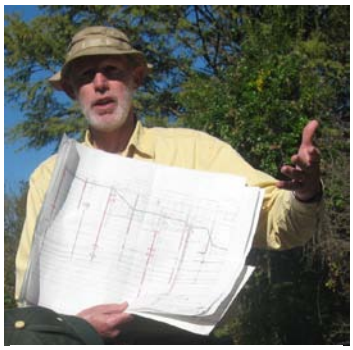
austin geological society



bulletin

volume 6
2009-2010

Cover photograph: During the Fall 2009 field trip Chock Woodruff discusses his work on the tunnel that passes beneath the Colorado River and transmits water to the City's Water Treatment plant. Photo by Ann Molineux.

note from the president

Reflecting on the past year is to remember much fun interacting with the members, learning from our slate of really good speakers, enjoying the terrific field trip, and having the chance to meet representatives from the other Texas societies at the GCAGS meetings. It was another active year for the Austin Geological Society. Membership rose to over 190 with 55 percent of those new members! Attendance at meetings continues to remain strong, although we still need to foster more student involvement. Our new digital sign-in system has simplified the tracking of attendance and we owe a great debt to Dallas Dunlap for this development as well as welcoming him as the President for 2010-2011.

Our talks were varied and reliably fascinating thanks in large part to the selection abilities of our VP, Pat Dickerson. We appreciated the ethics talk presented by the new dean of the Jackson School, Sharon Mosher. Her talk covered much ground and pointed to significant ethical issues that we, as geologists, must resolve.

The October Halloween field trip on the "Urban Hydrology of Austin, Texas' or more aptly, "Urban hydrologic horror stories" was a great success, thanks to leaders Chock Woodruff and Raymond Slade. It proved great fun and was highly informative. It was fitting that AGS this May honored Raymond Slade for his 'Outstanding Contribution' to AGS. Two $500 undergraduate scholarships were also presented that same meeting, and with the help of John Mikels we again saw the work of Austin area science fair winners at our poster session. Steve Ruppel and Amanda Masterson continue to ensure that our publications are made available to the public and that we reap financial benefit from such sales.

AGS joined with several other groups to sponsor the publication of a much needed Hydrologic Atlas of the Hill Country Trinity Aquifer, leading editors Al Broun and Doug Wierman. Expanded development into the Hill Country is stressing ground water supplies, last summer saw many reports of dry wells and it was imperative that we publish what is known about the aquifer systems in this area. We had the thrill of seeing the proof version of the completed atlas at the board meeting this summer. No wonder our finances remain strong in the hands of Treasurer Doug Wierman, he really gets things accomplished.

Our web site continues to develop thanks to Brian Hunt and we shall soon see digital versions of several field guides linked to routes plotted on Google Earth (due to Eddie Ficker's contribution). We are closer to completing the historical roster of the society with input from many people including our able historian, Doug Trombatore. Incidentally Brian will also take over the helm of the Bulletin from Robert Mace, and we express great thanks to Robert for all the hard work that he has put into the development of that publication. We have all become used to the newsletter arriving in digital form we need to remember the considerable organization and prodding by Angela Ludolph in order to accomplish that feat.

This year saw the initial steps towards our hosting the GCAGS meeting in Austin in 2012. Scott Tinker accepted the role as President of GCAGS for that year and Dallas Dunlap along with Doug Radcliff will be local chairs shouldering the task of organizing this important event.
We owe a great debt of gratitude to every AGS Officer and committee Chair. They are the backbone of the Society and without their continued support AGS would not thrive. We also thank Scott Tinker and Wanda La Plant at the Bureau of Economic Geology who continue to support AGS with the use of great meeting facilities and for permission to use the larger facility in the new Research Office Complex.

It has been an honor and a great pleasure for me to serve AGS and its members, and I look forward to continuing to work with you in the future.

Cheers,
Ann

Ann Molineux, 2009–2010 AGS President

austin geological society

mission: The mission of the *Austin Geological Society Bulletin* is to (1) summarize the previous year's activities of the Society and (2) publish technical papers, comments, and notes concerning the natural sciences of Central Texas.

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information to authors: The Editor of the *Austin Geological Society Bulletin* invites contributions relating to the natural sciences of Central Texas in the form of technical papers and discussions. If you would like to submit to the bulletin, please see the instructions to authors at the end of this document. All submissions should be sent to the editor in digital format.

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austin geological society

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news from the society

Raymond Slade Receives AGS Distinguished Service Award

At the May 2010 AGS meeting Chock Woodruff and Linda Ruiz-McCall presented the AGS Distinguished Service Award recognizing Raymond's years of distinguished contributions to the Society, and in particular to the fieldtrips and guidebooks. Congratulations Raymond and thank you for your great service and contribution to AGS!

First AGS Meeting a big success

A big thank you to UT-JSG Dean Sharon Mosher for her talk on ethics--it was a packed house. Shown here is Dr. Mosher (left) and AGS President Ann Molineux. AGS greatly appreciates UT and the BEG for their continued support of AGS meetings with their facilities.

about the technical content

The technical content in the Bulletin consists of abstracts or extended abstracts for presentations, summaries of the field trips, technical papers, and notes.

presentation

The Austin Geological Society hosts technical presentations from invited speakers concerning the natural sciences. We publish an abstract in the Society's newsletter and allow for an extended abstract in the Bulletin.

posters

The Austin Geological Society hosts a poster session each spring. Presenters can submit an abstract concerning their poster topic. Local middle and high school students, whose earth science projects were recognized by AGS at the Austin Regional Science Festival, are invited to present their projects at the AGS poster session. Student abstracts are published herein.

field trip

The Austin Geological Society tries to have at least one field trip per year. The summary included here provides an overview of this year's trip. Interested readers are encouraged to purchase the guide book for additional information and details.

technical paper

The Bulletin accepts technical papers for publication provided that the papers meet technical and editorial requirements.

note

The Bulletin also accepts notes, which may be technical or anecdotal.

presentation

august 31, 2009, bureau of economic geology

Ethics for Geoscientists

Sharon Mosher, Ph.D.

Dean, Jackson School of Geosciences

University of Texas at Austin

Professional ethics for geoscientists provide principles of conduct to govern decisions and actions within our profession. Like all ethics, the principles of behavior are based on morals, but applied to our professional, as well as personal, life. As professional geoscientists we have responsibilities to our employer, employees, students, associates, clients, and our profession. But we also have larger responsibilities as well to the public, science in general, and the environment. In this talk I will discuss guiding principles for each of these responsibilities as well as common ethical standards and issues. Ethical reasoning requires clear, logical thinking, arguments based on facts, and the ability to understand and articulate different points of view. The overall expectation of geoscientists is that we will recognize the difference between right and wrong and chose to do what is right, thereby adhering to the highest standards of conduct and maintaining both our personal and professional integrity. Our personal ethics are developed early through our observations of and interactions with our parents, families and teachers. Society, our culture and, in many cases religion, help shape our value system. As we become adults, we strive to balance our personal ethics with those of professional groups and legal and regulatory guidelines. Moreover, everyday decisions made in our occupations often cause ethical dilemmas. Resolution of ethical dilemmas is best handled by separately evaluating the consequences and the potential actions and then making a decision that involves weighing the relative importance of conflicting principles. Ethical geoscientists are necessary to protect the public, the environment, our professions, businesses and individuals within our professions and businesses.

presentation

october 5, 2009, bureau of economic geology

The Battle for Groundwater Supremacy -- A Dispatch from the Front Lines of the Great Texas Water Wars™ of the Early 21st Century

Matt Uliana, Ph.D.

Martin Geologic Consulting, Austin

Groundwater in Texas is a valuable commodity, one that will affect and in many ways control the future economic development of the state. As with any valuable natural resource, it has attracted the interest of various groups, ranging from those attempting to stop the inevitable ecological disaster associated with future development, to those hell-bent on making a fortune selling their water as fast as they can, to those stuck in the middle trying to find a way to develop the resource in a responsible and sustainable way. For all involved, we have the fortune (or misfortune, depending on your outlook) to live in interesting times. For the last decade or so, I have been involved in the groundwater development process as a lowly mercenary foot soldier selling my services to the highest bidder. During that time I have had an opportunity to interact with developers, groundwater conservation districts (GCDs), state agencies, environmental advocacy groups, and the general public, and I've had a chance to make numerous observations and develop an opinion or two concerning where we are and where we are going. This talk will be a presentation of my impressions and opinions, and my hope is that it will give those not involved in the process an idea of how complicated things are and how difficult it will be to come to anything resembling a consensus in the future. Topics addressed in the talk will include the concept of groundwater availability and the problems associated with determining availability and with communicating groundwater development strategies to the public. I will also talk about the planning process and Desired Future Conditions (DFCs), and describe my experiences working with GCDs to develop DFCs as required by the state. In addition, I will address the concept of sustainable development of the groundwater, and talk about whether anything we are doing is actually working towards eventual sustainability. Finally, I'll present some model results that will address the question of eventual sustainability of groundwater use in select aquifers.

presentation

november 2, 2009, bureau of economic geology

Mid-Ordovician Magmatism in the Marathon Basin -- The Rocks Haven't Changed but the Questions Have

Patricia Dickerson, Ph.D.
Jackson School of Geosciences
The University of Texas at Austin

The Marathon basin (W. Ouachita basin) and Cuyania (greater Precordillera, W. Argentina) are underpinned by Laurentian Mesoproterozoic basement and evolved together, as evidenced by isotopic, litho-, bio- and chronostratigraphic data, and recent paleomagnetic determinations. Ages, lead-isotopic and geochemical data correspond well for Cuyania (e.g., the anorthosite massif of Sierra de Umango) and for west-central Texas crystalline basement rocks, notably the Llano Uplift and Pecos layered mafic complex. Fully correlative carbonate successions developed on both the northern and southern basin margins and hosted homologous sponge-algae-stromatoporoid reefs. Within the off-shelf calcarenite debris flows and bentonitic shales of the Marathon Fm. is a 20-km-long layer of mega-olistoliths (to 10s of meters) of shelf carbonates. Those and analogous mega-olistoliths in off-shelf deposits of the Precordillera were shed from fault-bounded blocks during extension/transtension in the basin. Volcanic ash beds occupy the same positions in both stratigraphic successions. Precordillera metabentonites are dated at 469.5 ± 3.2 to 470.1 ± 3.3 Ma (U-Pb, SHRIMP, zircons) and are coeval with rhyolites of the Famatina continental margin arc of W. Gondwana. Pyroclastic zircons have been recovered from bentonitic intervals of the Marathon and Ft. Peña Fms., within identical faunal zones to those for ash beds within the San Juan and Gualcamayo Fms. of Cuyania. An age of 470 ± 6 Ma (U-Pb, SHRIMP, zircon) has recently been established for a Ft. Peña sample. The latest discoveries in the upper Marathon Fm. include basalt and rhyolite – a basalt flow that is co-folded with the sedimentary strata may permit the first paleomagnetic determination for Ordovician igneous rocks in this span of the Laurentian margin. A spherulitic rhyolite body has yielded magmatic zircons suitable for dating. Meter-scale volcanic olistoliths to sand-sized volcaniclastics have long been known in the basin. Extensional block faulting, variable shelf carbonate and outer-shelf/slope sedimentation, and volcanism characterized the W. Ouachita-Cuyania basin in Late Cambrian-Medial Ordovician time. Stratigraphy and structures of the basin support plate reconstructions based upon high-precision paleomagnetic data, which place S. Laurentia opposite W. Gondwana at low southern latitudes (~26ºS). The attenuated, thermally weakened Laurentian slab broke apart with continued right-oblique separation of Laurentia and Gondwana, and Cuyania departed with the southern megacontinent.

presentation

december 3, 2009, bureau of economic geology

Ignimbrites, Ammonites and Evaporites: Stratigraphy, Age and Correlation of Upper Jurassic Evaporites in NE Mexico

Gareth E. Cross, Ph.D.
Jackson School of Geosciences
The University of Texas at Austin

Upper Jurassic evaporites exposed in the Galeana area of northeastern Mexico preserve a diverse suite of well-exposed structures. Here, the décollement of the Laramide-age Sierra Madre Oriental fold belt has been exhumed by the thick-skinned, late- or post-Laramide Potosí uplift. I have mapped (at 1:10,000 scale) an 8 km long outcrop strip that exposes the full décollement stratigraphy. The décollement interval is at least 850 m thick, and consists of calcareous gypsum-anhydrite with 5 regionally-persistent carbonate members (up to 120 m thick) and numerous thinner (<5 m) carbonate interbeds. These carbonate units delineate macroscopic (map-scale) structural patterns within the décollement, and define two broad structural domains. The larger western domain is characterized by north, north-northeast and northeast-trending macroscopic folds that affect the middle and upper parts of the décollement section. Most folds are tight to isoclinal and overturned toward the east or southeast. In places, these folds are refolded by later ~east-trending folds. The smaller eastern domain exposes the lower part of the décollement, and is characterized by open folds, thrust repetition of carbonate members and a regionally persistent shear zone developed within the lowermost evaporite interval. The shear zone (up to ~70 m thick) is marked by spectacular banded mylonites with common intrafolial isoclinal folds and local lineations. Primary sedimentary structures in this interval have been completely obliterated. Such shear zone textures are only locally developed in western domain rocks. Thinner carbonate interbeds in both domains are commonly boudinaged, and where boudinage is extreme a mélange texture (with dismembered carbonate blocks "floating" in an evaporite matrix) is developed. The thick carbonate members locally show map-scale boudinage, typically spatially associated with large volumes of void-filling sparry calcite. Décollement structures may reflect two distinct kinematic processes. Folding of western domain rocks likely reflects deformation in response to folding of the overburden, perhaps by redistribution of décollement material as the overburden folds developed. Western domain thrusts and shear zones likely represent simple shear deformation associated with the bedding-parallel displacement of the rocks above the décollement relative to the sub-décollement basement. Stratigraphic compartmentalization of the structures associated with each process reflects strain partitioning during décollement deformation.

presentation

february 1, 2010, bureau of economic geology

Finding Einsteins in Unique Places:

GeoFORCE Texas

Doug Ratcliff
Jackson School of Geosceinces
The University of Texas at Austin

The UT-Austin Jackson School of Geosciences' GeoFORCE Texas Program addresses the critical need to increase opportunities for historically underrepresented women and minorities in careers in science, mathematics, and technology. This innovative program is designed to encourage students from minority-serving high schools in rural South Texas and inner-city Houston to take on the challenges of a rigorous math and science curriculum and pursue higher education and careers in these fields. Summer Academies and fieldtrips introduce students to exciting careers in the geosciences, involve them in authentic activities of a geoscientist, and inspire them to pursue higher education to prepare for science, technology, engineering, and mathematics (STEM) fields. This program builds collaborative partnerships among K-12 students and teachers, college students, university faculty, and working professionals.

presentation

april 5, 2010, bureau of economic geology

Jade Implements and Quarries in the Caribbean Realm

Sam Wilson
Department of Anthropology
The University of Texas at Austin

Recent archaeological research has shown beyond doubt there were prehistoric interactions between Caribbean people and the people of lower Central America. These apparently long-term vectors of diffusion are difficult to reconstruct in detail, and it is difficult to assess their significance for Caribbean prehistory. This presentation will explore new archaeological evidence for the long-distance diffusion of artifacts, especially jade, from Central America into the Caribbean. One likely source region for jade is Costa Rica. I will also discuss some of the ideas and ritual practices as well as cultural parallels in the cosmology, mythology, and ritual practice of the two areas.

presentation

may 3, 2010, bureau of economic geology

Ethiopian Geology and Petroleum Exploration in a War Zone

Bill St. John

Independent Petroleum Geologist, Kerrville

Geologically, Ethiopia resulted from the formation and breakup of several prehistoric supercontinents --- Rodinia, Pannotia, Pangea, and Gondwana. Basement rocks dominated the outcrops of the African continent until the Carboniferous-Early Jurassic Karoo rifting occurred, resulting in sediment-filled rifts from South Africa through Ethiopia. The encroaching eastern sea from the developing Tethys deposited Mesozoic sediments; clastic, carbonate and evaporite, across northeast Africa. Early Tertiary clastic sediments followed. Rifting, accompanied by volcanic activity, began in latest Oligocene and accelerated during the Miocene, resulting in extensive volcanic cover over much of Ethiopia. To date, petroleum exploration in Ethiopia has been concentrated in the eastern Ogaden Basin. That is now changing. A topographic map of northeast Africa indicates most of Ethiopia is a mountainous highland, 3,000-4,000 meters high, surrounded by hostile desert flatlands. Not only the environment, but the governments are hostile --- Sudan to the west, Somalia to the east and much of the south, and Eritrea to the north. The resulting isolation is considered responsible for the relatively backward development of Ethiopia. The so-called “Modern Period” of Ethiopia began with Emperor Tewodros II, through Yohannes IV, Emperor Menilek II, Emperor Lej Iyasu and Empress Zawditu. Emperor Haile Selassie was enthroned in 1930, ruled until 1974, then was overthrown by the Socialist Derg military and Mengistu Haile Mariam that controlled until 1991. The Ethiopian People’s Revolutionary Democratic Front (EPRDF) overthrew the Mengistu government in 1991, and the leader, Meles Zenawi, was elected Prime Minister of Ethiopia in 1995.

posters

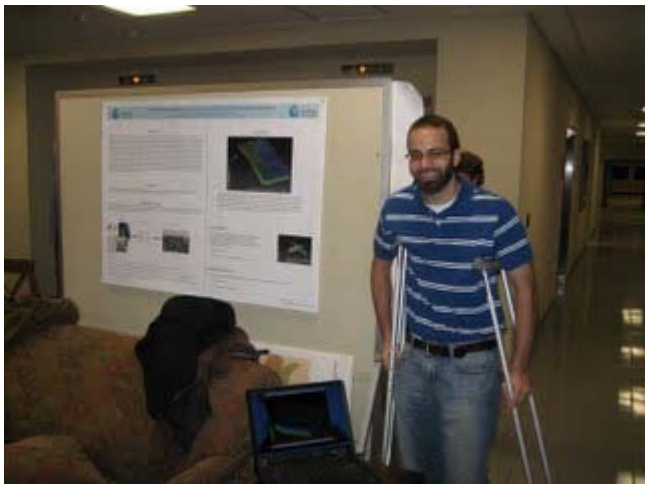
march 1, 2010, bureau of economic geology

The March meeting of the Austin Geological Society was the annual poster session meeting with about 13 posters on display. Below are some photos and a list of poster titles and authors.

- Springs of the Austin Area —Alan Cherepon; *Texas Commission for Environmental Quality*.
- Texas STATEMAP Program—Eddie Collins; *Bureau of Economic Geology*.
- Geologic Map of Mariscal Mt., Big Bend National Park— Patricia Dickerson[1] and Eddie Collins[2]; [1]University of Texas at Austin and the [2]*Bureau of Economic Geology*
- Promoting AGS Publications using Google Maps — Eddie Ficker, *App Geoscience.*
- Unusual hydrophysical response in a Edwards Aquifer monitor well: What is going on?—Brian B. Hunt; *Barton Springs/Edwards Aquifer Conservation District*.
- Three-Dimensional Geologic Model of the Barton Springs segment of the Edwards Aquifer, Central Texas — Brian B. Hunt, Nathanael Banda, and Brian A. Smith; *Barton Springs/Edwards Aquifer Conservation District*.
- Depositional Element Morphology and Architecture of the Atoka Interval, Fort Worth Basin, USA —Vishal Maharaj and Lesli Wood.
- University Geology Collections: An Untapped Resource — Ann Molineux; *Texas Natural Science Center*.
- An integrated geophysical study: Is there a cave on Bee Cave Road, Austin, Texas?—Mustafa Saribudak; *Environmental Geophysics Associates*.
- Don't Mess with a Geophysicist's House: A Case Study of Ground Penetrating Radar for Concrete Moisture Mapping and Void Detection in the Saturated Soil beneath the Concrete Foundation, Houston, Texas — Mustafa Saribudak; *Environmental Geophysics Associates*.
- Geophysical mapping of active Hockley growth fault in NW Houston, Texas: A few surprising results — Kadira Singh
- Hydrogeologic Atlas of the Trinity Aquifer in parts of Blanco and Hays Counties, TX; Doug Wierman, Alex S. Broun, and Wes Schumacher*; Hays-Trinity Groundwater Conservation District*.

Doug Wierman and Al Broun discuss some of the content of their pending publication: “Hydrogeolgic Atlas of the Blanco, Hays, and Travis Counties.”

Al Cherepon displays his poster of Austin Area springs and a sampling program for pesticides. His work is featured in this volume of the Bulletin.



Nathanael Banda displays a new 3D geologic model of the Barton Springs segment of the Edwards Aquifer.

Pat Dickerson discusses her work in West Texas.

Student science festival posters

The Austin Regional Science Festival was held at Palmer Auditorium on February 25, 2010. The following AGS members volunteered their time and talents as judges in the Earth Science and Environmental categories: Scott Tiller, Ernie Lundelius, Jim Sansom, Robert Baumgardner, and John Mikels. Five Austin area students were recognized for their exemplary projects with the AGS Award Package (Certificate of Recognition, Exhibition of their project at the AGS March Poster Session Meeting, a guided tour of the Bureau of Economic Geology, and publication of their project abstract in the AGS Bulletin). These five students include:

- Brittany Guy, Bowie High School (Austin Independent School District), "How Effective Are The Erosion Control Methods Used Around Sinkholes Draining to the Edwards Aquifer";
- Zachary Scott, Vista Ridge High School (Leander Independent School District): "Desalination Using Bacteria";
- Arnab Purkayastha, Harmony Middle School/Science Academy, Austin, Texas, "Do Sunspots Really Affect Our Lives";
- Vikram Parolkar, Harmony Middle School/Science Academy, Austin, Texas, "The Day After Tomorrow: T-test detection of abrupt transitions in model projections of climate"; and
- Claire Rowan, 6th Grade, Murchison Middle School (Austin Independent School District), "Is Your Countertop Killing You?"

John Mikels (Education Chair) presented Certificates of Recognition to 4 science fair students.

Desalination Using Bacteria

Zachary Scott
Vista Ridge High School

The purpose of this project is to find a way to perform desalination of saline water, using bacteria. If Bacillus subtilis remains in a saline solution, the salinity of the solution will decrease to a generally agriculturally safe level. Bacillus subtilis was grown on large Petri dishes with nutrient agar. The bacterial cultures were given an initial 24 hour growth period, then 40-80 mL of salt water was poured onto the plates. The salinity of the water was tested and a baseline of 36,388 ppm was established. The plates were put in an incubator for 6 hours, then removed and the water was tested with a salinity probe. The results varied by plate, with salinity ranging from 5230 to 7940 ppm. The water was then poured through a Britta water filter to remove excess bacteria. The water was added again to a Petri dish with B. subtilis and the salinity dropped an average 3796 ppm. The water collected from both tests was then applied to water bean plants, which are salt sensitive. After 14 days, the bean plants receiving the 3769ppm water were thriving, while the plants that received salt water, with a ppm of 36,388, all died within a day. The B. subtilis did cause a drop in the salinity to an agriculturally safe level. A t-test was used on all of the data from the plates and the chance of this happening in nature was less than .01%. For all of the test rounds the p value established was significant.

Zachary Scott is a student at Vista Ridge High School in Cedar Park, Texas.

Do Sunspots Really Affect Our Lives

Arnab Purkayastha
Harmony Middle School/Science Academy

There is little doubt that global temperatures have been rising and global natural disasters have been growing in number and severity. But why precisely this is happening, is still a debatable question. One theory is that, sunspots are causing an increase in temperature and global natural disasters. This research investigation looks into whether sunspots are affecting global temperatures and natural disasters. To test this, data from the Solar Influences Data Analysis Center, documenting the number of sunspots observed over the last 300 years were collected, analyzed, and graphed. Then, data from the International Disaster Database, covering all global natural disasters which occurred over the last 100 years were collected, graphed, and overlaid upon the sunspots data. After careful analysis, it was concluded that there was no correlation between sunspots and global natural disasters. Next, data from NASA over average global temperatures were taken, graphed and overlaid upon the sunspots data. Once again, after further analysis, no correlation was found. Thus, the final conclusion was reached that sunspots had no effect on global temperatures or global natural disasters.

Arnab Purkayastha is a student at Harmony Middle School/Science Academy, Austin, Texas.

The Day After Tomorrow: T-test detection of abrupt transitions in model projections of climate

Vikram Parolkar
Westwood High School

An abrupt climate change occurs when a climate system is forced to cross some threshold, triggering transitions in the variables of climate. However, this threshold for abruptness remains undefined in the scientific community. No method, to detect abrupt climatic change in current climate models (that assume freshwater forcing from Greenland), currently exists. Additionally, existing statistical methods are inaccurate because they assume unchanging distributions. Multiple best-fit regression analyses can be used to determine slope distributions of time series data plots. This paper demonstrates the ability to accurately detect abrupt shifts in a time series, by using t-test statistics that assume variable means and standard deviations. This t-test compares a data set both with a control set and with itself, internally and is run at a 99% confidence level to ensure the most accurate results with a percent error of only 0.1%. Finally, by graphing time series of highlighted grid points, the t-test is proven to be true. This new detection method of abrupt climate change can broaden the scope of future studies that investigate the reasons for, and find potential solutions to, abrupt climate change.

Vikram Parolkar is a student at Westwood High School, Round Rock ISD, Texas.

Is Your Countertop Killing You?

Claire Rowan
Murchison Middle School

The purpose of this experiment was to inform people about the potential hazards of granite. Granite may produce radon, which is currently the second-leading cause of lung cancer in the U.S. My procedures included testing 20 granite countertop samples with a Geiger counter. I tested gamma ray radiation both in the background and on the granite countertop (both sealed and unsealed parts). I found the averages of the range of data from the Geiger counter. For any samples that were greater than "double background" radiation, I did further testing with charcoal activated test kits. Then I sent in samples of the granite for laboratory analyses.

Out of 20 samples, only three had "double background" radiation numbers. Gamma radiation from the 20 samples ranged from 4.04 to 21.04 pCi/L, with most of the values falling in the 10-15 pCi/L range. Of the countertops that had "double background" radiation, the radon test results showed that these three granite countertops exhibited gamma emissions of less than 4.0 pCi/L, which is the level at which the EPA recommends homeowners should take action to reduce radon. So my experiment found a wide range of radon levels in the sample countertops but none of the samples were at a dangerous level.

Claire Rowan is a 6th grade student at Murchison Middle School, Austin, Texas.

austin geological society bulletin

field trip

Fall 2009 Field Trip

Urban Hydrology of Austin Texas: Some Halloween Tricks and Treats

trip coordinators:

C.M. Woodruff Jr. and Raymond Slade Jr.

trip summary:

By Ann Molineux and Brian Hunt

With the title “Urban Hydrology of Austin, Texas: some Halloween Tricks and Treats” this latest venture of Chock Woodruff and Raymond Slade sounded like a fun event. It lived up to expectations and indeed surpassed them on all fronts. There were 15 individual contributors and the resulting ‘expedition ‘was highly informative, great fun, and not without a mystery or two.

Raymond Slade reminded us of both the drought and the flood threats to Austin. Pete Rose followed with an interesting study of the El Nino and La Nina events and how tracking their cycles can be useful in planning and managing ranching in the Edwards plateau.

Colin Slagle, Brian Reis and William Espey put together an interesting description of the Waller Creek Tunnel project and its role in providing flood protection as well as the economic attraction of an Austin ‘river walk’. We stood at the proposed site of the intake tunnel in Waterloo Park, eventually diverting storm water from 3700 acres of urban watershed and discharging it into Lady Bird Lake. Doug Layman and Jeremy Gunter outlined the seismic refraction survey needed before the tunnel could be built. An onsite demonstration of the technique was really helpful.

Seiders Spring on Shoal creek was staked as the main ghost sighting spot. Sister Pat Elder took on the task on bringing us up-to-date on the history of the spring and Jim Sansom and Pat Bobeck produced a really interesting written account. The odd siphoning action of the springs and tales of bathhouses with beer, boiled eggs and dancing just seemed to set a suitable tone.

Just to keep up the intrigue, Barb Mahler and Peter Van Metre introduced us to the startling story of coal-tar pavement sealcoat and its contribution to polycyclic aromatic hydrocarbons (PAHs) in the urban environment. [Don’t ever sealcoat your driveway with this stuff!] We learned a technique to tell if a sealcoat was coal-tar based or not. You will be pleased to note that thanks largely to the work of Barb (and the USGS), Austin has banned the use of these sealants and several other cities in the USA have followed them. Raymond Slade then noted that PAHs were threatening water quality in Barton Springs although not yet a public health hazard.

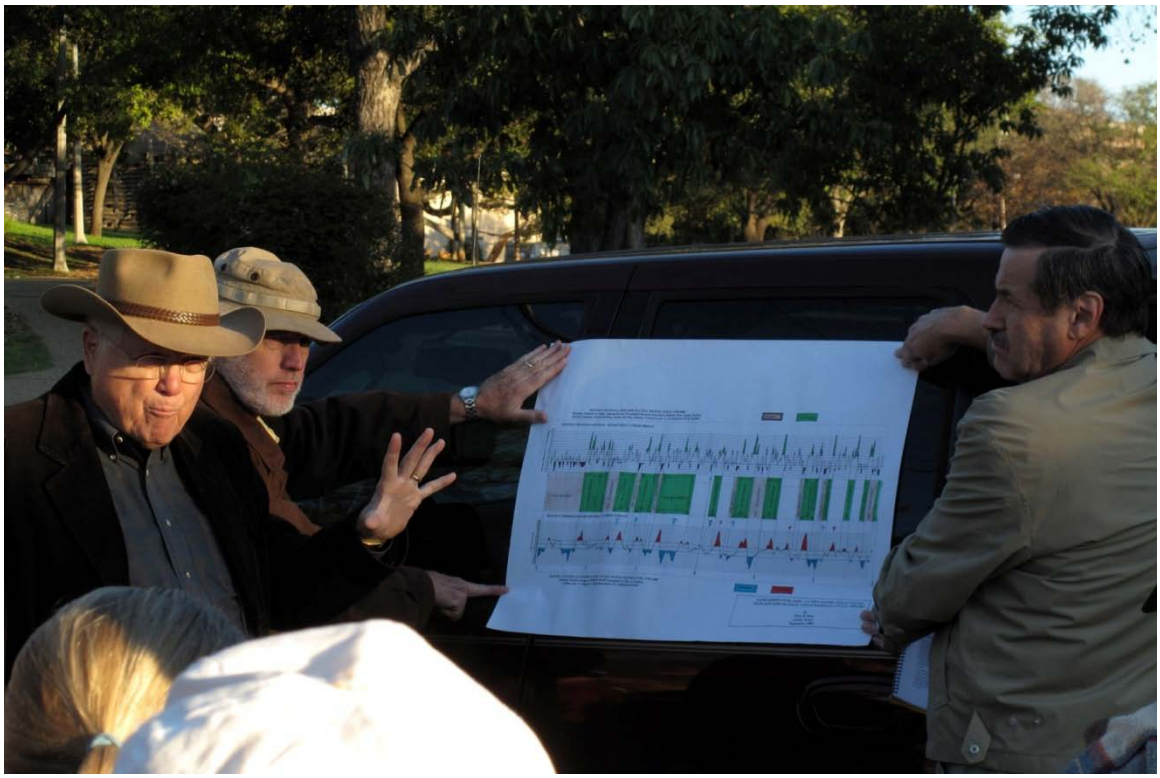
Lunch in Zilker Park and another myth was shattered by David Johns…the temperature of Barton Springs is NOT 68°F, measurements over the last 25 years indicate that the average is actually 70.2°F. Just remember that next time you are asked to state the average temperature of spring water. We were then treated to a lesson in how not to do a hydrologic dye study by Raymond Slade. Red dyed dogs in Town Lake were finally correctly attributed to leaking drums of red printing ink from the old Austin American Statesman building site, but the scientists had to bear the initial blame.

Next on the agenda was a detailed horror story from Jon Brandt and Larry Wilding who illustrated the hydrologic consequences of imported soils, or rather the reddish colored alluvial material, referred to by many gardeners as ‘red death’. This infertile, poorly structured material forms alternating hard crust in drought or muddy sludge in wet times.

The last stop was on Red Bud Island and Chock Woodruff discussed his work on the bedrock geology of Tom Miller Dam and the City’s water pipeline tunnel that passes beneath the island up to the treatment plant. Chock passed around his maps and photos of the tunnel work—a unique experience that not many geologists, especially in central Texas, get very often.

The trip was a great success and AGS is grateful for all the contributors and coordinators for a wonderful trip and producing a guidebook that will be a resource for years to come.

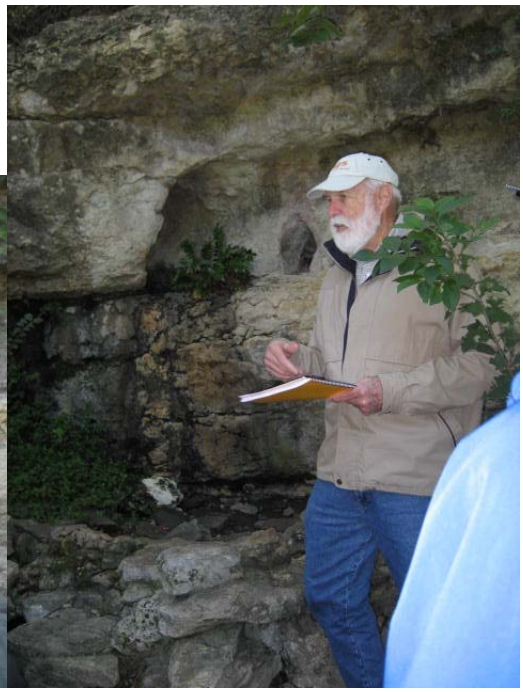
We had great weather and a full bus of geologists for a very interesting, if not scary, field trip to a variety of urban sites around Austin on Halloween. Field trip coordinators Chock Woodruff and Raymond Slade led a great trip and have a super guidebook (#31) as a result. Below are a few pictures.



Pete Rose discusses El Niño and La Niña events and how tracking their cycles can be useful in planning and managing ranching in the Edwards plateau. Photo by Jon Brandt.

Doug Layman and Jeremy Gunter demonstrated seismic refraction to map the soil-bedrock interface—this technique was used for the tunnel project. Photo by Jon Brandt.

Chock Woodruff and Jim Sansom speaking at Seiders Springs. Photo by Jon Brandt.



Sister Pat Elder discusses the history of the spring. Jim Sansom discussed the geology and hydrology of the spring and its odd siphoning action. Photos by Brian B. Hunt.

A USGS test site located at the BEG for studying seal-coat and PAHs. Photo by Jon Brandt.

Barb Mahler looks at the sample Raymond holds. A simple test was devised by the City to determine if the sealcoat was coal-tar based or not. Photo by Brian B. Hunt.

During our lunch break at Barton Springs, David Johns (right), spoke about Barton Springs temperature data—it's really 70.2° Fahrenheit. Photo by Jon Brandt.

Jon Brandt discusses the “soils” better known as “red death” to area gardeners. The soil is actually Colorado River Alluvial sediments and their use as a soil and fill has both hydrologic and biologic consequences. Jon also discussed the soils of the Glen Rose Formation of the Hill Country. Photos by Brian B. Hunt.

At our last stop of the day on Red Bud Island Chock discusses his work on the tunnel that passes beneath the river and transmits water to the City’s Water Treatment plant. Chock discussed the structures and a significant karst feature the tunnel encountered. Photo by Ann Molineux.

technical note

Select Springs of the Austin Area: Descriptions and Associated Hydrogeology

Alan J. Cherepon

Introduction

While Austinites are well aware of the most famous springs in the city, Barton Springs, few, including many geologists, are aware of the huge number of springs and seeps that grace the city. The City of Austin estimates over 700 such features (City of Austin database, unpublished). While impossible to address every one of them, representatives of the major spring types in the various rock and sediment units are presented herein. These springs are not described in the important work titled Springs of Texas (Brune, 2002), nor are they currently found in the internet-based Texas Water Development Board's Groundwater Database (TWDB, 2012).

A generalized geologic map is provided as Figure 1. Below the Edwards is the Walnut and Glen Rose Formations, which form the stair-stepped alternating beds of less-resistant marls and more-resistant limestones and dolomites. Springs in this formation appear in the western portion of the Austin area. Above the Edwards Group is the Georgetown Formation, which is combined with the Kainer and Person Formations to comprise the Edwards Aquifer in the Austin area. Above the Edwards Group is the Buda, Austin Chalk, and Colorado River Terrace Deposits, all of which include springs or seeps addressed in this summary.

Each of the springs and associated hydrogeologic units (except for a combined Edwards) will be presented stratigraphically from oldest to youngest. Figure 1 indicates by letters where the springs identified in this paper are located. The springs were chosen for the following reasons:

- Accessibility (both permission-wise and relative ease of getting to it in most weather conditions)
- Clear, impressive exposure of the rock units, or the best for that unit
- Classic stratigraphic characteristics for the units
- Adequate spring flow
- Additional interesting information

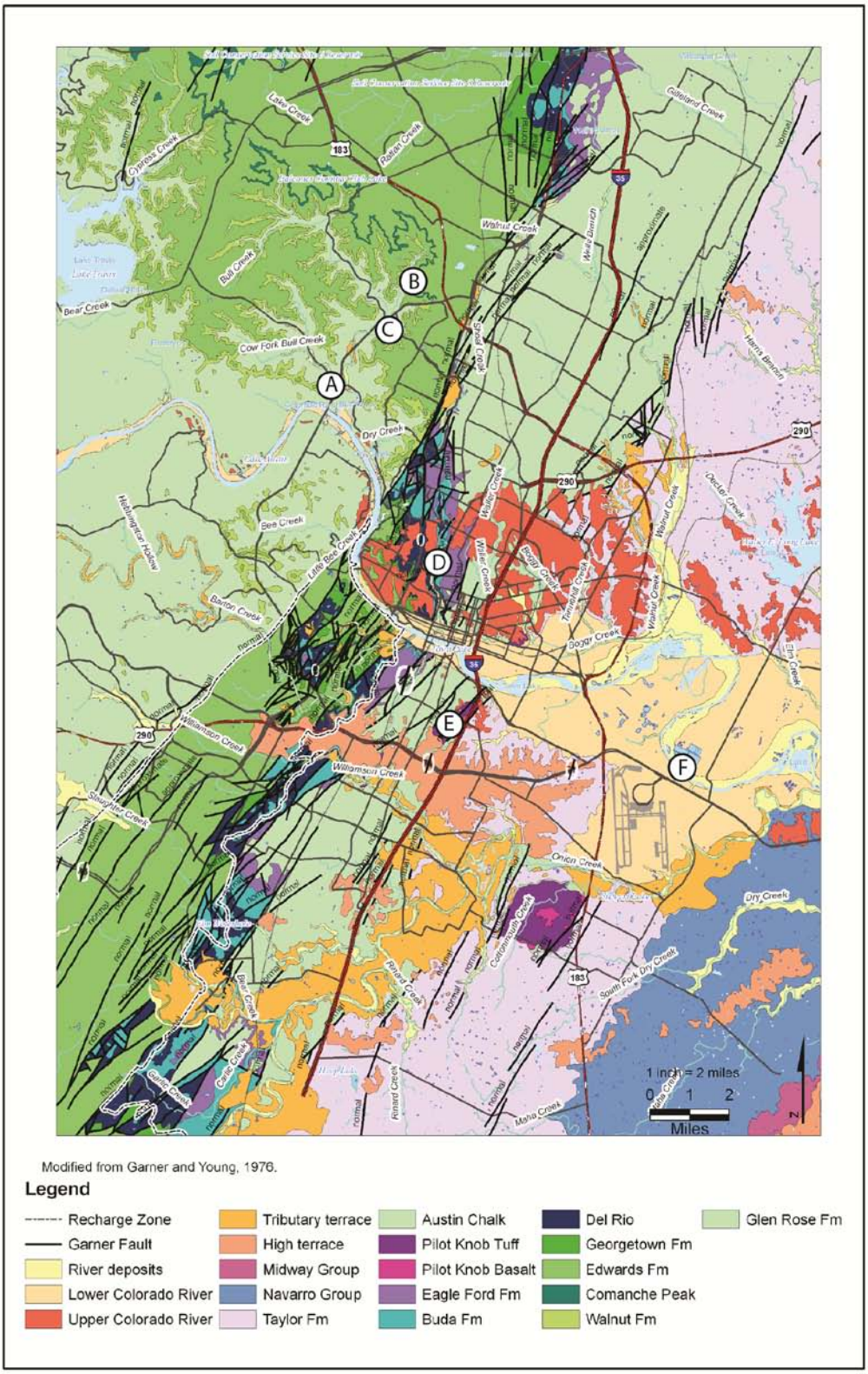


Figure 1. Geologic Map of Austin with springs indicated as A-F. Geologic basemap is from Garner et al., 1992.

A) Bull Creek (360) Springs (City of Austin database): Glen Rose Formation

The Glen Rose Formation and associated springs are typically found in the westernmost portion of the Austin area. Classic exposures are found along the Capitol of Texas Highway/Route 360, as stair-stepped examples of "layer-cake" geology. The overall structure is due to the weathered marl layers intermittently located between the resistant limestone and dolomite beds. Some good crystals of calcite and Celestine (the correct name for this mineral is Celestine, not celestite, as per the International Mineralogical Society and agreed to by the Mineralogical Society of America, however it is commonly and often still referred to as celestite) have been found along Hwy 360, and dinosaur footprints can be found in the South Fork of the San Gabriel River a little upstream from Hwy 183 in Leander. The seeps at the southwestern corner of Hwy 360 and FM 2222 provide a good view of several features in this spring-bearing unit, including (Figure 2):

- Tufa/Travertine deposits formed by seepage dripping down the bedding planes (note rapid deposition on roots and fresh leaves)
- Mini-caverns/vugs formed by the dissolution of the limestone, dolomite and evaporate materials, complete with mini-stalactites, columns, and root and weed coatings
- Colluvium (paleo creek-fill material above the Glen Rose)that allows for greater water flow to the underlying Glen Rose
- Textbook Glen Rose, with alternating more and less resistant beds forming characteristic stair-step stratigraphy along Hwy. 360

The exposure of the Glen Rose is a classic gravity-fed spring mechanism, where waters percolate downward from the hills above this steep road-cut. If the road cut had not been made, the waters would have naturally discharged along West Bull Creek near its confluence with the main stem of Bull Creek at FM 2222 and Hwy 360. The waters above percolate down through the colluviums and into fractures and faults in the Glen Rose, and when they encounter more solid beds, preferentially flow along the bedding planes and discharge through gravity flow at the cut face, or at dissolution openings as seen at the base of the cut.)

Figure 2. Small grotto and spring with lime encrusted roots, location A on Figure 1, Hwy 360 and FM 2222, Glen Rose Formation.

B) Great Hills Springs (City of Austin database): Walnut Formation

The Walnut Formation and associated springs are concentrated primarily in the northwestern portion of the Austin area. These exposures, which include Great Hills Park Spring, are located along an unnamed tributary that feeds into Bull Creek, in the Great Hills neighborhood of northwest Austin. The thin, weathered marly, argillaceous/silty beds are located below the fossil rich, honeycombed beds of the basal Edwards Kainer Formation, Kirschberg equivalent member. The lower portion of the Walnut is a thick, dense subgraphic limestone, which includes small fossils of gastropods, pelecypods, and hollow, calcite crystal-lined geodes above the Glen Rose. This is an example of a gravity flow spring, with surface waters trickling through the honeycombed Edwards above and into the Walnut beds and migrating down to the top of a confining unit. The springs are more like seeps trickling down to the thin upper beds of the Walnut, and vertically along faults or fractures on the cutbank cliff faces into a small, unnamed creek. Features in this unit include the following (Figure 3):

- Thin tufa layer coating cliff faces and surrounding vegetation, from seepage dripping down the cut-face

- A vertical fracture or fault showing vertical movement of water through more resistant beds
- A good exposure of the calcite geodes identified in several papers
- A view of what the Walnut Formation looks like in northwestern Austin, as one of the minor spring/seep-bearing units
- A great view of the honeycombed member of the Edwards and underlying Walnut

Figure 3. Hearth Springs, located in the Floral Park Drive and Raining Oak Cove, Great Hills neighborhood.

C) Stillhouse Hollow Spring (City of Austin database): Edwards Aquifer, Kainer Formation, Kirschberg Evaporite Member equivalent

Most field trips and papers frequent Barton Springs, as it is the classic Edwards aquifer location, is located in a park, and has an education center. The Stillhouse Hollow location is less frequently visited, but offers many interesting features not present at Barton Springs. The Kainer Formation and associated springs are found in the western half of the Austin area. This exposure is located off Spicewood Springs Road, near Hwy 360. City of Austin dye trace studies both in the preserve and adjacent neighborhood showed rapid travel times from karst features to springs. A sinkhole is visible next to the trail about 100 yards from the entrance. The honeycombed Kirschberg Evaporite Member equivalent is located above the more resistant and confining limestone bed of the Walnut Formation. The spring is another example of a gravity flow spring, with surface waters migrating into the honeycombed unit to the top of the confining unit, and down slope to this discharge point in a steep ravine. The trade-offs between this spring versus Barton Springs include the visible rock units and karst features. The spring is adjacent to

a rock shelter/observation deck in a City of Austin park (Balcones Canyonlands/Stillhouse Hollow Preserve). The spring area itself is off limits to the public due to the sensitive nature of the site and the presence of the Jollyville Plateau Salamander, a candidate for listing as an endangered species. Features in this unit include the following (Figure 4):

- Numerous karst features (sink hole, rock shelter, numerous springs)
- Great exposure of the Kirschberg Evaporite Member equivalent (honeycomb solution vugs)
- Large tufa mound and terraces in hollow just below spring
- Sensitive environment (Jollyville Plateau Salamander)
- Estimated flow rate

Figure 4. Stillhouse Hollow Spring, located in the Balcones Canyonlands/Stillhouse Hollow Preserve.

D) Big Boulder Springs (City of Austin database): Buda Formation

Big Boulder Springs are located on Shoal Creek and 29th Street, a little southwest of where the streets intersect next to the trail. The spring is another example of a gravity flow spring, with surface waters migrating down the overlying terrace deposits and Buda limestone, along fractures and faults and discharging at an opening along bedding plane where the fractured/faulted Buda sits on top of the Del Rio Clay. Similar springs are present adjacent to Shoal Creek from the Pease Park area to near Koenig Lane. Features in this unit include the following (Figure 5):

- Great exposure of the Buda Formation limestone above the Del Rio Clay
- Good, steady spring flow, not just a seep
- Tufa deposits

Figure 5. Big Boulder Spring, on Shoal Creek and 29th Street, in the Buda Formation above the Del Rio Formation.

E) Blunn Preserve Springs (City of Austin database): Austin Chalk Formation

The Blunn Preserve is located along Blunn Creek off St. Edwards Drive. The spring and seeps alongside the creek are also examples of a gravity flow springs, with surface waters migrating through fractures and along bedding planes to the top of the confining unit, and down slope to discharge points alongside Blunn Creek in several places. The beds of the Austin Chalk exhibit slopes off the side of the buried volcano that lies beneath nearby St. Edwards University. Brecciated, solutioned beds appear to be a major water unit, sandwiched between more massive and less transmissive beds of the chalk. Features in this unit include the following (Figure 6):

- Brecciated, solution features in the main water-bearing unit
- Blocky and nodular fossiliferous beds with abundant oyster beds

Figure 6. Blunn Preserve Springs, off St. Edwards Drive, along Blunn Creek in South Austin.

Costley Spring (F, Texas Water Development Board WIID database, 2010): Colorado River Terrace Deposits

Costley Spring is entirely in terrace deposits above the present-day Colorado River. It is located in Del Valle, on the east side of Hwy. 71, before toll road 130 and Austin-Bergstrom Airport, far southeast Austin. The location is the site of a former gristmill from the 1880s, with only the dam remaining. The springs can be seen leaking from a gravel bed of the terrace sediments just downstream from the dam, along a steep cut face with about a 30-foot drop from the dam to the pool below. This may be the best gravity fed spring exposure in the terrace deposits, exhibiting classic sediment layering of finer and very coarse beds through which surface waters percolate to the gravel bed that sits on top of the Taylor Clay and into the incised valley the stream cut through these sediments and the underlying clay. Just to the northwest are impressive bluffs on the Colorado River across from Hornsby Bend. Features in this unit include the following (Figure 7):

- Classic gravel bed in Terrace deposits as water-bearing unit above the Taylor Clay confining unit
- One of several springs in Austin that issues from permeable unit downstream from a dam
- Very picturesque and historical, yet relatively unknown site

Biography

Alan Cherepon received his BA in geology from Rutgers University in 1976 and began his professional career in Texas that year. He worked several years in uranium and oil and gas exploration before changing over to environmental and hydrogeologic work. He is a past-president of the AGS (2006-2007), and this paper will eventually become the third field trip and guidebook he has prepared and conducted for the society. He is presently employed by the Texas Commission on Environmental Quality conducting work to prevent pesticide contamination of groundwater, which he has done for the past 14 years. It is his spring sampling for pesticides in Austin and San Antonio that led to the writing of this note and eventual field guidebook and field trip anticipated in the future.

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TWDB, Water Information Integreation & Dissemination System (WIID), http://wiid.twdb.texas.gov/

Figure 7. Costley Spring issuing from a terrace deposit gravel bed on top of the Taylor Clay in southeast Austin.

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Faults and Fractures in the Balcones Fault Zone, Austin Region, Central Texas by E. W. Collins and S. E. Laubach, Coordinators with an experimental demonstration by B. C. Vendeville and a summary of the regional fracture patterns by W. R. Muehlberger. Includes road log. Guidebook 13, 1990, reprinted 2004, 34 p. **AGS 013, $12.00**

Water Quality Issues for Barton Creek and Barton Springs by D. A. Johns, Field Trip Leader. Guidebook to field trip containing road log of eight stops, excerpts from the report of the Barton Springs Task Force to the Texas Water Commission, and five articles on Barton Creek and Barton Springs. Guidebook 14, 1991, 95 p. **AGS 014, $15.00**

Edwards Aquifer–Water Quality and Land Development in the Austin, Texas, Area by D. A. Johns and C. M. Woodruff, Jr. Includes six articles and a road log to six stops in the Austin area. Guidebook 15, 1994, 66 p. **AGS 015, $10.00**

Fractures Caused by North-South Compression, Eastern Llano Uplift, Central Texas: **A Field Guide** by David Amsbury, Russell Hickerson, and Walter Haenggi. Includes road log and details of six stops. Guidebook 16, 1991, 31 p. **AGS 016, $8.00**

Zilker Park Walking Tour Guidebook: A Recreational Visit to the Edwards Limestone by J. L. Walker and P. R. Knox. Includes the geologic setting of the Zilker Park area with a guide to Zilker Park trail (11 stops) and a guide to the Barton Creek greenbelt (8 stops). Well illustrated. Guidebook 18, 1994, 48 p. **AGS 018, $10.00**

A Look at the Hydrostratigraphic Members of the Edwards Aquifer in Travis and Hays Counties, Texas by N. M. Hauwert and J. A. Hanson, Coordinators. Seven articles and a field trip road log that represents an update of research focusing on the Barton Springs segment of the Edwards Aquifer. Guidebook 19, 1995, 81 p. **AGS 019, $15.00**

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Geology, Frontier History, and Selected Wineries of the Hill Country Appellation, Central Texas by P. R. Rose and C. M. Woodruff, Jr. Guidebook 25, 2005, 109 p. **AGS GB 25, $15.00**

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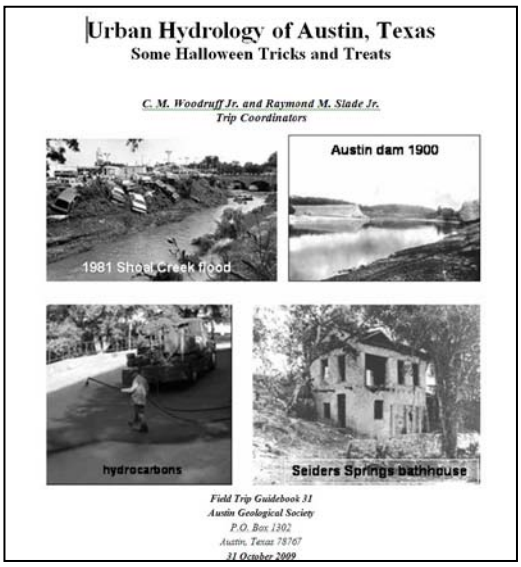

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James R.	Underwood
Scott	Underwood
Shane	Valentine
Cassie	Vauter
Joe J.	Vickers
Timothy	Walter
Aaron	Weeger
Houston I.	Welch
Jerry	Wermund
Leslie P.	White
Jerry	Wick
Douglas A.	Wierman
Charles R.	Williams
Stephanie	Williams
Clarence	Winzer
Charles M.	Woodruff
Rosemary	Wyman
Daisie	Young
Steve	Young
Doug	Zarker
Mark	Zell

AUSTIN GEOLOGICAL SOCIETY

CONSTITUTION

Approved October 7, 1965
Revised December 21, 1990
Revised August 14, 1995
Revised May 1, 2000
Revised August 27, 2007

ARTICLE I

Name and Objectives

Section 1. This organization shall be named "Austin Geological Society."

Section 2. The objectives of the Society are:

(1) to stimulate interest in and promote advancement of geology;
(2) to facilitate discussion and dissemination of geologic information;
(3) to encourage social and professional cooperation among geologists and associated scientists;
(4) to maintain a high professional standing among the members; and
(5) to enhance public understanding of the professional activities of the members.

ARTICLE II

Membership

Section 1. The members of the Society shall consist of persons concerned with the science and practice of geology.

Section 2. Various classifications of memberships and qualifications thereof shall be established by the Bylaws of the Society.

ARTICLE III

Government

The government of the Society shall be vested in five (5) elected officers and an Executive Board. The composition of this government, the manner of selection, the terms of office, the specific duties, responsibilities, and other matters relevant to such bodies and officers shall be as provided in the Bylaws of the Society. Any responsibility and authority of government of the Society not otherwise specified in these governing documents shall be reserved for the Executive Board.

ARTICLE IV

Amendments

Amendments to this Constitution may be proposed at any time by petition signed by at least 20 percent of the Active Members or by the Executive Board. Adoption of such amendments shall be by ballot in which approval is given by at least three-fourth of the total number of Active Members. There shall be an intervening Regular Meeting before the balloting and subsequent to the submission of the amendment.

ARTICLE V

Dissolution of Society

In the event it should be deemed advisable to dissolve the Society, all assets at the time of dissolution shall be donated to a worthy geologic cause, as selected by the Executive Board.

ARTICLE VI

Bylaws

The Bylaws, consisting of six (6) articles as appended hereto, are adopted and may be amended, enlarged, or reduced as provided in the Bylaws.

AUSTIN GEOLOGICAL SOCIETY

BYLAWS

ARTICLE I

Membership

Section 1. The membership of this organization shall be made up of Active, Honorary, and Student Members.

(1) To be eligible for Active Membership, an applicant shall have a degree in geology from a recognized college or university, or the equivalent experience, or have been actively engaged in the application of geology or related scientific or professional work for a minimum of two (2) years.

(2) Consideration for Honorary Membership shall be based on continued dedication and service to the Austin Geological Society. Honorary members shall be selected by the Executive Board. Any Active Member may submit the name of an individual to the Executive Board for consideration as an Honorary Member.

(3) Any person who is a student in good standing, studying for a degree in geology or related science, is eligible for Student Membership. Student Members shall not be eligible to vote or hold elective office.

Section 2. Any member who is in arrears of dues or legally incurred indebtedness to the Society shall be suspended from the Society. The Executive Board shall restore former membership status to any such suspended member when the indebtedness has been liquidated.

Section 3. All Active, Honorary, and Student Members shall be guided by the highest standards of business ethics, personal honor, and professional conduct. Any member who, after proper investigation by the Executive Board, is found guilty of violating any of these standards of conduct may be admonished, suspended, allowed to resign, or expelled from membership at the discretion of the Executive Board.

Section 4. Applicants for membership shall submit an application and dues to the Treasurer. Membership applications shall include the following information:

(1) Professional affiliation,
(2) Education, and
(3) A statement of how the prospective member qualifies for membership.

New members shall be announced in the next newsletter and introduced to the Society at the next meeting.

ARTICLE II

Dues and Special Assessments

Section 1. The annual dues for Active Members and Student Members of the Society shall be established at the beginning of each administrative year by the Executive Board. Dues shall be payable on or before November 1 each year. No dues shall be required of Honorary Members.

Section 2. Dues for new members who join the Society after the beginning of the administrative year shall be prorated according to the quarter of the administrative year.

Section 3. Members who are in arrears for dues and/or special assessments for a period of three (3) months shall be deemed suspended and may be dropped from the rolls at the discretion of the Executive Board. Such former members may be reinstated by the Executive Board upon payment of dues and/or special assessments in arrears plus a reinstatement fee of 25 percent of the amount owed.

ARTICLE III

Officers

Section 1. The officers of this organization shall be the President, President-Elect, Vice-President, Secretary, and Treasurer. The tenure of these officers shall be one (1) administrative year.

Section 2. The duties of the President shall be to preside at all meetings, call Special Meetings, appoint such committees as are not provided for in the Bylaws, and, jointly with the Secretary and Treasurer, sign all written contracts and other obligations of the Society. The President shall assume the duties of Chairperson of the Executive Board and supervise the business of the Society. The President

shall also be responsible for making arrangements for a meeting place for Regular Meetings and providing for an annual audit of financial records.

Section 3. The duties of the President-Elect shall be to participate in Executive Board meetings and serve as understudy to the President. The President-Elect will assume the office of the President the following year. The President-Elect shall also serve as Chairperson of the Election Committee.

Section 4. The duties of the Vice-President shall be to assume the office of president when a vacancy for any cause occurs and assume the duties of the President during the absence or disability of the President. In addition, the Vice-President shall serve as Chairperson of the Technical Program Committee.

Section 5. The duties of the Secretary shall be to keep the Minutes of all meetings, to attend to all correspondence and press notices, to receive and be custodian of all documents and papers of the Society, and to notify all Executive Board members of each Executive Board Meeting. The Secretary shall also serve as Chairperson of the Newsletter Committee. The Secretary, jointly with the President and Treasurer, shall sign all written contracts and other obligations of the Society and shall assume the duties of the President in the absence of the President and Vice-President.

Section 6. The duties of the Treasurer shall be to receive and disburse all funds as authorized by the Society, to keep accurate accounts thereof, and to submit annually a report of the Treasurer's records for auditing. The Treasurer shall be present or delegate a substitute to be present at each Regular Meeting to collect monies and membership applications. The Treasurer, jointly with the President and Secretary, shall sign all written contracts and other obligations of the Society, and shall assume the duties of the President in the absence of the President, Vice-President, and Secretary.

Section 7. The Executive Board shall consist of the President, President-Elect, Vice-President, Treasurer, and the last available past President. The Executive Board's duties shall be to appoint officers to fill vacancies occurring during the administrative year, except the office of President to which the Vice-President shall succeed; and to have general supervision of the organization.

Section 8. The election of officers shall be held at the Annual Meeting. Nominations shall be made by the Election Committee consisting of the President-Elect and at least two members appointed by the President-Elect. This Committee shall nominate two or more candidates for each elective office to be announced in the Society Newsletter prior to the Annual Meeting. At the Annual Meeting, additional nominations may be made from the floor following the report of the Election Committee. The Election Committee shall be responsible for preparation, distribution, and collection of the ballots at the Annual Meeting, and the tabulation of the results of said balloting. The committee shall present the results

of the balloting to the President of the Society during the Annual Meeting so that the newly elected officers may be presented to the Society. Voting shall be by secret ballot. Ballots shall be distributed during registration at the Annual Meeting and shall be returned to the Election Committee upon completion. If none of the candidates for a particular office obtains a majority of the votes cast, the candidate with the least number of votes shall be eliminated and a second ballot taken. If there is a tie between two candidates, a second ballot shall be taken at the Annual Meeting. If, after the second ballot, there is still a tie, the winner shall be decided by the flip of a coin.

ARTICLE IV

Standing Committees

Section 1. There shall be the following Standing Committees within the Society:

- Publications Committee,
- Technical Program Committee,
- Newsletter Committee,
- Field Trip Committee,
- Membership Committee,
- Web Committee,
- Election Committee,
- Awards Committee,
- Education Committee, and
- AGS Bulletin Committee.

The President shall appoint a Chairperson to those committees not already chaired by an officer. These appointments shall be for one administrative year. The Chairperson of a Standing Committee may, in turn, appoint any additional members in good standing with the Society to his or her committee.
In addition to the aforesaid standing committees, there is the Nominating Committee, as previously set forth in Article III, Section 8, of the Bylaws. The President may appoint any special committees as the Executive Board may authorize.

Any Committee Chairperson or member may be removed and replaced by a new appointee upon majority action of the Executive Board.

Section 2. The purpose of the Publications Committee is to oversee the sale of Society publications and assist in the publication of any other manuscripts or documents the Executive Board may authorize.

Section 3. The function of the Technical Program Committee is to provide a program for the Regular Meetings of the Society and to make necessary arrangements for that program.

Section 4. The function of the Newsletter Committee shall be to prepare and mail a newsletter to serve as an announcement of Society Meetings.

Section 5. The purpose of the Field Trip Committee shall be to organize the Society field trips on a suggested schedule of one in the fall and one in the spring.

Section 6. The Membership Committee shall encourage membership, assist the Treasurer and Newsletter Chairperson, maintain a list of active members, and prepare the Society Directory.

Section 7. The Web Committee shall be responsible for the design and upkeep of the Society Web page.

Section 8. The Awards/Scholarship Committee shall nominate and recommend award and scholarship candidates to the Executive Board.

Section 9. The Education Committee shall be responsible for promoting and facilitating AGS involvement in earth science education in Austin-area schools and outreach to the general public.

Section 10. The AGS Bulletin Committee is composed of an Editor (Chairperson) and an editorial team responsible for the annual publication [of the Society] summarizing significant news and events from the preceding year, including the abstracts of talks given at the monthly meetings. It is also a forum for publication of geoscientific papers and notes of regional interest.

ARTICLE V

Meetings

Section 1. The meetings of the Society shall be of three classes: Regular, Executive Board, and Annual.

Section 2. The Society shall hold at least one Regular Meeting each month from August through April except that, by vote of the Executive Board, additional Regular Meetings may be held or Regular Meetings may be discontinued for a period not to exceed three months. The appropriate time and place for Regular Meetings shall be selected by the President or a delegated Committee.

Section 3. Executive Board Meetings shall be held at such times and places and for such purposes as the Executive Board deems necessary and as announced by the President.

Section 4. The Annual Meeting shall be held during the month of May at a place and time designated by the Executive Board. The purpose of this meeting will be to complete the business of the administrative year and shall include the following order of business:

(1) Report of the Executive Board, the President, the Treasurer, and the Standing Committees. Standing Committees may be considered with the report from the President.
(2) Old or unfinished business.
(3) New business.
(4) Election of new officers.
(5) Program.
(6) Presentation of new officers.

Section 5. The administrative year shall be from August 1 of one year to July 31 of the following year.

ARTICLE VI

Awards

Section 1. The Awards Committee shall submit recommendations to the Executive Board for the Public Service Award, the Distinguished Service Award, and for scholarships to be awarded by the Society.

Section 2. The Public Service Award shall be given to recognize contribution of members to the Society to public affairs and to encourage geologists to take a more active part in such affairs. The recipient shall be a member of the Society, but may be in any class of membership. This award may be given without regard to previous awards. Granting the award in any year shall be discretionary.

Section 3. The Distinguished Service Award shall be given to members who have distinguished themselves in singular and beneficial long-term service to the Society. The emphasis shall be on long-term and, at the same time, meaningful service to the Society. The term singular does not necessarily mean without precedence, but rather that the activity be specific as distinguished from general service. More than one member of the Society may be considered in any one year for the award, but Honorary Members should generally be excluded.

Section 4. Scholarships shall be awarded from an endowed scholarship fund. The Executive Board shall select scholarship recipients from candidates recommended by the Awards Committee. Granting scholarships in any year shall be discretionary.

ARTICLE VII

Amendment to Bylaws

Amendments to the Bylaws shall be made by vote of three-fourths of the Active Members present at any Regular Meeting, provided that due notice of the proposed amendment has been submitted to the members of the Society at least two weeks in advance of the date on which the ballot is taken, and provided a quorum (twenty-five percent of the Active Membership) is present at said meeting.