TEXAS TECH UNIVERSITY
College *of* Arts & Sciences

Department of Geosciences

Department of Geosciences
Texas Tech University
Research Day 2012

Welcome everyone, to the Department of Geosciences 2012 Research Day.

This year we welcome an unprecedented number of undergraduate presenters to Research Day: ~24 by my best estimate. This is a tremendous achievement in terms of number of students graduating from the program, increased participation in research, and, as you will see from the variety of topics covered, the tremendous breadth that research in the Department encompasses.

In addition to local contributors, we once again welcome visitors from Angelo State University, who are presenting several posters this year. We also welcome representatives from industry who join us wearing a diversity of hats: poster judges; evaluators; potential recruiters; and, most importantly, continued supporters of the Department. We appreciate them taking time to visit us today, and hope that they enjoy their visit.

Undergraduate research in the University continues to attract significant attention from administrators, and support for developing undergraduate student research opportunities is part of the new strategic plan. The Department's long-standing support and commitment to undergraduate research represents a successful model, and one that we should seek to actively promote and showcase.

The Geoscience Society continue to be generous, and greatly appreciated, benefactors of this event and once again have provided coffee and cookies in room 230. For all sophomore and juniors joining us today I encourage you to take few minutes to look at some of the materials laid out in room 230. They introduce research opportunities, the Department's graduate programs, and opportunities for developing research skills here on campus – it is never too early to start preparing for GEOL/ATOM-4312!

A BBQ lunch, once again, most generously supported by the Geoscience Society will be served in Room 201 (Structure Lab) from 12:30 onwards. Everyone who enjoys the feast is asked to make a small contribution to the cost – just a dollar or two would be appreciated.

Finally, thank you to everyone, presenters and viewers, for coming along to participate in the event. I hope that everyone enjoys the morning and is inspired for their upcoming summer of research.

Callum J Hetherington

Log Analysis of the Avalon Shale
Team #3:

AMJAD ABDELRAHMAN, WENJING LI, SAMIHA MORSY, MATTHEW TAVE AND CHRISTOPHER TREAT
[1]Dept. of Geosciences, Texas Tech University, Lubbock, TX 79409-1053

The Avalon Shale is located in the Permian and Delaware Basins in Southeastern New Mexico and West Texas. This liquids-rich shale play has recently been one of the important plays in the United States. There are more than 10 active operators in this play as of 2010 and it is sometimes called the Leonard Shale or the Upper Bone Springs formation by some of these operators. This project evaluated the productivity of the Avalon Shale through log analysis using a standard logging suite. The thermal maturity index was calculated to determine if the shale is thermally mature enough to produce oil. The total organic content (TOC) was also determined by using some available core data and two different correlations. The method that best predicted TOC values was then used to determine the volume of kerogen in the rock which was used to determine the volume of quartz, volume of clay and total porosity by using simultaneous equations. Based on these calculations, we were able to determine the oil-filled porosity and permeability of the reservoir rock and calculated the original oil in place (OOIP) by using two permeability cut-offs (500nD and 1000nD). After completing the analysis, the team decided where to place the lateral section of the horizontal well and selected the 250 ft frac interval that will result in the highest recovery from this well.

Monitoring Migration of Transverse Dunes With Precision GPS

J. ALLEN and S. NAGIHARA
Dept. of Geosciences, Texas Tech University, Box 41053, Lubbock, TX 79409-1053 (Jennifer.Allen@ttu.edu)

GPS-based, high-accuracy topographic surveys were carried out in a section of transverse dunes in Monahans Sandhills State Park, Texas in late summer (October 2011) and then again in the spring (March 2012). The objective of the surveys was to document changes in the topography associated with strong winds in winter (north) and early spring (southeast). Wind data from the same period was obtained from a weather station nearby in Wink, TX. Comparisons of the two topographic surveys were made using the *ArcMap* and *ArcScene* GIS software packages. During the 5-month observation period, the profile of the dune stayed roughly the same, even though a number of strong winds (> 15 mph) were recorded during the winter. However, elevation of the dune increased by approximately 2 meters in some places. The dune surveyed formed blowouts in the spring and a secondary, small barchans-like dune formed over, and near perpendicular to the transverse dune, in its north eastern portion. Through the time that the dune was monitored, the elevation increased approximately 1 meter most portions of the study area. The dune in parts oversteepened and the crest shifted eastward with the months of the study. The movement of the dune coincides with the wind speed and directions for the area, as the winds were predominately to the north, before shifting to the southeast with the change of the seasons.

An Electrical and Electromagnetic Study of a Playa during Dry Conditions

M. BARRERA
Dept. of Geosciences, Texas Tech University, Box 41053, Lubbock, TX 79409-1053 (mabely.barrera@ttu.edu)

Playa wetlands are prominent physical and hydrological features in the Southern High Plains (SPH) of Texas. DC Resistivity and Electromagnetic surveys were conducted at a playa, about 8 miles north of Lubbock, Texas as a study that will be part of a larger ongoing project to study playas at Texas Tech. This study's main focus will be to understand how the water from the playa does or fails to find its way to the Ogallala aquifer, which is the main source of water for the region. Typically during the wet seasons the playa lakes will periodically fill with water and will hold water for various lengths of time. The larger goal of the playa studies is to use geophysical and geochemical methods to determine how much of the water infiltrates and the distribution of water in the ground as it infiltrates.

During the past year the playa being studied has remained dry due to drought. The dry period will be used to make baseline geophysical

measurements that may be repeated after heavy rains to observe changes that will indicate infiltration. DC resistivity methods employed arrays using Wenner, dipole-dipole, and quadrapole arrays to provide depth sounding, 2-D and 3-D images of the soil conductivity, respectively. For the electromagnetic survey, an EM 31 was used in vertical and horizontal dipole configurations to enable spatial imaging at two different depth ranges. Modeling Wenner data will provide a 1-D model of resistivity to understand the depth distribution of clay and moisture beneath the playa. A pseudo-section from the dipole-dipole data will provide a 2-D image of the shallow structure of the dry playa soil. Quadrapole data was collected with 5 and 10 meter spacing which will offer spatial maps of resistivity sensitive to two different depths. This study will provide a dry description of the playa for comparison with future studies done during wet seasons after the playa has filled with water.

Evaluation of the Permian Leonard (Avalon) Shale, Southeast New Mexico

S. CALDERON, H. EMADIBALADEHI, E. SUBRAMANIAN, A. WATTERS
Dept. of Geosciences, Texas Tech University, Box 41053, Lubbock, TX 79409-1053

The task of evaluating a well in Permian Leonard (Avalon) Shale located in south east New Mexico, outside the core producing area where many wells are operated was given. A set of data were given for the same. The following logs were plotted: Gamma, Resistivity, Porosity, Pe. Using the quick log scan evaluation, the producing reservoir depths were selected. The Maturity Index (MI) was calculated as 6.35 using the method by [Zhao et al, 2007]. Since the MI > 5, it indicates a productive zone.

Next, by creating the following cross plots vs TOC wt %: Bulk density, Neutron Porosity, ITT (Sonic), Pe, Schmoker, and Passey; it was concluded the best method to predict the TOC wt% was Pe Vs TOC wt% with R^2=0.6661 and the equation Pe =$24.063e^{-0.558(TOC)}$. Then TOC for the entire depth in question was calculated and also the volume of kerogen. The simultaneous equations were solved to find the volume of clay, quartz, and total porosity for each depth. Also, effective porosity, effective water saturation and absolute permeability were calculated for each depth.

From the Ka values, the decision was made to fracture at depths 7200 ft – 7450 ft using a 250ft fracture height. Found the OOIP to be 21.64 MMSTB and using the recovery factor as 3% recoverable oil is 0.649 MMSTB.

[1] Zhao, H., Givens, N., Curtis, B., Thermal Maturity of the Barnet Shale determined by well-log analysis, AAPG Bulletin, Vol. 9, Issue 4, Pages 535-549 (2007)

Mapping unravels mysteries of Mariscal Mountain anticline, Big Bend National Park.

M.J. CARTWRIGHT[1*], T.R. BIEBERLY[1], J.I. SATTERFIELD[1], D.P. MIGGINS[2]
[1]Dept. of Physics and Geosciences, Angelo State University, ASU Station #10904, San Angelo, TX 76909 (*mcartwright@angelo.edu)
[2]U.S. Geological Survey, Denver Federal Center, Box 25046, MS 974, Denver, CO 80225

Mariscal Mountain, southern Big Bend National Park, exposes a large plunging Laramide anticline (MMa) that contains Tertiary intrusions and abandoned cinnabar mine workings. 1:12,000-scale mapping in a small, 9 km² area of northernmost Mariscal Mountain reveals a previously unmapped high-angle fault and two phases of map-scale and outcrop-scale folds. Our work generally confirms recently published mapping [1,2]. We distinguished ten Cretaceous-Quaternary geologic map units, including Tertiary mafic and felsic intrusions. One mafic sill has been dated at 46.7 ± 0.3 Ma. An eastern felsic sill is 32-33 Ma. Paleomagnetic fold tests show mafic sills were not folded even though they crop out on both limbs of MMa [3]. Within our map area MMa axial plane strikes 329-002 and dips 68NE-76W while the 329-002-trending fold axis plunges from 36 to 3 to 20 to 7 from north to south. Outcrop-scale folds trend NNW, NW, and NE. A NNW-striking subvertical fault cross-cuts MMa west limb. Previous work and current geologic mapping suggest thissequence of events: 1) Cretaceous units deposited, 2) Cretaceous units folded into MMa and outcrop-scale folds at same

orientation as Sierra del Carmen Laramide folds [4], 3) Broad NE-trending folding produced MMa fold axis plunge variations, 4) Mafic sills intruded (46.7 Ma), 5) Felsic sills intruded, 6) High-angle fault cross-cuts MMa and possibly offsets mafic intrusions during Basin and Range extension, 7) Erosion, then Quaternary sediments deposited.

[1] Dickerson et al. (2010), *UT-BEG* **Map 48**, 1:24,000.
[2] Turner et al. (2011), *USGS* **Map 3142**, 1:75,000.
[3] Harlan et al. (1995), *Tectonics* **14**, 307-321.
[4] Satterfield and Dyess (2007), *WTGS Bulletin* **46**, 8-19.

Thermal Properties of Deep Sediments along the Texas Continental Shelf, Gulf of Mexico

CORY H. CHRISTIE, SEIICHI NAGIHARA
Dept. of Geosciences, Texas Tech University, Box 41053, Lubbock, TX 79409-1053 cory.christie@ttu.edu

In understanding the geothermal setting along the Corsair growth-fault zone, knowledge of the accumulation history, thermal as well as physical properties of the sediments is important. For my undergraduate research project, I am compiling such data for the Texas Continental Shelf with a more detailed look at the Matagorda Island federal lease area. Wire-line logs from wells in my study area were obtained from the Bureau of Ocean Energy Management, Regulation, and Enforcement (BOEMRE). Bottom-hole temperature (BHT) data were extracted from the logs along with their depths. After the BHT's were tabulated into a database, they were corrected to account for drilling-related thermal disturbance via the Horner Plot method in the Matlab software. With the corrected BHT's, temperature-versus-depth plots were created for the locations of the wells. The plots show a linear trend with increasing temperature and depth. The wells were then grouped based on their geographical proximity to one another. Geothermal gradients were determined for the individual well groups. Then, the geothermal gradients were spatially interpolated across the entire study area using the natural neighbors interpolation method and yielded a contiuous geothermal gradient map for a 3-to5-km depth interval. In taking a closer look at the Matagorda lease area I obtained paleontological data from BOEMRE for some of the wells, which enabled me to estimate the ages of sediments at various depths. Two-dimensional seismic profiles from the lease area were also obtained from CGG-Veritas. The information from the well data and the paleontological data were then overlain on the seismic sections. I used the velocity survey data in tying the well information to the seismic data. The combined data are useful in assesing the temperature and age of the sediments for the previously discovered hydrocarbon reservoirs.

Black Hills and Dagger Mountain intrusions, Big Bend Region: Determining emplacement styles from magmatic foliations and compositions.

J.D. CULLEN[1*], V.P. SILLER[1], J.I. SATTERFIELD[1]
[1]Dept. of Physics and Geosciences, Angelo State University, ASU Station #10904, San Angelo, TX 76909 (*jcullen2@angelo.edu)

SE Brewster County in the Big Bend region contains forcefully emplaced laccoliths in the Black Hills (BH) [1] and passively emplaced sills flanking Dagger Mountain (DM). BH laccoliths and DM sills intruded the same level of crust at about the same time. Mapping at 1:10,000-scale, thin-section petrography, and published data show differences in texture and composition appear to control emplacement mechanism. BH and DM intrusions are part of the Trans-Pecos Igneous Province, a belt of subduction-related Cenozoic igneous rocks that stretches across Mexico and West Texas [2]. BH contains three shallow alkaline intrusions that display pervasive inward dipping flow foliations assumed to be subparallel to original pluton margins [3]. Similar magmatic foliations parallel intrusive margins in Henry Mountains, Utah forcefully-emplaced laccoliths [4]. DM sills examined do not contain flow structures and do not strongly deform their well-exposed margins. BH intrusions are dated at 22 Ma (K-Ar on plagioclase) [1]; DM sills are 32 Ma ($^{40}Ar/^{39}$ Ar on monzonite) [5]. BH laccoliths intruded Cretaceous Santa Elena Limestone and

Del Rio Clay. DM sills intruded Cretaceous Boquillas Formation limestone and calcareous shale. BH trachyte, nepheline trachyte, and phonolite contain sanidine and nepheline phenocrysts, plus aegerine-augite, sodalite, natrolite, and zeolites [3]. DM quartz diorite, anorthosite, gabbro, leuciteolite, nephelinite, and leucite gabbro contain major minerals hornblende, leucite, plagioclase, and nepheline, and minor minerals orthopyroxene, clinopyroxene, biotite, potassium feldspar, untwinned feldspar, and quartz. Mafic minerals comprise 30-80% of DM samples.

[1] Dahl and Lambert (1986) UT-BEG **23**, 320-333.
[2] Ewing (1991), UT-BEG, 36 p.
[3] Dahl (1984) TCU Masters Thesis, 73 p.
[4] Saint-Blanquat et al. (2006) *Tectonophysics* **42**, 1-31.
[5] Morgan and Shanks (2008) USGS Circular 1327, 43-55

Sedimentology and geomorphology of Cretaceous and Triassic strata in Scurry County, Texas.

DANA FAHNTRAPP [1]
[1]Dept. of Geosciences, Texas Tech University, Box 41053, Lubbock, TX 79409-1053

Triassic and Cretaceous strata are exposed in western Scurry County along the edge of a mesa known locally as the Fluvanna "Cap". Triassic mudstones of the Dockum Group, originally deposited in lacustrine environments, are exposed along the foot of the mesa. A transgressive marine sequence of Cretaceous sandstone, shale, and limestone of the Trinity and Fredericksburg Groups form the caprock of the mesa. During Tertiary time, the region underwent erosion, and Cretaceous strata were removed from most of the region. The Fluvanna Cap represents a remnant of these strata on the ancient drainage divide between the Brazos River to the north and the Colorado River to the south.

Petrophysical analysis of the Permian Leonard (Avalon) Shale in south-eastern New Mexico.

A. FARHAN[1], P. GIFFORD[2], K. PRATT[2] , G.VENKATA[1], G.SHUBHAM[1]
[1] Texas Tech University, Bob L. Herd Dept. of Petroleum Engineering, Box 43111, , Lubbock, TX 79409-3111
[2] Texas Tech University, Dept. Of Geosciences, Box 41053, Lubbock, TX 79409-1053

The Permian Leonard (Avalon) Shale has recently been an important oil play in south-eastern New Mexico. Our team was assigned to evaluate a well that is outside the core area of a major production field; we were to determine multiple petrophysical parameters including OOIP (original oil in place), the total amount of recoverable oil, and where to place a 7100' lateral drilling zone.
A maturity index (MI) of 6.35 was calculated using the method of Zhao et.al. (2007), which indicated that the zone is mature enough to contain wet gas and condensate. Total organic carbon (TOC) was calculated using the methods of Schmoker and Passey, and additionally from core samples taken from the well. TOC obtained by Pe lab data resulted in the most reasonable values when constrained by our other measured and calculated parameters. Using these TOC values, other important variables such as volume of kerogen (Vke), volume of clay (Vcl), and volume of quartz (Vqtz) were determined. After placing the necessary conditions for water saturation (Sw), effective porosity (φe) and permeability cut-off, the OOIP for the 250 feet interval (7229.5' to 7476.5') was calculated to be 20.3 million barrels of oil (MBO). With a general 3% recovery factor considered for the field, the total amount of recoverables was 609,773 barrels of oil (BO) for a 500 nanodarcy cut-off.

Modeling Competency through Volume Expansion of Fine-grained Debris Flows Housed within the Fountain Formation, Colorado.

C. P. FINDLAY[1*] AND D.E. SWEET[1]
[1]Dept. of Geosciences, Texas Tech University, Box 41053, Lubbock, TX 79409-1053

The Pennsylvanian Fountain Formation comprises one of the coarse-clastic, wedge-shaped units that mantle the Precambrian cored uplifts of the

ancestral Rocky Mountains. One of the most volumetrically significant facies within the lower 500 m of the Fountain Formation is a very poorly sorted, massive pebbly mudstone. Beds range up to 4 m but are commonly 1-2 thick. Grain size distributions are skewed to the fine fraction with a σ^1 of 3.6 φ indicating very poor sorting. Clay and mud weight volumes range from 10 to 12% and 35 to 46%, respectively. Gravel fractions are < 10%. On average the finest 50 percent of the flows is < .065 mm, and the finest 10 percent is < .002 mm. To test for pedogenic accumulation of clays within this facies, we sampled beds that showed weak to strong pedogenesis. These samples had clay weight volumes of 17-26% depending on the degree of pedogensis, yet all of the pedogenic control samples had 70-116% more clay percent than unaltered deposits. Thus, a detrital origin for the clay is reasonable in deposits that show no pedogenesis.

The lack of sorting or stratification within the beds suggests a flow behavior similar to debris flows, however the lack of cobbles and boulders common to other facies stratigraphically adjacent suggest low competency uncharacteristic of 10-12% clay from debris flows elsewhere. Sweet and Soreghan (2010) proposed that the deposits could be the result of flow transformation from high-competency debris flow to low-competency, fine-grained debris flow. Here we explore an alternative hypothesis, that volumetric expansion of the flow from incorporated water significantly lowered competency. To test the expansion hypothesis, the flow was modeled to reflect 35%, 60% and70% volume matrix expansion where matrix is composed of water and clay. Assuming clay:water ratio as the sole competency driver, the model results suggest that flow competency varied from 57 mm, 3.5 mm and 1.7 mm, respectively, for each expansion percentage modeled. The coarsest 5% of these flows is typically >1.2 mm and ranged up to 4.5 mm suggesting that if the volume expansion model is the tenable mechanism, then the amount of matrix volume expansion of the flow was > 60% of which > 79% of that matrix space was water. This evidence suggests readily available and abundant water in the depositional system.

[1] Sweet and Soreghan. (2010) *GSAB* **122**, 575-594.

Trends in d(model)/dt for High Wind Events in the West Texas Region

T. FISHER[1*], B. ANCELL[2]
[1]Dept. of Geosciences, Texas Tech University, Box 41053, Lubbock, TX 79409-1053 (*tiffany.fisher@ttu.edu)
[2]Atmospheric Sciences Group, Texas Tech University, Box 42101, Lubbock, TX 79409-2101

In the West Texas region it is not uncommon to experience periods of high-sustained winds. Forecasting these high wind events can be difficult anywhere from 6 to 60 hours prior to the event. By using the idea of d(model)/d(t), which takes a series of model forecasts and verifies then for the same time, it can be determined the trends that may develop in a certain model. This study will take Global Forecasting System (GFS) data and run the Weather and Research Forecast – Advanced Research model (WRF). The model will be run at the 2-km resolution. Then, the results will be compared to the West Texas Mesonet (WTM), other surrounding mesonets and meteorological stations. An analysis of these high wind events with d(model)/d(t) will hope to provide insight into where error occurs in the model and ultimately improve forecasting for high winds in the West Texas region.

Petrology and source of dacite pebbles found in the Ogallala Formation, Southern High Plains, Texas.

ASHLEY C. GILBREATH [1]
[1]Dept. of Geosciences, Texas Tech University, Box 41053, Lubbock, TX 79409-1053

Distinctive pebbles of dacite porphyry are common in fluvial gravels of the Miocene-Pliocene Ogallala Formation on the Southern High Plains. A sample of 14 dacite pebbles was collected from the basal Ogallala gravel at Vega, Texas. Five of the pebbles are identified as biotite dacite porphyry, and the remaining nine are identified as hornblende dacite porphyry. The biotite dacite porphyry is holocrystalline, with abundant large phenocrysts of plagioclase, quartz, biotite and magnetite in a granular felsitic groundmass consisting of feldspar, quartz, and iron oxide. The hornblende dacite

porphyry is holocrystalline with abundant large phenocrysts of plagioclase, quartz, hornblende and magnetite in a fine granular felsitic groundmass consisting of feldspar, quartz, and iron oxide. The two porphyryitic dacites vary in the abundance of quartz phenocrysts, and in the proportions of biotite versus hornblende, and appear to represent end-members of the same basic rock type. There are three exposures of dacite in the likely source terrain of the Ogallala Formation; these are the Clayton-Raton volcanic field, the Ocate volcanic field, and the Palisades Sill. Dacites in the Clayton-Raton and Ocate areas have glassy groundmass, little or no quartz phenocrysts, and occur as dikes and plugs of limited aerial extent. It is unlikely that these areas were the source of the Ogallala pebbles. The Palisades Sill in Cimarron Canyon, and similar sills in that area, has a phenocryst assemblage particularly comparable to the biotite dacite porphyry pebbles found in the Ogallala. The present exposure of these sills is also very extensive, and they were probably the source for the Ogallala pebbles.

Avalon Well Number #1-5399 Analysis

TOM HARRINGTON, GREG DUNCAN, FANG YUAN, AND ABUBAKAR SULEONIBO
[1]Dept. of Geosciences, Texas Tech University, Box 41053, Lubbock, TX 79409-1053

The Leonard Avalon Formation is a Permian age shale unit previously identified for hydrocarbon potential. The Avalon Shale play is located in the Permian Basin in the Southeastern region of New Mexico. The Avalon- #1-5399 well log data was used to interpret the production potential from gamma ray, neutron porosity, photoelectric index (PE), bulk density, and resistivity contained within the 400' (7150'-7550') interval provided.

The Total Organic Carbon (TOC) was calculated from provided lab data using various methods. The various methods were then compared to find the result that best fit the data. The method with the best result was observed using the ITT vs. PE plot. The Maturity Index (MI) was calculated using the Zhao method to identify the thermal maturity of the carbon emplaced in the reservoir. The result of the Zhao method for MI was determined to be 6.3488, which plots within the Wet Gas + Condensate zone.

The Organic Oil in Place (OOIP) was then calculated from the simultaneous equation method. The OOIP was determined for a 250' hydraulic fracture height along a 7,100' lateral well. The placement of the horizontal drilling was chosen due to the largest calculated OOIP, which was 7351'. The calculated result from this depth was 20,328,093.87 barrels of oil for the coverage area, which assuming a 3% recovery rate would produce 609,842.8 barrels of oil. With current oil prices above $100/barrel this would provide a $609 million gross potential.

Well Log Analysis of the Permian Leonard [Avalon] Shale of Southeastern New Mexico (Group 1).

O. HILLER, M., OLADOKUN, E. ONYENWERE, T.A. SHILLER, J.D. URREA-VEGA
Dept. of Geosciences, Texas Tech University, Box 41053, Lubbock, TX 79409-1053

The purpose of this study was to employ methods of well log analysis to determine optimal hydrocarbon reservoirs within the Permian Avalon shale to be selectively fractured. The Avalon shale is a Leonardian-age formation that has produced important oil plays in southeastern New Mexico. This study focuses on well data collected from an area previously unprospected for Avalon oil plays.

By testing multiple methods of determining TOC, PE was found to be the most accurate method when compared to avaliable lab data. Using calculated TOC values the remainder of unknown variables (volume of kerogen, total porosity, volume of quartz and volume of clay) were determined. By analalyzing and applying limiting factors to this data, intervals with little or no reservoir potential were eliminated. The interval with the hightest production potential was found to be from 7228.5 to 7478.5 ft..

For this proposed 250 ft. fracture a total OOIP of 20.4 MMbbl of oil was calculated. With 3% recovery, this reservoir has the potential of producing 612,740 bbls of recovered oil.

An Analyses of Lightning Channel Speeds

S. HINOJOSA[1*], E. BRUNING[2]
[1]Dept. of Geosciences, Texas Tech University, Box 41053, Lubbock, TX 79409-1053 Stephen.Hinojosa@ttu.edu

[2]Atmospheric Sciences Group, Texas Tech University, Box 42101, Lubbock, TX 79409-2101

Through the analyses of Lightning Mapping Array (LMA) data of a flash from a winter storm in Washington D.C, the charge structure, velocities and accelerations of lightning channels are presented. The detailed map given by the LMA allows for accurate values of 3-dimensional speeds to be calculated. By comparing calculated speeds with positive and negative leaders in the lightning channels, an average speed can be calculated for the negative and positive leaders in a given flash. Velocity values in negative leaders that originate from low altitudes range from 20km/s to 35km/s. Velocity values from positive leaders that occur at higher altitudes range from 80 km/s to 180km/s. When comparing these results with those found by previous published work, it is likely that higher altitude channels do indeed travel faster than low altitude channels. It is possible that this is the result of stronger polarity in the positive upper levels of the storm clouds. The stronger polarity is likely caused by the larger amount of charged particles found at higher altitudes as precipitation grows and subsides, and or the strength of the positive and negative charge structures as they stack on top of one another in the storms structure.

Saba, M. M. F.,K. L. Cummins, T. A. Warner, E. P. Krider, L. Z. S. Campos,M. G. Ballarotti, O. Pinto Jr., and S. A. Fleenor (2008), Positiveleader characteristics from high-speed video observations,Geophys. Res. Lett., 35, L07802, doi:10.1029/2007GL033000

Analysis of WRF Model Forecasts at Different Resolutions for Convective and Winter Weather Events.

M. JARES[1*], B. ANCELL[2]
[1]Dept. of Geosciences, Texas Tech University, Box 41053, Lubbock, TX 79409-1053 (*megan.jares@ttu.edu)
[2]Atmospheric Sciences Group, Texas Tech University, Box 42101, Lubbock, TX 79409-2101

As technology and compuation power have advanced over time, the ability to compose forecasts at high resolutions has become more feasible. Choosing the most suitable resoltuion to create forecasts can reduce process time and can result in more accurate and reliable forecasts. Global Forecast System (GFS) data of three winter weather cases in the South Plains as well as three convective cases in the South and Central Plains will be used. The data will then be run through the Weather Research and Forecasting-Advanced Research (WRF) model at different resolutions, including 12 km, 4 km, 3 km, and 2 km, to generate a 24-hour forecast. The product models created at the different resolutions will then be visually analyzed and compared to actual radiosonde soundings and radar images recorded at the location of the weather events. The resolution whose model best follows the observed and recorded data can then be considered to be the best resolution for future forecasting. Further study in this research will yield numerical analysis and interpolation of real-time data recorded at mesonet stations.

Sedimentology of the Cloud Chief Gypsum (Permian) in Briscoe County, Texas.

KENNETH JONES [1]
[1]Dept. of Geosciences, Texas Tech University, Box 41053, Lubbock, TX 79409-1053

A depositional model for the Permian Cloud Chief Gypsum is presented on the basis of a stratigraphic section measured in Caprock Canyons State Park, and petrographic thin-sections made from samples collected there. From these observations it was determined that the gypsum found in the Cloud Chief was deposited under subaqueous conditions, in a shallow coastal lagoon or "salina" under an arid climate. Sandstone layers interbedded with the gypsum are eolian windblown sediments that accumulated in areas surrounding the lagoon. Repeated rise and fall in sea level or climate change during Permian time produced transgressive-regressive cycles, with the gypsum beds forming during times when the lagoon was submerged, and eolian sandstone beds forming during times when the lagoon emptied and was covered by windblown sand. The uppermost gypsum bed is thick and well laminated, with alternating layers of gypsum and dolomite, suggesting it probably formed when water depth in the lagoon was at its greatest.

Timing of folding and sill intrusion, Dagger Mountain area, Big Bend National Park and Black Gap Wildlife Management Area.

N.K. KNOX[1*], J.I. SATTERFIELD[1]
[1]Dept. of Physics and Geosciences, Angelo State University, ASU Station #10904, San Angelo, TX 76909 (*nknox2@angelo.edu)

Mapping at 1:12,000 scale on the south and east flanks of Dagger Mountain (SDM) in Big Bend National Park and Black Gap Wildlife Management Area reveals details about three phases of Laramide and Basin and Range structures. SDM is located in northern Sierra del Carmen, near the eastern margins of the Cordilleran orogen and Basin and Range province. Five Cretaceous map units, 32 Ma intrusions [1], and two Quaternary units crop out in the map area. Mapping and descriptive structural analysis complement previous mapping at 1:12,000 to 1:48,000 scales [2,3,4]. Descriptive structural analysis techniques applied to outcrop- and map-scale structures include: calculating axial plane and fold axis orientations using stereonets, describing fold symmetry, half-wavelength, interlimb angle, and limb-thickness variations, interpreting fault kinematic indicators, and constructing a tied cross-section grid. First-phase map- and outcrop-scale folds contain subvertical axial planes striking ~349 and fold axes at ~153 01. Second-phase folds contain subvertical axial planes striking 014-070 and fold axes at 195-248 2-6. Third-phase, high-angle faults striking 348 and 320 cross-cut first-phase folds, 32 Ma sills, and possibly second-phase folds. One sill appears folded in map-scale D2 and D3 folds, implying that D2 and D3 are post-32 Ma, or sills vary greatly in age, or the sill intruded into already folded strata. May 2012 mapping objectives are: 1) find southern termination of a major thrust, 2) map additional intrusions to establish timing relations with faults, 3) collect data on additional folds, 4) find fault-kinematic indicators.

[1] Morgan and Shanks (2008) USGS Circular 1327, 43-55
[2] Poth (1979) University of Texas Masters thesis, 56 p
[3] Moustafa (1988) UT-BEG map GQ0054
[4] Cooper and others (2011) UT-BEG map MM0050

Nature and origin of the Vealmoor Gravel, southwestern Borden County, Texas.

LOGAN LANGFORD[1]
[1]Dept. of Geosciences, Texas Tech University, Box 41053, Lubbock, TX 79409-1053

A gravel deposit near Vealmoor in Borden County, Texas has produced unique gravel used in residential and commercial applications around the High Plains for many decades. The Vealmoor gravel consists mostly (about 70% by weight) of distinctive white vein quartz pebbles with comb structure and sparse clusters of calcite crystals. The remainder of the gravel (about 30% by weight) is composed of dark laminated chert with quartz-filled fractures. This limited and uniform clast composition differs markedly from gravel typically found elsewhere around the High Plains. However, a gravel sample obtained from the upper part of the Triassic Dockum Group (Trujillo Sandstone) in the subsurface of Gaines County has nearly identical composition. This strongly suggests that the Vealmoor gravel is an outlier of the Trujillo Sandstone. Ordovician bedded chert in the Maravillas Formation, exposed in the Marathon fold belt of southwestern Texas, is highly fractured and deformed, and similar to the Vealmoor chert pebbles, but has calcite-filled fractures. More distant cherts of equivalent age in the Ouachita Mountains of Arkansas and Oklahoma are also fractured and deformed, and associated here with extensive quartz veins. These rocks are also present in the subsurface of the Texas coastal plain, where they have been penetrated by drilling. Although these rocks are now covered by Cretaceous strata, it is likely they were exposed during Triassic time, and provided a nearby source for the Vealmoor gravel.

The source of basalt pebbles in the Ogallala Formation, Southern High Plains, Texas.

ZACH LOFTIES [1]
[1]Dept. of Geosciences, Texas Tech University, Box 41053, Lubbock, TX 79409-1053

Basalt pebbles collected from gravel at three sites in the Ogallala Formation can be divided into four types. These are described here as aphanitic trachybasalt, microporphyritic olivine basalt, glomeroporphyritic olivine basalt, and olivine ?trachyandesite. Three of the Ogallala basalt pebble types are similar petrographically to older basalt lava flows in the Ocate volcanic field and with the Clayton basalts in the Raton-Clayton volcanic field of northeastern New Mexico. The nearly complete alteration of olivine to iddingsite observed in all of the Ogallala basalt pebbles, quartz xenocrysts surrounded by outward radiating reaction coronas of augite, and large vesicles in some cases filled completely by calcite are features most similar to those described for a few of the older Ocate lava flows (especially those at Coyote Creek, Black Lakes, and Guadalupita Canyon). A fourth pebble type (olivine ?trachyandesite) is unlike any rock type found in either the Ocate or Raton-Clayton volcanic fields. These pebbles may have come from a source within one of these areas that is now buried under younger lavas, no longer exposed, or yet to be described, or may have come from a completely different area.

Escherichia coli (E. coli) And Coliform Within the Concho River System, San Angelo, Tom Green County, TX

LOUDER, JARRETT[1*], TIMMERMANN, ANDREW[1], and WARD, JAMES W.[1],
[1]Department of Physics and Geosciences, Angelo State University, ASU Station #10904, San Angelo, TX 76909-1015,(*jlouder1@angelo.edu)

With expanding human population water borne pathogens have been a rapidly growing topic of concern for research and . The need for clean and pathogen free water is becoming more and more important with the spread of serious, sometimes fatal, illness. Pathogens are microorganism; such as bacteria, viruses, protozoa…etc. These pathogens can cause diseases and are readily found in all natural waters. This research study looked at the physiochemical parameters as well as amounts of *Escherichia coli (E. coli)* counts within the selected system for multiple sites along the Middle and South Concho Rivers, a state and National listed 303d impaired waterway. A moderate sized urban hub in west central Texas, San Angelo is dominantly surrounded by farm and ranch lands. The Concho River System drains these lands and flows through the center of town before heading to the Colorado River of Texas.

Preliminary data shows a nearly 10 times higher reading of *E. coli* in samples from the Concho River as it leaves San Angelo then when it enters the city. This finding is consistent with our sample counts as we moved west to east downriver sampling biweekly. Furthermore, June 2012 sampling for host specific Bacteroides 16s rRNA markers will aid determining the exact source of fecal loading within the Concho River System (e.g., are fecal inputs; human, bovine, avian, etc. in origin). Research findings suggests a future need to further study the contaminants found as well as the possible sources, type of contamination, and subsequent treatment of the water before the Concho River can be suitable for human contact by current EPA standards.

Calcite Growth; Emphasis on Size, Structure, Element Incorporation, and Potential Effects on Cementation in Reservoirs

LAURA M. MOORE*, CALLUM J. HETHERINGTON
[1]Dept. of Geosciences, Texas Tech University, Box 41053, Lubbock, TX 79409-1053 (*lauram.moore@ttu.edu)

Crystal shape, surface structure, nucleation density, and crystal growth rate during lithification and cementation are some of the important factors that control porosity and permeability of oil and gas reservoirs. Calcite is a common cement in sedimentary rocks and is also recognized to have one of the greatest diversities of crystal morphologies. Diversity in calcite crystal shape, growth direction, and crystal size during reservoir diagenesis may impact many decisions regarding reservoir viability as well as how a reservoir will behave during development (e.g. fracking), exploitation and extraction. A series of calcite precipitation and growth experiments have been conducted and the solution chemistry was doped with a range of 1, 2, and 3+ charged cations. The products of the experiments have been imaged by optical and electron microscopy, compositionally analyzed by LA-ICP-MS, and their crystallographic properties refined by X-ray

diffraction methods. Fifteen morphologies found in Goldschmidt's Atlas of calcite morphology have been identified and crystallite size was observed to vary significantly. Average calcite crystal size produced is ~0.7mm, but in solutions doped with sodium the size distribution profile is skewed towards 0.02mm, with a few larger crystals up to 0.05mm. Solutions doped with lanthanum produced larger dendritic crystals visible to the naked eye with size variances of 0.01mm – 3.0mm. The experiments demonstrate that fluid composition plays a first order control over calcite surface structures and crystal size, and by extension, may significantly impact the development of cement and its control over porosity and permeability.

The Sensitivity of Dryline Evolution to Soil Moisture and the El Niño/La Niña Southern Oscillation.

J. NAUERT[1*], C.C. WEISS[2]
[1]Dept. of Geosciences, Texas Tech University, Box 41053, Lubbock, TX 79409-1053 (*christian.nauert@ttu.edu)
[2]Atmospheric Sciences Group, Texas Tech University, Box 41053, Lubbock, TX 79409-1053

The study analyzes the effects that the El Niño/La Niña Southern Oscillation and soil moisture suppression have on the possible eastward displacement of the dryline across the Great Plains of the United States. Two years from each phase of the oscillation were selected from 2000 to 2011 by averaging multivariate index values for the highest ranking (El Niño) and lowest ranking (La Niña) years. The years 2002 and 2010 were selected to represent El Niño conditions while 2008 and 2011 were used to represent the La Niña phase. Dryline days were observed from the DIFAX map archive for each year during the spring months of April, May and June at 0000 UTC. Dates with dryline development covering a large domain were composited for each oscillation using the NCEP/NCAR reanalysis tool at 925 and 500mb. The data provided were input into the Unidata IDV system to analyze the general position of the specific humidity gradient for the El Niño and La Niña composites. For each dryline day, soil moisture readings from nine stations were obtained and averaged from the West Texas Mesonet data files at 0000 CDT.

Drylines were observed on 157 studied days. The El Niño composites favored dryline location near the climatologic dryline position of -101°W (Hoch and Markowski 2004) while the La Niña composites located the specific humidity gradient farther east near -100° to -99°W. Suppression of soil moisture occurred during La Niña oscillations with 2011 having the lowest water content and highest soil temperature. Soil moisture suppression during the La Niña oscillations and the cycle itself is suggested to be a cause of eastward displacement of the dryline.

[1] Hoch, J. and Markowski, P. (2004) *Journal of Climate* **18**, 2132-2137.

Heat and Fluid transport in the vicinity of the Corsair growth fault, Gulf of Mexico

NOSA OGIAMIEN[*], SEIICHI NAGIHARA[2]
Dept. of Geosciences, Texas Tech University, Box 41053, Lubbock, TX 79409-1053
(nosakhare.ogiamien@ttu.edu)

In the mid-section of the Texas continental shelf off Mustang Island, sedimentary thermal gradients in the vicinity of the Corsair growth fault zone (0.04- 0.05 K/m) are elevated relative to those off the fault zone (0.02 – 0.031 K/m). The mechanism responsible for the elevated thermal gradients has not yet been determined. It has been previously suggested that the faults that make up the Corsair system might serve as conduits for hot fluids recently expelled from over-pressured, deep sediments. The objective of my thesis research is to determine the mechanism that causes the high thermal gradient in the vicinity of the Corsair growth fault. This is accomplished by constructing computational models of sedimentary heat and fluid transport t in the hot section of the Corsair system throughout its geologic history. This type of computational model is called a basin model.

Construction of the basin models is a two-step process. The first is reconstruction of sedimentation and tectonic history of the study area. The second step is to model the heat and fluid transport through the sediments as they accumulate. I first construct a set of one-

dimensional (vertical) heat transport models for several localities and then generate a two-dimensional model along a profile that crosses the Corsair fault zone. Results from the one-dimensional models show that different sedimentation rates, and heterogeneity in sediments thermal conductivities does not account for the high thermal gradient observed. Either variations in basal heat flow or/and fluid flow along fault zone are likely mechanism that might be responsible for the high thermal gradient observed.

Structural and Stratigraphic Evolution of the Clemente-Tomas and Corsair Growth Fault Systems in the Texas Continental Shelf.

OLABISI. AJIBOYE*, SEIICHI. NAGIHARA
Dept. of Geosciences, Texas Tech University, Box 41053, Lubbock, TX 79409-1053 (*olabisi.ajiboye@ttu.edu)

In the Texas continental shelf in the Gulf of Mexico, the Clemente-Tomas and Corsair growth fault systems run roughly parallel to the shoreline. Using a 3-D seismic volume, borehole and core paleontology data obtained in the Mustang Island federal lease area, my thesis last year focused on the general structural evolution of this area from the Oligocene to the Late Miocene. The present study uses an additional chronostratigraphic surface, Buliminella 1 (3.8 Ma), to refine the time constraints to the geologic evolution for the more recent period.

The Clemente-Tomas growth fault was initiated by a shale mobile substrate evacuation in the Oligocene. The shale body developed into a linear diapiric ridge. By early Miocene (23 to 18 Ma), the shale diapirism was causing the basinward sliding of overlying sediments. This initiated the Primary Corsair growth fault movement. A temporary semi-starved mini-basin formed on the downthrown side of the Corsair fault and subsequent deposition into the mini-basin kept the fault active through the early Pliocene (3.8 Ma), while by the late Miocene (9.11 Ma) movement along the Clemente-Tomas fault slowed down considerably.

Geothermal Heat Flow Associated with Growth Fault in the High Island Area, Gulf of Mexico

MOTUNRAYO OLADOKUNU
Dept. of Geosciences, Texas Tech University, Box 41053, Lubbock, TX 79409-1053

In the continental shelf off the eastern Texas coast of the Gulf of Mexico, previously, high geothermal gradient anomalies were observed within 3- to 5-km deep sediments along the growth-faults zones. Such anomalies may be related to the hydrocarbon maturation histories and migration of hot fluids in this part of the basin. There are three major growth fault zones in the High Island federal lease area in the eastern portion of the Texas continental shelf, namely: the Clemente-Tomas fault zone, the Corsair fault zone and the Wanda fault zone. The Corsair fault zone is the most laterally extensive of the growth fault systems along the northern margin of the Gulf of Mexico. Within this margin, the High Island federal lease area is located in the mid-section of the Corsair and other growth fault systems. The geothermal data previously reported were not adequate for detailed studies of the heat transport and the thermal history for this area.

My thesis research focuses on building a computational basin model of heat and fluid transport through the sediments in the High Island area for understanding the origin of the thermal anomalies. A basin model is a schematic representation of the evolution of the basin from the past to present showing the different sediment types, structure, heat and fluid migration routes existing in the basin. An important constraint to the model is sedimentary temperature data. Bottom-hole temperature data were obtained from approximately 1533 wells and the Horner plot technique was used to correct them of the thermal disturbance due to drilling operations. A detailed mapping of the sedimentary temperature distribution in three dimensions was done using the software ArcMap. Highest thermal gradient values (0.016 – 0.027 oF/ft) were found in areas with the major faults.,

Using the software PetroMod 1D and 2D, and previously interpreted seismic sections, basin models are constructed which show the fluid migration pattern, burial and thermal history for the High Island area.

High-frequency dual-Doppler analysis of a retrograding dryline/baroclinic boundary intersection.

ANTHONY E. REINHART, C. C. WEISS, AND D. C. DOWELL
[1]Atmospheric Sciences Group, Texas Tech University, Box 42101, Lubbock, TX 79409-2101
[2]NOAA/ESRL/GSD, Boulder, CO

Two recently-developed Texas Tech University Ka band (TTUKa) radars were deployed during the second field campaign of The Verification of the Origins of Rotation in Tornadoes EXperiment 2 (VORTEX2). Using a non-linear pulse compression technique coupled with a high transmit frequency (~35 GHz), the TTUKa radars are designed to prioritize resolution (both spatially and temporally) and sensitivity. The high sensitivity allows for robust sampling of clear air boundaries including drylines and other mesoscale air mass boundaries.

On 14 June 2010 a westward retreating dryline interacted with a southward propagating outflow boundary and quasi-stationary preexisting baroclinic boundary. The interaction between the dryline and these boundaries produced sustained deep moist convection for several hours that reinforced the southward propagating air mass.

Between 0200 and 0300 UTC the two TTUKa radars collected PPIs of the triple point of the air masses east of Amarillo, Texas. The TTUKa radars sampled the intersection between these two air masses with a baseline and range of 8 km. Dual-Doppler analysis of the triple point and the surrounding air masses will be presented revealing the finescale structure and evolution of the triple point. Other kinematic variables including convergence and vorticity will be related to the evolution of vertical velocity in the triple point region.

Stratigraphy and Depositional History of a Stream Terrace at the La Morcora Site in Rio Blanco, Manabí, Ecuador

BRITTANY RENEAU
Dept. of Geosciences, Texas Tech University, Lubbock, TX 79409-1053 (*brittany.reneau@ttu.edu)

The La Morcora site in Manabi, Ecuador rests on a modern stream terrace of the Rio Blanco. Recent archaeological excavations at Rio Blanco focus on the Manteño occupation of the site. The Manteño culture dominated coastal areas during the Integration period (500 BC to AD 500). The La Morcora site consists of a large modified stream terrace with associated masonry structures. Stratigraphic excavations and test pits at the site indicate that the terrace is comprised of at least six alluvial deposits. The present stream terrace was formed by channel downcutting following a flood event that deposited Alluvium 1. This event took place post-Valdivia occupation, and pre-Manteño occupation. It is possible there was a Guangala occupation here at some point after Alluvium 1 was deposited as well. Cultural processes were most likely not involved in formation of the terrace; it appears to be a result of natural stream processes. Possible evidence for cultural modification consists of clearing some of the coarse gravel from the side of the upper terrace onto a lower terrace. The only clear evidence for modification of the stratigraphy (backfill of pits) was encountered in units excavated for archaeological purposes. Sediment at the top of the terraces appears to be culturally modified, while everything below is alluvium and appears to have been deposited by a series of flood events. Stream-rolled pottery was recovered in all of the alluvial deposits, providing an age range for deposition of each alluvial unit. The bottommost alluvial unit was deposited after the beginning of the Preceramic Period (3500 BCE) and uppermost alluvial unit was deposited before the Guangala Occupation (500 BCE) giving the terrace an age of 2000 years at the maximum.

The Source of Rhyolite Pebbles in the Ogallala Formation, Southern High Plains, Texas.

JONATHAN P. REPMAN[1]
[1]Dept. of Geosciences, Texas Tech University, Box 41053, Lubbock, TX 79409-1053

Rhyolite pebbles collected at several locations in the basal gravels of the Ogallala Formation in west Texas and eastern New Mexico can be separated into three types based on variation in the phenocryst assemblage and groundmass texture; vitrophyric rhyolite porphyry, glomeroporphyritic rhyodacite, and biotite rhyolite porphyry. The texture of the groundmass is glassy

in the vitrophyric rhyolite, but holocrystalline in the glomeroporphyritic rhyodacite, and poikilitic in the biotite rhyolite porphyry. The phenocryst assemblage consists of sanidine, quartz, and biotite in the rhyolites, but abundant plagioclase is present as glomerocrysts in the rhyodacite. The similarity in gross appearance of the three pebble types suggests that differences among them may reflect variation due to depth or position within the same source rocks; however, the vitrophyric rhyolite probably represents a flow, whereas the rhyodacite and biotite rhyolite may represent shallow intrusive rocks. Only a few areas in northern New Mexico could have been source areas for the rhyolite pebbles. Of these, the rhyolite and quartz latite porphyrys in the Latir Volcanic Field and the Relica Peak rhyolite plug near Wheeler Peak are of appropriate age, and very similar to the most common Ogallala pebbles, the glomeroporphyritic rhyodacite.

Carbonate facies of the Mulde Event (Silurian), Western Tennessee

B.RICHARDS [1]
[1]Dept. of Geosciences, Texas Tech University, Lubbock, TX 79409-1053 (*benjamin.richards@ttu.edu)

The Mulde Event is one of three extinction events and stable isotope excursions during the Silurian Period. The Mulde Event is not well-known in North America, so this research examined the event in two outcrops of the Wayne Formation near Clifton, Tennessee: the Clifton Roadcut (CRN) and the Clifton Quarry (CFTT). The formation was deposited in a carbonate ramp setting and consists of the Maddox limestone, the Waldron Shale and the Lego limestone. The conodont and stable isotope evidence show that the Waldron Shale contains the Mulde Event. The upper Maddox is largely composed of pale red, fine-grained skeletal packstone and contains broken bryozoans, ostracods, and echinoderm debris with a density up to 40%. The overlying one-meter-thick Waldron Shale is a gray-red, wackestone and calcareous shale with fewer bryozoans, and less broken allochems, representing a lower energy, possibly deeper water environment. The Waldron's allochem density does not exceed 15%. Above that, the lower Lego is a fine-grained skeletal packstone with a red-purple hue and contains broken bryozoans, echinoderm debris, trilobites and ostracods with an allochem density up to 50%.
The Waldron shale represents a flooding event in which an influx of clay entered the rock record and the Mulde occurred. Conodont diversity decreases sharply up section into the Waldron Shale and the carbon isotope excursion reaches maximum values. Though the Mulde Event is closely correlated with a eustatic rise, the cause of the Mulde Event remains unclear.

Synthesis and Characterization of the β form of MnO_2 via Hydrothermal Processes

JENNIFER R. RIEDEL[1] AND MOIRA K. RIDLEY
Dept. of Geosciences, Texas Tech University, Box 41053, Lubbock, TX 79409-1053([1]jennifer.riedel@ttu.edu)

The synthesis of β-MnO_2 (pyrolusite) was accomplished by two simple hydrothermal synthesis procedures. In the first method $Mn(NO_3)_2$ solutions were heated. In the second procedure, the composition of the synthesis solutions were more complex, comprising $KMnO_4$, $NaNO_2$, and H_2SO_4. Both methods produced uniform nanorods. The samples were characterized with SEM and XRD. The SEM images showed good crystallinity and XRD patterns confirmed the presence of β-MnO_2. To determine which experimental parameter had the greatest control on the morphology of the β-MnO_2 crystals, experimental conditions were varied, specifically, molarity of reactants and pH of the starting solutions, and reaction time.

The Impact of Chemical Abrasion on Trace Element, U-Pb, and Oxygen Isotope Analysis of Zircon by In Situ Micro-Analytical Techniques

A. ROMANOSKI[1*], N. COINT[1], C.J. HETHERINGTON[1], J.M. COTTLE[2], C.G. BARNES[1]
[1]Dept. of Geosciences, Texas Tech University, Box 41053, Lubbock, TX 79409-1053 (*anthony.romanoski@ttu.edu)
[2]Dept. of Earth Sciences, University of California, Santa Barbara, CA 93106-9630, USA

Zircon from the Red Bluff Granitic Suite in the Franklin Mountain near El Paso, Texas (ID-TIMS age 1120 ± 35 Ma) have been thermally annealed and chemically abraded prior to ion microprobe

and laser ablation inductively coupled-plasma mass spectrometry analysis. Ion microprobe analysis of chemically abraded zircon give a U-Pb date of 1109 ± 22 Ma with discordance between 11 and 103% (n = 7). This compares with dates of 1137 ± 48 Ma with discordancy between -3 and 11 (n = 14) for non-abraded zircon from the same sample. Data collected by laser-ablation inductively-coupled plasma mass-spectrometry gave calculated dates of 1119 ± 6.7 (n = 17) and 1127 ± 17 Ma (n = 14) for non-abraded and abraded zircon respectively. Other petrographic and analytical observations of the chemically abraded zircon include brighter cathodoluminescence (CL) intensity, lower rare earth element (REE) abundances, and more consistent (smaller scatter) negative Eu/Eu* anomalies. No variation in O isotope ratios between abraded and non-abraded zircon was observed. The data show that thermal annealing and chemical abrasion of zircon prior to analysis by in situ ion-beam techniques may result in better accuracy and greater concordance in U-Pb analysis of zircon. However, while improving the statistical quality of some components of the trace element dataset (e.g. U-Pb, Eu anomalies), chemical abrasion changed the measured abundances of the rare earth elements. The use of trace element data acquired from chemically abraded zircon to address petrologic and geochemical questions should be carefully considered.

Quartz Preferred Orientation and its Impact on Thermal Anisotropy in Sandstone and Quartzite

TRUDY WATKINS[1*],CALLUM J. HETHERINGTON
[1]Dept. of Geosciences, Texas Tech University, Box 41053, Lubbock, TX 79409-1053 (*trudy.watkins@ttu.edu)

Thermal conductivity is an important mineral and rock property because heat transfer is a factor in understanding the development of economic resources, including geothermal energy and hydrocarbon resource maturation. Quartz, one of the most abundant minerals in the Earth's crust and near-surface sediments is thermally anisotropic with higher thermal conductivity parallel to its c-axis compared to its shorter a-axes[1]. Its anisotropy suggests that quartz-rich lithologies with preferred orientation may have higher thermal conductivity. In this study the thermal conductivity of eight quartzite samples, with variable degrees of shape-preferred orientation from the Manzano Mountains, (NM), has been measured. Quartz shape preferred orientation data, measured on the basis of length to width ratios, were measured by optical microscopy. All samples have average length to width ratios in quartz >2. Thermal conductivity was measured on 2.54 cm diameter, ~4 mm thick discs that were cored parallel and perpendicular to the foliation in each sample. Preliminary measurements show that thermal conductivity does vary between samples, and that those samples with a greater degree of shape-preferred orientation have high higher thermal conductivity values when measured parallel to foliation[2]. The importance of the preferred orientation and its proportional relationship with bulk-rock thermal anisotropy can be used to improve models for heat transfer in the upper crust.

[1] Gibert, B., and D. Mainprice, 2009, Effect of crystal preferred orientations on the thermal diffusivity of quartz polycrystalline aggregates at high temperature: Tectonophysics, v. 465, p. 150-163.
[2] Horton, Brian, 2010, Quartz Preferred Orientation and its Impact on Thermal Anisotropy in Sandstone and Quartzite

Early Permian Wind Parameters Recorded in the Lyons Formation, Manitou Springs, Colorado.

A.J. WATTERS* AND D.E. SWEET[1]
[1]Dept. of Geosciences, Texas Tech University, Box 41053, Lubbock, TX 79409-1053

The Permian of western North America is characterized by the initiation of drying conditions that are in part related to the development of Pangean monsoonal circulation. At Manitou Springs, Colorado, the Permian Lyons Formation is a moderately well sorted to well sorted-subrounded, fine to medium quartsoze sandstone exhibiting large-scale (up to 9m) crossbedding with internally graded ripple laminae beds. The large-scale crossbedding is

bounded by thoroughgoing, relatively planar surfaces inferred as bounding surfaces. These relationships are consistent with an eolian interpretation inferred by other workers. Cross-bedding orientations were analyzed to test if monsoonal circulation influenced the surface winds that mobilized the Lyons dunes. Restoring bounding surfaces to horizontal, the mean down dip direction of restored planar crossbeds (N = 75) is 251 ± 6.9° SW. Correcting for rotation of the North American plate since deposition the , the mean down dip direction is 282 ± 6.9° NW. Given that the Lyons Formation was between 5-10° N latitude at the time of deposition, the surface wind direction reported here is consistent with dominantly westerly directed zonal circulation, but the northwesterly direction may suggest some cross-equatorial flow.

After disaggregation of samples by citrate-bicarbonate-dithionite method, laser particle size analyzer grain size distributions show a fine skewed histogram with a 5% mud tail. In thin section, the clay is most commonly observed as intragranular cement, thus removing the finest 5% should capture a better representation of the grain size distribution during transport. Histogram parameters of the coarsest 95% have a standard deviation of 0.47 and nearly symmetrical. Assuming no entrainment inhibiting factors, such as moisture content, sorting and vegetation, wind speed critical thresholds at the grain surface are calculated between 31.5 and 21.5 cm/s for the coarsest and median grain sized, respectively. Assuming a relatively flat and normally rough bed surface, these thresholds equate to wind speeds between 24 to 35 km/hr for entrainment and 20 to 30 km/hr (D0 and D50, respectively) under saltation for an elevation 3m above the surface.

A Two-Case Study of Convective Initiation Off the Dryline in the Texas Panhandle

H. WOOD[1], C. WEISS[2]
[1]Dept. of Geosciences, Texas Tech University, Box 41053, Lubbock, TX 79409-1053 (heather.wood@ttu.edu)
[2]Atmospheric Sciences Group, Texas Tech University, Box 41053, Lubbock, TX 79409-1053 (chris.weiss@ttu.edu)

Drylines are a prominent feature in the Central-South Plains and are known for initiating severe storms. This study looks at two cases of drylines, one that initiated convection and one that did not, in order to find environmental factors that may have aided or hindered convection. DIFAX maps, Storm Prediction Center outlooks and reports, satellite archives, NCAR reanalysis maps and radar images, soundings, and West Texas Mesonetwork data were all used to analyze these cases.

The radar images were used to find the dryline fine-lines so that WTM data could be used to calculate confluence values at 2130z for each case. The success case, June 9, 2005 had confluence values with magnitudes of 10^{-4} and 10^{-5} s^{-1}, while the fail case, May 21, 2004 had confluence values with magnitudes of between 10^{-5} and 10^{-7} s^{-1}. At 0000z June 9th also had more moisture available at 925 mb and more favorable values for lifted index and vertical velocity at 700 mb and 500 mb. The soundings showed large subsidence inversions for May 21st, which supports the reanalysis (i.e., model) solution for omega (vertical velocity), and a much larger cap to overcome. May 21st did have higher specific humidity at 500 mb compared to June 9th, a fact that could help or hinder convective potential. Overall June 9, 2005 had a more favorable environment for convection than May 21, 2004.

Building Initial 3D Initial Velocity Model Using 2D Deformable Layer Tomography

FANG YUAN
Dept. of Geosciences, Texas Tech University, Box 41053, Lubbock, TX 79409-1053 (fang.yuan@ttu.edu)

Deformable layer tomography (DLT) can be used to derive the layered velocity structure by directly inverting the depth perturbation of velocity discontinuities using first-arrival data. While the 3D DLT is costly, 2D DLT is generally stable, simple, and fast. For balancing effectiveness and accuracy, we put forward a new method to build 3D initial model by using 2D velocity profile. The entire data processing work-flow, from quality control to model building, will be briefly described in the study.

There are three main reasons for us to use 3D DLT by suing 2D velocity profile. First, 2D velocity mode cannot display the steep dip interface in

current seismic survey, especially the marine survey because the azimuth of location data is narrow. Second, all tomography methods are known to depend on the quality of the initial, ie. the better the initial model, the better the inverse results. Third, 3D is deeply influenced topography. In this study, the local earthquake data are adopted from Southern California Earthquake Data Center to determine the subsurface model and near surface structure of Southern California. A series of 2D DLT profiles are used to established the initial 3D model. The information of the number of velocity layers, layer interval velocities, and model cell spacing, provided by 2D profile inversion, can be used to build 3D initial model. Further research is focus on inversing lateral velocity variation in each model layer and 3D Moho geometry in Southern California.

INDEX

ABDELRAHMAN, A. 2
ALLEN, J. 2
ANCELL, B. 6,8
BARNES, C.G. 14
BARRERA, M. 2
BIEBERLY, T.R. 3
BRUNING, E. 7
CALDERON, S. 3
CARTWRIGHT, M.J. 3
CHRISTIE, C.H. 4
COINT, N. 14
COTTLE, J.M. 14
CULLEN, J.D. 4
DOWELL, D.C. 13
DUNCAN, G. 7
EMADIBALADEHI, E. 3
FAHNTRAPP, D. 5
FARHAN, A. 5
FINDLAY, C.P. 5
FISHER, T. 5
GIFFORD, P. 5
GILBREATH, A.C. 6
HARRINGTON, R. 7
HETHERINGTON, C.J. 10,14,15
HILLER, O. 7
HINOJOSA, S. 7
JARES, M 8
JONES, K. 8
KNOX, N.K. 9
LANGFORD, L. 9
LI, W. 2
LOFTIES, Z. 9
LOUDER, J. 10
MIGGINS, D.P. 3
MOORE, L.M. 10
MORSEY, S. 2
NAGIHARA, S. 2, 4, 11, 12
NAUERT, J. 11
OGIAMIEN, N. 11
OLABISI, A. 12
OLADOKUN, E. 7
OLADKUNU, M. 12
ONYENWERE, E. 7
PRATT, K. 5
REINHART, A.E. 13
RENEAU, B. 13
REPMAN, J.P. 13
RICHARDS, B. 14
RIDLEY, M.K. 14
RIEDEL, J.R. 14
ROMANOSKI, A. 14
SATTERFIELD, J.I. 3, 4, 9
SHILLER, T.A. 7
SHUBHAM, G. 5
SILLER, V.P. 4
SUBRAMANIAN, E. 3
SULEONIBO, A. 7
SWEET, D.E. 5, 15
TAVE, M. 2
TIMMERMANN, A. 10
TREAT, C. 2
URREA-VEGA, J.D. 7
VENKATA, G. 5
WARD, J.W. 10
WATKINS, R. 15
WATTERS, A. 3, 15
WEISS, C.C. 11, 13, 16
WOOD, H. 16
YUAN, F. 7, 16