The Louisiana Geological Survey

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LGS Mission Statement

The goals of the Geological Survey are to perform geological investigations that benefit the state of Louisiana by:

(1) encouraging the economic development of the natural resources of the state (energy, mineral, water, and environmental);

(2) providing unbiased geologic information on natural and environmental hazards; and

(3) ensuring the effective transfer of geological information.

The Louisiana Geological Survey was created by Act 131 of the Louisiana Legislature in 1934 to investigate the geology and resources of the State. LGS is presently a research unit affiliated with the Louisiana State University and reports through the Executive Director of the Center for Energy Studies to the Vice Chancellor for Research and Graduate Studies.

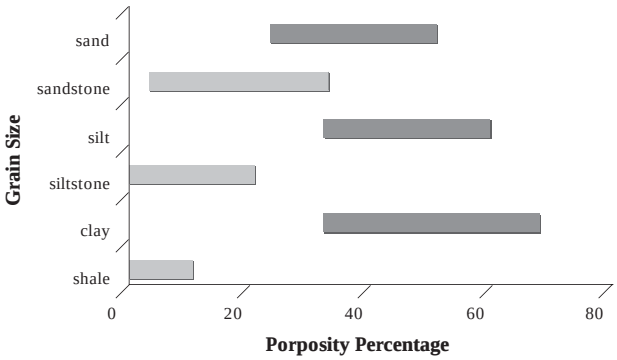

Figure 2. The impact of the lithification of loose sediment into a rock for common sediment-rock types (Table 5.1 of Driscoll, 1986; Tables 2.1 and 2.2 Domenico and Schwartz, 1990; and Tables 2.1 and 3.2 of Weight and Sonderegger, 2001 modified).

Porosity of Louisiana Sedimentary Units

Thie data set of porosity values presented here includes 35,430 results collected from the Louisiana Geological Survey's (LGS's) collection of permeameter tests that are stored within LGS's collection of geophysical logs and other data collected for hundreds of thousands of Louisiana petroleum boreholes. Raw permeameter results in LGS's collection were measured by the companies listed in the acknowledgements. In general, permeameter log reports do not include information of the stratigraphic unit(s) tested only: depth, ownership of well, field name, location, date of testing. The stratigraphic units were determined from interpollation of boring results relative to the cross-sections that appear in Bebout and Gutierrez (1982 and 1983) and Eversull (1984). These three sources have 10 north to south cross-sections that run from near the Louisiana-Arkansas border to the Gulf of Mexico and another 9 north to south cross-sections that run from near Louisiana-Mississippi border to the Gulf of Mexico. These three sources appear to have the most detailed and extensive network of cross-sections with a consistent stratigraphic nomenclature for Louisiana. However, this nomenclature is from the early 1980s and focused on oil bearing units, therefore, Figure 3 was developed to relate this nomenclature to the current stratigraphic nomenclature (Johnston et al., 2000) and hydrostratigraphic nomenclature of aquifers (Lovelace and Lovelace, 1995).

In general, porosity values for aquifers-sedimentary units of Louisiana are fairly similar to each other (Figure 4). The most porous and youngest unit, Pleistocene has an average porosity of 28.0%. The average porosity of the least porous and second oldest aquifer, Sparta, is 20.3%. The difference between smallest and largest porosity is about 40%. By comparison the difference of hydraulic conductivity from the least conductive aquifer, Wilcox, to the most conductive aquifer,

Figure 3. Stratigraphy and hydrostratigraphy of Louisiana. This study uses the Bebout and Gutierrez (1982 and 1983) and Eversull (1984) stratigraphy.

Mississippi River Alluvial, is about 26x (Carlson, 2004). In general,

Figure 4. Porosity of Louisiana sedimentary units that are aquifers in parts of Louisiana where they exist. The number at the end of each bar is the number of observations included in the determination of the average porosity.

Figure 5. Distribution of porosity values of Wilcox in Rapides Parish was determined from the parish's set of 825 permeameter tests.

Porosity as a function of sediment grain size

It appears that porosity to some extent is a function of sediment the typical grain size of the sediment. Middle Miocene age sand deposits of Louisiana is selected to examine the influence of texture on porosity because it has the largest number of observations with texture descriptions, 3,963, of which 98% are sands (Figure 8). Middle Miocene sands often lies at depths of 8,000 to 14,000 feet throughout southern Louisiana (Bebout and Gutierrez, 1982 and 1983). Two general observations can be made: (1), porosity decreases as grain size decreases and (2), porosity for less uniform sediment is less than for more uniform sediments (Figure 8). A more uniform sand as a narrower range of grain-sizes for sand grains than a less uniform sand.

For coarse sand to very fine sand, the average decrease of porosity is about 1.1% for one sand size category decrease. This is reasonable given that usually finer sediments will lose more porosity than coarser sediments under the same pressure (Beaumont and Fiedler, 1999). The more poorly sorted sediments (those described by two size categories) typically have a porosity that is about 2.4 % less than sediments which are more uniformly sorted (those described by one sand size category). This indicates that for sediments with a wider range of particle sizes there is a chance for smaller particles to fill spaces between larger particles (Montgomery, 2000).

Figure 8. The above display is of average porosity as a function of grain size for Louisiana's Middle Miocene sand. Number at the end of each bar is the number of observations used to determine the average.

Summary

There are a number of general properties of Louisiana sand deposits in terms of their porosity.

1) The average porosity of Louisiana sands is a fairly narrow range of 20% to 28%.
2) The distribution of porosity values for Louisiana sands yields an approximately normal distribution.
3) The average porosity of Louisiana sands decreases with increase in age.
4) The porosity of Louisiana sands decreaes with increasing depth of burial.
5) The porosity of Louisiana sediments decreases as the typical grain size of the sediment decreases.
6) The porosity of Louisiana sediments decreases as the sorting of sediments becomes poorer.

Acknowledgements

I would like to recongnize all the following corporations: A.C. Gauthier Jr., Analab Inc., Analog, Bell Coastal Laboratories Inc., Bell Core Laboratories, Ben A. Elmdahl Engineering, Continental Laboratories, Contract Coring Company, Coran Inc., Core Analysis Inc., Core Laboratories Inc., Delta Core Analysis Inc., Delta Well Logging Service Inc., Emrco Core Analysis, Erco Petroleum Services Inc., Exploration Service Company, Gulf Coast Well Logging Service Inc., Hart & Faul Laboratories, Hart & Kelley Laboratories, Humble Oil & Refining Company, Langford Core Analysis & Meredith Laboratories, O'Malley Laboratories, Parnell Core Laboratories, Petro-Core Service Co., Petroleum Reservoir Engineering, Petroleum Service Company, Petroleum Well Logging Service, Rig Time Inc., Shell Oil Company, Southern Mud-Logging Services Inc., Subsurface Evaluation, Texaco Inc., The Analysts, The Atlantic Refining Company, The Hycalog Company, Thigpen Core Laboratories, Union Producing Company,United Core Inc., United Gas Pipe Line Company, and Well Logging Baroid Service that collected and reported the basic analysis of the permeameter data found within LGS collection of permeameter test results.

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raphyu' revyher data such as periodic project surveys in order to

Coastal Research at LGS

Bill Good

On the coastal front, Dr. Bill Good has been pursuing research on coastal restoration projects that he hopes will assist in the advancement of project planning and design. He has currently been investigating two project types, hydrologic restoration and terracing.

The 2003 *CWPPRA Report to Congress* describes hydrologic restoration (HR) as follows, "Natural drainage patterns are restored as much as possible, either on a large scale by gating navigation channels and rebuilding natural ridges, or on a smaller scale by blocking dredged canals and cutting gaps in artificial levees." In practice, this frequently assumes three things: 1) that a major cause or contributor to accelerated land loss rates at the site is an increase in hydrologic connections between historically fresh/intermediate areas and areas characterized by higher tidal variability and salinity ranges, 2) this increased connectivity can be substantially reduced by closing off or restricting hydrologic exchange into the area through HR, and 3) that HR will result in an increased retention of freshwater. The basic concept is straightforward-repair hydrological features in order to return to a previously existing, more favorable set of environmental conditions.

The two projects reviewed were the GIWW-to-Clovelly HR Project and the Jonathan Davis HR Project. Both are near the mid-section of the Barataria Hydrologic Basin and are intended to will promote greater freshwater retention and utilization to prevent rapid salinity increases in the area.

The data reviewed were mainly in the form of monitoring reports from the La. Department of Natural Resources. Based on this review, Dr. Good suggests that there are fundamental questions regarding these projects that still need to be addressed. In particular, water exchange control at the level of the individual structure; at the level of the entire project perimeter; and control through time considering concomitant high water/high salinity event tuon thsTf l oTT32strai T*0 Tc 0 Tw (e.0331uPhistoricasanu' rev. Hcyms--Sou' rate. Adtime) creased maron processes.

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Significance of Buried Forests Exposed in the Lemannville Cutoff Road Pit, St. James Parish, Louisiana

Paul Heinrich

The excavation of the Lemannville Cutoff Road Pit within Point Houmas of the Mississippi River just northwest of Lemannville in St.

delta plain by Gagliano (2000) and Gagliano et al. (2003), resulting from reactivation of local faults by salt tectonics or gravity slumping could rapidly change base level locally. Such changes would not only create large depressed areas in which sediment would accumulate, but also low segments within natural levees where sediment-bearing flood waters could preferentially breach them. Subsidence would not only rapidly create depressions in which sediments can accumulate, but also allow for this sedimentation to take place. However, there is a lack of any obvious evidence for either faults or other structural features that can be the cause of such subsidence. Furthermore, a detailed study of sea-level history in the Gramercy - Lutcher area about 24 km (15 miles) southeast of the Lemannville Cutoff Road Pit by Tornqvist et al. 2004) found a lack of any indication of abrupt changes in sea-level rise that could be interpreted as representing significant variations in subsidence rates.

The rapid sedimentation responsible for creating buried forests with upright trunks, as exposed at the Lemannville Cutoff Road Pit might also have been the result of major changes in the regime of the Mississippi River. Excavations at the Raffman Site in northeast Louisiana and other ongoing research by Dr. Tristram R. Kidder (Washington University, St. Louis, Missouri) has uncovered what he regards as evidence of periods of massive flooding during the period of 2400 to 3200 BP far exceeding in magnitude any recorded historic flood. Such catastrophic flooding during the Late Holocene could certainly explain multiple periods of rapid deposition and in-place burial of forests by sediments exposed in the Lemannville Cutoff Road Pit. Unfortunately, the lack of radiocarbon dates from the buried forests make it impossible at this time to determine if the buried forests date to the period during which these floods are hypothesized to have occurred, and prevent any firm conclusion of their origin.

Regardless of their origin, it is apparent that these buried forests quite likely could provide useful information about the depositional

In Memory

David E. Pope, 84, who retired as Senior Research Geologist from the Louisiana Geological Survey (LGS) in December 1999 passed away on Sunday, May 29, 2005, after a short illness. Affectionately called "Dave" by most of his friends and colleagues he continued to work as a volunteer with LGS until the end. Dave began his career as a biostratigrapher and paleontologist with Union Producing Company in 1948 and worked with them for nineteen years in Houston, New Orleans, and Lafayette and retired in 1967 as District Paleontologist. He worked as a consultant from 1967 to 1975 at which time he joined the Louisiana Geological Survey in Baton Rouge.

Any individual who has ever served in any official capacity for the Gulf Coast Association of Geological Societies (GCAGS), the Baton Rouge Geological Society (BRGS) or for that matter, any of the member societies of the GCAGS will doubtless be aware of the valuable contributions made by Dave to every organization he has been involved with in various capacities. Dave was born in Forrest City, Arkansas, and graduated from Forrest City High School in 1938. He then attended Louisiana State University on a football scholarship, but his university career was interrupted when he was commissioned as a Second Lieutenant in 1942 to serve in the U.S. Army during World War II. He returned to LSU in 1946 and received his B.S. degree in 1947 and an M.S. degree in 1948 with specialization in micropaleontology. He was a student of H.V. Howe, OtPJ. Rc

Conferences & Awards

LGS/LSU Cartographers Win National Map Design Award

Louisiana Geological Survey cartographers John Snead, Lisa Pond, and Robert Paulsell have been honored by the American Congress on Surveying and Mapping–Cartography and Geographic Information Society for the map "*The Atchafalaya Basin*", that won in the professional category for "Best Reference Map".

The 32Thenual

Geological Society of America, Biloxi, Mississippi, March 17-18, 2005

Five LGS geoscientists presented four posters at the 54th annual meeting of the southeastern section of the Geological Society of America held March 17-18, 2005 at the Grand Casino Biloxi, Mississippi. The titles of the posters and associated abstracts which were published in Geological Society of America's Abstracts with Programs, v. 37, no. 2, are:

Carlson, Douglas, and Riley Milner, *"Multiple sedimentary axes impact on the Chicot Aquifer"*

Heinrich, Paul V., *"Contrasting Pleistocene and Holocene fluvial systems of the lower Pearl River, Louisiana and Mississippi, USA"*

McCulloh, Richard P., *"Basement tectonic signature in the orientation frequencies of streams in the western two-thirds of Louisiana"*

Miller, Byron, *"The Baton Rouge fault: conduit or impediment to groundwater flow?"*

LGS also had an exhibit booth at this meeting where LGS publications and ongoing research information were displayed. The booth attracted a large nymber of meeting attendees.

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