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The view looking south from the mouth of Danger Bay on Afognak Island across Marmot Bay to Kodiak Island, Alaska. Parrot Island sits in the foreground. Whale Island is located between Afognak and Kodiak (to the right). Sharatin Mountain and Elbow Mountain are snowy white in the setting sun. Photo taken March, 2011, by Christina Coulter, YP-0008.
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SCHOLARSHIP PROGRAM

Purpose
To assist students with college education costs and to promote student participation in the American Institute of Professional Geologists (AIPG). Up to four scholarships will be awarded to declared undergraduate geological sciences majors who are at least sophomores.

Scholarship Awards
Scholarship awards in the amount of $1,000.00 each will be made to eligible students attending a college or university in the U.S. Scholarships are to be used to support tuition and/or room and board.

Eligibility Requirements
Any student who is majoring in geology (or earth science), is at least a sophomore, and is attending a four-year accredited college or university in the U.S. can apply. Also, the student must be either a student member of AIPG or must have applied for student membership at the time the application for the scholarship is submitted.

Application Process
Applicants must submit: a letter of interest with name, mail and e-mail addresses, and telephone number; proof of enrollment in an eligible geological sciences program, transcripts; an original one-page essay on why the applicant wants to become a geologist; and a letter of support from a faculty member familiar with the applicant’s academic work. The application packet should be submitted to:

American Institute of Professional Geologists
Attn: Education Committee Chr.
12000 Washington St., Suite 285
Thornton, CO 80241

For questions regarding the application process call (303) 412-6205 or e-mail: aipg@aipg.org.

Applications must be received by
FEBRUARY 15th
Awarded the month of
SEPTEMBER

Basis of Awards
Awards will be based on the content and creativity of the essays as judged by the Education Committee. The decisions of the Education Committee are final.
Starting a Geology Student Club
Public Outreach Program

Sammy Castonguay, SA-2047, University of Oregon

Public exchange of geologic information is important for relating consumers of earth’s resources to the processes of the dynamic earth that created the resources. This need spans all levels of public; from policy makers and executives to public and community educators. As a student myself, I chose to focus on the most accessible and, in many ways, most impactful of the public: the next generation of public education students. Though, I encourage all students and professionals to become involved in educating the public on geologic information.

Both as an undergraduate and now as a graduate student, I have worked with the University of Oregon Geology Club to create a cohesive outreach program. That being said, it is not yet consolidated.

In nearly three years, the program has reached out to elderly communities, public and private schools grades 1-12, detention centers, community organized free-schools, and across campus.

Some suggestions for students interested in becoming involved in an outreach program:

- Find your campus ‘Geology Club’ (or similar). If one does not exist, start one through your student government and Geology Department.
- Get involved in the ‘Clubs’ outreach program. Again, if there isn’t one, start one.

Tips on starting and outreach program:
- Look up schools in your area, any level, or any place open for public exchange. Really, the possibilities are endless.
- Design some basic labs, or use some of your introductory course material. Getting people to handle rocks and minerals is one of the best ways to engage them. Ask your department to borrow samples from the teaching collection, or if your club has money to buy a set of teaching samples, do so.
- Contact the schools or specific teacher and ask if you can visit. Send them the labs or outlines you plan to conduct. This will show them you are organized and also give them the chance to suggest changes to the material.

- Go into the classroom with confidence and lots of energy. Always engage the students with eye contact and questions. You are a guest speaker, it is easy for them to write you off and not listen, so keeping them engaged and focused is important.

Our outreach program seems to be moving toward an 8-10 lab curriculum introduced over the course of a full quarter or semester. It has taken a lot of work, but eventually it can be a curriculum that transfers to all of the 7th and 8th grades in our area.

Whatever your interests or profession in geology, it is important to engage the public in your research and results. I encourage all geologists to try their hand at public outreach and education. Please contact me with any questions or comments: scaston1@uoregon.edu

Sammy, SA-2047, is a second year M.S. student at the University of Oregon, conducting structural research in the Southern Black Mountains of Death Valley, CA.

HAVE YOU SIGNED UP A PROFESSIONAL MEMBER LATELY? REQUIREMENTS FOR PROFESSIONAL MEMBERSHIP

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

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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.
AIPG had a booth at the National GSA Convention, October 9-12, in Minneapolis, Minnesota. Volunteers helped in signing up 139 new student members, and discussing the benefits of joining AIPG.

AIPG Headquarters would like to say Thank You to all of the booth volunteers. Those volunteers are John Grams, Jane Willard, Mike Urban, Nancy Radle, Mike Hultgren, Amber King, Dale Rezabeck, Laura Scheid, Billy Caldwell, Elizabeth Wuyep, Subho Mandal, Pat Collins, Greg Kimball and AIPG 2011 National President, Sam Gowan. Our volunteers were from all over the United States and beyond. Some were as close as Minnesota and one as far away as Nigeria.

The following names were drawn as raffle winners at the AIPG booth. Maritla Huber (hat), Shasta Morrero (water bottle), Jeff Chaumba (t-shirt), Jon Price (briefcase), Melanie Werdon (t-shirt), Keegan Kittock (water bottle) and the Grand Prize went to Sean Hammersburg (crystal tourmaline). The drawing was held at noon on the last day of the convention. All winners must be present to win.

We also gave out student chapter information, CPG applications and sold some store items.

The AIPG booth was a great success due to the help from all of the volunteers.
I remember being told as a child that a good solid education starts with mastery of the 3-R’s. They are the foundation for self-confidence and success -- especially in this fast moving, high-tech world. So, in high school I took every English, science, and math class offered. Now that I am in college, what’s next?

Next...

Same principal applies at the college level – get a good solid education. Here you will begin to expand on what you have already learned. Take English composition and technical writing. Take all the math you can stand. Take lots of physics, chemistry and at least some engineering. These are all fundamental to majoring in geology. No matter where your geo-career takes you, no matter the twists and turns of volatile employment markets, unexpected layoffs, or changes of heart, these basic skills will stay with you, should you ever need to show your résumé to a prospective employer.

Now, on to geo-curriculum. Don’t let them short you on fundamentals. In today’s world of “cram-even-more-course-work-into-the-same-number-of-units-needed-to-graduate” mentality, it is all too common for staff to combine several similar courses into one or two semesters of work to make space for some other new topic(s). The result: at a critical stage in your learning process, you miss out on basics that you would have otherwise received in a more complete and traditional course progression.

So, in addition to general education requirements, here is what to insist on for the geo-portion of your education. Full, unabbreviated semesters of: Physical Geology, Historical Geology, Mineralogy, Petrology, Stratigraphy, Structural Geology, Paleontology, Geophysical Methods, Geomorphology, Field Geology and Senior Thesis. These are all fundamental to your career in geology. Some of the material will be used more, some less. But, by having this solid foundation, you will be able to solve problems and perform with confidence amongst your peers.

And, yes, there are a lot of other courses that would be fun and interesting. You can take those in addition to fundamentals, or after graduation. Also, many employers will be happy to train you to perform certain tasks; they may even give you time off work and pay your tuition to take specific classes at a nearby university. As you can see, the learning process never ends – and there is always something new to discover!

You should graduate with the ability to see and think in six dimensions. Yes, SIX! These include, the traditional four, X, Y, Z, and TIME. In addition, you should be able to think in terms of:
• Number 5, the countless Dynamic Geologic Processes, and
• Number 6, the myriad and complex short- and long-term Geologic Changes over time.

These last two dimensions can challenge a geologist’s ability to unravel and document earth’s history – a sometimes elusive, but always fascinating story. The likelihood of the “last chapter” of earth’s history ever being written is somewhere between zero and “minus-one,” as these processes and changes are an ongoing and never-ending work in progress. (Read: Key to a geologist’s full employment.)

Don’t forget about additional opportunities that come with advanced degrees. Take responsibility for your education, your career and your life. A 35- to 40-year career goes by fast – faster than you may think. Choose well, work hard, be quick to admit mistakes and move on.

Good Luck and Godspeed – you are in for the ride of a lifetime!

After graduating from San Diego State University in 1966 with an M.S. in geology, Mr. Elliott accepted a position as an Exploration Geologist with Standard Oil Company of California. By 1970, a relatively painless transition from oil to soil (geotechnical engineering) was made by blending his traditional education with newly acquired oil-patch skills. Over four years of scientific/research experience combined with eight years of engineering/construction experience gave impetus to pursue his dream of becoming an independent Consulting Engineering Geologist. Thirty-three years later, the continuous challenge of blending science and engineering has not lost its luster or appeal. Retired from consulting, Mr. Elliott continues to enjoy geology through part-time teaching at SDSU. And like a faithful old dog, his formal education always follows him wherever opportunity knocks.

William J. Elliott, CPG-04194

Note To Self --

Get A Good Solid Education

Attention Sections:

AIPG National needs a listing of who your newly elected officers are. When your 2012 officers have been elected, please email this information to AIPG National.
aipg@aipg.org
or
vlh@aipg.org

www.aipg.org
“Get Involved!” – Career Advice for Graduate and Undergraduate Students

Michael J. Urban, MEM-1910

The college or university experience is for far more than simply obtaining a degree (though that is usually a very important first step in building any professional career); it is for networking—making those all-important professional connections that can often assist you later on—and gaining valuable practice or experience. My advice is straightforward: get involved! There are many different ways to “get involved,” each with its own benefits. Before discussing some of these, I’d like to first invite you to read and consider the three student scenarios below. As you’re reading, ask yourself these questions: Which student is most likely to find a good job? Who is most likely to have a long and successful career? Who will discover early on that s/he should really go on to graduate school?

Student A stays after mineralogy class one day and asks her professor about opportunities for undergraduate research. The professor does not have any active projects and no way to include the student in her own research, but refers the student to a colleague. The colleague has no paid research opportunities, but invites the student to volunteer her time and participate in minor laboratory activities (e.g., moving and labeling samples, assisting in the preparation of thin sections, setting up stereoscopes, pulling out materials for laboratory sections of class, etc.). The following semester, the professor asks the student if she has written about her volunteer activities in her résumé, and if she needs a letter of reference.

Student B is really interested in learning more about brachiopods and mentions his budding affinity for “brachs” to his paleontology teaching assistant. The teaching assistant (TA) informs the student that she is currently researching Shimodaia macclesfieldensis. The student asks the TA if he could assist in some way. The TA responds that, in fact, he was welcome to assist her in creating a poster for the university’s faculty-sponsored “research day.” The next semester, the TA runs into the student in the hall and informs him that the poster they developed had been accepted at the Geological Society of America (GSA) annual meeting and that the teaching assistant’s advisor has some grant money available to pay for all three of them to drive to the conference (only a couple of hours away from the university). While at the conference both students—the undergrad student and the grad TA—stand with the professor at the poster session and meet other students, visit with geological consultants (potential employers), and network with others having similar interests in brachiopods. Later, while taking a break from the poster session, the graduate student peruses the posted job announcements, vacancies, and internships, while the undergraduate student stops in the exhibit hall and chats with a member of a private geological consulting company about what skills are highly sought after in potential hires. [The conversation entices the student to take an additional GIS course the next term!] As both students make their way back to their poster they are stopped as they pass the AIPG booth and asked to consider a free student membership to the professional geological organization; the students eagerly sign up!

Student C attends class regularly, earns excellent grades, and stays abreast of current literature in professional journals. The student never says a word to his course professors, avoids the geology student lounge, and always passes up the opportunity to attend voluntary supplemental field trips offered by his instructors. Upon graduating, the student has a 4.0 GPA, but finds that he’s made no professional contacts, is not involved in any professional organizations, is unable to secure a reference from one of his geology professors, and has never attended a geological conference.

Let’s revisit the original questions: Which student is most likely to find a good job? Who is most likely to have a long and successful career? Who will discover early on that s/he should really go on to graduate school? Regarding the first question, I’ll be careful and say that any one of the students has a very good chance of finding a great job. Though, consider the respective résumés of each student. There is something to be said for the experiences gained while “getting involved” and for being able to write about them on your résumé. As for who is most likely to have a long and successful career, nothing demonstrates enthusiasm, dedication, and passion for a subject than willingness to “get involved” in extracurricular activities; and barring recession, or other unfortunate scenarios, the demonstration of enthusiasm, dedication, and passion through extracurricular activity may go an equally long way toward both piquing the interest of a potential employer and fostering a successful career. The final question posed—recognizing that graduate school may be for you—is really about time. Garnering valuable practical experience is critical, so entering the job force immediately after earning a bachelor’s degree can be very useful; on the flip side, waiting too long after graduating to enter graduate school may prolong a state of limbo prior to achieving your ultimate goal (though, it is never too late to go back to school!).

Volunteering your time for research and field experiences, attending professional conferences, and becoming a member of a professional organization all look great on any résumé read by a potential employer and provide great experience too. If I have learned anything from “getting involved” myself it is that opportunity begets opportunity—meaning, the more you get involved, the more opportunities you’ll have to become even more involved. Obtaining a degree with a relatively high GPA is still an important goal, but let’s not forget that there is so much more a student can acquire from a college or university experience and all of it may go a long way towards your future career.
way toward preparing one for a future career (or helping get a foot in the door with a potential employer).

**A Few Thoughts for Inspiration**

As an undergraduate student I gave little consideration to “getting involved” beyond anything I was required to do. I did not join a geology, or science, club; I did not take professors (or Teaching Assistants) up on opportunities for additional field trips or activities outside of normal class; I did not even stay after class to visit with my geology professors. The only reason I got to know even one of my professors – who did ultimately end up providing me with a reference – was because there were only three students in my “advanced earth science for teachers” class. I cannot say that I got involved as an undergraduate student, and though I do not believe it hurt my career, I have no way of truly knowing. However, I think my lack of initiative in “getting involved” did set me back. It was not until I entered graduate school that I got to know my professors as people (which is deeply enriching) and finally began to truly “get involved.” Graduate school opened many doors for me and afforded me numerous personal and professional opportunities, many of which, I did not even realize existed. I count myself lucky to have been referred by one of my professors (thank you, Bill H.) to AIPG as a potential candidate for an internship, and after a brief in-person meeting with the executive director (thank you, Bill S.) I was suddenly “involved” with AIPG. From there many more doors opened for me and I relished the opportunities that came with being a graduate student in the earth sciences: attending GSA for the first time, flying to the east and west coasts of the U.S. (paid for by my advisor’s grant money – thank you, Mike!), writing a guest editorial in a textbook (thank you, Les), developing curricular materials in the geosciences (thanks again, Mike), receiving a paid fellowship, and eventually earning my doctorate. I can’t help but wonder what my life might have been like if I hadn’t gotten involved – I suspect my career would have looked much different today.

**A Few Recommendations for “Getting Involved”**

To prospective undergraduate and graduate students alike, I encourage you to ponder how you might take advantage of opportunities related to the following (or, better yet, be proactive by going out and identifying these opportunities):

- Research (undergraduate or graduate experience; may lead to collaborations and/or presentations)
- Conference Attendance/Presentations (networking)
- Field Experiences (any time you can get into the field, there is something to be learned)
- Volunteering (service leads to opportunity)
- Professional Memberships, Clubs, and Organizations (consider joining AIPG if you’re not already a student member [it’s FREE!]; networking; potential discounts on conference attendance; local section/chapter participation; résumé posting to organizational web pages and access to employer-posted job vacancies; student scholarships)
- Get to know your Professors (opportunities abound, so let them know you’re interested; as an added benefit, it doesn’t hurt to gain a potential reference when job hunting)

Michael Urban, Ph.D., MEM-1910, Assistant Professor, Professional Education, Bemidji State University, Bemidji, MN 56601.
What Geology Students Need To Know About Professional Licensure

Robert E. Tepel, PG, CEG

Knowing important information about professional licensure while you are a student will help you choose the right schools and take the right courses to put yourself on the path to licensure well before you graduate. While not all professional geologists must be licensed to secure high-level employment in their chosen field, holding a state license is a requirement for many responsible positions — the place you might want to be a few years after graduation. Key fact: there are steps you can take while a student that will ease the path to licensure in the early stages of your career. Key hint: even if you think your career path will not require licensure, remember that geological career paths often have branches leading to unexpected employment opportunities, and your student days are the best days to prepare for job opportunities that might require licensure.

Why Licensure?

In the United States, the authority to regulate professional practice is reserved to the individual states. Professional licensure for geologists is in effect in 29 states and the Commonwealth of Puerto Rico. (See the MAP at www.asbog.org.) Together, these jurisdictions hold about 80% of the U.S. population. There are variations among the states in the details of their licensure laws and the way they are administered, but there are also broad similarities. For instance, all states use the same licensure examination. It is prepared by the National Association of State Boards of Geology (ASBOG©). One of ASBOG’s goals is to ease the route to mutual recognition of licensure among the states, so that when you are licensed in one state, you can become licensed in another with minimal fuss.

The justification for the regulation of any profession by a state is the legislative determination that the impacts of the profession’s work on its citizens’ health, safety, and wellbeing are sufficient to require a basic level of competence for the responsible practice of the profession. Licensure is the quality-control mechanism by which a state limits certain areas of professional practice to people who have demonstrated basic qualifications to practice, authorizes their practice, and imposes responsibility and accountability on practitioners. The interest of the state in the practice of geology goes beyond just protecting its individual citizens from incompetent or unethical practice because the impacts of geologic practice for one citizen can affect the interests of others — individuals, companies, and governmental entities.

For example, consider the case of a geologic investigation performed for a single-lot residential hillside development. Clearly, slope stability is of concern to the owner and the design engineer. If the geologic investigation does not find an existing potential landslide failure surface that can be corrected by engineered earthwork, a later landslide can affect not only the property owner but also adjacent private properties and public property — streets and utilities, and result in loss of utility services and road closures that affect many people (the public) for days or weeks, and impose emergency service and road repair costs on the city (i.e., taxpayers). Key fact: licensure is not a barrier to entry into the profession of geology. Entry-level positions are exempt from licensure (if their work is of the type that requires licensure, then entry-level employees must be supervised by a licensee who is in responsible charge of the work). Many employers (especially petroleum and mining companies) need few or no licensed geologists on staff because their geologic practice is internal to the company. However, if that practice travels outside the company and becomes practice on which the public will rely, a licensed professional may be required to be in responsible charge of the work and to sign and stamp the report or document that is released to the public. Examples would be a geologic report submitted to a regulatory agency in support of a request for a permit from that agency, or a progress report to an environmental regulator on a site clean-up if the company had a spill that contaminated soil or groundwater.

What Type Of Work Requires Licensure?

Key fact: while licensure is not required for entry-level positions, it is the gateway to advanced practice in responsible charge of work that will or can affect the public health, safety, and wellbeing. What kind of geologic work is this? Commonly, it is work related to civil engineering practice (including engineered structures, facilities, and land development); geohazards (slope stability, seismicity factors, expansive and collapsible soils, active faults, volcanic hazards, naturally-occurring hazardous minerals); environmental protection and remediation; groundwater resource management, development, remediation, and protection; permitting and regulatory compliance; and forensic practice (insurance, construction claims, and litigation work). In large part, this work is performed by consulting geologists who are retained by a variety of clients who need their expertise from time to time. Typical consulting geology practice settings include sole proprietorship, the small partnership or incorporated firm of geologists (or geologists and geotechnical engineers), and large civil planning, design, and construction corporations in which the geologist is part of a multi-disciplinary team. Some local, state, and federal regulatory and permitting agencies, as well as investor-owned public utilities and enterprise-operating public agencies, find it advantageous or necessary to have licensed geologists.
on their staff. Key fact: increasingly, employers of geologists view employee licensure as a plus for their business and require licensure for higher level technical or supervisory positions as a demonstration of employee professionalism and competence.

About The Licensure Exam

The ASBOG© licensure exam is an 8-hour multiple choice examination. It is administered in two 4-hour parts: Fundamentals of Geology, and Practice of Geology. The exam is based on a Task Analysis Survey that ASBOG© conducts about every five years. This survey presents a random selection of practicing (licensed) geologists with a list of tasks they typically perform and asks them to rate the tasks by importance in protecting the public. As the nature of professional practice changes with time, this twice a decade survey keeps the exam aligned with the current scope of practice and the body of knowledge that supports it. The exam questions are written by a panel of Subject Matter Experts, and the exam’s distribution of questions by subject matter is based on the responses to the Task Analysis Survey.

ASBOG© describes the general subject matter content of its exams in the Test Blueprints in its Professional Geologists Candidate Handbook, available on its web site, www.asbog.org. The Candidate Handbook provides sample questions and additional information about taking the exam and licensure. Commercial study guides and courses are also available. Key point: ASBOG© does not endorse, or give approval to, commercial examination preparation guides or courses.

The Fundamentals of Geology part of the exam tests your knowledge of academic subjects important to licensed practice. The Practice of Geology exam contains questions or problems that require more analysis; often there is a scenario set to frame the thinking necessary to answer the question. The Practice of Geology exam reflects the scope of knowledge and problem-solving skills that are used or acquired in the first few years of employment.

Applying To Take The Exam

Application to take the ASBOG© exam is made to a state board that regulates geologic practice, typically the board in the state in which you reside or attend college. The ASBOG© web site lists contact information for all state geology boards (click on State Boards). Key hint: in some states, students can take the Fundamentals exam while in their senior year in college. Clearly, if this option is available to you (check the board’s website), this is the best time to take the Fundamentals exam, while the academic knowledge it tests is fresh in your mind. All states that license geologists require 3-5 years of experience before applicants can take the Practice exam. The “Matrix” on the ASBOG© web site summarizes this information, but be sure to review all the information about qualifying for the exam and licensure, on the web site of the state board, so you know you meet all of the requirements.

Typically, 30 semester-hours (or equivalent) in geology or closely related classes are required to qualify to take the exam; some states require that a certain minimum number of these be in upper division courses. Key hint: be sure that the course load for your baccalaureate degree matches the state licensure board educational requirements for the state in which your school is located, if you can take the Fundamentals licensure exam as a senior, or matches the state board requirements for the state in which you will take the exam after graduation (perhaps the state that is the location of your first job).

Undergraduate Courses That Help Prepare You For The Exam

Would you like to be part of the 70+% of test takers who pass the exam on their first try? Take a close look at the Test Blueprint in the Candidate Handbook. Compare the Test Blueprint to your course work and ask, “Am I taking enough courses that cover exam content to give me the background I need for success on the exam?”

A review of the Test Blueprint will tell you that the exam is oriented toward applied geology practice. You will recognize that coursework topics needed for success on the licensure examination, in addition to the basic geology courses taken by all majors, include geomorphology, field geology, hydrogeology, engineering geology, Quaternary geology, structural geology, and geohazards. If your curriculum lacks only one or two courses that will supply this knowledge, you might find self-study or a commercially available exam preparation course to be helpful in exam preparation.

Matching Your Career Goals With Your School’s Program Goals

Key hint: many faculty members have little or no knowledge about professional licensure for geologists. Universities have programs and educational goals that match their missions. Some universities with large geology departments are focused on teaching geology to students who want careers in academia or research, and their undergraduate programs are limited to the courses those students need. Other large departments offer a variety of applied courses as part of their catalog. Schools with small geology departments are likely to focus on general courses and might lack faculty expertise and courses in some of the applied geology topics tested by the exam. Other universities or colleges focus on teaching students who want careers in industry, consulting, or government; these are the institutions that will be more likely have many of the courses that match the licensure exam knowledge base. It is up to you, the student, to analyze the match between your career objectives and what your school is prepared to teach you. Final key hint: if you see large gaps between your curriculum and the Test Blueprint knowledge base, review your career objectives. If your planned career path requires licensure, or if you want the career flexibility that licensure offers, you will be well served in both your education and your career by choosing a school that offers courses covering the breadth of the licensure exam.

Disclaimer

This article is entirely the work of the author and ASBOG© does not, by policy, endorse or approve articles about its examinations.

Robert E. Tepel is a licensed geologist in California and Arizona, and a Certified Engineering Geologist in California. His 47-year career emphasized engineering geology for water resources infrastructure. He is a past president of the Association of Environmental and Engineering Geologists.
One of the requirements for upper level geology courses in our program is for undergraduates to do independent research projects and to present their results in the class. We also encourage students to work in professors’ labs and their names are included in any paper that results from the lab project. Sometimes, students are encouraged to present their results to their peers in a campus-wide conference in addition to their classroom presentation. Also, we strive to encourage undergraduates to attend conferences, asking them to do volunteer work where possible for ‘free’ admissions.

There are several benefits that result from students’ participation in conferences. Students are acculturated into the world of research. Students see the use of and results from the use of research equipment such as SEM, XRD, rock saw, and microscope. Some students have continued their undergraduate research projects into graduate studies, and all benefit from having presentations and conference attendance in their professional resume. Students appreciate data better from their labs when they read research articles. The college or university also benefits through exposure of the college/university to outside colleges/universities and potential employers of the students. The opportunity to network and meet with other students are added benefits.

Several students who have presented their independent research projects have said that they value the experience of not just the research project, but for presenting their results.

Students who have presented their results at local, regional, and national conferences have expressed great satisfaction attending those conferences and they have also express satisfaction meeting some of the authors of articles or books they have read. Undergraduates should avail themselves of every opportunity made available to them to present or attend conferences, as it is a win-win situation for them and their home institution.

Dr. Isiorho is a professor of geosciences and the Chair of the Geosciences Department at Indiana Purdue University Ft. Wayne (IPFW). He has more than twenty-three years of university teaching experience, has given presentations at local, national, and international meetings in four continents. His research interests include using wetlands as outdoor lab for undergraduate student learning and examining the relationship between surface water and groundwater.
The drive up to the AIPG National Conference in September was much different than the drive down. The drive up was for the most part in the dark, and my main thoughts about what I was able to see didn’t extend much past “man, this really is flat!” or “fall colors!!!!” The drive down was spent looking for cell phone towers (i.e. glacial moraines).

My first AIPG meeting was also my first drive through Illinois and my first time going on a field trip while at a meeting (there were a lot of other firsts, albeit irrelevant to this column, on that trip: first time renting a car, first time in Chicago, first time hanging out with college friends in post-college life, first parking ticket, first martini on the 96th floor of a building…). Going to that meeting was definitely a good call. For one, the field trip was AWESOME! Don McKay, MEM-1764 and Dick Berg, CPG-08041, of ISGS, led it and took us to some sweet outcrops I would never have expected to see in a place with such a boring reputation as Illinois. My favorite by far was a beautiful paleosol (Sangamon Geosol), A (and maybe O?) horizon standing out boldly against a loess deposit above it (Wisconsin Episode) and a perfect grading down to the E horizon below it. Now, I thought I’d seen my fair share of glacial geology while in Wooster, OH, but this blew me away. An E and an A horizon!!! The geek in me almost couldn’t handle it. Successes of the day included: 1) managing to only pick up one rock 2) not breaking out from the abundant poison ivy we walked through 3) a tarantula sighting (in Illinois???) and 4) refraining from serenading the group with John Hartford’s “Long Hot Summer Days” when we stopped for lunch by the Illinois River (“For everyday I work on the Illinois River/get a half a day off with paaaaaaaaaaaaaaaaaaaaaay/on a towboat pickin’ up barges/on a long hot summer daaaaaaaaaaaay”).

Needless to say, the field trip was a great way to start the meeting off and the reason for the distinct difference in driving experiences. The next couple days I spent going to talks, listening to great keynote addresses, and meeting/catching up with people. The latter of that list is the main reason the experience was such a good one, besides the field trip: it was great to talk with people, to put faces to names I keep seeing in e-mails and articles, and to learn about what other geologists do. Networking is, after all, one of the main purposes of a meeting, and everybody at AIPG is so friendly and encouraging. While I was sitting through the awards ceremony on the last night of the meeting, I really felt the sense of community AIPG provides to us. And, as my good friend David Abbott pointed out before he was called up to be recognized, that’ll be us before we know it.

By the end of the meeting I was already looking forward to next year. It’ll be in South Dakota--talk about some field trips!

Stephanie is a masters student at Southern Illinois University, hailing from the great state of Kentucky with a little bit of Ohio in between. I’ve been enjoying learning my way around Carbondale, which (believe it or not) has an awesome music scene, plenty of ways to enjoy the great outdoors, and some fabulous restaurants.
Larry Cerrillo, CPG-02763
Hydrogeologist, Mediator/Facilitator

Most of us in the geosciences take few courses that will help us address the many conflicts we will face once we get into a project. Very early in our careers we get assigned to a project based on the technical degree we earned in a particular discipline. What we are not prepared for are the individuals or communities that are in some way affected, or perceived to be affected by our work. Typically “higher-ups” deal with the community or individual likely to be affected.

My message is therefore to prepare yourself because you are the one on the front line. “Higher-ups” typically hold community meetings at which they expound on the merits of the project and then provide two to three minutes for attendees to respond. Invariably, as you may imagine the responses are seldom friendly. This is your “DAD’s” way of doing things; Decide, Announce, and Defend. Changes to this process have been changing for the better, but unfortunately continues in many cases.

Be prepared to be the difference. You may not be able to make many of the weighty decisions, but you can be the geobassador. One of Webster’s definitions of ambassador is “an authorized representative or messenger”. You may not be officially authorized, but you can be a factor nonetheless. I recommend you take courses on conflict or do some reading on the subject. One of the better books is “Managing Public Disputes” by Susan L. Carpenter and W.J.D. Kennedy. Your success in the field, regardless of the arena in which you are working will depend on how well you can get along with those in the community. In fact, it will also depend on how well you interface with fellow scientists in different disciplines.

Often what you learn by engaging with others and with the community may be of value to “higher-ups”. Flexibility and changes during the course of a project based on what you learn may directly affect the bottom-line. Become a geobassador—learn how to prevent conflict before it occurs, and how to deal with it once it does occur. Remember, “Conflict is inevitable, litigation is not”

Larry is a past president of AIPG. He has a BS in Geology from Syracuse University and an MS in hydrogeology from Colorado State University. He is formally trained in environmental and public policy dispute resolution, and has numerous certificates of study in dispute resolution; including a Certificate of Advanced Study in Dispute Resolution from the University of Denver.

Larry Friedman earned his M.A. and Ph.D. from Columbia University. He earned a Doctorate of Science from the University of London and received an honorary Doctorate of Natural Science from the University of Heidelberg in Germany. Gerry initially worked as a geochemist and petrologist in the Appalachians and the Canadian Shield. He then went on to become a research geologist and director of sedimentology research at the Amoco Research Laboratory in Tulsa, Oklahoma.

Gerry began teaching at Rensselaer Polytechnic Institute in 1964. He retired from RPI in 1984 and went on to join the faculty at the City University of New York, Brooklyn, where he worked with graduate students and post-doctoral researchers on carbonate deposits, regional stratigraphy, the environmental geology of rivers, amongst a variety of other topics. He retired from CUNY in 2004, but continued his research on the sedimentology and stratigraphy of Paleozoic deposits and prospective gas storage reservoirs in New York State and evaporite and carbonate deposition worldwide.

Gerry joined AIPG in 1967 and continued his active support of The Institute throughout his exemplary career.

Gerry has won numerous prestigious awards for his work. He is the recipient of the SEPM Twenhøfel Medal, our societies highest award, as well as Honorary Membership and Distinguished Service Award. Other awards include the American Geological Institute’s 2005 Legendary Geoscientist Award, the Geological Society of America’s Mary C. Rabbit Memorial Medal, the AAPG Sidney Powers Memorial Medal, the AIPG John T. Galey, Jr. Memorial Award, The Association of Earth Science Editors Award for Outstanding Editing, the Distinguished Educator Award and the Hollis D. Hedberg Award in Energy from the Institute for the Study of Earth and Man at Southern Methodist University.

IN MEMORY

Gerald M. Friedman
CPG-01531
Member Since 1967
November 2011
Troy, New York

IN MEMORY
Georgia Section

The Georgia Section has had a busy month of October. We visited a remediation site in Kennesaw, GA where a new air sparge/soil vapor extraction (AS/SVE) system had been installed at an active gas station. Steve Diamond with S&ME, Inc. led the discussion on the history of the site. Afterwards we had lunch together and it gave an opportunity for the student members from Georgia State University to ask questions to the professionals. We hope to visit a dual-phase remediation system in the spring semester. A few days later I visited Columbus State University where I presented them with their student chapter plaque.

On October 21, 2011, we visited Georgia Southwestern State University and demonstrated installing a monitoring well, soil description, soil sampling, groundwater sampling, and surveying. Sam Almaee, CPG-06310 with GEC, Inc. led most of the discussion.

Ron Wallace, CPG-08153
Section President

Remediation site participants.

Columbus State University Student Chapter. Bryan Victor, SA-1966, with plaque, is student president.

Atlas Geo-Sampling demonstrating direct push.

Demonstrating surveying to the students.

Sam Almaee on left pointing out details from the soil samples.
It is with great pleasure that I start my term as National Editor with this Student issue. I started this special series when I was editor in 2001-2003 and it is great that this has become an annual issue. The student issue is written to encourage students to continue in the field of geology. Students are our future and we must mentor and encourage them in every way that we can. This volume achieves that goal. So please order extra copies and distribute among students in your area.

I have wanted to be a geologist since I was a young girl growing up in Baltimore, Md where I had an earth science class in junior high. Although I did not take another formal course in earth science until I was in college, I did literature reviews, science fair projects, and other science projects in my formal science classes. I guess I forced some of my high school science teachers into including geological topics in their curriculum just to shut me up.

The profession of geology is a unique field that combines aspects of science, engineering, history, art, and detective work. It is a fun, challenging and rewarding profession. Geologists utilize the scientific method throughout our investigations, but we also employ many other skills. Scientific and engineering principles guide our approach to problem solving. And as a geologist, one is seldom ever bored; there is always a new area to examine!

Since we are all students of geology this issue is important to all of us as a reminder that learning continues long after graduation. Geologists must take time from their work to continue to be informed and learn about new ideas and technologies in our particular fields—we never stop learning. Continuing education is important to be effective in our respective jobs. Learning does not end with getting that college degree, it only begins. Continuing education must be a life-time goal. Our field is constantly changing and the regulations and guidelines for us to practice geology are constantly changing and geologists must keep current on all of these issues. There are many ways to continue our education—take a look at the AIPG Continuing Education Program for examples (http://www.aipg.org/Education/CPDProgram.html). These include attending and presenting papers at conferences, and attending and presenting at short courses or other formal classes, and writing papers and reports, even writing an article for TPG.

Another way for practicing geologists to continue their education is by mentoring young people and giving presentations to both secondary schools and colleges/universities, as well as at other community functions. Career days offer an excellent opportunity for practicing geologists to pass on the word that geology is not only fun and rewarding, but can provide a sustainable living. AIPG has a web page devoted to educational materials to aid in practicing geologists in presenting lectures on careers and geology in general (http://www.aipg.org/Education/EducationalMaterials.html).

The future for professional geologists looks just as exciting as ever. Geologists will discover and help develop new energy and mineral resources that our hungry society will require in the future and in an environmentally friendly manner. Other issues such as climate change, natural hazards, atmosphere quality, the economy, national defense, and even travel to other planets like Mars will see geologists among those that solve these challenges. It is important to encourage and mentor future geologists and each of us can help.
1. Which of the following constitutes an example of a tabular, concordant pluton?
   a. Batholith.
   b. Dike.
   c. Sill.

2. Globally, deserts may be associated with:
   • The 30-degree latitude belts.
   • The rain shadow zone of mountain belts.
   • Regions within continental interiors at great distances from the ocean.
   • Tropical coastlines next to cold currents.
   • Polar areas.
Which of the following deserts is an example of the coastal variety next to cold currents?
   a. Thar Desert.
   b. Gobi Desert.
   c. Atacama Desert.

3. Seismic evidence in our chosen area for petroleum exploration indicates the presence of a possible ancient shoreline oriented NE-SW and a related fluvial channel system running in a general NW-SE direction. A well is drilled and encounters commercial hydrocarbons in a well-developed clean-sand sequence. The sand reservoir is characterized by coarser-grained strata at the bottom and progressively finer-grained sediments at its top. The SP curve, opposite the sand sequence as seen from wire-line logs is distinctly bell shaped. Which depositional environment is likely to describe the sand reservoir in our discovery well?
   a. Fluvial/alluvial point-bar deposits related to the roughly NW-SE stream-channel trend.
   b. Coastal barrier bar sediments associated with the generally NE-SW trending inferred coastline.
   c. Clastic deposits in lagoonal settings, expected between the barrier islands and the coastline.

4. In our study of planetary geology, we wish to calculate the “escape velocity” (in meters per second or m/s) or minimum velocity an object must achieve in order to escape the Earth’s gravitational field. Recalling:
   • Gravitational constant = \( G = 6.67 \times 10^{-11} \text{Nm}^2/\text{kg}^2 \)
   • Mass of the Earth = \( M_e = 5.98 \times 10^{24} \text{kg} \)
   • Radius of the Earth = \( R_e = 6.38 \times 10^6 \text{m} \)
   • Universal Law of Gravitation: \( F = G \frac{M_1 M_2}{R^2} = G \frac{M e}{R e^2} \)
   • Gravitational Potential = \( U = -GmMe/Re \)
Calculate the approximate “escape velocity”:
   a. 21,905 m/s
   b. 11,180 m/s
   c. 1,035 m/s
   d. Give me a break!
Looking Forward to the Year Ahead

Barbara H. Murphy, CPG-06203
bmurphy@clearcreekassociates.com

The American Institute of Professional Geologists has made notable progress in the past few years in developing additional services and programs, broadening membership categories, and by clarifying goals and objectives, all of which help to strengthen AIPG as a professional organization. Many of these developments also provide added value to our members. AIPG’s future is dependent on continued outreach and growth in this global profession.

Recent developments and revisions of AIPGs Strategic Plan focused on providing more value to our members and strengthening the financial stability of the organization. AIPG continues to have a strong focus on advocacy for the profession and professional development. AIPG continues to update its website and add features and services with web-based technology. The technical symposia held at various locations throughout the country have been successful in providing a forum for sharing technical information and expertise on a variety of timely topics pertinent to our members as well as members of other professional societies, regulators, policy makers and the interested public. AIPG is also developing a webinar program with the American Geosciences Institute (AGI) which will not only be of value to our members and other geologists as continuing professional development, but is also intended to promote the importance of geology and geologists and provide a forum for current issues to other professionals and to the general public. AIPG and AGI recognize the trend of professional and continuing education from in-person to online experiences. Development and implementation of this online learning program is also supportive of AIPG’s and AGI’s common interests in supporting the earth sciences and geology professions, providing updated technical and professional information for the geoscience and non-geoscience professionals, expanding educational opportunities for teachers and students of all levels, and providing practical services to its members.

The AIPG website can be a useful communication tool so I encourage each section to have a website to share information with all AIPG members and as a convenient option for posting newsletters and announcements, State and local legislative issues of note, section executive board and committee contacts, and other items of interest. It’s a great way for members to see what their section is doing and what other sections may have planned. AIPG headquarters maintains a website for several sections; however, it is still up to the section to send in materials to be posted and to check that the website is current and has correct information. A few AIPG sections maintain their own website.

These are all important ongoing efforts that add relevancy and value to AIPG and increased awareness of the important role of the professional geologist and the science of geology. AIPG, as an organization, and its members have a lot to offer through interaction with each other at section and national meetings, on field trips, at technical symposia, at functions with other professional organizations, through articles in The Professional Geologist, by providing updates on legislative and regulatory issues related to the profession, the use of web-based information and databases, e-mail communications, and now even through social media. Modes of communication have certainly changed in the last few years and AIPG is adding to its communication technologies.

Although we have made progress in services for our members and in continued advocacy for the profession, obviously there is more to do. For AIPG to become an even stronger organization, we need more of our members to become actively involved at the section and national levels. We are fortunate to have a very dedicated staff and executive director at headquarters. As with other similar organizations, AIPG is dependent on the work and efforts of its member volunteers. We are fortunate to have quite a few industrious members who volunteer their time and energy and resources on behalf of AIPG and the profession. Their efforts are greatly appreciated. However, we need more volunteers to help. For those of you who have been involved with your section and/or the national office, you are very aware of what a great group of people we have at AIPG. I think many of our members find the volunteer work efforts and professional camaraderie quite rewarding. If you are not yet an active member, I encourage you to become more engaged with your section and at the national level. AIPG’s future as a strong professional organization is dependent on these efforts and the input from member volunteers of all levels, as well as increased involvement from our students and young professionals. Participation with an AIPG section and with national activities may be very rewarding for professional development, perhaps even in finding that first job or learning of other opportunities in the profession.

I look forward to serving as AIPG’s President in 2012. I plan on continuing to work on additional services and programs to strengthen AIPG as a professional organization and encourage ongoing outreach for growth and greater public awareness of the geology profession. I hope to work with each section to strengthen communications amongst the sections, with the executive board, and with headquarters. I encourage you to contact any member of the executive board and let us know what is important to you and how AIPG can provide even greater service to its members and the profession. I look forward to hearing from you and I hope you will become actively involved with AIPG to help make it an even stronger professional organization.
GeoConnection Recruitment Packets: Getting Students Involved in the Geoscience Community

AGI’s GeoConnection Recruitment Packets provide geoscience departments with a tool to directly engage prospective geoscience majors in a discussion about the many career opportunities in the geosciences, and about the importance of participation in geoscience professional societies and conferences. There were 2,279 packets sent to 82 departments between 2009 to 2011. Information about geoscience careers and professional societies, a copy of the EARTH Workforce magazine, “Why Earth Science” DVD, and grain-size rulers are included in the packets. In addition, students can choose up to five free 1-year memberships to geoscience professional societies. Students also receive free access to AGI’s online Glossary of Geology for one year.

![Professional Societies that Students are Joining](chart)

An online survey was administered to students to assess packets’ value and effectiveness. Below are some students’ reactions to the packets:

“I appreciate the packet; it’s a very beneficial packet that opens the doors to a lot of geologic societies that I wouldn’t have known about otherwise.”

“I enjoyed the wealth of information about the different areas of Geology.”

“The membership aspect is awesome and now I receive a lot of different publications that are interesting to me.”

- Heather R. Houlton

Interested in Participating?
1. Contact Heather at hrh@agiweb.org
2. Request packets to be sent to your institution
3. Take our survey at: http://www.agiweb.org/workforce/ and tell us what you think!
The University of Kansas announces 2011 Award Winners.

The University of Kansas Geology Department recently announced the two alumni winners of the Industrial Haworth Award and Academic/Government Haworth Award for 2011. Eric Vogl with ExxonMobil received the Industrial and Ron Wallace CPG with Georgia Department of Natural Resources received the Academic/Government. The award is named for Dr. Erasmus Haworth, first chairman of the Department of Geology in 1892. Both Eric and Ron are members of the Geology Associates Advisory Board at Kansas University.

International Mining Alliance for Minerals Analysis has Election of Officers.

Dr. Michael Mound, CPG-03195, has been elected as Vice President for the International Mining Alliance.

The International Mining Alliance (IMA) is a leading not-for-profit association striving to be the largest mining-specific organization in the world. Its members come from every corner of the globe and cover virtually every aspect of the macro mining universe. Its four principal tenets include: to achieve equality, mutual benefits, resources sharing, exchange and cooperation of the global mining industry, to safeguard the legitimate rights and interests of the global mining industry, to promote the sustainable development of the global mining industry, and to enhance the international status and anti-risk capability of the mining industry. The Services Scope of the International Mining Alliance:

1. Organize mining technology research cooperation, key products, and equipment R & D.
2. Organize mineral rights information exchange, trade and cooperation so that the resources can be shared.
3. Provide investment and financing for projects and mineral rights of the Alliance enterprises.
4. Establish the network communication and information exchange for the Alliance members.
5. Organize or unite IMA members together to develop large mining projects.
6. Establish industry, academia, research interaction mechanisms among companies, schools, research institutes for IMA members and push the Alliance members to move to a higher level.
7. Organize all levels of innovative personnel training projects for IMA members.
8. Organize joint venture and cooperation between the financial institutions and provide industry consolidation, listing and financing for IMA members.
9. Carry out international mining cooperation and exchanges, organize IMA members to hold or participate in domestic and international mining exhibition, and foster and promote the influence and share of IMA’s mining products in the domestic and foreign markets.
10. Organize and carry out fellowship and public activities for international mining members.
11. Provide legal assistance and legal services for the Alliance members.
12. Provide mineral rights handling and management services for the Alliance enterprises to invest in mineral resources in their countries.

2011–2012 Richard Jahns Distinguished Lecturer

GSA Fellow Scott Burns, MEM-0599, has been named the 2011–2012 Richard H. Jahns Distinguished Lecturer in Engineering Geology. Burns is a professor of geology at Portland State University (PSU), where he specializes in engineering and environmental geology, soils, geomorphology, Quaternary geology, and terroir. He just finished his 21st year of teaching at PSU and his 41st year of teaching at the university level (including in Switzerland, New Zealand, Washington, Colorado, and Louisiana).

Burns received his B.S. and M.S. degrees from Stanford University, and earned his Ph.D. at the University of Colorado. He holds registrations in Oregon (RG & CEG) and a license in Washington (LG) and is a consultant and expert witness for legal cases. Burns has authored or co-authored more than 80 articles and 200 published abstracts as well as two books. His diverse research topics include landslide debris flows; radon and earthquake hazard mapping; heavy metals and trace elements in soils; loess stratigraphy; slope stability; the Missoula Floods; biogeomorphology; alpine soil development; and terroir.

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The American Institute of Professional Geologists is preparing to celebrate its 50th Anniversary. AIPG had a somewhat inauspicious start in 1963 when a dedicated group of petroleum geologists decided to found a professional society dedicated to advocacy and promotion of the profession. AIPG Founders were members of AAPG (many of the founders continue membership in both AIPG and AAPG.)

Demographics have changed during the ensuing 50 years, but the mission of AIPG to promote and advocate for the practitioner and the profession continues unabated through the efforts of dedicated volunteer members like the Founders. For the next few months leading to the AIPG's actual anniversary, this column will occasionally contain an excerpt from Richard Proctor’s, CPG-05091, “A History of AIPG 1963 -2003”. The remainder of this column is such an excerpt.

“Founding Convention, Golden, 1963

“Prominent Professional Geologists Plan New Organization

“On Friday the 13th of September, a meeting was held in Oklahoma City, which may be a milestone in the annals of the professional geologist.

“It was the meeting of a Steering Committee whose purpose it is to form the American Institute of Professional Geologists. Final plans for the founding convention are being made. It will be held on the campus of the Colorado School of Mines at Golden, Colorado on November 14th and 15th of this year. All Professional Geologists are invited. Each local, area and state geological society is asked to send an official observer appointed by the President of the local society. The official observer will also be a participant.

“The Steering Committee is composed of Professional Geologists who were mutually chosen because of their background and interest in the professional movement in geology. They have studied the problem over an extended period of years and are well informed on the subject. They are listed below:

“Robert M. Becker, CPG-41, Consultant, Oklahoma City, Oklahoma; Oklahoma Society Professional Standards Committee; Host of the Steering Committee meeting.

“Thomas R. Beveridge, CPG-3, State Geologist of Missouri, Rolla, Missouri; AGI Professional Standards Committee; Active in professional movement in Missouri.

“Frank B. Conselman, CPG-4, Consultant, Abilene, Texas; Past Vice President of AAPG; Geological Advisor of Southwestern Legal Foundation; AGI and AAPG Professional Standards Committee since inception of both.

“Bernold M. Hanson, CPG-187, Consultant, Midland, Texas; Chairman AAPG Professional Standards Committee and actively interested in professional up-grading.

“Adolph U. Honkala, CPG-7, Consultant, Richmond, Virginia; AGI Professional Standards Committee; Director, founder and Past President of the Virginia Association of Professional Geologists.

“W. W. Mallory, CPG-11, U.S.G.S., Denver, Colorado; AAPG Professional Standards Committee; Actively interested in the national professional upgrading of geologists.

“Ben H. Parker, CPG-212, Vice President, Frontier Oil & Refining; President of the Board of Trustees, Colorado School of Mines; Past President AAPG; five years on AGI Professional Standards Committee; First Chairman of AAPG Professional Standards Committee.

“Edward E. Rue, CPG-12, Consultant, Mt. Vernon, Illinois; Illinois Geological Society, AAPG and AGI Professional Standards Committees; Active in reorganization of IGS on professional level.


“Allen C. Tester, CPG-2, Professor of Geology, State University of Iowa, Iowa City, Iowa; AGI Professional Standards Committee; Active in the reorganization of the Iowa Geological Society on a professional level.

“Martin Van Couvering, CPG-1, Consultant, Pasadena, California; Past President of the Pacific Section AAPG and actively interested in improving the status of geologists.”


www.aipg.org
Students and Job Outlook

Are there jobs for geoscience students who are leaving school? Where are these jobs? I don’t have all, or even many of the answers, but I do have some observations that suggest that the job outlook may be pretty good, at least in some fields, because of the age distribution of practicing geoscientists. The current situation is not unlike the situation that existed when I entered the workforce. There were jobs and opportunities because there was an age gap preceding my age cohort.

The following age distribution histograms illustrate this point. Figure 1 presents the age distribution for the American Association of Petroleum Geologists (AAPG) in 2001.

Figure 1 shows a prominent high for AAPG members for those between 41 and 55 in 2001, who are 51-65 today. There is a smaller peak for those between 66 and 80, this is the remnant of the more experienced geologists who were 15-25 years older than my cohort and which in the mid-80s resulted in a distinctly bimodal age distribution at that time.

Figure 2 presents AIPG’s 2011 age distribution. While there is clearly a high between ages 50 and 69, there is still a minor peak from 80+ and another peak from 25 to 29, primarily composed of our graduate student members and those who’ve recently joined the profession. Figures 1 and 2 both show multiple highs with intervening lows that reflect periodic decreased job opportunities resulting from general economic swings, which affect the hiring of geoscientists. While neither the AAPG nor the AIPG data represent the whole geoscience profession, these data are consistent with similar, more broadly based analyses I’ve seen.

To me, Figure 2 shows that today’s students and young professionals have an age gap ahead of them that means that jobs will be available and more rapid advancement will be possible both in the work place and in professional society participation. Take advantage of this. My career has benefited from the fact that AIPG welcomed me as young professional and provided the opportunity for me to participate in various activities starting at the section and then national level.

So where are the jobs? I’m no expert but
I do know that the petroleum industry needs geologists to help exploit the shale gas plays and others that will be coming. One colleague who had started in the oil business and transferred to the environmental sector remarked that he’d like to get back in the oil business but at his age and point in his career, he didn’t see this as a viable alternative. Likewise there is a need for young professionals in the mining business. The environmental business has changed over the years, but is not going away.

The cyclic nature of geoscience employment has been part of the profession for decades and downturns will happen again. By getting experience in the good times and by being flexible in your interests and abilities, your chances of continuing employment in the profession are good. The need for a broad geoscience background and flexibility during your career are the major messages of Reflections on a Geologic Career, which is available for free on the AIPG website under “Publications.” Get a copy and read it.

Remember, the lack of a cohort ahead of you is an advantage; use it.

Blowing the Whistle—The Penn State Sex Abuse Scandal

The Penn State sex abuse scandal has been all over the news of late. While the facts are not all in, the fact that various people who knew about the problem and didn’t report it to the police widened the scandal beyond the alleged perpetrator. In this case, failure to alert the police has resulted in several firings. Although those fired apparently did comply with Pennsylvania’s law, they are viewed as having failed to live up to their moral obligations.

We have the same reporting obligation for violations of professional ethics. AIPG’s Ethics Code, Rule 2.1.3 states, “If a Member becomes aware of a decision or action by an employer, client, or colleague which violates any law or regulation, the Member shall advise against such action, and when such violation appears to materially affect the public health, safety, or welfare, shall advise the appropriate public officials responsible for the enforcement of such law or regulation.” Reporting up the chain may not be enough. The unethical situation must be corrected one way or the other. While blowing the whistle can have adverse consequences, failing to do so can also have adverse consequences.

A Hiring Question

Raphael Ketani, CPG-9003, sent me the following question. “A thought crossed my mind regarding hiring practices, both in the private sector and in the public sector, and ethics. I know of an environmental office where someone who is a managing geologist was allowed to hire a specific number of personnel without his boss indicating what type of technical specialist he could hire. This individual hired two geologists and eight engineers. Both of the geologists under him and the engineers perform the exact same duties and have the exact same responsibilities. The duties involve environmental project oversight and document review. By New York State law, the work plans and reports must be reviewed by a licensed engineer. However, the work plans and reports for the projects overseen by the geologists are their sole responsibility to review, comment on and approve or disapprove. This also holds true for the projects the engineers oversee. As I stated before, everyone performs the exact same type of work, even though none of the geologists have engineering licenses (and they are not required to get one). I know this geologist personally as I used to work under him. When this person had worked in a different office, he was given favors and opportunities to advance by the administration that he used to work under, which was comprised almost entirely of engineers. The point of all of this is that this same geologist who can hire whomever he wants prefers to hire engineers. Is this an ethics issue or just bad hiring practice?”

My initial reply to Ketani asked if the geologists and engineers were paid the same, or at least on the same scale adjusting for experience, etc.? Ketani replied that those at the same grade level were paid the same although there was an experience differential. I then sent Ketani’s original question and reply to the Ethics Committee for their comments.

John Gustavson, CPG-2637, and Larry Davis, CPG-7105, both commented that they saw no ethics issue. There may be bad hiring practices, which is a policy matter, and may be disappointing and foolish, but such issues are not a professional ethics issue.

Rima Petrossian, CPG-10036, wrote, “No ethics issue here, but this premise that engineers are preferable over geologists is deeply held by management in the places I have worked and where my colleagues work. If they are just hired for their seal, it would be an equally acceptable practice to reverse the ratio of 2 geologists to 8 engineers to 8:2. However, as it is presented, I do not see it as a bad or good practice just a personal
is ultimately responsible for each individual they hire. The more experience, the less in liability.

“A good comparison to this is National Incident Management System (NIMS). This is a comprehensive, national approach to incident management that is applicable to all jurisdictional levels and across functional disciplines. What it boils down to is to put the individual that is most qualified into the position that best reflects the individuals experience and expertise. Within the NIMS structure, there is no tolerance for ‘bruised’ egos. This is not an unethical situation.”

Ron Yarbrough, CGP-6545, replied, “In Illinois, the State EPA has hired geologists as supervisors because most engineers look at soils in a different way than a geologist who receives a different education as to the surface soils that can get polluted. Also, most engineers do not take organic chemistry as do most geologists. The gentlemen to whom I reported at the state concerning the clean-up of a brown field is a registered geologist. I was somewhat set back that I did not work with a state engineer. At least [Illinois] has learned that engineers cannot do everything concerning the environment.”

This is clearly a case in which more detailed information would be helpful although it appears that a professional ethical issue is not involved. Evaluation of hiring decisions requires access to the detailed job description and the applications filed for the positions, which we don’t have, and so we can’t really determine whether or not the best qualified applicants were hired. Yarbrough’s comments on the differences in outlook and training between geologists and engineers are pertinent. But these differences can be reduced by work experience. My education in economic geology did not involve organic chemistry as do most geologists. This is not an unethical situation.”

Fred Fox, CGP-1273, noted, “That [the supervisor] prefers to hire engineers is not an issue beyond the fact that he might not be hiring the best people. However, by hiring engineers he is hiring people who have more responsibility (by law) than the geologists, regardless of pay equity. These two facts are in opposition, but that’s the way government works.” Fox didn’t see an ethical issue and wasn’t even sure if it was bad hiring practice based on the information presented. Fox did note that this isn’t the way he would have done the hiring.

Michael Ruddy, CGP-9741, responded, “There is nothing unethical that I can determine. Salary level is completely based upon years of experience. Isn’t that what we all strive for? Even if a geologist is doing the same work as an engineer, in a supervisor position, then the one in the supervisor position should most definitely be paid more than one that is not in a supervisor position. Taking on a position of a supervisor brings on a higher degree of technical complexity along with a ‘Human Resources’ role as well. This is no different than hiring one with a B.S. degree in Geology versus one with an M.S. degree in Geology. Higher education should mean higher starting pay. Keep in mind that to date, geologist’s and engineer’s still have to diversify with the profession. Engineers are needed to sign off, and stamp, engineering documents that a geologist would not qualify for. The same goes for a geologist signing off, and stamping geological documents.

“If the person referenced, is a licensed geologist and is given the flexibility to hire geologist’s and engineer’s to fill these positions, what difference does it make? Geologist or Engineer. . . . I would go with the ones that have more experience in the profession and whom can bring more to the table for the company that is doing the hiring. I also negate the comment of ‘bad hiring practice.’ You hire the person with more experience, if allowed by the company. The company is ultimately responsible for each individual they hire. The more experience, the less in liability.

Ethics Committee Membership

AIPG’s Ethics Committee is composed of AIPG members who are interested in professional ethics. I periodically send the Committee members questions, such as the one above, asking for their thoughts. Even in cases, such as the one above, where all respondents agreed that there was no ethical issue, their discussions provide a variety of useful views on the topic. Anyone interested in joining the Ethics Committee should send me an e-mail stating willingness to participate and I’ll add you to the Committee.
Following is a news release from the National Ground Water Association.

National Ground Water Association to Develop Standard for Loop Wells in Ground Source Heat Pump Systems

The National Ground Water Association has announced plans to develop an American National Standards Institute third-party accredited standard for the construction of vertical boreholes used in closed loop ground source heat pump systems, a decision reached by the NGWA Board of Directors earlier this month.

“This effort will use our now nearly 15-year-old guidelines document on this topic as the basis from which to develop the standard,” explains NGWA Executive Director Kevin McCray, CAE.

NGWA’s Guidelines for the Construction of Vertical Closed Loop Heat Pump Systems, first published in 1997, have been revised by NGWA twice in the intervening years, most recently in 2010.

“NGWA’s motivation is to strengthen our contributions to this important drilling market segment heavily served by water well drilling contractor firms,” McCray said.

“We want to help assure that the drilling of loop wells — the vertical boreholes of many ground source heat pump systems — is done in a way that protects the groundwater from contamination risk. The number of boreholes typically drilled for such systems makes groundwater protection especially important,” McCray continued. “We also want to assure that loop wells are drilled to the design specifications so these systems operate effectively over their lifetime. This will strengthen customer satisfaction and customer support.”

The guidelines cover topics such as loop wellfield design, test loop wells and samples, borehole construction, loop tube installation, loop well grouting, loop wellfield identification, and permanent loop well decommissioning. NGWA anticipates the standard will ultimately cover similar interests.

“Having much of the standards completed by way of the guidelines, we hope will lead to rapid development of the standards and introduction to the required public comment periods on the draft,” McCray says. “However, the ANSI process is very deliberate and thoughtful, with an aim toward consensus agreement. We will follow the procedures to produce our best possible work.”

BESST Inc. Opens Houston Office and Welcomes John Hofer, P.G., Southeastern Regional Manager

BESST Inc. now has three locations to better serve your groundwater needs! BESST has outgrown its headquarters in San Rafael, California and sales office in Oak Ridge, Tennessee, and is pleased to announce the company’s full service debut into the great southeast with the addition of a new office in Houston, Texas.

BESST’s Houston office serves the state of Texas and the greater southeastern regional area with personnel departments specializing in products, services, and sales. To facilitate efficient service operations for our southeastern client base, a dedicated profiling rig is stationed in Houston. The same miniaturized equipment that BESST uses to profile and video survey groundwater production wells, without pulling the pump, is now available directly from Houston. Whether you need a Blatypus pump or a full dynamic profile of a groundwater production well, BESST’s Houston office will provide you with excellent service.

To lead BESST’s southeastern operations, BESST welcomes seasoned hydrogeologist, John Hofer, CPG-10341, P.G., as BESST’s Southeastern Regional Manager. Mr. Hofer has more than 20 years experience in geoscience consulting in the eastern US, with particular expertise in Ohio, Alabama, Tennessee, South Carolina, Mississippi, Florida, and Puerto Rico. Mr. Hofer has previously worked as a private consultant, as well as for DeNuke Services & V3 Technical Services, CDM Federal Services, Shaw Environmental, Inc., and Tetra Tech NUS.

Mr. Hofer’s professional strengths lie in remediation strategies for water supply wells and he has worked extensively with packer testing. He has long been an active member of several professional organizations, including the American Institute of Professional Geologists (AIPG), the National Rural Water Association (NRWA), and the East Tennessee Geological Society (ETGS). He served as AIPG Tennessee section President in 2004, 2006, 2008, and will serve again in 2012.

Although Mr. Hofer is new to BESST as an employee, he has been an advocate of BESST’s products and services for many years. Feel free to contact him directly should you have any questions regarding BESST’s miniaturized equipment for chemistry and flow profiling without pulling the primary production pump, profiling under pumping or non-pumping conditions, miniaturized cameras, or BESST’s in-depth data analysis that provides the information you need to optimize the best quality water from water supply wells, industrial production wells, aquifer storage and recovery wells, and irrigation wells.
If You Can’t Develop a Well, What Good is it?

William J. Stone

After a well is constructed, it is developed to flush out drilling mud that may adhere to the wall of the bore (if mud was used) as well as any fines that will make the produced water muddy. Development involves forcing water into and out of the screened interval(s) and is continued until standard target levels for water-quality parameters (such as turbidity and specific conductance) are met. The more forceful the development, the better will be the samples or water coming from the well.

At a facility where I was involved with characterizing the groundwater system, new wells were deep (often exceeding 1,000 ft) and constructed with multiple rod-based, wire-wrapped screens. In one well, rotation of the drill string when it was stuck at depth caused the bottom screen to be rendered useless by twisting. Being at the bottom, the screen didn’t need tensile strength as there was no pipe below it. However, it did need torque strength but didn’t have it. In a knee-jerk reaction, all subsequent wells were constructed with pipe-based screen because it is strong enough to resist twisting stress. The new screens consisted of two layers: an inner layer of pipe with numerous roughly dime-sized holes and an outer layer of typical wire-wrap screen. The two layers were welded together to form a single unit.

While this assured strength, it hampered well development. Water now had to be forced through two layers of openings: the round holes in the inner pipe portion and the narrow slots in the outer wire-wrap portion. Obviously, it is hard to maintain force through such a tortuous pathway and development was severely hindered by that choice of well screen. Pumping water in through the screen was easy enough, but surging water out through the screen was not. And that outward surge aspect of development is often the most effective. Therefore, it was hard to remove mudcake on the bore wall and to meet target levels of water-quality parameters.

While the selection of pipe-based screen resolved certain strength issues in the deep wells, it ignored the purpose of a monitoring well: representative water samples. Water-quality data are only as good as the well from which they come. Tip: In solving a well-construction problem don’t create a sampling problem. Well construction should insure sample quality by not precluding rigorous development.

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

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

In September, I had the opportunity to attend the AIPG National Conference. I made an observation as I looked around the room during the dinner on the last night: with a few notable exceptions and with all due respect, there were a lot of old men. This trend was even more apparent at a hydrogeology luncheon I happened to attend at the Annual GSA Meeting in Minneapolis a month later. Now, I don’t mean old as in actually old. I mean old in workforce terms, as in they’ll probably be thinking about adopting a more reasonable pace of life soon and leaving all (or at least some) of this work business to less wise folks.

What does this mean for us as students and/or recent graduates? Two very important things. One: There is a lot of knowledge and experience in those white hairs, not to mention good stories. And two: They’re looking for hands to pass the torch on to. Whose hands? Ours: recent or soon-to-be grads eager to make our mark on our chosen field. Granted, those that are able to attend such functions as meetings and luncheons do not provide a representative sample of the current workforce. As David Abbott points out in his article “Students and Job Outlook” in this issue, though, there is definitely an aging trend to be noted. He points out that the current workforce age distribution is very similar to the one present when he entered the workforce. His message: take advantage of it.

While most of the economy may not be looking that great, the outlook for geoscientist’s isn’t too bad. In fact, according to AGI’s Geoscience Currents (No. 53, September 30, 2011), the expected growth in geoscience-related jobs is 23%, compared to 10% for all U.S. occupations. The need for fresh blood was alluded to by James Robertson, Wisconsin State Geologist and moderator of the GSA Geology in Government Mentor Program, at the GSA Student Lunch, when he quipped that “we’re worried about the foodchain.” Translation: there should be jobs for us.

Getting a job is just a step to starting a successful career. Great tips for that can be found in Reflections on a Geologic Career, available on the AIPG website. Once we get those jobs we should keep that first consequence in mind—you’ll probably be working under people that have been in the field for a while, so take advantage of all that experience! Knowing as much as you can about the progression of your field can only help you in the future, and there’s no better way to learn than picking the brain of somebody who has seen a lot. Knowing how we got where we are is the first step to avoiding previous mistakes and to being the best geologists possible. At least try to get some of those stories out over a drink or two. I’d be willing to bet that, in about 30-40 years or so, we’ll be glad for the advice we received and will appreciate the chance to pass our hard-earned knowledge on. Our professions will probably look quite different then than they do now. For one, there will likely be a few more old women in the mix.

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.
Welcome to a new column in TPG debuting this year! The Educator’s Page is a column designed to reach the many geosciences educators that are currently members of AIGP, specifically supplying support for science education through three primary avenues: 1) discussions about geoscience-education issues (e.g., recommendations for applying pedagogical strategies, new ideas in geoscience instruction, etc.); 2) identifying and discussing instructional resources; and 3) introducing current or new technologies and how they might be implemented in the geosciences classroom. These three general areas are by no means listed in any particular order of importance or relevance, and not all of them will necessarily be covered in each issue.

The guiding philosophy behind the column is to share geosciences-related topics with interested readers, and provide a few thoughts each issue pertaining to geoscience education, share resources of potential value to instructors, or mention technological applications instructors might want to use or try in their classrooms. There are a number of journals specifically devoted to geosciences education, but for those members who may make TPG one of their only subscriptions, a column pertaining to education makes practical sense and ultimately may offer useful insight. Introducing resources in this venue may meet the needs of the busy professionals and educators who are discouraged by the often time-consuming nature of seeking and testing out new instructional resources or ideas.

Getting your Students Involved in Extracurricular or Supplemental Geoscience Activities

For this first installment of the Educator’s Page, I would like to tie into and build on another article I shared in this issue: “Getting Involved!” – Career Advice for Graduate and Undergraduate Students. That article is specifically directed at the students who are reading this issue; I will now direct a related message to educators.

Those of us who are teaching likely have an advising load of graduate or undergraduate (or both) students. As advisors we are typically responsible for approving classes, providing registration access codes, and recommending career paths to our advisees. One more, just as valuable, piece of advice we might provide our students with is a well-intentioned suggestion to “get involved” in supplemental geoscience activities such as: forming or joining a geology club, participating in voluntary field trips, assisting professors with undergraduate or graduate research endeavors, joining professional memberships, or attending geoscience conferences, to name only a few. Our justification for delivering this advice stems directly from the necessity of establishing a strong background and résumé in a relatively competitive job market today.

All educators and employers recognize the value of diversity of experience prior to the onset of a new career: the more a student has already experienced, the more potential the student brings to a job as an employee (or to future schooling or advanced graduate study). Though the value of these additional experiences is obvious to us (educators and employers) the value may be much less obvious to our students. Many of our students may not have considered extracurricular involvement at all. Consequently, I invite you – as an educator – to ponder ways to advise your students to become more involved in geoscience activities and to stand out by taking extra initiative. Oftentimes, all our students need is a seed of inspiration to be planted in their minds.

As for what specifically you – as an educator – might do to proactively engage your students in supplemental experiences, consider answers to the following questions: What are you doing to get your undergraduate students more involved in geology or geoscience? Are you offering opportunities for your students to assist you with research? Do you offer your students a chance to assist with preparing laboratory materials for, or during, class? Do you solicit volunteers to assist with field trips, or welcome them on field trips you have going in other classes? Do you encourage students to attend or volunteer at locally convened geoscience conferences? Are you amenable to sponsoring students for professional memberships? Are you willing to recruit an undergraduate assistant (the opportunity exists at many colleges and universities to allow students to pay for a credit to “help out” an instructor)?

If you have not considered answers to any of these questions before, take a moment now. How will you motivate your students, or how will you promote opportunities for your students to “get involved” beyond the minimum academic expectations?

Featured Resource (website) – On the Cutting Edge


It was pretty easy to identify NAGT’s On the Cutting Edge as the first resource to be featured in TPG’s Educator’s Page. Housed on the Science Education Resource Center at Carleton College’s website, the Cutting Edge is a comprehensive site providing information about a number of categories relevant to new and veteran faculty, including information related to: career management, enhancing instruction, and geosciences content. The site not only contains over 1500 geoscience-related
activities suitable for undergraduate instruction, but also contains links to additional websites of potential value.

Need ideas for writing a geoscience course syllabus? Peruse the examples included via the “Search the Site” by “Resource Type” and “Course Information” options. Want to attend a professional development workshop in your area? Review the “Workshop Schedule” for current and upcoming opportunities by date and location (also see what workshops have been offered in the past). Would you like to connect and interact with other geoscience professionals and educators virtually or in-person? Check out the “Email List and Discussion Board Site Guide.” Interested in resources outside of the geosciences? They have that covered too – just examine the “For STEM Educators” page. If you are unfamiliar with the Cutting Edge and what it has to offer you as a geoscience educator, or if you have used it before but have not visited it recently, I invite you to explore it (again) for new and creative ideas now!

Michael J. Urban is an Assistant Professor of Education at Bemidji State University, located in Bemidji, MN, one of several institutions comprising the Minnesota State Colleges and Universities System (MnSCU). He possesses a Master’s degree in Earth Sciences and a doctorate in Educational Technology, both from the University of Northern Colorado. Prior to pursuing graduate studies he was a middle school science teacher. He has worked for a private meteorological company as a meteorological technician, served as a student intern at the American Institute of Professional Geologists, and taught undergraduate courses in astronomy, meteorology, physical geology, physical science, and planetary science at several colleges and universities.

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Applicant Signature: ________________________  Date: __________

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

### Applicants for Certified Professional Geologists

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<td>MD</td>
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### Applicants Upgrading to CPG

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### New Certified Professional Geologists

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<td>PA</td>
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### New Professional Members

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<td>AK</td>
<td>Lucas Gamble</td>
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<td>CO</td>
<td>Brian White</td>
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<tr>
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<td>Timothy Jellett</td>
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<td>William Davis</td>
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<td>SD</td>
<td>John Roland</td>
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<tr>
<td>CO</td>
<td>Marty Houhoulis</td>
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<td>NM</td>
<td>Eric Koenig</td>
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<tr>
<td>WI</td>
<td>Jeffrey Linnott</td>
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<td>Arg</td>
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### New Young Professional Members

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<tr>
<td>TX</td>
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### Student Adjunct Upgrading to Young Professional

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<td>AK</td>
<td>Keith Torrance</td>
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<tr>
<td>AR</td>
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<td>AR</td>
<td>Jena Smith</td>
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<td>Beth Johnson</td>
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<td>CA</td>
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<td>S. Danielle Montgomery</td>
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<td>Jacob Hollander</td>
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<td>ID</td>
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<td>Laura Hanna</td>
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<td>Brian Schrock</td>
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<td>Caroll Karns</td>
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<td>Jeri Grevis</td>
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### AIPG Membership Totals

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KS    Mallory Stevenson SA-3292
KS    Jordan Taylor SA-3304
KY    Kathryn Prejeant SA-3185
KY    Rachel Bowles SA-3237
MA    Monica Rolls SA-3276
MI    Nathan Erber SA-3196
MI    Nicholas Scappaticci SA-3197
MI    Rachel Medina SA-3198
MI    Nicholas Anderson SA-3203
MI    Kayla Frisinger SA-3204
MI    Michael Stockoski SA-3238
MI    Trisha Smrecak SA-3248
MI    Christy Steffke SA-3256
MI    Kyle Eno SA-3263
MI    Kase Knochenhaver SA-3264
MI    Caitlin Leslie SA-3265
MI    Bruce Shultz SA-3281
MI    Adam Davis SA-3287
MN    Stefanie Mayer SA-3211
MN    Kaitlyn Nelson SA-3213
MN    Kathleen Brinton SA-3225
MN    Amelia Nachbar SA-3226
MN    Questor German SA-3233
MN    Ben Chorn SA-3233
MN    Marcy Nadel SA-3269
MN    Margo Varavitz SA-3291
MN    Carolyn Prescott SA-3293
MN    Dustin Kassera SA-3301
MN    Erin Peterson SA-3302
MN    Christina Slowinski SA-3305
MN    Matthew Manor SA-3315
MN    Sarah Sauer SA-3195
MO    Rachel Nynzyk SA-3209
MO    Allison Hugill SA-3236
MO    Josh Wallace SA-3240
MO    Levi Crooke SA-3241
MS    Kayla Calhoun SA-3303
MT    Anita Moore-Nall SA-3210
NC    Rebecca Deal SA-3246
NC    Jessica Parris SA-3306
NC    Emily Ayscue SA-3328
ND    David Ahumoda SA-3214
NE    John Stin SA-3234
NM    Austin Thompson SA-3261
NM    Shasta Marrero SA-3280
NM    Sandra Mader SA-3297
NV    Briana Johnson SA-3284
NV    Vincent Ugalde SA-3327

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New Members Continued on page 41.
Answers:

1. The answer is choice “c” or “sill”.

“Tabular plutons” are tabletop-shaped or narrow sheet-like intrusions, while “massive plutons” are quite large in all dimensions. “Discordant plutons” cut across sedimentary layering, while “concordant plutons” parallel the layering of the country rock.

Sills are classic examples of tabular, concordant plutons.

Dikes constitute plutons which are tabular also, but discordant in nature.

Batholiths depict massive, discordant plutonic bodies.

Laccoliths describe massive, concordant plutonic masses.

2. The answer is choice “c” or the “Atacama Desert” of Chile, covering 54,000 square miles and characterized by salt basins, sand and lava. The “Atacama Desert” is one of the world’s driest arid regions.

The Gobi Desert of China and Mongolia covers 500,000 square miles and is characterized by stony ground, sandy soils and dry grasslands or steppes. It lies within the continental interior at a great distance from the ocean.

The Thar Desert of India and Pakistan covers 175,000 square miles and lies near the 30-degree north latitude line. It is characterized by the presence of rocky and sandy ground and sand dunes.

3. The answer is choice “a” or “Fluvial/alluvial point-bar deposits related to the roughly NW-SE stream-channel trend”.

Point bars are fluvial in origin and part of the alluvial depositional environment. In stream channels, the coarser sediments are deposited near the undercut bank where currents are stronger. Where these currents are weaker, along the upper parts of the depositional bank, finer-grained sediments accumulate. Since meander bends migrate in the direction of the undercut bank, a classic bottom-to-top sequence of progressively finer sediments is observed in point bar deposits. Thus, typical SP curves in point bar sequences tend to be bell-shaped with abrupt deflections toward the shale base line occurring at the bottom of the sand section.

Barrier bars are coastal sand bodies that tend to be long and narrow. The sandy islands typically form parallel to the shore. From bottom-to-top, one passes from the bioturbated fine-to medium-grained sediments of the lower shoreface facies, with small-scale cross laminations and parallel stratification, to the medium- and coarse-grained sand of the upper shoreface facies. Upper shoreface sediments may exhibit planar, tabular bedding and high-angle cross-stratification. Overlying the upper shoreface, the beach facies is typified by medium- to coarse-grained, well-sorted sand and even larger clasts (pebble-size conglomerates, etc.). Since grain size increases from bottom to top, SP curves tend to be funnel-shaped.

Lagoons may separate the coastline from barrier islands. These lagoons are generally shallow with depths that may not exceed two to three meters. Lagoonal deposits are influenced by stratified flow and tidal motions. They may contain mixtures of sand and finer-grained clastic sediments that may be vertically bioturbated.

4. The answer is choice “b” or about “11,180 m/s”. The proof follows:

The Earth’s gravitational potential is:

\[ U = \int F \, dr \]

\[ U = \int \left( \frac{GM_1 \, M_2}{r^2} \right) \, dr \]

Let \( M_1 = m \) and \( M_2 = M_e \) and \( R = Re \). Then,

\[ U = \int \left( \frac{GmM_e}{Re^2} \right) \, dr \]

\[ U = GmM_e \left( Re^{-2} \right) \, dr \]

\[ U = GmM_e \left( Re^{-1/2} \right) \]

\[ U = \frac{GmM_e}{Re} \] (equation 1)

Equation 1 above is that of the Earth’s gravitational potential.
To calculate the "escape velocity", we must satisfy:

\[
\frac{1}{2}mV^2 = \frac{GmM_e}{Re} \quad \text{(equation 2)}
\]

Equation 2 dictates that, in order to escape the Earth's gravitational field, the kinetic energy of an object launched from the Earth must be equal in magnitude to the Earth's gravitational potential.

Simplifying (2), and ignoring friction, we obtain:

\[
\frac{1}{2}mV^2 = \frac{GmM_e}{Re} \quad \text{(equation 2)}
\]

\[
V^2 = \frac{2GMe}{Re}
\]

\[
V = \left(\frac{2GMe}{Re}\right)^{1/2} \quad \text{(equation 3)}
\]

For the Earth, equation 3 becomes:

\[
V = \left[\frac{(2)(6.67 \times 10^{-11} \text{ Nm}^2/\text{kg}^2)(5.98 \times 10^{24} \text{ kg})}{(6.38 \times 10^6 \text{ m})}\right]^{1/2}
\]

\[
V = (79.7732 \times 10^{13}/6.38 \times 10^6)^{1/2}
\]

\[
V = (12.504 \times 10^7)^{1/2}
\]

\[
V = 11,182.13 \text{ m/s} \quad \text{(equation 4)}
\]

Equation 4 corresponds to our choice "b" and is the answer to the question depicting the desired computation of "escape velocity".

---

<table>
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<th>AIPG Student Chapters</th>
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<tr>
<td>Founded in 2004</td>
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<td>Chapter Sponsor: Robert K. Vincent, MEM-0216</td>
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| **Central Michigan University** |
| Founded in 2003 |
| Chapter Sponsor: Eric Wallis, CPG-09518 |

| **Colorado School of Mines** |
| Founded in 1999 |
| Chapter Sponsor: Graham Closs, CPG-07288 |

| **Columbus State University** |
| Founded in 2011 |
| Chapter Sponsor: Ron Wallace, CPG-08153 |

| **Eastern Michigan University** |
| Founded in 2006 |
| Chapter Sponsor: Walter J. Bolt, CPG-10289 |

| **Georgia State University** |
| Founded in 2005 |
| Chapter Sponsor: Ronald Wallace, CPG-08153 |

| **James Madison University** |
| Founded in 1998 |
| Chapter Sponsor: Cullen Sherwood, CPG-02811 |

| **University of California-Davis** |
| Founded in 2010 |
| Chapter Sponsor: James Jacobs, CPG-07760 |

| **University of Nevada-Reno** |
| Founded in 2008 |
| Chapter Sponsor: Jonathan G. Price, CPG-07814 |

| **Ohio State University** |
| Founded in 2004 |
| Chapter Sponsor: Thomas Berg, CPG-08208 |

| **Temple University** |
| Founded in 2006 |
| Chapter Sponsor: Dennis Pennington, CPG-04401 |

| **University of Georgia** |
| Founded in 2011 |
| Chapter Sponsor: Ron Wallace, CPG-08153 |

| **University of West Georgia** |
| Founded in 2010 |
| Chapter Sponsor: Eric Lowe, MEM-0385 |

| **Wright State University** |
| Founded in 1996 |
| Chapter Sponsor: Thomas Berg, CPG-08208 |
The Permitting Process for Land Development Impacts to Section 404 Waters by the Army Corps of Engineers: A Case Study

Taylor M. Bell
University of Alabama at Birmingham

Abstract

Potential land owners/developers are faced with challenges and issues when developing a piece of land. When aquatic resources are present, a process is triggered in which the potential land developer must apply for an Army Corps of Engineers permit. The Army Corps of Engineers and the developer must both go through a process wherein each must address and comply with Army Corps of Engineer’s procedures. In this paper, the Army Corps of Engineers process of review will be used to evaluate a case study. This paper will focus on the individual aspects of the process required for permitting impacts to Section 404 waters.

Keywords: Waters, EPA, Wetlands, Section 404, Regulations, Mitigation, Public Interest, 404(b)(1) guidelines, Corps, Permit.

Introduction

The United States Army Corps of Engineers Regulatory Division (Corps) is the lead authority for permitting impacts to waters of the U.S., and regulates the discharge of fill material into waters under its jurisdiction. The regulatory power of the Corps is derived from Section 404 of the Clean Water Act and Section 10 of the Rivers and Harbors Act. In conjunction with other state and federal authorities, the Corps works to balance protection of the environment while allowing for development. There are many different types of permits that authorize work that impacts waters of the U.S. This paper will focus mainly on the Individual Permit as applied to a case study that involves the world’s first commercially viable feedstock flexible ethanol facility, and the issues and challenges that the Corps and applicant had to address and overcome.

Background

The Corps is delegated authority by Congress to issue or deny permits based on criteria established by the Corps and the Environmental Protection Agency (EPA). Projects are evaluated by reviewing case file information collected from various sources, including Public Interest Review; Section 404(B) (1) guidelines; National Environmental Policy Act; compliance with the 2008 Mitigation Rule; Department of the Interior Fish and Wildlife and The National Historic Preservation Act (NHPA). Because of the potential impact to jurisdictional waters, a review is triggered on the subject piece of property when applying to the Corps for a permit.

In this case study, the land owner, the Industrial Development Board of Greene County, was the permit applicant for a parcel to be developed by the Coskata Inc. Coskata Inc. is a “biology-based renewable energy company whose low-cost platform technology allows for the production of fuels and chemicals from a variety of input material” such as biomass and municipal wastes (Coskata Incorporated, 2011). Coskata’s requirements for siting this facility included (among others) proximity to a supply of wood biomass, access to large volumes of water for the ethanol process, and alternate means of transportation (railway and water) for the finished product. Coskata chose a 235 acre plot in Greene County Alabama now known as the Flagship site in the Crossroads of America Industrial Park.

The Process

Public Notice

Upon the receipt of a completed application, the Corps has 15 days to distribute a public notice. The public notice consists of a preliminary description of the project and the proposed impacts. This public notice is then forwarded to federal and state agencies, internally throughout the Corps, to adjacent/abutting property owners, and it is available for public review. The Corps then reviews and addresses all comments received in response to the public notice. During this period, the EPA reviews the project, and if they determine that it will have a substantial and unacceptable impact on aquatic resources, then the EPA may elevate the permit through the 404(q) policy elevation procedure. Within the policy elevation procedure EPA may deny the issuance of the permit. In the absence of any request by the EPA to the Corps for an extension of comments, no additional comments or subsequent policy elevation request will be considered by the Corps project manager after the 30 day comment period ends. In the case of the Coskata project, the Corps received and responded to comments from federal and state agencies, but there was no policy elevation.

404 (b) (1) Guidelines

When soil or other material is excavated, moved, and/or placed as fill on a development site, potential impacts to jurisdictional waters may result.
Developers need to select placement sites for dredge or fill material in accordance with Section 404(b) (1) guidelines established by the U.S. Environmental Protection Agency (40 CFR Part 230). According to the regulations in (40 CFR Part 230) “If no less environmentally damaging practicable alternative existed and if a project would not cause unacceptable adverse impacts on aquatic resources, the Corps could issue a permit”.

The Corps uses these guidelines to evaluate all practicable alternative sites for potential environmental impacts. If these alternative sites are unacceptable due to greater potential environmental impacts, then the Corps may request that new alternatives be evaluated before the project can move forward. In any case, the applicant is responsible for asserting that the proposed project is in compliance with 404(b) (1) guidelines, which the Corps then evaluates.

In the case of the Coskata project, modifications were made to the initial proposal based on analysis of land quality and the necessity for minimizing potential adverse environmental impacts as required by the Section 404(b) (1) guidelines. Examination of alternative sitings for the facility within the project acreage resulted in the identification of previously disturbed wetlands, and these were judged to be of lower quality than other nearby areas. The siting of the facility on this lower quality land was mutually beneficial for the Corps and the applicant for three important reasons. 1) It reduced potential impacts from 36.14 acres to 22.6 acres. The applicant thus demonstrated that it avoided environmental impacts to the maximum extent possible. 2) The applicant demonstrated that the selection of the lower quality site was the least environmentally damaging practicable alternative. 3) This reduction in environmental impact had potential economic value, as the likely cost of mitigation of the 13.54 acres difference was estimated to be $360,000. The reduced acreage of impact, and compliance with Section 404(b)(1) guidelines, allowed the Corps to reduce its scope of analysis and move forward with permitting the project.

Public Interest Review

The Corps must consider the public interest when evaluating a permit application. If the District Engineer finds that the permit would be contrary to any of the public interest review factors, then a permit may be denied. The applicable Corps regulation (33 CFR Part 320) follows:

“The decision whether to issue a permit will be based on an evaluation of the probable impacts, including cumulative impacts, of the proposed activity and its intended use on the public interest. Evaluation of the probable impact with the proposed activity may have on the public interest requires a careful weighing of all those factors which become relevant in each particular case. The benefits which reasonably may be expected to accrue from the proposal must be balanced against its reasonably foreseeable detriments. The decision whether to authorize a proposal, and if so, the conditions under which it will be allowed to occur, are therefore determined by the outcome of this general balancing process. That decision should reflect the national concern for both protection and utilization of important resources. All factors which may be relevant to the proposal must be considered including the cumulative effects thereof: among those are conservation, economics, aesthetics, general environmental concerns, wetlands, historic properties, fish and wildlife values, flood hazards, floodplain values, land use, navigation, shore erosion and accretion, recreation, water supply and conservation, water quality, energy needs, safety, food and fiber productions, mineral needs, considerations of property ownership and, in general, the needs and welfare of the people…”

In the proposed project, the Corps identified as having negligible effects the following public interest review factors: conservation, historic properties, fish and wildlife values, flood hazards, floodplain values, land use, navigation, shore erosion and accretion, recreation, water supply and conservation, safety, mineral needs, and considerations of property ownership. Water quality was the only factor shown to have an adverse affect on the public's interest. Potential benefits resulting from the project were identified for the following public interest factors: economics, energy needs, food and fiber production, and the needs and welfare of the people. Lastly, the factors of wetlands and general environmental concerns were shown as neutral, as a result of mitigative action. If the Corps had found that the project had a detrimental effect on any of the public interest factors, the permit would have been denied.

National Environmental Policy Act

Purpose and Need

Under the National Environmental Policy Act, the applicant has to prove that there is a purpose and need for the project in order for the Corps to move forward with it. The applicant provided documentation of the need for production of alternate fuels. It was expected that this production facility would be of widespread interest as a model for utilizing flexible carbon-containing waste streams in a process to produce fuel-grade ethanol that is cost-competitive with other fuels, such as corn-based ethanol and petroleum.

Mitigation

Compensatory mitigation is an important part of the Section 404 permitting process not because it is required under the Clean Water Act, but because the issuance of a Section 404 permit triggers mitigation requirements under the National Environmental Policy Act (Berry, Dennison, 1993). The purpose of the 2008 mitigation rule (33 CFR Part 332) is to achieve an overall positive benefit in the biological communities in the watershed. Mitigation is the regulatory instrument used to compensate for the loss of aquatic resources. Within the Corps review, the project manager must analyze the proposed mitigation for compliance with the 2008 mitigation rule. Through this process it was determined that mitigation proposed by the applicant was found to be the most beneficial for this site. The applicant's final mitigation plan provided for the restoration of 13.54 acres of bottomland hardwood functions to the regional watershed. The project will have a positive ecological impact on the entire watershed by restoring wetlands, thereby enhancing downstream water quality. The restoration of more than 19 acres of bottomland hardwood forested wetlands is also valuable to water quality, wetland and stream function, wildlife habitat, and species diversity.

State and Federal Agencies

Fish and Wildlife
A CASE STUDY

A part of the Corps review of the proposed project location is to assess the existence and locations, if any, of threatened or endangered species. The Department of the Interior Fish and Wildlife Service (Fish and Wildlife) is the authority for locating and assessing impacts to threatened or endangered species. After receiving a report from Fish and Wildlife, the Corps then makes a determination as to whether or not the permitted development would jeopardize the existence (if any) of a regulated species (50 CFR PART 17). Fish and Wildlife responded to the proposed project by stating “the proposed project may affect, but is not likely to affect the Potamilius inflatus”, a threatened freshwater mollusk called the Alabama heelsplitter. Although in this case the applicant did not have to alter or change the project in dimension or size because of potential impacts to endangered species, often times the applicant may be asked to change the dimensions of the project to avoid a critical habitat area, or alternatively, the applicant may be required to relocate the species through means of a licensed handler.

Cultural Resources (NHPA)

Within the Corps review, a determination must be made as to whether or not the project will impact any known historic sites that are of national importance, and if so, whether proposed plans would adequately mitigate for the loss of the site (36 CFR PART 800). Through this process the Corps found two sites located within the project’s footprint. Both sites were located in non-Section 404 waters (i.e., uplands), and were determined ineligible for listing with the Alabama Historical Commission. Additionally, a graveyard was discovered adjacent to, but outside of, the footprint of the proposed project. These sites were located in and around the project area, but they were not present within the scope of analysis and therefore would not be impacted. As a consequence, no mitigative action was required.

Violations

In many situations, some land developers may bypass the Corps permitting process. Reasons may include a lack of knowledge or deliberate evasion of the Clean Water Act. The Corps handles all projects and violations on a case-by-case basis. Potential violations are brought to the attention of the Corps by reports from agencies, concerned citizens, self-reporting violations and through Corps reconnaissance. Upon discovery of a violation the Corps will then send correspondence in the form a Notice of Discovery and/or a Cease and Desist order. A Notice of Discovery informs the potential violator that unauthorized work has taken place and that any further work will be considered as a knowing and willful violation of the Clean Water Act. A Cease and Desist order requires an immediate halt to any work under the threat of legal action. Pending assessment of the size and extent of the violation, the Corps may be the lead authority for resolution. The violator must then remedy the violation, if impacts are considered of great detriment, or if the violator knowingly and willfully violated the Clean Water Act, then the case is referred to the EPA. Violators are subject to fines from the Corps in the amount up to $25,000 per day and to criminal enforcement. The violator is also subject to EPA’s fines and criminal enforcement. Violators of the Clean Water Act are subject to federal law which includes fines and/or criminal enforcement. In this case study, the applicant was not a violator and followed the process of applying for a permit before impacting jurisdictional areas.

Conclusion

Alteration of land that impacts federally regulated waters is subject to review by the Army Corps of Engineers. The review process is an extensive one with possible input from other federal agencies, such as the Fish and Wildlife Service, and the Environmental Protection Agency. The review process requires the opportunity for public input during a comment period in order to determine if the project is contrary to the public’s interest. Various federal regulations, such as Section 404 of the Clean Water Act, trigger land and biological surveys. Such surveys are critical for the determination of detrimental impacts, if any, and for discovery of endangered or threatened species and sites of national importance. These triggers and surveys are a common occurrence for many projects. A project may not proceed without “a purpose and need” as required by the National Environmental Protection Act. All these issues, and more, guide the Corps in its review of an application prior to issuance of a Section 404 permit.

In the case study presented herein, cooperation and coordination among the Industrial Development Board of Greene County, Coskata Inc., and the Army Corps of Engineers, resulted in an acceptable development plan that minimized environmental impact and potential mitigation expenses, protected federally regulated waters and wetlands, and provided for the public interest. A section 404 permit was issued for the final project plans and the project is under construction.

Disclaimer: The views expressed in the article do not necessarily represent those of the Corps or the United States. The Corps handles every authorization on a case-by-case scenario. This paper does not cover every aspect of law in evaluating a permit decision. For a full list of applicable laws and regulations please visit our headquarters website at http://www.usace.army.mil/CECW/Pages/reg_materials.aspx.

Acknowledgements: I would like to thank Mrs. Cindy House-Pearson (Chief Inland North, Birmingham Field Office), Mr. Tom Landry (Assistant District Counsel) and Adrienne Davis (Ethics) from the Mobile District for permission to write about this project, without such, this manuscript would not have happened. I would also like to thank Mr. Casey Ehorn (Project Manager, Birmingham Field Office Mobile District) for his technical assistance that he provided while writing the paper. Finally, I would like to thank Dr. Scott Brande (Associate Professor in Chemistry, University of Alabama at Birmingham) for his teaching, guidance, and mentoring during my geological studies at UAB, and his encouragement to pursue my first professional publication.

References:


“Compensatory Mitigation for Losses of Aquatic Resources; Final Rule” 40 CFR PART 332 Federal Register (10 April 2008).


A CASE STUDY

“Regulatory Programs of the Corps of Engineers; Final Rule” 33 CFR PART 320 Federal Register (13 November 1986).

“Wildlife and Fisheries” 50 CFR PART 17 Federal Register (1 October 1997).

Taylor M. Bell currently a student seeking post bachelor credits at the University of Alabama at Birmingham. Taylor received a Bachelor of Arts and Sciences with a Major in Parks and Recreation Management at the University of North Carolina at Wilmington. Currently Taylor is in a SCEP (Student Career Experience Program) position with the Army Corps of Engineers Regulatory Division in the Mobile District at a field office located in Birmingham, Alabama. For two and a half years Taylor has been processing complex permits (cradle to grave), confirming delineations, conducting compliance inspections and resolving violations as part of day to day operations.

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Tool-Up to Inspire Future Geoscientists

Alexandria, VA - Geoscience careers encompass a diverse set of opportunities that appeal to a wide range of individuals. Geoscientists work all over the planet-in all possible work environments-in support of stewardship of the Earth. The American Geosciences Institute (AGI) has created a series of educational brochures and career guides to inspire the next generation of geoscientists. These materials answer the question, why geoscience?, and shed light on the positive job environment in this difficult economic climate.

AGI’s new Careers that Change the World brochures are now available in 10 and 100-packs. Taking a new approach to improving the understanding of geoscience career opportunities, this brochure focuses on providing a vision for students on the myriad of opportunities in a geoscience career, and how it impacts the world.

Also now available for purchase, AGI’s GeoConnection Recruitment Packet provides a tool for geoscience departments to directly engage prospective geoscience majors. It includes information about geoscience careers and professional societies, a copy of the EARTH Workforce Magazine, and a Why Earth Science DVD.

AGI’s Careers that Change the World Brochures and their Geoscience Today flyers explain the current challenges and future opportunities in the geosciences.

These resources help students translate their educational background directly to the workforce.
New Yellowstone Website Provides Interactive Maps on Volcanic Activity

From the Wyoming State Geological Survey-The Wyoming State Geological Survey’s (WSGS) Yellowstone Geologic Geographic Information System (GIS) Database at www.wsgs.uwyo.edu/Yellowstone is a new interactive website providing researchers and students alike with a look into Yellowstone’s geologic past and present.

“Geologically, the Yellowstone area is one of the most interesting places in the world,” said Wallace Ulrich, director of the WSGS. “This website was designed to gain a better understanding of the Yellowstone hotspot where a future volcanic eruption, fracturing, or the release of geothermal fluids from the caldera may occur,” he said. “We are offering this resource to the public so they can learn more about the past and current geologic activity in the region.”

Interactive maps illustrate the geology, earthquakes, and hydrothermal areas that make up Yellowstone National Park. The site includes downloadable GIS data sets that allow students and researchers to view layers ranging from past geologic events, to satellite imagery, lake bathymetry, and volcano monitoring equipment in the park. The data can also be viewed via Google Earth with 3D visualizations of the area.

The WSGS created the website as an educational information portal, representing a major collaboration between the WSGS and staff of the U.S. Geological Survey (USGS). “The aim of this project was to have a central repository of GIS information so we could collectively improve our efforts to identify, display, and analyze volcanic activity in Yellowstone,” Ulrich said.

The WSGS Yellowstone Geologic GIS Database website includes:

- More than 20 data sets available to download (individually or combined)
  - High resolution LiDAR (Light Detection and Ranging) and digital elevation models
  - Earthquake data (historical and current)
  - Geology (bedrock, surface, geothermal, etc.)
  - Hydrography (bathymetry of Yellowstone Lake)
  - Other information (trails, place names, boundaries)
- Interactive Mapping Application
  - Live webcams
  - USGS Live Earthquake Feed
  - Ability to search earthquakes in the park by magnitude and date
  - Print map feature
- Media Gallery
  - High resolution photos of the park
  - Videos of the Yellowstone Caldera by the USGS

The website’s main feature is a searchable map of Yellowstone that was created by combining data from a variety of state and federal sources into a single GIS database. The interactive map includes an overlay of colors representing different types and ages of rock. A user can then add various layers to the map such as topography, imagery (with zoom capability), and even query a search of earthquakes in the area by typing in a minimum and/or maximum magnitude and the years of interest.

“This map will be a tremendous resource for students interested in Yellowstone or who are learning about the area’s geology, past earthquakes, and volcanic activity,” Ulrich said. This project would not be possible without the support of US Sen. Mike Enzi, and former member of Congress, Rep. Barbara Cubin, as well as US Sen. John Barrasso, and US Rep. Cynthia Lummis, he said. “I would also like to thank Dr. John Eichelberger with the USGS and his team of scientists as well as acknowledge all the work of our staff with the WSGS toward this project.”

The present Yellowstone Plateau was created through volcanic cycles spanning two million years that included some of the world’s largest known eruptions. The Yellowstone region includes three calderas: the first cycle caldera formed 2.1 million years ago during the eruption of the Huckleberry Ridge Tuff, the Henry’s Fork Caldera formed 1.3 million years ago, near the town of Island Park, and the Yellowstone Caldera formed 640,000 years ago during the eruption of the Lava Creek Tuff, an event that spread ash over much of the North American continent. Since this time there have been approximately 80 additional but smaller eruptions such as lava flows. The youngest of these range from 70,000 to 160,000 years old.

“Interestingly,” said Ulrich, “the volcanic events that formed Yellowstone were not the products of many million years of geologic change ending many millions of years ago; we are seeing a time scale compressed into only the last 2.1 million years.” For the Greater Yellowstone Ecosystem, geologists and volcanologists study in detail the latest periods of geologic time, the Pliocene and the Quaternary, covering the last 5 million years of volcanic activity.
West Yellowstone (magnitude 7.5). “This was a major earthquake,” said Jacob Lowenstern, scientist in charge of the USGS Yellowstone Volcano Observatory. “It fractured geothermal reservoirs in Yellowstone, creating new geysers and destroying others. Flow rates and temperatures of hundreds of hot springs changed over night,” he said.

Data collection and the mapping efforts of the WSGS are intended to further research and information on Yellowstone’s geologic past and future. “With this Web-based tool, we have assembled data from a host of research entities into a single searchable format,” Ulrich said. “This website will be continually updated providing us with the opportunity to interpret the past and hopefully plan for the future of Yellowstone,” he said. “And if the past gives us a glimpse for what is to come, we know the Yellowstone landscape will continue to change.”

Also available on the WSGS website (www.wsgs.uwyo.edu) is a link to information on landslides in the state. The WSGS has mapped more than 30,000 landslides in Wyoming, and maintains an active database of these locations.

New Members Continued from page 33.

Dr. Barry F. Beck passed away November 28, 2011, at the age of 67 after a series of strokes left him debilitated with “Locked-in syndrome” for over the past 2 years.

Born in Hershey, PA to father, Daniel Beck, and mother, Verna Beck, Barry was raised almost entirely in a lower class setting in Rochester, NY. Paving his own path to success, Barry first obtained his Bachelor’s degree in geology at Rensselaer Polytechnic Institute and then followed with his Master’s and Ph.D. degrees in geology from Rice University in Houston, TX. He joined AIPG in 1993. (Here is a link to the obituary: http://hosting-16598.tributes.com/show/Barry-F.-Beck-92861815)

IN MEMORY

Barry F. Beck
CPG-09078
Member Since 1993
November 28, 2011
Oak Ridge, Tennessee

AIPG National would like to say Welcome to all of our new members!

IN MEMORY

New Members Continued

IN MEMORY

IN MEMORY
Studies Shed New Light on Denver Basin Groundwater

Following is a news release from the Colorado Geological Survey.

The Colorado Geological Survey has released three significant new reports on ground water in the Denver Basin. The reports, representing more than a decade of research, provide the most detailed information yet on the varied distribution of groundwater in the Denver Basin and show the most productive aquifers are concentrated near the mountain front and diminish to the east.

All three publications document in different ways that the strata from which many of the people living along the southern Front Range obtain their groundwater, are highly variable. Together, they present a science-based perspective of the complex geometry of the freshwater-bearing strata which resulted from a dynamic geologic history. This new perspective shows a non-uniform distribution of strata with favorable aquifer characteristics across the basin. Because of the way the strata formed, the thickest and most productive sandstones concentrate near the mountain front and diminish to the east.

The reports will help regulators, modelers, consultants, policymakers, and planners better understand the variability of water productivity in the Denver Basin, a major source of water supply for populous regions south of Denver. One of the publications is the result of a collaborative effort with the Denver Museum of Nature & Science (DMNS).

One of the publications is the result of a collaborative effort with DMNS. The first report; Geology of Upper Cretaceous, Paleocene and Eocene Strata in the Southwestern Denver Basin, Colorado; is a compilation of more than 1000 square miles of surface mapping of the aquifers where they are exposed along the mountain front. The mapping was originally carried out at a scale of 1:24,000 and is compiled into a 1:50,000 map consisting of two plates. This compilation also presents a simplified naming classification for the geologic strata of the Denver Basin.

The second report; Bedrock Geology, Structure, and Isopach [thickness] Maps of the Upper Cretaceous to Paleogene Strata between Greeley and Colorado Springs, Colorado; takes what was learned by mapping at the surface and extends it into the subsurface using data from nearly 3,000 wells. This report was a collaborative effort with DMNS, whose personnel also spent more than a decade independently working on the strata in the Denver Basin. The report contains seven maps that illustrate the thickness, depth, and distribution of the various freshwater-bearing strata in the Denver Basin. It also contains a depth map to the Niobrara Formation, and a thickness map of the Pierre Shale that separates the Niobrara from the freshwater aquifers. An additional three maps of ancient landscapes illustrate why the sandstone aquifers are concentrated near the mountain front. Included with this report is an illustrative poster that explains the various environments within which the strata were deposited. The poster is also sold separately.

The third publication; Cross Sections of the Freshwater Bearing Strata of the Denver Basin between Greeley and Colorado Springs, Colorado; contains four north-south, and eleven east-west, detailed cross-sections of the strata in the Denver Basin. These cross-sections integrate surface geologic mapping with subsurface well data to graphically illustrate variability in the types of strata across the entire basin. This report is oriented toward the professional community, rather than the general public.

All three publications come in hard copy and include DVDs with detailed PDFs of the plates and GIS shapefiles containing metadata. The publications can be ordered from the Colorado Geological Survey at 303-866-2611 or in the online bookstore at http://geosurveystore.state.co.us/.

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.

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Professional Liability insurance covers your business for human errors you or your employees make while performing your professional services. Professional Liability is also known as errors and omissions insurance. An example of a professional error would be an error in design documents, or a technical report that causes a loss or potential loss to your client. Professional Liability risks are not covered by your General Liability policy.

Types of Professional Liability: For Consulting Geologists and Engineers, there are two basic coverage forms, or policies, a Miscellaneous form and an Architects and Engineers form (A&E). The basic difference is that the A&E form provides coverage for design. Most Geologists are properly covered under the Miscellaneous form, and Engineers the A&E form.

Retro Dates: Are very important to understand. This is the start date of the first claims made Professional Liability policy your business has started. You are covered for any actual or alleged covered incident as long as it occurs on or after your retro date. That date remains the same and is not advanced as long as you renew your policy. Your retro date is also portable. If you currently are insured with someone else, you can transfer the retro date to your new policy.

Claims and Limits: Typically most of your clients will ask that you have Professional Liability limits of $1,000,000 per claim, though we are starting to see higher limits requested. One of the most important features of this limit is that it can be used to pay your cost of defense. You as a consultant can be part of a claim, just by being part of a larger project where an alleged E&O could have happened. Defending yourself against these claims is costly and time consuming. The Insurance carrier will bear the cost of the defense allowing you to continue running your business.

Coverage Forms – As there are many different Engineering and Geology specialities, there are different Professional Liability coverage forms. Feasibility Studies, Reserve and Resource Estimation, Mineral Appraising, Process Engineering, and Mine Design are just a few of the specific areas that a Professional Liability policy could cover or exclude from a policy. It is important that your insurance broker understands your practice, and matches that with the appropriate insurance carrier and policy form.

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U.S. Field Camp Attendance Continues Upward Climb

Attendance at U.S. field camps reached 2,525 in 2011, up 10 percent from 2010. Field camp attendance for 2011 was reported by 94 of the existing 118 U.S. field camps. (Some field camps run on alternating years). Recent increases in field camp attendance are attributed to both increased overall attendance as well as the addition of new and existing field camps to the U.S. Field Camp database. A total of 94 field camps have consistently reported field camp attendance data for the past five years (2007-2011), and 76 field camps have consistently reported attendance data for the past 10 years (2002-2011). In both cases, overall attendance has increased steadily: 37 percent over the past five years and 53 percent over the past 10 years.

![U.S. Field Camp Attendance (1998-2011)](image)

Source: U.S. Field Camp Database, Dr. Penelope Morton - UMN-Duluth

U.S. Field Camp Locations

Where do field camps take place?
Although field camps are offered by geoscience departments across the United States, a large proportion of field camps sites are located in the west, namely in Colorado, New Mexico, Wyoming, Utah, and Montana. However, some field camps also occur in the eastern part of the United States.

Darker colors on the map represent a higher concentration of field camps occurring in a state. Grey indicates no data.

The US. Field Camp database is maintained by Dr. Penelope Morton at the University of Minnesota Duluth. To make sure your field camp is listed, or to report your field camp attendance, please contact Dr. Morton at pmorton@d.umn.edu.

- Dr. Penelope Morton
University of Minnesota Duluth
Assessing a Groundwater Monitoring Network at a Dense Non-Aqueous Phase Liquids Remediation Site using Groundwater Temperature, Level and Analytical Data

Kevin Svitana, Ph. D., MEM-1840,

Abstract

Monitoring and remediation groundwater containing dense non-aqueous phase liquids (DNAPLs) in fractured sedimentary rock aquifers can be problematic. This paper looks at how previous investigations using groundwater temperature fluctuations as flow tracers and studies of DNAPL occurrence in fractured rock at older release sites are related. This relation is used to assess the accuracy of a groundwater monitoring network developed in a Triassic sedimentary rock sequence in eastern Maryland. Groundwater cleanup has been ongoing at the site since 2005. At this site, nine data loggers were placed in eight wells to collect field measurements of groundwater levels and temperatures. Water levels and temperatures recorded since 2007 provide seasonal trends and water level and temperature responses to significant changes in the aquifer’s hydraulic conditions (pumping versus non-pumping). Groundwater quality trends of quarterly sampling events along with measurements of water level and temperature changes were used to identify monitoring wells that represent matrix flow conditions and those that exhibit fracture flow characteristics. The results are in agreement with other studies; wells with minimal temperature changes when pumping conditions change also have less fluctuation in DNAPL concentrations indicating these wells are not influenced by fracture flow conditions. This data will be used to project water quality models and evaluate the need for ongoing remedial efforts as the DNAPL concentrations in the source area continue to be reduced.

Key words: Groundwater monitoring, groundwater tracer, DNAPL, fractured bedrock, temperature fluctuations, remediation, data loggers, monitoring network, fracture flow, matrix flow.

Introduction

Developing an effective and accurate monitoring well network for groundwater affected by dense non-aqueous phase liquids (DNAPLs) in fractured sedimentary bedrock can be challenging. This paper connects site-specific data to previous studies of groundwater temperature used as a tracer of flow and DNAPL concentration trends related to fracture flow. The site-specific data is comprised of long term and focused measurements of groundwater levels and temperatures along with quarterly analysis of groundwater quality at a remediation site in Maryland. The previous studies describe the use of groundwater temperatures as flow tracers and concentration trends of DNAPLs at older release sites. The results of this analysis combined with trends noted in the previous studies demonstrates linkages between pumping response, temperature fluctuations and chemical data and demonstrates the accuracy of a monitoring well network for defining aquifer conditions in fractured rock terrain.

Background

Temperature fluctuations have been identified as a significant tracer for assessing groundwater flow from specific sources. Heat carried by groundwater was identified as a potential tracer of groundwater flow in the 1960s, and the advent of accurate automated recording devices (e.g., data loggers) revived interest in this technique in recent decades (Anderson, 2005). One of the early papers (Windslow, 1962) looked at the effect of a thermal plume in an aquifer caused by the induced infiltration from the Mohawk River. Later studies describe the thermal gradients and temperature stratifications in near surface aquifers and the fluctuations of these gradients that occur in recharge and discharge zones (Silliman et al., 1995; Taniguchi, 1993). Groundwater temperature fluctuations associated with flow in fractured rock terrains were used to map fracture traces and evaluate injection and withdrawal rates of aquifer water (Drury, 1989; Silliman and Robinson, 1989; Malard and Chapuis, 1995). The trends and applications of using temperatures as a hydraulic tracer were summarized by Anderson (2005). Anderson’s summary describes various investigations where dedicated data loggers were used to record level and temperature measurements to assess flow in fractured aquifers.

Parker et al. (2010) describes the persistence of DNAPLs in fractured sedimentary rocks after the source has been eliminated. This study specifically looks at the water-quality model at older release sites where the DNAPL has diffused from the fractures into the rock matrix. The differences between flow in the fractures and the rock matrix are sharply contrasting. The fracture flow is rapid while the matrix flow can be described as stagnant. The diffusion of the DNAPLs into the rocks’ matrix coupled with the reduced flow result
in DNAPLs', like perchloroethylene's (PCE), persistence and relatively constant concentrations in samples taken from matrix pores (Lawrence 1990; Parker et al., 1994, 1997). With the lower rate of diffusion of compounds like PCE, concentrations in the rock fractures are typically lower as a result of higher velocities and rates of turnover of water in the fractures. These studies suggest the variability of PCE and other DNAPL concentrations in wells in fractures is typically higher, particularly when pumping from the aquifer changes the flow velocities in the fractures.

**Description of the Study Site**

The remedial system is located in Carroll County, Maryland. The site occurs on the New Oxford formation that has been interpreted by Faill (2005) as Triassic graben fill basin. The sedimentary sequences at this site are typical fanglomerate sequences, i.e. interbedded conglomerates, sandstones, shales and mudstones that are not laterally continuous. Figure 1 shows a cross section of the study site. The stratigraphic sequence is generalized as: the shallow interval, 15.3 meters below grade comprised of shales and mudstones; the intermediate interval, which is dominated by an angular quartz sandstone that occurs approximately 27.4 to 53.3 meters below grade; and a deeper interval which occurs more than 61 meters below grade. This unit is comprised of interbedded sandstone and shale layers (Stone Environmental Engineering & Science, Inc., 2006, 2011). The sequence is fractured vertically, and the fractures appear to have some interconnection. The permeability of the intermediate unit was determined to be between 4.3 x10⁻³ and 8.5 x10⁻³ meters/minute. The deeper interval’s permeability is similar to the intermediate. The shallow interval’s permeability is less than 1.2 x10⁻⁷ meters/minute. In non-pumping conditions, head differences between the intermediate and deep zones are typically upward (rising). A source of PCE occurs in the shallow interval, and the PCE leaches into the intermediate zone. The PCE concentrations in groundwater samples from the shallow and intermediate zones decline by an order of magnitude in the intermediate zone and are seldom detected in the deep zone.

**Remediation System Overview**

A groundwater recovery and treatment system has operated at the site for more than six years. The system is situated near a public water supply well (MW-13, Fig. 2), which draws from both the intermediate and deeper stratigraphic intervals described above. MW-13 is an open rock borehole open between 36 to 168 meters below grade. Prior to 2009, the water supply well pumped cyclically at a rate of 530 liters per minute. The remedial system’s recovery well (and open rock borehole) is open between 35 to 55 meters below grade with a sustained pumping rate of 189 liters per minute. The pumping system was designed to create a capture zone in the intermediate interval that is completely encircled within the capture zone of the water supply well. Water recovered by the remedial system is treated using asestripping and carbon polishing to remove the PCE, and treated water is injected up gradient of the source area, in essence creating a pumping/injection loop within the intermediate interval. The hydraulic gradient is increased in the injection well area, but there is minimal effect on the capture zone of the water supply well. Figure 3 illustrates the water table surface when the water...
supply well (MW-13) is pumping and when the supply well is not operating.

In June 2005, five data loggers (pressure recording transducers) that measure water level were placed in select monitoring wells constructed in the intermediate sandstone layer (27.4 to 53.3 meters below grade) at the site to help understand the dynamic flow of the fractured rock system (Svitana and Krissek, 2005). In 2007, the original data loggers were replaced with nine data loggers that had temperature recording capabilities. The new data loggers were programmed to record level and temperature at continuous 4 hour intervals.

Methods for Assessing Correlations of Water Levels, Temperatures and PCE Concentrations

Originally the operation of the two pumping systems overlapped and made it difficult to assess the flow dynamics of the fracture flow system. In March 2009, the operation of the water supply well (MW-13) ceased. The absence of pumping from the water supply well quickly changed the dynamics of the aquifer, and water levels in the intermediate zone rose by more than 9.2 meters. Water levels also increased the shallow zone but levels rose less than one meter. This drastic hydraulic change necessitated an evaluation of both the aquifer and remedial system operation in order to assess if plume capture was maintained.

In August 2009, after the operation of MW-13 ceased, the remedial system operation was suspended because of an equipment failure. The groundwater elevations and temperatures measured by the data loggers showed some wells had abrupt changes in levels and temperatures while others had less pronounced fluctuations. After August 2009, observations of data trends continued in an effort to better understand the complex fracture flow system.

In November 2010, the system was scheduled to be shut down for maintenance. The data loggers were temporarily reprogrammed to record measurements at 1 minute intervals so the drawdown response to restarting the pumping system could be assessed.

In June 2011, data loggers were placed in treatment system storage tanks that occur before and after the airstripping treatment of recovered groundwater. The temperature measurements in the two tanks were used to evaluate water warming/cooling as a result of airstripping.

Results and Data Analysis

The discussion that follows is predicated on some consistent measurements and trends that have been documented since the new data loggers were installed (2007). These observations provide the basis for interpreting the hydrogeologic characteristics of this site.

Water temperatures are lower in the intermediate zone of the saturated groundwater intervals. Based on data collected in June 2010, groundwater temperatures in shallow monitoring wells (less than 15.2 meters deep) typically are above 14.25°C, and intermediate monitoring wells (between 30.5 to 46 meters deep) are less than 14°C. In June 2010, data loggers were placed in MW-03-D at depths of 13.7 and 46 meters below grade. The average temperature for the shallow data logger was 14.36°C, and the deeper data logger was 13.52°C. MW-02-A, located 6.1 meters northeast of MW-03-D, had an average temperature of 13.88°C at a depth of 30.5 meters below grade. With the exception of AW-87-01, the temperature gradient is consistent across the site.

When municipal well MW-13 is not operating (Figure 3), there are consistent upward hydraulic gradient. Figure 4 shows the water elevation measurements for MW-03-D (screened at 92.4 - 152.4 meters below grade) and MW-02-A (screened at 30.5- 44.2 meters) for times when MW-13 was operating and when the well was not being pumped.

Figure 3. 3-dimensional images of the intermediate zone water table. The image on the left is when MW-13 is pumping and the image on the right is when MW-13 is not pumping. MW-13 is in the foreground of each image, the injection well is in the background. The remediation system pumping well capture zone is in the upper right of each image (from Svitana and Krissek, 2005).

Figure 4. Graph showing water level elevations for MW-02-A and MW-03-D. Prior to March 2009 well MW-03-D typically had lower water level elevations than MW-02-A. The opposite condition is prevalent since the municipal well MW-13 ceased operation at the end of March 2009. Note: the 11/20/2003 measurement was taken when MW-13 was not pumping.
The temperature of the water treated by airstripping is warmed or cooled with respect to ambient air temperatures. Data collected in June 2011 shows influent groundwater temperature has little fluctuation and has an average value of 13.80°C, while temperature measurements for water that has passed through the airstripper had an average temperature of 14.71°C. The post airstripper water temperatures fluctuated with ambient air temperatures, with lowest readings (14.52°C) occurring at 5:30am and the highest reading (14.98°C) occurring at 1:30pm on June 14, 2011. These high and low values correlate to the high and low temperatures that occurred during the monitoring period.

The groundwater data compiled at this site includes measurements of water levels and temperature in response to changes in remedial system pumping operations along with the ongoing sampling and analysis of groundwater from the monitoring wells. The following describes the data collected and the findings.

Figures 5a, 5b and 5c show the water depth (i.e. a column of water above the data logger) and temperature measurements for wells MW-B, MW-04-H and AW-87-01. Data for MW-B and AW-87-01 are from December 17, 2007 through June 13, 2010. MW-04H data ends at March 22, 2010. These wells represent the typical conditions noted in both wells that likely encounter fractures as well as ones that are representative of bedrock matrix conditions described by Parker et al. (2010).

There are two significant events to be noted on the figures: Event A is March 29, 2009, when the city discontinued the operation of MW-13, and Event B is the period in August 2009 when an equipment failure interrupted the remedial system operation for 12 days. Water depths in all three wells showed almost immediate rises with the termination of pumping from MW-13 (Event A). Likewise, water depths quickly changed when the remedial system operation was interrupted (Event B). Water depths rose in wells MW-B and MW-04-H, and the water depth of AW-87-01 stabilized then rose. It should be noted that AW-87-01 and MW-04-H are 15.8 and 29 meters (52 and 95 feet) from the injection well, respectively. The daily fluctuations in water level measurements in these wells are related to treated water injection sequences. MW-B is 16.8 meters (55 feet) from the remedial system recovery.
well, and the water level measurements for this well are influenced by pumping cycles rather than injection cycles.

Some general water level trends that are apparent on Figures 5a, 5b and 5c include:

- The larger range of level fluctuations related to seasonal precipitation/recharge trends disappear after the use of MW-13 is discontinued. The low groundwater levels noted on each graph from June through September 2008 represent the extended drought that occurred during the summer and fall of 2008.
- The groundwater recovered by the remedial system is injected; thus, the water levels recorded after March 2009 remains at more consistent levels.
- Daily fluctuations related to pumping/injection cycles disappear when the remedial system operation is suspended.

There are distinct trends related to groundwater temperatures recorded for each of the three wells. Descriptions of these trends include:

- Well MW-B’s temperatures have minimal fluctuations for the December 2007 through June 2010 monitoring period. The two spikes are related to readings recorded while the data logger was out of the well. MW-B is south of the remedial system recovery well, in a portion of the recovery well cone of capture that has minimal effect from injection water. This deeper monitoring well (>30.5 meters deep, screened into the sandstone unit) has a consistently cooler temperature (between 13.17 to 13.35°C). Data related to Event A and Event B had no apparent temperature changes measured. Similar water level and temperature trends are present in the data from wells MW-02-A and MW-04-I.
- MW-04-H has two unique temperature trends noted for the monitoring interval prior to Event A and during Event B. Prior to Event A, the temperature and water level values had an inverse relation in that lowering water levels are often coupled with rising water temperatures. These changes are not as easily correlated prior to Event A. However, after MW-13 pumping ended a more apparent relation occurs when the remedial system pumping is suspended; groundwater temperatures abruptly decline as groundwater rises in response to the suspension of pumping (Event B). This decline in groundwater temperatures is related to recharge from the deeper portion of the aquifer. This similar trend is noted in MW-04-G.
- AW-87-01 has a different trend between water levels and temperature that reflects the influence of the treated and injected waters being warmed and cooled by airstripping. The December 2007 through June 2010 data show clear seasonal trends with temperatures rising as ambient air temperatures rise, then falling as the summer progresses into fall, with the lowest temperatures occurring in the winter months. The typical delay between ambient air temperature peaks and groundwater temperature peaks noted in data from the other wells is not occurring in this well. This shows the effect of water warming/cooling as it passes through the airstripping unit. This indicates fracture connection between the injection well (MW-07-N) and AW-87-01.

Figure 6 shows the maximum, minimum and average temperatures for the monitoring wells for March, April and August 2009. These dates represent the first two weeks in March when MW-13 was operating (March 2009) for the last two weeks of April, approximately one month after MW-13 pumping ended (April 2009) and the 12 days in August when the remedial system was not operating (August 2009). This graph has a bar to show the range of temperature measurements and a diamond to show the average value. As previously discussed AW-87-01 has the highest fluctuation of groundwater temperature measurements, and the groundwater temperature increased similar to the seasonal increase in ambient air temperatures. Wells MW-04-I, MW-B and MW-02A have the least fluctuation of temperatures for the three time periods referenced, further indicating these wells likely have minimal influence related to fracture dominated flow. Wells MW-04-H and MW-04-G, which are projected to be influenced by fracture flow, show more variation in recorded temperatures for the three referenced times.

An additional line of evidence relating the correlation of monitoring wells’ hydraulics influenced by fracture flow is the water level response to pumping that was conducted on November 30, 2010. The data loggers were programmed to record at 1 minute intervals so that water level and temperature changes in response to pumping could be evaluated. The remedial system groundwater recovery pumps were shut off, and water level began to equilibrate over a 150 minute period. Then the pump was reactivated and response to pumping drawdown was measured. Table 1 lists the maximum drawdown measured for each well prior to the start of a treated water injection cycle. The distances from the pumping well are also listed. The data

<table>
<thead>
<tr>
<th>Monitoring Well</th>
<th>Total Drawdown (m)</th>
<th>Distance to Pumping Well (m)</th>
</tr>
</thead>
<tbody>
<tr>
<td>AW-87-01</td>
<td>3.05</td>
<td>126.5</td>
</tr>
<tr>
<td>MW-04-H</td>
<td>1.46</td>
<td>79.3</td>
</tr>
<tr>
<td>MW-04-G</td>
<td>1.10</td>
<td>39.6</td>
</tr>
<tr>
<td>MW-04-I</td>
<td>0.61</td>
<td>53.3</td>
</tr>
<tr>
<td>MW-B</td>
<td>0.37</td>
<td>15.2</td>
</tr>
<tr>
<td>MW-02-A</td>
<td>0.09</td>
<td>83.8</td>
</tr>
</tbody>
</table>

Table 1. Water level drawdown in response to remedial system pumping Nov. 30, 2010.
shows that drawdown does not correlate to the distance from the pumping well, a strong indication of fracture controlled flow.

Discussion

The understanding of contaminate migration in fractured rock media has expanded considerably since the hazardous waste management regulations were promulgated. Studies by Pehme et al. (2010), Anderson (2005) and Neuman (2005) have looked at methods to evaluate fracture flow and temperature variations associated with various forms of hydraulic measurements as well as measuring induced stress from pumping or injection of water in a fractured system. Parker et al. (2010) further provided an understanding of the relation between DNAPL diffusion into the aquifer matrix and the concentration of DNAPLs in fractures. Parker’s study defined that for older DNAPL release sites, higher concentrations of DNAPLs occur in wells constructed in the aquifer matrix, while wells constructed in fractures represent the true potential concentrations of DNAPL migration from the rock matrix source. At this site, the quarterly groundwater sampling results show that wells with minimal temperature fluctuations associated with pumping cycles have consistent DNAPL concentrations. The wells where temperature changes abruptly with pumping cycles have higher variability in DNAPL concentrations, particularly when normal pumping cycles are interrupted prior to sampling. Figure 7 illustrates the trend. MW-B is a well constructed in non-fractured bedrock (matrix). This will has consistent (declining) PCE concentrations. MW-04-H, which had fractures identified in the borehole during drilling has a less consistent pattern of PCE concentrations.

This study demonstrates that water level and temperature data trends associated with fluctuations in pumping cycles can be used to evaluate if monitoring wells have the characteristics of fracture flow versus matrix (non-fracture) conditions. Data collection is facilitated using data loggers, and this data can be compared to temporal variations in groundwater quality to further assess the fractured/matrix conditions encountered at each well. At this site, prior to March 2009, the multiple effects of the hydraulic responses to the municipal well pumping, remedial system pumping and injection of treated water made developing or comprehensive understanding of temperature gradients, vertical heads and fracture flow effects in specific lithologic units problematic. When pumping of the municipal supply well ceased, data trends related to water level and temperature fluctuations were more apparent and predictable. Tests to assess water warming/cooling from air-stripping and drawdown rates related to groundwater pumping fluctuations provide data further defining the hydraulic condition of specific monitoring wells. Understanding the transfer of PCE and daughter compounds from the matrix to the more permeable fractures at the site will facilitate better prediction the potential migration of dissolved phase DNAPLs.

Additional efforts to reduce PCE in the source area (shallow interval) are being considered for the Carroll County site. Since total removal of PCE from the shale matrix is unlikely, a comprehensive understanding of the fracture/matrix conditions at the site will facilitate projecting risk from residual concentrations of DNAPLs. Having a well defined hydraulic model for the site will be integral to evaluating when PCE concentrations in the source area are low enough to permit termination of groundwater pumping and treatment.

Acknowledgments: I would like to thank John Dillenburg and Jon Zanders for their dedicated assistance with the ongoing data collection at the study site. I also would like to extend a special thanks to Neil Schemm, Jeff Lehman, Donna Rhodeback and Christine Svitana for their assistance with preparing and reviewing the manuscript.

References:


Malard, F., and R. Chapuis. 1995. Temperature logging to describe the movement of sewage-polluted


AIPG exhibited at the Deep Foundation Institute’s annual meeting, held in Boston in mid-October.

AIPG booth, in the foreground, at the DFI convention in Boston.

Brandon Fisher, Bill Siok, AIPG Executive Director and Richard Soppe in the DFI exhibit hall.
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