  William A. Newton  Richard M. Powers  James A. Gibbs

Current Trustees

Raymond W. Talkington, NH, CPG-07935, Chairman
Richard M. Powers, FL, CPG-06765, Vice Chairman
Robert K. Merrill, TX, CPG-04984, Secretary
Kelvin J. Buchanan, NV, CPG-06058, Treasurer
Robert G. Font, TX, CPG-03953
Adolf U. Honkala, VA, CPG-00007
Ernest K. Lehmann, MN, CPG-00583
P. K. Medhi, AZ, CPG-01913
Barbara H. Murphy, AZ, CPG-06203
Mark W. Rogers, CA, CPG-08926
Russell G. Slayback, CT, CPG-02305
Daniel St. Germain, NY, CPG-07858
Lawrence C. Weber, TN, CPG-07120

This year marks the fifteenth anniversary of the distribution of grants by the Foundation. The amount of funds dispersed in that first year totaled $10,000, which seems modest compared to the present yearly fund disbursement of $20,000-$25,000. To provide the increase in funding, the Foundation is grateful to the continued support of AIPG’s members. The Foundation has been able to create a more sustainable program for grants, thus becoming less dependent on investment income as a result. The Foundation continues to look for opportunities to work with members of AIPG, AIPG sections, and others interested in promoting earth science education and the geologic sciences. The Foundation appreciates the donations of money and time from the members of AIPG and hopes for the continued support of the AIPG membership.
Celebrate Earth Science Week!
October 10-16, 2010

EXPLORING ENERGY

Join the millions of people worldwide celebrating Earth Science Week by exploring the science of energy! Each year, local groups, educators, and interested individuals organize Earth Science Week activities to discover the geosciences and promote responsible stewardship of the Earth. This year’s activities will encourage young people to learn about the many forces interact in the Earth system to power our planet!

You can:
- Order an Earth Science Week Toolkit for your school or for your children’s or grandchildren’s science teacher.
- Plan an Earth Science Week event at your organization, school or business.
- Visit a local museum or classroom to talk about your work as an earth scientist.
- Attend an Earth Science Week event near you — visit www.earthsSciweek.org to find out what is going on!

Hurry — order your Earth Science Week kit now! For more information, visit: www.earthsSciweek.org
Network online with your colleagues
Facebook
LinkedIn

We’ve Moved

AIPG Headquarters has relocated their office. Our New address is:
AIPG
12000 Washington Street, Suite 285
Thornton, Colorado 80241

Dues Time Again!
2011 Dues Invoices have been mailed.

Options to pay your dues:
Online
Fax
Email
Mail
Phone

INSURANCE PROGRAMS
Available to AIPG MEMBERS
GeoCare Benefits Program
For information:
Life and Health Insurance
GeoCare Benefits Insurance Plan
http://www.geocarebenefits.com/
Phone: 800-337-3140 or 805-566-9191
Liberty Mutual Insurance
Auto and Home Insurance
http://www.libertymutual.com/lm/aipg
Phone: 1-800-524-9400
Please mention client #111397 when you contact Liberty Mutual.
AFLAC
Supplemental Insurance
http://www.aflac.com
Phone: 303-674-1808
Please identify yourself as an AIPG Member to receive the AIPG Association discounted prices.
Representative: Carol Streicher
The Wright Group
Professional Liability Insurance
General Liability Insurance
http://www.thewrightgroupinc.com
Phone: 303-863-7788
Financial Services
The Consulting Group at RBC Wealth Management
David Rhode, Senior Investment Management Specialist/Financial Advisor
http://rbcfc.com/david.rhode/dave.rhode@rbc.com
Phone: 1-800-365-3246 Fax: 303-488-3636

Dues Time Again!
2011 Dues Invoices have been mailed.

Options to pay your dues:
Online
Fax
Email
Mail
Phone

INSURANCE PROGRAMS
Available to AIPG MEMBERS
GeoCare Benefits Program
For information:
Life and Health Insurance
GeoCare Benefits Insurance Plan
http://www.geocarebenefits.com/
Phone: 800-337-3140 or 805-566-9191
Liberty Mutual Insurance
Auto and Home Insurance
http://www.libertymutual.com/lm/aipg
Phone: 1-800-524-9400
Please mention client #111397 when you contact Liberty Mutual.
AFLAC
Supplemental Insurance
http://www.aflac.com
Phone: 303-674-1808
Please identify yourself as an AIPG Member to receive the AIPG Association discounted prices.
Representative: Carol Streicher
The Wright Group
Professional Liability Insurance
General Liability Insurance
http://www.thewrightgroupinc.com
Phone: 303-863-7788
Financial Services
The Consulting Group at RBC Wealth Management
David Rhode, Senior Investment Management Specialist/Financial Advisor
http://rbcfc.com/david.rhode/dave.rhode@rbc.com
Phone: 1-800-365-3246 Fax: 303-488-3636
Introduction

This paper was developed during 2008 and presented to Texas licensed geologists to satisfy three purposes.

1. Completing the one-hour annual ethics training required by the Texas Board of Professional Geoscientists (TBPG) to maintain good standing as a licensed Texas geologist.
2. Giving fellow geologists a comparative list of ethical practices required by four geological entities in Texas including the Texas Commission on Environmental Quality (TCEQ) which is a Texas commission that regulates geologic practices in the state, the Texas Board of Professional Geoscientists (TBPG) which is the Texas Professional Geologist licensing agency, the Association of Environmental and Engineering Geoscientists (AEG) and the American Institute of Professional Geologists (AIPG) which are both national geological associations.
3. Presenting two examples of working circumstances that would require ethical consideration.

These requirements provide guidelines to work within proper ethical parameters and to complete projects with acceptable quality. It becomes evident that ethics and quality are basically “two sides of the same coin.”

The Paper is organized into three major sections including:

1. What are Good Ethics?
2. What are the Ethics Regulations?
3. What Ethical Situations Do We Encounter?

1. What are Good Ethics?

Webster’s Dictionary:
Rules or standards of conduct governing the members of a profession.

Mother’s rule:
If you can’t do it in front of your mother, your boss, or your spouse, don’t do it.

Newspaper rule:
If you don’t want to see it in tomorrow’s newspaper, don’t do it.

2. What are the Ethics Regulations?

The following section includes ethics requirements of four geologic entities including TCEQ, TBPG, AEG, and AIPG. Although each organization has a different method of presenting their ethical requirements, they are generally similar and the main purpose is to ensure that geologists plan and implement projects in an ethical manner. All entities require that geologic study is performed by persons competent to provide that service and that procedures and resultant reporting follows acceptable geologic and regulatory practices. Some of the more important requirements include determinations based on adequate and complete study using methods that would point out circumstances or data that could result in failure as well as success.

Each geologic entity has procedures to determine if properly trained geologists are providing various services and procedures or principles to guide the promotion of the study of geology.

There are three main differences in the entities. Generally, the TCEQ is an agency of the State of Texas mandated to regulate geologic activity of companies that provide industrial services. The TBPG is the Texas agency mandated to license and regulate professional requirements of geologists working in the state. Both the AEG and the AIPG are geologic associations that provide educational and associated activities to ensure that licensed geologists have opportunities to advance the science of geology and to further the input of geologic procedures in the planning and implementation of engineering, environmental, and educational programs in the state. It is to be noted that the following lists are condensed and paraphrased from the requirements of the four entities. They include the important material; however, the reader is advised to review the ethics requirements as published by the four entities to obtain the complete information. Any exclusion, omission, or misinterpretation by the author is unintentional.

2.1: Texas Commission On Environmental Quality (TCEQ): Operating Policies And Procedures, Section 12.08: Employee Ethics (Paraphrased)

12.08.01. Policy: TCEQ Mission: Protect Human Health and The Environment Consistent With Sustainable Economic Development. In order to fulfill the public trust, TCEQ employees must treat public and private interests fairly and even-handedly.

12.08.02. Conduct: Strive for excellence, public confidence, no conflict of interest, integrity, impartiality, courtesy, honesty, and adherence to statutes, rules, and regulations.

12.08.03. Guidelines: Concerning Outside Activities And Conflicts Of Interest:

- Inappropriate conduct and interests: Making investments or engaging in business relationships with outside customers who have a direct interest in TCEQ decisions.
- Personal gain: TCEQ confidential information used for personal gain is subject to criminal penalties (penal code §39.06)
- General list of unethical issues to be understood by TCEQ employees: No lending, borrowing, accepting contributions, gifts or benefits from “interested persons;” no misuse of company property for personal use; outside employment only if approved by ethics staff; volunteer work may be provided if no perceived or actual conflict of interest.
- Revolving Door: No former employee in the pay groups A17, B9, or higher may receive pay from, or represent, an “interested person, on any particular matter before the agency following
employment at the agency if that former employee worked on that particular matter while employed by the agency. (See General Rule: Subject Matter Rule.)

- **Confidential Information:** Any information designated as confidential shall not be disclosed to “interested persons.”

- **Penalties:** Penalties for ethics violations may be imposed upon employees or former employees, and range from disciplinary action to, in some cases, criminal penalties.

  2.2. **Texas Board Of Professional Geoscientists (TBPG):** Title 22, Part 39, Chapter 851, Subchapter B: Code Of Professional Conduct (Paraphrased)

  **Rule §851.101(a):** General: Code of Conduct is binding on all license holders.

  A license holder shall:

  **Rule §851.102(a):** Be qualified by education and experience, and act with reasonable care and competence.

  **Rule §851.103(a):** Provide complete and unbiased information on geoscience projects protective of the safety, health and welfare of the public.

  **Rule §851.104:** Neither perform actions that will deceive the public nor omit information that is required for completeness of geologic study. Do not accept anything of significant value as an inducement to secure geoscience work.

  **Rule §851.105:** Prior to accepting geoscience work, provide any potential employer with personal business or financial interests which may actually or perceptually affect decisions, conclusions, or recommendations.

  **Rule §851.106:** Abide by all provisions of the geoscience act. Do not aid or abet any non-licensed person from practicing and sign-off/sealing of geoscience work

  **Rule §851.107:** Only practice as a licensed geoscientist if currently licensed.

  **Rule §851.108:** Provide the licensing board with any information regarding personal criminal conviction. This applies to applicants and license holders.

  **Rule §851.109:** Do not abuse alcohol or drugs in a manner that would impair the ability to provide geoscientific work in a manner protective of safety, health, or welfare of the public.

  **Rule §851.110:** Shall be subject to a board determination and possible enforcement action if any statutory provisions or rules are violated. Enforcement actions may be initiated by a formal complaint in writing and may result in actions ranging from a reprimand to suspension of a license for a period not to exceed five years.

  **2.3: Association Of Environmental & Engineering Geologists (AEG): Principles Of Ethical Behavior (Paraphrased)

  **Preface:**

  - Serve the public with scientific knowledge, experience and good judgement.
  - Protect health, safety and welfare of the public with honesty, fairness and high quality work.

  **Article I: Responsibility to the Public Health, Safety and Welfare.**

  I. Mitigate geologic hazards.
  - Be Trustworthy.
  - Serve in public positions where your knowledge may benefit the public.
  - Disclose whether conclusions and recommendations are based on fact or opinion.
  - Practice in a legal and ethical manner.

  **Article II: Responsibility to Clients and Employers**

  II. Practice with loyalty to clients consistent with legal and ethical standards. Place priority on quality of work.
  - Maintain undivided loyalty to clients consistent with their obligations to the public.
  - Uphold clients’ trust by practicing with professional and fiscal responsibility.
  - Respect confidentiality between client and self.
  - Disclose to client any actual or perceived conflict of interest.
  - Do not misrepresent professional credentials or capabilities.
  - Accept work only if qualified.
  - Alert client if another professional’s work is required.
  - Express professional opinion only if supported by fact or experience.
  - Tell client if the consequences of their work may negatively impact the health, safety or welfare of the public or negatively impact the success of their project.

  **Article III: Responsibility to Colleagues**

  III. Interact with honesty and integrity.
  - Do not abuse alcohol or drugs in a manner that would impair the ability to provide geoscientific work in a manner protective of safety, health, or welfare of the public.
  - Serve in public positions where your knowledge may benefit the public.
  - Disclose to client any actual or perceived conflict of interest.
  - Do not misrepresent professional credentials or capabilities.
  - Accept work only if qualified.
  - Alert client if another professional’s work is required.
  - Express professional opinion only if supported by fact or experience.
  - Tell client if the consequences of their work may negatively impact the health, safety or welfare of the public or negatively impact the success of their project.

  **IV. Advance the profession of environmental and engineering geology**

  - Set a professional example for all.
  - Upgrade technical capabilities through continuing education and professional activities.
  - Encourage academic development.
  - Encourage qualified persons to enter the field of environmental and engineering geology.
  - Advertise and solicit geologic services.

  2.4: **American Institute Of Professional Geologists (AIPG): AIPG Policies And Procedures, Code Of Ethics (Paraphrased)**

  AIPG Code Of Ethics Has Three Parts That Include Five Canons (Broad Principles) Sectioned Into Standards (Goals) Such As 1.0, 2.1, 2.2, And Rules (Mandatory Conduct) Which Are Detailed As Subsections In The Code Of Ethics. Following Are Sections That Summarize The Principles, Goals And Rules.

  1.0. Maintain integrity and professional conduct.
  - Protect human health, safety and welfare and avoid actual or appearance of impropriety. Uphold all laws and regulations.
  - Be accurate, truthful and candid in all communication with the public.
  - Provide impartial service to the public.
  - Provide employers with information on any potential conflict of interest.
  - Protect customers’ interests and do not use customers’ information for personal gain without written permission.
  - Provide competent professional information based upon personal knowledge, education or experience,
and provide customers with names of other professionals for information, if appropriate.

3.4. Be diligent and timely in performing work.

3.5. If customers actions conflict with professional or ethical standards, either correct the actions or resign.

4.1. Give credit to other professionals’ work.

4.2. Be accurate, truthful, and candid in all communication regarding professional colleagues. Recognize that differences of professional opinions are common, and do not provide false, exaggerated, misleading, unwanted, or defamatory communication about professional colleagues.

5.0. Strive to improve The Profession of geology by improving professional knowledge, cooperating with colleagues, and encouraging development of geologic sciences. Encourage colleagues to further professional practices. Disallow and/or report unprofessional or unethical behavior.

3. What Ethical Solutions Do We Encounter?

Following are two possible scenarios and considerations for proper ethical actions.

Example 1. In evaluating a property for cleanup actions, laboratory results from 15 different drilling points demonstrate that one out of the 15 is anomalous and above regulatory limits. What do you do?

The answer is somewhat gray. First, it is an anomaly when compared to results from other data points; therefore, it may be a false positive. Second, the mean value of all data points may be acceptably within the range of regulatory requirements. If the 15 samples are taken on a grid pattern with drill spacing close enough to demonstrate that they are representative of the area under question, this average may be ethically acceptable. This could be appropriate in the case of determining soil contamination; however, it would be unacceptable in the case of determining groundwater contamination. The reason for this is that persons walking or working on the surface would only encounter the contaminated area during a short period of time. If it is groundwater contamination, a person could drill a drinking water well at the point of contamination and ingest an unhealthy amount of contaminated water. The ethical procedure would be to make a complete report to proper regulatory authorities including all results and conclusions. Then, decisions may be made to either obtain additional data or to accept the results of the study with a conclusion as to whether cleanup is required or not.

Example 2. Under a similar scenario, an ore body, rather than a cleanup, may be under evaluation. Assume that one sample out of 15 has analytical results that, when averaged with the other 14, causes the average grade of ore to be 50% higher than the average grade without using that one value. What do you do?

The answer to this question is rather clear to experienced mining geologists who have undergone financial successes as well as setbacks or failures. This type of abnormal data point is truly part of the ore body, but can be considered a “nugget” hole. Going back to early gold mining days, nuggets of gold could be found downstream of the actual ore body. The nuggets were evidence that an ore body did in fact exist, but more evidence was needed to start the costly process of mining. Additional investigative work may have resulted in finding the actual ore body and mining it out. Any data point that, by itself, results in upgrading the average value of an ore body by more than 10% must be considered an anomaly and treated as such in calculating the average grade of the ore body. It also must be remembered that the data point is real. The ethical procedure is to allow some value to this data point in calculating the grade of the ore body.

In the writer’s 15 years of mining experience, this procedure would include using all data points to determine the areal extent of the ore body. This includes assigning a “proven” area around each drill hole such as a circle or ellipse of influence. Connecting all these circles by tangent lines yields a “connect the dots” area that could be the ore body. A specific “proven” area/volume may be assigned to the anomalous drill hole with the rest of the area/volume assigned as the larger portion of the ore body. An example may be to have 14 data points with a value of 10 and one data point with a value of 80. The resultant mean is 14.6. The writer has learned that this value would exceed the produced value. If a specific percentage value is assigned to the anomalous data point, a more realistic result may be obtained. For instance, a calculation of 99% of 10 plus 1% of 80 results in an ore body value of 10.9. Experience has show that this overall value would be closer to the actual produced value.

Some evaluators have concluded that the anomalous value should be left out of the calculation and others have concluded that the anomalous value should be used to determine a “simple” mean value. The writer has experienced in numerous cases that the ethical procedure for calculating the average mining grade and for determination of mining feasibility is to use the above-procedure of assigning a small value to anomalous data points. This could also be considered an example of using good quality or a conservatively realistic approach to mining evaluation.

Final Thoughts

Ethical procedures and actions are required on a regular basis when providing any service or product. It is imperative that all decision makers plan and implement projects with a goal of producing that service or product in a timely manner with quality and integrity. Government agencies and business entities require completion of services that impact the needs and wants of the general public. Ethics is an integral part of the implementation of any service. When geologists are involved in this implementation, they must consider what they should do when a decision requiring an ethical determination is required. What do you want to see in tomorrow’s newspaper if you are required to make that determination?

George FitzGerald, CPG-06582 is the first geology graduate from Humboldt State University, Northern California in 1968. His career includes 39 years in mining and environmental geology; including technical and economic feasibility studies for uranium and copper mine development and operations, licensing of radioactive material disposal facilities, and remediation of hazardous waste disposal facilities throughout the United States. Currently, George is retired and consulting on mining and remedial projects, including appropriate ethical and quality assurance practices. Mr. FitzGerald may be contacted at 2200 Bent Bow Dr., Cedar Park, TX 78613. Ph: (512) 335-4737 or Cell: (512) 694-6540.

George FitzGerald, CPG-06582 is the first geology graduate from Humboldt State University, Northern California in 1968. His career includes 39 years in mining and environmental geology; including technical and economic feasibility studies for uranium and copper mine development and operations, licensing of radioactive material disposal facilities, and remediation of hazardous waste disposal facilities throughout the United States. Currently, George is retired and consulting on mining and remedial projects, including appropriate ethical and quality assurance practices. Mr. FitzGerald may be contacted at 2200 Bent Bow Dr., Cedar Park, TX 78613. Ph: (512) 335-4737 or Cell: (512) 694-6540.
AIPG Student Chapters

<table>
<thead>
<tr>
<th>University</th>
<th>Founded</th>
<th>Chapter Sponsor</th>
<th>Sponsor Name</th>
</tr>
</thead>
<tbody>
<tr>
<td>Bowling Green University</td>
<td>2004</td>
<td>Robert K. Vincent, MEM-0216</td>
<td>TDC, Inc</td>
</tr>
<tr>
<td>Central Michigan University</td>
<td>2003</td>
<td>Eric Wallis, CPG-09518</td>
<td>BCI Engineers &amp;</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>Scientists, Inc.</td>
</tr>
<tr>
<td>Colorado School of Mines</td>
<td>1999</td>
<td>Graham Closs, CPG-07288</td>
<td>Entrix</td>
</tr>
<tr>
<td>Eastern Michigan University</td>
<td>2006</td>
<td>Walter J. Bolt, CPG-10289</td>
<td>MWH Global</td>
</tr>
<tr>
<td>Georgia State University</td>
<td>2005</td>
<td>Ronald Wallace, CPG-08153</td>
<td></td>
</tr>
<tr>
<td>James Madison University</td>
<td>1998</td>
<td>Cullen Sherwood, CPG-02811</td>
<td></td>
</tr>
<tr>
<td>University of California-Davis</td>
<td>2010</td>
<td>James Jacobs, CPG-07760</td>
<td></td>
</tr>
<tr>
<td>University of Nevada-Reno</td>
<td>2008</td>
<td>Jonathan G. Price, CPG-07814</td>
<td></td>
</tr>
<tr>
<td>Ohio State University</td>
<td>2004</td>
<td>Thomas Berg, CPG-08208</td>
<td></td>
</tr>
<tr>
<td>Temple University</td>
<td>2006</td>
<td>Dennis Pennington, CPG-04401</td>
<td></td>
</tr>
<tr>
<td>Wright State University</td>
<td>1996</td>
<td>Thomas Berg, CPG-08208</td>
<td></td>
</tr>
</tbody>
</table>
## PROGRAM

### Saturday, September 11, 2010

<table>
<thead>
<tr>
<th>Time</th>
<th>Event</th>
</tr>
</thead>
<tbody>
<tr>
<td>7:00 am–5:00 pm</td>
<td>Registration</td>
</tr>
<tr>
<td>7:00 am–8:00 am</td>
<td>AIPG – Executive Committee Breakfast</td>
</tr>
<tr>
<td>7:30 am–4:30 pm</td>
<td>Field Trip – Florida Limestone Mining</td>
</tr>
<tr>
<td>8:00 am–12:00 noon</td>
<td>AIPG – Executive Committee Meeting (open to all registrants)</td>
</tr>
<tr>
<td>8:00 am–5:00 pm</td>
<td>Workshop – High Resolution Surface Geophysics for Hydrogeologic/Engineering Investigations</td>
</tr>
<tr>
<td>1:00 pm–4:00 pm</td>
<td>AIPG – Advisory Board Meeting (open to all registrants)</td>
</tr>
<tr>
<td>4:00 pm–5:30 pm</td>
<td>AIPG – 2010-2011 Joint Executive Committee Meeting &amp; Business Meeting (open to all registrants)</td>
</tr>
</tbody>
</table>

### Sunday, September 12, 2010

<table>
<thead>
<tr>
<th>Time</th>
<th>Event</th>
</tr>
</thead>
<tbody>
<tr>
<td>7:00 am–5:00 pm</td>
<td>Registration</td>
</tr>
<tr>
<td>8:00 am–6:00 pm</td>
<td>Field Trip – Aquifer Recharge, 4-Sites (Tampa – St. Petersburg)</td>
</tr>
<tr>
<td>8:00 am–4:00 pm</td>
<td>AIPG Foundation Fundraiser – Deep Sea Fishing (tax deductable)</td>
</tr>
<tr>
<td>6:00 pm–8:00 pm</td>
<td>Welcome Reception – Exhibit Area Open</td>
</tr>
</tbody>
</table>

### Monday, September 13, 2010

<table>
<thead>
<tr>
<th>Time</th>
<th>Event</th>
</tr>
</thead>
<tbody>
<tr>
<td>7:00 am–5:00 pm</td>
<td>Registration</td>
</tr>
<tr>
<td>7:00 am–8:30 am</td>
<td>AIPG – Past President’s Breakfast</td>
</tr>
<tr>
<td>7:30 am–9:00 am</td>
<td>AWG Breakfast – Panel Discussion on Issues Relating to the Gulf Oil Spill</td>
</tr>
<tr>
<td>7:30 am–5:00 pm</td>
<td>Field Trip – Florida’s Springs Coast</td>
</tr>
</tbody>
</table>

### Monday, September 13, 2010 (continued)

<table>
<thead>
<tr>
<th>Time</th>
<th>Event</th>
</tr>
</thead>
<tbody>
<tr>
<td>8:00 am–5:00 pm</td>
<td>Field Trip – Central Florida’s Sand Mining District</td>
</tr>
<tr>
<td>8:00 am–12:00 noon</td>
<td>AIPG Foundation Trustee Meeting</td>
</tr>
<tr>
<td>8:30 am–5:00 pm</td>
<td>Technical Sessions</td>
</tr>
<tr>
<td>9:00 am–5:00 pm</td>
<td>Exhibits Open</td>
</tr>
<tr>
<td>12:00 noon–1:30 pm</td>
<td>Luncheon - E.A. “Gene” Shinn Speaker</td>
</tr>
<tr>
<td>5:00 pm–6:30 pm</td>
<td>FAPG a Section of AIPG Annual Executive Board Meeting (open to all registrants)</td>
</tr>
</tbody>
</table>

### Tuesday, September 14, 2010

<table>
<thead>
<tr>
<th>Time</th>
<th>Event</th>
</tr>
</thead>
<tbody>
<tr>
<td>7:00 am–4:00 pm</td>
<td>Registration</td>
</tr>
<tr>
<td>7:30 am–4:30 pm</td>
<td>Field Trip – Central Florida Phosphate District</td>
</tr>
<tr>
<td>8:30 am–5:00 pm</td>
<td>Technical Sessions</td>
</tr>
<tr>
<td>9:00 am–5:00 pm</td>
<td>Exhibits Open</td>
</tr>
<tr>
<td>9:00 am–4:00 pm</td>
<td>Field Trip – Canoeing Adventure on the Wekiwa River</td>
</tr>
<tr>
<td>12:00 noon–1:30 pm</td>
<td>Luncheon - Dr. Jonathan Arthur Speaker</td>
</tr>
<tr>
<td>6:00 pm–8:30 pm</td>
<td>Awards, Dinner and Entertainment</td>
</tr>
</tbody>
</table>

### Wednesday, September 15, 2010

<table>
<thead>
<tr>
<th>Time</th>
<th>Event</th>
</tr>
</thead>
<tbody>
<tr>
<td>7:00 am–8:00 am</td>
<td>Registration</td>
</tr>
<tr>
<td>8:00 am–5:00 pm</td>
<td>Field Trip – Kennedy Space Center</td>
</tr>
<tr>
<td>8:00 am–6:00 pm</td>
<td>Field Trip – Aquifer Recharge, 3-Sites (Orlando – Okeechobee)</td>
</tr>
<tr>
<td>8:30 am–10:00 am</td>
<td>Technical Sessions</td>
</tr>
<tr>
<td>9:00 am–11:00 am</td>
<td>Exhibits Open</td>
</tr>
</tbody>
</table>
# Registration Form

<table>
<thead>
<tr>
<th>NAME (Last)</th>
<th>(First)</th>
<th>(Middle Initial)</th>
</tr>
</thead>
<tbody>
<tr>
<td>EMPLOYER</td>
<td>NAME FOR BADGE</td>
<td></td>
</tr>
<tr>
<td>ADDRESS</td>
<td>CITY, STATE, ZIP CODE</td>
<td></td>
</tr>
<tr>
<td>PHONE</td>
<td>E-MAIL ADDRESS</td>
<td></td>
</tr>
</tbody>
</table>

| *SPOUSE/GUEST NAME | NAME ON SPOUSE/GUEST BADGE |

## Fees and Payment Information

<table>
<thead>
<tr>
<th>ANNUAL MEETING REGISTRATION</th>
<th>Amount</th>
<th>Amount</th>
</tr>
</thead>
<tbody>
<tr>
<td>Full Registration</td>
<td>$375.00</td>
<td>$</td>
</tr>
<tr>
<td>AWG Full Registration</td>
<td>$375.00</td>
<td>$</td>
</tr>
<tr>
<td>Daily Registration</td>
<td>$190.00</td>
<td>$</td>
</tr>
<tr>
<td>*Spouse/Guest (Admission to Welcome Reception, Breakfast, Lunch, Breaks and Exhibits)</td>
<td>$190.00</td>
<td>$</td>
</tr>
<tr>
<td>Student Full Registration</td>
<td>$60.00</td>
<td>$</td>
</tr>
<tr>
<td>Daily Student Registration</td>
<td>$40.00</td>
<td>$</td>
</tr>
<tr>
<td>I Would Like to Pay for a Student's Full Registration</td>
<td>$60.00</td>
<td>$</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>FIELD TRIPS (Must be Registered for the Conference) (All field trips depart and return to the Royal Plaza Hotel)</th>
<th>Amount</th>
<th>Amount</th>
</tr>
</thead>
<tbody>
<tr>
<td>Florida Limestone Mining (Sat., 9/11, 7:30 am – 4:30 pm)</td>
<td>$95.00</td>
<td>$</td>
</tr>
<tr>
<td>Aquifer Recharge, 4-Sites (Tampa – St Petersburg) (Sun., 9/12, 8:00 am – 6:00 pm)</td>
<td>$70.00</td>
<td>$</td>
</tr>
<tr>
<td>AIPG Foundation Fundraiser - Deep Sea Fishing (tax deductible) (Sun., 9/12, 8:00 am – 4:00 pm)</td>
<td>$150.00</td>
<td>$</td>
</tr>
<tr>
<td>Florida's Springs Coast (Mon., 9/13, 7:30 am – 5:00 pm)</td>
<td>$135.00</td>
<td>$</td>
</tr>
<tr>
<td>AWG Breakfast - Panel Discussion on Issues Relating to the Gulf Oil Spill (Mon., 9/13, 7:30 am – 9:00 am)</td>
<td>$33.35</td>
<td>$</td>
</tr>
<tr>
<td>Central Florida Phosphate District (Tues., 9/14, 7:30 am – 4:30 pm)</td>
<td>$95.00</td>
<td>$</td>
</tr>
<tr>
<td>Canoeing Adventure on the Wekiwa River (Tues., 9/14, 9:00 am – 4:00 pm)</td>
<td>$95.00</td>
<td>$</td>
</tr>
<tr>
<td>Aquifer Recharge, 3-Sites (Orlando - Okoechobee) (Wed., 9/15, 8:00 am – 6:00 pm)</td>
<td>$70.00</td>
<td>$</td>
</tr>
<tr>
<td>Kennedy Space Center (Wed., 9/15, 8:00 am – 5:00 pm)</td>
<td>$95.00 ($85 child)</td>
<td>$</td>
</tr>
</tbody>
</table>
### FIELD TRIPS (Must be Registered for the Conference)  
(All field trips depart and return to the Royal Plaza Hotel)

<table>
<thead>
<tr>
<th>Activity</th>
<th>Amount</th>
<th>Amount</th>
</tr>
</thead>
<tbody>
<tr>
<td>Aquifer Recharge, 3-Sites (Orlando – Okeechobee) (Weds., 9/15, 8:00 am – 6:00 pm)</td>
<td>$70.00</td>
<td>$</td>
</tr>
<tr>
<td>Kennedy Space Center  (Weds., 9/15, 8:00 am – 5:00 pm)</td>
<td>$95.00 ($85 child)</td>
<td>$</td>
</tr>
<tr>
<td>Airboat Rides  (Weds., 9/15, 8:00 am – 11:30 am)</td>
<td>$95.00 ($75 child)</td>
<td>$</td>
</tr>
</tbody>
</table>

### WORKSHOP (Must be Registered for the Conference)

<table>
<thead>
<tr>
<th>Activity</th>
<th>Amount</th>
<th>Amount</th>
</tr>
</thead>
<tbody>
<tr>
<td>High Resolution Surface Geophysics for Hydrogeologic/Engineering Investigations (Sat., 9/11, 8:00 am – 5:00 pm)</td>
<td>$130.00</td>
<td>$</td>
</tr>
</tbody>
</table>

### SOCIAL EVENTS/MEETINGS (Must be Registered for the Conference)

<table>
<thead>
<tr>
<th>Activity</th>
<th>Amount</th>
<th>Amount</th>
</tr>
</thead>
<tbody>
<tr>
<td>Welcome Reception (Sun., 9/12, 6:00 pm – 8:00 pm) Included with Registration</td>
<td>$</td>
<td>$</td>
</tr>
<tr>
<td>AIPG Past-Presidents Breakfast  (Mon., 9/13, 7:00 am – 8:30 am) Invitation Only (please circle if attending)</td>
<td>$</td>
<td>$</td>
</tr>
<tr>
<td>Awards, Dinner and Entertainment  (Tues, 9/14, 6:00 pm – 8:30 pm)</td>
<td>$60.00</td>
<td>$</td>
</tr>
</tbody>
</table>

### DONATION TO AIPG or AGWT FOUNDATION (Voluntary)

<table>
<thead>
<tr>
<th>Activity</th>
<th>Suggested Amount</th>
<th>Amount</th>
</tr>
</thead>
<tbody>
<tr>
<td>AIPG Foundation</td>
<td>$25.00</td>
<td>$</td>
</tr>
<tr>
<td>AGWT Teacher Training Program</td>
<td>$25.00</td>
<td>$</td>
</tr>
</tbody>
</table>

### DUE

<table>
<thead>
<tr>
<th>Activity</th>
<th>TOTAL AMOUNT</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>$</td>
</tr>
</tbody>
</table>

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

<table>
<thead>
<tr>
<th>Activity</th>
<th>Attending</th>
<th>Attending</th>
</tr>
</thead>
<tbody>
<tr>
<td>AIPG National Executive Committee Meeting (9/11)</td>
<td>yes / no</td>
<td>Welcome Reception (9/12) yes / no</td>
</tr>
<tr>
<td>AIPG 2010 Advisory Board Meeting (9/11)</td>
<td>yes / no</td>
<td>FAPG 2010 Executive Board/Section Meeting (9/13) yes / no</td>
</tr>
<tr>
<td>AIPG 2010-2011 Joint Executive/Business Mtg. (9/11)</td>
<td>yes / no</td>
<td></td>
</tr>
</tbody>
</table>

Full Registration includes: Welcome Reception, Technical Sessions, Student Poster Sessions, Exhibits, Mid-Morning Continental Breakfast, Lunch, and Breaks on Monday/Tuesday, a Mid-Morning Continental Breakfast on Wednesday, and Registration Packet.

I understand that by registering for the AIPG 2010 Annual Convention & Exhibition, I release and agree to indemnify The American Institute of Professional Geologists (AIPG), The American Ground Water Trust (AGWT) and its agents, officers, volunteers and employees from any liability for any loss, damage or injury sustained by me while involved in any way with the Convention and Exhibition except that AIPG and AGWT 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 AGWT 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.).

TOTAL AMOUNT DUE $__________

### METHOD OF PAYMENT

**PLEASE CHECK METHOD OF PAYMENT**

- [ ] Check No. Enclosed (drawn in U.S. Dollars on a bank located in the US or Canada)
- [ ] International Postal Money Order (in U.S. Dollars)
- [ ] VISA □ MasterCard □ American Express (*Credit cards are processed in US dollar amounts only*)

Card No. Expiration Date

Print name of cardholder: REQUIRED: Credit Card Billing Address (street, city, state, and zip):

Authorized Signature

Mail to:
American Institute of Professional Geologists
12000 N. Washington Street, Suite 285, Thornton, CO 80241
or fax to (303) 253-9220 or register on-line at www.aipg.org, phone (303) 412-6205

Refund Policy: A 90% refund of total fees paid (10% withheld to cover administrative costs) will be given upon receipt of a written request until 7/31/10. Cancellations made by written notification received between 8/1/10 and 8/27/10 will be assessed a charge of 20% (to cover administrative costs) of the total fee paid. Cancellation of the 2-day field trip made between 7/15/10 and 8/27/10 will be assessed an additional $75 to cover hotel cancellation fees. NO refunds will be given for cancellations received after 8/27/10 or for no-shows after the meeting. Substitutions welcome. Based on the decision of AIPG and AGWT field trips and workshops are subject to cancellation due to lack of participation. Notification and a full refund for field trips or workshops will be given in case of required cancellations.
Cape Cod – Glaciers, Seals, Sharks, Sunfish and Hurricanes

Robert A. Stewart, CPG-08332

TPG often carries articles on parks and road trips of geological interest, and for this month’s column I’d like to share my near-lifelong enjoyment of Cape Cod. I have vacationed on the Cape since childhood, and the ever-changing landscape provides a magnificent natural laboratory for vacationers and professional scientists alike. Scavenging the beaches for interesting rocks and fossils doubtless contributed to my eventual choice of geology as a profession. Cape Cod National Seashore was established by President Kennedy in 1961, and within the Seashore the National Park Service sponsors a variety of local field trips and guest speakers throughout the summer. At the entrance to Cape Cod Bay is Stellwagen Bank National Marine Sanctuary, established by Congress in 1992, which occupies 842 square miles and is a popular venue for whale-watching cruises to view the seasonal populations of humpback, fin, and right whales. There are also myriad opportunities to enjoy the Cape’s geology and natural history through the Audubon Society and other state and local organizations.

Cape Cod owes its origin to the eastern margin of the Laurentide ice sheet. By about 18,000 years BP, the glacier margin in eastern Massachusetts was receding in a lobate fashion; the South Channel lobe lay offshore of the outer cape, and the Cape Cod Bay lobe occupied Cape Cod Bay. The outer cape, between the yellow and blue arrows on Figure 1, is built of a series of coalesced outwash plains that were deposited from east to west by the South Channel Lobe into glacial Lake Cape Cod. Glacial Lake Cape Cod was impounded between the South Channel Lobe to the east, the Cape Cod Bay lobe to north, and the Sandwich Moraine to the south; the latter moraine trends east-west along the inner arm of Cape Cod. I recommend Oldale (2001) for an excellent treatment of Cape Cod’s geology.

I have positioned the yellow, blue and red arrows for another reason – they mark the locations of sizable seal colonies in the South Beach area of Chatham (Figure 1, #1), near Head-of-the-Meadow Beach in Truro (Figure 1, #2), and Lieutenant Island, near Wellfleet Harbor (Figure 1, #3). The colonies are mostly grey seals, which were hunted subject to a bounty in Massachusetts through 1962. Seal sightings along Cape Cod were rare in the 1960s-1970s. With the passage of the Marine Mammal Protection Act in 1972, the population has recovered to the thousands around the Cape Cod coast. Seal watching tours by boat are a popular event in Chatham. The Truro colony is accessible by foot, or off-road vehicle (by permit), about 1.5 miles north from Head-of-the-Meadow Beach. Grey seals are often seen in ones and twos along the Atlantic beaches between Chatham and Truro. They are big – bulls run to 600 pounds, and they are not shrinking violet around humans, often emerging within 20 feet of swimmers and surfers, and even swimming below surfers in deeper water, visible as a somewhat ominous, gray, streamlined shape from above.

Not surprisingly, the seal colonies have attracted great white sharks, which, absent seals, typically stay well offshore of the Cape. This summer, a great white made a meal of a seal within camera distance of the Truro shoreline, and the sequence of images was quickly broadcast by TV and the Internet. The sharks prowling the Chatham seal colony near South Beach have been tagged by state biologists to learn more about their habits, and their close proximity to shore has resulted in beach closures. At least this summer, the sharks have been a tourist draw as well (cue the Jaws theme), with vacationers hoping to catch a glimpse of a dorsal fin, or better, from shore. So far, no sharks have been sighted near the Lieutenant Island colony. This is fine with me, as I swim across part of Wellfleet Harbor with friends who train for distance swim events, and this keeps us in the water for about 1½ miles and 45 minutes, depending on wind and currents. Occasionally ocean sunfish wander into the harbor, and their dorsal fins can induce sudden v-fib if you’re not aware of these large but harmless fish. Word spreads quickly of a sunfish sighting, and local boaters usually investigate promptly. The length of the sunfish, and the great whites for that matter, rival the size of the kayak used by our spotter while swimming.

The night of September 3-4, I watched the remains of Hurricane Earl pass the Cape, with several hours of drenching rain, moderate wind, and happily, no significant damage in time for Labor Day weekend. The information about ongoing hurricanes is amazing. I followed Internet reports of Earl’s morphology changing to a flat-topped storm as it moved northward from the Carolinas, indicating that the eye was drawing in dry air, and starving itself in the process. Earl followed the pattern common to Atlantic hurricanes that skirt the eastern seaboard – fast-moving, and generally diminishing strength to the north. The level of detail available during Earl’s movement was remarkable. The last hurricane to hit the Cape was Bob in 1991, with plenty of warning, but without the detail of the Internet age. Following Bob, on Halloween of 1991, was, of course, The Perfect Storm, of book and cinema fame.

Reference:

Figure 1: Cape Cod, image from NASA/Landsat 7, accessed September 6, 2010 - http://landsat.gsfc.nasa.gov/images/lg_jpg/f0006_06.22.02.jpg.
Illinois Sulfate Pilot Test to Enhance Anaerobic Degradation of Hydrocarbons

Lyle G. Bruce, CPG-07714, Hernando Albarracin, Mike Lowder, Michael Teeling, CPG-10498, John Puckett, and Arati Kolhatkar

Abstract

Microorganisms are ubiquitous in groundwater environments (Chapelle, 2001). The presence of hydrocarbon contamination from petroleum spills tends to further stimulate microbial activity. When oxygen is available aerobic microbes dominate and suppress anaerobic activity. In the past the assumption was that the primary process was aerobic biodegradation. However, geochemical data indicate that most sites have multiple natural processes occurring concurrently, and that anaerobic processes account for more than eighty to ninety percent of the hydrocarbon mass being degraded (Kolhatkar et al. 2000, Wiedemeir et al. 1999, and Wilson et al. 2002). At most hydrocarbon contaminated sites oxygen is rapidly depleted on the up-gradient side of a plume. When this occurs, anaerobic microbes such as iron reducers and sulfate reducers have an opportunity to bloom. Under these conditions, adding an appropriate electron acceptor such as sulfate should increase microbial activity in the same manner as adding oxygen to an aerobic system. This should increase the rate of natural attenuation of contamination.

As a pilot study, we chose three LUST (leaking underground storage tank) sites in Illinois where dissolved phase hydrocarbon plumes existed. The plumes chosen for the study had to be stable in area but not shrinking for at least two years. This indicated that there was a balance between the attenuation rate and the average mass of contamination contributed by the source area over time. Additionally, there had to be sufficient geochemical data to show that the plumes were undergoing natural anaerobic degradation processes that included sulfate reduction.

After the sites were chosen, we added sulfate to the groundwater in the plume and the smear zone source areas and monitored over a three year period. In all cases the primary regulatory chemical of concern was benzene. The attenuation rate for dissolved benzene was calculated using Student t test for time-concentration regression (a.k.a. two dimensional F test of regression). In each case, the benzene attenuation rate increased after sulfate was added. In two of the cases the change was statistically significant. This means that the time of remediation would be substantially reduced as a result of adding sulfate. Statistical tests were also run on contaminant concentration versus water table fluctuations to assure that the changes in concentrations were not caused by changes in the water table level.

Introduction

Natural attenuation and biodegradation is occurring at nearly all sites that have petroleum contamination in the subsurface. In the past the assumption was that the primary process was aerobic biodegradation. However, geochemical data indicate that most sites have multiple natural processes occurring concurrently, and that anaerobic processes account for more than eighty to ninety percent of the hydrocarbon mass being degraded (Kolhatkar et al. 2000, Wiedemeir et al. 1999, and Wilson et al. 2002). In general, if one were to view the three dimensional geometry of the degradation process areas in a dissolved hydrocarbon plume, it would resemble an asymmetric onion with aerobic degradation on the outer layer followed inward in sequence by nitrate reduction (if available), iron III reduction, sulfate reduction and lastly methanogenesis at the core near the contaminant source (Chapelle, 2001). The primary control on which processes are active in different parts of a plume and the size of their reaction area is the availability of electron acceptors such as oxygen, nitrate, iron III, sulfate, and carbon dioxide or acetate.

Because dissolved sulfate is substantially more abundant in natural groundwater it follows that sulfate reduction should be the dominant process. Geochemical mass balance across dissolved hydrocarbon plumes confirms this logic (Wiedemeir, 1999). It also follows that if additional sulfate were provided to zones where sulfate reduction of hydrocarbons was already occurring, degradation should be enhanced (Bruce, et al 2007). BP and the IEPA tested this hypothesis at three LUST sites in Illinois that were undergoing natural attenuation. In each case, the plumes were stable in geographic area with benzene concentrations at individual monitoring wells generally stable or erratic.

Materials and Methods

Geochemical Data

Groundwater was analyzed at each site for specific inorganic geochemical data up-gradient of and in the plume, and field measurements of pH, dissolved oxygen (DO) and oxidation reduction potential (ORP) were taken from background across the plume at each site. Inorganic analyses included sulfate, nitrate, dissolved iron (filtered samples), bicarbonate or alkalinity and bromide.

The goal of obtaining these data were to determine if the groundwater in the plume area had become anoxic and if there were indications that anaerobic activity was occurring in conjunction with the presence of dissolved phase hydrocarbons.
Our criteria were that
1. dissolved oxygen in the heart of the plume should be less than 1 mg/l and/or ORP a negative 50 millivolts or lower,
2. dissolved iron increased in the plume compared to background, indicating iron reduction was occurring in the presence of dissolved hydrocarbons,
3. bicarbonate or alkalinity increased in the plume over background indicating successive anaerobic respiration zones, and
4. groundwater in the area naturally contained abundant sulfate outside the plume which was depleted or severely reduced in concentration in the plume indicating sulfate reduction was occurring.

If most of these criteria were met, especially the negative ORP and the depletion of sulfate in a plume, we were confident that the plume was undergoing anaerobic processes and that sulfate reduction was taking place. Two of the sites had background sulfate concentrations of approximately 100 mg/l and the third approximately 300 mg/l. In the heart of each hydrocarbon plume, however, sulfate concentrations were less than 2.5 mg/l (or non-detect).

At all sites the background ORP was positive, in some cases in excess of +200 millivolts, indicating strong aerobic groundwater. In the heart of each hydrocarbon plume, however, ORP readings were strongly negative in the -100 to -200 millivolt range indicating strongly reducing anaerobic conditions.

Additionally, we wanted the pH in the plume to be 6.5 or higher. This is because bisulfide ions (HS-) and hydrogen ions (H+) stay dissociated above a pH of about 7 with very little combination above 6.5. This minimizes the probability of forming hydrogen sulfide in the plume. All three sites met these criteria.

**Estimating Mass of Sulfate Required for Mass of Hydrocarbons in the Smear Zone**

For each site the mass of hydrocarbon in the smear zone source and plume area was estimated based on existing soil data or the Gallagher method which uses contour maps of the total BTEX in the dissolved phase concentration (Gallagher, 1995). This estimated hydrocarbon mass was increased by 50% to account for other hydrocarbons or organic sinks. Then the mass of sulfate required to degrade the total hydrocarbon mass was calculated using a factor of 4.7 grams of sulfate per gram of hydrocarbon (Bruce, 2007).

The most efficient way to apply sulfate to a plume and smear zone was via Epsom salt solution in water injected into trenches and/or selected wells. Epsom salt is magnesium sulfate heptahydrate (MgSO₄ • 7 H₂O) which is 39% sulfate by weight. Epsom salt is a common pharmaceutical for human consumption as a laxative. It is also used as a bath salt and soak to ease achy joints and to make skin smooth, and it is frequently used as an agricultural amendment to increase tilth and buffer the soil. The standard agricultural solution of Epsom salt as a soil amendment is 3 lbs per gallon which yields 1.17 lbs of sulfate per gallon.

Adding the total calculated mass of sulfate may not be necessary, however, because sulfate is present in the background groundwater at each site and would be available over time as groundwater migrates across the plume area. Additionally, the hydrocarbon concentrations did not have to be brought to zero for regulatory closure.

There is a secondary drinking water standard for sulfate of 250 mg/l. This is an aesthetic limit based on odor. It is not health based. Most, if not all of the added sulfate was projected to be consumed in the degradation of hydrocarbons, causing essentially no increase in background sulfate concentration outside the plume. Additionally, basic modeling calculations showed that if any added sulfate did migrate beyond the plume area it would disperse to near background levels in relatively short distances.

**Site Selection**

Three sites were chosen because of their diverse geologic conditions. One was primarily silty sand with relatively good hydraulic conductivity of about 3 ft/d (10E-3 cm/sec), one was silty with intermediate hydraulic conductivity of about 0.3 ft/d (average slightly less than 10E-4 cm/sec) and the last was predominantly clay with low hydraulic conductivity of 0.03 ft/d (10E-5 cm/sec).

All three sites had LNAPL to some extent early in their remediation history. In the initial stages of remediation, underground storage tanks were removed with over-excavation of contaminated soils. After excavation the service station sites were put back into commercial operation with new tanks located in different areas. Also, in early remediation, LNAPL was removed via interceptor trenches or pumping prior to review for this pilot test. At the time of the pilot, each site had no current active remediation but had been monitored for at least eight quarters after active remedial activity had ceased.

At each site, BTEX plumes appeared to be stable in area with contaminant concentrations in individual monitoring wells generally near stable or erratic. Attenuation rates for benzene prior to the pilot test were slow with average half lives on the order of 1000 to 2000+ days.

All three sites met the geochemical criteria for indicating anaerobic zones were present in the plume and that sulfate reduction was occurring. Additionally, plate counts and/or PLFA (phospholipid fatty acid analysis) were run on selected wells to either show the presence of anaerobic microorganisms or specifically the presence of sulfate reducing bacteria. All three sites had positive indicators for the presence of sulfate reducing bacteria.

---

**AWG Breakfast - September 13, 2010**

**Orlando, Florida**

Panel Discussion on Issues Relating to the Gulf Oil Spill

**When:** Monday, September 13, 2010
at 7:30 am – 9:00 am

**Where:** AIPG/AGWT/FAPG 2010 Conference

**Cost:** $33.35

AWG President Charlene Sundermann has arranged speakers: Dr. Ping Wang and his graduate student Tiffany Roberts, with USF. They have been collecting beach sand data related to the spill.

Site Data

Site 1

The geology at this site was fine sand to silty sand with hydraulic conductivity of approximately 3 ft/d (10E-3 cm/sec). The hydraulic gradient was to the south at approximately 0.03 ft/ft. The plume extended approximately 200 feet down gradient from the old UST basin with a width of approximately 80 feet (Figure 1). The highest benzene concentrations exceeded 10,000 ppb and lay just down gradient of former LNAPL interceptor trenches. Sulfate was present naturally in background groundwater at concentrations between 100 and 200 mg/l, but was depleted in the area of the hydrocarbon plume (Figure 1).

Figure 1. Contour maps of benzene concentration (ppb) and sulfate concentration (mg/l) at Site 1 before sulfate applications. Note that sulfate is depleted in the area of dissolved phase hydrocarbons. Background concentration is 100+ mg/l.

LNAPL had been present in the mid 1990s but was removed with trench pump-and-treat systems. After LNAPL removal, residual contamination was sufficient to maintain a stable plume down gradient for an extended period of time. Based on time-concentration plots and linear regression, estimates for time of remediation with no enhancement of the natural attenuation rate were one to two decades.

Geochemical profiles and field parameters showed that this site met all of the criteria listed. Using methods described it was estimated that a total of 28,000 pounds of sulfate, or approximately 24,000 gallons of agricultural sulfate solution would be required to entirely degrade the source and plume.

Site 2

The geology at Site 2 was primarily silt with hydraulic conductivity of approximately 0.3 ft/d (10E-4 cm/sec). The hydraulic gradient was toward the north at 0.02 ft/ft. The dissolved BTEX plume was roughly egg shaped 200 feet wide by 300 feet long. The highest benzene concentration exceeded 3,000 ppb and centered on the former LNAPL interceptor trench (Figure 2). Sulfate was present naturally in background groundwater in concentrations close to 100 mg/l. Sulfate was depleted, however, in the area of highest BTEX concentrations (Figure 2).

LNAPL had been present in the mid 1990s but was removed with a trench pump-and-treat system. After LNAPL removal residual contamination was sufficient enough to maintain a stable plume for an extended period of time. Based on time, concentration plots and linear regression, estimates for time of remediation with no enhancement of the natural attenuation rate were several decades.

Geochemical profiles and field parameters showed that this site met all of the criteria listed. Using methods described it was estimated that a total of 19,000 pounds of sulfate or 16,000 gallons of agricultural sulfate solution would be required to entirely degrade the source and plume.

Site 3

The geology at Site 3 was predominantly clay with hydraulic conductivity of approximately 0.03 ft/day (10E-5 cm/sec). The hydraulic gradient was toward the west at 0.005 ft/ft. The dissolved BTEX plume was an irregular ovoid shape which was about 250 feet wide by 250 feet long. The highest benzene concentration exceeded 5,000 ppb centered on the east (up gradient) side of the site (Figure 3). Sulfate was present...
naturally in background groundwater in concentrations over 300 mg/l. Sulfate was depleted, however, in the area of highest BTEX concentrations (Figure 3).

LNAPL had been present in the mid 1990s but was removed through pumping and limited excavation. All of the original monitor wells were destroyed during a rebuild of the service station. After LNAPL removal residual contamination was sufficient to maintain a stable plume for an extended period of time. Based on time-concentration plots and linear regression, an estimate for time of remediation with no enhancement of the natural attenuation rate was over 1.5 decades.

Geochemical profiles and field parameters showed that this site met all of the criteria listed. Using methods described it was estimated that a total of 30,000 pounds of sulfate or 25,000 gallons of agricultural sulfate solution would be required to entirely degrade the source and plume. In each case the sulfate was applied via gravity only from a tanker truck. No excess pressure, pumping or fracturing were employed. Trenches and appropriate wells were, however, evacuated with a vacuum truck prior to sulfate application to make room for the treatment fluid without affecting plume mobility.

The sites were then monitored for eight quarters to gauge the effect of the application on the plume, to determine if excess sulfate would escape the plume area, and to allow for natural sulfate in ground water to work on the plume.

The results were encouraging in that there was a direct inverse correlation between a rise in sulfate concentration and decrease in benzene and BTEX concentrations in the plume. Additionally, no excess sulfate appeared to escape the plume area. However, the mass of sulfate applied was not enough to reduce concentrations enough for closure.

Subsequently, another liquid application was applied to each site in mid 2007, followed by direct application of dry granular Epsom salt to trenches and/or wells as applicable through 2008. In each case, however, a total of only about 50% of the estimated mass of sulfate required to completely eliminate the source and dissolved phase plume was applied.

The reasons the applications were limited were:
1. By the end of 2008 the benzene concentrations dropped...
sufficiently at the Site 1 site to apply for site closure.

2. By the end of 2008 the benzene concentrations at Site 2 had decreased and site conditions were conducive to apply for closure.

3. At Site 3 the geologic formation was so tight that it was very difficult to apply enough sulfate solution without applying under pressure or fracturing the formation.

Statistical Methods and Results

Each site was evaluated for statistically significant trends in benzene attenuation rates over time. Each monitor well at each site was evaluated during pre- and post-treatment time periods using linear regression of the natural log of benzene concentration versus time. A two dimensional Fisher’s F test of significance (equivalent to the Student T test) was applied to determine the validity of the regressions. This is a more precise test than a simple correlation coefficient. A two dimensional F test was also applied to determine if changes in water table over time affected the concentration trends. Lastly, a three dimensional F test was applied to test the significance of both time and water table level on benzene concentration.

The null hypothesis in the statistical test was that there was no relationship between benzene concentration and time or benzene concentration and water table elevation. In other words, the null hypothesis was that the data were random. Our criteria to reject the null hypothesis was for the statistical test to indicate that there was less than 10% chance the null hypothesis was true. The criteria were met if the calculated F value exceeded the critical F value for N-2 degrees of freedom, where N is the number of sampling events in the regression.

Site 1 Results

At Site 1 the average half life for benzene before sulfate application was 1362 days or 3.7 years. The average half life for benzene after sulfate was applied was 286 days or 0.78 years. Only two of seven monitoring wells had statistically significant decreasing trends in benzene concentration before sulfate application. Ten out of eleven monitoring wells had statistically significant decreasing trends in benzene concentration after sulfate application. The change in attenuation rates after the addition of sulfate at Site 1 was statistically significant.

Only one monitor well at Site 1, MW-1, had a statistically significant correlation between benzene concentration and water table elevation. That correlation was not as good as the concentration versus time comparison on which attainment rates were estimated.

Site 2 Results

At Site 2 the average half life for benzene before sulfate application was 1157 days or 3.2 years. The average half life for benzene after sulfate application was 581 days or 1.6 years. Only three of six monitoring wells had statistically significant decreasing trends in benzene concentration before sulfate application. Six of ten monitoring wells had statistically significant decreasing trends in benzene concentration after sulfate application. The change in attenuation rates after the addition of sulfate at Site 2 was statistically significant.

At Site 2 two monitor wells pre-application and two wells post application had statistically significant correlations between benzene concentration and water table elevation. However, none of these correlations were as strong as the concentration versus time regressions.

Site 3 Results

At Site 3 the average half life for benzene before sulfate application was 2447 days or 6.7 years. The average half life for benzene after sulfate application was 803 days or 2.2 years. However, these calculations are based on limited significant data. Overall, data for this site did not show a statistically significant increase in degradation rates.

Four of seven monitoring wells had statistically significant decreasing trends in benzene concentration before sulfate application. Three of seven monitoring wells had statistically significant decreasing trends in benzene concentration after sulfate application. Site 3 appeared to have too low a permeability to allow sulfate to be dispersed to the required

<table>
<thead>
<tr>
<th>Well</th>
<th>Rate</th>
<th>N</th>
<th>F crit N-2</th>
<th>F</th>
<th>P&lt;0.10</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>-0.0065</td>
<td>14</td>
<td>3.19</td>
<td>9.68</td>
<td>0.04</td>
</tr>
<tr>
<td>2</td>
<td>0.0001</td>
<td>12</td>
<td>3.29</td>
<td>3.33</td>
<td>0.23</td>
</tr>
<tr>
<td>3</td>
<td>-0.0011</td>
<td>11</td>
<td>3.36</td>
<td>0.53</td>
<td>0.48</td>
</tr>
<tr>
<td>7</td>
<td>-0.0008</td>
<td>9</td>
<td>3.59</td>
<td>24.56</td>
<td>0.00</td>
</tr>
<tr>
<td>8</td>
<td>0.0004</td>
<td>9</td>
<td>3.59</td>
<td>0.98</td>
<td>0.39</td>
</tr>
<tr>
<td>10</td>
<td>0.0011</td>
<td>7</td>
<td>4.56</td>
<td>0.21</td>
<td>0.67</td>
</tr>
<tr>
<td>17</td>
<td>-0.0027</td>
<td>5</td>
<td>5.54</td>
<td>0.63</td>
<td>0.49</td>
</tr>
<tr>
<td>22</td>
<td>NA</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>23</td>
<td>NA</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>24</td>
<td>NA</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>25</td>
<td>NA</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Well</th>
<th>Rate</th>
<th>N</th>
<th>F crit N-2</th>
<th>F</th>
<th>P&lt;0.10</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>-0.0005</td>
<td>8</td>
<td>3.78</td>
<td>10.45</td>
<td>0.03</td>
</tr>
<tr>
<td>2</td>
<td>-0.0001</td>
<td>11</td>
<td>3.36</td>
<td>0.20</td>
<td>0.67</td>
</tr>
<tr>
<td>7</td>
<td>-0.0011</td>
<td>10</td>
<td>3.48</td>
<td>60.53</td>
<td>0.00</td>
</tr>
<tr>
<td>8</td>
<td>-0.0064</td>
<td>10</td>
<td>3.48</td>
<td>11.75</td>
<td>0.00</td>
</tr>
<tr>
<td>10</td>
<td>-0.0007</td>
<td>8</td>
<td>3.48</td>
<td>3.89</td>
<td>0.08</td>
</tr>
<tr>
<td>17</td>
<td>-0.0036</td>
<td>8</td>
<td>3.78</td>
<td>4.67</td>
<td>0.07</td>
</tr>
<tr>
<td>22</td>
<td>-0.0013</td>
<td>10</td>
<td>3.48</td>
<td>5.93</td>
<td>0.04</td>
</tr>
<tr>
<td>23</td>
<td>-0.0032</td>
<td>11</td>
<td>3.36</td>
<td>7.06</td>
<td>0.03</td>
</tr>
<tr>
<td>24</td>
<td>-0.0032</td>
<td>11</td>
<td>3.38</td>
<td>5.59</td>
<td>0.04</td>
</tr>
<tr>
<td>25</td>
<td>-0.0013</td>
<td>4</td>
<td>8.53</td>
<td>68.45</td>
<td>0.01</td>
</tr>
</tbody>
</table>

Table 1. Attenuation rates for benzene from regression of the natural log of benzene versus time at Site 1. The table also includes the number of sample points (N), the critical F value to meet our criteria, the calculated F value from the regression analysis, and the probability that the null hypothesis is correct. A probability less than 0.10 means the regression is not random and the correlation is valid.
Figure 4. Graph of historic benzene concentration in ppb (left scale) and sulfate concentration in ppm (right scale) in MW-8 at Site 1. The vertical arrows are dates sulfate was applied.

Table 2. Attenuation rates for benzene from regression of the natural log of benzene versus time at Site 2. The table also includes the number of sample points (N), the critical F value to meet our criteria, the calculated F value from the regression analysis, and the probability that the null hypothesis is correct. A probability less than 0.10 means the regression is not random and the correlation is valid.
areas for uniform degradation of hydrocarbons. The change in attenuation rates after the addition of sulfate at Site 2 was not statistically significant.

At Site 3 only one monitor well, 21R, had a statistically valid correlation between benzene concentration and water table elevation.

**Conclusions**

Over the three year period of sulfate application the attenuation rate of benzene significantly increased and the time of remediation substantially decreased at two out of three sites. Permeability of soils at the third site appeared to retard the effectiveness of the sulfate additions. Attenuation rates may have increased more rapidly at all sites if additional sulfate would had added earlier in the remediation process. Attenuation was not instantaneous. Even when additional electron acceptors were added, the response lagged primarily because of the time needed for the electron acceptor to reach key parts of the contaminant plume, and for the microbes to respond.

In summary:

- Natural attenuation is not wholly dependent on the availability of oxygen.
- Anaerobic processes are significant in degrading hydrocarbon contamination.
- The same barriers to efficiency exist for sulfate as those for oxygen or other electron acceptors.
- Geology matters. Permeable zones were easier to treat and reacted faster.
- The reacting agent must be disbursed throughout the target treatment zone in order to be available for the microbes and contact the contaminants.
References:

Bruce, L., Cuthbertson, J., Kolhatkar, A., Ziegler, J. S., and Graves, B., 2007, Anaerobic Degradation of Benzene was Enhanced through Sulfate Addition Substantially Increasing the HC Degradation Rate at a Central Indiana Site. NGWA Petroleum Hydrocarbons & Organic Chemicals in Groundwater Proceedings, Houston, TX November 2007.


Reviewed by AIPG Associate Editors: Solomon Isiorho, CPG-07788, Robert Minning, CPG-02565, and Doug Perisutti, CPG-10055.

Lyle Bruce, CPG-07714, has over 35 years geologic experience. For the last twenty years he worked for BP Remediation Management focusing on investigating petroleum contamination, identifying and fingerprinting products, and providing solutions for remediation and cleanup. Prior to entering the fields of hydrogeology and environmental geology, Dr. Bruce was an exploration geologist for 15 years. He has an M.S. from The Ohio State University and a Ph.D. from Oklahoma State University. Lyle retired from BP in August 2009 and founded L. G. Bruce Consulting.

Hernando Albarracin has 21 years experience with the Illinois Environmental Protection Agency. He has been the manager of the Leaking Underground Storage Tank Program since 2008. Prior to holding this position, Hernando was a unit manager in the Leaking Underground Storage Tank Program from 1996 to 2008, and an environmental engineer in the Permit Section, RCRA Unit, from 1989 to 1996. Hernando has a B.S. in Mining Engineering from Southern Illinois University at Carbondale.

Mike Lowder is the a unit manager for the Leaking Underground Storage Tank Program at the Illinois Environmental Protection Agency, Springfield, Illinois.

Michael Teeling, CPG-10498, has over 24 years geologic experience. For the last nineteen years, he has worked in the environmental remediation industry assessing petrochemical sites, performing feasibility analyses and applying solutions to attain regulatory closure. Prior to entering the “environmental field,” Mr. Teeling provided geological research and technical consulting to NASA and offices within the Department of Defense. Mr. Teeling has a B.A. in Geology from the University of Buffalo and an M.S. from Kansas State University. Mr. Teeling is currently with Stantec Consulting Corporation.
John Puckett is a professional engineer with over 17 years experience in the environmental remediation industry. Mr. Puckett’s experience includes the design and implementation of in-situ and ex-situ remediation technologies at numerous sites impacted with petroleum and chlorinated solvents. Mr. Puckett has also designed and implemented several wastewater treatment systems for the construction and manufacturing industry including a wastewater treatment system for the Neutrinos at Main Injector Project for Fermilab and the DOE. Mr. Puckett has a B.S. in Civil Engineering from Southern Illinois University and is currently employed with Stantec Consulting Corporation.

Arati Kolhatkar’s 15 years of experience is in the varied fields of biotreatment of wastewaters/constructed wetlands, biodesulfurization, microbially enhanced oil recovery, development of hydraulic fracturing fluids, and soil/groundwater remediation. As an Environmental Engineer in BP/Remediation Management for the last eight years, Arati focused on clean-up of petroleum-impacted sites. She has a M.S. in Chemical Engineering from The University of Tulsa and is currently pursuing a PhD in Chemical Biology at The University of Houston.

Director, Kansas Geological Survey-
The University Of Kansas, Lawrence.

DIRECTOR – Kansas Geological Survey-The University of Kansas, Lawrence. Full-time position serving as the Director of the Kansas Geological Survey (KGS) and State Geologist. Must develop and articulate a vision of KGS programs, understand the concept of serving Kansas through high-quality research in the applied geosciences, and embrace a collegial leadership style. Requires doctorate in the geosciences with 10 years professional experience, national recognition in geoscience research, excellent communication skills, knowledge of natural resources and the environmental aspects of their use, and demonstrated ability to deal with natural-resource policy issues.

The KGS is a research and service division of the University of Kansas (KU). Created in 1889, the Survey studies the geology of Kansas, develops new techniques for exploring and analyzing geologic data, and produces and disseminates maps, reports, and scientific papers. Among the premier earth-science research and service institutions in the U.S., the KGS has an annual state budget of $6 million and employs more than 90 researchers, support staff, and students in four research sections and a number of service sections. Staff collaborate extensively with faculty and students in academic departments at KU.

Complete announcement/application information at www.kgs.ku.edu/General/jobs.html. Review will begin Nov. 19, 2010, position open until filled. For further information contact Jim Butler (jbutler@kgs.ku.edu). KU is an EO/AA employer.
Annual Meeting Supporters

Exhibitors

Adventus Group
Association for Women Geoscientists
BCI Engineers & Scientists, Inc.
Boart Longyear
Clear Creek Associates
Entrix
FAPG-A Section of AIPG
Future Pipe Industries
Hose Solutions, Inc.
HSA Engineers & Scientists
Huss Drilling Inc.
Illinois-Indiana Section of AIPG
In-Situ Inc.
JRW Bioremediation, L.L.C.
MWH Global
Ranney Collector Wells
TDC, Inc.
University of Florida
Abstract:

Drilling for resource evaluation has been used as a technology for more than 3,000 years. Its applications are varied and cross all scientific and engineering disciplines. This article focuses on the use of drilling technology in the evaluation of the vertical dimension in mineral resource evaluation, exclusive of energy fuels and water. The best drilling method is the one that yields the most useful information, and this varies by commodity, time, location and the nature of the host rock; and is underpinned by the price of the commodity being sought.

Key Words:

resource evaluation, percussion drilling, cable drilling, rotary drilling, reverse circulation (RC) drilling, dual wall reverse circulation drilling, diamond drilling, sonic drilling, exploration drilling, evaluation drilling, subordinate types of drilling.

Georgius Agricola (1556) in his famous mining tome De Re Metallica, (Hoover & Hoover translation, 1950) astutely observed: “since by far the greater number of miners are unskilled rather than skilled in the art, it follows that mining is a profitable occupation to very few men, and a source of loss to many more.” Notwithstanding Agricola’s admonition, the use of appropriate drilling methods serves to improve the potential for “profitable occupation”.

In Agricola’s time, virtually all vertical penetrations of the earth’s surface were done with hand-dug shafts for which the many safety and technical issues in constructing shafts are described in his book. However drilling of vertical holes for resource evaluation is a technique that goes back to at least the Chinese in 1,100 BC, who used percussion drilling to obtain water (Wellspring Africa, May, 2010 website). There have been many variations of the percussion tool, but the basic design has remained the same. The early percussion drills used strips of bamboo tied together with a heavy stone or metal weight on the tip (Elson and Shaw, May 15, 2010). This tool was lifted and dropped by large teams of men, sometimes working for years, cutting holes up to three thousand feet deep, but normally much shallower. Water is man’s most important mineral resource, essential to his survival. Therefore it is not surprising that his earliest methods using technology and tools were in the pursuit of one of life’s necessities.

The purposes of drilling bore-holes or wells are many and varied, but fall into four main categories:

• To determine the stratigraphic or rock sequence penetrated by the hole.
• To locate and evaluate minerals and hydrocarbons that may have economic value.
• Where feasible to extract and bring to the surface any such economically valuable substances, i.e., minerals, hydrocarbons or geothermal steam.
• To provide data for correlating between holes the lithologic sequences penetrated in order to facilitate the plotting of underground stratigraphy.

This paper examines the use of drilling for evaluation of mineral resources, exclusive of energy fuels. Water, of pre-eminent importance, is a specialized discipline whose evaluation is a science and technology in its own right.

Extensive drilling is also performed to evaluate construction foundations, dam support, slope stability, environmental baseline, and engineering studies. The author worked with a pioneering paleomagnetic team in the early 1960’s, where diamond core was recovered and analyzed to determine the position of the earth’s magnetic field during distinct periods in geologic time. It was interesting to recount one summer when our drilling determined the position of the magnetic North Pole 230 million years b.p.

The four primary methods of modern drilling methods are: cable drilling, rotary drilling, diamond drilling and sonic drilling.
Cable drillin (figure 1 and 2) uses the percussion method mentioned above. In drilling, the tools are alternately lifted and dropped, the rock being cut by the repeated blows of the bit. Some water is always kept in the hole, whether naturally occurring or added from the top. The rock cuttings are removed using a bailer, which is lowered at intervals sufficiently frequent to keep the bottom of the hole clean of debris. These cuttings are dumped into a “slush pit” near the collar of the hole and serve as samples of the rocks drilled. The drilling advance is a function of the hardness of the rock (Lahee, 1961).

Rotary drilling is accomplished by the rotation of a rock bit, firmly attached to the lower end of a string of pipe, known as a “drill stem”. The drill stem itself is rotated by a turn-table at the mouth of the hole. The stem is lengthened by the addition of new “joints” of pipe whenever the increasing depth of the hole demands. During drilling, a thin mud is kept constantly flowing downward inside the drill stem, exiting through the perforations in the drill bit. The mud then flows upward between the drill stem and the walls of the hole (or innermost casing) and is discharged at the top or collar of the hole (Stewart Brothers Drilling, 2010 website). The mud serves the dual purpose of cooling the bit and supporting the walls of the uncased portion of the hole through the hydrostatic pressure exerted by it. In drilling dry formations, where no water is anticipated, air may be substituted for mud.

Reverse Circulation Drilling (RC) (figure 3 and 4) is a variant of rotary drilling. In rotary drilling, the viscosity and up-hole velocity of the drilling fluid are the controlling factors in removing cuttings effectively; and if they are not removed, drilling cannot continue. In RC drilling the flow of the drilling fluid is reversed compared to rotary drilling. Water-based drilling fluid, often containing polymer additives, is pumped down the annular space between the drill pipe and borehole wall to the bottom of the hole. Rock cuttings “entrained” in the fluid reenter the drill pipe through ports in the drill bit where they are then carried to the surface and collected in a rotary cyclone from which samples are collected. RC drilling is the least expensive method for drilling large-diameter holes in unconsolidated formation. When geologic conditions are favorable, increasing the diameter of the borehole does not appreciably increase the cost of the well.

The dual-wall reverse circulation rotary method has been used for many
years to obtain accurate geologic samples from known depths. It is much favored in precious metals exploration in the western United States because of its ability to minimize downhole contamination of the drill cuttings. Unlike conventional RC, the drilling fluid does not run down the outside of the drill pipe, but instead the flow is contained between the two walls of the dual-wall pipe and only contacts the walls of the borehole near the bit. Air or water is forced down the annulus to lift the cuttings to the surface through the inner pipe. Surface casing is not needed when the dual-wall system is used. The advantages of the dual-wall system include:

1. Continuous representative formation and mineralization samples can be obtained
2. Fast penetration rates are possible in coarse alluvial deposit or broken rock
3. Problems of lost circulation are either eliminated or reduced dramatically
4. Washout zones are reduced or eliminated

**Diamond Drilling** is another process in which the drill stem and bit are rotated. The bit is a hollow cylinder of soft steel composite whose lower edge is embedded with small industrial diamonds that project from the outer and inner edges of the cylinder. Until the mid 1970’s, most diamonds were natural and manually set into the bit. These, although still used on large diameter bits in the oil industry, have been mostly replaced by artificial diamonds in bits of greater uniformity and consistent quality. The bit is screwed to a “core-shoe” which is then screwed to the lower end of a “core barrel”, and the core barrel in turn, is screwed on to a string of hollow steel rods which reach to the top of the hole. During drilling, the string of rods and the tools attached to it are rotated. The rods are clamped to a hydraulic feed which enables the driller to control the downward pressure applied to the bit (Shuter and Teasdale, 1989). A stream of clear water or thin mud is kept flowing inside the rods and core barrel and up between the rods and the walls of the hole or casing, thereby cooling the tools. The diamonds embedded in the crown of the bit cut the rock into a cylindrical solid core of rock which remains in the hollow core barrel. When the rock core extends to the top of the barrel, the rods must be extracted from the hole and the core removed. For improved drilling productivity and speed, it is common practice to use a “wire-line core barrel”. This tool is so designed that the inner tube of the core barrel is removable, without the necessity of removing the rods and the diamond bit from the hole. Typically, the driller drops an “overshot” tool on a wireline cable inside the drill rods until it catches a latching mechanism on top of the core barrel. The latching releases the core barrel from its fastening inside the rod and the core barrel is then winched to the surface and the rock core removed (Boart Longyear Company, May, 2010 website). Once the wire-line barrel is removed by the driller, an empty second core barrel is allowed to free fall to the bottom (or is pumped for up-holes) where it locks into place inside the bottom rod containing the diamond bit. “Wire-line core barrels” can save considerable time because they eliminate the time needed to “break down”
and “make up” the drill stem for each core as in conventional core drilling. The significant advantage to core is that the pieces of core are preserved in the order in which they were obtained and furnish an excellent record of the rocks penetrated by the hole. Measurement of the amount of core recovered for each interval drilled is critical to determine the representivity of the sample (Berkman and Ryall, Editors, 1982). Samples with less than 80 percent core recovery are not acceptable in the mining industry for calculation of resource estimates. In general, resource and reserve auditors expect that at least 20 percent of the drill hole information in a deposit will be derived from diamond drill core.

Sonic Drilling uses the vertical vibrations of the drill stem and sample to advance downward by slicing through unconsolidated materials. The drill head is a hydraulically activated unit that imparts high frequency sinusoidal wave vibrations, ranging from 50 to 180 Hz, into a drill string to effectuate a cutting action at the bit face (WDC Exploration, May, 2010 website). Hz is the SI unit of frequency, defined as number of cycles per second. The Sonic drilling method yields excellent soil and unconsolidated core recoveries in formations that can be difficult or impossible with other methods. The rate of penetration varies with the type of formation, but the Sonic drill easily drills through alluvium, sand, clays, permafrost, and caliche (Sonic Drilling, May, 2010 website). As metal prices rise, the need to effectively sample tailings ponds, abandoned waste piles and related mining sites for new economic parameters makes the use of Sonic drills an important evaluation tool. Sonic samples are continuous, highly representative and relatively undisturbed core samples extruded in the drilling process into clear plastic sleeves which minimize the loss of material and allow field screening devices to provide soil or rock chemistry immediately after drilling.

Which Drilling Method to Use?

Some mineral discoveries result from a stroke of luck, or by serendipity. Others have been located only after perseverance and painstaking work by a team of explorationists over many years. Exploration proceeds in a series of calculated progressive steps involving the review of existing records, geologic maps, mining history, aerial photographs, satellite imagery, geochemical and geophysical surveys; but eventually the vertical, but unseen third dimension, must be tested. The typical exploration approach is an initial exploration drilling program followed by a targeted drilling program to evaluate any interesting results of the exploration drilling. The goals of both programs are to economically and skillfully test a property, or test the potential for an economically exploitable resource, such as an ore body. Once such a target has been “discovered”, the next stage is the evaluation and resource definition drilling stage; whose emphasis is on providing high quality drill core or samples of rock cuttings.
Figure 4 – Reverse Circulation Drilling. Using Air Injection. In In-Verse Drilling, air is injected into a special double-walled drill stem to increase the efficiency of cuttings removal. Use of this system permits top-head drive, direct rotary rigs to drill large-diameter boreholes by reverse circulation methods. (In-Verse Tool Corporation)

Figure 5 – Basic Diamond Drilling.
The type of drilling best suited to mineral exploration or more detailed evaluation is determined by the requirements for sampling and information collection. Examples of sampling requirements include: chips from mud or air circulation; auger or vacuum samples; core and sludge; or special core types such as oriented core used in geotechnical/slope stability analysis.

The type and size of the drill rig to be used depends not only on the hole size and depth, but also on the nature of the drilling site and its location. For example, a heli-portable diamond core rig at 1200 pounds is much more transportable than a 20-ton reverse circulation drill on wheels. Location factors include: remote or difficult access, surface or underground, and drill angles for machine setup, since many rigs only drill vertical holes.

The type of drilling, rig type, and the most suitable drilling tools are all dependent on the deposit type and the rock formations to be penetrated. These may include: uniform conditions throughout the length of the hole (rare); foliated or bedded rock; broken and unpredictable ground; high clay content; presence of swelling or sticking clays; etc.

Cost factors are usually the ultimate criterion. The drilling must be cost effective; producing benefits at least equal to costs. Other equally compelling factors may be the available drilling technology and driller skills. With much of the current exploration taking place in foreign countries, a specific type of drill rig, which cannot be brought through customs, is not a viable option.

Exploration managers may decide that they will get a better volume of samples and assays by using less expensive chip sampling or dual pipe sampling than the considerably more expensive diamond core drilling. Their job is to balance less reliable methods against cost and time. Pincock Allen & Holt recommend a minimum of 20 percent coverage of diamond core in the total drilling coverage for complex metallic deposits. One effective means of achieving lower drilling costs in vertically zoned deposits, where an upper zone is barren of mineralization, is to use two different drilling methods. Such a program would drill through the uppermost layer with the least expensive method, set casing in this upper portion and then drill the mineralized zone with diamond core to obtain maximum geologic information and optimum material for analytical purposes. The coal industry has been using this approach for decades, since core samples are required for coal quality determination.

The Australian Drilling Industry Training Committee Limited’s textbook “Drilling” (Lewis Publishers, 1997) describes different drilling results in other subordinate types of drilling used in exploration and mining:

**Cable tool:** In unconsolidated and weathered formation, cable tool drilling can produce “pieces” of formation. These “pieces make better samples than the disintegrated particles usually returned by fluid circulation methods. To achieve accuracy of sampling, casing must be driven close behind the bit.

**Rotary water/mud:** When the bit is operated to produce large chips, rotary methods provided good samples from most formations. Mud may be necessary to stop chips disintegrating. Often the exact source of the sample is doubtful.

**Reverse water/mud:** The reverse circulation system ensures that the cuttings are delivered to the surface rapidly and without contamination.

**Rotary air (RAB):** The more efficient bottom-hole clearing and the rapid up-hole velocity of air circulation provide samples superior to those from a liquid circulation system.

**Reverse air (tri-cone or blade):** Using dual-tube techniques, reverse air circulation provides large chips and small pieces of core from consolidated formations.

**Rotary hammer:** Pressured air circulation will drive a down-hole hammer and produce superior chips even from very hard formations. A dual-tube system, achieved using either a center sample (RC) hammer or a cross-over connection above a conventional hammer, provides the benefit of rapid return of quality samples. This is the most commonly used method in the Western USA for metal deposit evaluation.

Auger drilling, jet drilling, hollow rod drilling (direct push) and casing wash techniques all provide formation samples, but will only sample unconsolidated, weathered or soft formations.

In summary, mining and exploration management have a wide variety of drilling methods from which to choose; however, in light of the much more stringent regulatory framework in which we work, some methods are more reliable and accurate for the determination of metal and mineral content than others; these are the primary methods for evaluating mineral deposits.

![Figure 6-Sonic drill schematic.](image)
upon which sound economic decisions are ultimately based.

Acknowledgements:

The author would like to thank his employer, Pincock Allen & Holt (PAH), a division of the Runge Corporation, for permission to publish this article based in part on work done for PAH; and for the worldwide exposure to drilling evaluation and resource calculation estimates that PAH’s clients have provided to him. The author also thanks Mr. David Bardsley of WDC Exploration for use of the sonic drill head diagram, and Mr. Wayne Wise, owner of the Acker Drill Company, for permission to use some of the diagrams in their drilling handbook authored by W.L.Acker III.

References


Reviewed by AIPG Associate Editors: John Berry, CPG-04032, Virginia McLemore, CPG-07438, and U Kar Winn, CPG-11219.

Mr. Stone has been involved in the drilling evaluation of resources since starting as a driller’s helper in 1965 while on a university summer break. He has worked on drilling evaluations in Africa, Australia, Russia, Central America, South America, Canada, and the USA in precious metals, base metals, uranium, industrial minerals, iron, oil sands and coal. His e-mail address is bart.stone@pincock.com.

Looking Forward to Seeing YOU in Orlando, Florida!
1. Which of the following carbon compounds describes an “unbranched alkane” hydrocarbon of the paraffin family?

   a) $\text{C}_4\text{H}_{10}$
   b) $\text{C}_2\text{H}_5\text{OH}$
   c) $\text{H}_2\text{CO}_3$

2. Erosion has created a hole in a “nappe”, through which the underlying “autochthonous” strata can be seen. Which term defines this structural condition?

   a) Klippe.
   b) Fenster.
   c) Inselberg.

3. We are correlating lithologic units at two outcrops. At each, we have recognized a prominent “lumachelle” zone. Which of the following applies?

   a) The zone depicts an aqueous sedimentary environment.
   b) The zone reflects an extrusive igneous sequence.
   c) The zone indicates high-pressure metamorphism.

4. An earthquake causes the detachment of a massive, coherent, three-ton rock mass which falls vertically from the edge of a canyon for a distance of one-half mile. Which of the following choices reflects the stored or potential energy of the rock mass and the velocity that it attains at the point of impact at the canyon’s floor?

   a) $\text{PE} = 15,840,000 \text{ ft-lb and } V_f = 411 \text{ ft/sec.}$
   b) $\text{PE} = 159,000,000 \text{ ft-lb and } V_f = 320 \text{ ft/sec.}$
   c) $\text{PE} = 1,508,000 \text{ ft-lb and } V_f = 912 \text{ ft/sec.}$
   d) Run from the hills; the boulders are coming!

Answers on Page 36
Politics and Cooperation

Michael D. Lawless, CPG-09224

In July Vickie Hill, Membership Services Manager, and I represented AIPG at the National Conference of State Legislatures (NCSL) in Louisville, Kentucky. The conference illustrated the importance and effectiveness of two themes that have been discussed in the pages of TPG this year, namely the importance of the intersection of politics and geology and the effectiveness of cooperation between geoscience societies. We shared a booth with the Association of American State Geologists (AASG), the Geological Society of America (GSA), the American Geological Institute (AGI), and the Association of Environmental and Engineering Geologists (AEG). The conference is the annual legislative summit where state legislators from across the country convene to exchange ideas and learn from each other's experiences. The conference was also attended by international delegations as well as student civic groups.

We had the opportunity to speak with many legislators from across the country and it became apparent that most are unaware of the link between geology and the important issues facing the US and the world today. It was also apparent that once a dialogue is started they understand and appreciate the connection. The discussions included topics such as living with and reacting to natural hazards, protecting and managing our water supplies, diversifying our energy portfolio, and balancing our need for raw materials with our desire to mine those materials in an environmentally responsible manner. AGI has prepared a document that outlines these issues (among others) and the role of the geosciences in addressing them entitled, “Critical Needs for the Twenty First Century.” The document was prepared in 2008 as a transition document for the incoming Obama administration, but it has a much broader application and audience. It is clear, concise and written in language that is easily understandable by legislators and their staffs. It is available on the AGI website and is a recommended resource when you are meeting with your state representatives.

Sharing the booth with the other geoscience societies illustrated that we, not surprisingly, have overlapping goals and objectives and that the differences in the details of the missions and visions of each society are complementary; additionally, those differences enrich the common message that geology is integral to the future success of our standard of living. The cooperative approach also indicated that we can in fact work together despite the independent nature of most geologists. The business world has seen the contraction of the number of service providers in many sectors in recent years. Similarly, the large number of geoscience societies seems destined to be reduced, perhaps spurred on by the current economic climate. We can strengthen the profession of geology, as well as our voice, by working together, sharing resources, and minimizing duplication of effort. Many professional societies are dealing with funding constraints and tighter budgets. By working together we can increase our efficiency and effectiveness despite the current economy.

One of the pleasant surprises of the NCSL was the participation and attendance by a number of students of high school age and younger. According to Vickie, this was a change from past conferences which were virtually without students. Some of the students had prepared posters on various societal topics ranging from human rights issues to environmental challenges, and presented their perspectives on those issues. It was encouraging to see young people getting informed about the major issues of the day and getting involved in the political process.

The conference was a great opportunity to raise the profile of geology and communicate its importance to the continued prosperity of this country directly to our elected leaders.

HAVE YOU SIGNED UP A MEMBER LATELY?

REQUIREMENTS FOR GENERAL MEMBERSHIP

EDUCATION:
30 semester or 45 quarter hours in geological sciences* with a baccalaureate or higher degree

SPONSORS:
1 required from a CPG or Member

SIGN-UP FEE (prorated):
Dec-Mar = $100; Apr-Jun = $75
Jul-Sep = $50 Oct-Nov = $25

ANNUAL DUES: $100 plus Section dues

APPLICATION: Available on website www.aipg.org

*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.
Ordinary Soot Key to Saving Arctic Sea Ice

WASHINGTON—The quickest, best way to slow the rapid melting of Arctic sea ice is to reduce soot emissions from the burning of fossil fuel, wood and dung, according to a new study.

The study shows that soot is second only to carbon dioxide in contributing to global warming. But, climate models to date have mischaracterized the effects of soot in the atmosphere, said its author Mark Z. Jacobson of Stanford University in Stanford, California. Because of that, soot’s contribution to global warming has been ignored completely in national and international global warming policy legislation, he said.

“Controlling soot may be the only method of significantly slowing Arctic warming within the next two decades,” said Jacobson, director of Stanford’s Atmosphere/Energy Program. “We have to start taking its effects into account in planning our mitigation efforts and the sooner we start making changes, the better.”

The study will be published this week in Journal of Geophysical Research (Atmospheres). Jacobson used a computer model of global climate, air pollution and weather that he developed over the last 20 years and updated to include additional atmospheric processes to analyze how soot can heat clouds, snow and ice.

Soot – black and brown particles that absorb solar radiation – comes from two types of sources: fossil fuels such as diesel, coal, gasoline, jet fuel; and solid biofuels such as wood, manure, dung, and other solid biomass used for home heating and cooking around the world.

Jacobson found that the combination of the two types of soot is the second-leading cause of global warming after carbon dioxide. That ranks the effects of soot ahead of methane, an important greenhouse gas. He also found that soot emissions kill over 1.5 million people prematurely worldwide each year, and afflicts millions more with respiratory illness, cardiovascular disease, and asthma, mostly in the developing world where biofuels are used for home heating and cooking.

Jacobson found that eliminating soot produced by the burning of fossil fuel and solid biofuel could reduce warming above parts of the Arctic Circle in the next fifteen years by up to 1.7 degrees Celsius (3 degrees Fahrenheit). For perspective, net warming in the Arctic has been at least 2.5 degrees Celsius (4.5 degrees Fahrenheit) over the last century and is expected to warm significantly more in the future if nothing is done.

Soot lingers in the atmosphere for only a few weeks before being washed out, so a reduction in soot output would start slowing the pace of global warming almost immediately. Greenhouse gases, in contrast, typically persist in the atmosphere for decades – some up to a century or more – creating a considerable time lag between when emissions are cut and when the results become apparent.

The most immediate, effective and low-cost way to reduce soot emissions is to put particle traps on vehicles, diesel trucks, buses, and construction equipment. Particle traps filter out soot particles from exhaust fumes. Soot could be further reduced by converting vehicles to run on clean, renewable electric power.

Jacobson found that although fossil fuel soot contributed more to global warming, biofuel-derived soot caused about eight times the number of deaths. Providing electricity to rural areas, thereby reducing usage of solid biofuels for home heating and cooking, would have major health benefits, he said. Soot from fossil fuels contains more black carbon than soot produced by burning biofuels, which is why there is a difference in warming impact.

Black carbon is highly efficient at absorbing solar radiation in the atmosphere, just like a black shirt on a sunny day. Black carbon converts sunlight to heat and radiates it back to the air around it. This is different from greenhouse gases, which primarily trap heat that rises from the Earth’s surface. Black carbon can also absorb light reflecting from the surface, which helps make it such a potent warming agent.

Black carbon has an especially potent warming effect over the Arctic. When black carbon is present in the air over snow or ice, sunlight can hit the black carbon on its way towards Earth, and also hit it as light reflects off the ice and heads back towards space. Black carbon also lands on the snow, darkening the surface and enhancing melting.

“There is a big concern that if the Arctic melts, it will be a tipping point for the Earth’s climate because the reflective sea ice will be replaced by a much darker, heat absorbing, ocean below,” said Jacobson. “Once the sea ice is gone, it is really hard to regenerate because there is not an efficient mechanism to cool the ocean down in the short term.”

Jacobson is a senior fellow at the Woods Institute for the Environment. This work was supported by grants from the U.S. Environmental Protection Agency, NASA, the NASA high-end computing program, and the National Science Foundation.

AGU Contact information: Kathleen O’Neil, AGU Public Information: (202) 777-7524, koneil@agu.org
Louis Bergeron, Stanford News Service: (650) 725-1944, louish3@stanford.edu.
Answers:

1. The answer is choice “a” or “\( \text{C}_4\text{H}_{10} \)” or “butane” (“n-butane”). The paraffin family is defined by the alkane hydrocarbons with the general formula \( \text{C}_n\text{H}_{2n+2} \). N-butane gas is commonly used as fuel for cooking and camping. Butane (\( \text{C}_4\text{H}_{10} \)) is the common fluid in cigarette lighters, used as a propellant in aerosols and mixed with propane (\( \text{C}_3\text{H}_8 \)) and other hydrocarbons in “LPG”.

Choice “b” or “\( \text{C}_2\text{H}_5\text{OH} \)” defines “ethanol” or a straight-chained alcohol. Ethanol is used in fuel cells and has been utilized as rocket fuel, as a chemical component of feedstock, in the development of antiseptics, as an antidote for certain poisonous substances, as an anesthetic and as an ingredient in perfumes and deodorants.

Choice “c” refers to “carbonic acid”.

2. The answer is choice “b” or “fenster” (window).

Choice “a” or “klippe” refers to a solitary erosional remnant of a “nappe” found in the middle of “autochthonous” lithic units.

Choice “c” or “inselberg” describes a “monadnock” or isolated hill, ridge or knob which rises prominently from a level plain or gently-sloping surface. Initially the term was used to illustrate these features in mature, arid landscapes only. Currently, it applies to any erosional remnant found in landscapes related to mature cycles of erosion.

3. The answer is choice “a” or “the zone depicts an aqueous sedimentary environment of deposition.” The term “lumachelle” typically refers to a concentration of sea shells, mainly oysters, in a stratigraphic sequence.

4. The answer is choice “a” or “\( \text{PE} = 15,840,000 \text{ ft-lb} \) and \( V_f = 411 \text{ ft/sec} \)”. The proof follows:

The potential energy (PE) is equivalent to the work required to elevate the rock mass to its position above the canyon’s floor. Thus,

\[
W = F * S \\
\text{PE} = W = (3)(2,000 \text{ lb}) \times (5,280 \text{ ft})/2 = 15,840,000 \text{ ft-lb}. 
\]

The time that it takes for the rock mass to fall is calculable as follows:

\[
s = \frac{at^2}{2} \\
t^2 = \frac{2s}{a} \\
t = \frac{(2)(2,640 \text{ ft})/(32 \text{ ft/sec}^2)}{2} = 12.85 \text{ sec}. 
\]

The velocity at the point of impact is calculated below:

\[
a = \frac{(V_f - V_o)}{t} \\
V = at \\
V = (32 \text{ ft/sec}^2)(12.85 \text{ sec}) = 411.2 \text{ ft/sec}. 
\]

Please note that in the equations above PE = potential energy, \( W = \) work, \( F = \) force, \( s = \) distance, \( a = \) acceleration, \( t = \) time, \( V = \) velocity, \( V_f = \) final velocity and \( V_o = \) initial velocity.

---

**Introduction to Well Logs and Log Analysis for New Hires**

- A review of well logs in petroleum exploration and development.
- Prerequisites for finding commercial reserves.
- Exploration techniques.
- Integration of geophysical exploration records with log data.
- Calculating reserves and field size.
- Importance of economics and risk analysis.
- Drilling and logging.

- Lithologic and mud logs.
- Electric logs.
- Basic and specialized porosity logs.
- Other logs and log curves used in exploration and production work.
- Selecting log suite.
- Basic log analysis (recognizing pay zones).
- Identification and classification of logs and well log data management.

A product of Geoscience Data Management, Inc.

Author: Robert Font, PhD, CPG, PG

Power Point slides with review and self assessment questions.

AIPG accredited 1 CEU (with exam) or 0.5 CEU (without exam).

Reference CD available

To order the course or for more information go to www.aipg.org.
EXECUTIVE DIRECTOR’S COLUMN

Continuing
The Pursuit

William J. Siok, CPG-04773

It seems that many of our concerns and a lot of our time these days are consumed focusing on the abysmal economy, the political unrest, the increasing number of people finding themselves unemployed, the constant threat of terrorism, etc., etc. This column steers clear of these momentous issues and gets right down to the work-a-day issue of continuing professional development.

AIPG has been working diligently to develop programs which support professional development (aka. continuing professional development, continuing education). AIPG presently offers a variety of regular programs for members and non-members alike, and is assessing the potential for a significant expansion of distance learning options.

The current opportunities include technical sessions and field trips held in concert with the annual meeting/convention; on-line self-directed technical courses; and, topical seminars throughout the USA. In an effort to provide a service to all members of the geologic community, AIPG is qualified to award and does award CEUs for attending of these continuing education activities.

The 2010 AIPG meeting/convention for example, consists of numerous options for 30 or more contact hours between the technical program and the informative and educational geologic and hydrologic oriented field trips. Depending upon the organization or licensing authority for which the CEUs are reported, the practitioner is able to obtain a certificate attesting to the number of contact hours, or in lieu of a certificate, some administering authorities accept reporting on the honor system. Either way, the attendee benefits from the interchange with experts in the respective technical subjects offered.

Note that as a general rule-of-thumb, a single contact hour (PDH) is equivalent to 0.1 CEU. This may vary by jurisdiction, but should satisfy most requirements.

Because each jurisdiction, particularly the states, but also professional certifying bodies and societies establish unique CPD requirements, a given educational program may require tailoring to a specific jurisdiction. AIPG is gradually developing its offerings to satisfy CPD requirements for those states with licensure maintenance standards. Currently, AIPG offerings satisfy the programmatic requirements for these states: Alabama, New Hampshire, Pennsylvania, South Carolina, and Texas.

The rationales for CPD, regardless of the oversight group may include licensure maintenance; assurance that the practitioner will remain current with technical, legal, and regulatory developments in his particular field of endeavor; professional curiosity; satisfaction derived from achievement; employer requirements; and even opportunities to interact with fellow practitioners outside the normal workplace.

Please contact AIPG headquarters for further information on the ongoing efforts to create more options for self-directed professional development.

Plan to Attend the
2010 Annual Meeting Orlando, Florida
September 11-15, 2010

Online Course: Geotechnical Properties and Engineering Problems of some of the North Central Texas Clay-Shales – Regional Geology Case History Series

- Cretaceous shales in the north-central Texas area give rise to engineering problems. This online short course covers:
  - Regional geologic setting, structure and stratigraphy.
  - Specific material geotechnical properties including:
    - Clay mineralogy, values of Atterberg limits and indices, potential volume change, shear strength, etc.
  - Engineering problems and solutions concerning:
    - Accurate shear strength determination as dictated by field conditions, mass wasting, swell pressures and more.

Robert Font, PhD, CPG, PG, EurGeol – Author
Geoscience Data Management

AIPG Accredited! 0.5 CEU

www.geodm.com
www.aipg.org
My Favorite Frauds

My article in the May TPG prompted Peter Dohms, CPG-07141, to write, “Your article on ‘My Favorite Frauds’ triggered both personal and heritage memories for me.

The ‘heritage’ memories arise from the experience of my grandfather, Franklin G. Pardee, who was the State Geologist for Michigan in the early 1950s (before he retired for the first of 3 times). In my personal collection I have the typed manuscripts of two lectures he gave in the 1930s and 1940s based on his experiences with the Michigan Blue Sky Commission (the one is titled, ‘Michigan’s Mythical Gold Mines’). He entertained his audiences with tales of some of the mining frauds he encountered—his favorite was the ‘micronic gold’ scam (gold too finely divided to be detected using standard fire assay techniques; there was always a ‘secret’ assay method involved), and some of the stories were downright hilarious.

‘Personal experience—when I was a mineral exploration geologist with New Jersey Zinc out of Tucson in the late 1960s, my former boss and I were conducting reconnaissance in the Henry Mountains of south-central Utah and we stumbled upon a little exploration camp where a tunnel was being driven. Sure enough, the claim was ‘micronic gold’—I kept my mouth shut [being the ‘junior’ geologist], my boss was polite and we went on our way. Driving back south I told him of my grandfather’s experiences in the 1930s and he agreed there was nothing new under the sun.

“The other one I remember vividly was in the mid-1980s—I was a consulting geologist by this time, working on the Mother Lode, and a gentleman walked into our office one day. Turned out he had been approached to invest in a gold-platinum exploratory play on the east side of the Sierra Nevada Range. To make a long story short, we flew over, and I was introduced to the promoter and the property. It comprised about 1,000 acres where the Rest Springs Shale cropped out. The promoter claimed that the gold and PGMs could only be detected if the fire assay analysis included inquartation (fire assay and ‘industry-accepted’ inquartation fire assay methods failed to find even ‘other 1 mg’ was the source of the 1 opt assay values he was brandishing. My samples, run using both standard fire assay and ‘industry-accepted’ inquartation fire assay methods failed to find even ‘crustal abundance’ of gold or PGMs. I told my client to sit on his wallet, but had to field a phone call from the irate promoter.”

Dohms’ reminiscences reflect experiences similar to mine. Our stories are by no means unique. In 1941, Jay A. Carpenter, Director of the Nevada Bureau of Mines and Geology published “An Investigation as to the Presence of Commercial Quantities of Mercury and Gold in the Dry Lakes of Nevada” (University of Nevada Bulletin 35, renumbered as Nevada Bureau of Mines Bulletin 35, 20 p.), which covered many of the same problems with “micronic” gold. Given the current high prices of precious metals, I expect that similar scams are coming out of the woodwork.

Dohms sent me Franklin G. Pardee’s two manuscripts on gold frauds in the lower peninsula of Michigan. “He and I edited them and submitted them as another article in the “Looking Back” series, “Michigan’s Mythical Mines” that appears elsewhere in this issue.”

Justice—what’s the right thing to do? A review and reflection

“With freedom and justice for all” (Pledge of Allegiance), “If you want peace, work for justice” (bumper sticker). Justice is one of those topics such as the weather and integrity that is frequently discussed, generally without a great deal of understanding of the details of what is really meant. Heal the sick, feed the hungry, assist the poor, end ethnic-gender-etc. discrimination, and many other worthy causes fall under the umbrella of “working for justice.” Fine, but what specifically should be done in any particular case? The debates and disagreements are in the details of what specifically is being or should be done to promote justice in particular cases.

C.S. Lewis points out that justice in the sense being discussed means fairness. And there are two types of fairness justice, individual justice and collective, corporate, or social justice. Individual justice applies to individual cases. In the advertising phrase of one local personal

1. The average prices for the period January 1, 2010 through August 5, 2019 were: gold $1,159.26, silver $17.69, platinum $1,587.45, and palladium $466.55 (from Kitco.com).
injury firm, “Justice for victims begins here.” Respecting the dignity of each person is another form of individual justice.

In *Justice—what is the right thing to do?* (2009, Farrarm Straus & Giroux), Michael J. Sandel’s concern is with social justice, justice as applied to society in general whether on a community, national, or worldwide level. Morality and ethics generally are thought of in terms of individual decisions concerning what to do as discussed for example by Bernard Gert in *Common morality—deciding what to do.*

But morality and ethics can also be discussed in collective, corporate, or social terms. But modern discussions of social justice frequently attempt to avoid moral questions because of a desire not to impose a particular version of morality on those who do not share the religious, moral, or philosophical position of those advocating a particular social justice position, which is viewed as a desirable goal in a diverse and inclusive society.

Sandel disagrees with this avoidance of moral issues in considering social justice questions, but this is getting to the end rather than the beginning of Sandel’s discussion of social justice.

Sandel describes four basic philosophical approaches to social justice: utilitarianism, libertarianism, equalitarianism, and cultivation of virtue and the common good (the teleological approach). I should note that Sandel groups libertarianism and equalitarianism together as will be explained later. However, since each concept is developed separately, I'll keep them separate for the moment.

**Utilitarianism** is based on the principle that social justice should be based on concepts and programs that seek to do the greatest amount of good for the most people while reducing the amount of harm imposed on those adversely affected to the lowest amount possible in terms of both numbers of people adversely affected and the amount of adverse impact. The Robin Hood approach of stealing from the rich to give to the poor is one example. Progressive income tax rates are a modern example of the same principle. A flat-rate 10% income tax results in more adverse impact on those with low incomes compared with those with high incomes. Because there are more low income people than high income people, progressive income tax rates benefit more people.

Medical care for the terminally ill is another area where utilitarian ideas provide a philosophical basis for one approach. The costs of providing medical care to the terminally ill in their last months of life frequently greatly exceed all the medical costs the person has incurred prior to that time. It is also true that medical resources, physicians, nurses, medical equipment, hospital beds, etc. are in limited supply. Is it not better to use these medical resources and the money required to employ them on those for whom recovery is possible? Isn’t society better off if the terminally ill are kept comfortable but not are not kept alive through the use of scarce and expensive medical technology that will only prolong life for a short time? Living wills and “Do not resuscitate” (DNR) orders that direct that such “heroic” life saving and sustaining measures not be used are increasingly popular and reflect concern about this issue. While living wills and DNR orders are individual choices, their use can be collectively urged.

Strict application of the utilitarian approach attempts to reduce all social issues to a cost-benefit analysis in which a common denominator, usually monetary, is used to rank the various alternatives. In the case of progressive income taxes the issue is how to reduce the economic impact of taxation for the most people. Likewise, for the terminally ill the issue is how to best allocate scarce resources and their benefits, again usually on the basis of cost. The problem with the utilitarian approach is that it fails to adequately address such moral questions as human rights and the value and quality of life. While quality of life issues are frequently debated in discussions about the terminally ill, there remains a strong utilitarian underpinning to the basic idea that scarce medical resources should be reserved for those for whom the most good can be done, again usually based on a monetary common denominator using a variety of cost-benefit analyses.

**Libertarianism** as used by Sandel does not refer to the Libertarian political party but rather to a philosophy based on the idea that each of us has the right to choose what we want to do, including deciding what to do with what we own, provided that we respect everyone else’s right to do the same. Thus individual rights and choices are paramount and should be as little infringed on by laws and the government as possible. Those adopting the libertarian approach favor the following positions, some of which you probably agree with and others you don’t:

- **Income rates should be equal for all.** Wealth redistribution through progressive income tax rates interferes with the individual’s choice of how to spend his or her money. Stealing from the rich to help the poor is still theft.
- **Charity is an individual choice regarding both which charities to support and the level of support.**
- **There should be no paternalistic laws such as those requiring the use of seat belts, child car seats, or motorcycle (or bicycle) helmets.** Whether to use these safety devices should be a matter of individual choice.
- **There should be no morals-based laws—reproductive decisions (abortion, surrogate mothering), prostitution, and homosexuality are no one else’s business.**

Libertarianism supports the free market approach. However, Sandel questions how free markets really are and uses the draft versus an all-volunteer approach for filling the military’s enlisted ranks as an example. Military drafting was first done in the US during the Civil War. However, the Civil War draft provided that a draftee could avoid service by either providing a substitute (who was presumably paid something by the person avoiding the draft) or by paying a set fee to the government. While such draft avoidance options were not allowed during the Vietnam conflict, many were able to defer the draft by obtaining student waivers. Currently, the US has an all-volunteer military supported by signing bonuses, higher salaries, the GI educational benefits, etc. Morally, the all-volunteer approach in which the government rather than individuals pays the benefits of joining the military is essentially the same as the Civil War approach. This approach is also similar to paying mercenaries to join the military. Indeed non-US citizens who enter the country legally and join the military are provided with an expedited means of gaining citizenship. Currently, the enlisted ranks for those aged 18 to 24 come primarily from the middle to upper lower income levels in the US.

---

Those from rural communities have a significantly higher percentage in the military than in the overall population. Those from the lowest economic levels are not represented and are frequently rejected for service because they don’t meet the educational requirements. The result is that the younger enlisted ranks do not reflect the overall US population. Sandel asks why military service for one’s country should be different from mandatory jury service that seeks to reflect the average of the community (at least in theory)?

Sandel points out that because libertarianism recognizes individual rights, it avoids the first of the problems with the utilitarian approach, which doesn’t recognize rights, but it does suffer from the sample lack of concern for the value and quality of life issues.

**Equalitarianism** is an approach championed by John Rawls. Rawls believes that social justice ought to stem from the principles we would agree to in a situation where everyone is initially equal. He believes that two fundamental principles would emerge. The first is the recognition of individual rights (free speech, religious freedom, etc.) and general social and economic equality. Rawls recognizes that those with exceptional talents that are socially desirable would be allowed to earn more than the average person but there would be limits on the amount of additional compensation and “excess” compensation would be taxed in order to provide the basics of social and economic equality in such things as housing, medical care, educational opportunity, etc. for everyone. Equalitarianism seeks to redress past inequalities such as slavery, poverty educational opportunities, inherited wealth or lack thereof, etc. Equalitarianism focuses on the basic respect and value each individual has and suggests that everyone should be entitled to at least a “just” or fair amount of income to reflect each individual’s worth. Just how adequate and allowable additional compensation are determined is left to truly impartial decision makers.

The problem with equalitarianism is its failure to fully define the principle or procedure to be used for deciding, once and for all, whatever distribution of income, power, or opportunity result from the defined principle or procedure. As with libertarianism, equalitarianism recognizes individual rights and the fact that individual talents differ. It likewise fails to address a number of important values or moral issues that are important for a just society, in particular communal values.

The **Teleological** approach is the third of Sandel’s major philosophical approaches for deciding questions of social justice (when libertarianism and equalitarianism are considered together). The teleological approach was advocated by Aristotle who asked, “What is the basic purpose of a particular institution or organization?” Who has the best or fittest claim to use a particular resource? Should not the best musician be provided with the best quality musical instrument? The teleological approach asks, “How is justice distributed?” Is justice distributed to the “deserving,” whatever “deserving” is determined to mean in a particular situation or is it available to everyone equally?

Deciding on the fundamental purpose of something has important consequences. For example, if the purpose of the university is to educate the brightest students, then university admissions should be strictly based on high school grades, standardized tests, and similar predictors of expected academic performance. But if the purpose of the university is also to educate and provide leadership training of students representing the diversity of society so that society’s leaders reflect society’s diversity, then additional criteria regarding ethnicity, economic status, geographic diversity, gender, and similar factors should be included in the admissions decision process. Therefore an applicant who brings some diversity factors to the university may be admitted over an applicant with a higher grade point average and standardized test scores.

Sandel uses the example of workers in a large chicken processing plant to contrast the libertarian, equalitarian, and teleological approaches to justice. The libertarian views the jobs of the workers as just if there was a freely agreed upon exchange of labor for compensation (wages and benefits). The equalitarian asks that there not only be an agreed upon exchange of labor for compensation but also insists that the workers come from a background of free and equal social conditions. The teleological approach asks if the workers are suited for the tasks they are being asked to perform. If the tasks are demeaning for the workers or are otherwise unsuitable, then the task is unjust regardless of the compensation offered or the equality of social conditions.

Sandel notes that the libertarian, the equalitarian, and the teleologist all focus on individual rights and freedom and recognize of the value of individuals. However, these approaches do not consider communal obligations such as loyalty to family, community, state, nation, or other groups. Communal obligations are those of the group rather than the individual. Does a community have a responsibility to take care of its sick? If the fans of a sports team trash an opponent’s stadium, shouldn’t the sports team and its fans be responsible for clean-up and repairs? When a group acts unjustly, are all members of the group, and even their descendants responsible for the injustice? For example, are Japanese or German citizens born after 1945 responsible for the atrocities committed by Japan and Germany during World War II? Are living white Americans collectively responsible for slavery or the ill treatment of Native Americans during the 19th century, including those whose ancestors never owned slaves and who may have condemned the practice or whose forbearers did not come to the US until the 20th century?

Sandel argues that there are three sources of responsibility for social justice.

1. **natural duties and rights that do not require consent such as the duty to respect the rights of others;**
2. **voluntary obligations that require the consent of those accepting responsibility;** and
3. **obligations of solidarity arising from belonging to a particular group, which also do not require the consent of the individual members of the group—examples include familial obligations, patriotism, and obligations arising from membership in a particular religious denomination.**

Sandel also argues that religious and moral questions cannot be removed from important questions about social justice. Debates about issues such as abortion, gay rights, and embryonic stem cell research inherently result from particular religious and moral views. Resolution of such issues cannot occur without consideration of the underlying religious and moral positions advocated by those on both sides of the issue. For example, one’s views on abortion ultimately rest on one’s views about when human life begins. If one believes that human life begins at the moment of fertilization of an egg by a sperm cell creating a zygote,
then induced abortion is murder. If one believes that human life begins at some later time, for example, when the fetus is capable of living outside the womb or when a new-born takes its first breath, then abortion prior to that time is not murder.

The purpose of marriage lies at the heart of the current debate over whether marriage should be restricted to the union of a man and woman or be opened to unions of same-sex couples. If, as is argued, that the purpose of marriage is the procreation and raising of children, then the restriction of marriage to a man and woman makes some sense. However, because marriage is allowed between older men and women who are beyond procreation age, the argued restriction loses its foundation. Marriage clearly has purposes other than procreation and the raising of children including mutual affection and support, purposes for which the gender of those to be married is irrelevant. While the “purpose” of marriage is framed as a teleological debate, one’s underlying views are usually based on religious or moral beliefs.

If marriage were strictly a religious ceremony, then debates about who should be married would be matters addressed by each denomination. However, marriage is also recognized under civil law and carries with it various civil law rights of inheritance, property ownership, parental rights, etc. There are three solutions to the civil law marriage issue.

1. Marriage is restricted to unions between a man and woman, which is the current situation in most jurisdictions and which is deemed unjust by the gay community.
2. Marriage between two people regardless of gender is permitted in civil law.
3. Marriage is no longer recognized under civil law. Instead civil unions are recognized means through which the rights currently granted by marriage are granted. Marriage then becomes a religiously recognized ceremony only.

Sandel concludes that questions of justice are invariably judgmental questions regardless of whether the topic is bailouts of financial institutions, welfare policies, affirmative action, gay rights, abortion, etc. These questions are inevitably bound up with competing views of honor, virtue, pride, recognition, etc. “Justice is not only about the right way to distribute things, it is also about the right way to value things.”

Because, as Bernard Gert points out,4 moral people disagree on the relative ranking of moral values, morality cannot solve all questions of either morality or how social justice should be distributed. While Sandel identifies the limitations of the utilitarian, libertarian, egalitarian, and teleological approaches to social justice, arguments based on each of these philosophical approaches continue to be advocated for the solution of particular social issues. Such solutions may have particular applicability to a particular issue. But because judgments about values and the ranking of competing values ultimately underlie social justice questions, there will continue to be irresolvable debate on the resolution of social justice questions. A particular resolution may be adopted, but not everyone will agree with it. This is why taking action on so many social justice issues is so difficult. These difficulties are compounded because when most social justice issues are considered in any depth, a number of differing, often competing, issues are involved.

It’s easy to say, for example, feed the hungry. But how? No one has the individual resources to feed everyone who is hungry. Collectively, there are a variety of government welfare programs, private food banks, homeless shelters, etc. engaged in feeding various segments of the hungry population. Which should one support? What qualifications, if any, should recipients have? The more one looks at the issue, the more complications arise and so do debates about particular decisions. What is the right thing to do? Finally, one decides where one should devote one’s money, time, and talents towards the goal of feeding the hungry.

But what about working for a cure of a particular type of cancer or some other disease, or working for the rights one of a number of oppressed groups, or educational reform, or immigration issues, etc. None of us can do everything. We pick and choose, making individual choices about the relative importance of various social justice issues and which and how we individually will contribute to them. Our diverse decisions result in something being done for all issues but there are no universally correct choices.

Not All Sinkholes are Equal

William J. Stone

Ground-water recharge is not uniform across a region, but varies with the landscape setting. For example, areas with soil or granular rock at the surface experience greater recharge than areas where bare unfractured crystalline rock crops out. Also, depressions, where water stands, permit greater recharge than slopes on which water quickly runs off. Sinkholes are a type of depression that collects runoff, and because they form in fractured rock, they are ready conduits for recharge.

Sinkholes were one of the landscape settings encountered during a ground-water recharge study I was involved in beside the River Murray in South Australia. It was correctly assumed in regional hydrologic studies that these features are good recharge sites. In fact, modelers had determined the total area they represented and used that to calculate a recharge volume.

But there seemed to be two populations of sinkholes. Most were large, old, and seemingly plugged. The rest were small, younger (some are still forming today) and more permeable. Often the young sinkholes occur within the old sinkholes.

An examination of the local geologic column suggested two phases of karst development was responsible for the different types of sinkholes. The initial phase probably occurred while the water table was high, before the River Murray had fully cut its valley. At this time, a shallow gypsum bed would have been the focus of karst activity. Since the gypsum resulted from evaporation in isolated lakes, the bed was discontinuous and bodies were large and irregular in shape. The second phase presumably came when the valley was cut deeper and the water table followed, dropping below the level of the gypsum. At this time, karst processes centered on the underlying limestones. These sinkholes are smaller and more regular in shape.

This is not just a clever bit of geologic detective work or interesting geomorphic trivia, it is the key to coming up with a more accurate water balance for the area. Because only the small, young sinkholes contribute significantly to recharge, using the total area of all sinkholes results in an overestimation of recharge. The area and recharge volume for the younger depressions had to be determined separately. Tip: A sinkhole is not just a sinkhole.

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 by e-mail: wstone04@gmail.com.

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.
Johnny Horton was playing in my head as I landed in Juneau in early June to begin two weeks of fieldwork for my senior thesis (Independent Study, I.S., it is formally called—a big deal at The College of Wooster). Another reason why I love geology: we get to go to SWEET places! Though my work didn’t involve chipping away at outcrops, there was a lot of climbing involved (devil’s club, *Oplopanax horridus*, is very appropriately named) and I learned a lot about glacial geology. The purpose of the project I’m working on is to unravel the glacial history of Glacier Bay and to develop a tree-ring chronology for the area. My part specifically deals with trees from glacial refugia—patches of forests that were above the trim line of the most recent glaciers, hence the climbing.

In the midst of doing my fieldwork, as well as that for other parts of the larger project, I took the opportunity to begin grad school discussions with my advisor. This is a pretty daunting topic for me, as I know is the case for others at this stage of the game (it is a daily topic of conversation among my friends). It seems to require knowing what you want to do with your life…not something I’ve been able to make up my mind about. His laid back attitude about it was a stark contrast to my biology advisor’s (an observation that I feel could probably be taken as a generalization of their respective fields) and even more so to the advisors of my chemistry friends (again, a likely characteristic of the field). My thoughts were complicated by the experience of an ‘01 Wooster alum, a high school teacher, who was with us—after getting her masters she was considered “overqualified” for jobs she applied for, which is something I’m still having trouble understanding. So, not only do I need to prepare myself for the various career paths I can see myself taking, but I need to make sure to not get too much preparation, in case I become overqualified for something I want to do? That’s comforting.

While this process seems daunting now, I know things will become clearer as I go…hopefully. Upon returning to Wooster, I helped out with a summer orientation program, which reminded me of the process I went through to end up here. Though it simultaneously seems like yesterday and a lifetime ago that I was an overwhelmed, wide-eyed freshman having just gone through that dreaded college search, I remember vividly how my plans melded from not having any idea in the beginning of my search to confidently declaring my majors at the end of my freshman year (which is early for Wooster). However, there seem to be a lot more decisions to make for grad school—not only the where and what, but who, what degree (Masters or PhD?), how long (can it really take 7 years?), when (work first, or dive straight in?), and how (external fellowships, NSF GK12, or TA?), among others. It also seems so much more final. In the past few years I’ve been able to take the approach of “I’ll do this now, see where it takes me, and then actually figure things out for grad school,” which no longer seems like a viable option.

Alaska was a good place for this reflection. Glacier Bay National Park, which is where our research was centered, seems to be a mecca of sorts for various kinds of research. The USGS folks we were housed with were studying the impacts of sea otter population growth on prey populations (which somehow also involved fishing…wild king salmon is amazing!). There were bear people, whale people, historians, naturalists, and, of course, us crazy geologists hiking to tree-line and scouring the shores for wood. The park headquarters had shelves of books about everything Glacier Bay-related, from invasive plants to glacial advances to native histories. Though it was only two weeks, I was given a good taste of fieldwork and was able to observe it in its various forms—good insight to have when thinking about grad school. Now comes the decisions—how many devil’s club thorns can I take?
NGWA 2010 Ground Water Expo and Annual Meeting in Las Vegas promises to be big show.

(Westerville, OH—August 10, 2010) The groundwater industry’s premier event heads back to Las Vegas with the National Ground Water Association’s Ground Water Expo and Annual meeting on December 7-10. Early registration ends November 5.

Concurrent with the Expo and Annual Meeting is NGWA’s Petroleum Hydrocarbons and Organic Chemicals in Ground Water: Prevention, Detection, and Remediation® Forum on December 9. Registration for the forum includes registration to the Expo.

NGWA’s Ground Water Expo attracts on average more than 5,000 groundwater professionals from throughout the industry. The average market segment breakdown is:

- 50 percent groundwater contractors
- 24 percent manufacturers
- 14 percent suppliers
- 8 percent groundwater scientists and engineers
- 4 percent miscellaneous

The Expo show floor will be open a total of 12 hours over December 8-9 with hundreds of manufacturers and exhibitors putting the latest equipment and technology on display.

In addition to kicking off the 2011 William A. McEllhiney Distinguished Lecture Series in Water Well Technology, attendees will have an opportunity to see the last presentation of the 2010 Henry Darcy Distinguished Lecture Series in Ground Water Science.

More than 70 other educational offerings will be provided, including:

- Consider Getting into Geothermal Drilling? It’s More than a Hole in the Ground
- Designing More Effective Well Systems
- Fleet Safety: Preventing Common Water Well Driller Fleet Accidents
- How the New Tax Laws Will Affect You
- Impacts of Shale and Coalbed Gas Extraction on Groundwater
- Improving Well Pumping System Efficiency
- The 21st Century Contractor
- Profit Mastery: The Most Important Thing to Do Now!
- Challenges to Exempt Wells: An Update

To learn more about the Expo, as well as the many other NGWA educational programs, visit www.ngwa.org and click on the “Events/Education” tab or call 800-551.7379 (614 898.7791).

Phil Brease, CPG-09296, Star of Denali’s ‘Charismatic Megafauna’ by Cass Ray.

Park Geologist for 24 Years is Remembered as ‘Epitome of a Public Servant’

Phil Brease was the “main source of knowledge about geology here for so many years that it’s hard to imagine not having him here,” noted his longtime colleague, wildlife biologist Tom Meier. To Paul Anderson, superintendent of Denali National Park and Preserve in Alaska, Brease was “the epitome of a public servant.” The park geologist for twenty-four years will be remembered, added Anderson, as “the public face of the park’s science and research program—and for how he touched so many people.”

Brease “shaped countless young lives,” recalled Pam Sousanes, Denali environmental specialist, and her husband, Ken Karle, a hydraulic engineer. They cited “everyone from the seasonal technicians he encouraged to the volunteers and interns he mentored to the hundreds and hundreds of students he inspired.” Brease somehow managed to make “geology fans” of “the most unsuspecting listeners,” noted Guy Adema, Denali physical scientist and glaciologist and Brease’s supervisor.

Steve Martin, former park superintendent in Denali and now superintendent at Grand Canyon, praised Brease’s “dedication to his work, the park, the park service, park visitors, and his communities.” Opined Linda Stromquist, coordinator of the park service’s regional paleontology program and of its abandoned mineral land program, and Brease’s colleague for many years, “Of all the ‘charismatic megafauna’ found in Denali National Park and Preserve, Phil Brease was the star.”

Brease, 61, died on May 12, while leading students on a hike in Healy, Alaska. A celebration of his life at the Denali Visitor Center on May 21 drew hundreds of friends, colleagues, neighbors, and acquaintances.

Namesake of a Devonian Brachiopod

What Brease called his “long and unstable slope” toward Denali began after his graduation from Central Washington University. Among the many venues for his professional adventures were Washington’s Wenatchee National Forest, Idaho, the North Slope, and Glennallen. Some of his fondest memories were of designing and building sections of the Pacific Crest Trail in Washington’s Cascade Mountains.

In 1986 Brease became park geologist in Denali, and, as he later recalled, the job eventually evolved to include mining claim administrative duties, geologic mapping, geotechnical applications, establishing a glacier monitoring program, studying water and soil resources, and geo-educational outreach. He evaluated landslides and slumps, designed the park’s first roadside trail, and pursued paleontological investigations. In 1996 a newly discovered fossil, a Devonian brachiopod, was named in his honor, Myriospirifer breasei. As noted by Anderson, anyone who received an e-mail from Brease the past fourteen years probably is no stranger to that signature, “breasei.”

The namesake of that brachiopod also taught several field courses on local
geology and paleontology, and, as Meier recalled, even taught a night course at the park on geology. “Field trips with Phil were accompanied by music and his humble, good-natured approach to challenges, and of course always were punctuated by Phil’s wry sense of humor,” noted Stromquist. “He managed to find the irony in every situation.”

Brease and Meier “both came to the park in 1986—he stayed, I went away for a while,” recalled Meier. “When I came back, I was amazed at all that had been done in clearing up the mining claims in Kantishna. It sounded like Phil had spent a lot of time in court and had come up with a lot of money to buy out claims, in addition to all of the reclamation work that had gone on.” Brease was a “brilliant witness for the park service during the trials for mineral claims” in Denali, noted Stromquist, recalling that the regional solicitor who litigated the cases “felt Phil’s testimony was responsible for favorable verdicts for the park service.”

What Phil was doing was unchartered territory, and Phil accomplished the task.” Anderson recalled that Brease “garnered respect, support, and cooperation in achieving the park mission from broad and diverse segments of park users, from Kantishna miners and resource professionals to co-workers, university faculty, and students of all ages and disciplines.” The park superintendent cited Brease’s passionate devotion to “better understanding and protecting this special place for all Americans today and for all those generations to come.” With his “unwavering enthusiasm for geology, for the park, and for science,” noted Anderson, Brease “inspired us all to greatness.”

Brease also was the backbone of the Water, Air, Geology, and Soils (WAGS) branch of the natural resources program in Denali, noted Sousanes and Karle. Geology, that “G” in WAGS, may have been Brease’s chief passion, they added, but his interests were far-reaching and covered all aspects of the world of physical science. Brease was “a scientist in the truest sense of the word,” they noted, “always mapping, always measuring, and always asking more questions. From glaciers to earthquakes to fossils to dirt, he had his hands in it all.”

Speaking at the celebration of Brease’s life, Anderson noted that Brease “was a thread in the fabric of the park, which is made up of its natural and cultural resources and all those who work to gain more knowledge of what is here, educate others about its significance, and protect it for the future. Phil’s thread has broken, leaving a gap in that fabric. The fabric is still whole, and it will continue to function. Over time it will mend, but it will never be like it was before.”

‘Big Shoes to Phil’ and an Extraordinary Spirit of Generosity

Adema, Brease’s supervisor, noted that Brease’s “love of life” left “a legacy that will continue to inspire,” and, reflecting the eyebrow-raising puns so beloved by Phil Brease, couldn’t resist adding that Brease “left big shoes to Phil.” Brease is survived by his wife, Barbara, his daughter Ana, both also Denali employees, his daughter Emily, and son Michael.

If I, a co-worker of Phil’s for four and a half years, may be allowed a personal note, I, like so many others, am such a fan of all the musical Breases that I consider their considerable talents to be gifts to all of us. Hence, a year or two ago, when I discovered Sinatra’s version of the exquisite Sammy Cahn/Jimmy Van Heusen ballad, “All My Tomorrows,” I immediately suggested to Phil and Candace Mudge, his daughters’ music teacher, that the song might prove perfectly suited to his daughter Ana’s lovely, expansive style of singing. I handed off the Sinatra CD to Phil, and it may have been a year or more before I saw it again. The morning after Phil died, as I drove to the park, the tune came on my ipod: “Right now it may not seem like spring to all/We’re drifting and the laughs are few/But we’ve got rainbows planned for tomorrow/And all our tomorrows belong to the park, the tune came on my ipod: “Right now it may not seem like spring to all/We’re drifting and the laughs are few/But we’ve got rainbows planned for tomorrow/And all our tomorrows belong to you.” There’s no one who met Phil that did not benefit from the man’s extraordinary spirit of generosity, and for that, all of us always will be grateful.

IN MEMORY

Phillip F. Brease
CPG-09296
Member Since 1994
May 12, 2010
Healy, Alaska

Randall S. Luwe
CPG-07497
Member Since 1988
July 11, 2010
Kenner, Louisiana

IN MEMORY

Phillip F. Brease
CPG-09296
Member Since 1994
May 12, 2010
Healy, Alaska

Randall S. Luwe
CPG-07497
Member Since 1988
July 11, 2010
Kenner, Louisiana

IN MEMORY

Phillip F. Brease
CPG-09296
Member Since 1994
May 12, 2010
Healy, Alaska

Randall S. Luwe
CPG-07497
Member Since 1988
July 11, 2010
Kenner, Louisiana

IN MEMORY

Phillip F. Brease
CPG-09296
Member Since 1994
May 12, 2010
Healy, Alaska

Randall S. Luwe
CPG-07497
Member Since 1988
July 11, 2010
Kenner, Louisiana

IN MEMORY

Phillip F. Brease
CPG-09296
Member Since 1994
May 12, 2010
Healy, Alaska

Randall S. Luwe
CPG-07497
Member Since 1988
July 11, 2010
Kenner, Louisiana

IN MEMORY

Phillip F. Brease
CPG-09296
Member Since 1994
May 12, 2010
Healy, Alaska

Randall S. Luwe
CPG-07497
Member Since 1988
July 11, 2010
Kenner, Louisiana

IN MEMORY

Phillip F. Brease
CPG-09296
Member Since 1994
May 12, 2010
Healy, Alaska

Randall S. Luwe
CPG-07497
Member Since 1988
July 11, 2010
Kenner, Louisiana

IN MEMORY

Phillip F. Brease
CPG-09296
Member Since 1994
May 12, 2010
Healy, Alaska

Randall S. Luwe
CPG-07497
Member Since 1988
July 11, 2010
Kenner, Louisiana

IN MEMORY

Phillip F. Brease
CPG-09296
Member Since 1994
May 12, 2010
Healy, Alaska

Randall S. Luwe
CPG-07497
Member Since 1988
July 11, 2010
Kenner, Louisiana

IN MEMORY

Phillip F. Brease
CPG-09296
Member Since 1994
May 12, 2010
Healy, Alaska

Randall S. Luwe
CPG-07497
Member Since 1988
July 11, 2010
Kenner, Louisiana

IN MEMORY

Phillip F. Brease
CPG-09296
Member Since 1994
May 12, 2010
Healy, Alaska

Randall S. Luwe
CPG-07497
Member Since 1988
July 11, 2010
Kenner, Louisiana

IN MEMORY

Phillip F. Brease
CPG-09296
Member Since 1994
May 12, 2010
Healy, Alaska

Randall S. Luwe
CPG-07497
Member Since 1988
July 11, 2010
Kenner, Louisiana

IN MEMORY

Phillip F. Brease
CPG-09296
Member Since 1994
May 12, 2010
Healy, Alaska

Randall S. Luwe
CPG-07497
Member Since 1988
July 11, 2010
Kenner, Louisiana

IN MEMORY

Phillip F. Brease
CPG-09296
Member Since 1994
May 12, 2010
Healy, Alaska

Randall S. Luwe
CPG-07497
Member Since 1988
July 11, 2010
Kenner, Louisiana

IN MEMORY

Phillip F. Brease
CPG-09296
Member Since 1994
May 12, 2010
Healy, Alaska

Randall S. Luwe
CPG-07497
Member Since 1988
July 11, 2010
Kenner, Louisiana

IN MEMORY

Phillip F. Brease
CPG-09296
Member Since 1994
May 12, 2010
Healy, Alaska

Randall S. Luwe
CPG-07497
Member Since 1988
July 11, 2010
Kenner, Louisiana

IN MEMORY

Phillip F. Brease
CPG-09296
Member Since 1994
May 12, 2010
Healy, Alaska

Randall S. Luwe
CPG-07497
Member Since 1988
July 11, 2010
Kenner, Louisiana

IN MEMORY

Phillip F. Brease
CPG-09296
Member Since 1994
May 12, 2010
Healy, Alaska

Randall S. Luwe
CPG-07497
Member Since 1988
July 11, 2010
Kenner, Louisiana

IN MEMORY

Phillip F. Brease
CPG-09296
Member Since 1994
May 12, 2010
Healy, Alaska

Randall S. Luwe
CPG-07497
Member Since 1988
July 11, 2010
Kenner, Louisiana

IN MEMORY

Phillip F. Brease
CPG-09296
Member Since 1994
May 12, 2010
Healy, Alaska

Randall S. Luwe
CPG-07497
Member Since 1988
July 11, 2010
Kenner, Louisiana

IN MEMORY

Phillip F. Brease
CPG-09296
Member Since 1994
May 12, 2010
Healy, Alaska

Randall S. Luwe
CPG-07497
Member Since 1988
July 11, 2010
Kenner, Louisiana

IN MEMORY

Phillip F. Brease
CPG-09296
Member Since 1994
May 12, 2010
Healy, Alaska

Randall S. Luwe
CPG-07497
Member Since 1988
July 11, 2010
Kenner, Louisiana
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.

**ONE YEAR LISTING FOR ONLY:**

<p>| | |</p>
<table>
<thead>
<tr>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>AIPG Member</td>
<td>$300.00</td>
</tr>
<tr>
<td>Non-Member</td>
<td>$400.00</td>
</tr>
</tbody>
</table>

*Space can be increased vertically by doubling or tripling the size and also the rate.*
## AIPG MEMBER APPLICATION

**American Institute of Professional Geologists Membership Application**

New Member Dues (Membership is activated upon receipt of dues.)
If you apply Dec-Mar = $100  Apr–Jun = $75  Jul-Sept = $50  Oct-Nov = $25

<table>
<thead>
<tr>
<th>Last Name:</th>
<th>First Name:</th>
<th>MI:</th>
<th>Suffix:</th>
</tr>
</thead>
<tbody>
<tr>
<td>Employer Name:</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Preferred Mailing Address:</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Street:</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>City:</td>
<td>State:</td>
<td>Zip:</td>
<td>Country:</td>
</tr>
<tr>
<td>Work Ph:</td>
<td>Home Ph:</td>
<td>Fax:</td>
<td></td>
</tr>
<tr>
<td>Email:</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Geological Degree:</td>
<td>BA</td>
<td>BS</td>
<td>MA</td>
</tr>
<tr>
<td>ATTESTATION:</td>
<td>I attest that I meet the requirements for AIPG Member (30 semester hours/45 quarter hours for Member) and agree to abide by AIPG Bylaws and Code of Ethics.</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

**Applicant Signature:**

**Date:**

**AIPG Mbr Sponsor**

**Signature (Required):**

**AIPG #:**

**Date:**

**HEADQUARTERS USE ONLY**

| Amt: | Date Rcvd: | Mbr #: |
### STUDENT APPLICATION FORM

American Institute of Professional Geologists Student Membership Application

If applying between November 1 and June 30, the application fee is $20; if applying after June 30, the fee is $10.

<table>
<thead>
<tr>
<th>Last Name:</th>
<th>First Name:</th>
<th>MI:</th>
<th>Suffix:</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>School Name:</th>
<th>Undergraduate □ Graduate □ Doctoral Candidate □ Birth Year:</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Preferred Mailing Address:</th>
<th>□ Home □ School</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Street:</th>
<th>City:</th>
<th>State:</th>
<th>Zip:</th>
<th>Country:</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>School Ph:</th>
<th>Home Ph:</th>
<th>Fax:</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Email:</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
</tr>
</tbody>
</table>

**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.

<table>
<thead>
<tr>
<th>Applicant Signature:</th>
<th>Date:</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Print Faculty Sponsor Name:</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Faculty Sponsor’s Signature (Required):</th>
<th>Date:</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>HEADQUARTERS USE ONLY</th>
<th>Amt::</th>
<th>Rcvd:</th>
<th>Mbr #:</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
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.

*Due to the availability of AIPG’s online directory, new member address information will no longer be printed in TPG. If you need assistance locating this information please contact Headquarters.

**NEW APPLICANTS AND MEMBERS (6/18/10 - 8/24/10)**

**Applicants for Certified Professional Geologist**

AZ-David S. Boyer  
NV-Paul A. Pelke  
Ghana-Reginald N. Boyor

**Applicants Upgrading to CPG**

AK-Aaron Banks-MEM-0455  
CA-Paul Dockweiler-MEM-0902  
MI-John A. Bacon MEM-1914  
NV-Douglas Wills-MEM-1646  
NY-Jo Ann Robertson MEM-1926

**New Certified Professional Geologists**

AK-Joseph M. Kurtak CPG-11359  
AK-Lisa C. Nicholson CPG-11356  
CA-Charles G. Clifton CPG-11354  
CO-Craig A. Vrabel CPG-11357  
CO-Kenneth W. Pacheco CPG-11367  
CT-Glen D. Stefaniak, LEP CPG-11375  
ME-John R. Bredlove CPG-11360  
MI-Thomas L. Herrick CPG-11355  
NC-Cheryl A. Youngblood CPG-11365  
NM-John D. Sorrell CPG-11366  
NV-Walter M. Martin CPG-11358  
NY-Janne M. Asquith CPG-11362  
NY-Scott M. Hulseapple CPG-11363  
PA-Dennis J. Ritko, Jr. CPG-11361  
VA-David M. Sayre CPG-11364  
Mexico-Tawn D. Albinson CPG-11368

**New Members**

AZ-Kim S. Wilson MEM-1788  
DC-Tamara L. Dickinson MEM-1921  
FL-Brad A. Dupke MEM-1917  
FL-Charlie B. Way, Jr. MEM-1823  
FL-Daniel C. Grossman, PG MEM-0987  
FL-Gerald O. Black, IV MEM-1907  
FL-Scott E. Purcifull MEM-1906  
GA-Mary C. Stacy MEM-1911  
KY-Barry L. Vinsant MEM-1918  
KY-William L. Brab, P.G. MEM-1925  
MD-Radhia K. Kandukuri MEM-1922  
MI-John A. Freeland MEM-1920  
MN-Brian K. Hartley MEM-1923  
MN-Michael J. Urban MEM-1910  
NJ-Matthew G. Ayers MEM-1915  
NM-Andrew L. Brill MEM-1924  
NV-R Forrest Hopson MEM-1919  
PA-Brian T. Redmond MEM-1916  
PA-Charles M. Handschin MEM-1912  
PA-Gregory M. Stanish MEM-1908  
PA-John C. Roe MEM-1909  
PA-Peter R. Michael MEM-1913

**New Student Adjuncts**

CA-Garth Stamp SA-1861  
CT-Robert A. Jansen SA-1860  
NY-Eva Lipiec SA-1862

**New Associate Members**

PA-Robert E. Murphy AS-0056  
CO-Carl F. Brink AS-0057

**AIPG Membership Totals**

As of 8/10/09  
As of 8/24/10

<table>
<thead>
<tr>
<th>Category</th>
<th>Active</th>
<th>Non-Practicing</th>
<th>Member</th>
<th>Associate</th>
<th>Student Adjunct</th>
<th>Corporate Member</th>
<th>TOTALS</th>
</tr>
</thead>
<tbody>
<tr>
<td>CPG / Active</td>
<td>3,535</td>
<td>424</td>
<td>941</td>
<td>18</td>
<td>285</td>
<td>3</td>
<td>5,206</td>
</tr>
<tr>
<td>CPG / Non-Practicing</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>3505</td>
</tr>
<tr>
<td>Member</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>396</td>
</tr>
<tr>
<td>Associate Mem.</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>941</td>
</tr>
<tr>
<td>Student Adjunct</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>17</td>
</tr>
<tr>
<td>Corporate Member</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>3</td>
</tr>
<tr>
<td>TOTALS</td>
<td>5,206</td>
<td></td>
<td>5,241</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

AFLAC

**Why Supplemental Insurance?**
Even the best health insurance plan can leave you vulnerable to:
- Unpaid medical bills... including deductibles, co-payments, and out-of-network charges.
- Loss of income... if a serious illness or accident seriously reduces the total earning power of the afflicted employee and/or spouse.
- Out-of-pocket expenses... such as the cost of travel, lodging, meals, child care, home care, and special equipment, as well as everyday living expenses like mortgage/rent, car, utilities, food, and credit card balances.

That’s why over 40 million people worldwide have turned to AFLAC. Our full range of guaranteed-renewable insurance policies includes:
- Accident/Disability
- Short-Term Disability, Cancer, Hospital Confinement Indemnity, Hospital Intensive Care, Specified Health Event, Life, Long-Term Care, Dental

Most important, all of our policies pay cash benefits directly to you even if you have other coverage. You decide where the money goes. It’s your choice!

**AFLAC**
http://www.aflac.com  
Carol Streicher, AFLAC Sales Associate  
Phone: (303) 674-1808

Please identify yourself as an AIPG Member to receive the AIPG Association discounted prices.

Welcome to AIPG  
Come join us for our AIPG Annual Meeting in Orlando, Florida!
Michigan’s Mythical Mines

Franklin G. Pardee


Pardee worked for the Michigan Geological Survey for many years, rising to the rank of Appraiser of Mines before serving as the Survey’s Director and State Geologist for the last year before his retirement from the Survey. He was best known for his knowledge of Michigan’s taxation of iron mines and he wrote The Michigan Mine Appraisal System, which was included as Appendix A in the 3rd and 4th editions of Baxter and Park’s Examination and Valuation of Mineral Property, a book that for many years was the standard reference on the subject.

The one genuine gold mining myth in Michigan goes back to the days of the first State Geologist. As we have the story, Douglass Houghton left camp one day in the company of an Indian and when he returned he carried with him some specimens of rich gold ore. A short time after this Houghton drowned and he either did not make any notes of the location of this gold ore, or they were destroyed with him. In any event, no one ever knew where Houghton got this rich ore.

Without doubt this legend contains grains of truth as over $600,000 in gold has been taken from the Ropes Mine in Marquette County and a spectacular specimen of gold ore from the Michigan Mine in the same locality was exhibited at the 1893 World’s Fair in Chicago. There have been many explorations for gold in the hard rocks of the Northern Peninsula but this paper is concerned with the gold mining “myths” of southern Michigan.\(^2\)

The glacial overburden of Michigan no doubt carries a tremendous amount of gold worn off the hard rock hills of northern Michigan and Canada, but by the very nature of these glacial deposits this gold has been scattered across the state. It is possible to imagine that somewhere there may be a concentration of gold of commercial importance in southern Michigan, probably along some glacial river bed, but to date no occurrence of this sort has been reported. The chances for a concentration of this character are remote and it would be looking for a needle in a haystack to search for such a deposit.

The underlying strata of southern Michigan are undisturbed Paleozoic sedimentary rocks, and gold mines in rocks of this type are usually found where the sediments have been broken or altered by intrusive igneous activity. With no signs of igneous rocks or action in this part of the state, reports of economically viable gold occurrences are viewed with a great deal of skepticism.

Many years ago during the early days of copper mine speculation there were a number of companies that got more income from the stockholders than from the mines. Their company policy appeared to follow this line—"When in doubt, issue more stocks and proceed as before." Mr. Finlay, the engineer who first appraised the Michigan mines, said in his formal report that the continued operation of these properties was "psychological phenomena." In all fairness these copper mines had some showings that gave them encouragement. I would like to have heard Mr. Finlay’s description of these mythical gold mines that, as far as we were able to find out, never in the twenty-five years of their existence have ever produced a dollar’s worth of natural gold.

In 1914, R. C. Allen, then state Geologist, wrote a paper on “Gold in Michigan.” After reviewing the gold mines and prospects in the hard rock areas, he listed the reported occurrences of gold in about thirty places in the southern part of the state. All these so-called discoveries were from the sand and gravel beds above the solid rock and represented the location of one or two samples of containing some small amounts of gold—for example, a small nugget or perhaps a few colors in a pan of gravel. Since that time there have many other reports of gold being found in glacial overburden but, like the former ones mentioned by Allen, none was of commercial importance.

The “Alpena Rand”

About 1924 we received in the Survey office information on an “important gold” occurrence in Alpena County. We thought at first someone had hit a concentration in the shale and had mistaken the pyrite found in this shale for gold. Pyrite’s reputation as “fool’s gold” is well-deserved, as its brassy yellow color is often confused for real gold.

As we got the story, a promoter from the west came to Alpena, and on a trip to the old well saw this pyrite and exclaimed to his companions that they mined that material for gold out west, so why not here. Just who this promoter’s companions were at this time is not known, but he later became associated with a horse doctor and a dentist. Before long a company was organized to mine this “gold.” Somewhere along the line

---

1. Editor’s note; about 30,000 ounces at the then-prevailing price of $20.67/ounce.
2. Editor’s comment—see www.mindat.org for some background on the Ropes Mine, which appears to have been worked when gold was pegged at $20.67/oz, 1883-1901, through mercury amalgamation and later cyanidation of the tailings. The total dollar yield was closer to $800,000, after reworking the tailings, before the mine re-opened in the late 1970s.
they picked up an agreeable chemist, one who either knew better and sold out or was careless and was fooled by the samples given him.

The stock selling campaign was successful due partly to a small newspaper that kept the stockholders cheered up. Before this boom collapsed they had raised over $250,000 and had sunk a shaft in wet gravel, shale and limestone to a depth of about 238 feet. This would indicate a cost of over $1,000 a foot but as you all know in 1924 it would take a “superior type of mismanagement” to obtain this cost. Granted the company was mismanaged there certainly was quite a bit left over for the promoters, which was the general idea in the first place.

When we found that gold was reported from the limestone of that area we felt that a careful checkup was in order. This investigation was started and finished (so we thought) by a careful examination of the district—some accurate sampling followed by assays by some reliable chemists. We found shortly that the gold not only was absent in the original rock, but the only real gold found was put there by artificial means. It took some time to bring this condition to light and in the meantime we had to contend with a “wonderful method” for the extraction of gold. The chemist for the Alpena group reported a “new process for recovering the extremely finely divided gold” that was missed in the assays made by the best laboratories the country. This assertion of finely divided gold explained why the gold could not be seen in rock and offered a plausible story to the uniformed who put up the money.

We reported [our results] to the Blue Sky commission3 and the newspapers. This was not a popular report as the people locally liked the activity. Farms were leased and there were many people who would have liked to have the excitement continue. We thought that by showing the results obtained by our work that the gold excitement would die down but unfortunately that was not the case.

The shortest report which has ever been presented to the Michigan Geological Survey was the result this gold mining “boom.” One of the large gold mining companies in Canada sent a very able geologist by the name of Wright to look over the Alpena area. He saw what was going on. His remarks about the situation in Alpena were far from complimentary. For some reason he suspected that a copy of any telegram sent would be obtained by one of the promoters. In order to confuse the issue he sent a garbled statement to his office that he knew would be understood by the person to whom it was addressed. It is reported that Wright’s wire went something like this, “Too near fresh water. Smells like fish.”

Mr. Wright shortly afterward came to Lansing and reported his experiences to our office. A State Senator, who was a big stockholder in the “Alpena Rand” as it was called, insisted that we make another examination and wire a report to the office. Dr. W. I. Robinson made the trip and spent a couple of days around the so-called mine. He had been asked to report by wire as soon as possible and he decided to word his telegram in a manner that would not give any information except the person receiving it. He succeeded, and the wording of his wire, “Wright was right,” become a byword in the Michigan Geological Survey when an examination is made of some property that will not stand up under careful scrutiny.

Mr. Wright completed his job by getting the “Alpena Rand” chemist to take some samples to Canada to demonstrate his methods. The assayers at the Canadian gold mines were old hands and not easily fooled. We heard indirectly that they finally found some dental gold cemented inside some of the samples. The “Alpena Rand” chemist left Michigan shortly afterwards and, after a year or so, the Alpena excitement died down. The reports of all the investigations, the lack of funds, the departure of certain individuals from Michigan all contributed to this end.

We thought that the “Alpena Gold Fields” or, as the area was called in one prospectus, the “Alpena Rand,” was dead, but we were far from correct. We had no idea at that time of the effects of the depression and the increase in the price of gold which would have on the search for this metal. Once the price of gold went up,4 it was obvious that a boom would revive the “Alpena Rand” but there was no one who would have predicted the rash of “gold fields” that broke out over southern Michigan. Gold was in “astonishing quantities” from the so-called Vernon, the Ortonville, Perry, Montrose, and Grand Rapids “gold fields,” to mention just a few, but in no place has accurate sampling shown any gold. While on the subject the Alpena district, however, it may well to complete the Alpena story.

The Montrose Gold Field

The next chapter appeared to be unrelated to the Alpena Rand, as it started a few years later southwest of Saginaw near a town called Montrose. The area around Saginaw was once covered by an old glacial lake and a thick bed of clay and hardpan soil was deposited in that area. We were more than surprised to hear about gold being discovered in the clay and hardpan along some of the creeks. We didn’t even take any samples at first because we were too skeptical, but finally we were forced to take some in an endeavor to kill the stories that were reaching us all the time.

The Montrose district is a typical development of one of these mythical or promotional gold mines and a description of this area and a statement of a few of the things that happened will serve as an illustration of all of the developments that have been taking place within the last 15 years5 in Southern Michigan. These promotions are often called “pocket mines”—not because the gold is found in pockets in the earth but because the profits come entirely from the pockets of the investors.

There is no record of just how this area was first brought to our attention but the first stories told of gold ore being found in Montrose that assayed from $20 to $100 a ton. This was too good to pass up, and a couple of trips were made to inspect this “rich deposit.” The area of the “Montrose field” was about six miles square lying about two miles northwest of town of Montrose. The topography is level, but streams have cut down about 20 feet into the landscape. The river bank showed the soil to that depth to be till with occasional large, rounded boulders, with the

3. State securities commissions were known as “Blue Sky” commissions. Many of them were formed to deal with fraudulent stock dealings in the early 20th century. The US Securities & Exchange Commission was not formed until 1934.
4. In 1934, in the United States the price of gold was increased from $20.67 to $35.00 per troy ounce. [Editor’s note – see http://www.finfacts.ie/Private/currency/goldmarketprice.htm for a history of gold prices.]
5. The 15 years following the increase of the price of gold from $20.67 to $35/ounce.

www.aipg.org
bulk of material fine enough to be classed as clay. It was in these river banks that the first “gold” was found by the excited promoters and it was here that the first sampling was done. An oil well test near Montrose showed about 80 of till above the bedrock in this vicinity.

A talk with the people connected with the development of this “gold district” brought out their reason for testing this area and, as we expected, “some old settler had talked with an Indian chief who got gold from somewhere around here,” but it was not until these particular people came along that anyone had found source of the Indian’s “gold.” We saw reports running up to $100 per ton, but our panning failed to show any gold colors, and when our samples (carefully watched) were sent to reliable assay offices, the reports indicated at best only a trace of gold. All this in spite of the fact that we took our samples from close by or from the same holes that yielded the big returns to the promoters the district.

In one instance three samples were taken in a most careful manner, crushed, ground thoroughly, and quartered. One quarter of each sample was sent to a laboratory that was constantly reporting large values. The other three were sent to other well known laboratories. The results were as follows.

<table>
<thead>
<tr>
<th>Laboratory A</th>
<th>Laboratory B</th>
<th>Laboratory C</th>
<th>Laboratory D</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Gold by weight (oz. per ton)</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Sample 1</td>
<td>0.01</td>
<td>0.015</td>
<td>0.010</td>
</tr>
<tr>
<td>Sample 2</td>
<td>0.005</td>
<td>0.005</td>
<td>trace</td>
</tr>
<tr>
<td>Sample 3</td>
<td>0.008</td>
<td>0.008</td>
<td>trace</td>
</tr>
</tbody>
</table>

| **Gold in dollars per ton of ore (gold at $35 per oz.)** | | | |
| Sample 1 | $0.35 | $0.53 | $0.35 | $7.00 |
| Sample 2 | $0.18 | $0.18 | none | $21.00 |
| Sample 3 | $0.28 | $0.28 | none | $12.25 |

Laboratories A, B, and C were reliable laboratories but laboratory D was the one that always got the high value to “lead on” the investors. Incidentally laboratory D charged about twice as much as the others for each assay which is another indication of the character of this institution. Someone was cynical enough to remark that a laboratory that reported no gold would get no repeat business and the higher the gold in the sample the more samples would come in for assay.

At about the same time another four samples were also sent to laboratory D, which was able to obtain such interesting results. Three of these special samples were made from material given to students at the Michigan College of Mines for their laboratory work. These samples had been assayed many times and their values were well known. The reports by laboratory D for these three samples were all high and in no case closer than 18 percent to the correct results. The fourth sample was made up of gold-free sand which was used in the College of Mines’ laboratories for testing their chemicals. The return on this sample from laboratory D was $89.60 gold and $2.79 in silver per ton—an astonishing result but one which clearly showed why this organization was in business.

By the use of these high assay returns the promoters in the Montrose area returned to the owners the district with the expected results. No impression on the people who were familiar with the gold district, but none for the persons who backed the developments. Every so often the fever of the activity would die down and we would think that the promoters in the Montrose area were marketing the leases. They were also quite able to make some money for themselves but none for the persons who backed them up with their cash. We published our findings and got some hot blasts in the papers and over the radio, but made no impression on the people who were putting up the money for these tests and promotions. Every so often the fever would die down and we would think that we had the project under control, but it usually broke out again.

However, some of the promoters got the idea that the area contained free mercury—this was during the shortage of strategic minerals needed for World War II. As everyone knows, free mercury would not stay in any one place very long, and it is absurd to think of it being found in soil moved by the plow, or broken up by the roots of plants and trees or otherwise disturbed many times.

We were surprised one day to hear that a mill was being built to take the gold out of the shale and hardpan. We watched it grow—a sort of “Rube Goldberg” arrangement with the mill separated into two units about 200 yards apart. The launder between the mills was an engineering masterpiece made of some gutters apparently taken from an old building. We watched it operate and it took a couple of men with paddles to move the muddy water—the heavy parts of the gravel all piled up under the launder and had to be moved with wheelbarrows.

The launder was designed to take the material to a small rod mill located near the road where the “investors” could see some activity. Naturally they recovered no gold but they hit the jackpot when they tried out a suggestion that mercury in the mill would pick up the gold. They tried this and carefully weighed the mercury they put in and the mercury they took out. The dirty mercury that they took out of the machine weighed more than the mercury put in. They found out that the excess weight was not gold and therefore this excess must be mercury. They now had a mercury mine instead of a gold mine. As I mentioned, this was during the shortage of strategic materials needed for World War II, and the promoters immediately wrote a letter to their Congressman telling him they had a mercury mine. He naturally referred the letter to the Bureau of Mines, who according to their policy made a field investigation.

Some of you may remember Terry who was at the Minneapolis station of the Bureau of Mines. He was sent to the property and arrived there on one of the coldest days of the year. You all know how hard it is to get a sample of frozen gravel and it took all of his strength—he is a very big and powerful man—to get a few samples. They took them at points on surface where the promoter said there on one of the coldest days of the year. You all know how hard it is to get a sample of frozen gravel and it took all of his strength—he is a very big and powerful man—to get a few samples. They took them at points on surface where the promoter said he had a mercury mine. He naturally referred the letter to the Bureau of Mines, who according to their policy made a field investigation.

In due time the returns came in with the expected results. No mercury. The Bureau policy then was to give these reports to the owner or promoter personally and Terry asked me to go with him when he turned in the results. We met the promoter and his principal financial backer, gave him the bad news and got away without too much argument.

I later learned the sequel to our visit. After we left, the promoter turned to his backer and said, “I always knew that the State Engineers were dumb, but I thought the Federal Engineers would have more sense than to sample the surface of a mercury mine on a cold day in winter. He should have known that
he would get no mercury from these samples as it is just common sense that mercury always goes down in cold weather."

**The Grand Rapids Grifter**

Somehow or other this “gold” excitement spread over the lower peninsula of Michigan. There were rumors of gold from many places. The next big excitement came from Grand Rapids. In that city they not only had the advantage of the Pontiac laboratory but they had a chemist who could assay “micronic” gold—whatever that is. The group in Grand Rapids put up over $15,000 and in addition to their prospecting around Grand Rapids they again opened up the “Alpena Rand” investigation.

This latter engineer worked with a chemist who not only discovered another new process for the recovery of this very fine gold but described this particular type of gold ore in his report by the suggestive name of “micronic” gold. We looked over the Grand Rapids “deposit” and the chemical laboratory that recovered “micronic” gold but were not impressed. We took some samples, divided them carefully and gave the Grand Rapids assayer one part. One part went to Houghton to be assayed and one part was saved to be assayed at Houghton under the direction of the Grand Rapids assayer but using College of Mines chemicals and apparatus. Apparently “micronic” gold requires a great deal of heat and we nearly ruined one of the Michigan College of Mines furnaces following the directions of the Grand Rapids expert. Needless to say we obtained no gold. Likewise, the chemist obtained no gold either natural or “micronic” by his new process. This chemist left Michigan rather abruptly, forgetting to leave us his forwarding address.

Now comes the part that I do not enjoy talking about to an audience, most of whom belong to the AIME. This Grand Rapids chemist was supported by a consulting engineer from New York who was a member of the AIME. I obtained a copy of this engineer’s report and was surprised to find that the engineer did not visit the Alpena area but based his whole report on a single piece of drill core which was given to him. From this core he wrote a twenty-nine page report that went into the geology, drilling, analytical methods and many other subjects. The engineer furnished a three-page list of his former jobs, accomplishments and writings that was very impressive. The engineer also had a Broadway address and the price he was reported to have received for the report, $2,500, added to its prestige.

I’ll quote just one part of the report so you can see what kind of literature he turned out. To appreciate this gem it is necessary to know that the glacial drift in the area where the drilling was done ran from 90 to 100 feet and below that was shale and limestone. The report places the rich horizons at 200-300 feet and although not identified specifically, the core probably came from this depth. Now listen to the geology described from a single core.

“The material appears to be of glacial origin deposited in blanket form of considerable thickness, and covering many thousands of acres. “The theory of glacial deposits harmonizes with the generally accepted geology of northern Michigan and is confirmed by the opinion of qualified investigators from a study of micro sections.”

“This appears to be not markedly different from that which is known to exist in southern Ontario. From this section the great glacial migration presumably came, carrying with it untold tonnages of eroded material, much of it reduced to an almost impalpable powder, and giving the appearance in its present compact form of a near amorphous structure.

“While certain sections of the core show the deposition of fairly coarse crystalline particles, other sections representing a clay-like structure may quite readily be the sediment of glacial rivers or indeed the deposition remaining after the passage of the ice age.”

After checking over all the material we could find on this case we reported the incident to the Members Conduct Committee of the Institute, but I am sorry to report nothing was done except to tell this engineer not to write any more such reports.

This whole story had its tragic side. Two officials of a small fraternal insurance company, the president, and I believe the treasurer, became so sold on the gold prospects in Alpena, apparently in part due to the engineer’s report just mentioned, that they invested their own money as well as some of the insurance money in the project. They were perfectly honest and left an afternoon session with us with tears in their eyes wondering how they were going to explain to their directors and members. In the Montrose area there were many farms that barely made a living for their owners. Some of these farmers were so taken in by this gold excitement that they did not plant any crops in the Spring. That Fall and Winter was a sad one for those who believed these stories.

An oil field broker from Texas promoted too many dry holes and looked around for some new sucker bait. He heard of the “Alpena Rand,” took up a lot of leases and started to sell them to his customers. We advised the S.E.C. who got him into court at Laredo, Texas. While on the stand he asked to be excused to get some records. As he did not show up in court the next day a search was started for him and shortly after his body was found on the town dump where he had gone to commit suicide.

We thought that the story was finished, but there was still more to come. A few years ago an old gentleman came into our office asking for information on Alpena gold. We started to tell him but soon saw that he did not believe us. He told us before he left that he had saved up $17,000 and was going to pump out the Alpena shaft and extend the shaft three to five feet to get at the real gold horizon. We tried to dissuade him and as he was in his late seventies we suggested that he take the money, go to Florida and live his last few years in peace and comfort. Needless to say, he did not agree and he went ahead. During the operations some gas from the limestone apparently collected in the bottom of the shaft. The newspaper reports, as I recall them, told about five men being killed by a gas explosion.

When I left the Survey we had a file on these “Mythical Gold Mines” that was about a foot thick. The file will continue to grow I am sure, human nature being what it is, and in a few years someone from the Survey can pick up where I left off.

It has been said that the discovery of gold or oil will disturb the equilibrium of the most conservative Scottish banker. Those people of Michigan who put their money into these “gold” enterprises with
hope of getting rich cannot be blamed too much as many businessmen have invested their funds with little investigation. However, we hope that, in the future, anyone finding gold on his farm, or receiving assay results showing large amounts of gold in samples sent to some laboratory, will stop for as many minutes as may be necessary, look over the situation very carefully, and listen to the advice of persons who have spent some time in the study of deposits of this character.

In fact there is an interrelationship between all these mythical gold developments; to discuss these stories and areas fully would take too much time. They all follow a similar pattern in that somewhere in the story there appears a chemist or assay office that obtains results that cannot be confirmed by reliable laboratories. It would be charitable to say that these assays showing large amounts of gold were due to improper sampling or improper work in the assay office. However, the difference between the extraordinary results obtained in dubious assay offices and those far more modest results from reliable laboratories are so great as to make only one conclusion possible—that the assay results grossly exaggerate the actual gold content of the samples. The reason for this is obvious. A laboratory charges a fair price for making a gold assay. If a person sends a sample of material from his property and receives that answer from the laboratory that the sample contains no gold, he pays his bill and forgets the whole thing. If, however, gold is reported in the sample, he starts looking for other samples and runs up a bill at the laboratory that is impressive in its size. His activity has furnished some money to the laboratory, which may or may not go through the motions of making analyses before the misleading results are sent out. Multiply this procedure by even a small number and you can see how an unscrupulous laboratory can make money, even in a state where gold mining is not an important industry.

Call In Our Crew
We specialize in the research, analysis and electronic data capture of geoscience data.

Examples include: unconventional hydrocarbon resources and HC field studies.

GeoScience Data Management Proudly Presents
An Introduction to Landslides or Mass Wasting
An Online Course
AIPG Accredited (3.5 CEU’s)
- Landslides classification
- Soil mechanics principles
- Strength of earth materials
- Geologic influences
- Case histories
- Factors influencing mass wasting
- Control & prevention of mass wasting problems
- Slope stability analysis

For more information, contact
rgfont@geosciencedm.com,
slbishop@geosciencedm.com,
or visit our website at www.geodm.com or www.aipg.org
Robert Font, Ph.D., CPG, PG, EurGeol - Author

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 ‘How to Join’. 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
California Section

State Science Fair-The California Section is pleased by the many years of service provided by Dave Sadoff who attended the California State Science Fair in Long Beach in May 2010. He gave out two awards: a Senior and Junior Division award. Judging science exhibits takes significant concentration and quite a bit of patience and time. Dave has been active judging the earth science exhibits and interviewing the young scientists at the California State Science Fairs for almost a decade. Our congratulations to Dave for doing such a great job! Other judges are needed and we request those interested to contact Dave at davesadoff@sbcglobal.net.

11th Annual Sacramento Drive-In: A Success-The California Section of AIPG took an active role in the 11th Annual CCGO-CORE Sacramento Drive-In on June 22, 2010, several delegates met to discuss important issues with regulatory agencies as well as legislators. The CORE Environmental Foundation, representing consultants, owners, regulators and enviro-vendors also joined forces with CCGO. CORE focuses primarily on issues of closure and underground storage tank cleanup funding. CCGO present-ed environmental award to Mr. Ira Ruskin, Peter Hartnett and Erin Shaw for their work in successfully passing AB1188 in 2009, which temporarily increased fees to financially stabilize the California Underground Storage Tank Cleanup Fund. Members of both organizations (CORE and CCGO) benefitted greatly by this bill.

The Sacramento Drive-In delegates also met with the State Geologist, Dr. John Parrish and the Executive Officer of the State Mining and Geology Board, Stephen M. Testa. A variety of regulatory, resource, funding and professional issues were discussed in a lively manner. Other delegates met with the Board with David Brown (Executive Officer of the Board for Professional Engineers and Land Surveyors - BPELS) and Susan Christ (BPELS’ Staff Engineer) in the State Capitol building in Sacramento. Those delegates included Fred Ousey (CORE), Jared Pratt (AEG S.F.), and Charles Nestle (AEG So. Cal.). The purpose of the meeting was to discuss issues relating to BPELS’ administration of the Geologist and Geophysicist Act resulting from passage of ABx4 20 in June of 2009.

First California Student Chapter Set Up-The first California Section AIPG Student Chapter was set up at the University of California at Davis. Professor Robert Zierenberg is the chapter advisor, and various students worked with Jim Jacobs (sponsor) to get it off the ground. Most notably, Allison Price worked hard with all the paperwork. The first talk was presented by the California State Geologist, John Parrish and the lecture was attended by about a dozen interested students. Dr. Parrish spoke about his career, and job opportunities in the public sector.

Jim Jacobs, Section President

Colorado Section

Cripple Creek & Victor Gold Mine Field Trip-The National AIPG Executive Committee meeting was held in Westminster the weekend starting Friday, June 11, 2010. As an adjunct to that meeting, the summer field trip for the Colorado Section of the AIPG was held that same day with a day trip to Teller County, Colorado, to visit the only operating gold mine in the state. The National group chartered a very nice bus for the occasion and it was almost a full busload with a headcount of 51.

About a third of those people in that commingling were associated with the Colorado Section.

Once the bus was headed south on I-25 out of the Denver suburbs, Bill Siok handed the microphone over to David Abbott for a continuous narrative of the geology and mining history of Colorado along the way. David Abbott is a proud Colorado native and many of us on the bus who have made Colorado home for more than a couple of decades learned quite a bit from David’s discourse. There were ongoing discussions about the Palmer Divide, The Wall Mountain Tuff at Castle Rock, the (poorly) disguised cell phone towers atop Monument Hill, the Rampart Range and its eponymous fault, construction of the Air Force Academy stadium and myriad other topics, large and small, along the way.

Due to a traffic jam in Colorado Springs, our intrepid driver was able steer us clear of further delay along an alternate route that afforded some really excellent views of Garden of the Gods in Colorado Springs. What should have been world-class viewing of Pikes Peak was not to be had nearly all day due to a nagging cloud ceiling that refused to bend to our collective will and exit the region.

As we headed west on Highway 24 through Manitou Springs, everyone on the bus got a really good look at the unconformable relationship of Paleozoic rocks lying on top of Pikes Peak granite. There was a geography lesson shortly thereafter about the exact location of the North Pole and whether or not it really is on the flanks of Pikes Peak. No Brunton compasses were involved. David Abbott did not miss a beat.

We continued west out of Woodland Park until we turned on to a county road at a junction located somewhere off to the northwest of Pikes Peak. In relatively short order, we were in little burg of Victor.

Once on the mine property proper, the group viewed the prerequisite safety video and all in attendance signed the necessary waivers in case of accidental death or dismemberment. I just want to make sure you are still with me. We did sign the paperwork.

Because of the alkalic nature of the deposit, the Cripple Creek & Victor gold mine is something of an anomaly in economic geology. It is operated by AngloGold Ashanti. Two very capable young site geologists narrated the
onsite portion of our tour. Once inside the working pit, we were allowed to visit the high-grade ore stockpiles and sample some of the phonolites and lamprophyres. Many of the folks on the tour understandably stuffed backpacks and sample bags. We also visited the mill where big rocks become little rocks before they are transported out to the leach pads.

For our roadside lunch stop, Cathy Duran and Wendy Davidson from National sprang into action and we suddenly found out that there were sandwiches, fruit, drinks and snacks galore to be had for the taking. During our mid-day repast, we were treated to a “shoot” wherein a bench in the mine was blasted at a safe distance to our chorus of ooohs and aaahs. It was cool.

The trip back to Denver was relatively uneventful. Both Cathy and Wendy ably worked the aisles serving snacks and cleaning-up after us as only seasoned flight attendants can. The trip through Colorado Springs along the way involved a deluge of epic proportions that made me really glad that I was not driving. About half of the Colorado contingent disembarked at Park Meadows Mall. The remaining travelers headed north to Westminster. Although it was only a coincidence, it rained bucket loads later that night and for the next two days. (Some of us returned home to significant hail damage! ed. note)

The Colorado Section really owes a debt of thanks to all of the folks from National for putting this trip together. It is also noteworthy that National headquarters moved at the same time as this trip and they were able to put the trip together in the middle of the “moving” maelstrom. Again, many thanks.

If you didn’t make the trip this year and you are just now reading about it here for the first time, straighten-out your thinking and join us next year. These trips are a lot of fun and you just might learn a thing or two about the geology in your own backyard.

Matthew J. Rhoades,
Section President

Florida Section (FAPG)

2010 Legislative Recap-The Annual FAPG/AIPG Legislative Day in Tallahassee was held March 15-16, 2010. This year, the event was held in conjunction with the Florida Ground Water Association (FGWA). Members attended an evening dinner at La Fiesta on March 15. In attendance was Mr. Phil Leary, FAPG’s recently-contracted governmental lobbyist. Following introductions and a short business meeting, a presentation was given by Mr. David Mica, of the Florida Petroleum Council.

On Tuesday, March 16, several FAPG/AIPG members, FGWA members, and other non-members walked the halls of the capitol to visit with many of Florida’s legislators and staff.

The primary purpose of the FAPG/AIPG Legislative Day is to continue building on past efforts to educate our legislators of the importance of Florida’s geologists. This is obviously an on-going process, and as always we encourage everyone to participate - at least once during their career - in this enlightening and eye-opening event. Special thanks goes to TestAmerica Laboratories, Inc. for sponsoring the Monday night dinner. TestAmerica has been a reliable sponsor of FAPG/AIPG, and we appreciate their support.

Combined FAPG/AIPG, Southeastern Geological Society Field Trip-The Southeastern Geological Society (SEGS), in conjunction with FAPG/AIPG, held its’ 2010 meeting and field trip in Central Florida on May 14th and 15th. The business meeting and dinner on Friday included a barbeque dinner and complimentary beverages. A total of 13 active and new members attended the dinner meeting; it was a good meeting with fruitful discussions.
The field trip on Saturday, May 15th began at Wekiva Springs State Park. The area geology and hydrogeology of springs in central Florida was discussed, followed by a morning canoeing trip on the Wekiva River and Rock Springs Run, with lunch at the state park. The afternoon field stop was at Wolf Branch Sink in neighboring Lake County. This visit was facilitated by Walter Wood (Past President of FAPG) who arranged access to the property. This is an impressive swallet feature located in the active karst terrain west of Wekiva and Rock Springs, and it even has a small waterfall cutting through lower Hawthorn sediments to the well-developed sink. This locality will definitely stay on the list of places to visit for future SEGS field trips in peninsular Florida.

Note: SEGS and FAPG/AIPG signed a Memorandum of Understanding in 2006. Since then the two organizations have periodically collaborated on technical meetings, field trips, and other endeavors.

Joe Fuhr,
Section President-Elect

Georgia Section

National Executive Meeting-Prior to the meeting on Saturday June 12, 2010, the Colorado Section held their spring field trip on Friday and the Executive Committee was invited to attend. We went to the Cripple Creek & Victor Gold Mining Company open pit and we had a great time looking at the geology and the mine activities. You can go to AIPG home page and pictures from the trip are posted.

Eight student scholarships were awarded ranging from $500.00 to $1,000.00. Our section did not receive one this year. There were a few recommendations dealing with students that were approved. National will simplify the student application form and let student join by filling out an application on-line and emailing it to National. There will also be a reduction of dues for recent student graduates to become members. National will work on the amount of dues and period before the dues go up. There was a recommendation for a student member on the Executive Committee. It was not rejected but it wasn't decided as to how you pick a student. Most likely they would come from a student chapter. Individual sections can currently add students to their section officers, if so desired.

Last Meeting-The AIPG Georgia Section recently completed a field trip to Tellus Science Museum on May 14, 2010. The Tellus Science Museum is located in the Cartersville Georgia on the site, which was formerly the Weinman Mineral Museum.

The museum’s curator, Julian Gray, accompanied a group of professionals and Georgia State University students through the museum. There were several large exhibit halls, which included a large mineral exhibit named in honor the Weinman family. The mineral hall is modeled after the Smithsonian exhibit in Washington DC and is impressive.

There is an exhibit hall dedicated to fossils (large and small) ranging in age from the dinosaurs, through the giant animals of the most recent ice age. There is also an exhibit hall dedicated to the history of transportation including a replica of the Wright Brother’s plane, space capsules, cars, bikes, etc. Kids can also dig for fossils, pan for gold, and enjoy the planetarium show. AIPG got a special behind the scenes look at the processing and handling area and Julian told us about the various casting and restoration of fossils and recent acquisitions of collections.
Ohio Section

Scott Tinker, Ph.D to Serve as Ohio AIPG Key-Note Speaker, November 18, 2010-The Ohio Section of AIPG is pleased to announce that Dr. Scott Tinker will be the Key-Note speaker for our annual meeting / dinner presentation on November 18, 2010. Dr. Tinker is the Director of the Bureau of Economic Geology, the State Geologist of Texas, Director of the Advanced Energy Consortium, and the 2009 President of the American Association of Petroleum Geologists (AAPG). Given his renowned expertise in the energy field, we look forward to Dr. Tinker’s insights regarding the state of the petroleum sector, and challenges and opportunities facing the future. You will not want to miss this event. Contact President-elect Tom Berg to RSVP.

Student Members May Apply for Ohio Section Cash Prize-With our panel of judges in place, Ohio Section student members may now apply for the student cash prize, by uploading their research paper onto the Ohio Section website: http://www.aipg-ohio.org/. The closing date for submission is September 30, 2010. The winner of the $750 student cash prize must be the primary author of a faculty sponsored paper. The finalists and winner will be recognized dinner guests at the Ohio Section Annual Meeting/Dinner Presentation, in Columbus, Ohio on November 18, 2010.

SISTER SOCIETY NEWS

BC Geoscientist, George R. Cavey, P.Geo., Receives 2010 Canadian Professional Geoscientist Award.

Vancouver-Geoscientists Canada is pleased to announce the recipient of the 2010 Canadian Professional Geoscientist Award – George R. Cavey, P.Geo. of Vancouver, British Columbia. The Canadian Professional Geoscientist Award is given to recognize the achievements of an individual, who has made an outstanding contribution to the development and practice of professional geoscience and who has advanced public recognition of the profession in Canada in his or her capacity as a registered professional geoscientist.

This year's recipient, Mr. George R. Cavey, P.Geo. is an accomplished and respected professional with over 30 years of experience in mineral exploration. He is the founder and President of OreQuest Consultants Ltd. a firm that has completed and evaluated exploration projects throughout the Americas, in Africa and in Europe, and which has provided services to numerous publicly listed companies in Canada and overseas. Mr. Cavey obtained his B.Sc. degree in Geology from University of British Columbia in 1976.

Beyond his technical achievements, Mr. Cavey became personally dedicated to giving back to his profession—dedication that has earned him the respect and recognition of colleagues, peers and clients in his home province as well as both nationally and internationally.

Mr. Cavey was an instrumental member of the Task Force to Register Professional Geoscientists in BC from 1989 to 1990. He went on in 1991 to serve as a founding member of APEGBC’s Geoscience Committee, then on Council and on the association’s Investigation Committee, where he served until 2009. Following the successful integration of geoscientists into APEGBC, he became President of Geoscientists Canada (formerly Canadian Council of Professional Geoscientists) from 2003-2004. He also served his sector extensively, assisting the Canadian Securities Administrators as a member of the Mining, Technical, Advisory and Mentoring Committee, leading up to and following the introduction of National Instrument 43-101.

Dear Mr. Lawless:

I would like to express my gratitude to the AIPG Education Committee, the Executive Committee and Director William Siok for awarding me the AIPG National Scholarship. I hold this honor in the highest regard and I am very grateful that AIPG selected me as a recipient. I must apologize for not responding promptly to this award; I have been away from home for the past few months.

It is also an honor to have my essay published in The Professional Geologist, as I am sure that most undergraduate students do not get such an opportunity. I look forward to writing an article as soon as my studies permit it. This scholarship brings me one step closer to successfully completing a degree in Earth Sciences and pursuing a career as a geologist; for that I am very grateful.

Sincerely,

Calvin Mako, SA-1746 University of Maine-Earth Sciences
AIPG President Attends Meeting and Convention

AIPG President Michael Lawless attended the Geoscientists Canada annual meeting. This year’s Geoscientists Canada (formerly the Canadian Council of Professional Geologists, CCPG) was held in Yellowknife. The area has a rich mining heritage, first gold, now diamonds, and perhaps rare earth elements in the future. The arctic landscape was beautiful and the hospitality of our Canadian colleagues most welcome.

AIPG co-hosted an exhibitors booth at the NCSL convention in Louisville, Kentucky. The other organizations involved were AGI, AASG, AEG, and GSA. President Michael Lawless was there to help support the AIPG booth. For more information about this successful convention, please read the ‘President’s Message’ on page 33 of this TPG.

Staffing the booth are Vicki McConnell, Oregon State Geologist representing AASG, AIPG President Michael Lawless, and Kentucky State Geologist Jim Cobb, also representing AASG.

A serious Geology discussion between Vicki McConnell, Oregon State Geologist and John Steinmetz, Indiana State Geologist.

Booth Visitors.

AIPG President Michael Lawless and Jonathan McIntyre, representing AEG, having a discussion with a booth visitor.

Oregon State Geologist Vicki McConnell and AGI Director of Government Affairs Linda Rowan collecting souvenirs.
Geoscience NSF Graduate Fellowships Quadrupled in 2009

The NSF Graduate Fellowship program conferred an average of 927 graduate fellowships per year between 2000 and 2008, the majority (56-59%) of which were awarded to graduate students in the life sciences and engineering fields. During this period, approximately 3.5 percent of NSF graduate fellowships were awarded to geoscience students (~31 fellowships per year).

In 2009, there was a 37% increase from the previous year in the total number of graduate fellowships awarded, and the percentage of fellowships awarded to graduate students in the life sciences and engineering disciplines dropped to 50 percent as other disciplines were awarded a higher proportion of fellowships. The percentage of fellowships awarded to graduate students in the geosciences nearly quadrupled between 2008 and 2009 (from 26 to 94), and in 2009 geoscience graduate fellowships comprised 8 percent of the total number of NSF graduate fellowship awards. With the large increase in the number of fellowships awarded in 2009, the total value of the NSF graduate fellowships awarded to geoscience students jumped from just over $1 million dollars in 2008 to $3.8 million dollars in 2009.

The top seven fields of study for NSF graduate fellowships awarded to geoscience students in 2009 (e.g. Geology, Geophysics, Paleoclimate, Chemical Oceanography, Paleontology, Geochemistry, and Hydrological Sciences) accounted for 72 percent of all NSF geoscience graduate fellowships awards.


- Leila Gonzales
**POLO SHIRT**

Silk Touch POLO SHIRT. Fabric/Style: 5-ounce, 65/35 poly/cotton pique; flat knit collar and cuffs, double-needle armholes and bottom hem, side vents; metal buttons with dyed-to-match rims. Available Colors: Banana, Bark, Black, Burgundy, CoolGrey, CourtGreen, DarkGreen, Hibiscus, LightBlue, Navy, Red, Royal, Stone, White. Sizes: S-3XL. Prices: $30.00 (S-XL) / $31.50 (2XL) / $33.00 (3XL) Also available in Ladies Sizes.

**NEW PROMOTIONAL ITEMS**

Lightweight Jacket and Cap
Price: $44.25 SAVE $5.00!

**JACKET**
- Thanks to mesh lining and wraparound vents, you'll enjoy exceptional breathability in this lightweight jacket.
- 100% nylon shell Mesh-lined upper body
- Locker loop Slash pockets Full cut sleeves with elastic cuffs
- Bottom drawstring with cord locks Available Colors: Black, Dark Navy, Hunter, Maroon, Royal. Sizes: S-XL.
Price: $36.50

**CAP**
- Velcro closure.
- Embroidered AIPG spelled out with pick and gavel. Colors: black, tan, royal and white.
Price: $12.75

**SALE SALE SALE**

**BOOK**
- Learn about the Geology of Northern Arizona with maps, photos and expert descriptions! This 6”x9” paperback has 321 pages that are packed with detailed information about Northern Arizona Geology.
Price $10

**SALE SALE SALE**

**BOOK**
- An excellent resource, the Second Edition of Roadside Geology of Colorado is a great book to add to your backseat. So pickup this book and hit the road.
Price $10

**SALE SALE SALE**

**BOOK**
- If you have wondered about the actual dangers of asbestos, radon, earthquakes, etc., that are not explained very well in the news, then this book is for you.
Price $12

**POLAR FLEECE 1/4 ZIP PULLOVER**
- Elastic waist and cuffs, contrast collar, embroidered AIPG lettering with pick and gavel. Colors: Black, Navy, Royal, Charcoal, Burgundy, Forest, Khaki. Sizes XS - L.
Price: $27.00

**AIPG Expandable Briefcase** has the embroidered AIPG pick and gavel logo, durable 600 denier polyester fabric and a large main zippered compartment. Created with several pockets and pouches for optimum organization. Available Colors: Black, Hunter, Navy, Red, Royal.
Price: $31.00

**CHECK OUT OTHER GREAT ITEMS AVAILABLE AT WWW.AIPG.ORG**
Not Just Software. . . RockWare. For Over 27 Years.

AqQA™
Spreadsheet for Water Analysis
- Create Piper diagram, Stiff diagram, Ternary, and eight other plot types
- Instant unit conversion - shift effortlessly among units
- Check water analyses for internal consistency
- Manage water data in a spreadsheet

WellCAD™
Well Log Data Management
- PC-based composite log package, combining comprehensive graphic editing and data processing tools
- Integrates all data acquired in a well into a single document
- Combines excellent display, editing and analysis capabilities for well data

PetraSim™
A Preprocessor and Postprocessor for TOUGH2, T2VOC, TMVOC & TOUGHREACT, TOUGH-FX/HYDRATE, and TETRAD
- Model multi-component fluid flow, heat transfer and reactive transport process
- Saturated and unsaturated conditions
- Fractured and porous media
- Mesh generation, parameter definition, and display of results

The Geochemist Workbench®
GWB is the premiere software solution for simulation of:
- Scaling
- Sourcing
- Flooding
- Formation damage
- Frac jobs
- Fluid compatibility

Free trial available at www.rockware.com
$249

Free trial available at www.rockware.com
$3,120

Free trial available at www.rockware.com
$3,000

$7,999

RockWare®
Since 1983
303.276.3534 • 800.775.6745
RockWare.com