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WINTER 2006 - 2007

MICHIGAN TECHNOLOGICAL UNIVERSITY

On the Faultline

Citing new wells in Boaco

AQUA TERRA TECH, a student-run Enterprise team at Michigan Tech, is aimed at creating water security in the small Nicaraguan town of Boaco. The rural community of 34,000 relies on water from a polluted river and a single well.

These two sources are only able to supply about one-third of the community's water. Getting more water is problematic. The underlying aquifers are in volcanic rock, so the production of a well depends on the density and distribution of subsurface fractures.

When fractures are few and far between, the water in a fracture is depleted quickly and refills slowly. As a result, only two of the 40 or so wells that have been drilled in the area produce water that can significantly contribute to the city's needs. A solution for increasing the success of new wells: use the latest subsurface testing techniques to find more fractures for citing new wells.

Last year, Aqua Terra Tech sent nine of its members to Boaco for 12 days. They studied the terrain and performed as many geo-

Students conduct a very low frequency electromagnetic survey in a crop field, near a producing well.



physical surveys as time and sight conditions permitted.

The team conducted linear passes over a survey grid for magnetic field and electromagnetic field readings. "Differences between an expected field reading and actual readings are due to variations in the magnetic and electrical properties of the subsurface," explains geological engineering senior, Rob Porritt. "Quick to employ in the field, these methods give a general picture of the subsurface. But key hydrologic properties cannot be discerned," he adds. "An emerging technique known as azimuthal resistivity measures the lateral profile by rotating a constant survey geometry around a central point. This method can more clearly reveal water-bearing fractures and their orientation." The team will use new equipment, purchased with funds donated by alumni, to apply the azimuthal resistivity technique on their next trip.

A National Science Foundation grant has provided Aqua Terra Tech with the means to work on the project for the next five years, with annual trips to the project site. They will return to Boaco in December.

Their goal: choose a well site and design a water system that can supply the city within the next few years.

Letter from the Chair



FALL IS ENDING as I write this, and winter break is nearly upon us for the academic year 2006-7.

Today's new freshmen were born in or near 1988, for the most part. They have never known a life without Google, let alone the internet. They have known only two presidents (unless they were aware of politics at a remarkably tender age).

We like to say each year that the freshmen get younger, but we (the faculty) never get any older ... Or do we?

The faculty and staff of a university provide it with its continuity and to some extent its reputation...but the students are its lifeblood and energy. This newsletter concentrates on the stories of the students in the Department of Geological and Mining Engineering and Sciences. Some of the stories are about accomplishment; others are about adventure, particularly with our programs in Latin America, which forms the focus of this issue. They are all about life at Michigan Tech as a student, and hopefully they will provide you with a glimpse of the way things are, from their point of view.

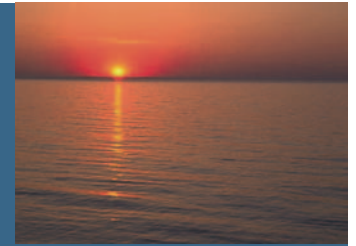
Please remember: most of the stories that are told in this newsletter were made possible in large part due to donations to the Michigan Tech Fund in support of our program. Without these gifts from generous alumni and friends, the experience of a student would be quite different, and not for the better. We thank all of you who have supported us in the past, and look forward to continuing to make you proud of what our students accomplish.

Wayne D. Pennington, Professor and Chair
Geological and Mining Engineering and Sciences



GMES is on the 6th floor of the Dow building. Come by for a visit sometime!

Notes from the field...



IT IS WELL known throughout Michigan Tech's campus that the best way to experience the Keweenaw is to spend a summer up here. Let's face it: this place is Michigan's—if not the Midwest's—best-kept secret. If you miss a gorgeous sunset one night, there's another one waiting for you in about 24 hours...but that's beside the point.

I stayed in Houghton after a grueling winter semester to take Field Geology and Field Geophysics. My favorite part about both of these courses was just how much I learned. Everyday you learn something new, and are constantly building on what you've learned in previous days and classes. Going to Johnson's Knob for field geology was by far my favorite site. Johnson's Knob is a large knob of gneiss providing a spectacular view of the Huron Mountains, as well as Lake Superior and the Keweenaw Peninsula in the distance.

Field Geophysics provided me with a glimpse of the type of group problem-solving undoubtedly lying ahead of me after graduation. Three passionate, stubborn group members provided an interesting lesson on group dynamics and getting work done. Another thing about Geophysics that I enjoyed was actually going into the field and using some techniques we read about in the classroom. It is one thing to read about the techniques in a textbook—but to actually retrieve your own data and interpret that data in your own report really made it a great learning experience.

The only complaint was of course the bugs, which were only a major problem during Field Geology. I'll never forget Taylor Mine, where I learned a new technique: geologic mapping while running from swarms of hungry black flies.

Both Field Geology and Field Geophysics provided real-world, meaningful lessons about the earth under our feet, and about working in a professional atmosphere where only the best is expected from you. These experiences are the kind of lessons I hope to use to better prepare myself for working in a professional environment.

- **Walt Rathbun**
Geological Engineering '08

Summer Geophysics Field Course
with Professor Jimmy Diehl



Newly graduated PhD gets her Dream Job

WHEN I BEGAN my Ph.D. in geology (volcanology) at Michigan Tech, very far from my home in Puerto Rico, I never thought I would see the light at the end of the tunnel.

The time has finally come when I am writing my thesis. Not only am I achieving a goal I've had at least half my life, but I got a job!

Late last spring I was becoming worried about reaching the end of my funding. I was waiting to hear back from the universities to which I sent my curriculum vitae. I had sent documents to most universities in Puerto Rico, since my main goal was to return home to teach.

And it happened: I got an e-mail in May from Dr. Johannes Schelleken, director of the Department of Geology at the Universidad de Puerto Rico, Mayagüez, asking me if I was interested in coming to teach.

It was a dream come true, since the university is in my home town of Mayagüez. It is also the place I completed my B.S. and M.S. degrees in geology. In short, it is the university I always wanted to come home to.

I was hired with a temporary contract until summer 2007. I have an office and everyone calls me "Profesora" which most of the time sounds so strange. My contract is for teaching, and I have a full load, with two classes. The first of these is Earth Sciences, which is an introductory



course in Physical Geology, taken by students of many different departments. It obviously means that I have a lot of students: one section with 105 students and the other with 92. The hardest thing is that of those, there are maybe 20-25 geology freshmen students who are the most interested in the class. But they all behave pretty well, even

though there are so many. I hope that maybe I can convince some of the students from other departments to move to geology.

At the other end I am teaching a course for second year geology students, called Elementary Geomorphology, with 30 students. This course allows more contact with the students, but it also requires more of my time. The course has a laboratory portion, for which I have a Teaching Assistant, but which I coordinate.

I am enjoying the opportunity a lot and I think I am reaching the students, which is what I always wanted to do. And to be paid for something you like so much is wonderful. What lies ahead, I am not sure, but the plan is to hopefully get my contract extended and be eligible for a permanent position in the Department.

- Lizette Rodriguez, Universidad de Puerto Rico, Mayagüez; pictured above in El Salvador

GMES student earns President's Award for Leadership

ADAM PECKENS, a geological engineering senior, has won the Michigan Tech President's Award for Leadership.

Peckens has been actively leading in both the academic and co-curricular arenas, including the Inter-Residence Hall Council, Wadsworth Hall Student Association, and First Year Experience House. In the GMES Department he is an executive member of the Geology Club, as well as a teaching assistant.

His largest impact has come through nearly four years of dedication to the First Year Experience (FYE) program, where he has been a hall member, house president, peer mentor and program coordinator. He has worked hard to make FYE an exceptional program by continuing the hall's traditions, while introducing new programs and a

sense of belonging to everyone in the community.

"I am privileged to have had such unique opportunities to grow in my leadership abilities at Michigan Tech," says Peckens. "I hope that by sharing my knowledge, ideas and enthusiasm, it will result in even stronger leaders for Michigan Tech's future."



Adam at Barrick Goldstrike in Elko, NV

Going under the Volcano

JANUARY 2006—Marika Dalton stands confidently by her poster at the Convento San Francisco in Quito, Ecuador, site of the fourth Cities on Volcanoes Conference. Most of the renowned volcanologists walking through this historic monastery glance at her poster and move on, but once in a while one stops to ask her questions about her research on Reventador Volcano.

Many of these volcanologists are familiar with Reventador, one of Ecuador's most active volcanoes. It covered Quito with a layer of ash in a 2002 eruption. Dalton, however, has studied this volcano from a different perspective using various satellite sensors located hundreds of kilometers above the volcano. Her research using remote sensing techniques is cutting edge—standard for the kind of research conducted by graduate students and faculty in the GMES department at Michigan Tech.



Bill Rose

The volcanology program, led by Professor Bill Rose since 1970, is one of the largest and most well-known programs of its kind in the country. "There aren't many graduate volcanology programs in the U.S.," says Rose. "Our program is unique because we have emphasized field work for a long time, and our research is in active volcanism."

Rose is most proud of Michigan Tech's collaborations with other universities and volcano observatories all around the world. These collaborations ensure that the GMES department is involved in research that includes the world's most active volcanoes.

Michigan Tech's strong presence at the CoV conference— as well as at other volcanology conferences—is not limited to faculty and graduate students. Many alumni from the volcanology program have found careers as prominent volcanologists and are active at this conference.

Paul Kimberly, who graduated with an MS in geology in 1995, now works at the Smithsonian Institute's Global Volcanism Program. He credits Rose with being one of the main reasons Tech students become successful volcanologists. "Bill Rose does a great job of making sure that his students are introduced to everybody. By the time we graduate, we know all the key players and are very prepared for the working world." Kimberly also agrees that collaboration between MTU and other programs, such as NASA and the University of Hawaii, keep Tech's research



at the front of the line. GMES graduate students Marika Dalton, Taryn Lopez, Kelly Durst, Elisabet Head and Alexandra Matiella Novak.

After the CoV conference, Marika Dalton flew to Montreal for a special exchange program. She spent a semester sharing what she had learned at Michigan Tech with faculty and students at McGill University.

PROFESSIONAL travel is a vital part of graduate education. This past year, 17 trips were taken by GMES graduate students studying natural hazards.

Travel

For the next two years, students can travel to any of our partner universities: McGill and Simon Fraser in Canada, and UNAM and Universidad de Colima in Mexico. Funding comes from the U.S. Department of Education.

October 2005: Eight students attended a short course in Volcanic Hazard Maps in Mexico City and visited Popocatepetl Volcano.

January 2006: Two students visited Colima Volcano, and attended the 10th International Hazards Workshop at Colima.

January-May 2006: Two students did a semester-long exchange visit to McGill, with internships at the Montreal Volcanic Ash & Aviation Centre.

May-August 2006: One student did a semester-long exchange visit to the Colima Volcano Observatory, with field work at Socorro Island.

June 2006: Three students took part in a field trip to see active calderas at Yellowstone and Long Valley, CA. The trip was also attended by 17 international students from Canada and Mexico.

July-August 2006: One student traveled to Colima to sample volcanic ash as part of his Master's research.

January-April 2006: Advanced graduate class in Supervolcanoes with 13 visiting experts was held at low cost via internet coordination through several campuses. Ten students from MTU participated along with approximately 25 more from Mexico and Canada.

Empowering the local community in Rosario de Tesopaco

PEOPLE IN THE SMALL Mexican town of Rosario used to call Agustin Robles “that crazy lagoon guy.” Now, when he visits, they call him Engineer Robles and he gets more invitations to breakfast, lunch and dinner than he can handle. “I couldn’t find enough time or space in my stomach to accept them all,” he says. “My last few weeks there were exhilarating.”

What caused the residents of Rosario to change their minds about Robles, then a master’s student in environmental policy at Michigan Tech, was the news that their town had finally received the money to build a new sewage treatment facility. Rosario’s first sewage system, built

when the town submitted their proposal, they were turned down twice—once because of bureaucratic reasons, and again because federal officials didn’t think the community had the resources to build and maintain the system.



Agustin Robles

With Mayer’s encouragement, Robles went to work.

He interacted with hundreds of citizens to assess local attitudes on water treatment, the environment, and public health in general. He passed on what he learned to local officials, who were initially skeptical that the town needed a better system. And he provided technical training on the construction and operations of the design proposed by Mayer’s class.

“Agustin took it upon himself to educate the right people in the community—the local officials, the engineer—and he also had a sense of what was going on in the bureaucracy,” Mayer said.

With Robles’s help, the town drafted a different proposal and requested a hearing. “I went as an external advisor, but a local engineer defended every part of the project,” says Robles. This time, Rosario got the money for its new system. The local authorities built it in little over a year with local labor and local materials. The town began pumping its sewage through the gravel-filled pit in September.

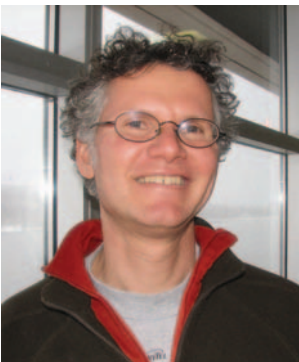
“The system is called a constructed wetlands, and it’s based on how wetlands and swamps work in nature,” Mayer explains. “It requires little maintenance.”

Robles has earned his master’s and is now pursuing a Ph.D. in Environmental Engineering, in part because he wants to continue what he started in Rosario.



in the 1980s, had deteriorated into a pipe feeding a lagoon that drained raw sewage into the local river. The lagoon was located in the city center, surrounded by Rosario’s poorest residents.

Alex Mayer, whose field engineering class designed the system, credits Robles with knitting together the social and political alliances that made it happen. The story began several years ago, when Mayer, a professor of geological and environmental engineering, was in Mexico as part of an ongoing partnership between Michigan Tech and the University of Sonora. “I was asked if I could help with wastewater treatment in Rosario,” he says.



Alex Mayer

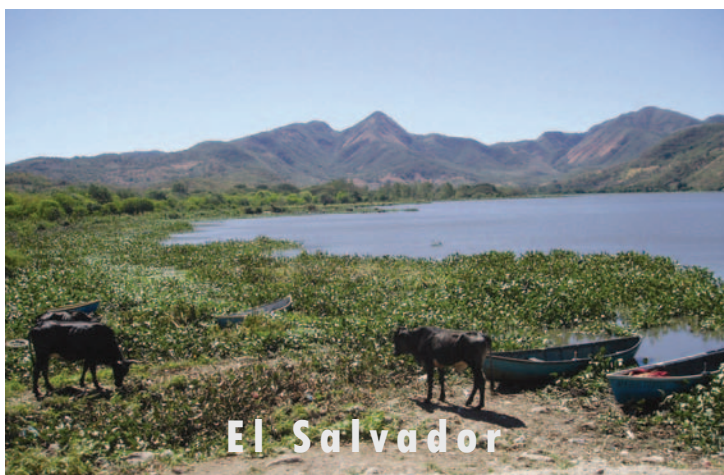
Mayer set a class of fledgling Peace Corps volunteers on the task, and they came up with a simple, effective design. But



Peace Corps Masters students in Central America

ARMEDA VAN DAM is taking part in Michigan Tech's Peace Corps Master's International Graduate Program in Geological Engineering. She is stationed in the southern part of El Salvador on Lake Olomega, where reports indicate arsenic poisoning among the population.

People fish and swim in the lake, which is being choked by "nimfa"—an invasive weed named for the mythical water nymph. Nimfa is also used for making



El Salvador

baskets—a source of livelihood that could be toxic.

Van Dam recently began performing bio-geo-chemical research to determine the extent of the arsenic problem: taking water samples from various sources; performing a social survey in an effort to ascertain the people's understanding of the arsenic threat, as well as their health and living habits; and gathering hair samples to determine the extent and distribution of the poisoning.

"Nimfa weeds may also contain arsenic," notes Gregg Bluth, an associate professor of geology. "Grazing animals eat the nimfa, and then people eat the animals." Bluth recently returned from Central America, where he visited Van Dam and another Peace Corps Masters student, Essa Gross

About 200 miles southeast of El Salvador (and not far from Boaca, featured on the first page of this newsletter), Gross is stationed in Juigalpa, Nicaragua. Each spring—right around the end of the dry season—many of the wells run dry.

"In a hydro-geological study of well productivity, Essa will pump several wells in a series of experiments to determine how much the water table is affected," Bluth explains. "She will then extrapolate data to determine

how long water should last in a given well."

Gross will test the wells of four families living in her rural area. The DeVlieg Foundation provided funding for several 250 gallon tanks so that water pumped during the experiment can be saved and used by the families.

An excerpt from Essa's blog (www.essanicapc.blogspot.com)

MY NEW HOME...I decided to get away from the hustle and bustle of the main highway and am now about as far away as I can get while still in the city. It's much smaller, too, which helps cut down cleaning time. The owners, Auxiliadora and Jose Luis, live right next door—so close we can talk to each other through the walls. They are really great and have helped a lot in getting my house in order.

I gave up some amenities (toilet and shower). I now have a latrine and share a stall for bucket bathing in the yard with a neighbor, but did gain a decent-sized yard for Gueguense (my dog) to play in. No well either, like I had at the last house, which will make this summer harder (they say sometimes they go up to a month without water) but Jose Luis spent two weeks fixing a 1000 gallon ferro-cement tank in the backyard, so I'm sure that'll help out a lot.

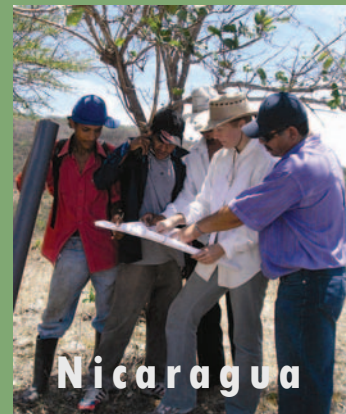
I got a cold last week, and Auxiliadora came over often to chat while I was laid up in bed. She made me breakfast one day—eggs and beans, and demanded that I drink her sure-fire cure to the common cold: A tea of lime juice, honey, cinnamon, garlic and onion. Sounds rank, but the honey and lime dominated so it was pretty good.

Victoria, a woman who lives near the rural school, and her daughters run a little *guirila* stand that caters to passing busses and people working in the area.

Every time I walk by they are sitting there, shucking their 1000s of corn cobs. They get up at 3 am, which gives them time to prepare enough tortillas and *cuajada* for the morning rush of busses. Victoria's granddaughter, Carla, displays the *guirila* —a hot corn tortilla with a slab of salty white cheese. Sustaining and tasty.



Armeda Van Dam and friend



Nicaragua

Essa Gross (2nd from right)



New books ... by students, faculty, and alumni

FLYING HIGH AMERICA is a collection of oblique aerial photographs. The author, Jim Wark, is a '54 Michigan Tech alum with degrees in mining engineering and geological engineering.

Wark "retired" from the mining industry and paired his "reverence for the earth's geography" with his experience as a naval aviator and airshow pilot: a late life occupation that most of us will envy.



The result is a series of beautiful books, one of which is reviewed here. *Flying High America* collects several hundred photographs,

reproduced in exquisite detail, grouped in themes that an earth scientist will appreciate.

Wark travels the continents in a high-wing bush-type plane with a large side opening for unobstructed camera work. It has the capacity to operate in rough areas, allowing him to use remote sites as operating bases.

He uses this platform to good purpose. Photos are taken at low altitudes, providing a sense of three dimen-

sions that is often missing from downward-looking images. They include metropolitan areas (the frontispiece shows lower Manhattan long after the twin towers were gone); deserts and other desolate areas; islands, rivers, and lakes; mountainous regions; farmlands;

coastlines; and surface evidence of mining.

The format of *Flying High America* is modest—9" wide, 6¼" tall, and 2" thick—not a typical "coffee-table" size tome. But good use is made of each page. Some photos fully cover two facing pages. Others have smaller complementary images on the facing page, showing the feature from a different angle, or a nearby similar feature.

I have given copies of the book to friends and family and I have watched people pick up my copy at home and begin to thumb through it. Nobody puts it down until they need either food or sleep. It is that good.

I recommend it highly to anyone with an interest in looking at the earth from another viewpoint, particularly if you don't mind getting so wrapped up in it that you find yourself looking at it for hours on end.

- Review by Wayne D. Pennington



FLYING HIGH AMERICA • \$25 • hardcover • 500 pages
Autographed copies available at www.airphotona.com, or contact Jim Wark at 719.545.1051, airphotona@comcast.net

Want to make a gift to the GMES department?

ALTHOUGH Michigan Tech is a state institution, it receives less than one-third of its funding from state appropriation. Your gift helps keep the GMES department on the cutting-edge.

There are three ways to give:

- Use Michigan Tech's online gift form at www.mtf.mtu.edu/giving
- Call the Michigan Tech Fund at 906-487-2310
- Mail a gift to the Michigan Tech Fund using the enclosed envelope

In order to make sure 100 percent of your gift goes to the GMES department, please specify GMES account #1325A0.

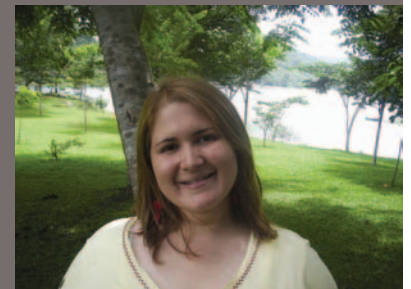
Many, many thanks!

GMES hosts Yalitzia Caraballo

YALITZIA CARABALLO, aka Yaly, came to the GMES department from Universidad de Puerto Rico. She spent the summer working on a project with Professor Gregg Bluth, studying SO₂ emissions from the Nyamuragira volcano in the Democratic Republic of Congo.

Yaly used satellite data from the HIRS (High Resolution Infrared Sounder) to analyze the 1981-82 eruption, which emitted over four million tons of sulfur dioxide during two weeks of activity. She also performed literature studies to learn about the satellite instrument and analysis method, the Nyamuragira volcano, and the country itself.

Now back home in Puerto Rico, Caraballo will present a poster of her work at the Fall meeting of the American Geophysical Union in San Francisco.



Field excursion to drought-stricken Sonora

THE RIO SONORA watershed, along with the entire state of Sonora, has experienced drought conditions for a decade. The only surface water reservoir in the capital city of Hermosillo has been empty for four years.

GMES sophomore Katelyn FitzGerald was one of 13 students from Michigan Tech, University of British Columbia, and Universite Laval who traveled to the area last May. They toured the length of the Rio Sonora, from its terminus in the city of Hermosillo to its source near Cananea, home of the largest copper mine in Mexico. They also visited Coste de Hermosillo, a coastal basin area that has undergone intensive groundwater pumping for irrigation, resulting in severe saltwater intrusion problems.

Here, FitzGerald shares some notes from the field:

We toured many vastly different areas, ranging from the state's capital city of Hermosillo with a population of nearly 700,000, to small villages in the mountains consisting of several households.

The city of Hermosillo was in some ways like large cities elsewhere, but there was a distinct architectural style to it. Lightly colored adobe houses, such as the one we all stayed in, were common. Sizes of houses were generally smaller and garages were scarce but there was much variation. I remember the University there being a beautiful place. However, the one thing that I noticed most was the garbage. Trash was just

dumped over hillsides and blown every which way throughout the city.

One of our nights on the road we were forced to split the group and go to two hotels. To my fellow students' surprise, no water came from their faucets, showerheads, and toilets. I lucked out.

A few more memories of the trip:

- *More dry river beds than I had ever seen...the first time I saw water in one of those, everyone on the bus knew it.*
- *Feeling only very light raindrops once on the trip...I'm not sure they made it to the ground.*
- *Dry reservoirs created for flood times...*
- *Empty concrete canals in the city of Hermosillo...*
- *Touring a vineyard and packing plant...the water table is dropping...smaller farmers will be forced out over the next 5 years or so.*

Looking back now, I realize the trip broadened my world-view significantly. It is one thing to read and hear about a region, another to actually be there, and another yet to live in the region and deal with issues we all study on a day-to-day basis. I stopped in the middle of that with this trip, but hope to continue to expand my knowledge.



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