December 14, 2012

Bubble, bubble, tremors and trouble: The Bayou Corne Sinkhole

Prof. Jeffrey Nunn, Louisiana State University

Abstract: At the end of May 2012, methane bubbles were first observed in Bayou Corne in Assumption Parish, LA. Geochemical analysis revealed that the methane was thermogenic rather than biogenic. Additional sites of methane bubbling in Bayou Corne and nearby Grand Bayou have developed over time. Bayou Corne and Grand Bayou flow above the Napoleonville salt dome which has been an active area for oil and gas exploration since the 1920s. In addition, the dome is a site of dissolution salt mining which has produced numerous large caverns with diameters of up to 300 ft and heights of 2000 ft. Some old caverns are used for storage of millions of barrels of LNG and Butane. In addition, there are gas pipelines in the region. In mid-July, some local residents felt tremors. Microseismic activity was confirmed by the USGS at the Earthscope seismic station in White Castle, LA. The USGS set up seismic stations in the area which recorded more than 60 microseismic events in late July and the first couple of days of August, 2012. These microseismic events were located on the western side of the dome. Estimated focal depths place the events just above the top of salt. In the first week of August, 2012, a sinkhole approximately 400 ft in diameter and more than 400 ft deep at its center developed overnight just to the northwest of a plugged and abandoned brine filled cavern. The sinkhole continues to grow in size due to slumping and has consumed a pipeline right of way. Microseismic activity stopped for several weeks following the formation of the sinkhole. A relief well drilled into the abandoned cavern found that the bottom 2/3 of the cavern is now filled with sediment. A 2007 seismic survey suggests that the bottom of the abandon cavern breached the edge of the salt dome allowing direct contact with permeable formations. Recently, microseismic events have reoccurred but less frequently than before formation of the sinkhole. Geophysical logging of shallow wells has found gas in the Mississippi River Alluvial Aquifer on the western side of the Napoleonville dome.

Biography: Jeffrey A. Nunn is the Ernest and Alice Neal Professor of Geology and Pereboom Professor of Science at Louisiana State University in Baton Rouge. He received his Ph.D. from Northwestern University working on the Thermal-Mechanical Evolution of the Michigan Basin under the supervision of Norman H. Sleep and Lawrence L. Sloss. He has been a faculty member at Louisiana State University since 1981. His research interests include: geodynamics of sedimentary basins, thermal and pore pressure history of sediments in the Gulf of Mexico and Alaska, and subsurface fluid flow with associated heat and solute transport especially along faults/fracture networks and salt structures.

November 9, 2012

CSI: Cyclostratigraphy Investigation: Magnetic susceptibility and gamma ray spectroscopy as proxies for Milankovitch astronomical forcing

Ryan Ellis, Louisiana State University

Abstract: Through examining current research being conducted on the Devonian/Carboniferous (D/C) boundary in southern Oklahoma, we will explore the use of bulk magnetic susceptibility (MS) and gamma ray spectroscopy (GRS) as proxies for Milankovitch astronomical forcing. With an overall biostratigraphic framework, it is possible to generate a time-series analysis from the MS and GRS signals with statistical techniques such as the Fourier transform and Multi-Taper methods. The spectral peaks provide evidence of the cyclicity that influenced the deposition of the strata. With this information, strata can be dated with far more accuracy than with just biostratigraphic data alone, allowing for precision down to the half-cycle of the shortest duration Milankovitch cycle present in the rock record at a given outcrop. There is also the advantage of using these techniques in regions that have a less robust fossil record. High-resolution dating is highly useful for many practices including paleoclimate modeling, boundary correlation, and determination of sedimentation rates. The research in Oklahoma will also touch on the current state of the D/C Global boundary Stratotype Section and Point (GSSP), and efforts to nominate a new section.
Biography: Ryan Ellis is a second year master's student currently studying with Dr. Brooks Ellwood at Louisiana State University. Growing up in Parkersburg, West Virginia he attended high school at Parkersburg High School and earned his undergraduate degree at Marietta College in Marietta, Ohio. Ryan's love of geology came at a young age when he saw a dinosaur display at the local mall. Ever since he has never passed up an opportunity to go on a fossil hunt. He is currently pursuing a career in the petroleum industry.

October 12, 2012

Conquering the complexity of southeast Louisiana soil conditions

Richard J. Varuso, Ph.D., P.E., U.S. Army Corps of Engineers

Abstract: Southeast Louisiana is known for having some of the weakest and most complex soil conditions in the world when they are relied upon to resist the forces associated with navigation and storm surge projects. By using innovative science and working closely with colleagues in the geologic, engineering, and construction industry on a compressed timeline, the U.S. Army Corps of Engineers, New Orleans District, has nearly completed construction of the approximately $15 billion Greater New Orleans Hurricane and Storm Damage Risk Reduction System. At this meeting, you will hear Rich Varuso, Deputy Chief of the New Orleans District's Geotechnical Branch, discuss how the Corps and its construction contractors conquered challenging soil conditions to build the largest Civil Works project in Corps history in only six years.
Biography: Dr. Varuso obtained his Bachelor of Science degree in civil engineering from the University of New Orleans in 1994 and began working for the New Orleans District of the US Army Corps of Engineers as a geotechnical engineer. While working for the Corps, he obtained his Masters degree from the University of New Orleans in 1998 and his Doctorate degree from Louisiana State University in 2010. Dr. Varuso's major areas of expertise include levee and floodwall design, deep foundations, retaining walls and braced excavations, and design and utilization of geosynthetics. As Levee Safety Program Manager,

he focuses his efforts to ensure risks to the community are minimized and that any residual risks are communicated to the public. He has been routinely relied upon by the Corps' attorneys as well as those from the U.S. Department of Justice for his expertise in the field of geotechnical engineering.

September 14, 2012

LIDAR in 3D: Interpreting Depositional, Erosional and Fault Topography Near Lafayette, LA.
Gary L. Kinsland, UL - Lafayette

Abstract: About eight years ago I became aware that LIDAR (Light Detection and Ranging) data were available over the area near Lafayette, Louisiana. LIDAR data are collected from aircraft outfitted with a specialized pulsing laser whose beam is directed toward the ground. The time of flight of the pulse to a reflecting surface below and back to the aircraft is determined and converted to distance. Specialized processing converts these data to "bare earth" digital elevation values with a vertical resolution on the order of 15 cm and a pixel size on the ground of one square meter. These data are publicly available at the Atlas website at LSU (atlas.lsu.edu/lidar/). I recognized that these data could be used to answer many of the topographical/geological questions I had been asking myself about the area around Lafayette since I came here in 1977. Therefore, I sought and found someone who could help me. John Wildgen, then at UNO, collaborated with me. With his expertise in making maps and cross-sections from the LIDAR data using GIS software and my knowledge of the Lafayette area we described the history of the development of the Vermilion Bayou, which I will present. Later, in a collaborative effort with Christoph Borst of the Center for Advanced Computer Studies (CACS) at UL - Lafayette, the LIDAR data of the Lafayette area were imaged in a 3D virtual reality (3D VR) system in CACS. Within the first twenty minutes I spent walking within these data I stopped and said, "I have to write another paper. I have found another possibility for how the Vermilion reoccupied its incised valley." I will explain this. With this success we input a larger area of LIDAR data into the 3D VR system and I have continued to find fascinating features within the LIDAR topography including: faults scarps, stream captures, Pleistocene Red River distributaries and natural levee deposits obscuring fault scarps. We have unraveled these features into a relative geological time scale for the area of southern-central Louisiana. Perhaps someone will come along and apply absolute dating to the features we have located, identified and placed in the relative time scheme.
Biography: Gary L. Kinsland grew up in the state of Oregon, mostly in Coquille about 10 bird miles from the Pacific Ocean. His degrees; BS Physics, MS and PhD Geology; were all earned at the University of Rochester in Rochester, NY where he was able to attend thanks to generous scholarships from Bausch and Lomb and Georgia Pacific. He was a visiting assistant professor for one year at Arizona State University and then moved to Lafayette in 1977 to begin his tenure in the geology program at what is now the University of Louisiana at Lafayette. He is married to Kellie and has three daughters; Cynthia, 40 (from previous marriage to Leslie), Mikaila, 13, and Victoria, 12. Kellie, Mikaila, Victoria and he live with six cats in a remodeled old Cajun prairie house in the country near Sunset.

May 11, 2012

Impact of the 2011Mississippi River flood on the Atchafalaya Basin

Thomas Van Biersel and David Fruge, LDNR

Abstract: The 2011 Mississippi River flood and associated floodwater diversions into the Atchafalaya Basin of Louisiana represented an opportunity to specifically document, record and archive information from a very large flood event. The Louisiana Department of Natural Resources' Atchafalaya Basin Program sought to compile a report which focused on the impacts if that inundation on Atchafalaya Basin resources and assets to public health and safety associated with the opening of the Morganza Floodway by the U.S. Army Corps of Engineers for the second time in history. The project was composed of a data analysis and collection phase, and a data compilation and graphic display phase. Thirteen different entities collected field measurements and samples within the Atchafalaya Basin during the flood event. Those efforts focused on water quality parameters. Field measurements began May 19, 2011, and ended in November 2011. This flooding event impacted basin residents and users, the oil and gas industry, agriculture and forestry, sport and commercial fisheries, fish and wildlife, wildlife management areas and a wildlife refuge, roads, and the tourist industry. Between 60 and 72% of the basin was affected by floodwaters for a period in excess of 138 days. There was a reduction in oil production of approximately 2,000 barrels/day and in natural gas production of 17.9 million cubic feet/day. Approximately 95,500 acres of agricultural land were inundated by this flooding event. It was estimated that two Louisiana black bears, as well as numerous deer, small mammals and ground nesting birds perished in the flood. Wildlife Management Areas and Refuges were closed for extended periods of time and the hunting season reduced. Approximately 700 to 800 camps and residences, 90 businesses, and numerous boat landings were flooded, and some of those boat landings received silt deposits requiring removal. Preliminary observations from the data indicate that the Atchafalaya Basin captured approximately 10% of the nutrient load contained in the floodwaters diverted through that floodway system. Some water quality improvement was observed as a result of the flood flows, although areas of black water remained in the basin during the flood.
Biography: Dave Fruge and Thomas Van Biersel work for the Louisiana Department of Natural Resources in Baton Rouge, LA.

April 13, 2012

Examination of factors influencing methane concentration within the Wilcox Aquifer in northwestern Louisiana

Doug Carlson, LGS

Abstract: Recent studies relate the occurrence of methane within groundwater to the proximity of drilling/hydraulic fracturing activity associated with development of the Marcellus shale gas play in Pennsylvania and New York. However, for the Wilcox Aquifer in northwest Louisiana other factors appear to impact methane concentrations in groundwater more than proximity to drilling/hydraulic fracturing activity with the Haynesville gas shale play. Seventy-five groundwater samples were analyzed for dissolved methane concentration and 815 samples were analyzed for head space methane

concentration for wells in southern Caddo, southern Bossier and northern De Soto Parishes in the study which covers approximately 200 township sections. Dissolved methane values were determined by gas chromatography-mass spectrometry; methane head space values were determined by a gas chromatography-flame ionization detector. Analysis shows that head space methane concentration (HSM) appear to be related to dissolved methane concentrations by a ratio of approximately 4.3:1 with strong correlation factor of over 0.8; hence variations in dissolved methane are implied by HSM in this discussion. The following parameters were considered for the more abundant HSM data; location, depth to sand, sand seam a well is screened in, proximity to lignite in the aquifer, and number of oil and gas wells in the same section as water wells, total, and recent Haynesville shale gas play wells. Results show significant difference of HSM values among the three parishes. The average HSM (AHSM) in Bossier Parish is 5.4 times that in Caddo Parish and 4.6 times that in De Soto Parish. Both differences have a statistical confidence of difference >99.9%, which is significant. Results also show that oil and gas exploration and production in the study exert little or no influence on AHSM in the study area. The AHSM in nine sections with 3-4 Haynesville well is approximately half the value of AHSM in 74 sections that have no Haynesville wells. Furthermore, AHSM in 31 sections with 0-1 older oil and gas wells is approximately twice that of AHSM in 22 sections with more than 20 older oil and gas wells. However, where screen position is known AHSM is approximately four times greater in the lower sand than in the upper sand. AHSM for wells with lignite in the screen interval is approximately 2.5 times that for wells that lack lignite. These results imply a stronger relationship between AHSM and aquifer geology than proximity to oil and gas activity. It appears that the gas field under the Wilcox Aquifer has a significant impact on HSM concentration within the aquifer. The highest median HSM values are over the Sligo and Elm Grove fields which are in Bossier Parish. The lowest median HSM values are over Bethany-Longstreet and Holly fields in De Soto Parish. The differences of HSM values are probably largely a result of the differences of underlying fields on these values.
Biography: Professor Carlson holds a B.S. degree in Geology and Geophysics from the University of Minnesota, a M.S. in Geophysics from the New Mexico Institute of Mining and Technology, and a Ph.D. in Geosciences from the University of Wisconsin at Milwaukee. Prior to working at the Louisiana Geological Survey (LGS), Douglas was a college instructor/lecturer teaching classes in environmental geology, physical geology and physical hydrogeology at the University of Wisconsin-Milwaukee. He also taught physics and astronomy at Ball State University, and physics and geophysics at the University of Wisconsin at Stout. Since 2002, he has been involved at the LGS in research projects focusing on water quality, and hydraulic properties of aquifers, using a variety of hydraulic testing, analytical and geophysical techniques both surface and down hole. Over the past several years his research has focused on groundwater resources in northern Louisiana.

March 9, 2012

Simulation of groundwater flow in the "1,500-foot" and "2,000-foot" sands and simulation of saltwater movement in the "2,000-foot" sand of the Baton Rouge area

John K. Lovelace, U.S. Geological Survey.

Abstract: Saltwater encroachment into freshwater sands in the Baton Rouge area has been a concern since 1948, when a municipal well in the City Park area had to be abandoned because of rising salinity.

An investigation of saltwater encroachment conducted during 2004 and 2005 indicated that saltwater is present north of the Baton Rouge fault in 8 of the 10 sands, and chloride concentrations (an indicator of saltwater) are increasing in 7 of the sands, which indicates that additional encroachment if occurring. The most notable recent saltwater encroachment was in the "1,500-ft" sand "2,000-ft" sands, which are important sources of freshwater to public supply and industry. The USGS, in cooperation with the CAGWCC, LaDOTD, and EBR City-Parish, is developing a computer model of the aquifers that can be used to investigate the impacts of various future pumping scenarios on groundwater flow and saltwater movement.

Biography: John Lovelace works for the USGS in Baton Rouge, LA.

February 10, 2012

Assessing the Risk of Chloride Impact from Produced Water at Oil and Gas Sites in Louisiana
Brian Carter, Conestoga-Rovers Associates

Abstract: Formation water produced from oil and gas production sites has been released into shallow groundwater at numerous locations in Louisiana. Formation water may have chloride concentrations in excess of 30,000 mg/L whereas the EPA secondary drinking water standard for chloride is 250 mg/L, and surface water standards may be as low as 10 mg/L. Therefore, there is a concern that the migration of shallow impacted groundwater may degrade drinking water aquifers or surface water bodies. An evaluation of a former oil and gas production site is presented here, where a coupled MODFLOW and MT3D groundwater model was used to evaluate the potential migration of chloride in groundwater to identified receptors as part of a risk assessment under state regulatory guidance. The model projected that groundwater concentrations could exceed the surface water protection standard at the point of exposure after about 5,000 years. The underlying aquifer was predicted not to become impacted. Regulatory policy for site closure required that the site be monitored for 5 years to verify the model predictions. The results of monitoring showed that chloride concentrations in all wells were declining and that the prediction of chloride migration was greater than observed conditions. The site received regulatory closure on the basis of the model predictions and monitoring results. The evaluation of the site indicated that a standard groundwater numerical model appeared to be more conservative than observed site concentrations warranted. The numerical model results can be also compared to analytical models contained in regulatory guidelines in Louisiana for groundwater dilution and attenuation. The results from this site and others indicate that models of chloride migration in fine-grained alluvium should be protective of human health and the environment.
Biography: Brian Carter, PhD, PG - Dr. Carter is a geologist/hydrogeologist with a bachelor's degree from North Dakota State University and graduate degrees from Louisiana State University, Baton Rouge. He has over 20 years of experience in environmental hydrogeology and forensic services and is a licensed professional geologist in several southeastern states. He is an Associate with Conestoga - Rovers and Associates, Inc, Baton Rouge.

January 13, 2012

Use of Physical and Numerical Modeling to Lay Out a Future of the Lower Mississippi River.

Clinton S. Willson, Ph.D., P.E., LSU Department of Civil & Environmental Engineering

Abstract: When allowed to flow naturally, the Mississippi River formed one of the world's largest deltas and created a significant portion of the Louisiana coast. However, economic and development needs dictated that the river be managed in a way that has prevented the river from naturally responding to changing forcings and conditions. The result is an economically vital river and coastal system that is under great deal of stress. In this talk, I will will briefly discuss the 2011 flood event, the changing hydrodynamics and sediment transport patterns in the lower ~100 miles of the river, potential impacts of relative sea level rise and proposed river diversions on the lower river hydraulics and the planning and design of a new movable-bed physical model of the river.

Biography: Clint received his BS in Aerospace Engineering from Penn State in 1985. After spending ~ 6 years as an officer in the US Marine Corps, he attended the University of Texas Austin where he received a MS in Environmental Engineering and a PhD in Civil Engineering. After graduating from UT-Austin, he worked for 2 years as a postdoc at UNC-Chapel Hill in the Dept of Environmental Science and Engineering and then moved to Baton Rouge. Since that time, he[1]s been working in the areas of single and multiphase flow in porous media and physical and numerical modeling of river hydrodynamics and sediment transport.