News from Geosciences

Houston Alumni Activities

By Steve Naruk, Staff Geologist
Shell International Exploration & Production, Inc.

Houston Alumni were “Hot this Summer!” Just couldn’t resist that double entendre! But before you turn the page, note that back during the first Bush administration, Houston’s Chamber of Commerce seriously considered “Houston’s Hot!” as a promotional slogan! Proof-positive to many non-natives that Houston’s climate can, indeed, have deleterious effects on the IQ!

Be that as it may, Houston is to geology what Wall Street is to finance. If you want to do big things in geology, with big money and all the data that money can buy, Houston’s the place to be, from the oil industry to NASA! There are more geoscientists per capita in Houston, and a more vibrant geoscience community, than anywhere else on the planet with the possible exception of field camp. ExxonMobil alone has 30+ UA grads here in Houston, ranging from new hires to senior executives. Many more alumni are dispersed throughout the other oil and engineering companies, consulting firms, and leading universities.

Taking advantage of that locally intense geoscience community, Regina Capuano (MS ’77, PhD ’87, University of Houston) Carlotta Chernoff (PhD ’02, ConocoPhillips), Jeff Seekatz (BS ’74, ExxonMobil) and Bob Krantz (MS ’83, PhD ’86, ConocoPhillips) organized an alumni Happy Hour at a local pub in Houston’s “early summer” (May!). Susan Beck and Bob Butler flew in just for the occasion, which ultimately grew to include dinner, dessert, and coffee early the following morning. Alumni attendees covered a wide spectrum of vintages and disciplines, such that probably no one was spared at least one story from graduate school that they hoped everyone else had forgotten. A very fine time was had by all, including Amy (Ruf) Apotria (MS ’87), Alex Bump (PhD ’01), Regina Capuano, Carlotta Chernoff, Ken Evans (MS ’72), Bob Krantz, Steve Lingrey (PhD ’82), Steve Naruk (MS ’83, PhD ’87), Steve May (PhD ’85), Ghopal Mohapatra (MS ’95, PhD ’96), Andy Sandberg (MS ’83), Marc Sbar, Jack Schlemmer...cont’d page 4
From the Department Chair

The University of Arizona continues to be in a state of change as we move toward President Peter Likens and Provost George Davis’ vision of Focused Excellence. The University is pushing to increase research, increase diversity, and raise admission standards for incoming freshman as part of their vision.

The broad field of earth science continues to be a major theme. Provost Davis has appointed a focused study team to look at how we can do more earth and environmental science across campus. Both Jonathon Overpeck and I are on that committee. The message is clear that the UA has to find sources of money other than the state of Arizona. The good news is that the Department did not get another state budget cut for the 2003/2004 year. The administration worked very hard with the Board of Regents and the Governor to minimize any additional cuts to the University state budget. However, the past cuts are permanent, and there is very little chance that any of these cuts will be restored any time soon. As expected, tuition increased 40% this year. The UA still ranks in the lower half of all state universities for tuition, but it was a shock to students to have such a large increase in one year. The UA is increasing financial aid to help offset the cost increase.

We have had some changes in the Department. Terry Wallace took a position at Los Alamos National Laboratory last June. We are currently advertising for a Geophysics faculty position at the Assistant Professor level that we plan to fill for Fall 2004. Judy Parrish has taken a job as Dean of the College of Science at the University of Idaho that started in September. We plan to have another faculty search next year to fill Judy’s position.

John Sutter (Team Chief Scientist, Western Earth Surface Processes Team, USGS) and I (as well as many others on campus) continue to work on plans for a joint US Geological Survey (USGS) — UA Earth Surface Processes Research Institute (ESPRI) on campus. As I reported in the last newsletter, the USGS has plans to increase their presence in Tucson in the coming years, and the University and the USGS have been working hard to find funding for a new building to house the USGS as well as other UA units; the Tree Ring laboratory, and the Institute for the Study of Planet Earth (ISPE). Last May and June, we held four workshops to design a science plan for the development of ESPRI that were very successful. The development of ESPRI will have a major impact on and strengthening of the surface processes areas of the Department.

In this issue, we have focused primarily on land and water issues: land issues at the Desert Laboratory on Tumamoc Hill, tropical lake productivity, and Tucson basin groundwater.

We had a great alumni party in Houston last May that Bob Butler and I attended. Thanks to Alumni Advisory Board members Regina Capuano, Steve Naruk, Carlotta Chernoff, and Jeff Seekatz for organizing it.

Last, but not least, I want to thank all of our Geoscience alumni and friends for their continued and generous support of the Department.

Mark Your Calendars
GeoDaze 2004 will take place on April 1st, 2nd, and 3rd this year. Plan now to join us then. Jessica Conroy and Jessica Rowland will be co-chairs for the symposium. We hope to see many of you at this annual event!

The Geosciences Advisory Board will also meet on April 1st and 2nd.

Alumni Drawing Winner
Kathleen Devaney (BS ’82), an instructor at El Paso Community College, won a Geosciences T-shirt for sending in her updated contact information.

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The Department of Geosciences expresses its gratitude to alumni and friends who continue to support programs and scholarships through their generous contributions.

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Alumni Drawing Winner
Kathleen Devaney (BS ’82), an instructor at El Paso Community College, won a Geosciences T-shirt for sending in her updated contact information.
In the past year, Tumamoc Hill and the Desert Laboratory have often made the local newscast. Three reasons for this notoriety involve (1) an ill-fated effort by the University to obtain title to land it currently leases for ecological research; (2) hydrological investigations at an abandoned landfill on the land that turned up low levels of PCE (tetrachloroethylene) contamination, probably from solvents used in dry cleaning; and (3) a now imminent 100-foot by two-mile clearcut to replace a petroleum pipeline along an existing easement following the pipeline’s rupture in July 2003.

The first issue involves a 320-acre parcel of State of Arizona Common School Trust Lands. The land in question is immediately adjacent to 349 acres of University deeded land and 200 acres of State Trust Lands of which the University is the direct beneficiary. Together, these 869 acres were fenced and have been the grounds for ecological research at the Desert Lab since its inception in 1903. The 320 acres of Common School Trust Lands, which are supposed to make money for K-12 schools, are zoned RX-2 (2.2 houses per acre) and conceivably could be bought and developed by a private party.

For the past decade, the University has been trying to secure title to the 320 acres, which contain several long-term vegetation plots that have been monitored for nearly a century. Tumamoc Hill and the quest to purchase the 320 acres served as the poster child for passage of the Arizona Preserve Initiative (API) in 1996. This initiative made State Trust Land eligible for purchase or lease to preserve land for conservation or open space for the first time. In 1997, a Pima County Space Bond Issue set aside $1.4 million for purchasing the 320 acres, and in 2000, the State’s Growing Smarter Trust Land Acquisition Grant Program provided matching funds for the purchase of API properties. Pima County was poised to purchase the 320 acres at state auction in October 2000. The auction was canceled, however, due to complications with the County’s obtaining title to a 25-acre abandoned landfill that is part of the 320-acre parcel and a legal challenge to the API from a Tucson citizen who identified himself as a member of People for the West.

The landfill issue was resolved when the University offered to obtain direct title to the parcel using Pima County and Growing Smarter funds. The University and City of Tucson, who operated the landfill briefly in the 1960s, have been collaborating in hydrologic investigations to define the extent of PCE contamination, which does not threaten any area wells. Eventually, the landfill will be recapped to eliminate any further infiltration and transport of contaminants.

In April 2003, a second auction of the 320 acres was scheduled, then canceled, by a new Land Commissioner in response to another challenge by the same individual from People for the West. To make matters worse, the Land Commissioner also rescinded the patent restrictions accorded to the parcel by API. While there are no plans to schedule a new auction in the future, the lack of patent restrictions leaves room for future development. If the 320 acres are lost to development, the Desert Lab stands to lose not just a few permanent plots, but almost half of the ecological reserve. Plant and animal populations sustain themselves in part by dispersal and immigration from immediately adjacent lands. In effect, Tumamoc Hill would become more of an ecological island, compromising a century’s worth of research (download a synopsis of past and ongoing Desert Lab research at wwwpaztcn.wr.usgs.gov/tumamoc_research.pdf).

The third land issue involves the same Kinder Morgan (KM) petroleum pipeline that burst in Tucson on July 30, causing gasoline shortages and price gouging in Phoenix through the month of August. This particular pipeline, which runs from El Paso to Phoenix, was constructed in the 1950s. As with other utility easements, the pipeline easement was negotiated during the Forest Service’s tenure on Tumamoc Hill and before the University’s purchase of the Desert Lab. In the 1950s, this “open” land fell outside of the incorporated city limits. Since then, however, the city of Tucson has literally developed on top of the pipeline, raising safety concerns.

KM purchased the pipeline in 1998, and in 2002, the company started planning to replace the old eight-inch pipeline with a new twelve-inch one. A KM contractor contacted Desert Lab administrators in December 2002 to obtain landowners’ permission for environmental surveys in advance of new pipeline construction. Had the pipeline not burst in July, the City of Tucson, Pima County, and the State of Arizona would now be contemplating whether to install a new pipeline along the existing route through populated areas of Tucson, or relocate it to a safer environment. Once it burst, however, KM made the case to government officials for immediate replacement along the existing easement, which includes a two-mile run through Tumamoc Hill. The University and Desert Lab petitioned that the pipeline be rerouted along Starr Pass Boulevard and Greasewood Road to avoid damage to ongoing ecological studies, but this petition was vetoed by the City and State, who preferred pipeline replacement on Tumamoc Hill. Construction will take place in November and December. Jan Bowers and Julio Betancourt, USGS-Desert Lab, have collaborated with Harris Environmental Group in Tucson in prescribing a revegetation and mitigation plan funded by KM.

By Julio Betancourt, Adjunct Professor

Tumamoc Hill in the News

Aerial view of Tumamoc Hill looking southwest (Photo by Peter Kresan). Indicated are the 320 acres of State of Arizona Common School Trust Lands, the landfill, and the Kinder-Morgan Pipeline.
Department News

Retirements
Jo Ann Overs retired in June after over 20 years with the Department. She will be missed, but we wish her the best as she moves on with her life.

New Positions
Spence Titley accepted the position of Curator for the Department of Geosciences Mineral Museum. Spence’s leadership and expertise will help us continue our strong tradition with the museum.

Judith Totman Parrish was appointed Dean of the University of Idaho’s College of Science. The UI created their College of Science a year ago as part of an institution-wide reorganization effort. The college includes the following departments and areas of study: chemistry, biology, mathematics, statistics, physics, geography, geological sciences and earth resources. Judy has been the Associate Dean of the UA’s College of Science for the past three years. We wish Judy well in her new position.

Terry Wallace took a position at Los Alamos National Laboratory in New Mexico. We wish Terry well in his new position.

University News

New Grant at UA
Michael Drake (joint appointment Lunar and Planetary Sciences and Geosciences), Peter Smith, William Boynton, and their colleagues in the Lunar and Planetary Lab received a $325 million NASA grant to oversee the instruments and operations of the May 2008 Phoenix Mission launch to Mars (named for the mythological Egyptian bird reborn of its own ashes, not our capital city to the north!). The Phoenix mission has two goals: to study the geological history of Martian water and search for evidence of a habitable zone. The grant is the largest in UA history.

Houston Alumni cont’d...
(BS ’74), Jeff Seekatz, Elena Shoshitaishvili (BS ’97, MS ’02), John Sumner, John Zumberge (MS ’73, PhD ’76), the boss who signed off on my expense account, and even a few UA Geoscience wannabes from the local Texas universities, where they incline to “former student associations” rather than actual alumni associations (to keep attendance up?). Another event is tentatively planned for April or May of 2004. Network with any of the above or watch the newsletter for details.

Keeping the ball rolling, in early July (still early summer in Houston) Carlotta and Regina organized an event to welcome UA Geosciences summer interns Stacie Gibbins, Andrew Leier, and Trey Wagner at a local state park. The fact that there were three interns from the UA in the industry’s constantly downsizing environment is testimony to the strength of the Geosciences Department.

Alumni and interns all powered-up in their 4WD SUV’s around 4 PM, rendezvoused briefly at a reserved pavilion, and then went off hiking, biking, bird watching, and gator watching for a couple of hours. (No kidding about the 4x4’s, but most had at least a few dings and there were no Hummers, Escalades, or ASU stickers!) Native alligators are the park’s BIG attraction, and many were seen, from varying distances. This is always a thrill because, although alligators resemble logs in appearance and activity, they can suddenly break into a sprint at speeds up to 40 miles/hour! That seems improbable until you recall those little lizards sprinting across the rocks in the Tucson desert, going from 0 to 60 in the blink of an eye. Now, imagine that those lizards are ten feet long (Texas-sized!), hungry, and carnivorous, and you can imagine the thrill!

Later we BBQ’ed, in Bullwinkle-like oblivion, while feisty raccoons stole everything that wasn’t being cooked out of the SUV’s and ate it themselves!! (Be glad the gators aren’t as smart as the raccoons!)

Following a feast of chicken, hamburgers, sausages, wursts, potato salad, coleslaw, chips, watermelon, apples, peaches, cookies, and yes, tofu dogs — Rocky Raccoon not withstanding — we zipped off to the park observatory for a spectacular show. Through the official main telescopes, incredible images of Jupiter and its moons and diamond-like star clusters were plainly visible! In addition, being that native Texans are truly gregarious extraverts, there were lots of “amateur” astronomers who set up their own quite-professional-grade telescopes on the observatory roof and vied for spectators to look through them! Incredible! It was near full moon, and we were treated to views of the first and last lunar landing sites up close and personal!
Global Warming Impacts
Tropical Lake Productivity

By Andy Cohen, Professor

Scientists from the UA’s Department of Geosciences have demonstrated a strong linkage between rising tropical lake water temperatures and declining primary productivity in Lake Tanganyika, the largest of the East African rift valley lakes. The study (published in the 14 August 2003 issue of *Nature* by Catherine O’Reilly, Simone Alin, Pierre-Denis Plisnier, Andrew Cohen, and Brent McKee) documents how rising surface lake water temperatures in the African tropics during the latter part of the 20th Century (consistently about 0.1˚C/decade between lakes), coupled with declining wind velocities during the same period, have caused lake waters to become more stably stratified. This makes it more difficult to mix the nutrient-rich deep waters of the lake and bring them to the surface. Because the primary production of algae in this lake depends on the renewal of nutrients from deep water to the surface, increased stability of stratification has led to less nutrients, less algal growth in surface waters, and ultimately, smaller fish populations. O’Reilly *et al.* were able to demonstrate this process through a combination of instrumental records of temperature and windiness, fishery catch statistics, and sediment core records of indications of primary production, especially from stable isotope ($\delta^{13}C$) records of sedimented organic matter, which are sensitive to surface water productivity.

Because the Lake Tanganyika fish catch (estimated to be about 200,000 tons/yr) is an extremely important source of protein regionally, a decline in fish productivity is considered a serious issue. Global climate model projections for further surface water warming and even greater water column stratification will require governments and international fishery agencies, such as the UN’s Food and Agriculture Organization, to watch these climate trends and their lake ecological implications closely.

The O’Reilly *et al.* study was funded by both the United Nations Global Environmental Facility’s Lake Tanganyika Biodiversity Project and the US National Science Foundation. NSF has contributed to this work through its support of the UA Nyanza Project’s interdisciplinary research training course on tropical lakes, in which both O’Reilly and Alin participated as students, and O’Reilly and Cohen as instructors.
Research Scientist Joins Department and GEON Project

Allister Rees joined the Department of Geosciences in February 2003 to work on the GEON project, a multi-institutional, NSF-funded effort to create a cyberinfrastructure for the geoscience community. GEON is a five-year project among 14 US universities and institutions (including the USGS), and the San Diego Supercomputer Center.

One aim is to develop a scheme to ensure interoperability of geoscience databases, so that any user at a computer terminal anywhere can search seamlessly for available information, much the way an online search for airline tickets works. Another part of the GEON effort is the examination of the evolution of mountain building in North America.

Allister Rees and principal investigator Karl Flessa are interacting with geophysicists, structural geologists, petrologists, and other geoscientists to assess the effects of tectonic evolution through time on climate and biota for two study regions, the Rocky Mountains and the Appalachians. Allister has started assembling floral, faunal, and sedimentological data for the Rocky Mountain area, which contains good plant and vertebrate assemblages spanning the Late Cretaceous through Miocene. One challenge is to try and distinguish the effects of mountain building on local climate and biota from more regional (or indeed global) climate change through these intervals.

Allister is also developing links to other “soft rock” databases, including the Paleobiology Database (http://paleodb.org/), and is transferring the PGAP (Paleogeographic Atlas Project, University of Chicago) database from the private domain for use within the GEON framework.

GEON: Geosciences Meets Information Technology

By Paul Tooby
The San Diego Supercomputer Center

The GEON project is a collaboration between information technology (IT) and geoscience researchers with the goal of creating a modern information technology framework, or cyberinfrastructure, for the earth sciences. IT research in GEON is coordinated by Chaitan Baru of the San Diego Supercomputer Center (SDSC). The geoscience research component of GEON is coordinated by A. Krishna Sinha of Virginia Tech and researchers from ten additional universities, including the University of Arizona. The Digital Library for Earth Sciences Education is coordinating the GEON education and outreach program.

The goal of GEON is to establish an interoperable geosciences information network consisting of digital libraries populated with high-quality, freely available data, along with an integrated, robust set of software tools for access, analysis, visualization, and modeling. The tools and services made available through GEON will change the way geoscience research is conducted, providing researchers with seamless access to feature-rich and hierarchically deep geosciences databases, along with tools that will enable studies of both fundamental and applied earth science problems. With its emphasis on ease of access and use, GEON will be an important resource not only for geoscientists but also for educators, students, industry, the public at large, and policymakers who need to make informed decisions on land use, the environment, natural disasters, energy, and resources.

The IT part of the project encompasses the three core components of a national information infrastructure — grid computing, data management, and visualization. The earth science research will emphasize the development of information and concept-integration procedures as well as modeling and research that bridge traditional subdisciplines.

By enabling multidisciplinary research, GEON will help geoscientists study questions like the evolution of biodiversity through time, the interplay between tectonics and ocean chemistry, fluid-rock interactions, the water cycle and its impact on society, mountain building, and hazards such as earthquakes and volcanoes.

The San Diego Supercomputer Center permitted use of this article; see the original source (Envision, Vol 19, No 2, April-June 2003) for more details about the project.
For many years, Tucson depended entirely on groundwater pumped from the regional aquifer in the Tucson basin and neighboring Avra Valley for a water supply. The Tucson basin is typical of the Basin and Range province in containing thousands of meters of sediment derived from the surrounding hard-rock ranges. Predominantly sand and gravel in the upper few hundred meters of the basin have been the principal source of water. The basin groundwater is replenished from streams that drain areas of high rainfall (relative to rainfall in the basin itself) in the mountains to the north and east, and in the uplands towards the Mexican border.

Colorado River water now supplements the city’s water supply, and the pumping of groundwater is now greatly reduced under central Tucson. The city is growing unabated, nonetheless, and groundwater will continue to be a crucial water resource. Future exploitation of the aquifer will necessitate a better understanding of the ages, origins, and flow paths of the groundwater as basic information for the construction of groundwater flow models. It is difficult to locate zones of recharge at the surface, and even more difficult to track the movement of concealed groundwater. An essential first step towards understanding water movement is the construction of a map of static water levels. Using data from the hundreds of wells in the Tucson basin, such a map was assembled in the late 1990s (see www.ag.arizona.edu/AZWATER/publications/sustainability/index.html, Fig. 3.2).

Isotope studies provide additional information revealing the complexity of the recharge process. Stable oxygen and hydrogen isotopes label the water molecule itself, and their ratios vary as a function of condensation temperature during precipitation, evaporation, and water-rock interaction. These ratios can be used to distinguish waters of different origin — in the Tucson basin, for example, rain or snow from the surrounding high mountains can be distinguished from rain at the basin floor — and to detect mixing between waters of different origin. Isotopes in sulfate and bicarbonate ions provide information on sources of solutes. In Tucson, sulfur isotopes are useful because of the isotopic contrast between Permian (~250 million years ago) marine gypsum that is present to the southeast, and other sulfate sources in soil or sediment that represent a combination of sulfur from igneous rocks and dust. Natural radioactive isotopes such as tritium and radiocarbon provide information about the age of groundwater.

Over the last 20 years, the Laboratory of Isotope Geochemistry has assembled an isotope data set for hundreds of sample sites in Tucson, and for almost every measurable rain event. Past graduate students – notably Bob Kalin, Sofie Pasilis, Joy Gillick, John Lindquist, David Esposito, and Erin Cunningham – have constructed portions of the maps of O, H, S, and C isotopes. Recently, we have completed coverage of the central part of the basin. Much of the work was supported by our publicly-funded Laboratory as a service to the community; more recently, the University and the SAHRA Science and Technology Center have supported us.

In this brief article, we present an interpretation of our S and O isotope results in the central part of the basin (Fig. 1).

Figure 1. Location map of study area (patterned), showing major streams of the Tucson basin: PC = Pima Creek, VC = Ventana Creek, SC = Sabino Creek, ACC = Agua Caliente Creek

Delta Notation and Isotope Fractionation
Using mass spectrometers, we measure isotope ratios $R$, e.g.

$$R = \frac{^{18}O}{^{16}O}, \text{ or } \frac{^{34}S}{^{32}S}$$

Using $R$ values for samples, and for standard materials (VSMOW, a seawater standard, for O; and CDT, a meteoritic sulfide standard, for S), we define delta values as follows:

$$\delta^{18}O = \left( \frac{R_{\text{sample}}}{R_{\text{standard}}} - 1 \right) \times 1000 \text{ per mil}; \text{ likewise } \delta^{34}S.$$ 

Evaporation of water enriches $^{18}O$ in the vapor relative to the composition of the liquid water. Such a separation of isotopes is termed fractionation. Condensation does not generally reverse this process completely, so that average rain in most places is enriched in $^{18}O$ relative to 0‰ seawater. Average rainwater and groundwater therefore have negative $\delta^{18}O$ values.

Isotopes in Tucson Basin Groundwater
We possess $\delta^{18}O$ data for groundwater from more than 300 sites, and $\delta^{34}S$ data for dissolved sulfate from 137 sample sites. A complete list of the data and isotope...cont’d page 8
As a working hypothesis, we proposed that most water in the upper part of the regional aquifer derives ultimately from the major streams that enter the basin. If the water in each stream has a characteristic isotope signature, and if a similar distinctive signature is found in part of the aquifer, then we may be able to infer that the stream is the main water source for that area.

Stream water could be sampled at the surface during flow events, but this approach yields a broad range of δ18O values reflecting the isotopic variability of rainwater. A better estimate of the average isotopic content of water available to replenish the regional aquifer from each stream is obtained from shallow wells in the flood plain. Fig. 2 shows δ34S and δ18O data of flood plain groundwater. Several distinctions can be made — between Cienega Creek and the other streams on the basis of δ34S, and between Rincon Creek and the Santa Cruz River on the basis of δ18O. The empty ellipse corresponds to a water composition not known from the major flood plains.

The δ18O and δ34S distribution maps (see website) show basin-scale features with boundaries that do not coincide. The existence of large map features argues for the importance of recharge from basin-scale sources such as the major streams. The major feature of the δ18O map is a boundary, near Interstate 10, between mountain-derived water with δ18O < -9‰ to the northeast, and basin-derived water with δ18O > -8‰ to the southwest. On the δ34S map, the major feature is a plume of sulfate-rich water with δ34S > 10‰, derived ultimately from Permian gypsum, that extends across the basin from southeast to northwest. Surrounding water contains sulfate with δ34S < 10‰.

We can divide the basin map into domains using the δ18O and δ34S boundaries together (Fig. 3). Each domain contains water with a characteristic combination of δ18O and δ34S. Between domains C and D, the boundary is defined by a change in δ18O; between domains B and C, the boundary is defined by changes in δ34S. The domains match the major streams as follows:

- **Domain A**, with δ18O < -9‰ and δ34S < 10‰, corresponds to water from Rillito and Tanque Verde Creeks and their northern tributaries.
- **Domain B**, with δ18O > -8‰ and δ34S < 10‰, corresponds to water from the Santa Cruz River.
- **Domain C**, with δ18O > -8‰ and δ34S > 10‰, contains water that matches flood plain groundwater from Cienega Creek.
- **Domain D**, with δ18O < -9‰ and δ34S > 10‰, matches the empty ellipse in Fig. 2.
- **Domain E**, with δ18O < -10‰ and δ34S < 10‰, corresponds to Rincon Creek.
- **Domain F** has δ18O > -8‰ and δ34S < 10‰ like domain B, but is remote from the Santa Cruz River.

The domain map tells us a great deal about the origin of groundwater in different areas of the Tucson basin. For a domain having clear geographic and isotopic relationships with a specific stream, we deduce that the stream is the source of the groundwater. Domain C does not appear to be continuous at the southeastern end; all attempts to find samples to bridge the gap have failed so far. The water in this domain is following one or more Pleistocene courses of Cienega Creek, which has not always followed the present course into Pantano Wash. The water in Domain D must have originated at high elevation, probably in the Rincon Mountains, but has a Permian sulfate S-isotope signature. It appears to be upwelling in the southeastern corner of the basin, possibly dissolving gypsum at depth in the basin-fill sediments. Oligocene lacustrine gypsum, reworked from Permian strata, crops out in sediment closer to the southeastern edge of the basin.

Isotope maps showing the distribution of tritium and radiocarbon in groundwater (see website) help to confirm the domain boundaries established by S and O isotopes, and provide much additional information about the age of the groundwater. But that is a story for another time!
Jana Van Alstine Receives H. Wesley Peirce Scholarship

My research focuses on the stratigraphy of the Shellenberger Canyon Formation, a fluvio-deltaic unit that flowed into the lake that occupied the Bisbee rift basin in the early Cretaceous, from a limnogeologic perspective.

The bulk of my research entails measuring detailed stratigraphic sections obtained through field work in the Whetstone Mountains. The stratigraphy will allow me to form a detailed picture of the depositional environment, and evaluate models of stratigraphic architecture in the delta infilling phase of continental rift lake evolution. The lacustrine sediments within the Bisbee Basin also provide an outstanding setting to test depositional models based on observations of modern rift lakes, such as Lake Tanganyika in east Africa.

Lacustrine basins are exemplary environments to study when looking for historical regional data. They are closed basins that provide regionally specific data on the climate and structure of the area in and around the basin. They enable us to infer past conditions on the continents where we live, unlike the global marine data the oceans give. Lakes are very sensitive systems that respond to regional changes, such as switches in climate and tectonic activity, which may alter a lake and its drainage basin. Rift lake development and persistence is limited by tectonic controls. Tectonics control topography and topography controls deposition. The intimate relationship between structure, topography, and sedimentation permits reconstruction of the depositional history of the basin.

I am very grateful to have received the H. Wesley Peirce Scholarship to support my research in limnogeology, and I would like to thank all those who have generously donated to the scholarship fund. I would also like to thank Andy Cohen, Bill Dickinson, Charles Ferguson, and Floyd Gray, whose knowledge and support have been invaluable to me.

Memorials

Francis Bartos King died on April 2, 2003. Francis received a MS degree from the Department in 1972.

Philip Matter III died September 27, 2003. Phil attended the UA and earned a PhD in Geology in 1969, specializing in mineralogy and petrography. He was employed by Phelps Dodge Mining Company in Douglas, Arizona, and in Johannesburg, South Africa. Phil was also active as an independent consultant with various mining and exploration companies.
Congratulations to all of our graduates and best wishes in your new pursuits!

Student Receives NSF Dissertation Grant

Kirsten Rowell, a Geosciences PhD candidate working with Karl Flessa, received a National Science Foundation dissertation enhancement grant that will support her dissertation project while building relationships with Mexican scientists. She will work at the Universidad Autónoma de Baja California, in Ensenada, Mexico, where biologists have a rearing/release program for the endangered fish, totoaba (Totoaba mcdonaldi).

She will calibrate the $^{18}O$ and $^{13}C$ in the carbonate of these fishes’ otoliths (ear stones) with that of water and food. Otoliths are concentrically laminated, aragonitic structures that can be used as geochemical recorders of environmental conditions during the life of the fish. The $^{18}O$ variation can be used to estimate temperature and determine if brackish water was important in the fish’s early life history. The $^{13}C$ provides information about food resources and habitat. This work will help her determine the importance of Colorado River flow to ecologically and economically important marine fish in the Gulf of California.
Michael Bikerman (MS ’62, PhD ’65)
As an emeritus professor, I was recently elected as president of the Pittsburgh Geological Society for the second time. The first time was in the late 1970s. Some of us never quit!
~bikerman@pitt.edu

Rogelio Monreal (BS ’82, MS ’85)
I was a student of Dr. Joseph Schreiber. I have been in charge of the graduate program at the Geology Department of the University of Sonora, Mexico, from 1997 until August of this year. I have also been in charge of several hydrogeology projects for the National Commission of Water Resources of Mexico and agricultural organizations. In September, I was elected Director (Dean) of the Exact and Natural Sciences (which includes the Departments of Geology, Mathematics, Physics, and Research in Physics) at the University of Sonora in Hermosillo, Sonora.
~www.dcen.uson.mx/

Jeanette (Ingram) Abarca (BS ’97)
I have been working at AMEC Infrastructure in Tucson since August 1999 as a survey technician and AutoCAD draftsman. I was married on March 1, 2003, to Jacob Abarca, a UA grad and research scientist with the UA College of Pharmacy/Center for Health Outcomes and Pharmacoeconomic Research. The picture below is from our honeymoon in Manzanillo, Mexico.
~cadgirl316@hotmail.com

Bob Kalin (MS ’87, PhD ’94)
Bob is a professor and chair of Environmental Engineering in the School of Civil Engineering and QUESTOR Centre at Queen’s University Belfast in Northern Ireland. He and his colleagues had a paper published in Science in early July. Some of his group’s research activities are listed on the web at www.prb-net.qub.ac.uk/eerg/eerg.htm.
~r.kalin@qub.ac.uk

Brigette Martini (BS ’97)
After finishing up at the UA, I headed west to UCSC. I got my PhD in 2002 studying structural control of the hydrothermal system and the volcanogenesis of Long Valley Caldera in the eastern Sierra. I officially crawled over every fault, fracture, and hot spring within a 50-km radius of Mammoth Lakes and loved every minute of it. My research was heavily funded by the geothermal and oil industries, and I have since gone corporate rather than succumbing to the persuasive call of academia. I moved to Sydney, Australia, in October 2002, where I work for a hyperspectral imaging firm (HyVista Corporation) as a geologist and image analyst. The job takes me all over the world, and I love consulting on diamond exploration one day and mangrove ecosystem mapping the next. If anyone is ever down under, look me up. You’d be surprised how many UA alums I’ve run across here already!
~martini@hyvista.com

Jeanette and Jacob Abarca in Manzanillo Mexico.

Chris Notgrass (BS ’91)
I am currently mobilized for Operation Enduring Freedom (I am an officer in the Army Reserves). No matter where I go, my Army buddies always ask about the geology of where we are. Fortunately, there are two other geologists in my unit.

When not serving Uncle Sam, I am a hydrologist with the Arizona Department of Environmental Quality. I work in the Total Maximum Daily Load (TMDL) program. With my background in exploration geology, I always seem to get assigned to the mining-related projects. The last TMDL project I finished was along Boulder Creek in the vicinity of the abandoned Hillside Mine near Bagdad, Arizona.
~notgrass.chris@ev.state.az.us

Jacqueline (Jean) Shinker (BS ’96)
JJ will complete her PhD at the University of Oregon this spring. The title of her dissertation is “Mechanistic Controls of North American Climate Variability.”

Next fall, she will join UA geology graduate Jim Speer (BS ’94, MS ’97) in Indiana State University’s Department of Geography, Geology, and Anthropology. JJ has a tenure-track faculty assistant professorship.
~shinkerj@darkwing.uoregon.edu

Kathryn Gregory-Wodzicki (PhD ’92) and Wojtek Wodzicki (PhD ’95)
Anna Maria Christina Wodzicki was born at 5:11 PM on her big brother’s 2nd birthday (Oct. 19). She weighed 7 lb 7oz, and she is doing well. She slept 5 straight hours last night, so mum and dad are doing well, too!
~wodzicki@novus-tele.net

Kathryn Gregory-Wodzicki (PhD ’92) and Wojtek Wodzicki (PhD ’95)
Please update your contact information!

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