

geophysics

Colorado School of Mines

Spring 2009



Geophysics 2008 Field Camp



The GP Spirit

In this geophysics newsletter you will find the familiar types of articles we all enjoy: field camp, graduation, study abroad, student internships, research activities, alumni focus. You will also find some articles on what was perhaps the biggest news this year — the retirement of Sara Summers!

In November, Sara retired from her position as office manager after serving in the Department of Geophysics almost 30 years. While many other aspects of the department had changed over the years, Sara was a consistent presence. For many research sponsors, recruiters, and returning alumni, Sara was the “face” and the “voice” of geophysics at Mines. We enjoyed celebrating her career on several occasions before her retirement was official and we finally said “goodbye.” Then we welcomed Michelle Szobody as Sara’s successor. Michelle is familiar to many as the program assistant for the Center for Wave Phenomena (CWP) for the past seven years. We are in good hands!

We hope you enjoy all the articles and pictures in this newsletter that convey the life and spirit of the Department of Geophysics!



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Corporation has graciously donated funding that helps with the costs of publishing this annual geophysics newsletter. We typically print and distribute 4,000-5,000 copies to students, prospective students and their parents, research sponsors, alumni, recruiters and others. We are grateful for the financial support from Shell that makes this possible.

THE GREEN CENTER: *within these walls*

A Bit o' Sprucing Up!

Over the past couple of years, the Green Center has received some overdue care and repair. There is new paint, carpet, and tile in the public and study areas; a new street-accessible elevator, which connects all three levels and opens to glass, natural light-filled atriums that have views of North Table and Lookout Mountains.

One of the best benefits of renovating the Green Center is the construction of a new teaching lab on what has become affectionately referred to as the “garden level” (basement). Professor Gary Olhoeft had a big role in designing this state-of-the-art lab whose principal use is by his GPGN210 Materials of the Earth class. This is one of the first courses taken by sophomores entering the geophysical engineering major. The course challenges the students to develop a professional approach to



Experiment in progress in the new undergraduate teaching lab.

pursuing scientific inquiry, conducting laboratory experiments, and maintaining good lab notebooks as they learn all about the properties of soils, rocks, fluids, and other materials. It is a pleasure to finally have a teaching lab purposely built for the instruction of undergraduates!



Formerly the garage entrance, the new east entrance to the “garden level” now brightens the interior hall.

Riding in Style



Artist Ken Williams from Pueblo, Colorado, designed and created the glazed clay-tile mosaic adorning the entrance to the new elevator on the south side (16th Street) of the Green Center. This project, which depicts the earth's subsurface, was commissioned by the Colorado's Art in Public Places program.



Sara Summers Retires from CSM

A Tribute to Sara

In a sense, Sara and I started in the administration of the Department of Geophysics at the same time. In 1979, I was acting department head, and we needed some administrative help. The two best candidates (Sara and Dorothy Nogues) only wanted to work half time, which turned out to be a great deal for the Department because both were outstanding. It wasn't long before Sara discovered she liked the Department and agreed to work full time. That was the start of a relationship that had become legendary by the time she retired in November 2008.

A few years after arriving, Sara was appointed as executive assistant to the department head. Her first act in that role was to remodel so that the only entrance to the department head's office was through *her* office. That arrangement enabled Sara to be so knowledgeable about the Department and CSM that students, faculty, and visitors alike relied on her as their primary source of information.

A Really Good Run!

When Dr. Romig asked me to come in and talk about a position in the Department of Geophysics, I never dreamt that I wouldn't say good-bye to the Green Center for the next 29 years. Within about three months that part-time typist job he had in mind evolved into full-time secretary status

— Phillip R. Romig, Jr., Assoc. VP for Research

During that time, Sara and my wife became best friends. I often have said that I had the easiest job in the world. My wife told me what to do at home; Sara told me what to do at work; and all I had to do was follow orders. The story usually was interpreted as a joke, but there's more truth to it than most people realize.

Sara is a study in contrasts. On one hand, she is an inveterate extrovert who brightens the day for everyone she meets. At the same time, she is a consummate professional who strives for perfection and expects the same from everyone with whom she works. She was equally at home making travel arrangements for a visiting executive, being a surrogate mother to a lonely freshman, or partying into the night with the SEG staff after the exhibition hall closed. She dealt with people from all walks of life (and countries) with respect, dignity, and humor; and in return, she was liked and appreciated by everyone, regardless of their age

— Sara Summers

and moved forward from that. And, by the way, I passed that typing test on an electric typewriter taking dictation from a Dictaphone machine. How things do change!

During those 29 years I had the pleasure of primarily working for two really great department heads, Phil Romig and Terry Young. I occupied the same northwest corner of the 2nd floor for all of those years. That offers some explanation of why it took a good many boxes (and the assistance of several) to move items from my office to my home.

There were many highlights during those years — wonderful commencement celebrations watching our students receive



or position. As a testament to her interpersonal ability, she eventually was appointed as office manager—the only person on campus to hold that title.

For years, the Department has been known across campus as a place where people respect each other, enjoy what they are doing, and do it extremely well. Sara gets a lion's share of the credit for creating that environment. She long will be remembered for helping make the Department of Geophysics what it is today.

their diplomas; the awesome experience of attending the annual SEG meetings, and an opportunity to see alumni and many corporate friends of the Department from around the world.

I was blessed to work with some of the very finest faculty and many wonderful staff. My contact with them and our awesome students would be the biggest reason that to retire was such a difficult decision.

At my parting, I was overwhelmed with kindness and gracious words from so many people. Right now, I'm transitioning into the next adventure of my life as a retired grandmother.

I don't know exactly what's over the horizon for me, but I do know that these past 29 years have been a **REALLY GOOD RUN!**



Sara poses between two "really great" department heads whom she worked with during her 29 years at CSM: Phil Romig Jr. (left) and Terry Young (right).

Who's Minding the Office?

(re-)Introducing Michelle Szobody

She's **B-A-C-K!**

In December 2008, Michelle Szobody returned to the geophysics department, stepping into the office management position vacated by retired Sara Summers. Michelle first joined the Department in 1994 as administrative assistant, working part time for the Department and part time for Ken Lerner, the C.H. Green Professor of Exploration Geophysics.

In 1999, Michelle moved next door to become program assistant for the Center for Wave Phenomena. Now she has stepped back through that same door.

Already familiar with the ins-and-outs of the campus, Michelle's transition to her new responsibilities has appeared to faculty, students, and fellow staff as effortless.

In addition to her full-time role in the GP department, Michelle simultaneously continues classwork as a student at Mines, majoring in mechanical engineering. She is a member of the engineering honor society, Tau Beta Pi.



Be sure to save the date!

The Annual CSM Geophysics luncheon will be held at the SEG meeting in Houston on Tuesday, October 27, 2009, at noon. CSM students and alumni are invited to attend.

GP 'Life-Support' System!



The GP department remains in good hands with the talented support of (left to right) Susan Venable (Reservoir Characterization Project), Dawn Umpleby (GP Special Projects), Pam Beckman (Center for Wave Phenomena), Michelle Szobody (GP Office Manager), and Barbara McLenon (Center for Wave Phenomena).

SARA RETIRES



David Wald Receives Frank Press Award

USGS research scientist and GP adjunct professor David Wald is the recipient of the Frank Press Public Service Award from the Seismological Society of America (SSA). This award recognizes outstanding contributions to the advancement of public safety or public information relating to seismology.

As stated in the award announcement, throughout his career David has expanded the reach and application of seismic data through development of widely-used programs such as ShakeMap and "Did You Feel It?" Wald's work has ensured the efficient spread of earthquake information to first responders and government officials and aided countless others touched by earthquake disasters.

Steve Hill Selected President-Elect of SEG

Steve Hill, CSM adjunct geophysics professor, was announced as president-elect of the Society of Exploration Geophysicists at the 2008 Annual Meeting in Las Vegas. As president-elect, Steve will succeed current SEG president Larry Lines at the end of his term in November 2009. Until then, Steve serves as backup to Larry and shares some of the travel assignments.



Steve works as a consultant, providing seismic geophysical education to the industry, as well as to CSM undergraduates. Steve spent a long career in various assignments with Conoco, and over the years, he has lent valuable service to the SEG in several capacities.

ABOUT SHAKEMAP

ShakeMap is a program created by Wald and others that provides near-real-time maps of ground motion and shaking intensity following significant earthquakes. Until a decade ago, rapid information about damaging earthquakes was limited to magnitude and location data.

ShakeMap and other of Wald's advancements make it possible for organizations and governments to reach critical decisions and to quickly disperse appropriate resources within minutes following an earthquake. To date, more than 70,000 individuals receive ShakeMap alerts in California, Washington, Utah, Hawaii, Nevada and Alaska.

DID YOU FEEL IT?

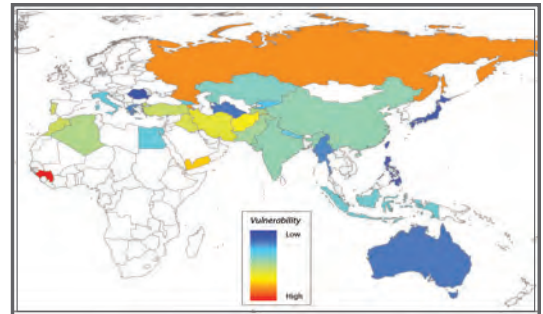
Drawing on the power and interactivity of the Internet, David also created the program "Did You Feel It?" to help researchers gain a better understanding of what occurred during an earthquake. Following an event, people can log on to the Internet to provide detailed personal observations of an earthquake experience, which are then translated into maps that continuously update as information is received. More than one million people across the globe have contributed observations.



ABOUT PAGER

Still a third program that David helped to launch is the Prompt Assessment of Global Earthquakes for Response (PAGER). Previously, responders had to rely on earthquake reports to filter in, which could take several hours or even days. The PAGER system is able to estimate the number of people subjected to levels of ground shaking within 30 minutes of an earthquake anywhere around the globe.

David was honored during a presentation April 8 at the 2009 SSA Annual Meeting in Monterey, California.



Spatial representation of the global earthquake vulnerability ranking. Intuitively we know that the vulnerability of global communities varies from country to country. For example engineered structures in the developed world are more likely to resist failure under strong ground shaking than structures in the developing world. Using the catalog of human exposures from earthquakes in the Atlas of ShakeMaps, combined with fatality information in PAGER-CAT, we have developed a simple, yet objective, vulnerability ranking scheme for global countries. In developing global fatality models, it is important to be able to rank and group countries of similar construction and vulnerability, particularly where we have little information to constrain our models. – From *Development of an exposure catalog for PAGER loss modeling*, by Trevor Allen, Paul Earle, David Wald & Kristin Marano, USGS.

Scientists and educators, Roel Snieder and Ken Larner have

graduate students and other young researchers acquire the skills

communication; publishing papers; writing proposals; effective

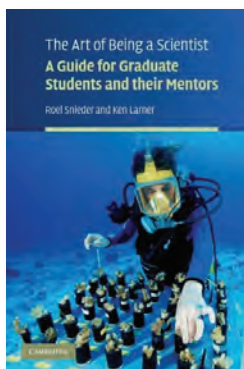
The book also provides a sample curriculum designed for a course similar to that taught by Roel, which could be used by other graduate-level instructors. Because of the wealth of advice offered in this book, it is also useful reading for mentors of graduate students and other junior researchers.



Ken Larner, University Emeritus Professor and Roel Snieder, W.M. Keck Distinguished Professor of Basic Exploration Science.

The Scientist as Teacher

Exemplary Mentoring



a lot of advice to impart. Their book *The Art of Being a Scientist*, which grew out of a graduate course that Roel has been teaching at CSM for the past six years, is a hands-on guide aimed at helping

needed for a career in research.

Although some aspects of the philosophy of science are covered, most of the book's content is of a practical nature—applicable to all fields of science, engineering, and humanities.

Topics covered include how to choose a research topic, department, and advisor; how to make a work plan; the ethics of research; how to use scientific literature; how to perfect oral and written

tive time management; how to plan your scientific career, and how to apply for a job.

Talking about his motivation for writing the book, Roel points out that in traditional graduate education, students learn these skills “on the job,” often by doing them poorly at first, with the result that much time is lost. This book explicitly teaches students the skills that are needed to be successful in research.

Teaching With a Heart

Sharing a Vision of Education

— Roel Snieder

Along with colleagues from the Colorado School of Mines, nearby Red Rocks Community College, and the Jefferson County School System, Roel has organized a working group focused on education innovation along the lines of the statement at left. Among the issues to be addressed by the group are creating better learning opportunities for underprivileged students, a more efficient transition between education at different levels, and a larger awareness of sustainability.



Celebrating graduation with students in 2007.

With colleagues from the working group, Roel started discussion groups that will read the book “Brain Rules” by John J. Medina, Ph.D., which addresses the connections found to exist between neuroscience and education.

About 25% of the faculty at the Colorado School of Mines and 50% of the faculty at Red Rocks Community College are participating in the reading groups. This large voluntary response indicates the interest among faculty in education innovation.

“An education system with a heart facilitates learning in an environment that fosters creativity which is not restrained by reservation, stimulates students to discover their values, helps them to articulate those values and to live their life accordingly. Such education is open to growth, expression, and fearless learning, and it is infused with joy, enthusiasm, and inspiration. It motivates one to work hard and develop the skills to focus, and it helps students reach their potential, whatever that may be for any student. Teaching with a heart creates a social awareness and a realization of being connected, embraces dissent and diversity, and fosters the skills and willingness to make a new synthesis. It helps students discover and integrate both halves of their brain and lead balanced lives.”

Anisotropists Hold Biennial Meeting in the Colorado Rocky Mountains

— Ilya Tsvankin
GP Professor



CSM geophysics professor Ilya Tsvankin and University Emeritus Professor Ken Lerner played a major role in organizing the 13th International Workshop on Seismic Anisotropy in Winter Park on August 10-15, 2008.

Ilya and Ken teamed up with Edward Jenner and James Gaiser of ION/GXT Imaging Solutions on the organizing committee. 13IWSA continued the great tradition of biennial gatherings of anisotropists, which dates back to the 1980's.

The previous workshops, attended by scientists from all over the world, are widely credited with helping to move anisotropy to the forefront of applied seismology. In Winter Park, more than 70 geophysicists from industry and academia discussed both theoretical aspects of anisotropy and application of anisotropic processing/inversion methods to seismic exploration and reservoir monitoring.

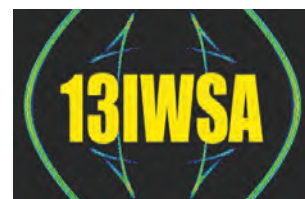
The workshop proceedings will be published in a special issue of the journal *GEOPHYSICS* edited by Ilya, Ken, and James Gaiser.

The workshop was enthusiastically supported by oil and service companies, with ION/GXT, Chevron, Devon Energy, ExxonMobil, PGS, Shell, and Western-Geco forming an impressive sponsorship group. In particular, the sponsors provided travel grants to a number of graduate students from USA and abroad, who otherwise would not have been able to present their research results at the workshop.

In addition to the busy technical program, the attendees enjoyed a number of well-organized social events including excursions in the Rocky Mountain National Park, a violin/piano recital, and the workshop dinner at a restaurant located on a spectacular mountaintop. In his thank-you letter, Jorge Martins from Brazil writes: "I have no words to express how exciting my rafting trip

in the Rockies was! Please also send my thanks to the three highly skilled musicians who played unforgettable pieces of classical music in their recital."

The 14IWSA will be held in Perth, Western Australia, April 12–16, 2010.



**Winter Park, Colorado
August 10-15, 2008**



Providing a musical reprieve for 13IWSA attendees were pianist Olga Dashevskaya (center), and violinists Lydia Svyatlovskaya and Vladimir Petrov. Olga is the wife of Ilya Tsvankin.

Spreading the Word — Serving the World

Geoscientists *Without* Borders



Craig Beasley, "... we have a significant contribution to make as geophysicists."

CSM geophysics students and faculty listening to the Distinguished Heiland Lecture on February 12 received a lesson, not regarding research, but regarding the responsibility of geophysicists to apply their skills and knowledge to humanitarian efforts in disadvantaged areas.

Speaker Craig Beasley, former president of the SEG (2004-2005), is chair of the newly formed SEG Foundation Committee for Geoscientists without Borders.

Craig explained that the motivation to establish an initiative, such as Geoscientists without Borders, came during his term as SEG president when the 2004 Tsunami disaster occurred. This event highlighted the tremendous need for skilled response to those global areas that are the most vulnerable to natural disasters and that lack the resources for recovery.

"Despite the depth of knowledge and technology in the geosciences today, it is unfortunate that direct impact from the geosciences on improving the lives of the world's underserved people still is lacking—particularly in the case of the geoscientists and technology residing in the energy sector."

At the beginning of 2008, through the efforts of many, the SEG Foundation accepted a \$1,000,000 donation from Schlumberger to found Geoscientists Without Borders. The program will make grants on the order of \$100,000 per year over the next five years for selected projects. Proposed projects must involve the application of geophysics to humanitarian needs and must include geoscience students and institutions in a significant way. Thus, the program seeks not only to accomplish significant humanitarian goals, but also to involve next-generation scientists in worthy causes.

Geoscientists Without Borders has already made two project awards, and many other proposals have been received. One of the initial projects will address the severe water crisis in rural India by using electromagnetic induction to map soil moisture and shallow aquifers in the Salri watershed in the State of Madhya Pradesh. The goal of this project is to increase the water supply through water capture, storage, and usage management.

In northern Thailand, three distinct humanitarian efforts under one project are planned to mitigate earthquake hazards, address water quality issues, and preserve cultural heritage through archaeological mapping. Seismic, ground penetrating radar, electrical, gravity, and magnetic methods are to be used to address geotechnical problems in Chiang Mai, Thailand.

Craig Beasley is vice president for WesternGeco and a Schlumberger Fellow.

Universal Language Not Just Words

— Arianne Dean

CSM McBride Program Provides Humanitarian Experience

During summer 2008, I traveled to Honduras with six other students in the CSM McBride Honors Program. We spent time with village children teaching them about recycling. One of our teaching methods was to make crafts with them, using recycled materials.



Out of the group of six CSM students, three of us spoke some Spanish. At first, it was entertaining trying to listen to government meetings and playing with the children when we could not communicate. And though throughout the trip we learned additional words, we found that we could effectively communicate without words.

We worked in the local village during the week, and traveled as tourists on the weekend. The most enjoyable visit was to the Mayan ruins at Copan. Our guide there, had an enormous amount of knowledge about the Mayans and their history.



CSM at the Mayan ruins at Copan.

During the three weeks, our bus driver, Berto, became one of our best friends and protector. The first time we handed out free soccer balls to the community, both children and adults began to swarm us. Berto pushed through the crowd to rescue us. Many times he protected the bus by acting as "bouncer" to keep people out. We were able to communicate with Berto using the few Spanish words we knew and the very few English words he knew. But, imagine a secret language that included a dozen words with lots of actions – that was our language during the three weeks we spent in Honduras.

The McBride Honors Program is a program of seminars and off-campus activities whose primary goal is to provide selected CSM students the opportunity to explore how their technical expertise might interface with the humanities and social sciences.

So little time; So **much** to do

A popular study abroad program for CSM geophysics students is that offered by the Delft University of Technology. In fall 2008, five students departed for a semester-long experience. “Book study” was not the only objective of their study abroad, as two students describe.

One Place Leads to Another

— Dylan Connell

I arrived in Holland on a sunny, cloudless day and spent the first weekend on the beach at the North Sea. “Those rain stories can’t be true,” I said to myself. Within the next week an umbrella became my permanent travel companion. Despite the rain, The Delft University of Technology (TU Delft) is home to friendly people and an all-around great culture.

As with every semester spent abroad, a student experiences the cultural learning curve. This time for me it was navigating the narrow European streets, becoming an expert bike rider, and paying attention to train schedules.

A great attraction for a student traveling abroad in Europe is the easy access to the transportation systems. Fast, well-connected trains, cheap flights and even ferries can whisk an eager

traveler away to far locations, if even for only a long weekend. Inexpensive hostels made it possible for me to make my way to Norway, Sweden, Belgium, Germany, Luxembourg, France, Italy, The Vatican, and the Czech Republic.

TU Delft is a top school and can boast of many high ranking technical degrees. Luckily for U.S. students, almost every native person speaks fluent English. Most of the geophysics courses that Mines offers can also be taken there and will transfer to CSM for credit.

My semester at TU Delft was made even better by a great bunch of Dutch students who took me in for the semester. If you decide to venture abroad to Delft, don’t forget to bring your cooking skills for communal meals...and don’t forget your umbrella.



A scene in Delft of the Oude Kerk (Old Church).



Dylan on the Eiffel Tower during an excursion to Paris.

Learning How Small the World Really Is

— Jeremy Brown

Classes at Delft were tough like those at Mines. I learned a lot — not only in my classes, but also from my exploration of the peninsula of north-west Eurasia (Europe). I discovered that by taking advantage of long weekends and breaks it is very possible to get in a lot of traveling.

When I was not studying, I was traveling: From The Netherlands to Belgium to France to Germany to Italy to Greece and Turkey, my time abroad has opened my perspective on the world and different cultures. It was meaningful to share that experience with friends, building lifelong memories.

During my travels, I was surprised to often run into another person from Mines, or one who was related to someone who went to Mines. I met a woman in Greece whose father went to Mines and now lives in Cairo working for a major energy company. Her brother recently graduated from Mines. When in Italy, I met a geology student who applied to Mines, and his brother is an alumnus. I quickly realized how small the world really is. Mines connections around the world are amazing.



Jeremy in Ancient Ephesus, Turkey.

And despite what people may think, especially my parents, I never did miss classes.

ADVENTURE & DISCOVERY

The Department's weekly Heiland Lecture hosts speakers who broaden the exposure of GP students to real-life geoscience issues and career possibilities. Pasquale Scaturro is a returning favorite, who took the Heiland audience on his African river adventures.

— Dawn Umpleby, GP Staff

Colorado-based geophysicist and global expedition leader, **Pasquale Scaturro**, wowed Heiland Lecture attendees with a presentation of his most recent adventures: “Exploration of the Great Rivers of Africa.” Set on the Omo, Zambezi, Tekeze, and Blue Nile rivers and billed as “what geophysicists do in their spare time,” these odysseys combined studies in geophysics with geology, archaeology, anthropology, biology, and most importantly, human ability. Within a backdrop of visually stunning geography, the lecture focused on the unlimited possibilities for challenging oneself and finding inner strength in some of the most adverse conditions on the planet. In the first ever complete descent of the Blue Nile, challenges included 114 days and 3000 miles of navigating river rapids 5-35 feet in height, continuous 115+ degree heat, dodging gunfire from local bandits, arrests by unfriendly militias, malaria, exhaustion, and

very close encounters with some of the most aggressive crocodiles and hippopotami on earth.

Pasquale revels in teaching people that the realm of possibility has no limits. Many of his mountain and river expeditions have included members with little or no experience. In the case of his most famous ascent of Mt. Everest, one of the climbers was blind. Pasquale’s 26 years of managing geophysical projects in some of the most remote, dangerous, and challenging areas on earth have taught him the lessons that he demonstrates to expedition members: patience, planning, persistence, and flexibility to overcome unexpected obstacles. On the Nile adventure, his favorite to date, the local guides did not know how to swim and the rapids in the northern river gorge stood as high as 35 feet. “There is a fine line between an exciting rapid and a deadly one,” says Pasquale “and my greatest responsibility is keeping everyone alive.”

Pasquale has worked and explored throughout North and South America, Africa, and the former Soviet Union and is constantly seeking the next exploration opportunity. Running the Blue Nile through Sudan, Pasquale eyed the western mountains like a hungry carnivore staring at a large piece of meat: “I’ll bet that no Westerner has explored those mountains... .”



The Spark of Discovery

— Alex Radelet, GP student



Through every rift of discovery some seeming anomaly drops out of the darkness, and falls, as a golden link, into the great chain of order. Edwin Hubbel Chapin

At the most Eastern end of the Silk Road, the sun was setting on Hua-Piao Hill. I had a few moments to think while I packed up the Nikon and notepads. I looked at my brother: he was interviewing an old Chinese fortune-teller on a veranda

of the last remaining Manichaeon Temple in the world. There were bones, dried tea leaves, notepads, and language guides strewn over a dusty Chinese Chessboard. The heat and humidity were intense and the cicadas were buzzing loud enough to make your head hurt. Discovery, I thought. It is beautiful, unique, and it matters (and it would be nice to have more of it!).

No one knew where the two of us were. In fact, no American university—not even the Library of Congress—had coordinates, dimensions or data for this place. The Library of Congress had two black and white photos from the 1960’s. Through some excellent grant writing, my brother had convinced the Ford Foundation that he and his brother (thanks, Ben!) could find the temple and document it. Imagine: the last extant temple from the world’s first known disseminated religion—intact—and no one knew where it was or what it really even looked like! (I believe it is now a UNESCO World Heritage Site).

It is no small challenge to realize that there are, right now, many important things to discover—and that their discovery is often accessible to us. This can be especially difficult for students who, like myself, must concern themselves so fully with existing knowledge and studenthood.

Sparked in China, the issue of discovery has since begged some important questions of me: Where do the initial ideas for original projects come from? What are they sparked by and how can one get/see more “sparks”? Are there things personally one can do to recognize them or avail ourselves to them? What about hard work, necessity, and all the other historically-defined cornerstones of invention? Is there a conducive mind set to have? What opportunities do my knowledge and experience create right now?

I am new to Mines and the Geophysics Department; I look forward to the learning and the discoveries! (And, thanks, Mr. Pasquale Scaturro, for inspiring me to think about these things again!)



Interdisciplinary Graduate Program Targets Intelligent Geosystems



Dave Hale
GP Professor

Imagine a levy or earth dam that monitors itself daily, identifies its weak link, and takes action to fix it. Or *imagine* a region-wide remote sensing system that is able to identify mm-scale movements in rock and soil formations signaling a possible landslide — and then deploys field personnel to take mitigative action.

CWP Professor Dave Hale is one of four principal investigators of a new integrative graduate program at CSM called **SmartGeo**.

SmartGeo is designed to prepare leaders in the study and development of intelligent geosystems: engineered and natural earth structures and systems that can sense their environment and adapt to improve performance.

The curriculum to meet this program's ambitious goals requires a different framework from the traditional doctoral program, which is normally based on individual research and limited to a single discipline.

SmartGeo students will design their M.S. or Ph.D. program across two or more departments. They will engage in five key activities: 1) interdisciplinary collaborative research teams, 2) social and environmental ethics and policy, 3) leadership and teamwork, 4) cross-disciplinary technical knowledge, and 5) internships.

Research will primarily be in modules: 1) sensor technologies (wired and wireless); 2) signal processing (data analysis, visualization); 3) modeling calibration, sensitivity and uncertainty analysis; and 4) decision support (control theory, neural networks).

CSM faculty participating in SmartGeo represent three areas—geoengineering, geoscience, and computer science, and include 22 academic faculty from ten disciplines and six research centers, as well as geo-engineers from the U.S. Geological Survey.

In addition to interdisciplinary education and research, the program seeks to achieve broader

integration with the social sciences, humanities, and policy studies. Students will gain knowledge and skills in leadership and management, and apply these to a non-profit community project. In this portion of the program, Professor Roel Snieder will be a participating faculty member through his course, "The Art of Science."

Collaboration among faculty and students across study disciplines will be augmented by working closely with industry partners and government policy makers.

SmartGeo students receive fellowships funded by the National Science Foundation through its Integrative Graduate Education and Research Traineeship (IGERT) program.

Jim Teeri, Director of the IGERT National Recruitment Program states, "...there has been a growing realization that the really big problems in science are not going to be solved within one discipline. The complex problems, like those affecting the environment or advances in information technology, will require expertise from many areas."

For more detailed information on SmartGeo, visit <http://smartgeo.mines.edu>.



Potrerillos Dam, Mendoza Argentina

The past few years, I have organized various geophysical field projects on volcanoes around the world, particularly on the islands of Stromboli and Vulcano in Italy, and Ruapehu in New Zealand.

The planning for field projects begins several months in advance in order to arrange the logistics, the equipment, and prepare the schedule of the measurements, which usually includes DC-resistivity, self-potential, temperature, and soil gas measurements (CO₂ soil concentration and flux and radon flux). Very frequently, however, decisions must be made in the field in order to adapt to an unexpected situation. This part, I personally really like, as too much preparation is not my cup of tea—there always should be a place for adventure.

These projects have gathered many students from all over the world into a great environment. The students are selected on their ability to work as a team, enduring hard field conditions in rough settings. They must have strong personal discipline to work in active volcanoes where there are many potential dangers—from rolling stones along steep slopes, to the dangers inherent to the volcanic activity itself.



Measurements with georadar at the top of Stromboli volcano during a windy day.

The scientific output of these missions has been beyond my dreams. Recently published in the *Journal of Geophysical Research*, is a paper written by me and all the students that were involved in collecting the data. One of the main results was a tomographic cross-section of the volcano showing what the forge of the ancient god Vulcan was like. Indeed, in ancient times, the Romans believed that Vulcano was the chimney to the forge of the god Vulcan. It was thought that

the glow of eruptions was from his forge and that the island had grown because of his periodic clearing of cinders and ashes. The earthquakes that either preceded or accompanied the explosions of ashes were attributed to Vulcan himself, making weapons for the other gods.

Master's student Alicia Hotovec is currently crunching numbers to make a 3D image of this volcanic edifice—the first one!

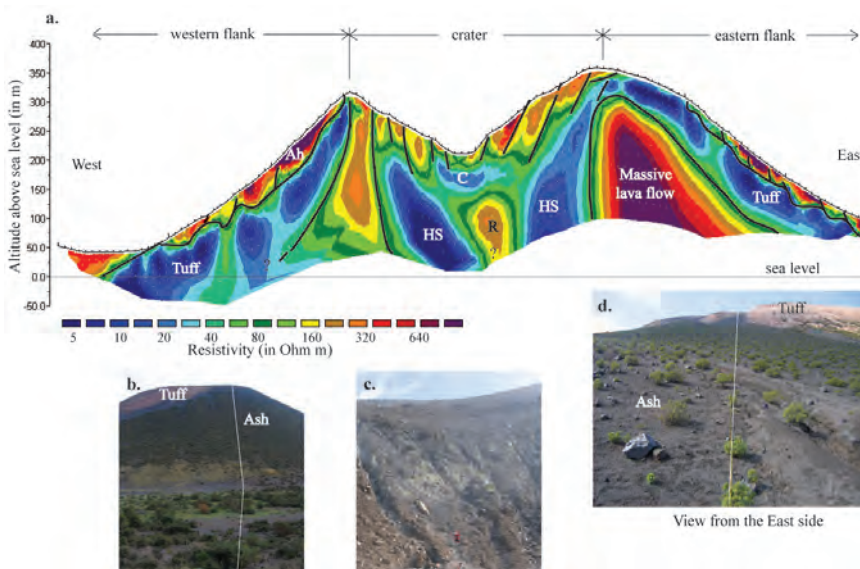


— André Revil
Associate Professor

Exploring Active volcanoes with geophysical methods



A solid meal at the top of Stromboli volcano with a wonderful view onto the active vents, an internationally friendly atmosphere with a lot of fun. Life is good!

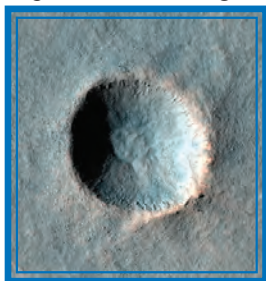


Cross-section of la Fossa di Vulcano. a. Architecture of the Fossa cone along the profile 1 (resistivity tomogram). "Ah" and "HS" stand for respectively Ash and Hydrothermal System. "C" and "R" stand for "Conductive" and "Resistive" body, respectively. b. and d. Pictures of the Fossa cone from the west and east sides, respectively, showing the position of the ashes relative to the position of the hydromagmatic tuff (the line shows the position of the profile). c. Picture taken inside the crater showing the pyroclastic deposits.

Geophysics **INVADES** the Solar System!

While the modern-day era of planetary exploration goes back more than four decades, the last ten years have seen a renaissance in planetary geophysics.

The early days of planetary exploration relied primarily on geomorphic interpretations of images of the surfaces



Recent HiRISE image of small crater on Mars. — NASA/JPL/University of Arizona.

of the various bodies in the solar system (with a few notable exceptions, particularly some excellent early geophysical data from the Moon gathered during the Apollo missions).

Then, the Mars Global Surveyor (MGS) mission in 1998 revolutionized our understanding of the Red Planet by providing the first high-resolution topography from the Mars Orbiter Laser Altimeter, and gravity data from tracking of the radio signal of the spacecraft. MGS marked a turning point in our understanding of the geophysics of Mars, shedding new light on old problems, and revealing new puzzles that could not even have been anticipated in earlier years.

The modern era of Martian geophysics continues, with ground penetrating radar from the Mars Advanced Radar for Subsurface and Ionospheric Sounding (MARSIS) aboard Mars Express, and the Shallow Radar (SHARAD) sounder aboard the Mars Reconnaissance Orbiter (MRO) now revealing the structure of the shallow crust and polar caps. Meanwhile, there have been similar improvements in remote sensing data, including hyperspectral images from the CRISM instrument aboard MRO, which have revealed extensive evaporite deposits on Mars.

Closer to home, our understanding of the structure of the Moon took a leap forward in the mid-1990's, with topography data from the Clementine LIDAR and gravity data from tracking of the Clementine and Lunar Prospector satellites. The next several years, will revolutionize our understanding of the Moon with vastly improved topography from the Lunar Reconnaissance Orbiter and the first high-resolution gravity study by the Gravity Recovery and Interior Laboratory mission.

Mercury, too, has fallen victim to the ever-expanding reach of geophysics, as the MESSENGER mission brings the Mercury Laser Altimeter, and becomes the first orbiter of Mercury providing global grav-

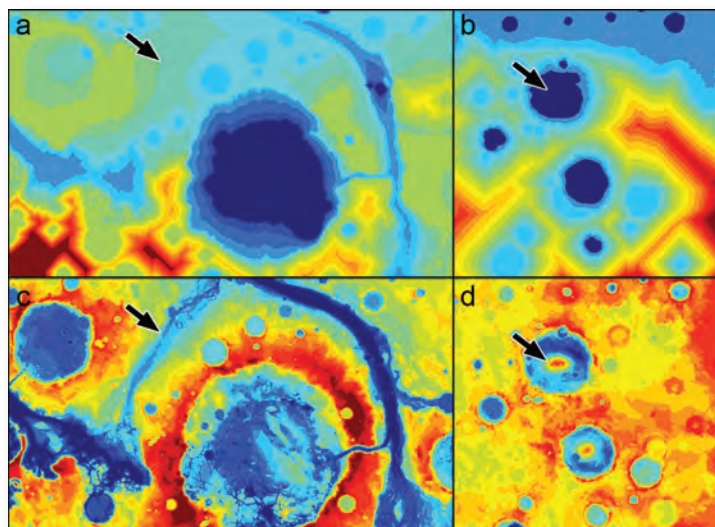
ity coverage. Even the outer solar system has not escaped the onslaught of geophysics, with synthetic aperture radar on the Cassini spacecraft revealing for the first time the surface of Saturn's moon, Titan, with its rivers and lakes of liquid methane.



— Jeff Andrews-Hanna
Asst. Professor

Over the last several years I have had the pleasure of working with topography and gravity data for Mars, studying problems as diverse as groundwater hydrology, tectonics, and global crustal structure. While we can't predict what new discoveries will be made with the vast wealth of new data that will soon be available, this much is certain: wherever unanswered questions remain and new data abounds, science will flourish. Years from now I will look back and reflect on my good fortune to take part in such an exciting time in the field; but for now, there is science to be done!

Mars then and now. Color topographic maps from the Viking data of thirty years ago (a, b) and the MOLA altimeter aboard Mars Global Surveyor (c, d). In addition to the long-wavelength errors and low resolution, note the missing channel (a, arrow) and sedimentary deposits within the craters (b, arrow) in the Viking data. Even greater improvements will soon be made to the topography data of the Moon and Mercury.

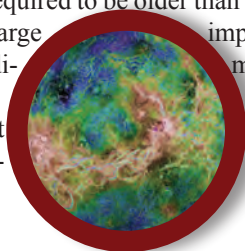


The surface of Venus is known primarily from slant-radar reflectivity and low-resolution radar altimetry from satellite Magellan. Warren Hamilton, Distinguished Senior Scientist in the Department of Geophysics, is almost alone in interpreting this imagery as showing a surface saturated with large impact structures, which by analogy with dated structures on the Moon is required to be older than 3.8 Ga. The younger of the ancient large impacts were concurrent with early sedimentation in oceans whose sediments form or constitute the floor of the vast Venusan plains. Conventional interpretations, by contrast, are fit to the assumptions that Venus must be as active internally as Earth and that the imagery must be interpreted in terms of young magmatism. In those popular terms, the thousands of large (to 2000 km) rimmed circular depressions of Venus, which overlap like cookie-cutter bites, are products of “plumes”, not impacts, and the plains are of flood basalts, not sediments.

Large tracts of Venusan plains display polygonal reticulation, wherein radar-bright lines define variably nested irregular polygons down to the limit of resolution of about 1 km (Figure 1). Although the lines cannot be fissures within single units because they cross boundaries between turbidite flows, they are conventionally explained as giant cooling cracks, implausibly 1000 times larger than in terrestrial analogues, in basalt flows.

Terrestrial analogues that are viable occur in sediments of many marine basins. As documented most extensively by Joseph Cartwright of Cardiff University, UK, and his associates, 3-D seismic-reflection surveys reveal Venus-like nested-polygonal fault systems (Figure 2). The structures are seen in vertical profiles to be normal faults, with tens of meters of offset, strata-bound within sections of fine-grained, low-permeability sediments. The structures are products of compaction and dewatering.

Surface temperature of Venus is now about 450°C. Hamilton infers the polygonal structures (and also superabundant mud volcanoes) to record downward desiccation under a heating supergreenhouse atmosphere after evaporation of seawater. Small post-3.8 Ga impacts cratered the surface during late-ocean and desiccation stages. Most “pristine craters”—the only impact structures of conventional literature—post-date desiccation.



Oceanic Sediments on Venus



— Warren Hamilton
Distinguished Sr. Scientist

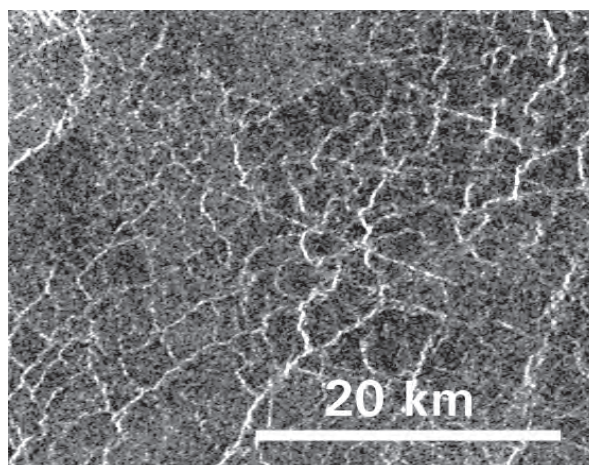


Figure 1. Radar-reflectivity image of nested-polygons reticulation of plains of Venus. Radar-dark surface is smooth. Image, centered on 224.80°E, 31.75°S, from U.S. Geological Survey.

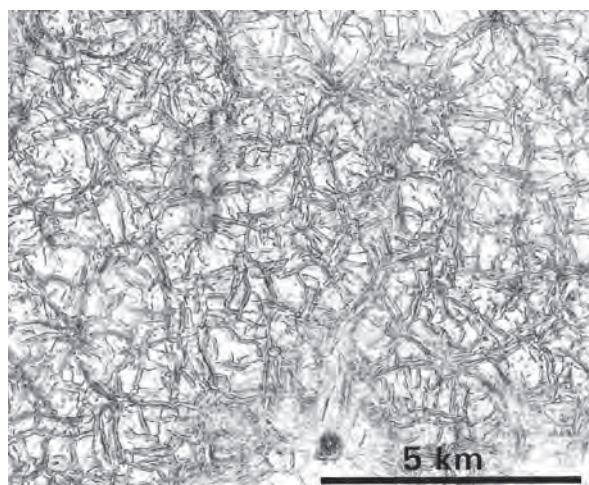


Figure 2. Horizontal slice through 3-D seismic-reflection model in More Basin, North Sea. Nested polygons are outlined by small normal faults produced by compaction and dewatering. Image provided by Joe Cartwright.

“Kia ora”

Greetings from New Zealand

I am writing from my new job at the GNS Science Wairakei Research Centre, a research group of about 50 people, located near Lake Taupo in the middle of the North Island of New Zealand. We work on a variety of projects having to do with geothermal resources. We are part of the larger Institute of Geological and Nuclear Sciences based in Wellington. So far my projects include acquiring time domain electromagnetic soundings to increase our knowledge of the resistivity structure of the Taupo Volcanic Zone, and thermal infrared imaging and soil temperature wave analysis to address sustainability of low enthalpy geothermal resources. We also plan to do more deep three-dimensional magnetotellurics over the next couple of years. A Mines geophysics education has given me the ability to apply knowledge and creativity to solve a variety of problems. It is quite enjoyable.

New Zealand is a beautiful country and my husband John Creighton (Mines '84) and I feel fortunate to have this experience. We are enjoying the fantastic mountain biking and local hot springs. The first often necessitates the second! It has rained quite a bit since I arrived in September, but summer is on the horizon. On clear days the view of the Ruapehu-Tongariro-Ngaruhoe volcanoes is awe inspiring.

Although we are living somewhat off the beaten path, “the world” still shows us how small it is. I recently ran into a friend/colleague from the US whom I hadn't seen in several years. He is bicycling from Auckland to Christchurch. Beth Burton (also a Mines alum) will be coming through on her way back from Antarctica. We

do miss our families and friends, but are able to keep in touch via the internet. My daughter Sarah is a senior at Fort Lewis College, Durango Colorado, and may join us for a while once she graduates. We used to joke that she would graduate from college before I finished my PhD. I made it with a little over a year to spare.

Te aroha

Te whakapono

Me te rangimarie

Tatou, tatou e.

May love, faith, And peace

Be with us all



Erin Wallin and her husband John Creighton standing next to a blooming Kowhai tree in New Zealand. Erin writes that as they were riding their bikes this particular day, the “view was inundated with brilliant yellow flowers. It was beautiful!”



New PhD Erin is congratulated by daughter Sarah following CSM commencement ceremonies, December 2008.

Kia ora is a Māori language greeting that entered New Zealand English. It means literally “be well/ healthy”

Leaving Las Vegas — *Our Way*

— Norm Bleistein
University Emeritus Professor

Las Vegas was not our favorite venue for a meeting. So, my wife Judy and I decided that we would drive there and back with some stops on the return. That decision provided us with two rewards. The first was the drive in both directions through the Virgin River Canyon, falling then rising between the altitudes of the Utah Desert to the Nevada Desert. The second reward was the indirect route home that we took stopping along the way at both Zion National Park and Bryce Canyon National Park.

I remember the Virgin River Canyon fondly from an early trip with colleague Jack Cohen. The convolutions of the steep rock faces had us gaping. Jack said to me, “Norm, are we supposed to invert that?”

So, on this trip, Judy and I cut west at St. George, Utah, onto back roads and headed to Zion. We found a wonderful motel room facing the Zion River, sheltered with lovely shade trees, and with spectacular rock formations as a backdrop.

The next day, we took a walk along the Zion River. At 4,000 feet or so of altitude, it was still autumn with extraordinary low November sun backlighting the trees and with low reflected light partially illuminating the steep rock faces that would otherwise have been in shadow—tough lighting for photography. After that walk, we drove to the upper level of the park for a somewhat more treacherous hike along a rock ledge, in parched desert country again.

We then drove on toward Bryce arriving just as the sun was setting, with formations in the distance still sunlit while the foreground was already in shade. In Bryce, we thought we would drive the “viewpoints” trail first and



Bryce Canyon Arch.

then hike. However, we could not skip a single viewpoint because the panorama changed so much from one to the next. So we only managed a few modest walks to overlooks with dramatic drops to the valley floor.

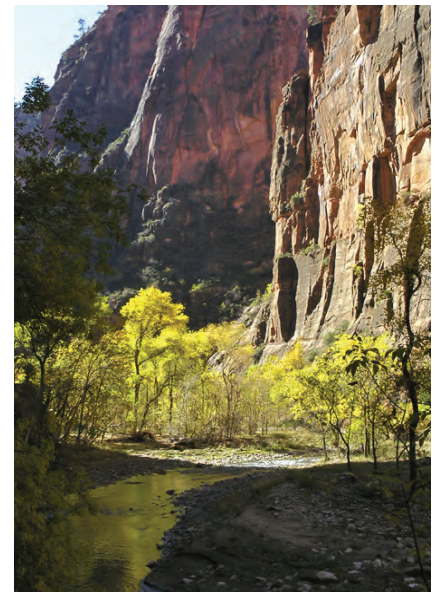
The most famous view of Bryce is reminiscent of the standing terra cotta army in Xi'an, China. Photos provide only a modest hint of the sheer grandeur of the view.

During this trip, there were glorious vistas along the entire route with an impossibly wide spectrum of colors: white, pale yellow, ochre, Indian red, burnt sienna, burnt umber, purple—all constantly changing with the angle of the sun. We have resolved to return to both places with time to hike.

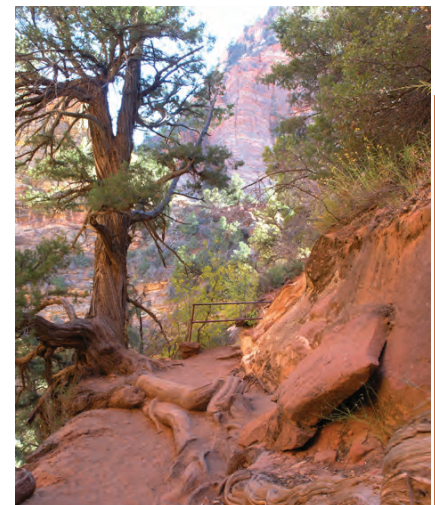
The meeting in Las Vegas was really worthwhile for me because of the people and the technology, but the road home was the real highlight of the trip.

For the photography buffs, I used an 8 Mp Olympus 8080 camera, a lightweight Leki tripod with a lightweight 3-way Manfrotto tripod head. PhotoShop? Of course! Recreating the image in my mind's eye. More photos are at www.cwp.mines.edu/~norm/Photos/

Editor's note: Norm's paper presented at the 2008 SEG in Las Vegas was ranked among the top 30, his fourth consecutive year to receive this honor.



A walk along the Zion River Canyon.



Plateau in Zion Park.

2008 Geophysics Field Camp

A Student's Perspective

by
Chris Lang



A requirement of graduation for every Mines student is to attend field camp, each major having its own.

The geophysics field camp is held the summer after the junior year. Because the junior year is an intense year of taking all the core geophysics classes, field camp is an opportunity to connect what was learned to a real-world application.

Our goal for the 2008 field camp was to research the geothermal activity in the Upper Arkansas River Valley, Chaffee County, Colorado. Our camp base was near the town of Buena Vista. We spent two weeks doing field work using the Department's fancy geophysical instruments as well as borrowed instruments and expertise (CGGVeritas, Sercel USA, Ion Geophysical/GXT, and USGS).

Although the geophysics was fun, the *real* fun was spending two weeks outside in a very scenic area and staying in camp cabins where we were fed an amazing dinner every night (paid for by the city). Imagine feeding 30 college students who were working 10 hours a day in the field!

You would think that after we ate, we would relax and go to bed early. Wrong! Every night was a new adventure. Sometimes we ventured to town to buy groceries or stopped in at our favorite establishment, the Green Parrot. We even had opportunities to go out to dinner with field camp sponsors. The fun did not end there, because we also went bowling and jumped into the hot springs, only a mile away from

camp. There was never a dull moment; and little time to sleep.

The two weeks in the field were followed by two weeks back at school processing and interpreting the data that had been collected. By the end, the class had collectively written more than 100 pages explaining everything we did and the results we found. The culminating event was a morning of presentations displaying our results to those who were interested: citizens from Buena Vista, our professors, friends, and family. GP Field Camp was an experience I will never forget and something that few other schools have to offer.

We are very grateful that CGGVeritas provides vibroseis equipment and crew each year for our summer field camp. We are also grateful to Sercel for donating a seismic field system and then sending an expert to our field camp each summer to help us use it! These are enormous contributions to the success of a field camp that now serves not only the students from Colorado School of Mines, but also students from Boise State University, Imperial College, and elsewhere. Thank you, CGGVeritas and Sercel!





Undergraduate Opportunities

INTERNSHIP SAMPLER

Hazardous Duty

I worked last summer with geophysicists on the Geologic Hazards Team at the USGS. My duties began with archiving data from previous surveys, mostly vibroseis surveys in the New Madrid Seismic Zone (Arkansas). After archiving all of that data for public access, I was left wondering what it took to gather data like this. I was given the opportunity to find out.



— Roxy Frary
Internship, USGS

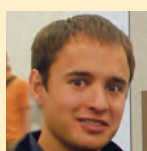
In August, I joined the team on a survey in the Pacific Northwest. In this case, a Thumper truck was used rather than vibroseis. The Thumper is a truck mounted to a weight that is lowered to the ground and then an impulse is generated and input through the weight. It is quite an experi-

ence to watch and to hear it. We did seismic lines in Portland, Oregon, and Seattle, Washington. I was able to learn what it took to discover just a little bit about what is going on beneath the earth's surface. With a crew of ten, we were able to get about 12 km worth of surveying in thirteen days. It was a lot of physical work in weird August weather – pouring rain one day and 80 degrees and sunny the next.

During this experience, the crew learned to work together, finding our own niche. It was tiring, but enjoyable.



The USGS recording truck, 'the doghouse.'



Faultless in Seattle

— Michael Mitchell
Internship, IRIS

As part of the IRIS (Incorporated Research Institutions for Seismology) internship program, I worked this past summer with research scientist, Lee Liberty, from Boise State University. IRIS is a nonprofit

consortium funded by the National Science Foundation that works to pair undergraduate interns with researchers in the field of seismology who could use some help with their research projects.

The overall purpose of our fieldwork was to collect high resolution seismic data to better understand the tectonics and faulting of the Seattle region. At the current time, the location of the western-most end of the Seattle Fault is not well constrained. If we are able to better characterize that location, we will be able to better model the seismic hazards of the region and estimate the

maximum magnitude earthquake that the fault structures can accommodate.

Working in the field for two weeks, we would alternate jobs from day to day so that everyone had many opportunities to lay and pick up cable, operate the source, survey the line with the GPS, or work with Dr. Liberty in the recording van.

Spending several more weeks in Boise, we analyzed seismic data. While my fellow intern, Patrick Karel from Eckerd College began processing the data that we had collected in the field, I worked on marine seismic lines shot in some of the southern arms of Puget Sound. The results of both these data sets are significant as far as characterizing the faulting geometries of the regions, allowing us to better understand the magnitude of the seismic hazards.

As a culmination, I was able to help present the work that we did at the AGU conference in San Francisco over winter break.



Michael collecting data.

Undergraduate Opportunities

INTERNSHIP SAMPLER

Being Nondestructive

— Freelynn “Joey” Cohrs
Internship, Olson Engineering

Like all Mines students, I value the experience arising from summer internships. For seven months in 2008, I worked with Olson Engineering, a nondestructive investigations company as a geophysical technician. Being a small company, I worked directly under the project engineers for several months before contracting, designing, testing, and reporting on my own jobs



Timeout for Joey.

Olson Engineering specializes in nondestructive infrastructure testing, such as GPR, Crosshole and Downhole Seismic Logging, Vibration Monitoring, and Strain Gauge Testing. Most of these tests are implemented to determine concrete stability and strength. I mainly worked with GPR at construction sites in many different environments (including hospitals, high rises and military bases). I also became involved with rebound hammer and impact echo testing, measuring micro-seismic waves in concrete slabs on roads, tunnels, and dams.



Colin Leek

Throughout my time with Olson Engineering, I worked with fellow geophysics student, Colin Leek. We had a great technical and learning opportunity.

Life Lessons Learned as an Intern

— Elise Goggin
Internship, Newmont Mining Corporation

Now know several synonyms for the word intern. “Pack mule” and “slave” are definitely on the list. But, my favorite came from a man named Jim Wright, who affectionately called me a “drooling knuckle dragger.” Yes, according to Jim, I dragged my knuckles all over the hills of Nevada last summer, as an intern for Newmont Mining Corporation. While this experience taught me a lot about large-scale mining geophysics, I feel like the most important lessons were the ones having very little to do with geophysics. As a result, I have prepared what I call “The Drooling Knuckle Dragger’s Guide to Life Lessons Learned as an Intern in Elko, Nevada.”



The lessons, briefly summarized:

1. Living out of a hotel for an extended time.

Take advantage of every amenity possible. This includes, but is not limited to, free HBO, free WiFi, the pool, sauna or hot tub. Look for warm cookies such as are found at the Shilo Inn in Elko.

2. Eating dinner out every night.

How to eat dinner out every night in a small town should be considered a fine art. It was in Winnemucca, Nevada, where I learned this lesson. The first step is to try as many restaurants as you dare, narrow the list to the ones that are acceptable, and then make a schedule that cycles through the suitable ones. My cycle went something like this: Mexican, Basque, pizza,

Mexican, Basque, Chinese, Mexican, Basque, salad bar...

3. Making the best of down time in the desert.

I have found that most geophysical field work includes a lot of down time while collecting the data. Some diversions I have used: singing a “song of the day” that will continuously run through the head of other crew members, poking fun at other crew members, napping—or as a substitute to napping—throwing rocks, watching a spider make a web, trying to catch a lizard, snake or rabbit (I have been successful at the first two).

If you would like more lessons from the Drooling Knuckle Dragger, contact Elise Goggin.



Elise and fellow crew members looking for rabbits in Nevada.

Undergraduate Opportunities

INTERNSHIP SAMPLER

Surveying the Possibilities

— Brent Putman
Internship, SJ Geophysics, Ltd.

Physically exhausting and mentally draining. After just a few days, I was convinced that IP was an acronym for “Intense Pain.”



This past summer, I signed on to a geophysics crew with SJ Geophysics, my first experience with the profession. And at times I wanted it to be my last. Being a pack mule for a geophysics company isn’t as glamorous as it sounds. Activities included carrying a 65-pound pack on my shoulders, hiking all day, and scaling some good-sized talus slopes. Not to mention, conducting the survey itself.

Traveling to such exotic and foreign locales as Utah and central Nevada, the crew conducted a couple of

3D IP (Induced Polarization) surveys. Our days started at four in the morning and we returned in the afternoon with just enough time to eat, sprawl out on our beds, play tetris and go right back to sleep.

Although the first few weeks were hard, eventually I gained a rhythm of how the day was put together. And the job had its perks. It takes a little time, but it grows on you: I got to work outdoors, exercise, and even have some fun. The company covered my expenses. I saw how a real geophysical survey works.

Now I know that IP isn’t short for the unkind term I had given it. It was physically satisfying and mentally rewarding. As the season drew to a close, I was ready for school, but I can’t wait for what next summer has in store.



Brent trekking the rocky terrain in Nevada.

A Different Lifestyle

— Ryan Paynter
Internship, Global Geophysical Services.



During my summer internship with Global Geophysical Services this past year, I saw every side of a seismic survey. The first part of my internship was spent in Buffalo, Texas, a small town between Houston and Dallas. When I say that Buffalo is a small town, I mean it is *very* small – roughly 1800 people. It was a culture shock for me, having grown up with shopping malls and fast food restaurants everywhere. In Buffalo, there is one grocery store and a couple of restaurants.

During my time there, I experienced every aspect of the survey—working with the health and safety department, getting permits, surveying, drilling, trouble shooting, living in the ‘dog

house’ and the best part—which is every boy’s dream—exploding dynamite. I found that everything needs to go like clockwork during a seismic survey.

If you ever want to have a good workout, go drilling during the middle of summer in Texas, throwing around heavy metal pipes all day.

The next stop with Global was in Elk City, Oklahoma. This assignment was another seismic survey, but this project had both a land and a marine part. Because of this transition zone, I had the chance to lay cable in the water and be on a gunboat (seismic source boat) in operation. I also became quite familiar with driving the vibes. What guy wouldn’t like driving big tractors? Oklahoma offered some of the hottest weather I have ever experienced, peaking at 109 degrees F.



Ryan driving the vibes in Elk City.

This summer opened my eyes to all the precise work that must go into exploration geophysics. It showed me new lifestyles and allowed me to meet some of the nicest and hardest working people I will ever know.



THE INAUGURAL Experience

GP sophomore Ashley Fish was selected as an “Inaugural Scholar” to attend the University Presidential Inaugural Conference in Washington DC, which included the 2009 Inaugural Day events. The honor is based on academic performance and leadership. Below is Ashley’s narrative of her experience.

— Ashley Fish
GP sophomore,



It all began at 2:30 AM, January 20, 2009. A group of friends from all around the nation and the world and I began our walk to the Capitol from downtown Washington DC to witness history: the day that president-elect Barack Obama would be sworn into office.

Police and US military were on every street corner. Snipers lined the roofs above us as we neared the National Mall. In the streets, thousands of people were still continuing a night of partying, while others were just beginning to congregate. The air was so cold that it pierced straight through us; but, our hearts remained warm, our spirits high.

Two blocks from the Capitol, on the frozen ground of the Mall, my friends and I were surrounded by millions of “Michelin men” bundled up in their down parkas, scarves, hats, mittens, ear warmers, sleeping bags, blankets, and even cardboard boxes. Yes, some had been sleeping in cardboard boxes. In the distance, the Capitol shone brightly in the dark sky. I had never before seen so any people in one place at one time for one purpose. The atmosphere was electrifying.

Our shiver reflexes were getting tired. We couldn’t feel our hands or feet. . . At last, sunrise!

After hours of enduring the bone-chilling cold, something finally began to happen at the Capitol. First, there was P-Diddy on the Jumbotron screen in front of us. Then came Arnold, Colin Powell and Al Gore. (Earlier in the week, my friends and I were fortunate to hear General Powell and former vice president Gore speak.)

Next the senators, representatives and governors appeared on the screen. The crowd began to stir with excitement. People started to sing and cry with overwhelming emotions. “My man’s gonna be president today!” The lady next to me was so proud of ‘her man,’ Obama. American flags circulated throughout the crowd like a rising tide. Only an hour to go.

And then, Obama appeared on the giant screen. There he was; only two blocks away from where we were standing on the Mall. The camera zoomed in on the future president. Flags waved frantically. The crowd chanted, “Yes We Can! Yes We Can!”

The time had finally come for the swearing-in ceremony. The fact that we were cold, tired, and cranky was put on the back burner. We all focused intently on what was about to happen. “... to protect and defend the Constitution of the United States” The crowd went wild! ... “Ladies and Gentlemen, the President of the United States.”



Dawn breaks on Inaugural Day
(Photo above was taken
January 20, 2009 at 7:07 AM.)



The crowd reacts with flag waving as Obama completes his oath of office. (Photo on left was taken at 12:06 PM.)

GP Curling Enthusiast Skips for Team Mines

— Kris Davis, GP graduate student

Four students from CSM participated in the National Collegiate Curling Championships in Chicago this spring, just missing the opportunity to play for third place by losing to Boston University in an extra end.

The “skip” (team captain) for Team Mines was geophysics graduate student Kris Davis. Other members of the CSM team were Sarah Morgan, undergraduate in physics who played



Kris Davis

lead, followed by Chase Williamson, a graduate student in environmental engineering, and Todd Gedvilas, an undergraduate in mechanical engineering.

Curling consists of each team throwing eight 40-pound polished granite rocks (called stones) 150 feet, along a lane of ice into a 12-foot ring, or house, and is scored like shuffleboard. The stone is helped along by team members “sweeping” the ice with brooms.

Thought to have been invented in late medieval Scotland, curling has been an official sport in the Winter Olympic Games since 1998.

Another GP curling aficionado, Professor Tom Davis (no relation to Kris), takes credit for Kris’ proficiency at the game after first recruiting him to his own team last fall—a smart move, as it turns out.



Skip Kris Davis (right), and teammate Todd Gedvilas sweep the stone for Team Mines during competition.

The Aikido Advantage

Akido roughly translates from Japanese as “The Way of Harmonious Energy” and is a pacifistic martial art. Instead of focusing on kicking or punching our opponent, we direct their energy in the form of throws. We make them think twice about coming back for more with joint stimulations that, while painful, cause no permanent damage if performed correctly.



Alicia Hotovec

I began practicing Aikido in a class offered at CSM. After a semester of rolling around on the mat and having a lot of fun, I decided it was something I wanted to continue outside of school. I found a nearby dojo (a school for training) and enrolled as a beginner.

I originally thought I would do this for just a few weeks, and then return

to the class at CSM. Instead, I found a new home.

The people who practice at the dojo, Nippon-Kan, besides being very nice are also very talented. Homma-Sensei, the founder of the dojo, is a first-generation practitioner of Aikido and has studied directly with O-Sensei, the founder of Aikido. With much practice, I eventually earned the right to wear the traditional pleated pants (hakama) worn by advanced members.

Homma-Sensei invited his students to join him on a trip to Japan to celebrate the 40th Anniversary of the Kobayashi. And so in September 2008, four others from my dojo and I, along with eight others from a sister dojo in Mexico, traveled to Japan where we spent a week sightseeing in Tokyo and Kyoto, as well as practicing Aikido. During the main Aikido event five hundred people were in attendance, the most packed-in practice I’d ever seen, as well as the best!

— Alicia Hotovec, GP graduate student



Students Hitting the High Notes

“Every human culture uses music to carry forward its ideas and ideals. And the value of music in shaping individual abilities and character are evident.”

— The National Association for Music Education

For Whom the Be s Toll

— Karolina Volker, GP senior



Between my school courses and my off-campus work load, I am about as under the wire as I’ve ever been. My relief? Making beautiful music! More specifically, I ring handbells. I’ve been a member of the Mountain Ringers Community Handbell Ensemble, an English handbell choir, for seven years. Last semester I had to give up ringing bells due to an evening class—it was my worst-ever semester GPA.

Coincidence? Not at all; I truly believe it was a cause-and-effect transition. Without my weekly breakaway from all things school-related, I was struggling to stay afloat.

Have you never heard of English handbells? Say so no longer! The best handbell choir in Colorado, The Pikes Peak Ringers from Colorado Springs, are winners of the Yo Yo Ma “Celebrate and Collaborate” contest! The prize is to record a collaboration with the world-renowned cellist that will appear on an upcoming commercial. This was not just a handbell competition—the selections were made from applica-



A view of my handbell choir during a practice break. My bells are front and right.

tions of every kind of musical presentation. (The co-winner is a heavy-metal band.) So, you will be hearing a lot more about handbells in the near future.

Ringling handbells is a complex group effort, and nothing like the cowbells I first thought I’d be playing. Handling the bells takes as much care as playing them takes concentration and coordination. Most people cannot comfortably lift the large bells (my largest is about 12” diameter and 9 pounds). When I began playing the bells, I was weight-lifting, but now it is just practice that makes playing the large bells do-able for me. More than just do-able, this is truly beautiful fun and a great stress-reliever to boot!

Chocolate for the Soul

— Catherine Cox, GP sophomore

As most students would attest, at a school as rigorous as Mines, it is important to supplement your education with non-stressful, extra-curricular activities. I am a member of several campus organizations, but I have found that nothing releases the ol’ steam quite like music, which I like to refer to as “chocolate for the soul.”

Being involved with the CSM marching and concert band has not only provided a welcome escape from daily pressures, it is also a social outlet, an opportunity for leadership, and once in a while, a source of awesome road trips. One example is the recent school-sponsored journey to St. George, UT, to cheer on the CSM football team at the Dixie Bowl. It seems that one-hundred-plus college students crammed into two buses for more than fifteen hours results in much hilarity and sleep deprivation.

The college memories I have made through my band experiences are some of my favorites. Participating is a great way to gain more involvement in, and increased spirit for, Mines. It may be difficult to imagine, but even as a group consisting primarily of engineering students, we can still manage to make some “sweet” sounds—chocolate for the soul.



Catherine (left) with fellow band members in the traditional CSM hard hat and red-plaid flannel shirt uniform.

Geophysics: Class ACTION



Field trip for the “Physics of the Earth” class to the USGS National Earthquake Information Center, Golden, Colorado. Host: Dr. Harley Benz (back row, 2nd from left).

CLASS ACTION



A campus gem: “Materials of the Earth” class explores the CSM Geology Museum.

Geophysics: Class ACTION

Sr. Design Venture Becomes a Family Affair

— Cericia Martinez, GP Senior

It is not every day the terms “geophysics,” “father,” and “daughter” would have anything to do with each other. Thanks to my senior design project, I was able to make that connection and have a one-of-a-kind experience.

My senior design group was lucky enough to become involved with an archaeological application of geophysics. The Chaco Canyon National Historical Park in New Mexico is a site that teemed with life over 1,000 years ago. The main goal of our project is to gather new information, and gain a deeper understanding of a civilization that existed far before our time.

To achieve this, we had the opportunity to personally collect data during a field trip to the canyon. This is where “geophysics,” “father,” and “daughter” comes in. With a group of only three, we thought it wise to bring along some extra field hands. My dad volunteered. As a young lad, my dad received his degrees in archaeology and anthropology. I remember his telling me of Cha-



Cericia and her dad, James H. Martinez, take a lunch break.

co Canyon when I was younger; specifically, about the wonders that had been discovered there.

Spending a week working in the ruins was something I will never forget: waking before the sun rose and tramping into the field, with my dad whispering as the sun came up across the expansive desert, equipment in tow – it all felt both natural and calming. That week gave my dad and me the chance to enjoy and share a bit of our youthful endeavors in a truly timeless fashion.

Inspiration Starts Early

CSM members of the Society of Student Geophysicists (SSG) spent an evening at Mitchell Elementary school, Golden, assisting at Family Math and Science night. Interactive math games (Math can be fun!), as well as science activities and demonstrations (How does that work?) were available for all to try. From these pictures, it's hard to tell which age group is having the most fun.



anomalous haiku

undulating waves

geographical gradients

uncensored canvas



— David Manthei
GP Junior



Revisiting their elementary-school years: (back row) Kristen Swaim, Joey Cohrs, Chris Lang and Jeff Godwin; (front row) Joyce Hoopes, Sarah Devriese, Roxy Frary, and Renee Francese.

GP Culture: A Rich Blend

GEOPHYSICS GRADUATE RESEARCH

Several research centers or groups – depicted in pictures on this page – operate within the Department of Geophysics. Each is funded by a consortium of research sponsors and/or research grants from government agencies or industry partners. This funding enables us to attract and sponsor top graduate students pursuing thesis-based MS and PhD degrees. Often there are faculty and students from one research group contributing to the research of another group. For instance there are natural synergies between the rock physics group and the Reservoir Characterization Project (RCP), and between RCP and the Center for Wave Phenomena (CWP).



Gravity, Electrical and Magnetics



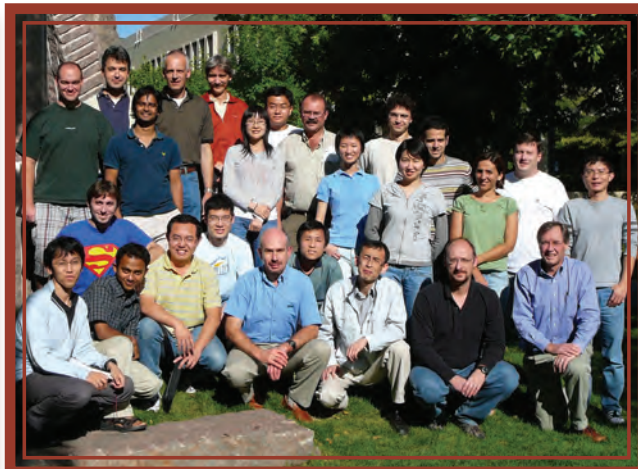
Hydrogeophysics and Porous Media



Reservoir Characterization



Rock Physics



Wave Phenomena

Cloning Experiment Cloning Experiment

— Kristen Swaim, GP Junior



As if one is not enough: those in the front row assume the identity of classmates in the back row.

The undergraduate community in the Department of Geophysics is very small. This factor of the department is one that I enjoy for a multitude of reasons, such as: getting to know our professors very well; losing our inhibitions to ask questions and speak up during class; and best of all, forming close relationships with our classmates. These same 17 students have taken classes together for four semesters and we will graduate together.

We have developed a comradeship that I believe is rarely found elsewhere on campus. One Halloween, some of us decided to dress as another student

in the class. We even went so far as to sit in the chairs of our double during lectures. The professors found this amusing; and we found it hilarious.

I don't know if I will ever again get to spend so much time with a group of people and develop relationships like those with my classmates. I will forever cherish this part of my GP undergraduate years.

WIG

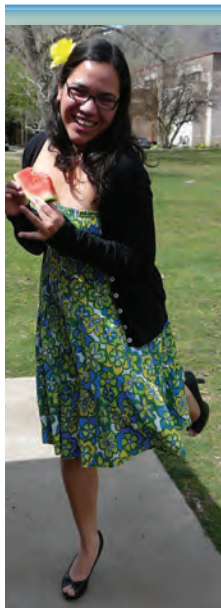
34% of geophysics undergrads and 33% of geophysics grad students are women (compared with 24% and 27% for CSM as a whole). Several years ago there was a student-led initiative to form a special interest group of the women students within the Department.

The group chose the name WIG — Women in Geophysics. The primary aim was to connect CSM female geophysics students with female geoscientists working in the Denver area who could serve as mentors.



Front and center, Professor Mike Batzle, makes a strong bid for male inclusion in WIG gatherings.

Today, WIG continues through the efforts of its student members. Most recently, BS/MS student Karoline Volker has taken the lead to organize monthly meetings at which female geoscientists from industry make presentations and lead discussions. The group also sponsors social activities. All WIG gatherings are fun and play a part in promoting the Department camaraderie. Contact Karoline (kvolker@mines.edu) to join us!



Diversity: An everyday partner


— Cucha Lopéz
RCP graduate student

The Reservoir Characterization Project (RCP) defines itself as a research consortium whose mission is to develop and apply 4-D, multicomponent seismology and associated technologies to effectively model complex reservoirs. Although that is true, there are other important things that RCP students learn along the way that are as valuable as the degree we earn.

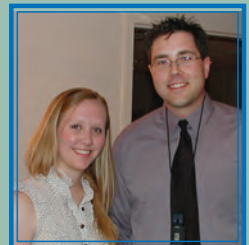
I am referring to the fact that, in just one room, there are eight different nationalities from all around the world! The major challenge is to be able to co-exist and work as a team when so many differences exist. But even though we see the world from many different perspectives, learned from different religions and traditions, we embrace all those differences and make them our com-

mon point. We use them to our favor towards a common goal by applying and teaching to others what is well known in our countries, but might seem a bit odd to others. Even a simple demonstration of a salsa dance can teach and show a lot about you — a whole lot more than words.

It takes patience, understanding, and an open mind to match so many personalities. But it is actually this mix in colors that makes us that exposes us to the diversity, which in such a global business as geophysics, will be our everyday partner after we leave CSM. We are all different; we deal with it and profit from it.



GP Day Celebration 2008





2008 Graduation

Geophysics

Fall

Bachelor of Science

Geophysical Engineering

Daniel J. Liechty

Colin Erik Melvin (Cum Laude)

Master of Science

Geophysics

John C. Mathewson

Geophysical Engineering

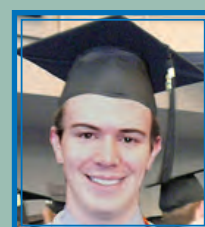
Elizabeth Ann LaBarre



Dan Liechty



John Mathewson



Colin Melvin

Spring

Bachelor of Science

Geophysical Engineering

Haider Al Abdulaal

Aubry A. Bingham (Cum Laude)

Derek Carlton Grimm

Zachary Justin Pember

(Double Degree – MCS)

Mpho Moh Ramaselaga

Gary Dayton Scherer

Shannon Marie Simons

Adrian Ryan Weaver

(Summa Cum Laude)

Master of Science

Geophysics

Afolabi Oluwole Babalola

Rames G. Meza

Nelson Rojas Avella

Kurtis Russell Wikel

Professional Master

Petroleum Reservoir Systems

Phyllis L. Spear

Doctor of Philosophy

Geophysics

Erin L. Wallin



Erin Wallin



Afolabi Babalola, Rames Meza,
and Nelson Avella



Aubry Bingham



Derek Grimm



Haider Al Abdulaal



Adrian Weaver and
Mpho Ramaselaga



Phyllis Spear



Shannon Simons

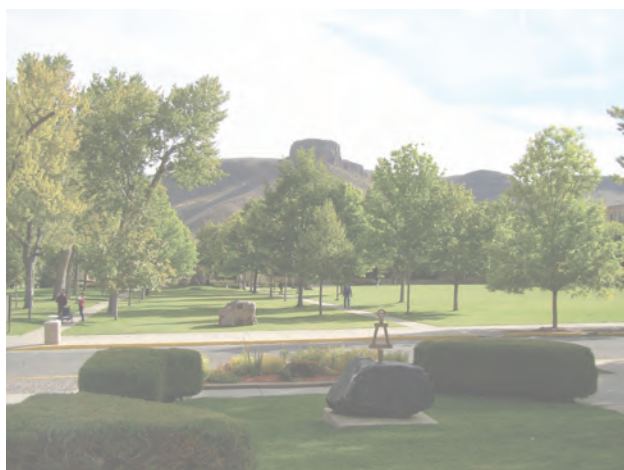
2008-2009 Geophysics Faculty



Front row (l to r): Terry Young (Dept. Head), Jeff Andrews-Hanna, Paul Sava, Roel Snieder, Yaoguo Li, Ilya Tsvankin and Tom Davis.

Back Row: (l to r): Adel Zhody, Steve Smith, Rich Krahenbuhl, Warren Hamilton, Michael Batzle, John Stockwell, André Revil, Misac Nabighian, Robert Benson, Dave Hale and Gary Olhoeft.

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