2018 Spring MSEIP Colloquium

Date: **Friday, April 27, 2018**
Time: **1:30 pm to 5:30 pm**
Where: **MS 2.02.53**

Dear students and mentors:

Thank you for taking time from your busy schedule to contribute to the success of the MSEIP Program. The colloquium contains 18 research papers. The content covers a diverse spectrum of contemporary topics from geology, environmental science, and civil engineering. Six ESE PhD students from different fields of Geology, Environmental Science and Engineering will serve as the judge committee to evaluate all the presentations. Each poster consists of ~5 minutes presentation with ~5 minutes of judges asking questions, maximum 10 minutes. The judge committee will rank the top presentations based on the overall quality and professionalism. Cash awards will be given to top 5-6 presenters: first place ($250), second place ($200), and third place ($100).

Judge Committee (ESE PhD Students):

Chris Ray, Dawit Tesfaldet, Lijun Tian, Salman Sakib, Seyed Omranian, and Shuang Xia

Final Program of 2018 Spring Colloquium				
Poster #	**Student**	**Major**	**Mentor**	**Title**
1:30 pm - 3:00 pm: Poster Session 1				
#1	Adetunji Adeleye	Geoinformatics	Hongjie Xie	Physical processes of precipitation using vertical pointing miroradar
#2	Armando Montante	Civil and Environmental Engineering	Heather Shipley	The role of quorum sensing in the development of *M. aeruginosa* blooms: gene overexpression
#3	Corbin Reyes	Environmental Science	Jeff Hutchinson	Establishment of Aquatic Macrophytes in the San Antonio River - Pilot Study

#4	David Luna	Geology	Alberto Mestas	Spatial Variability in Biogeophysical Water Properties in the Northern Gulf of Mexico from Buoyancy Glider Observations
#5	Erica Saucedo	Geology	Yongli Gao	How Groundwater and Surface Water Interactions Respond to Storm Events: Cibolo Creek, Kendall County, TX
#6	Fabiola Estrada	Civil and Environmental Engineering	Vikram Kapoor	Tracking the Primary Sources of Fecal Pollution in the Recharge and Contributing Zones of Edwards Aquifer in Bexar County, TX using Molecular Tools
#7	Jerry Chavez	Geoinformatics	Newfel Mazari	Land use Land cover variability over the Edwards Aquifer boundary from 1990 to 2017
#8	Jorge Riva	Geology	Blake Weissling	Orthorectification of thermal/optical imagery of Antarctic sea ice: an application of MATLAB
#9	Karen Mendiondo	Geology	Alberto Mestas	Statistics of Surface Ocean Currents and Surface Winds in the Gulf of Mexico Continental Shelf Region
3:00-3:15 Coffee Break				
3:15 pm - 4:45 pm: Poster Session 2				
#10	Katie Miick	Environmental Science	Jeff Hutchinson	The Effects of Freezing Temperatures on *Lygodium japonicum* Spore Germination
#11	Kristen Cabatingan	Geology	Yongli Gao	Modeling the Brackish Water Zone in the Edwards Aquifer - Analyzing the Water Interaction with Limestone Using PHREEQC
#12	Mara Alcantara	Environmental Science	Brian Laub	Vegetation Patterns along Environmental Gradients on a Portion of Guadalupe River in Kerrville, Texas
#13	Maria Solis	Geology	Walt Gray	Petrology and Geochemistry of Enclaves in the Marschall Creek Dike Complex A study of the enclaves from the Enchanted Rock Batholith

#14	Miguel Bernardo	Geology	Alex Godet	The significance of hardground surfaces in the Austin Chalk Group of south Texas
#15	Muhammad Sharif	Biology	Newfel Mazari	Analysis of Hurricane Harvey Rainfall
#16	Robert Ramirez	Geology	Judy Haschenburger	Suspended Sediment Transport in the San Antonio River near Floresville
#17	Sergio Teran	Geology	Steve Ackley	Snow Cover in the Antarctic and its Contribution to Sea Ice Formation and Properties
#18	Tiffany Faller	Geology	Lance Lambert	Apparatus Reconstruction of the Genus *Gondolella*
4:45-5:00pm Coffee Break and Judge Meeting for Ranks				
5:00-5:30pm Award Ceremony				

Physical processes of precipitation using vertical pointing microradar

Adetunji Adeleye and Hongjie Xie
Department of Geological Sciences

The importance of hydrometeorology/water resources cannot be over-emphasized because precipitation is the major component for depositing most of the fresh water on earth and it also plays a major role in shaping (or molding) the landscape.

We have realized the importance of documenting the processes (rainfall size distribution, liquid water content, drop size) and rates of precipitation over the past centuries but have always relied on the rain gauge to do this. Rain gauges have limitations such as backlash, measurement only at ground level and from a point (rather than area), wind ect. These measurements do not also include the physical variabilities between different rain types and events which we need to accurately monitor and the form of physical processes involved in each rain event.

This paper hopes to provide valuable information about these physical characteristics that might be useful for weather warning systems, telecommunications, air traffic control or other relevant uses.

The role of quorum sensing in the development of *M. aeruginosa* blooms: gene overexpression

Armando Montante, Gisella Lamas-Samanamud, Heather Shipley
Department of Civil and Environmental Engineering

Microcystin is a cyanotoxin produced by *Microcystis aeruginosa*. This toxin causes serious damages to the liver and thus, it affects aquatic plants, fish and even human health. One of the largest events associated to algal bloom of *M. aeruginosa* happened in 2014, when microcystin concentration increased to 200 μg/mL. This was the highest record for the presence of this toxin in Lake Erie. However, this toxin can also be found in surface waters of creeks around San Antonio such as Leon Creek. *M. aeruginosa* growth is also favored by warmer temperatures. Therefore, water contamination and warming conditions could potentially increase the frequency and the scale of events such as the one in Lake Erie in 2014. This project focuses on the expression of the gene *luxS* in *M. aeruginosa* and how it affects the development of algal bloom. The *luxS* gene in *M.aeruginosa* PCC7806 is associated to quorum sensing. This cell-cell communication may be responsible for algal bloom and consequently, microcystin production. Herein, the *luxS* gene will be tested by q-PCR throughout *M. aeruginosa* growth for 30 days to determine its concentration in the growth media. To determine which are the possible proteins involved in the bacterial cell growth and in the production of toxin(s), a study of DNA and RNA is going to be carried out. These results could possible lead to the development a biomarker which indicates the exact time in which samples reached the quorum sensing "on" switch that causes biofilm formation, toxin production.

Establishment of Aquatic Macrophytes in the San Antonio River - Pilot Study

Corbin K. Reyes and Jeffrey T. Hutchinson
Department of Environmental Science and Ecology

Aquatic macrophytes contribute to the biodiversity of rivers by providing different types of structure for algae, invertebrates and fish. However, macrophytes are mostly absent in the San Antonio River. This study will evaluate an attempt to establish native aquatic macrophytes in the Missions District of the San Antonio River in South-Central Texas. Plots (n= 6, 0.25 m^2) of single species monocultures and five species polycultures will be established in the Missions District with 12+ native aquatic macrophytes. Macrophytes that will be planted include *Heteranthera dubia* (water star-grass), *Potomogeten illinoensis* (Illinois pondweed), *Ludwigia repens* (creeping primrose willow), *Hydrocotyle umbellate* (water pennywort), *Bacopa monnieri* (water hyssop), *Equisetum hyemale* (scouring horsetail), *Pontederia cordata* (pickerelweed), *Justicia americana* (American water willow), *Marsilea macropoda* (water clover), *Sagittaria platyphylla* (delta arrowhead), *Paspalum distichum* (knotgrass), and *Leersia oryzoides* (rice cutgrass). Plots will be established in areas with no water velocity and areas with low water velocity (< 0.15 m/s). Growth, competitive ability and survival of each species will be evaluated from May to August of 2018 as a pilot study for a 4-year project. The results of this study will be used to guide future macrophyte plantings in the San Antonio River to increase structure and composition within the river and increase aquatic diversity.

Spatial Variability in Biogeophysical Water Properties in the Northern Gulf of Mexico from Buoyancy Glider Observations

[1]David Luna, [1]Alberto M. Mestas-Nuñez, and [2]Steven Francis DiMarco
[1]Department of Geological Sciences, University of Texas at San Antonio
[2]Department of Oceanography, Texas A&M University College Station

During fall 2015, Texas A&M University launched two Slocum G2 ocean gliders into the waters of the northern Gulf of Mexico near the shelf break. The gliders headed into the deeper Gulf and recorded high-resolution vertical profiles of temperature, salinity, colored dissolved organic matter, chlorophyll, and dissolved oxygen. The spatial patterns observed by the gliders are interpreted based on the contemporaneous state of the large-scale surface circulation based on satellite altimeter observations. MATLAB was used to generate plots of the data and to perform statistical analysis/calculations.

The glider data shows large spatial variability contrasting the background biogeophysical properties of the coastal and deep waters of the Gulf with those of the waters brought into the Gulf by the Loop Current. A notable feature is the weakening and deepening of the subsurface (50-100 m) chlorophyll maxima across the Loop Current waters which includes a localized maxima reaching depths greater than 200 m. The likelihood that some of these features is linked to the effects of hydrocarbon seeps is explored.

The study illustrates the usefulness of subsurface glider observations in complementing sea surface height observations from satellite altimeter. The spatial patterns in the subsurface glider observations motivate new research questions that could be investigated by target process studies and/or numerical model simulations.

How Groundwater and Surface Water Interactions Respond to Storm Events: Cibolo Creek, Kendall County, TX

Erica Saucedo and Dr. Yongli Gao
Department of Geological Sciences

This study investigates how interactions between Cibolo Creek and the Trinity Aquifer respond to storm events within Kendall County, Texas. Water samples were collected from both springs and surface waters within the Cibolo Creek watershed in order to establish a baseline. Water quality data was also measured and recorded at time of collection. Some interpretations of the field data collected have been made, however, analysis of stable isotopes and some geochemical data was not able to be conducted due to limitations. Future plans are to collect isotopic data and geochemical data from groundwater in wells located in Kendall County as well as data from specified locations after storm events. Water samples collected will then be analyzed for $\delta^{18}O$ and δD as well as cations, anions, and alkalinity to determine how the surface water and groundwater interactions respond to storm events in this study area.

Tracking the Primary Sources of Fecal Pollution in the Recharge and Contributing Zones of Edwards Aquifer in Bexar County, TX using Molecular Tools

Fabiola Estrada and Vikram Kapoor
Department of Civil and Environmental Engineering

The Edwards Aquifer, located in south-central Texas, is one of the most prolific aquifers in the United States. The Edwards Aquifer is a Karst Aquifer which means that its topography is composed of soluble rocks and characterized by underground drainage systems of sinkholes, springs, water wells, and streams. The Edwards Aquifer satisfies the industrial, agricultural, domestic and recreational needs of more than two million people in the region. Karst systems are extremely vulnerable to animal and human contamination because of its distinctive high porosity and permeability; therefore a rapid movement of water from the land surface into and through the subsurface is present. The rapid movement of water limits the time available for physical and biogeochemical reactions that would otherwise reduce the concentration of pollutants and lessen the damage. Sewage contamination of water represents a major risk for environmental and human health and it is important to identify the sources of fecal contamination since it is essential to control water quality and mitigate pollution.

This project has a duration of three years (01/18-12-20) which includes sampling sites establishment and sampling events, PCR/qPCR optimization, full day storm water events, fecal source identification, and public outreach. For the establishment of the sampling routes GIS map synthesis was used to identify and assess the sites inside the recharge and contributing zones of the aquifer in Bexar County (figure 1). Twenty one sites were established and divided into two routes for efficiency purposes (figure 2 and 3). The sampling event started on January 23, 2018 and its scheduled weekly for the rest of the project´s duration. The water quality parameters performed on site include pH, temperature, dissolved oxygen, and dissolved nitrogen. Samples are collected in sterilized 1 L Nalgene bottles, stored on ice, and transported to the lab for filtration. Samples are then filtered through a 0.45 μm pore-size membrane, labeled and stored at -80.0° c until DNA extraction. DNA is extracted from filter samples using The Dneasy Powerlyzer Powersoil Kit (by Qiagen) protocol, and stored at -20.0° until further studies. From the start of the project to this date, there have been thirteen sampling events in which we have now more than fifty samples of DNA. When DNA has been extracted from the samples PCR/qPCR optimization reactions are used to target specific DNA molecules. For this study, the presence or absence of fecal bacteria and human pathogens is targeted. Since the project is on the first stage, very few PCR/qPCR optimizations have been completed targeting the e-coli genome and the results are being analyzed.

As stated above, this project will be continuing thought out the summer and fall. The sampling events will be scheduled weekly, filtration and DNA extractions will be performed as the collection continues. PCR and qPCR optimizations for other bacterial and human markers will begin, and results will be analyzed. Upon competition of this project, we will have identified the major pollutants and their locations in within the established sampling region. The molecular tools implemented in this project will provide concise data on the contaminants, concentration, and location which will assist the Edwards Aquifer Authority (EAA) and San Antonio River Authority (SARA) to mitigate pollution contributions to the aquifer and prevent future contamination.

Land use Land cover variability over the Edwards Aquifer boundary from 1990 to 2017

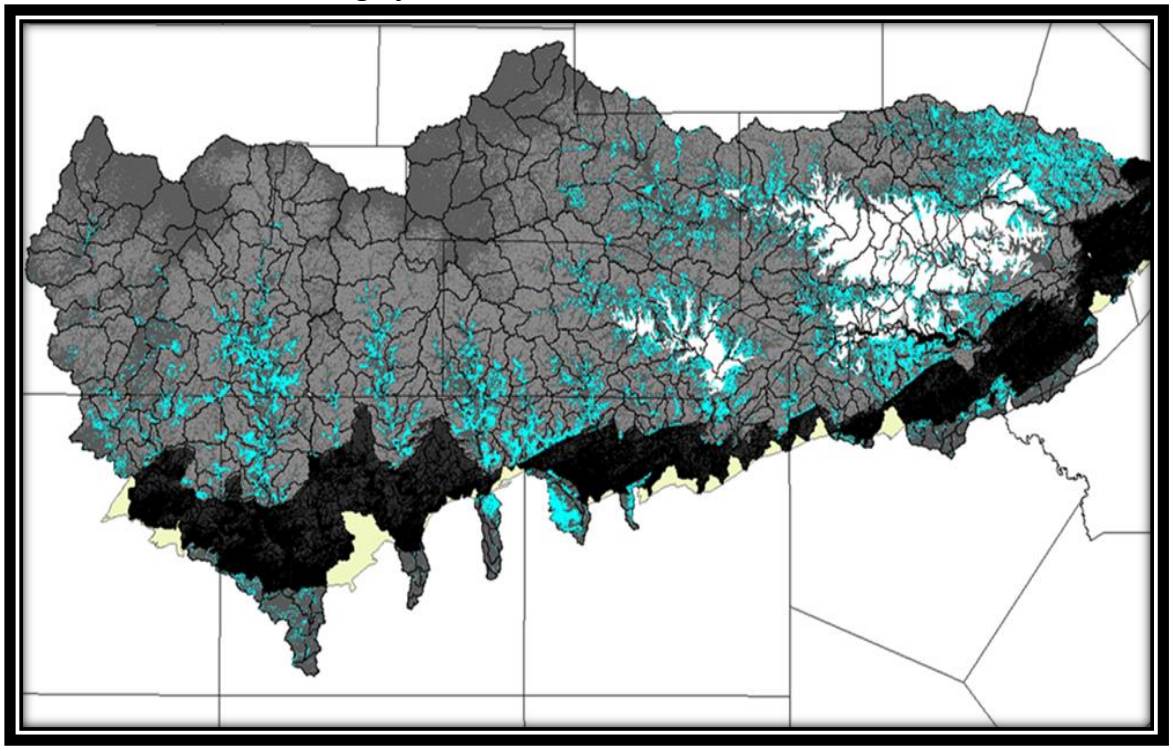
Jerry Chavez and Newfel Mazari
Department of Geological Sciences

Land use and land cover (LULC) is an important parameter for estimating stream flow and ground water recharge. Recent development and continuous urban and economic growth over the Texas Hill Country, and especially over the Edwards Aquifer recharge zone, will have a direct impact on the quantity and the quality of water and ground water recharge.

Groundwater Hydrologic models such as HSPF (Hydrological Simulation Program Fortran) use the LULC imagery from USGS as defined by LBG-Guyton Associates in 2004 (HSPF Documentation Appendix H). The accuracy, sensitivity and outputs of the HSPF models are largely dependent on the LULC imagery used.

The study will assess the variability of LULC from 1990 to 2017 over the Edwards Aquifer boundary using remote sensing imagery from Landsat and MODIS (moderate resolution imaging spectrometer). Spatial resolution will range from 30 x 30 meters to 250 x 250 meters. LULC will be based on criteria defined for ground water recharge estimation using the HSPF models (created by LBG-Guyton Associates in 2004 for the HSPF models).

The results will then be evaluated and compared with the LULC satellite imagery presently used in the HSPF hydrologic modeling over the Edwards Aquifer boundary. To minimize HSPF model output errors, the accuracy of the LULC data should be as high as possible. The varying spatial and temporal resolutions of Landsat and MODIS present challenges to the readily available LULC satellite imagery.



Orthorectification of thermal/optical imagery of Antarctic sea ice: an application of MATLAB

J. de la Riva and Blake Weissling
Department of Geological Sciences

The precise measurements of sea ice parameters such as concentration, type, and floe sizes in the polar regions are difficult to obtain due to a variety of environmental challenges. These include prolonged periods of darkness and variation in the horizontal tilt of floating platforms. One of the primary goals of the SCAR's Antarctic Sea Ice and Climate (ASPeCT) initiative is to develop a uniform system that eliminates human bias during sea ice observation. Evaluative Imagery Support Cameras (EISCam) are used to record ancillary data on ship. Images are taken in oblique view every six to eight seconds, but must first be orthorectified to a nadir true scale before sea ice characteristics can be determined. Schwendeman and Thompson (2014) developed a MATLAB program to orthorectify oblique-view imagery based on a horizon identification and tracking method that ultimately calculates the camera's orientation in space and the necessary parameters (eg. pitch and roll) for orthorectification. While this method is over 90 percent effective in daylight scenarios, horizons were not detectable in images taken at night using ship spotlights. Here we introduce a comparable method that can be used with infrared images. By utilizing both thermal and optical imaging techniques, observations can be continuously obtained despite changing conditions. These orthorectification techniques can be implemented more broadly by climate researchers to generate true-scale visual archives of ice conditions.

Statistics of Surface Ocean Currents and Surface Winds in the Gulf of Mexico Continental Shelf Region

Karen C. Mendiondo and Alberto M. Mestas-Nuñez,
Department of Geological Sciences

Surface ocean current magnitudes and surface wind magnitudes in the Gulf of Mexico's outer continental shelf region are statistically analyzed using MathWorks® MATLAB for use in various applications, such as the engineering design of large-scale structures for the cultivation and harvesting of macroalgae as a renewable, marine biomass energy source. The outer continental shelf region of the Gulf of Mexico, with a depth range of thirty meters to one hundred fifty meters, is a strategically-ideal coastal area for macroalgae farms. This selected isobath range would enable raising of the marine-farming structures to shallower thirty-meter depths to maximize growth in the photic zone while providing the option to lower the structures as needed to minimize potential damage during severe storm events.

Oceanographic surface current data for the region of interest is obtained from the Ocean Surface Current Analysis Real-Time (OSCAR) global surface current database. Surface wind data for the identical investigation area and time period is extracted from the North American Regional Reanalysis (NARR) data set; both the OSCAR and NARR geophysical data sources provide onethird-degree resolution gridded data. Generation of maps of the Gulf of Mexico and polygons identifying regions of the continental shelf area aid in extraction and statistical analysis of the study-area data.

Preliminary results for the study region indicate mean and maximum surface current magnitudes of 0.014 and 0.639 meters per second, respectively, for the year 2015. During the same time frame, mean and maximum surface wind magnitude calculations are 4.95 and 18.16 meters per second. Additional useful statistics quantifying the physical oceanographic and atmospheric conditions in this Gulf of Mexico region, such as extreme statistics and trends for different regions of the outer continental shelf, may also be computed and the data subsets expanded to include multiple years.

Analysis of geophysical data for the outer continental shelf region in the Gulf of Mexico provides statistics which are essential for the design of cost-effective, efficient, large-scale marine-biomass structures and useful in various other engineering applications.

The Effects of Freezing Temperatures on *Lygodium japonicum* Spore Germination

Katie Miick and Jeff Hutchinson
Department of Environmental Science and Ecology

Lygodium japonicum is native to Southeast Asia but has become an invasive plant of concern in wetlands and hydric forest of the Southeastern United States. The fern exhibits indeterminate growth and grows into the upper tree canopy where it serves as a fire ladder. Lygodium japonicum has recently been detected in Europe as a hitchhiker on imported bonsai plants, but limited information is known on it habitat requirements in colder climates. It is important to gather the freezing tolerance for L. japonicum by investigating spores from 2015, 2016, and 2017 and comparing the frozen samples to the unfrozen control.

In this study, we will examine the freeze tolerance of L. japonicum spores and gametophytes to different freezing temperatures (-17 and -13 °C) and exposure times (0.5, 1.0, 2.0, 4.0, and 8.0 hours). Percent germination and survival for frozen spores and gametophytes will be compared to controls (unfrozen). Non-linear regression will be used to determine the lethal temperatures (LT 95) for spore and gametophytes.

Modeling the Brackish Water Zone in the Edwards Aquifer - Analyzing the Water Interaction with Limestone Using PHREEQC

Kristen Cabatingan and Yongli Gao
Department of Geological Sciences

The goal of this research project for the MSEIP Program at the University of Texas at San Antonio is to analyze the interaction of brackish water with the limestone constituting the Edwards Aquifer. Brackish water is the product from the mixing of salty water with fresh water, typically resulting in salinity content ranging from 0.5 to 2.0 parts per thousand. Throughout the research project, I preformed sensitivity analysis using the PHREEQC software to analyze the interaction of various amounts of brackish water with the limestone of the Edwards Aquifer. PHREEQC is a computer program used for speciation, batch-reaction, one dimensional transport, and inverse geochemical calculations. Additionally, tests were preformed in PHREEQC to determine how changes in PH and temperature affect calcite and dolomite saturation curves present in the brackish water of the Edwards Aquifer.

Vegetation Patterns along Environmental Gradients on a Portion of Guadalupe River in Kerrville, Texas

Mara Alcantara and Brian Laub
Department of Environmental Science and Ecology

Riparian ecosystems are highly sensitive and receptive to minute changes within the environment. As urbanization begins to encroach into a variety of ecosystems, riparian systems are susceptible to direct changes, as well as alterations to the river systems that sustain them. This study focuses on understanding habitat-riparian vegetation relationships on a portion of the Guadalupe River, by distinguishing the occurrence of species and levels of diversity in relation to the river system. The Guadalupe River spans a fair portion of southeast Texas, beginning in Kerr County and eventually feeding into the Gulf of Mexico. The river is used economically and for recreation purposes, but the study site on the river has minimal amounts of alteration relative to other portions of the river. The minimal amount of human-use and habitat degradation within the site will help ensure that riparian vegetation distribution is driven by natural environmental factors, and not human alteration within the environment. The targeted site will focus on a relatively small island formation (~3 hectares) within the Guadalupe River. Within the area, transects that run parallel to the river system will be established at 10m increments. Along the transects, quadrats of 3x3m will be established every 10 m to survey the abundance and diversity of vegetation. The vegetation species composition is expected to change systematically moving from the river edge to the center of the island. By understanding how natural environmental factors influence riparian vegetation patterns, the research will help inform ways to mitigate impacts from future land use development and alterations to the river system.

Petrology and Geochemistry of Enclaves in the Marschall Creek Dike Complex A study of the enclaves from the Enchanted Rock Batholith

Maria T. Solis and Walt Gray
Department of Geological Sciences

The genesis of enclaves is still a mystery to the geologists and petrologists who study them. The accepted theory is that magmatic mixing picks up enclaves that have settled to the bottom of a magma chamber, and through convection, places them at locations throughout the igneous body. This research involves the enclaves of the Enchanted Rock Batholith between the cities of Llano and Fredericksburg in Texas and is part of the Marschall Creek Dike Complex.

The purpose of this study is to find the petrology and chemistry of enclaves and dikes throughout this Batholith and compare the results to determine a possible source magma that could be responsible for these features, and to find a relationship between the enclaves and dikes, if one exists.

Participants of this study include Dr. Walter Gray, geologic sciences professor at the University of Texas at San Antonio, who was the supervisor to the overall project. Yadira Jimenez-Magana, who is a geology student at UTSA studying the dikes of this same area, whose results will help to complete this project. I had the honor of studying the enclaves of the western side of the Enchanted Rock Batholith. Dr. Alexis Godet, geologic sciences professor at the University of Texas at San Antonio, provided instructions in the chemistry laboratory and also aided with the chemical analysis of the enclave samples. Juan Campos and other geology students at UTSA helped extract the samples in the field. Juan also provided training on the UTSA rock lab equipment.

Dr. Gray, the team, and I first went out to collect the seven samples of enclaves and Yadira's dike samples on 27 Jan. 2018 at 0800 in the morning at Marschall Creek on the western side of the Batholith. The samples were double-packaged in plastic zip bags and labeled with location, year, and sample number (i.e. ERE018-001 through 007) and brought them to the rock lab for further processing. A few other online courses had to be taken in order to train on laboratory procedures, including Hazardous Waste Generator Training, Hazard Communications and Laboratory Training, and X-Ray Safety. We then proceeded to get trained on the fluxer and the loss-on-ignition (LOI)

equipment in the chemical laboratory by Dr. Godet on 01 Feb. 2018 at 10am. The next natural step was to cut two samples of the enclaves into 2" x 1" rectangles on 06 Feb. 2018 and send them to a laboratory elsewhere to be made into thin sections for further analysis with the microscope. They were received in thin section form on 28 Feb. 2018. The samples were then cut into small squares with the water saw on 06 Mar. 2018 in preparation for powdering. I used the Shatterbox in the UTSA rock laboratory to powder the 7 enclave samples on March 23rd and 27th at 1pm and 11am, respectively. Training on these procedures was provided by Juan Campos

and Dr. Gray. On April 3rd and 10th, the samples were made into beads for chemical analysis. LOI values were also taken for all 7 samples. Results for these were received on 16 April 2018.

Basic findings for the thin sections include mineral composition analysis and mineral distribution throughout the enclave matrix. The enclaves had significant amounts of quartz, plagioclase, biotite, and microcline, but mostly quartz. The plagioclase grains showed exsolution features, where they were being consumed by sericite. Accessory minerals included apatite, zircon, and titanite. Mineral grain boundaries displayed diffusion structures and embayment, which indicates grain boundary migration through high temperature and deviatoric stress because the quartz grains were highly rounded. Plagioclase anorthite content was at 34% through 37% according to the Michel-Levy Method.

The results of the chemical analysis for the beads and LOI content were averaged and are as follows in mass%: Na2O (4.944), MgO (0.955), Al2O3 (14.237), SiO2 (68.172), P2O5 (0.257), K2O (1.788), CaO (2.460), TiO2 (0.710), MnO (0.097), Fe2O3 (5.392), and LOI (0.835). This information was input into the KWare Magma program for igneous classification by sample and average. The results were also plotted on a TAS diagram and both phaneritic and aphanitic diagrams.

The results are consistent with the igneous rock classification of Granite, more specifically Monzogranite, while the TAS diagrams concluded that the chemistry of these enclaves falls into the Dacite region. The Rapakivi texture of the grains in the hand samples indicates the mixing of two magmas (host granite and enclave magma).

With this information, it is possible to conclude that the enclaves throughout the Batholith are the result of a mix of magmas, but information for the dike chemistry is still being processed, and further research is planned for this study. Future work includes collecting and analyzing the rest of the enclave samples from other locations of the Batholith, collecting and analyzing representative samples from the host rock (granite), and comparing the results of these samples to develop models useful in identifying source magmas for enclaves, dikes, and Enchanted Rock Granite.

The significance of hardground surfaces in the Austin Chalk Group of south Texas

Miguel Bernardo, John Cooper and Alexis Godet
Department of Geological Sciences

Hardground surfaces represent periods of reduced marine sedimentation, and are characterized by the presence of encrusting organisms, borings, peculiar mineralogy and geometry. In south Texas, previous studies of the late Cretaceous Austin Chalk Group (e.g., Lundquist, 2000; Hardwick, 2016; Cooper, 2017) defined a synthetic representative lithological column, described depositional geometries and morphologies that highlighted the occurrence of hardground surfaces, but without specifying their diagenesis and paleoenvironmental significance. This study aims to fill this gap in knowledge.

The petrographic analysis of 70 thin sections allowed the characterization of three hardground surfaces in the San Antonio area, which were described based on their fossil content, depositional texture and matrix. The stratigraphic evolution of allochems is constrained by point counting on selected thin sections, and suggests changes in the faunas and energy within the Austin Chalk Group. Peculiar features of these hardgrounds include their higher fossil content, almost grain-supported texture, and oxidation. Finally, the chronology of diagenetic events that led to the formation of these hardgrounds is constrained with cathodoluminescence microscopy, as two phases of cementation are identified. First, a dark brown to black luminescent cement supports the good preservation of parts of the shells, which precipitated from a fluid rich in oxygen. A second, dull yellow luminescent cement suggests that most cementation occurred during late stages of burial diagenesis. Based on our petrographic study, a chronology of diagenetic events is proposed for hardgrounds developed by the Austin Chalk of South Texas. In particular, previous to the main phase of phosphogenesis, a period of subaerial exposure may have exposed the shallow marine ecosystem to meteoric waters, generating an early stage of cementation.

Although hardgrounds developed in the same depositional environments as the rest of the Austin Chalk Group succession, they represent periods of high energy during low sea levels, promoting winnowing and hosting a unique fauna and flora, adapted to these conditions.

References cited:

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Analysis of Hurricane Harvey Rainfall

[1]Muhammad Sharif and [2]Newfel Mazari
[1]Department of Biology and [2]Department of Geological Sciences

The hurricane season of 2017 was the most extreme in United States history, impacting millions from Puerto Rico to Florida and across the Texas coast. In Texas, Hurricane Harvey resulted in record rainfall totals of 34 trillion gallons of water. Given the fact that Hurricane Harvey made landfall twice, the events occurred I three phases: the initial landfall in Aransas County, Texas; the unprecedented rainfall in the Houston Metroplex and surrounding areas; and Hurricane Harvey's second landfall that caused massive flooding in Southeast Texas. Following these three phases, tens of thousands of homes that had never been flooded took on water, and evacuations and rescues continued for days after landfall. This research provides an overview of the rainfall amounts of Hurricane Harvey on Houston, Texas (Harris County) and surrounding areas, resulting flooding, and recommendations to minimize the impacts of similar hurricanes in the future. A timeline of the hurricane, rainfall and flooding data, and resulting damages are described based on analysis of data provided by the National Oceanic and Atmospheric Administration (NOAA) Advanced Hydrologic Prediction Service (AHPS), the National Hurricane Center (NHC), the Harris County Flood Control District (HCFCD), the U.S. Army Corps of Engineers (USACE), and the Texas Section of the American Society of Civil Engineers (ASCE).

Suspended Sediment Transport in the San Antonio River near Floresville

Robert Ramirez and J.K. Haschenburger
Department of Geological Sciences

Suspended load makes up the majority of sediment transported in most rivers and its contribution to the shoreline decreases erosion from waves. The aim of this study was to investigate what sizes of sediment are transported in the water column of the San Antonio River, where over 90% of the annual sediment load is by suspension. Field observations of bed material and flow conditions come from the San Antonio River near the Floresville, but suspended sediment concentrations and grain sizes were collected near Elmendorf. Suspension of different grain sizes was determined by comparing their settling velocities to the shear velocity for 9 different flow levels. The shear velocity that indicates suspension was compared to the shear velocities of observed flows, which were then compared to a flow duration curve based on discharges measured at the nearby US Geological Survey flow gage. Using the Rouse equation, the concentration gradients were determined for four representative grain sizes to understand where in the water column the different sizes are transported. Relatively coarse-sized sand grains are expected to be in suspension a little less than half of the year. Concentration gradient for the smallest grain size is almost vertical throughout the water column, while the gradient for the largest grain size is not evenly distributed but does reach the water surface. Based on these results, the annual sediment load is relatively coarse.

Snow Cover in the Antarctic and its Contribution to Sea Ice Formation and Properties

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Sea ice forms on the ocean surface during polar winter, usually by the direct freezing of sea water. During the Oden 2010-2011 summer expedition into the Amundsen Sea pack-ice, fourteen ice cores were collected and a CRREL Ice Mass Balance (IMB) buoy was installed. Data collected from the buoy and oxygen isotope analysis of meltwater from the ice core located next to the IMB has provided insight into how the snow cover can also contribute to the formation of sea ice by a process possibly unique to the Amundsen Sea region of the Antarctic; surface flooding at the snow cover base during summer months. Shown by the buoy data, surface flooding in the summer is driven by the bottom melting of sea ice. This process lowers the ice surface below sea level and causes the snow cover flooding followed by re-freezing and salinity fluctuations due to brine rejection as the ice refreezes in fall. Negative oxygen isotopes are found if there is a contribution of snow to the ice sample, unlike the positive values found if seawater is the only source. A trend of increased salinity and upwards decreasing $\delta^{18}O$ concentrations, was observed in seven out of eight ice cores analyzed. This speaks to the dynamic process and impact that meteoric snow-loading of the surface and bottom melting of pre-existing sea ice have on the growth of the Amundsen sea pack-ice. In comparison to data collected from sea ice samples at Ice Station Weddell (ISW) and during the Antarctic Zone Flux Experiment (ANZFLUX), the Amundsen sea pack-ice shows a lower negative $\delta^{18}O$ concentration, that is more snow flooding and refreezing than these other regions. One consequence of an increased contribution of snow to sea ice formation in the Antarctic is a reduction in the brine rejection as the sea ice forms which can impact the ocean salinity and its vertical mixing beneath the ice cover.

Apparatus Reconstruction of the Genus *Gondolella*

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The purpose of this project is to reconstruct the apparatus of conodont *Gondolella* from the Hushpuckney shale to see if any of the multiple species inside *Gondolella* are a highly variable genus or if a new species can be made from one of those sets. Joachimski and Lambert began work with the Pennsylvanian phosphatic black shales looking into the paleoclimatology, paleogeography, and paleoecology of the shales during the Pennsylvanian, using conodonts as evidence for their study. Research was continued on the conodonts found in these shales because of differences seen in their morphology, and based off of these morphological differences there is believed to be grounds for separating the *Genus Gondolella* into a new species. To obtain the samples from the Hushpuckney shale, the shale was baked at 50 degrees Celsius and later soaked in Stoddard solvent which took a minimum of one week to complete. These specific samples currently remain in the process of being broken down which is prolonged because of their high organic content. Previously processed and sifted samples of the same Hushpuckney shale, from varying locations across the US, are the samples represented and examined to determine whether *Gondolella* should be subdivided. By processing these samples and separating the conodonts by morphology, this research will extend beyond the current colloquium and the anticipated results will impact our understanding of the diversity and evolutionary history of Gondolellid conodonts.