

Applications of the Louisiana Coastal Geohazards Atlas in Groundwater Management

Chris McLindon
April 16, 2019



Coastal Geohazards Atlas

Project Team

Dr. Charles Groat - Acting Director of LGS, former CEO of TWIG, former director USGS

Dr. Jeff Hanor - Professor Emeritus, LSU Dept of Geology & Geophysics

Dr. Woody Gagliano - CEO, Coastal Environments, Inc.

Dr. Gary Kinsland - Professor, ULL School of Geosciences

Dr. Nancye Dawers – Chair, Department of Earth and Environmental Sciences, Tulane

Dr. Mark Kulp - Director of the Coastal Research Laboratory, UNO

Dr. Raphael Gottardi – Assistant Professor, ULL School of Geosciences

Dr. Karen Wicker – Senior VP, Coastal Environments, Inc.

Dr. Elizabeth McDade - Geological Consultant, 30 years oil and gas industry experience

Mr. Michael Merritt – retired S.L.F.P.A.-W.

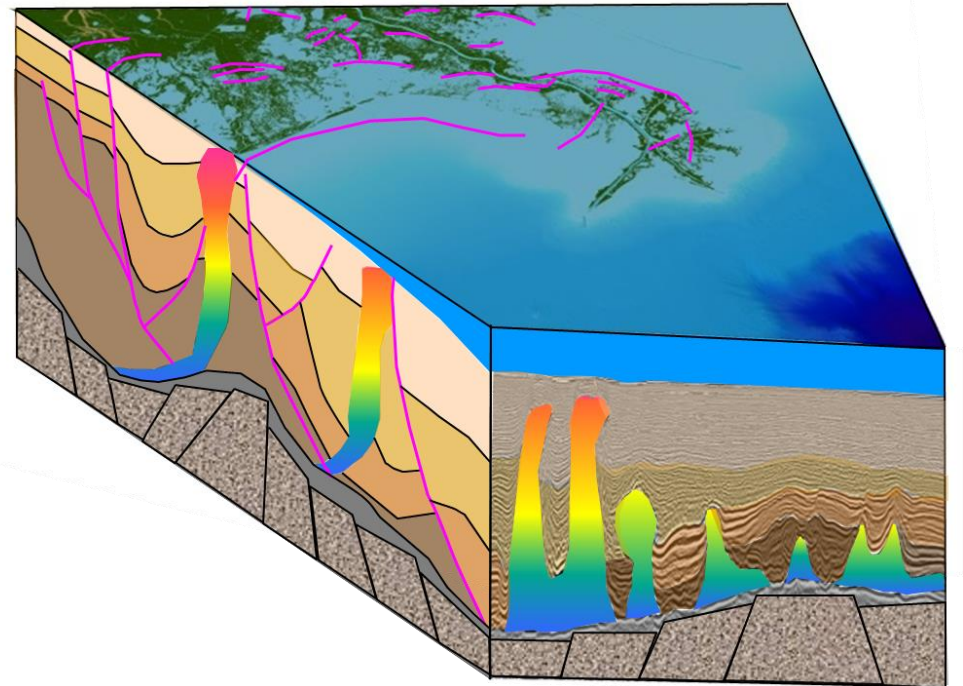
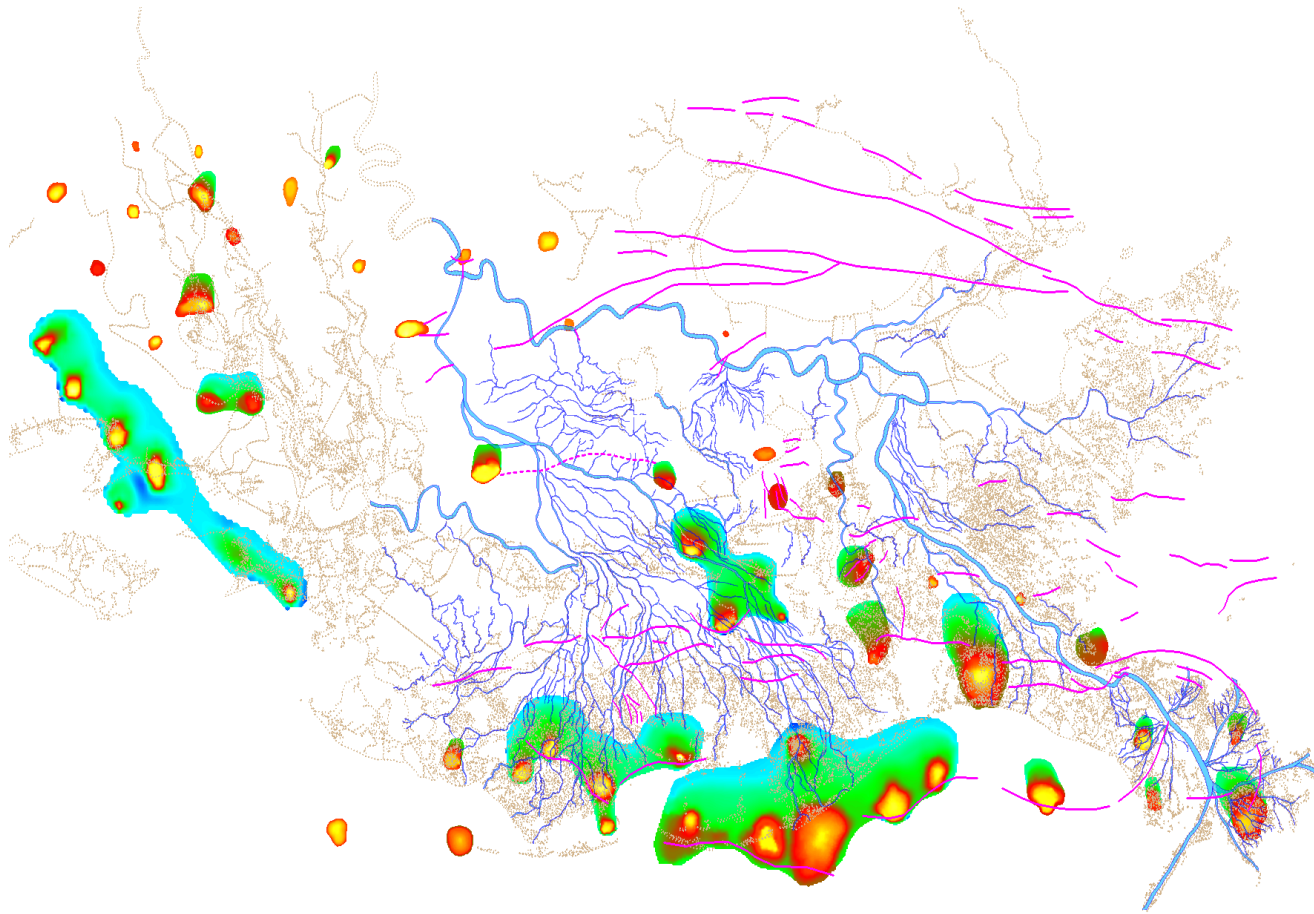
Mr. Chris McLindon - President, New Orleans Geological Society

Mr. John Johnston - Geological Review, Louisiana Geological Survey

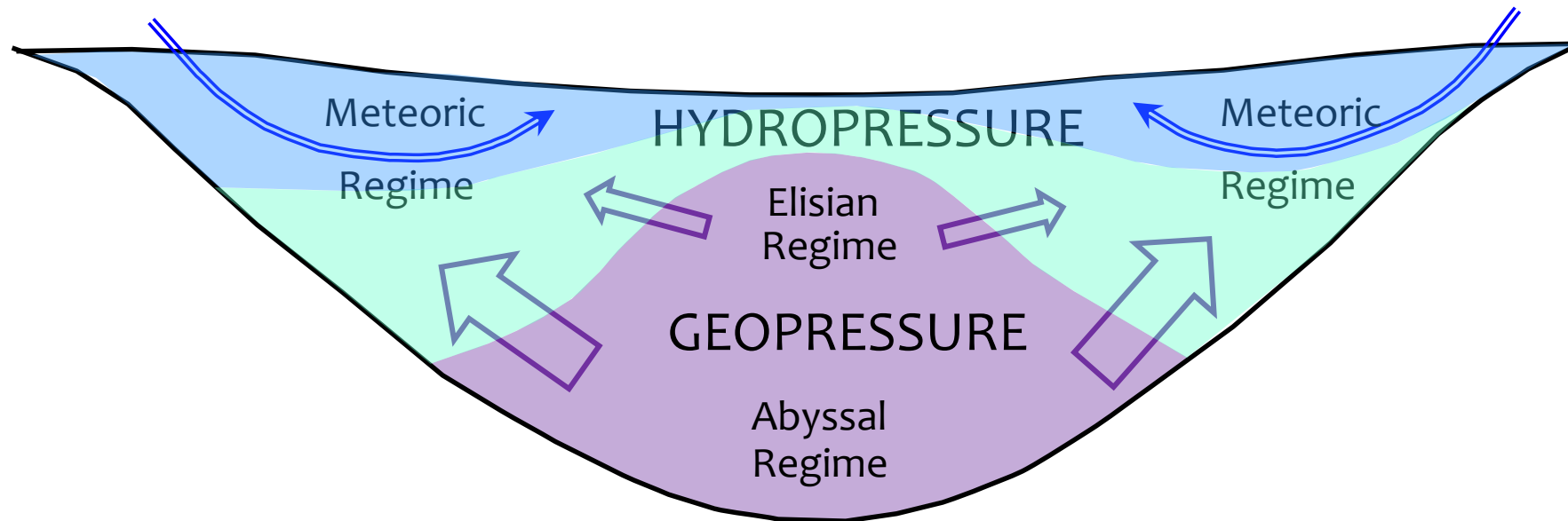
Mr. Rick McCulloh - Research Associate, Louisiana Geological Survey

Mr. Paul Heinrich - Research Associate, Louisiana Geological Survey

Working Map

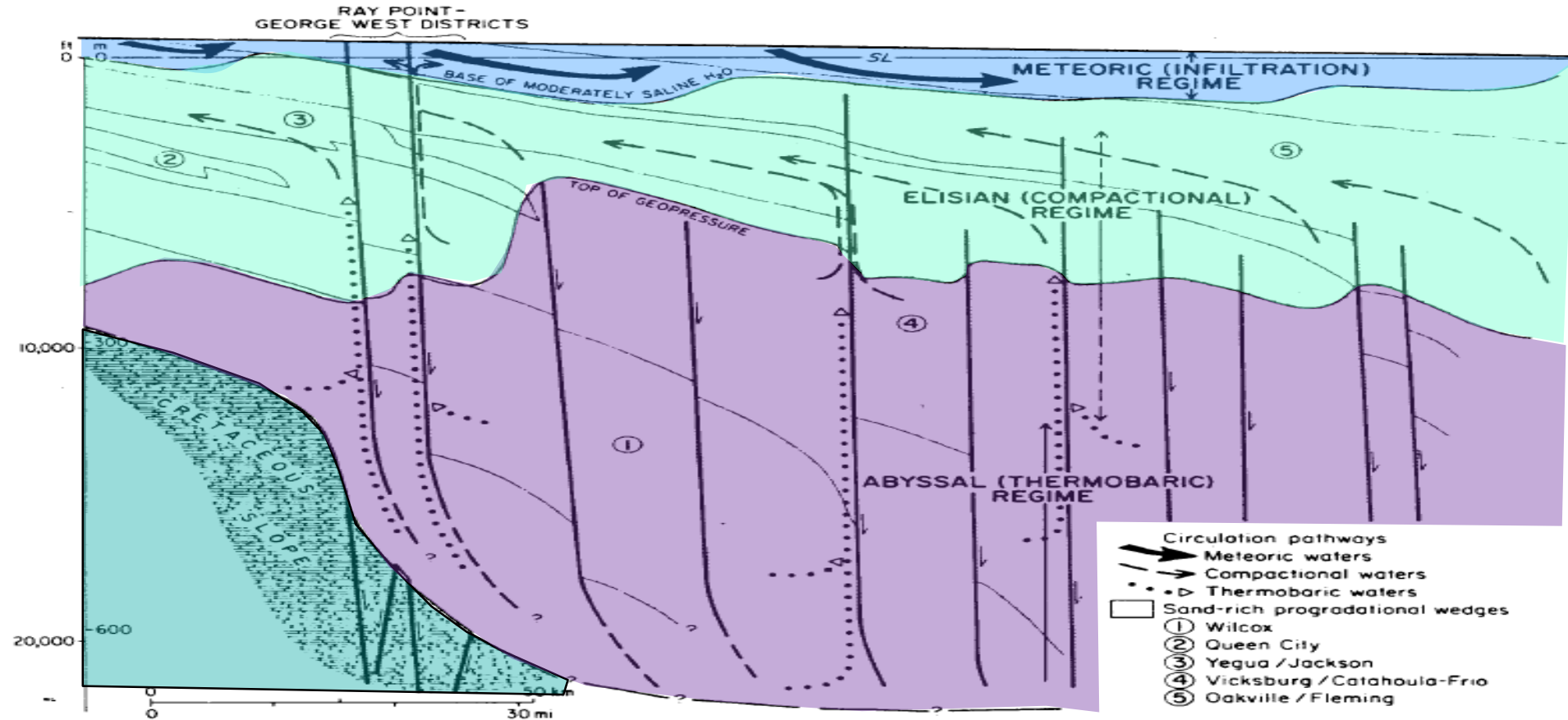


Groundwater flow



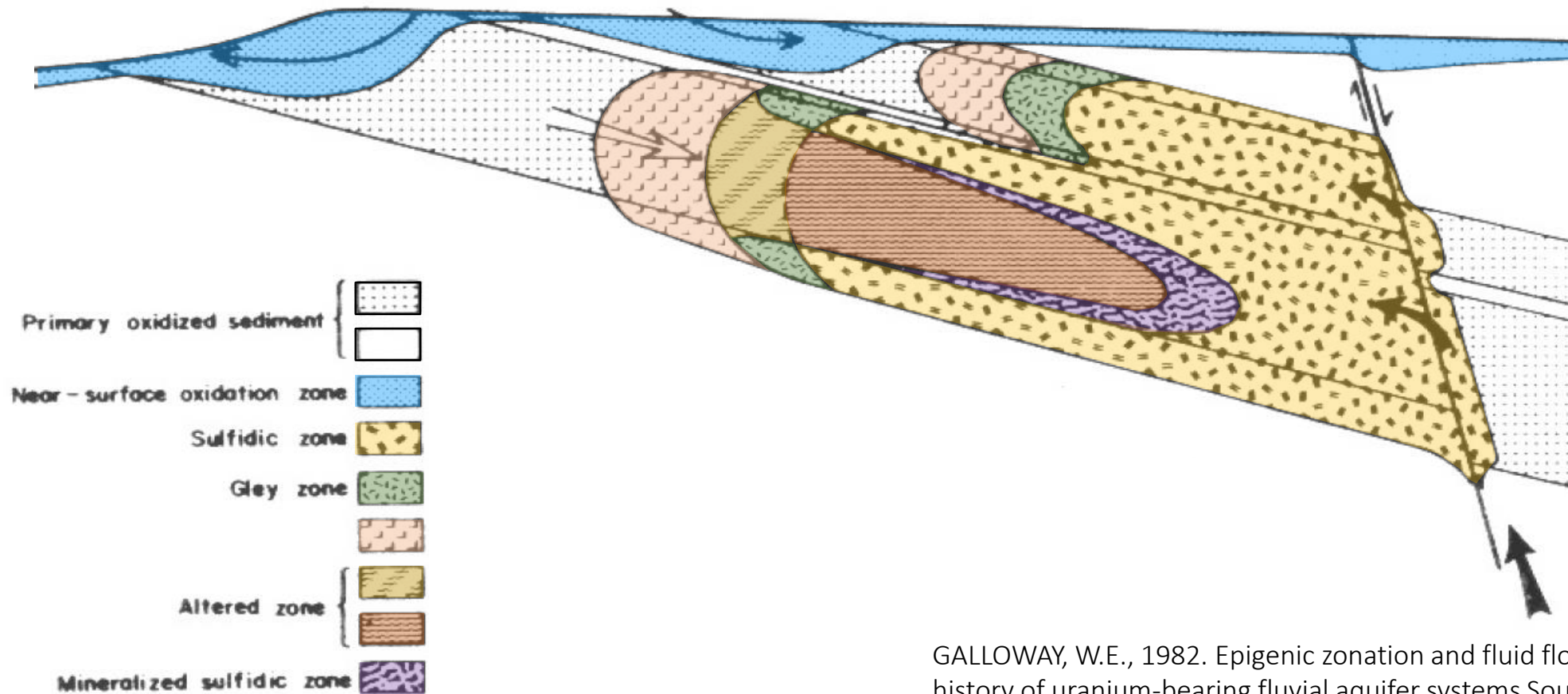
GALLOWAY, W.E., 1982. Epigenic zonation and fluid flow history of uranium-bearing fluvial aquifer systems South Texas uranium province

Groundwater flow



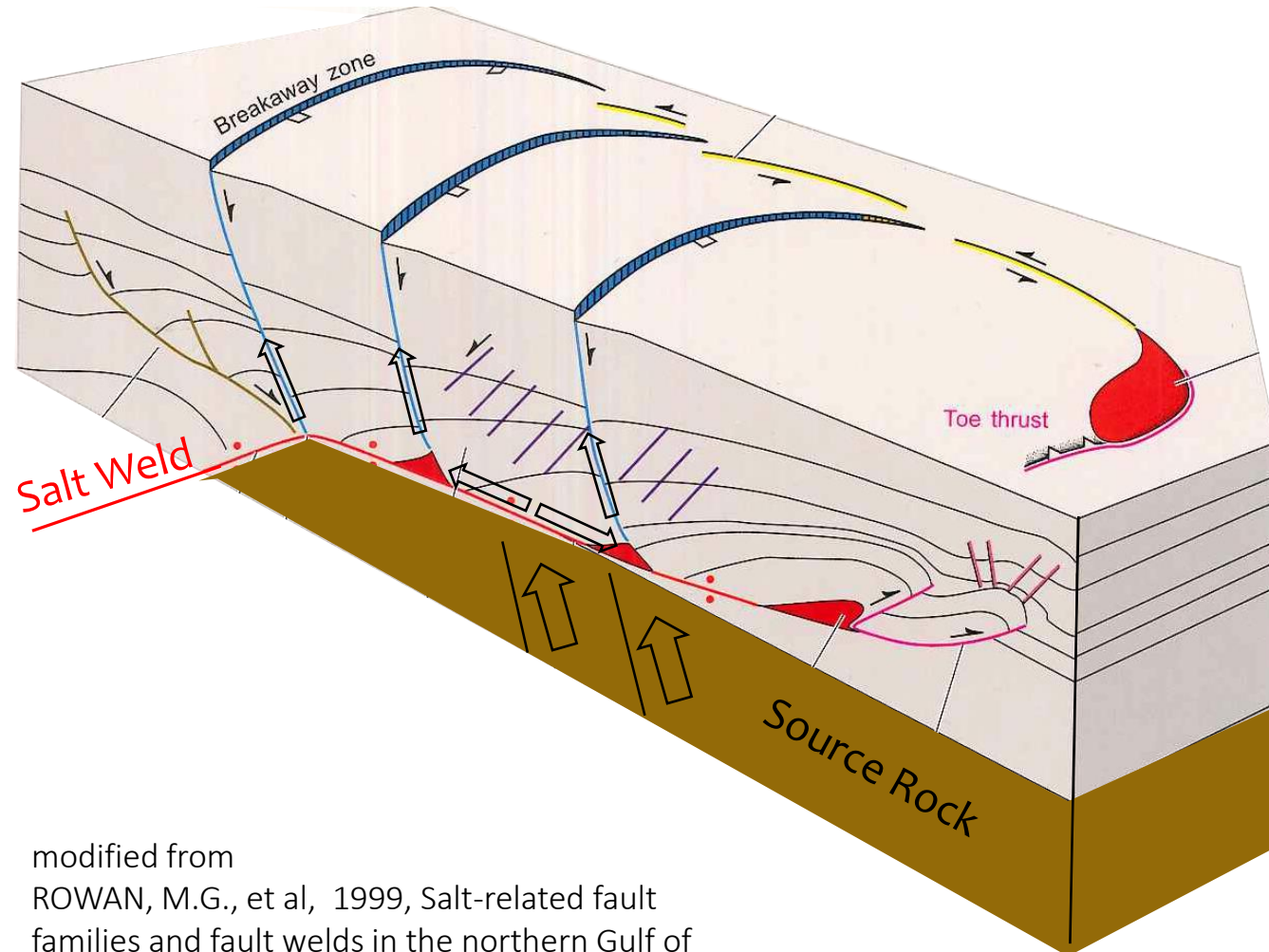
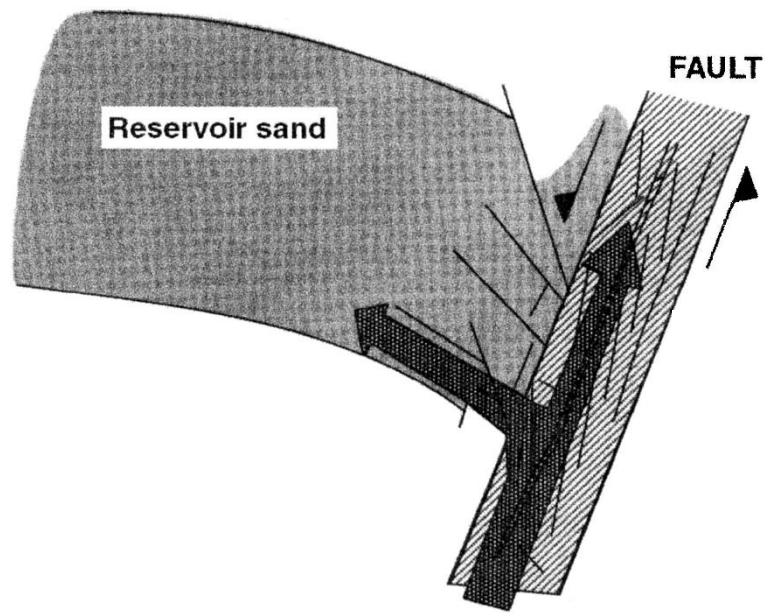
GALLOWAY, W.E., 1982. Epigenic zonation and fluid flow history of uranium-bearing fluvial aquifer systems South Texas uranium province

Groundwater flow



GALLOWAY, W.E., 1982. Epigenetic zonation and fluid flow history of uranium-bearing fluvial aquifer systems South Texas uranium province

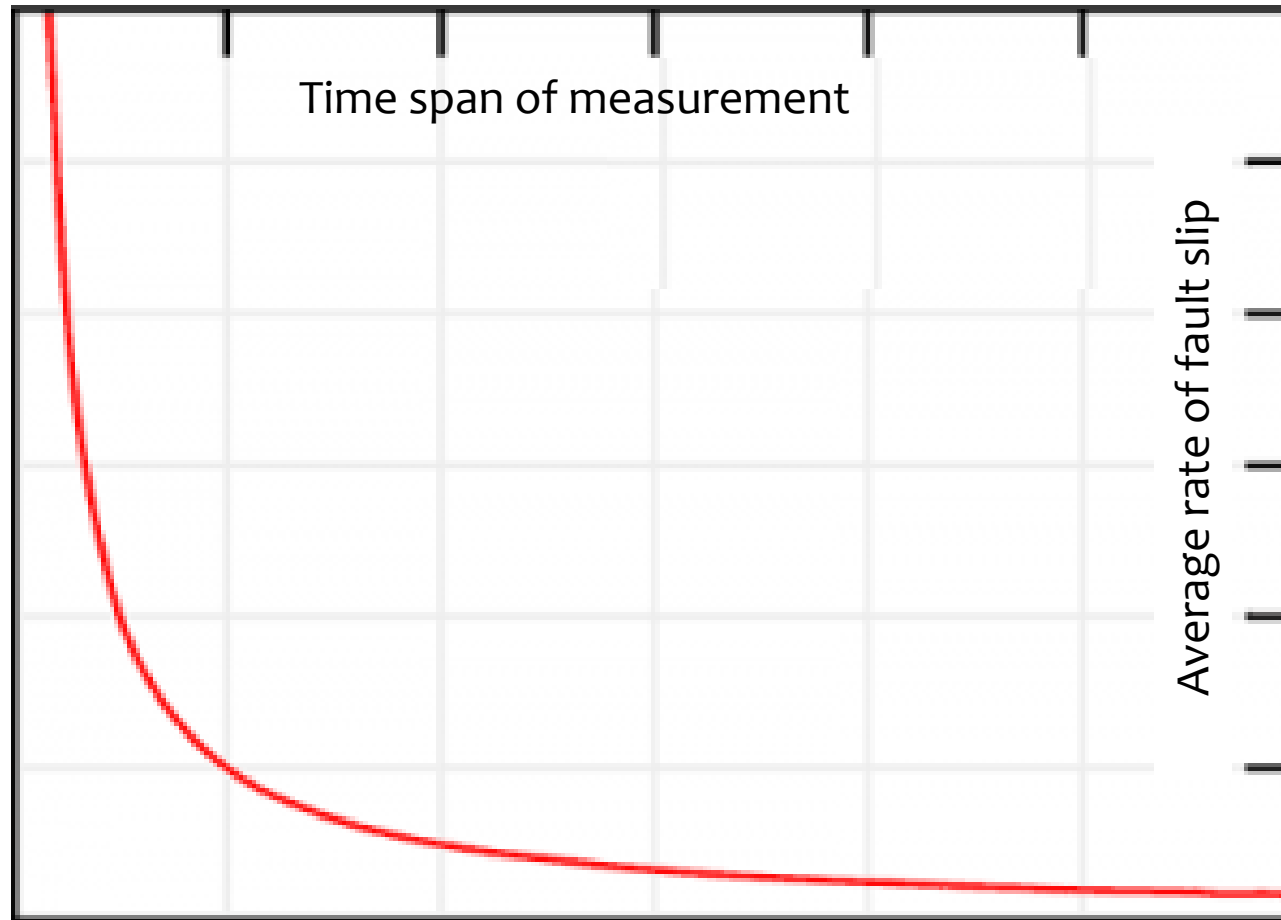
Subsurface fluid flow



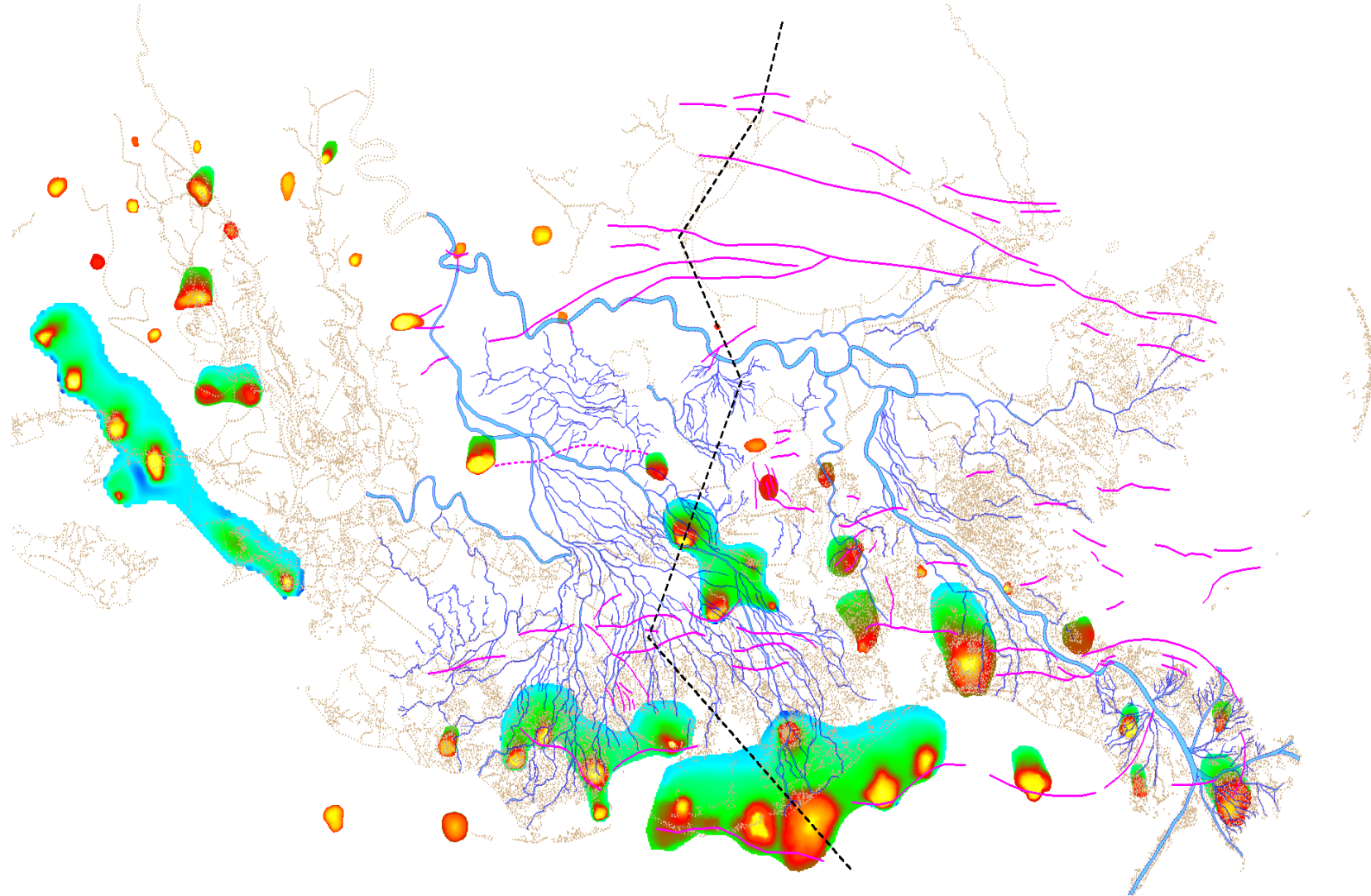
KUECHER, G.J., et al, 2001. Evidence for Active Growth Faulting in the Terrebonne Delta Plain, South Louisiana

modified from
ROWAN, M.G., et al, 1999, Salt-related fault families and fault welds in the northern Gulf of Mexico

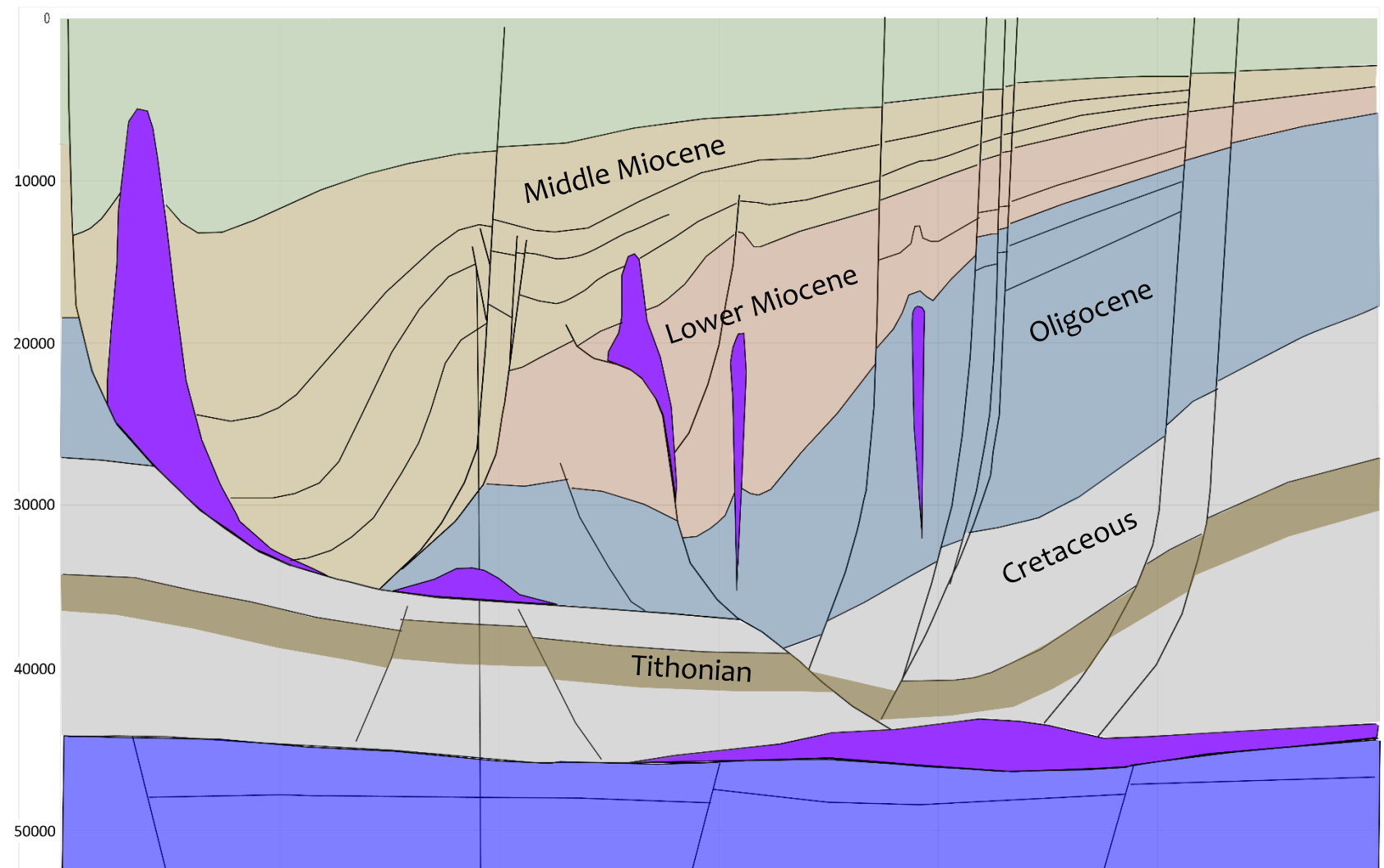
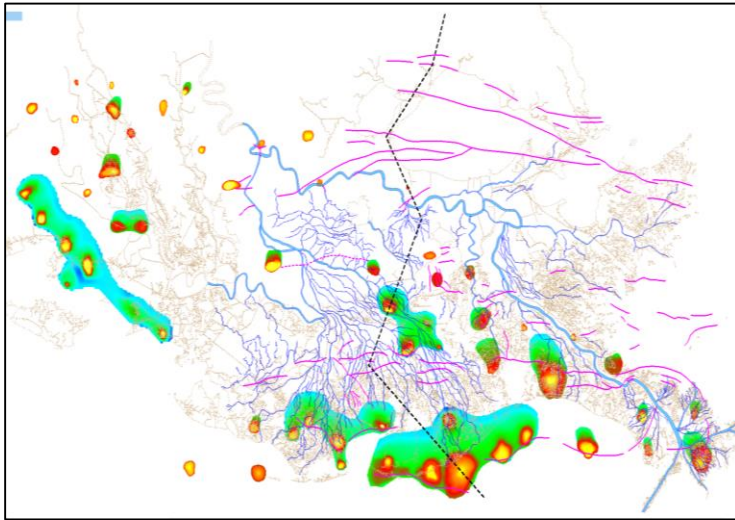
Fault slip and fluid flow



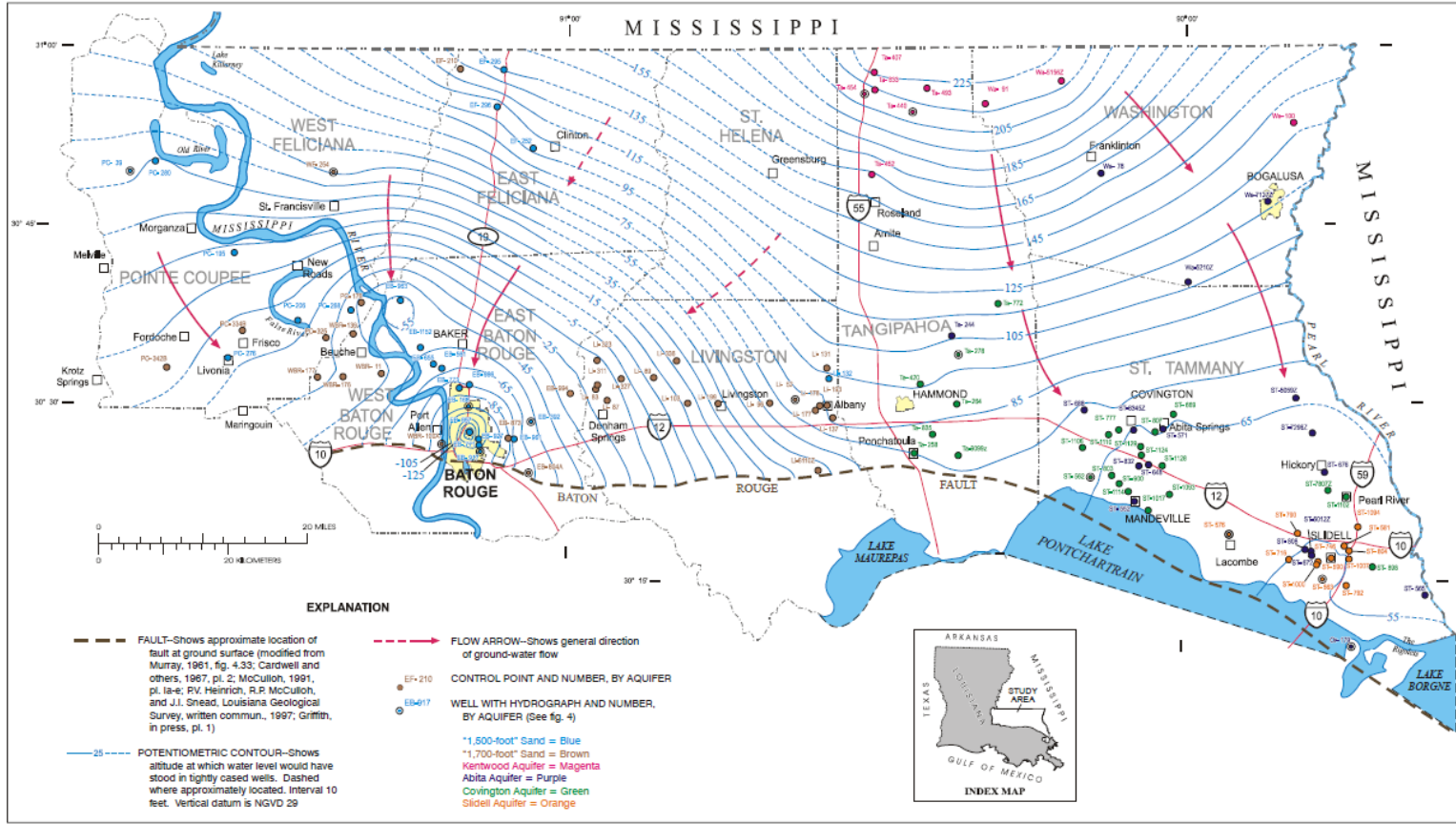
Regional Profile



Regional Profile



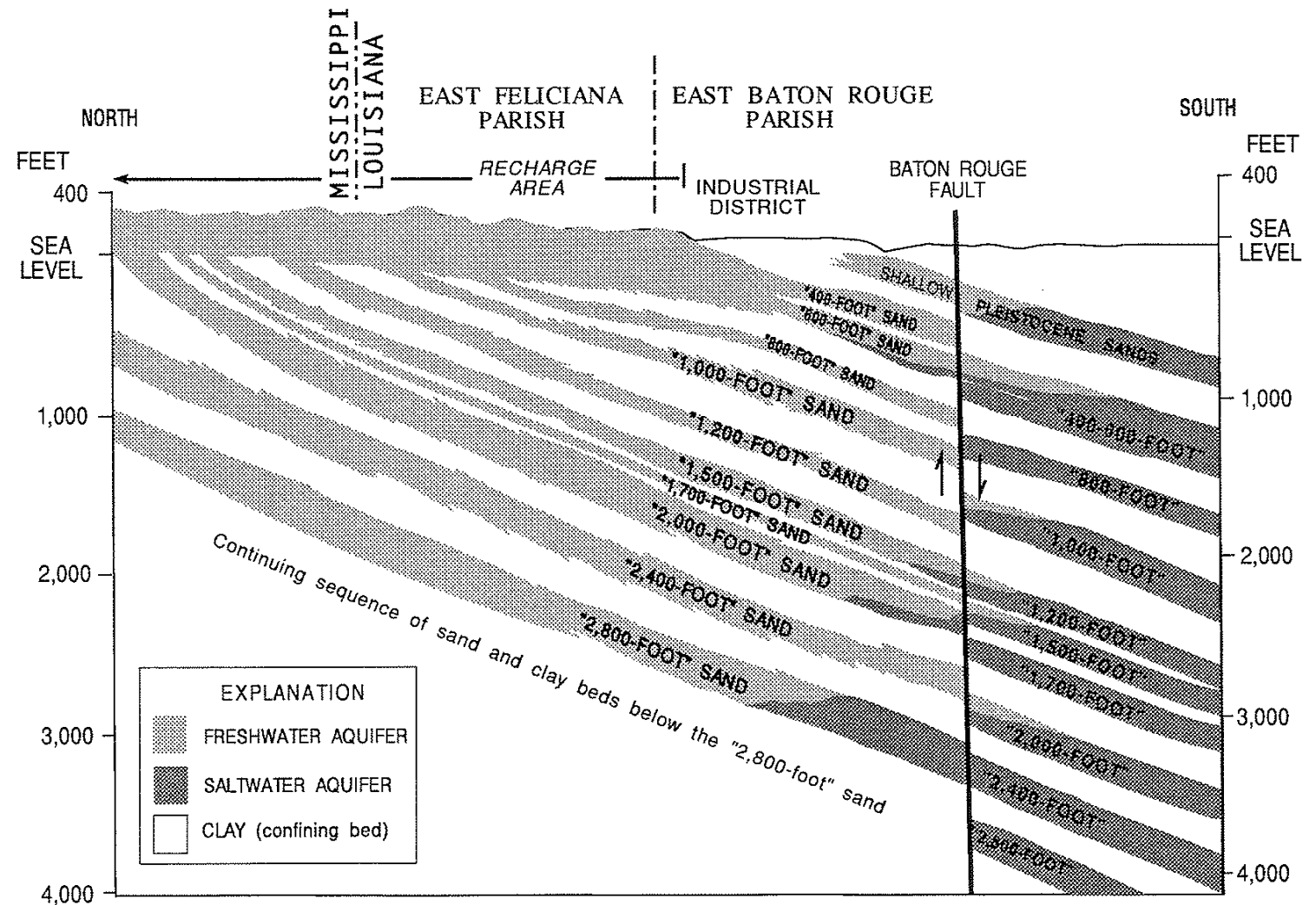
Kentwood Aquifer



PRAKKEN, L., 2004. Generalized Potentiometric Surface of the Kentwood Aquifer System

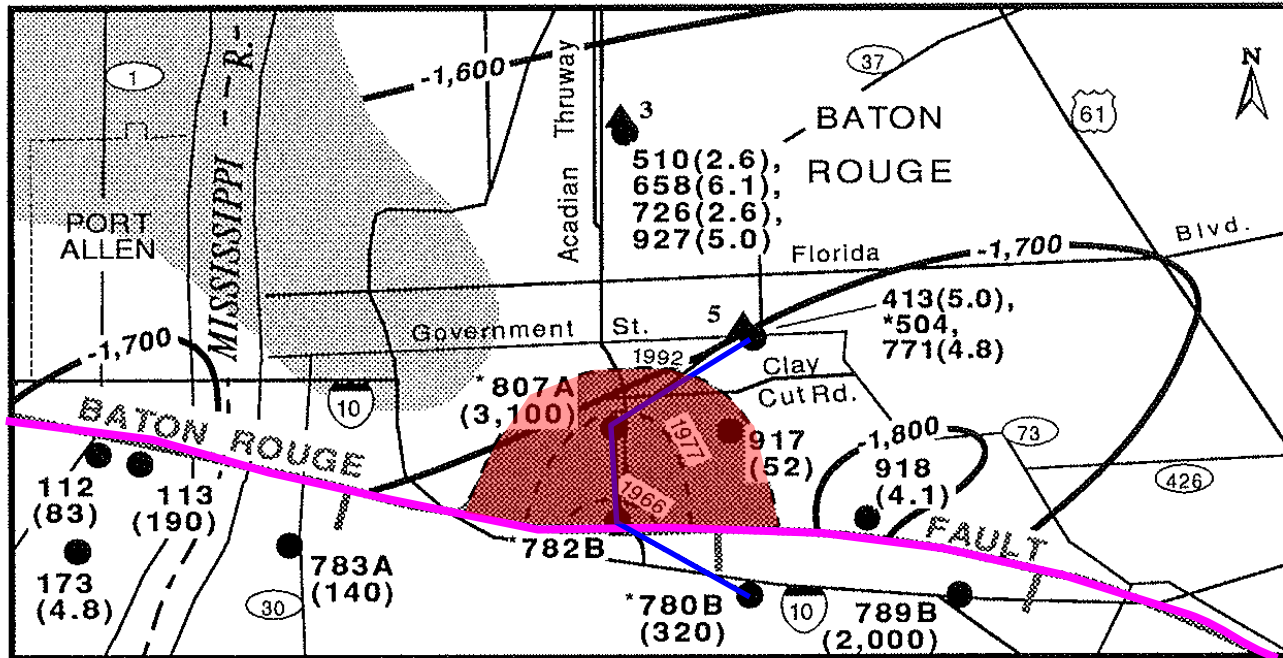


Baton Rouge Area

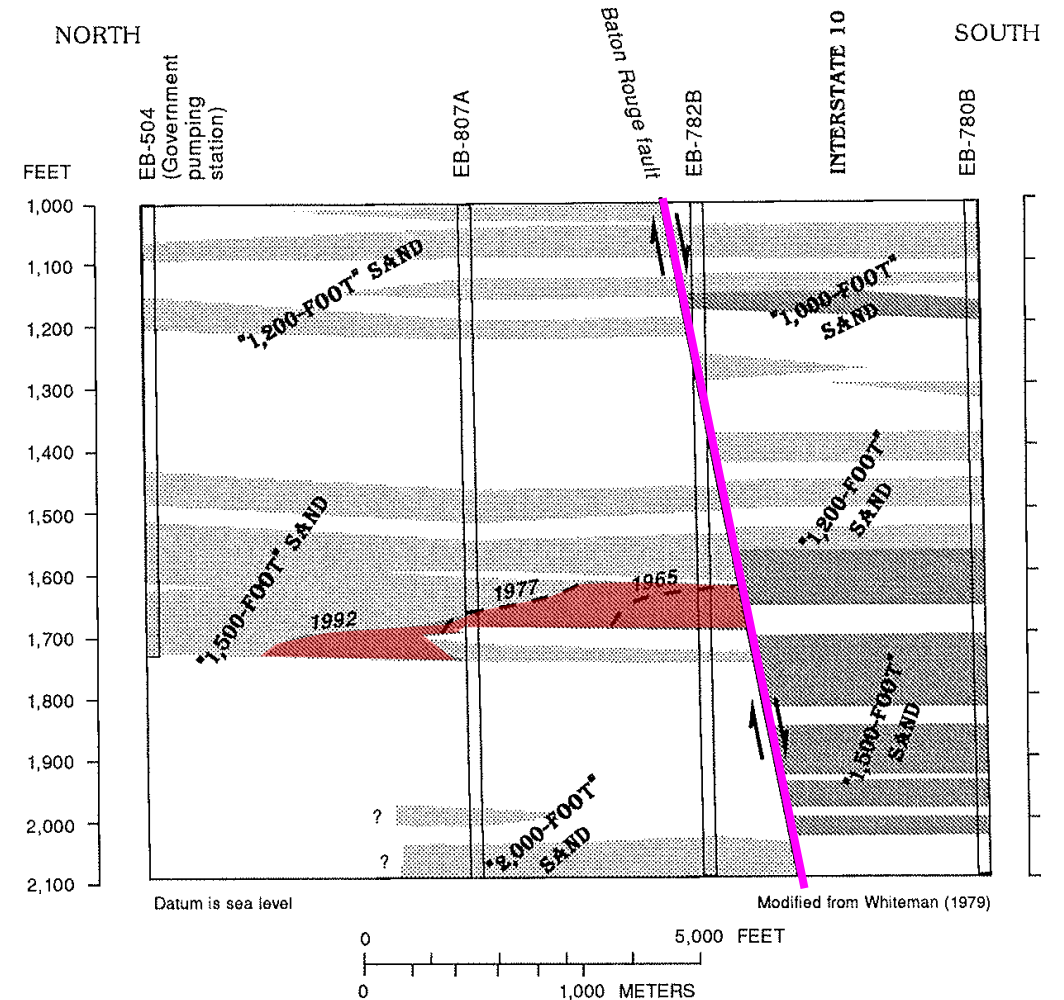


TOMASZEWSKI, D.J., 1996. Distribution and Movement in Saltwater Aquifers in the Baton Rouge Area, Louisiana 1990-92

Baton Rouge Area

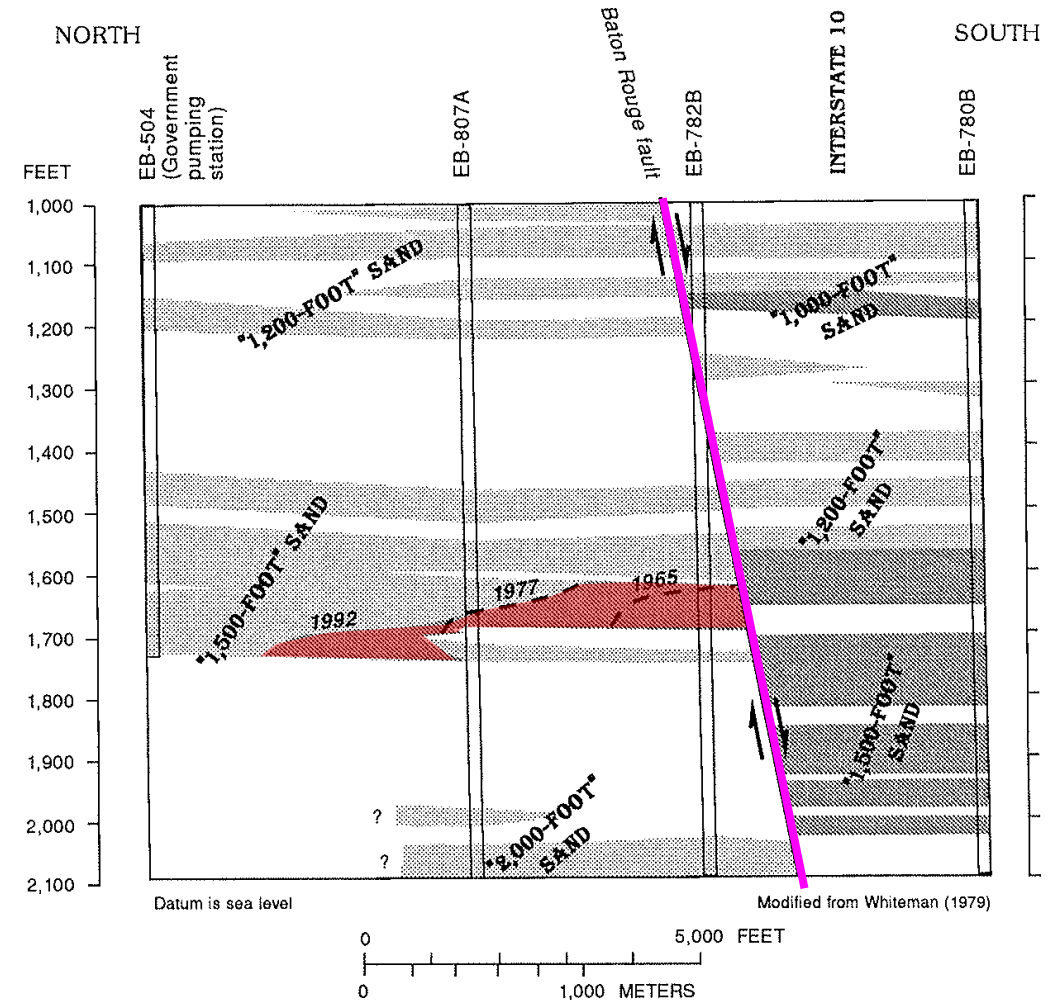
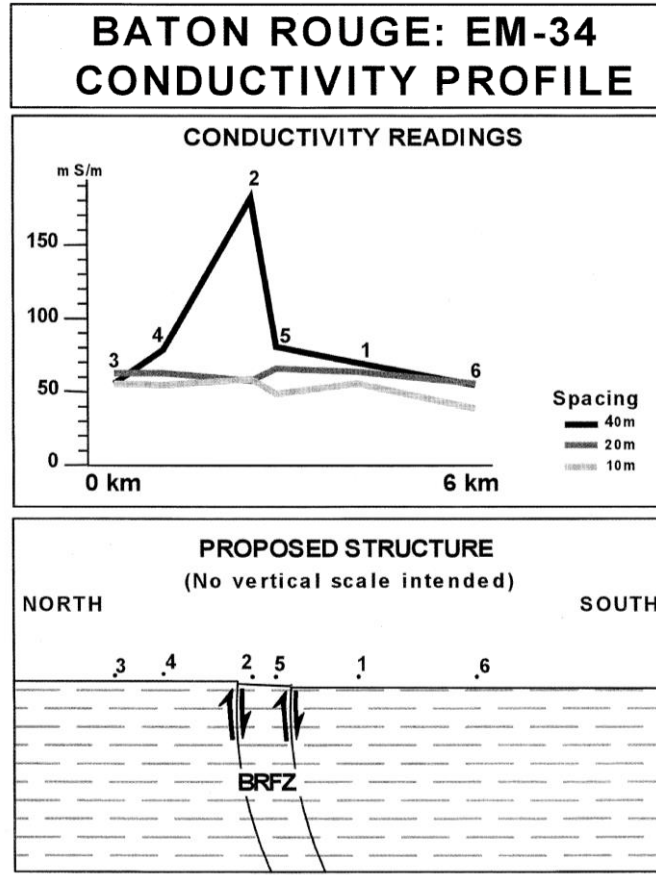


TOMASZEWSKI, D.J., 1996. Distribution and Movement in Saltwater Aquifers in the Baton Rouge Area, Louisiana 1990-92



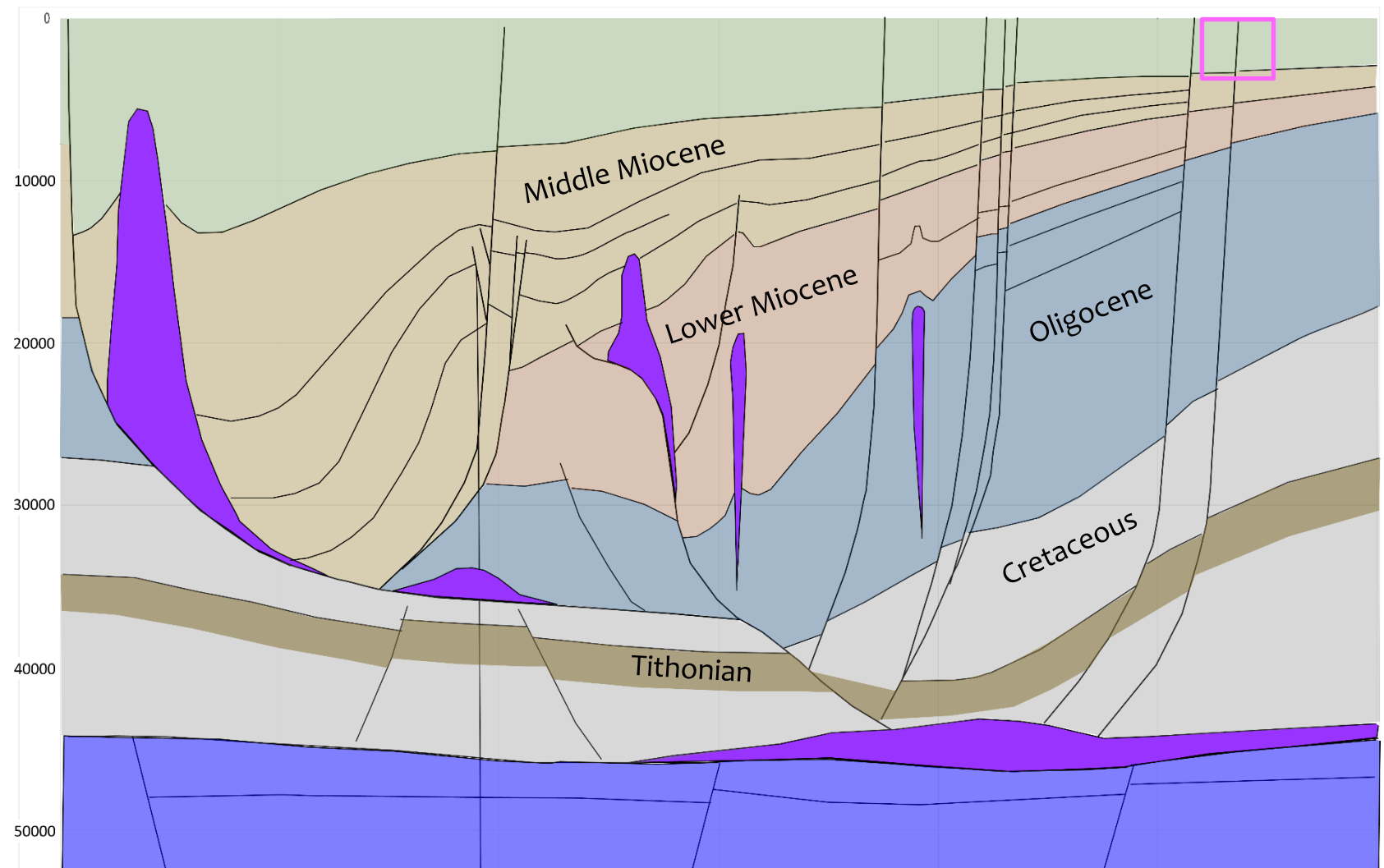
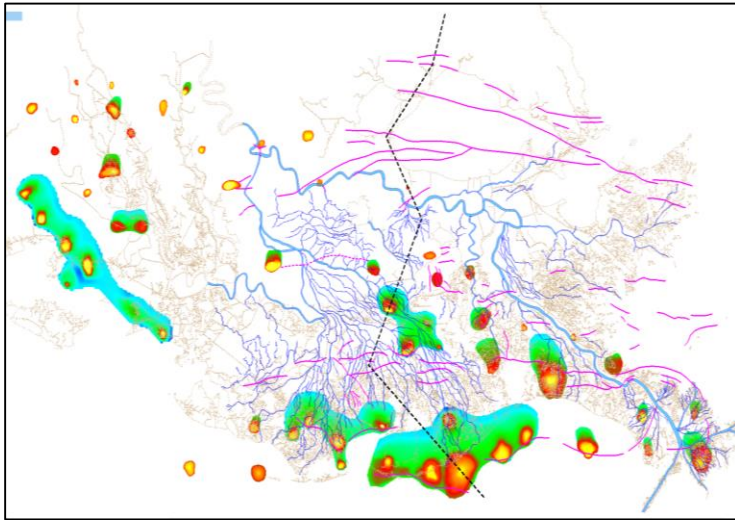


Baton Rouge Area

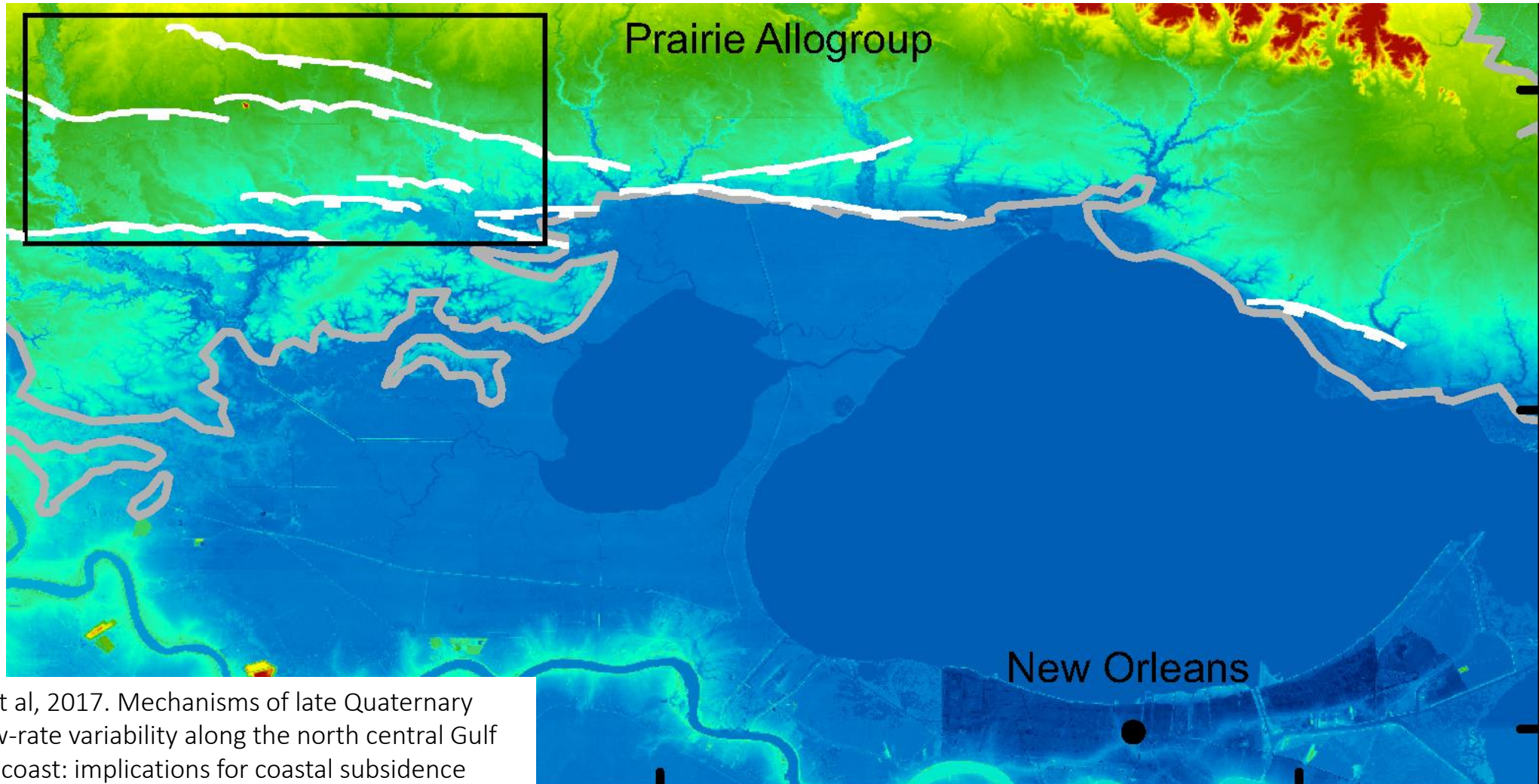


KUECHER, G.J., et al, 2001. Evidence for Active Growth Faulting in the Terrebonne Delta Plain, South Louisiana

BR Fault Zone

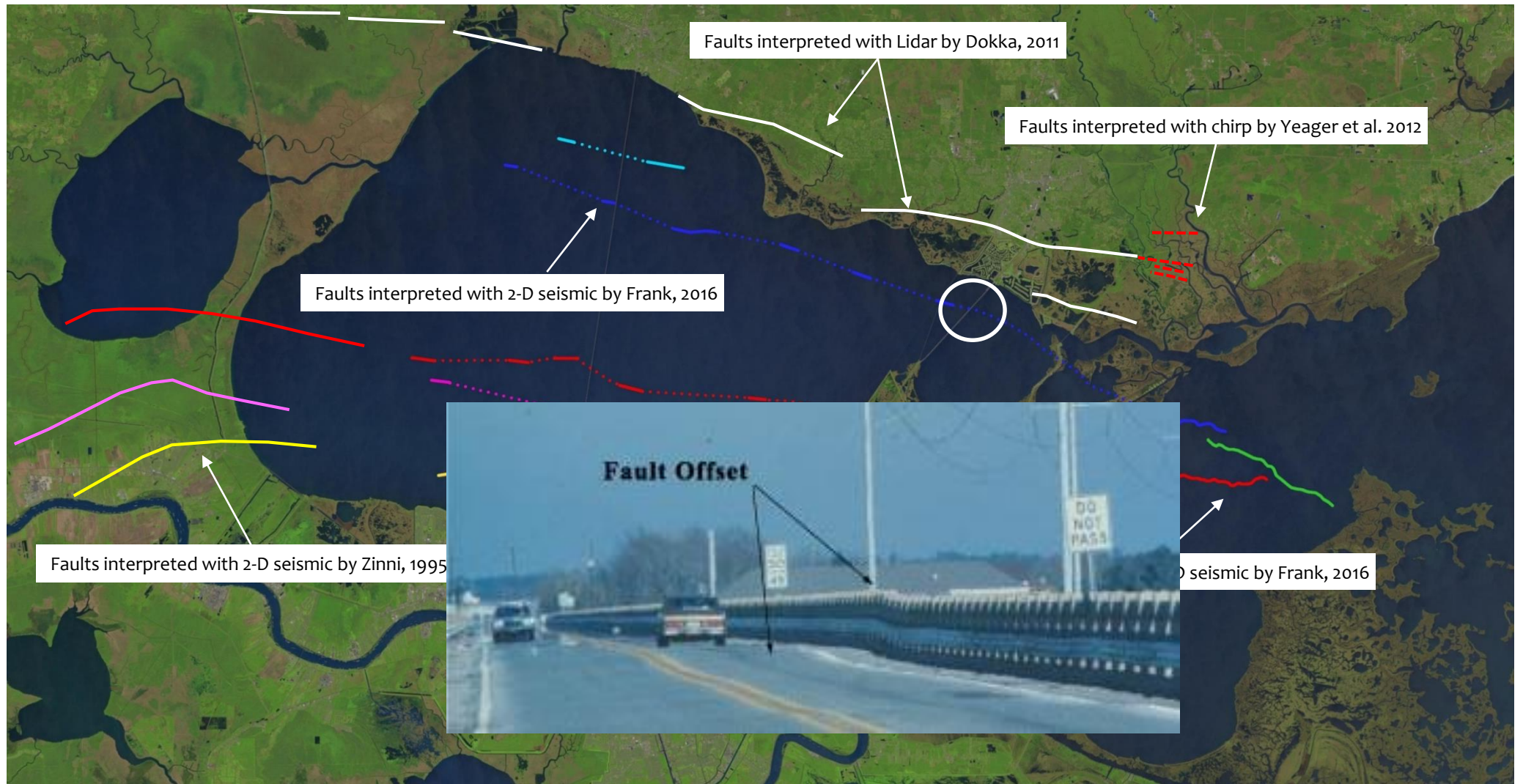


BR Fault Zone

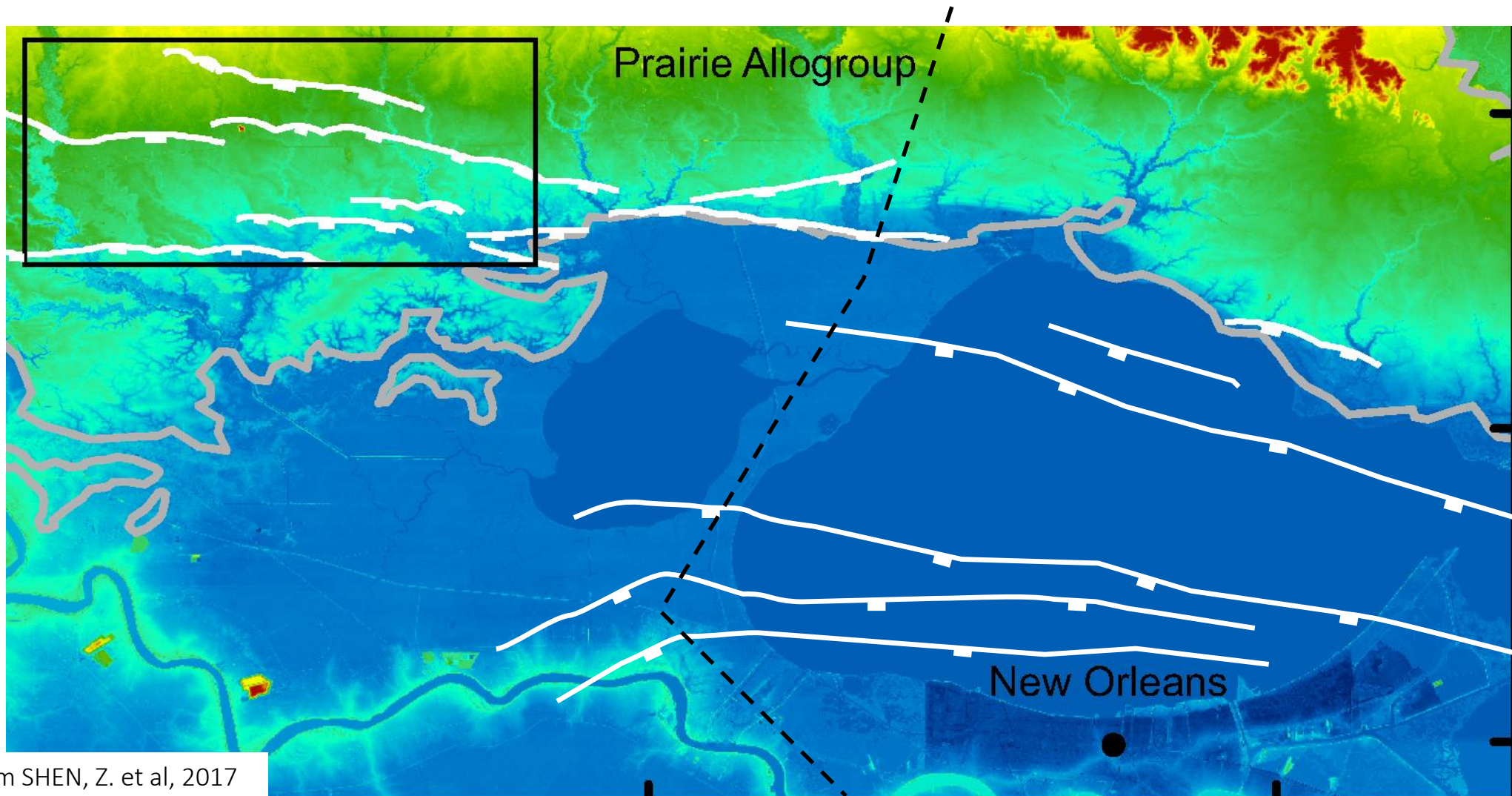


SHEN, Z. et al, 2017. Mechanisms of late Quaternary fault throw-rate variability along the north central Gulf of Mexico coast: implications for coastal subsidence

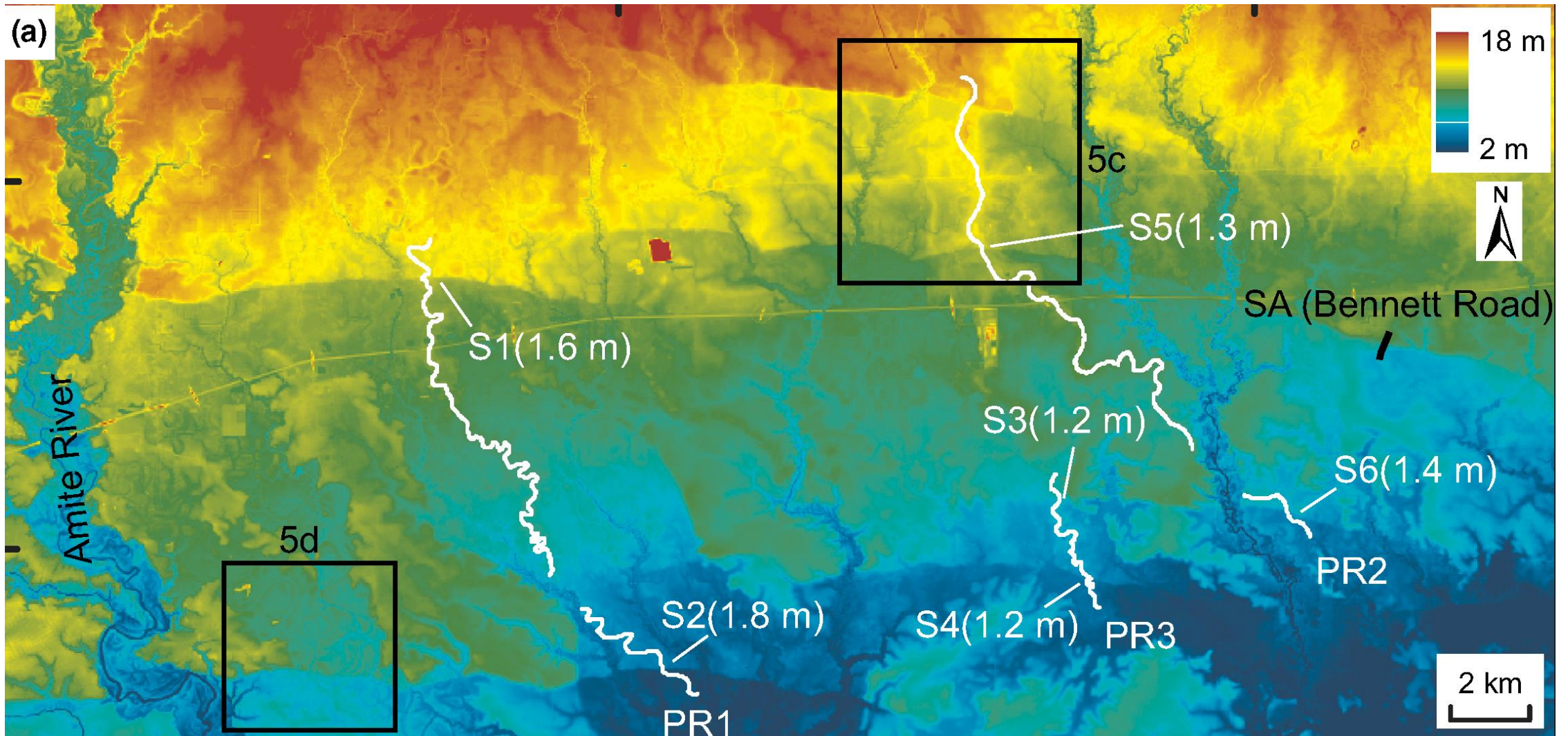
BR Fault Zone



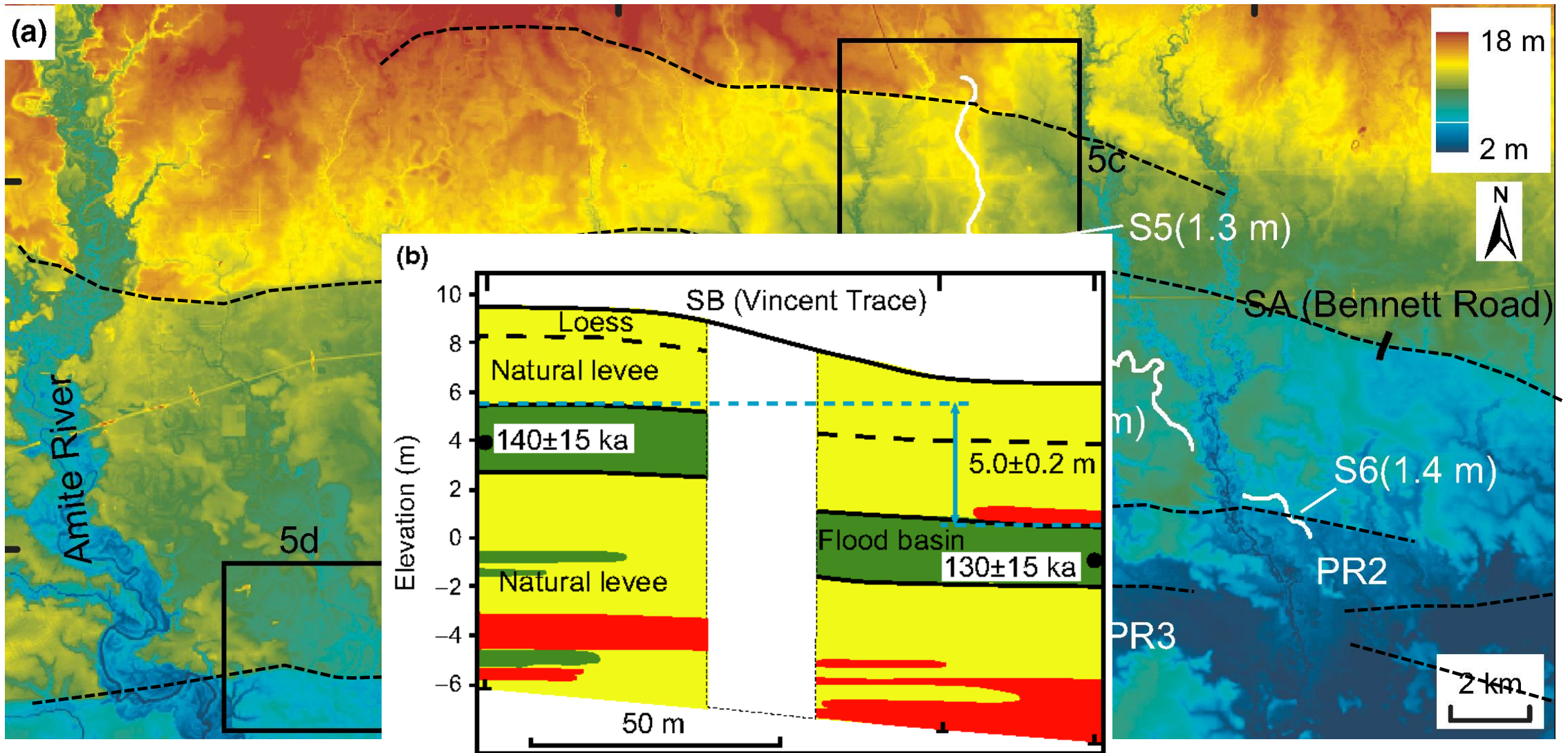
Fault Compilation Map



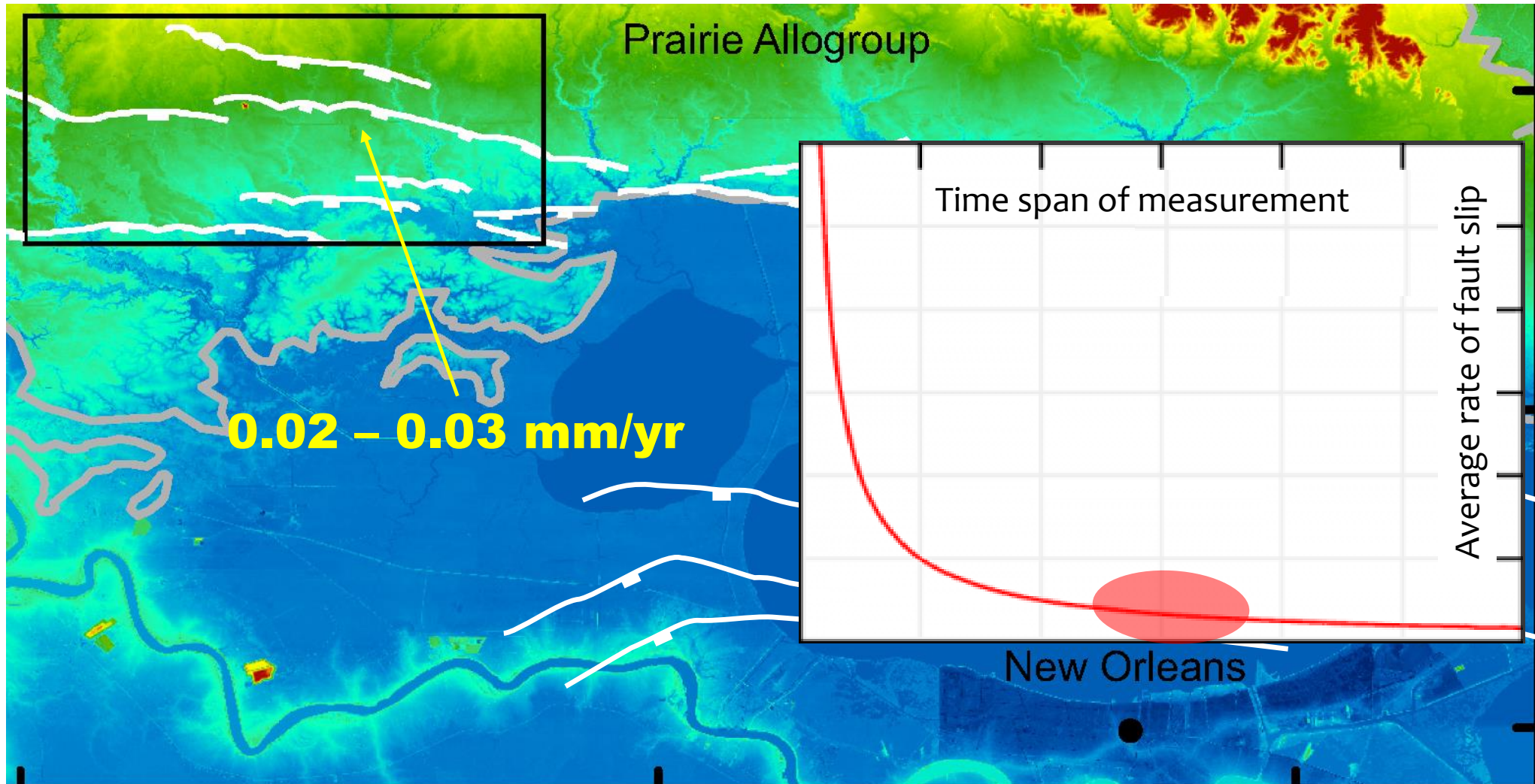
Shen, et al



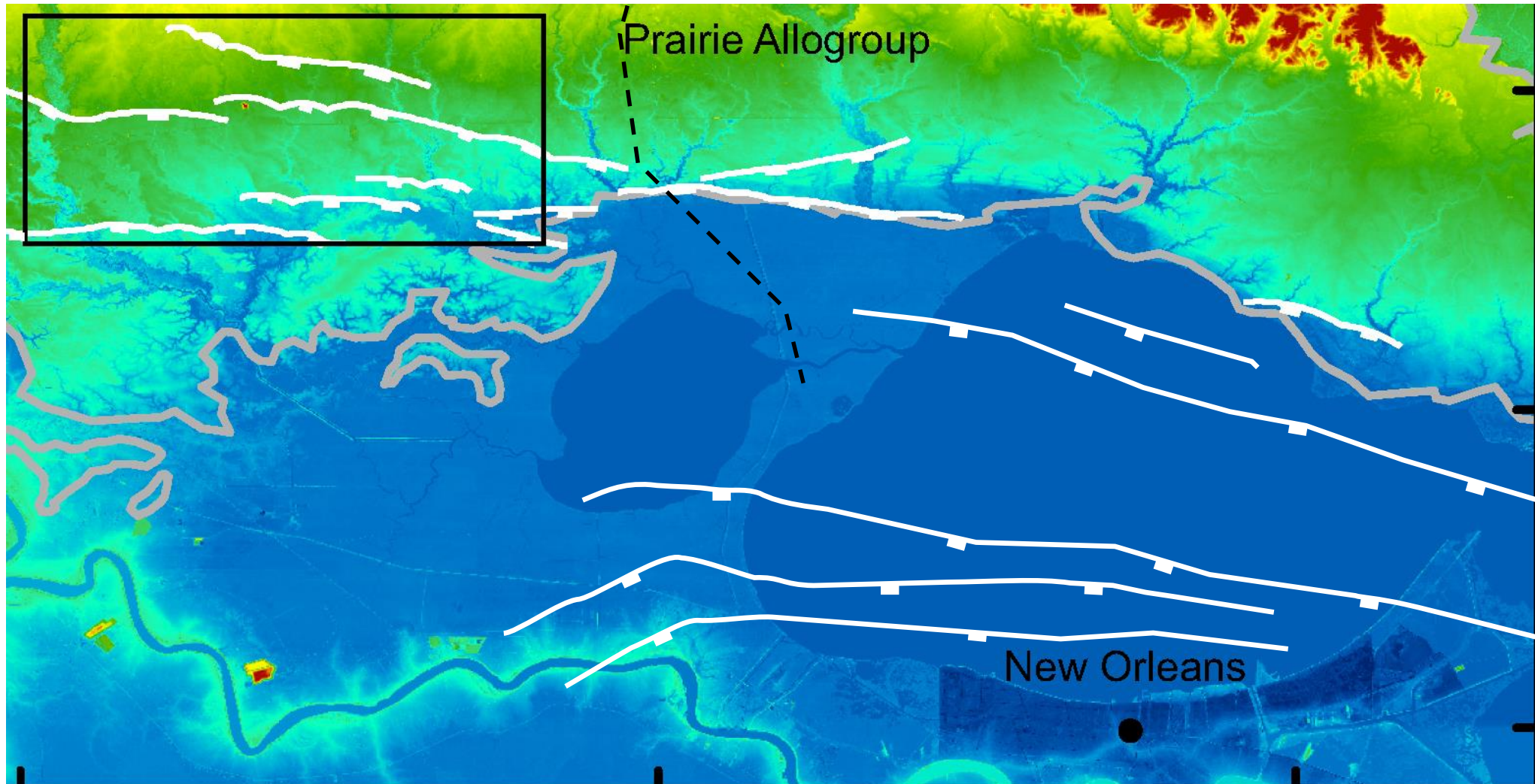
Shen, et al



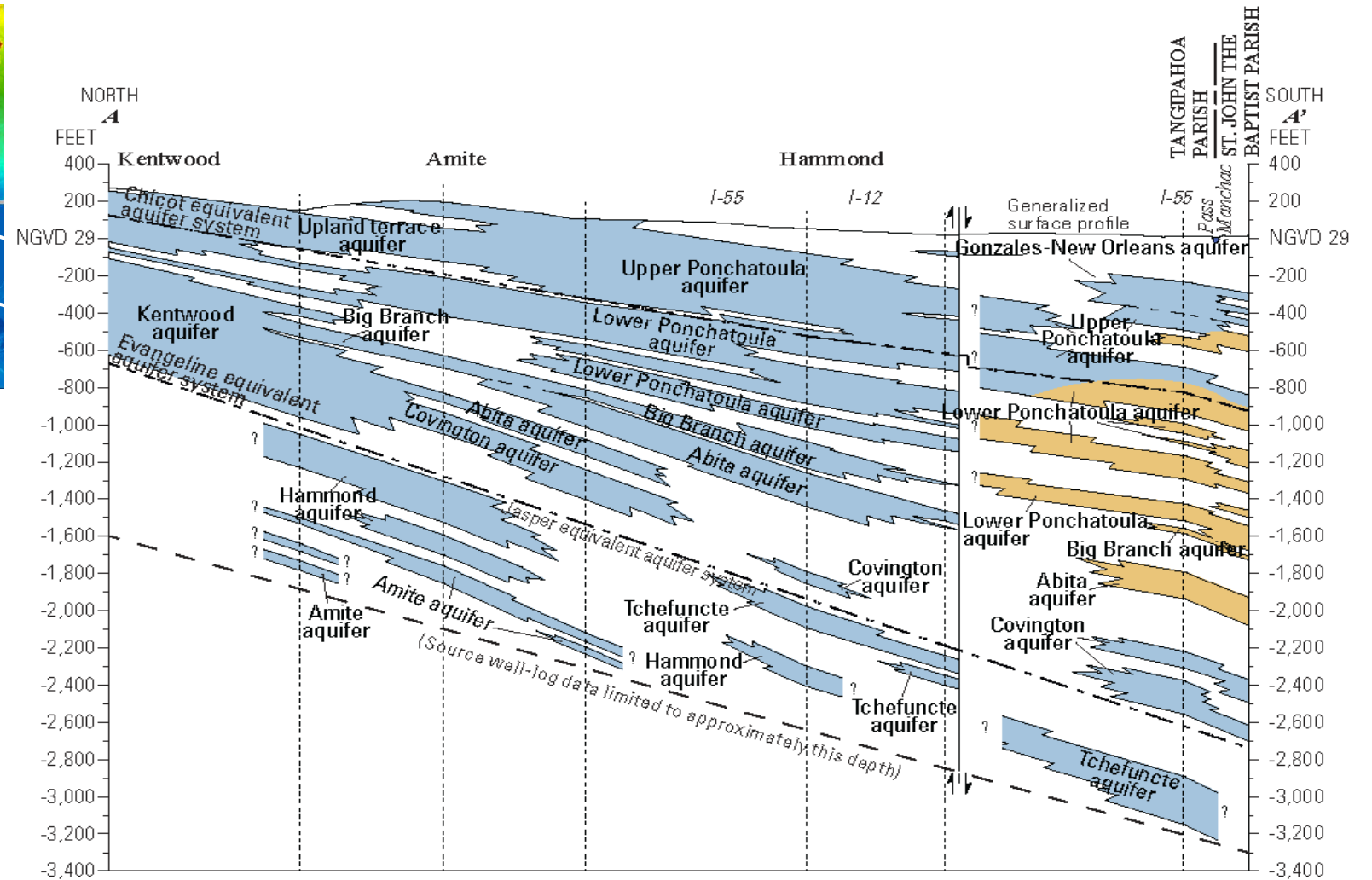
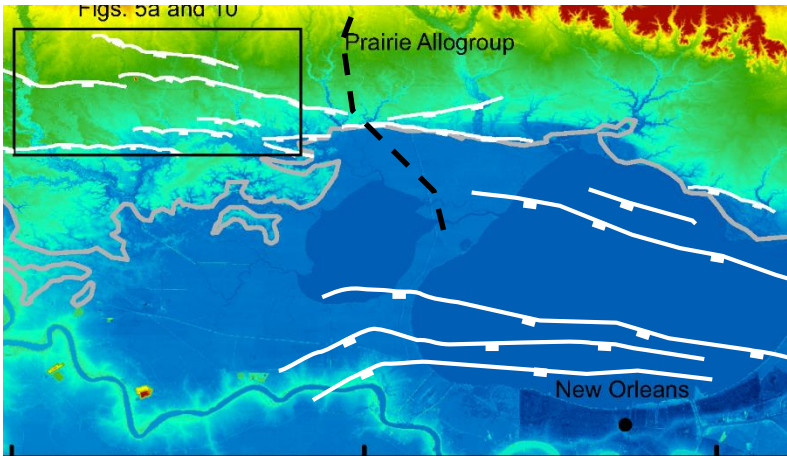
Shen, et al



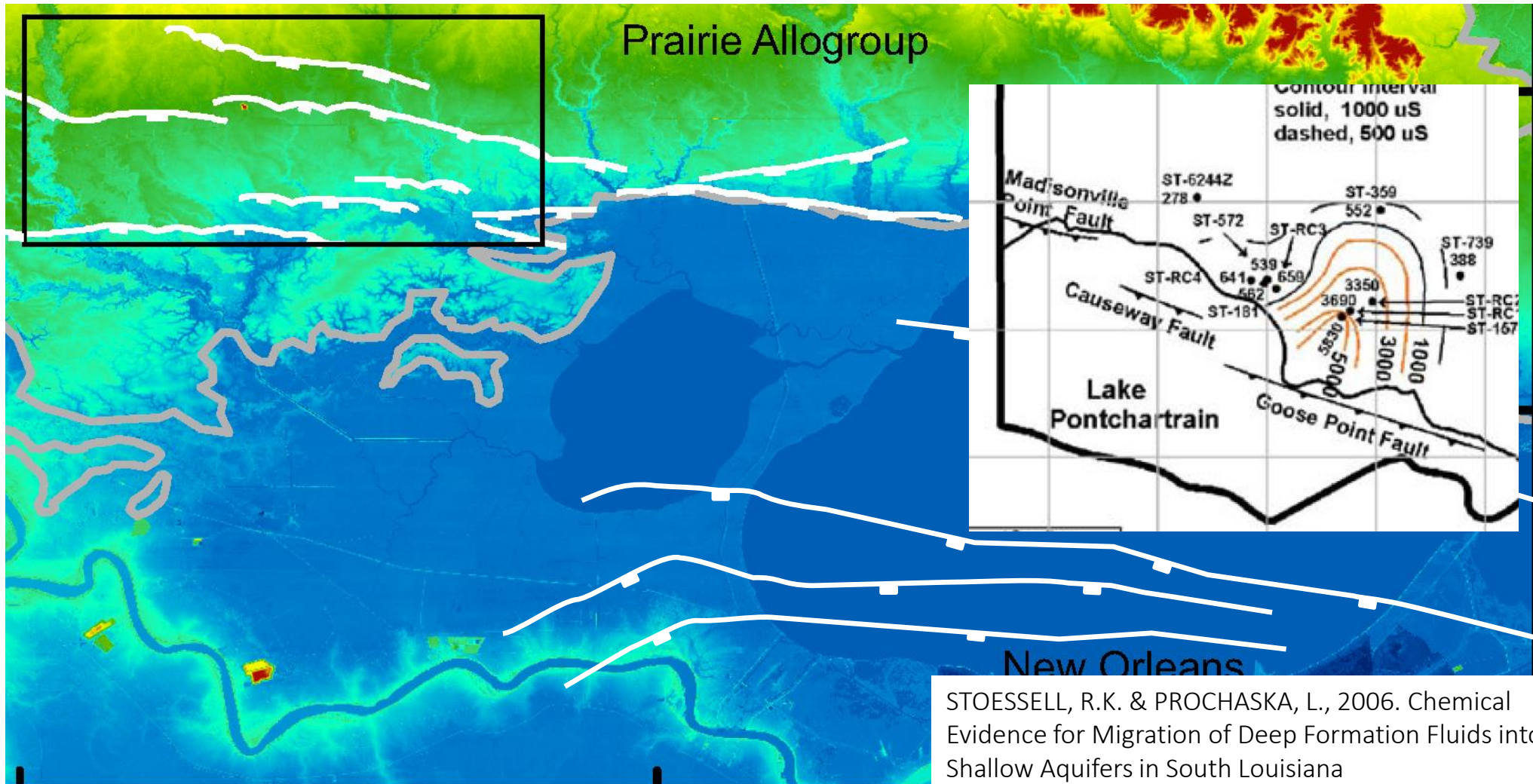
Tangipahoa Area



Tangipahoa Area

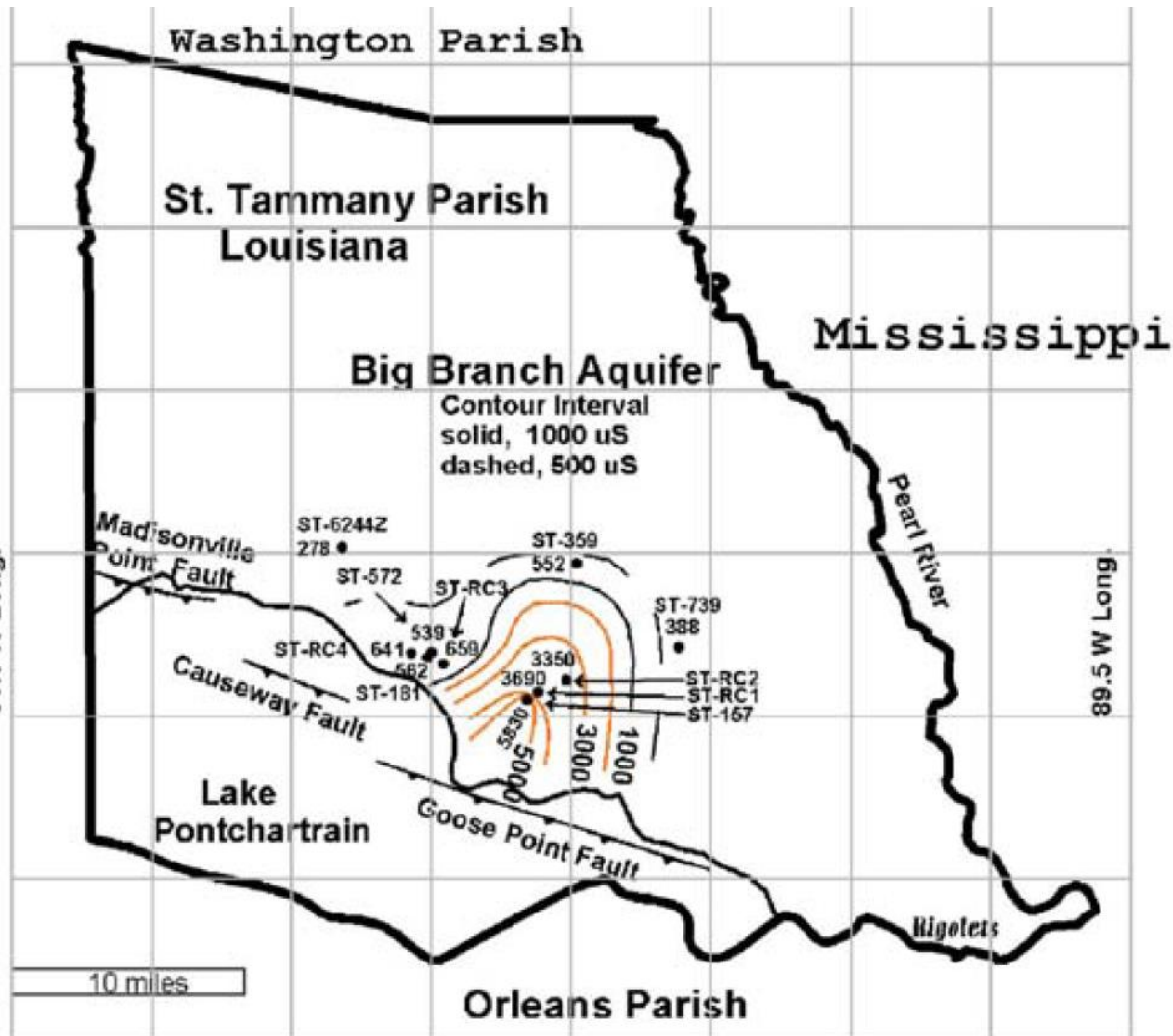


St. Tammany Area



STOESSELL, R.K. & PROCHASKA, L., 2006. Chemical Evidence for Migration of Deep Formation Fluids into Shallow Aquifers in South Louisiana

St. Tammany Area



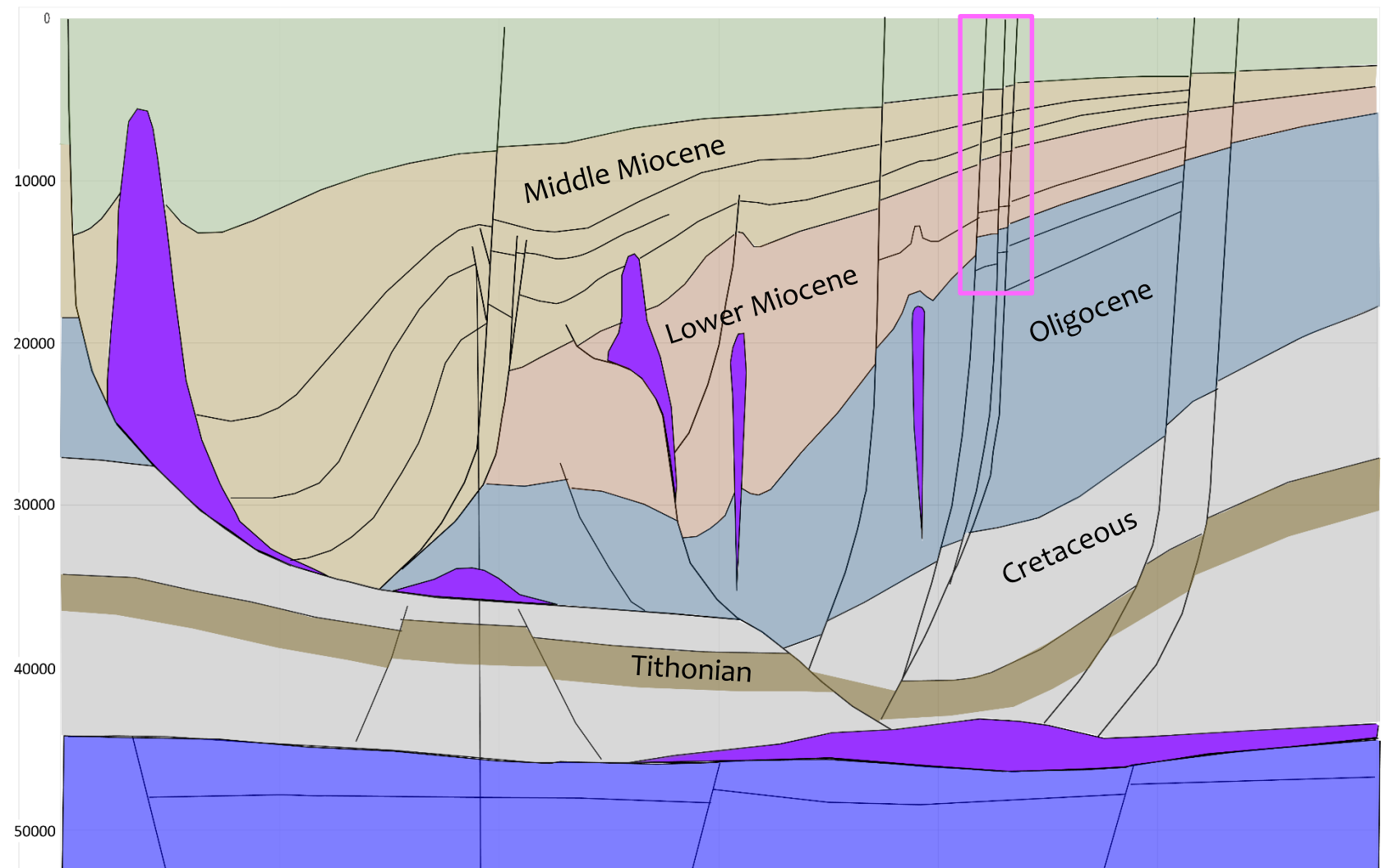
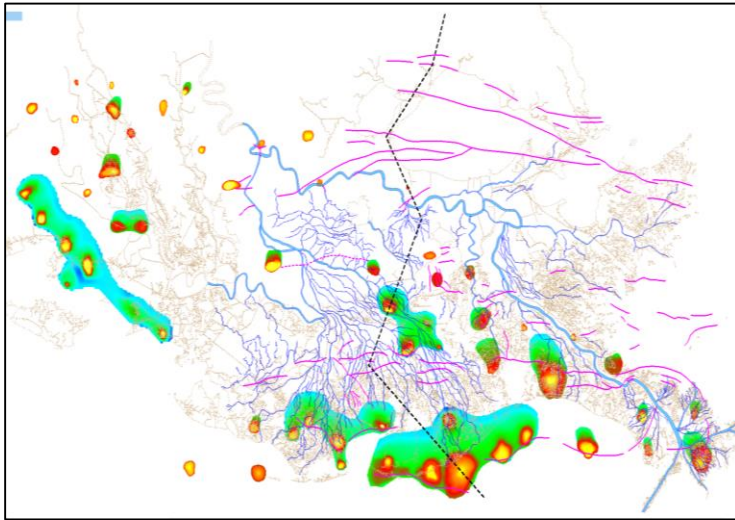
Chemical Fingerprints

- Low Molar BR/CL ratios
- Na/Cl ratios ~ 1
- Low Molar K/Cl ratios
- Depleted SO₄ and Mg concentrations

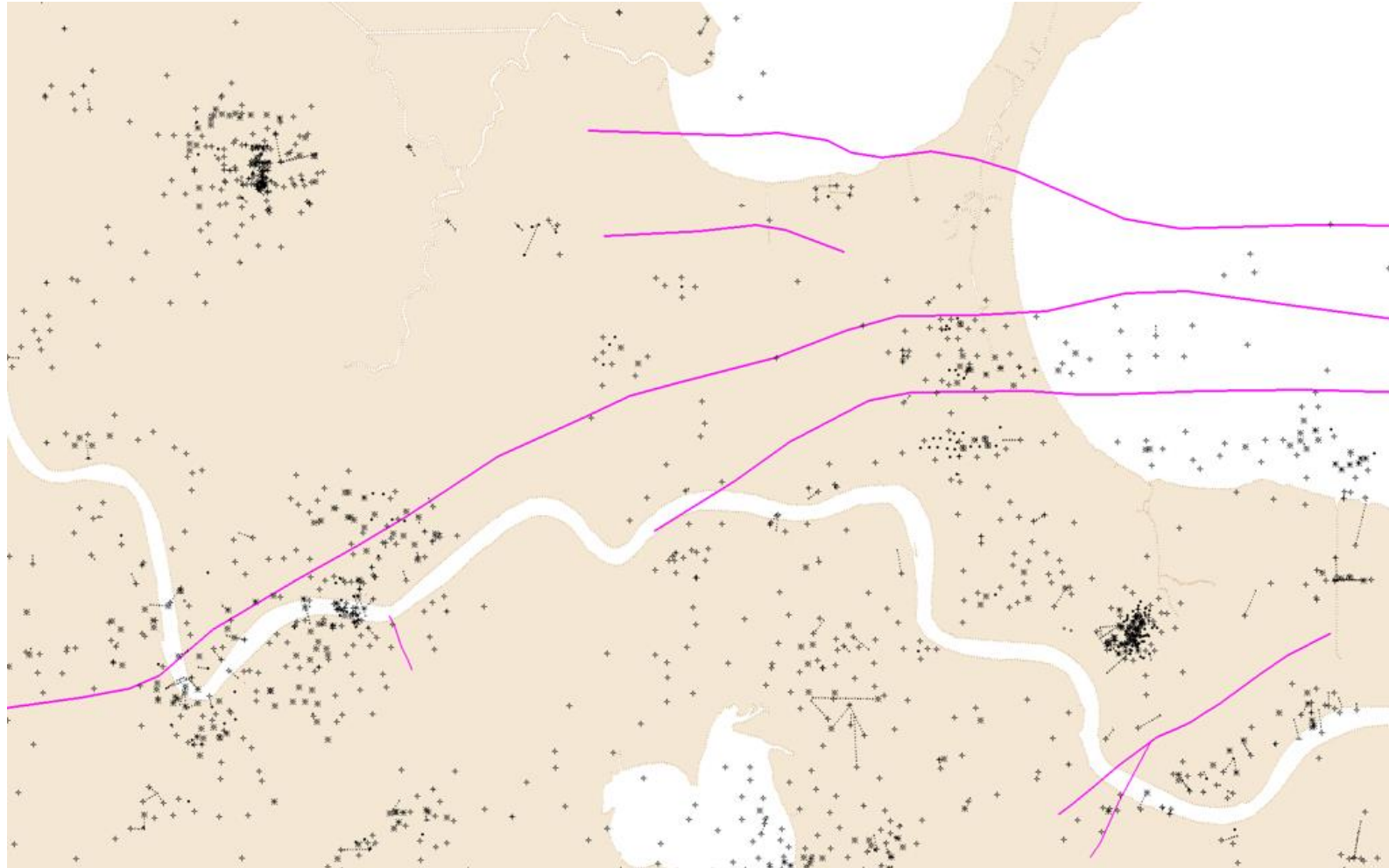
“These chemical profiles indicate that saltwater, including in the brackish water, are derived from deep migrating formation fluids, derived from dissolved halite migrated up fault planes”

STOESSELL, R.K. & PROCHASKA, L., 2006. Chemical Evidence for Migration of Deep Formation Fluids into Shallow Aquifers in South Louisiana

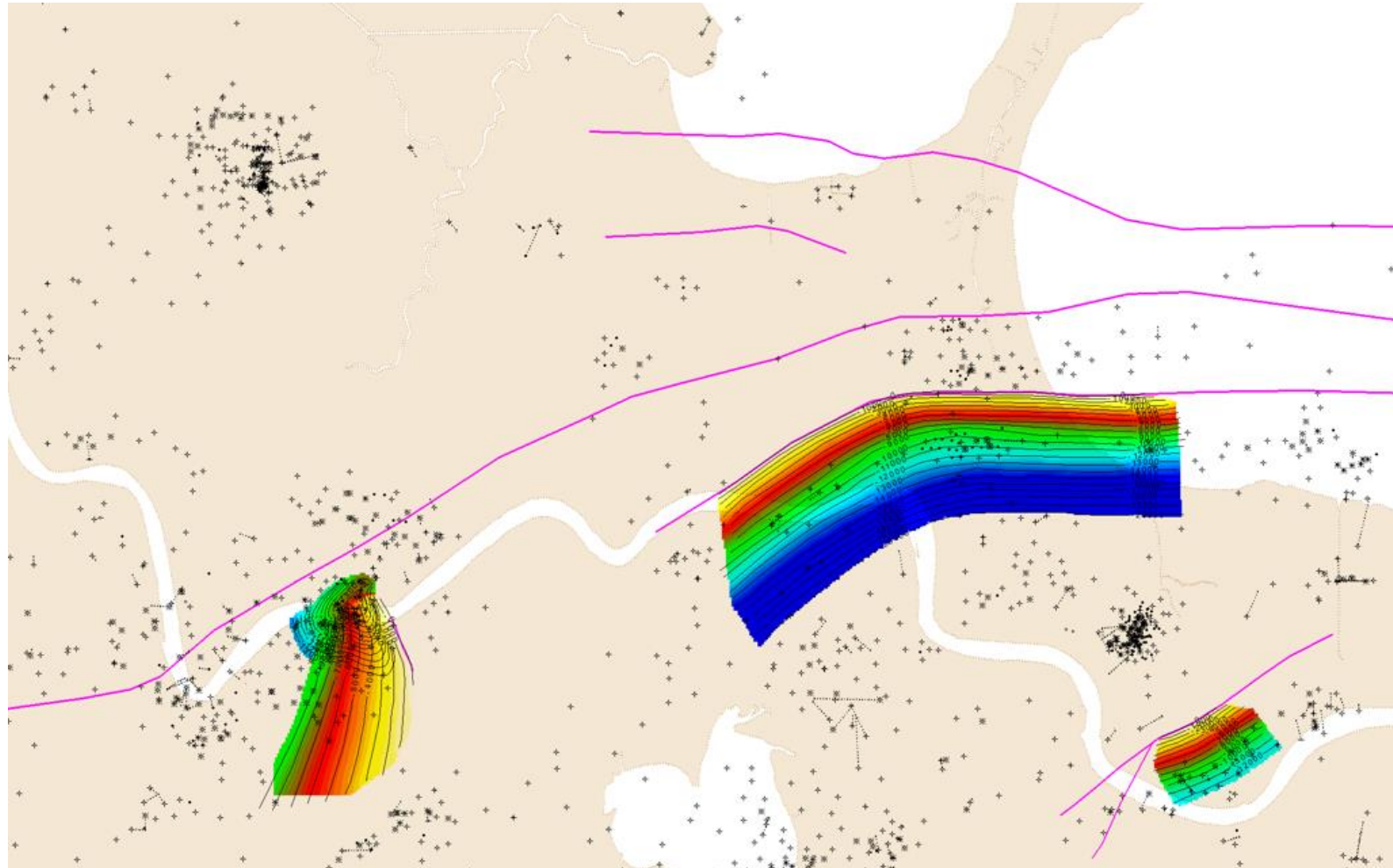
St. John - St. James Area



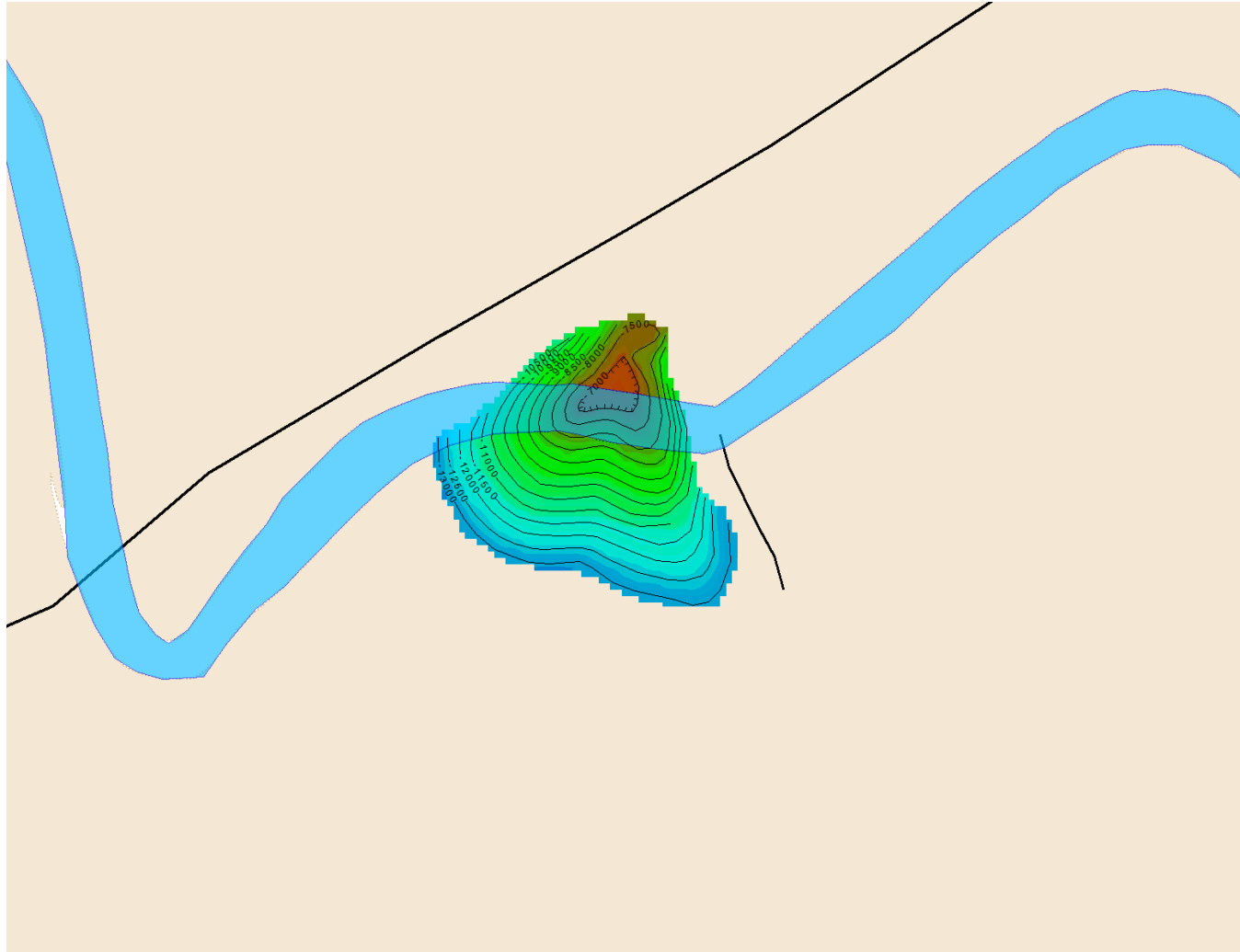
St. John - St. James Area



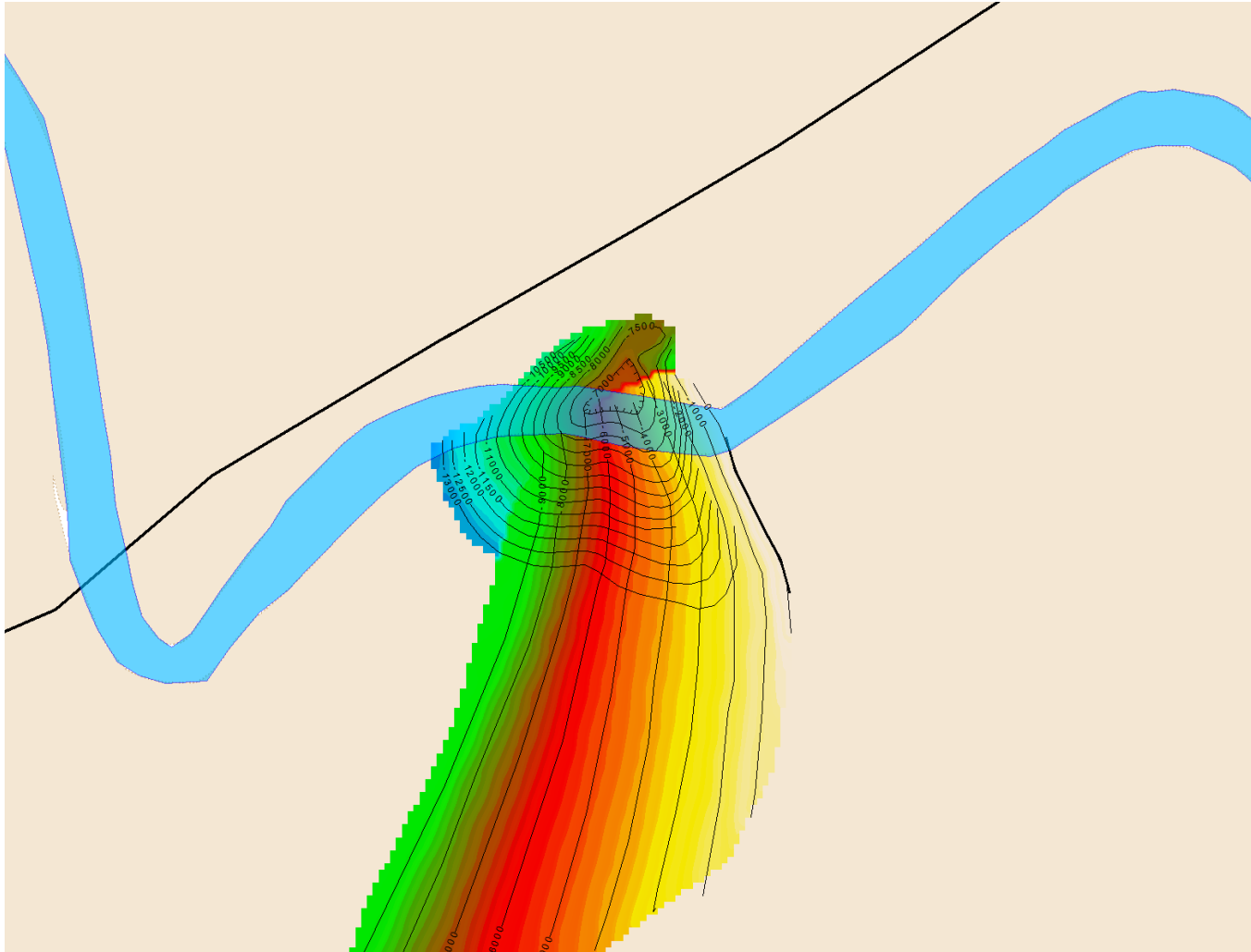
St. John - St. James Area



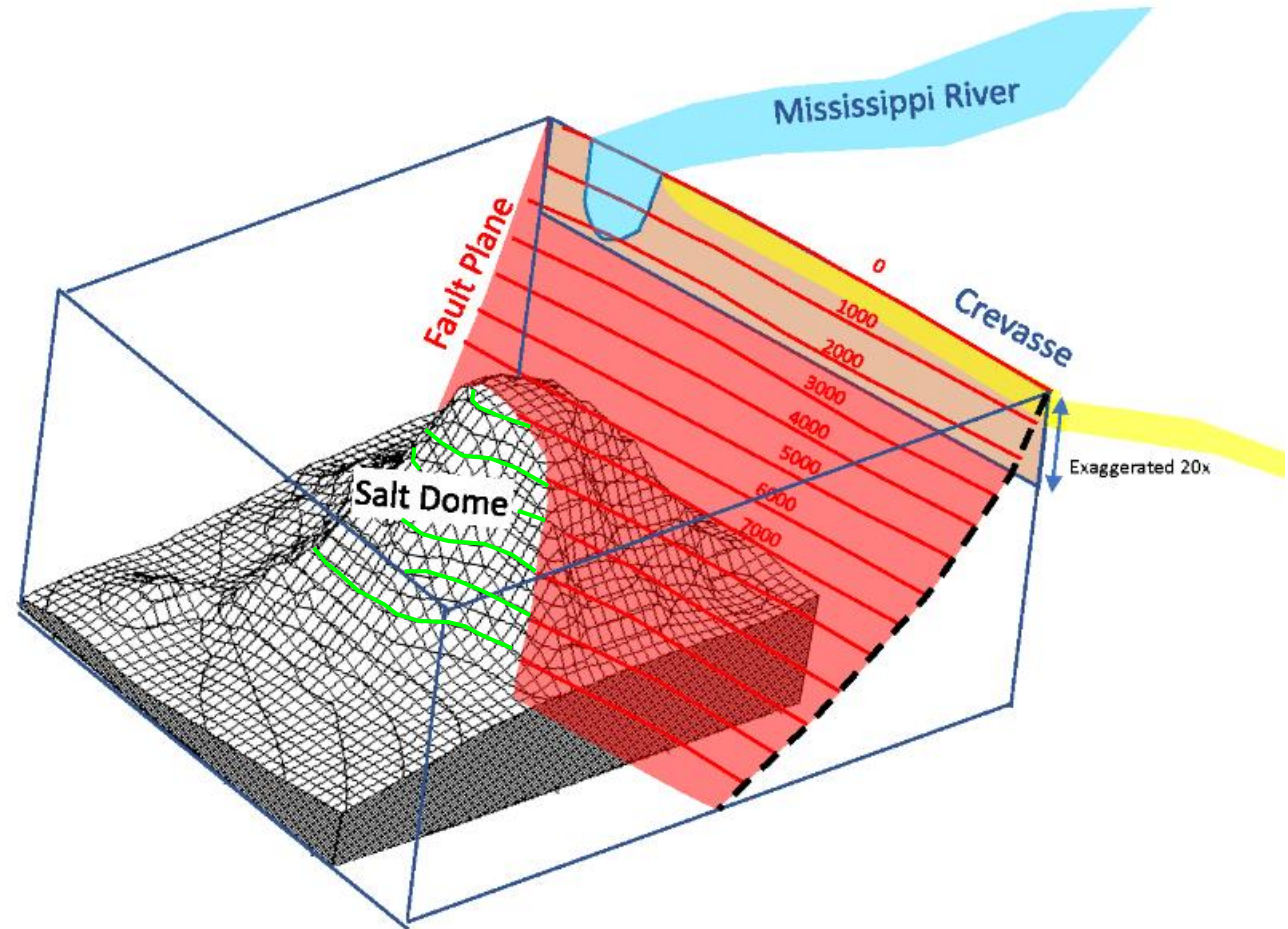
Vacherie fault – Hester dome



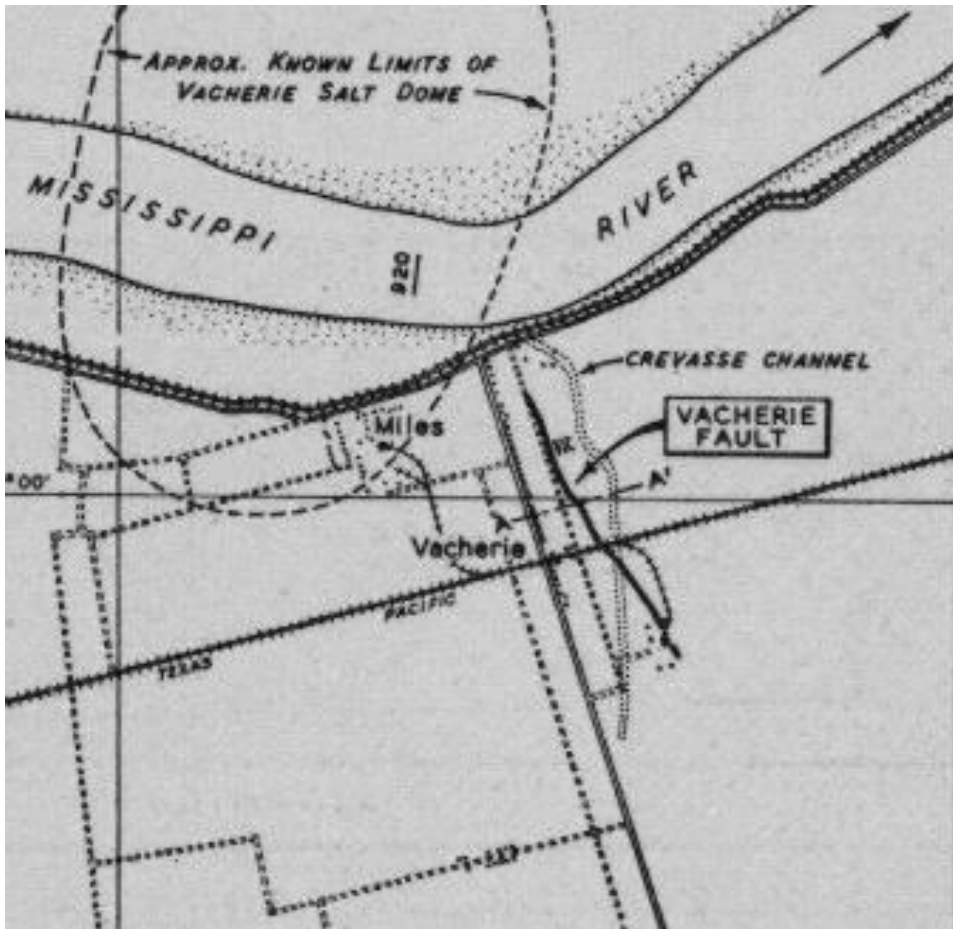
Vacherie fault – Hester dome



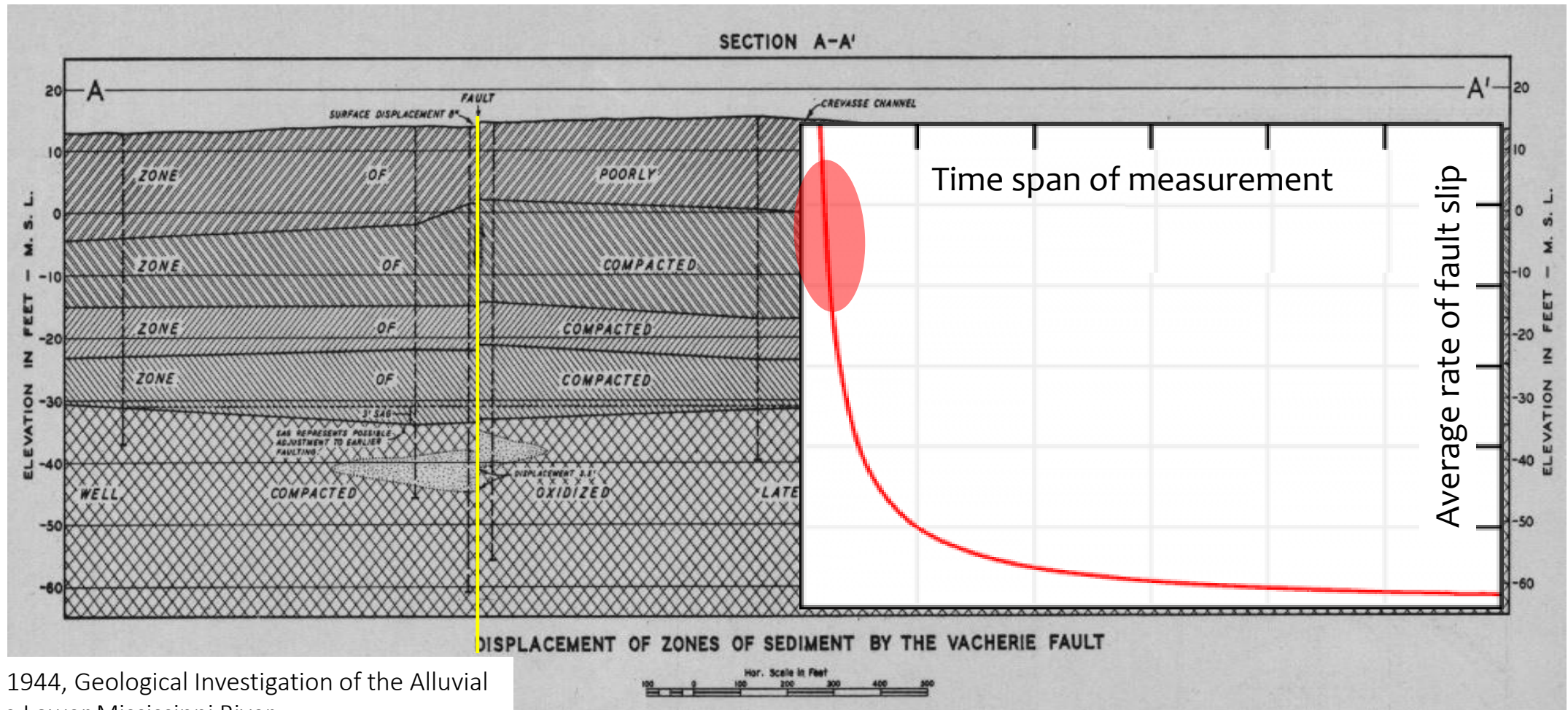
Vacherie fault – Hester dome



Vacherie fault

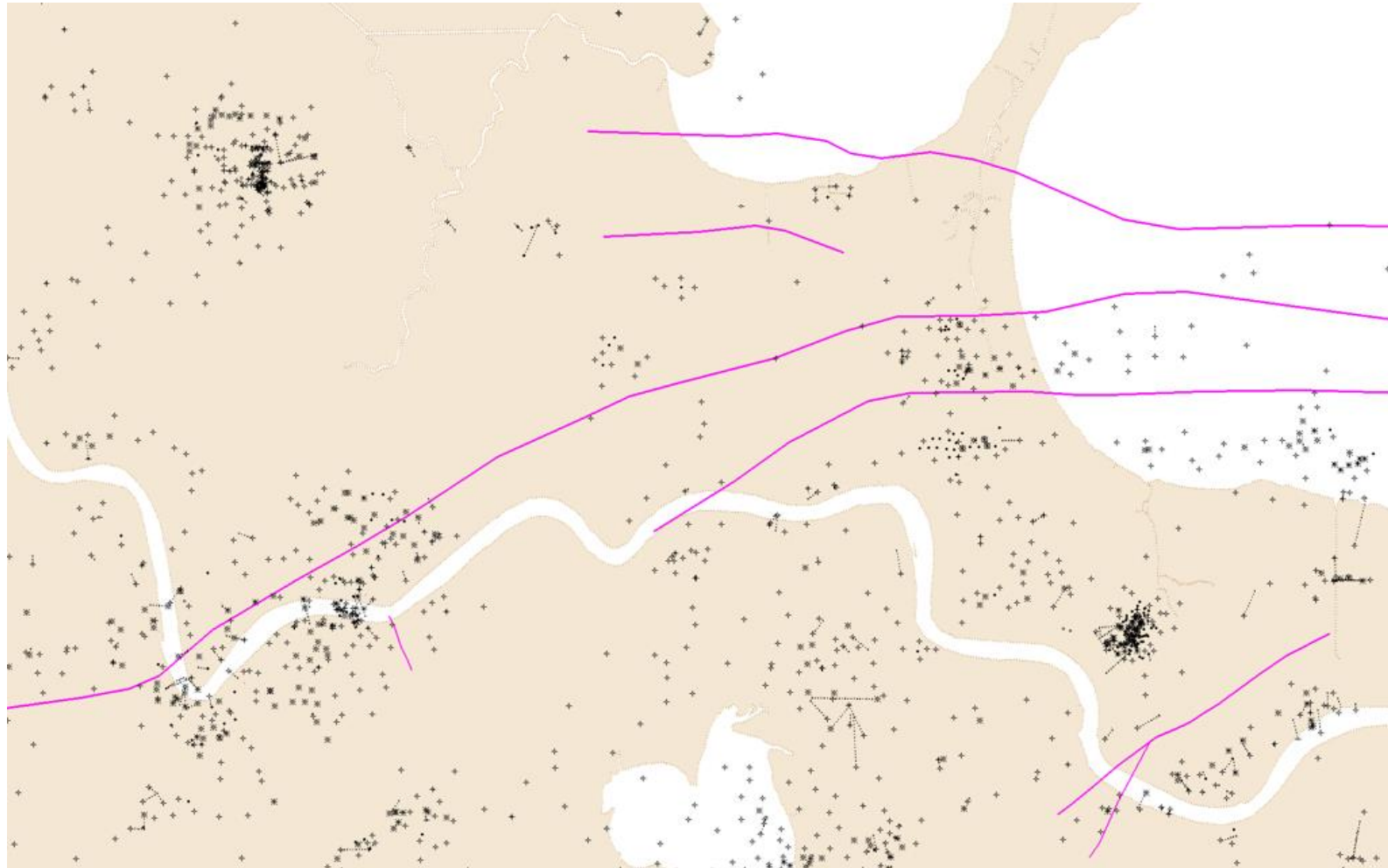


Fault Offset

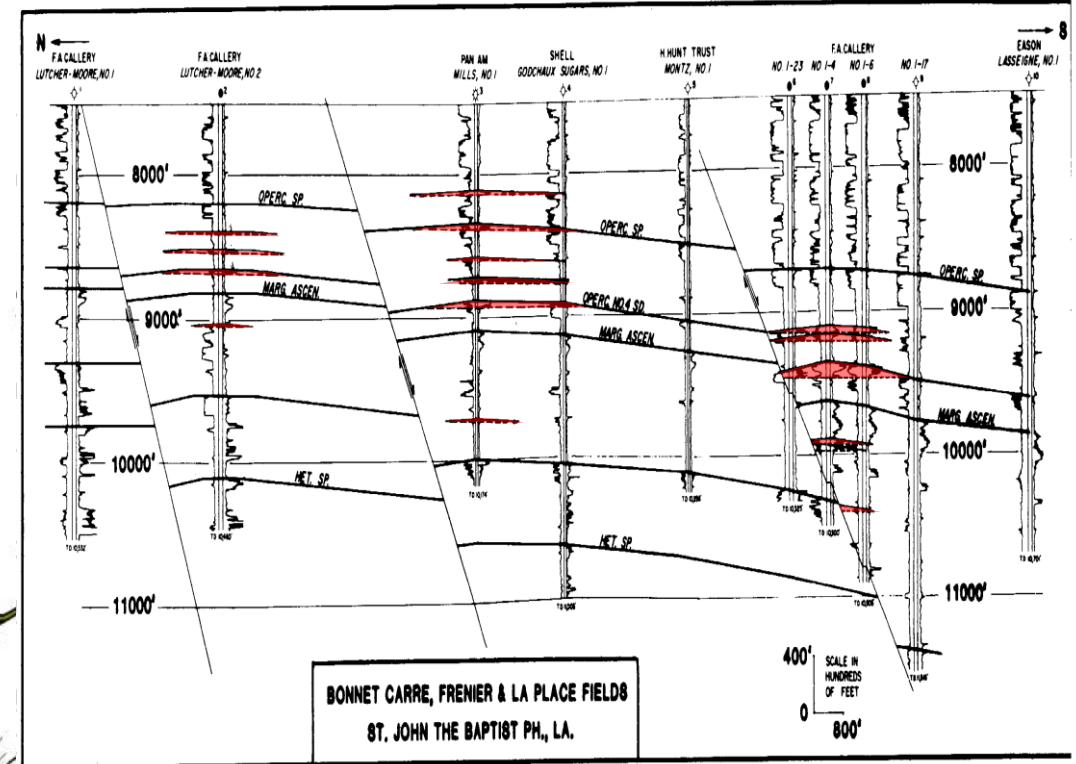


FISK, H. N., 1944, Geological Investigation of the Alluvial Valley of the Lower Mississippi River

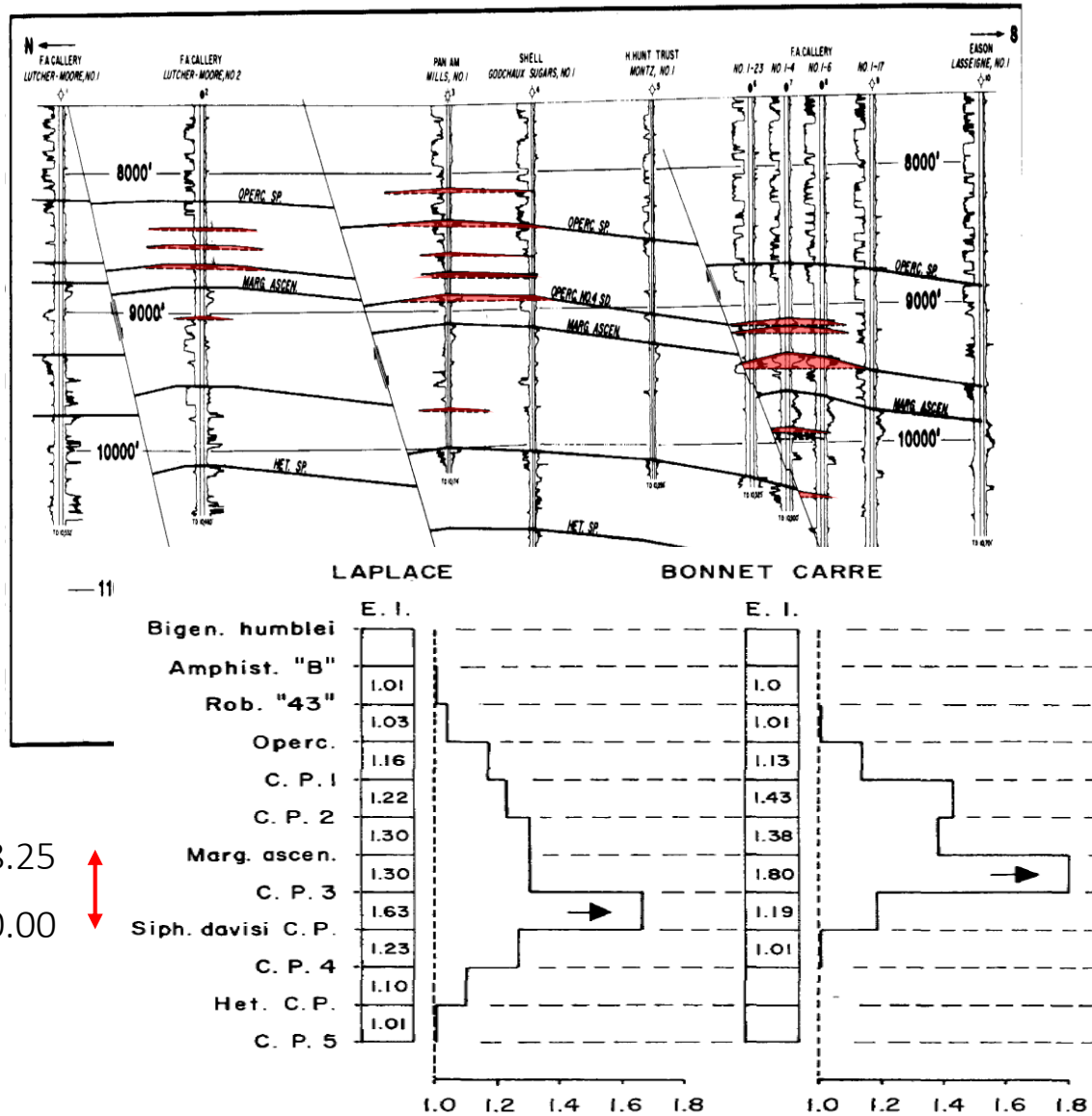
St. John - St. James Area



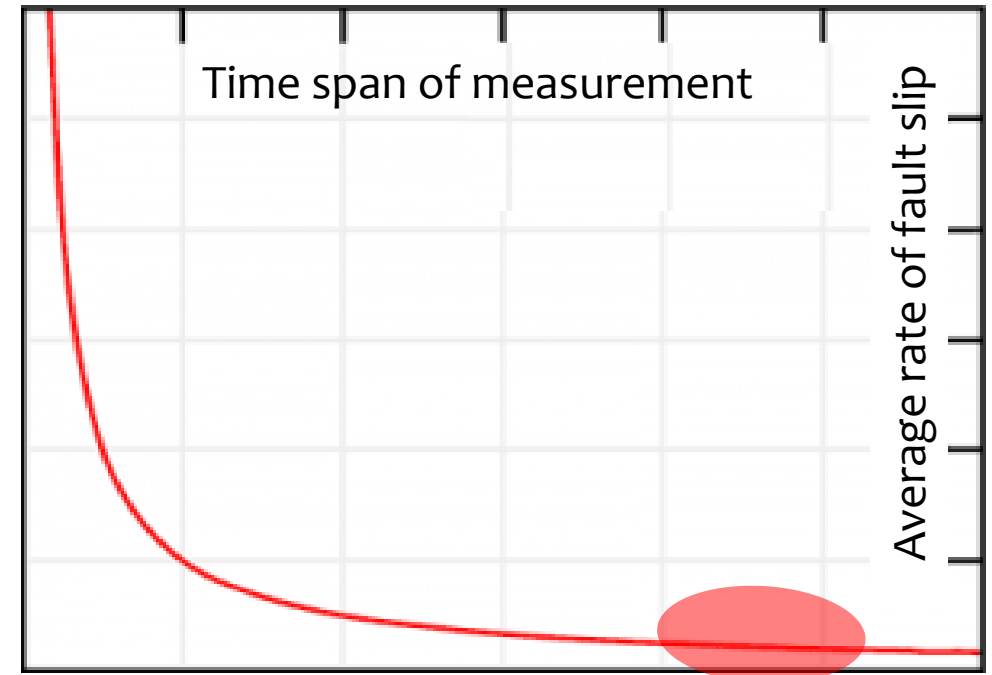
Laplace – Bonnet Carre Fields



NOGS, 1966, Laplace Field, St. John Parish, Louisiana

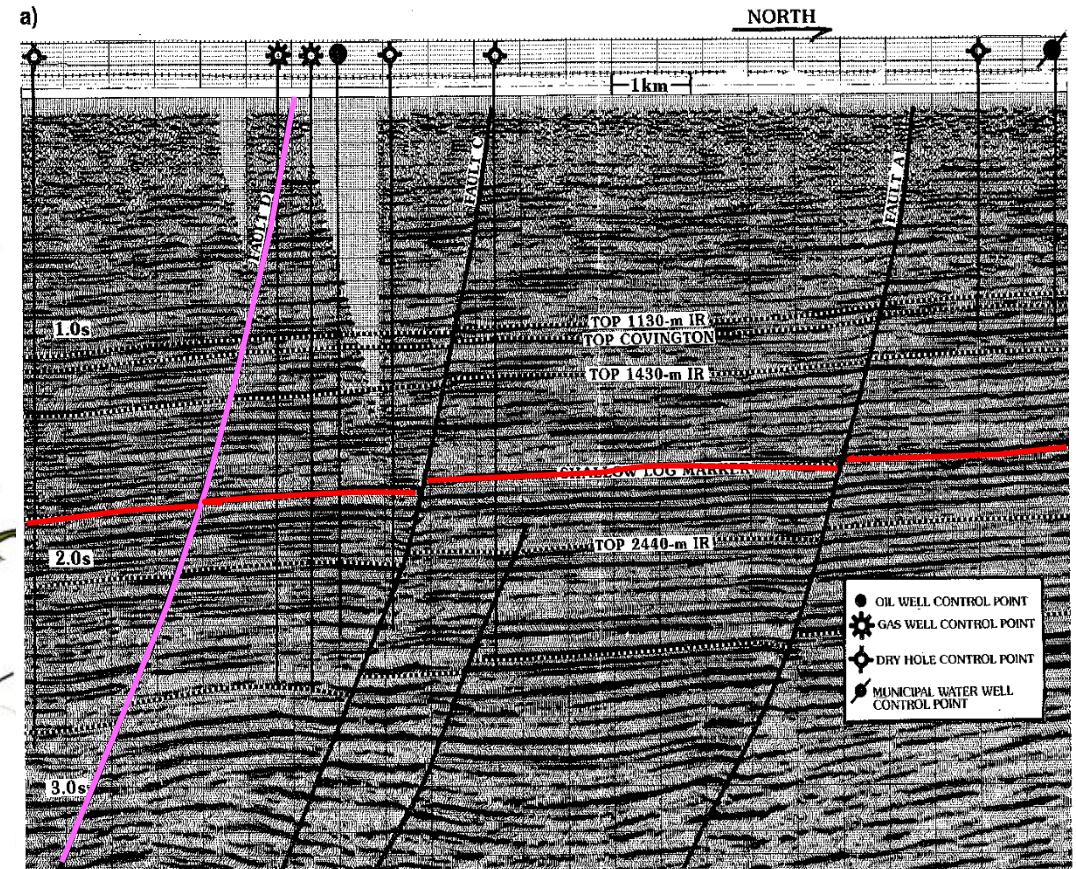
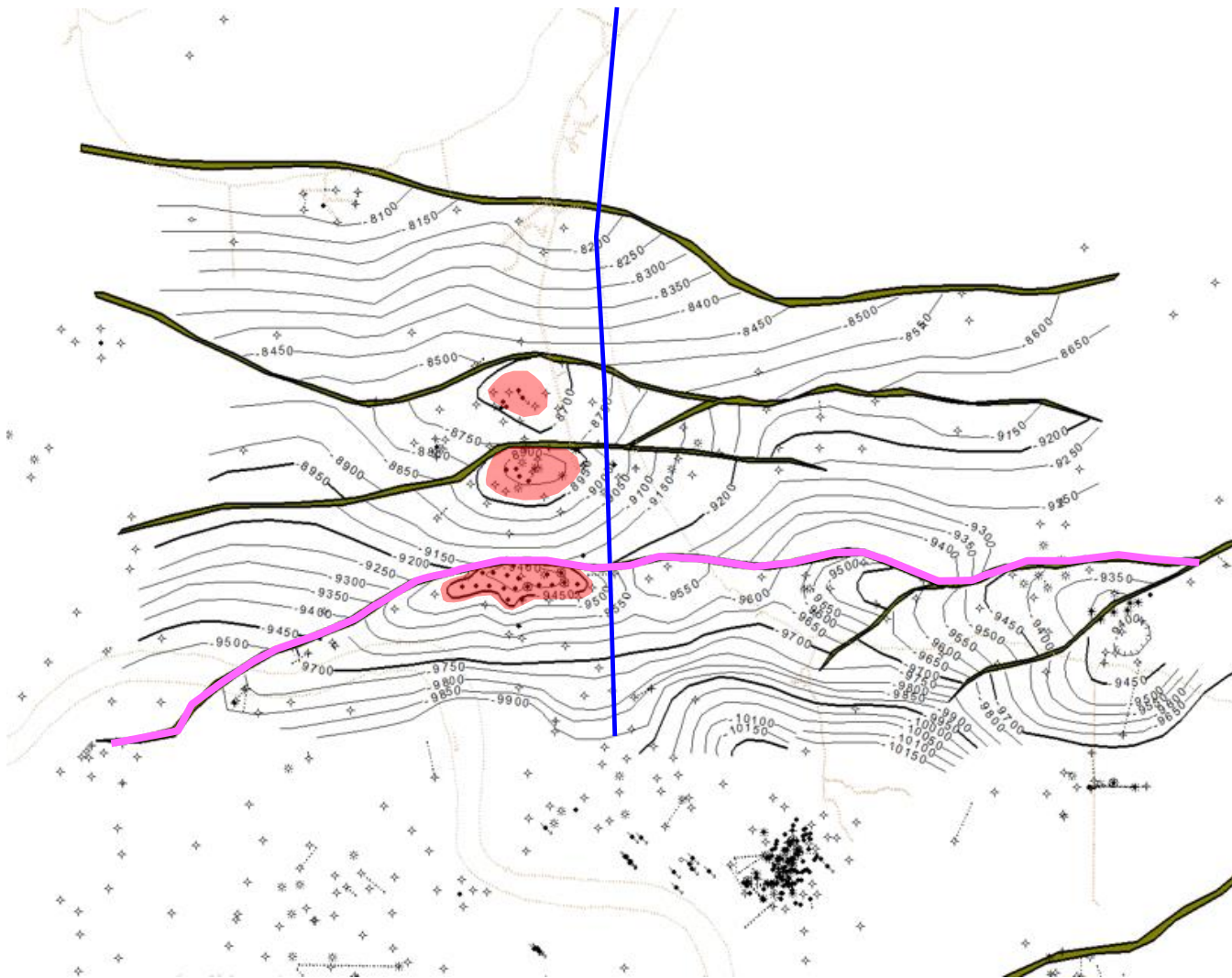


18.25
20.00



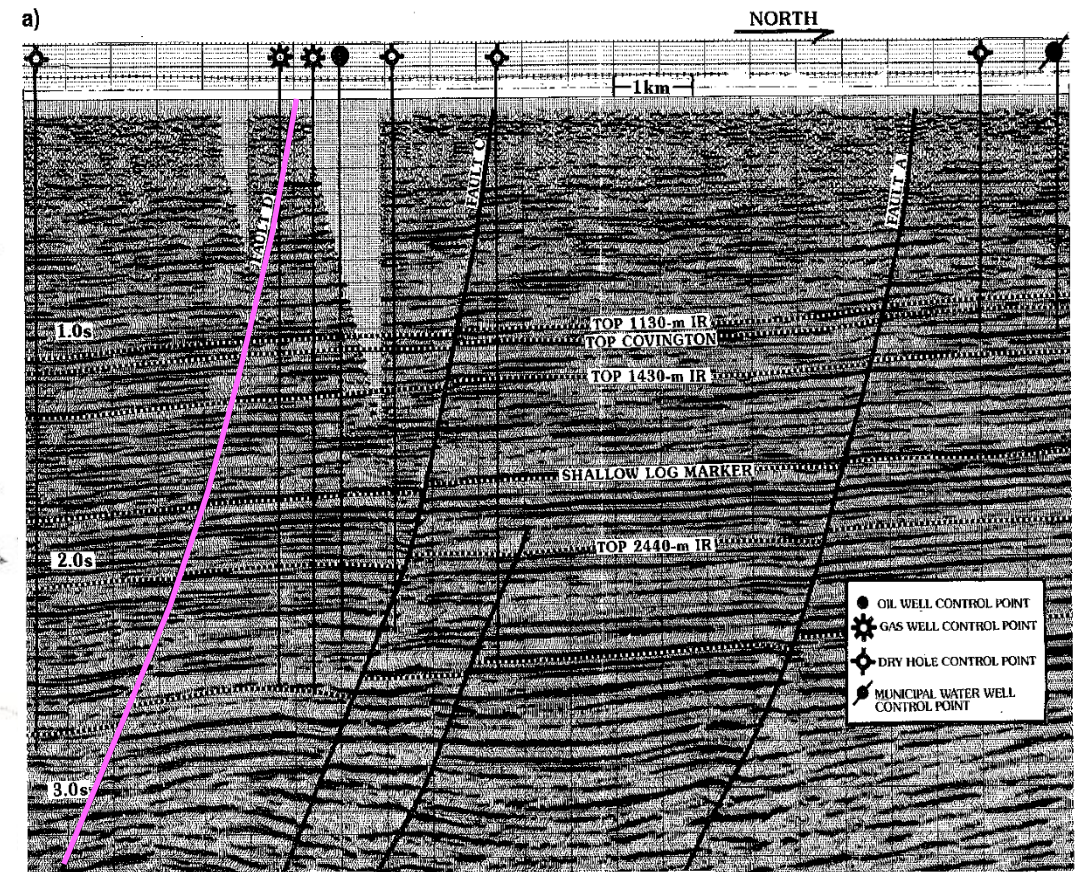
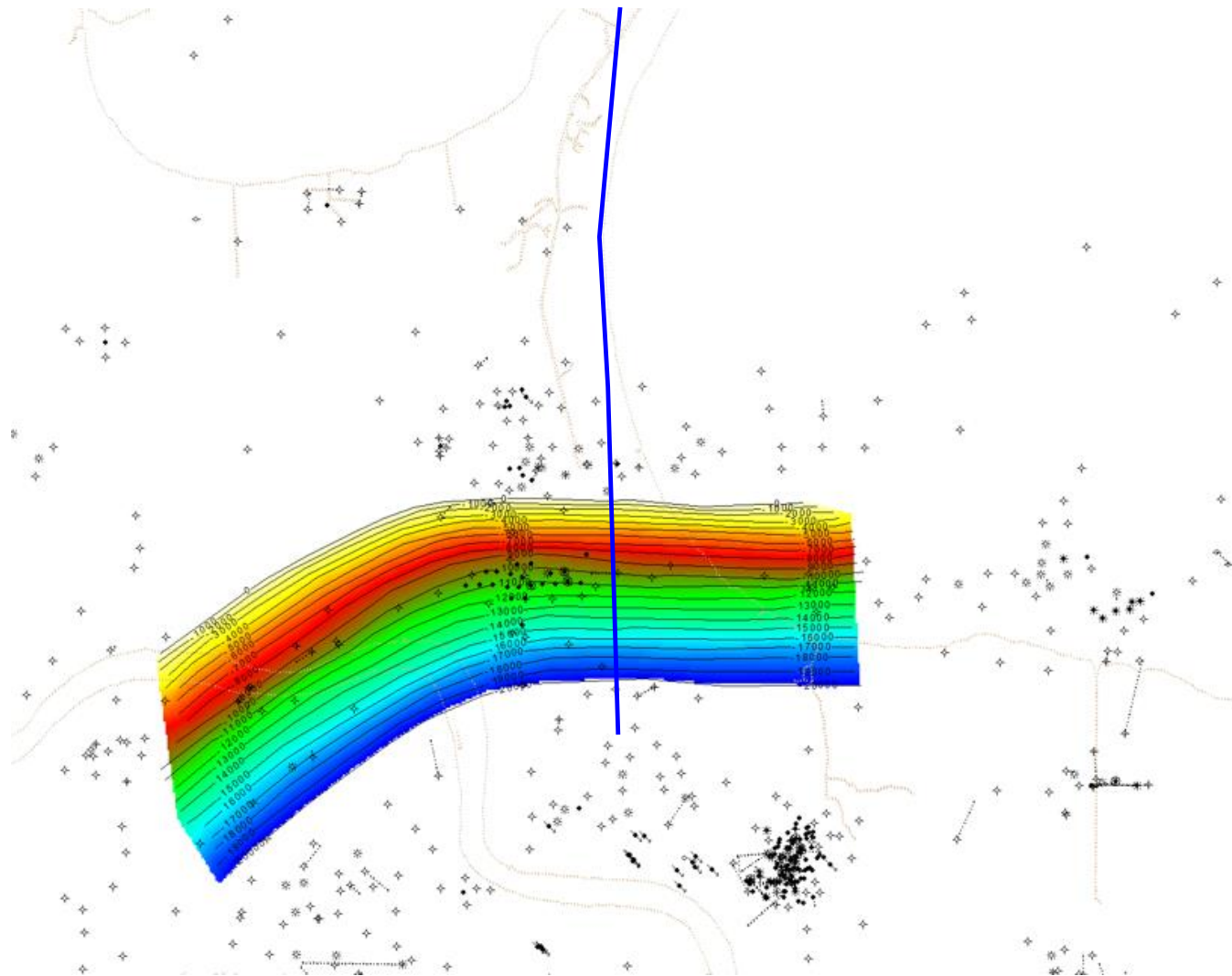
THORSEN, C.E., 1963, Age of Growth Faulting in Southeast Louisiana

Laplace – Bonnet Carre Fields



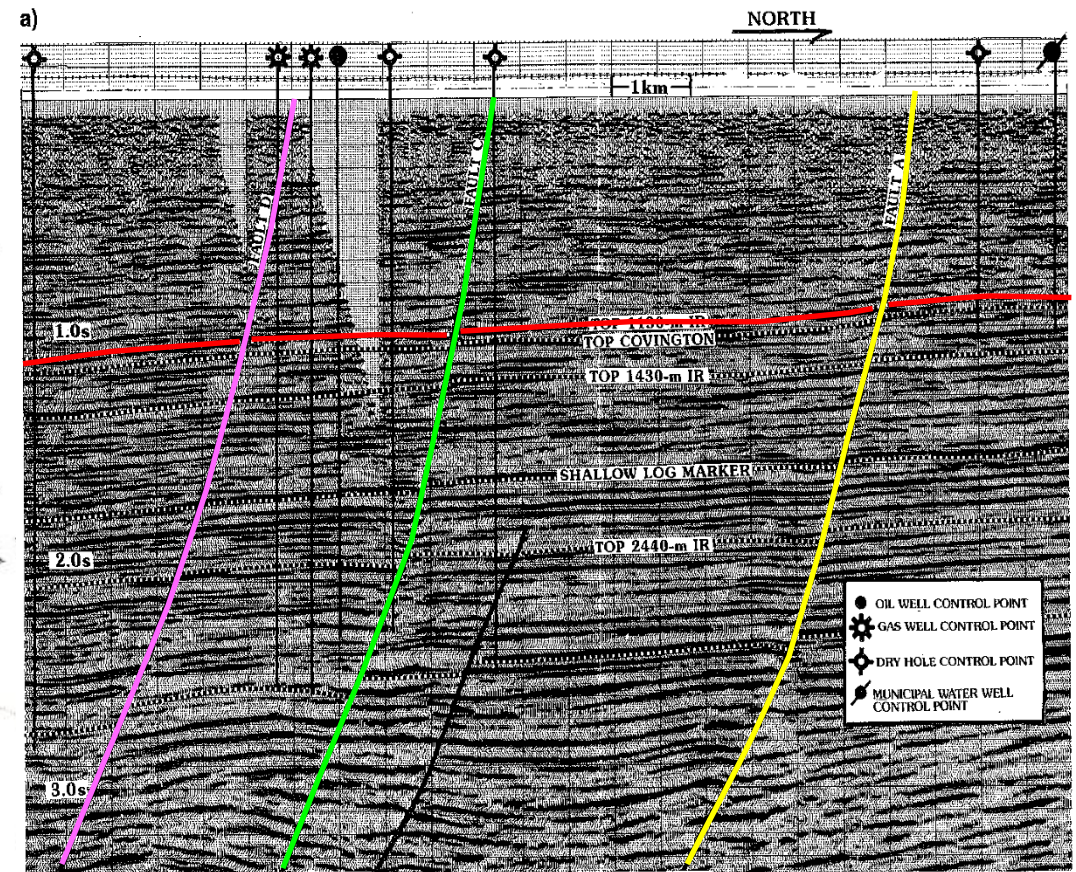
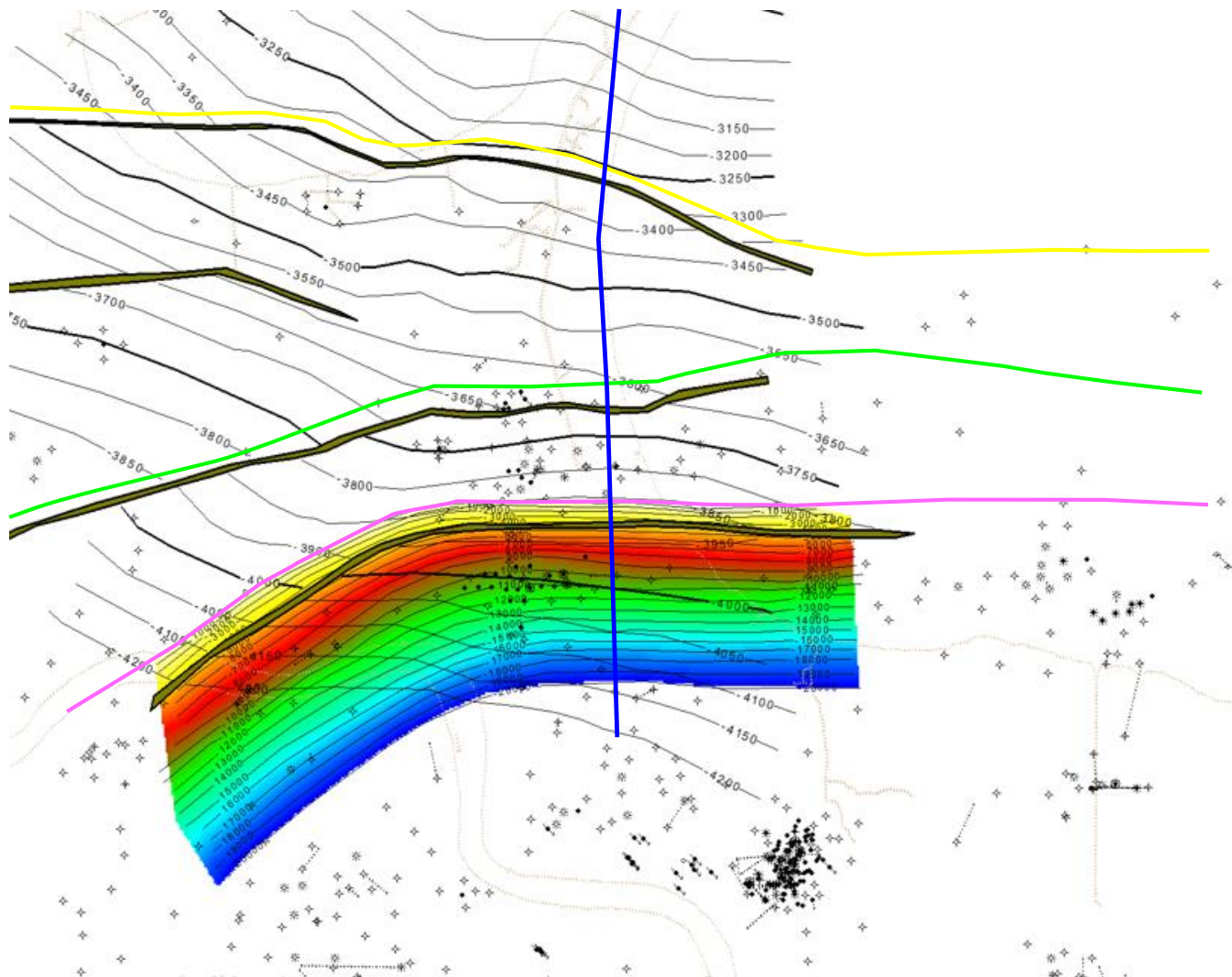
ZINNI, E.V., 1995, Subsurface fault detection using seismic data for hazardous-waste-injection well permitting

Laplace – Bonnet Carre Fields



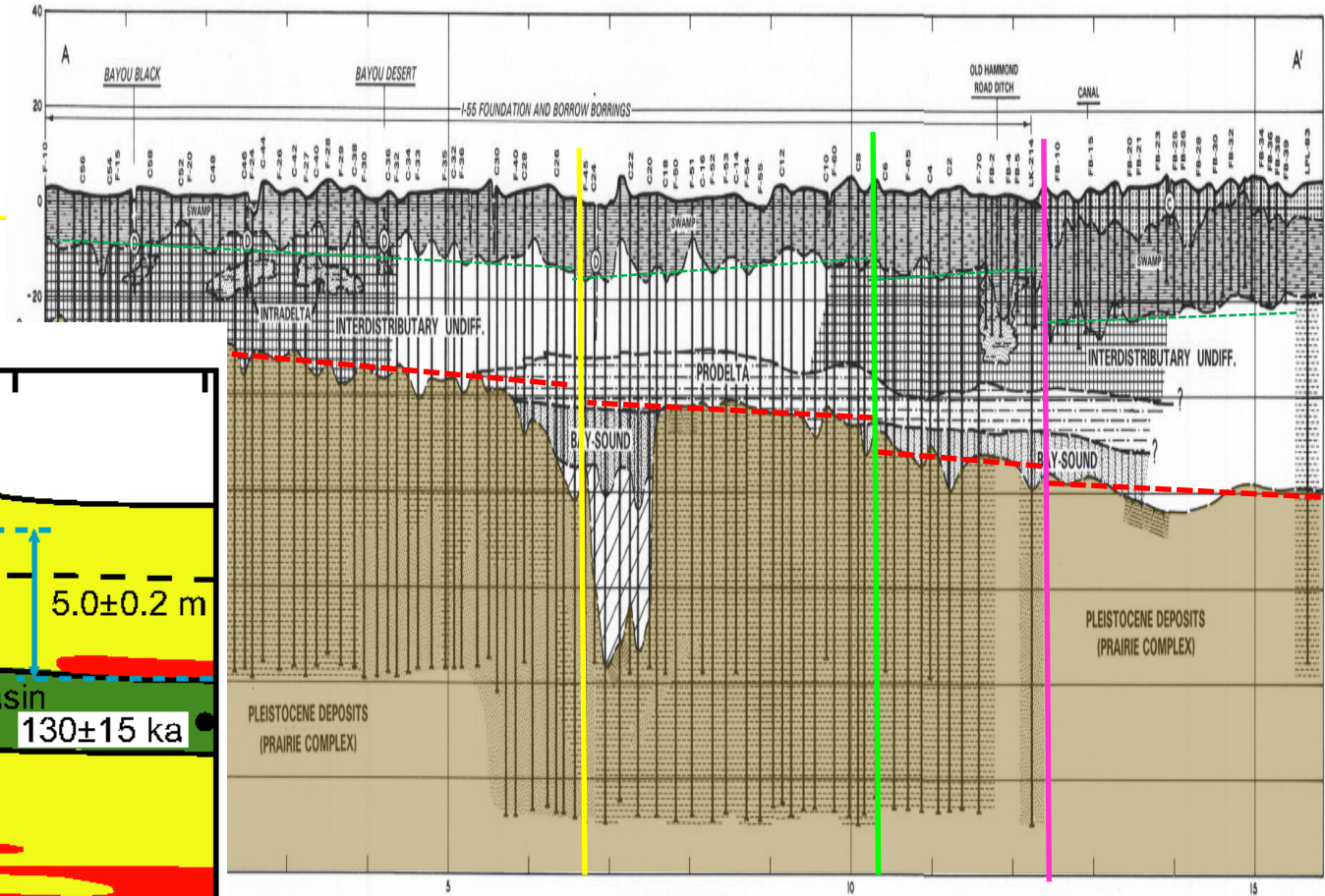
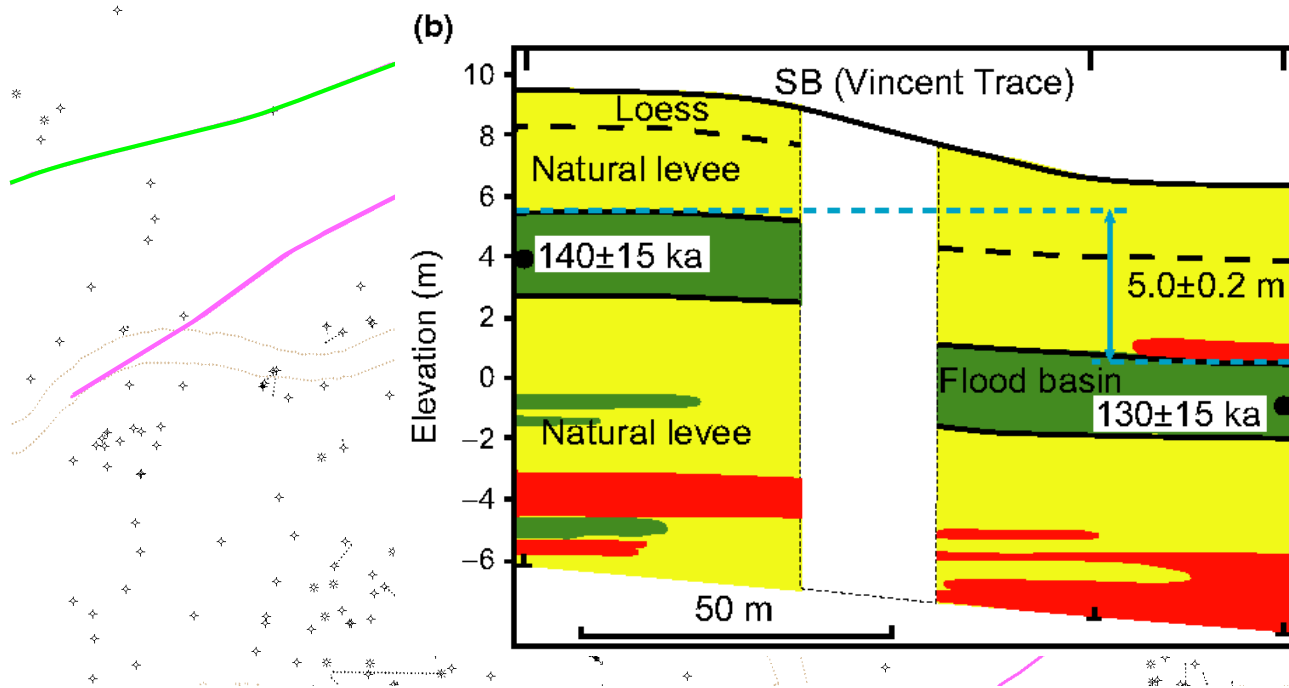
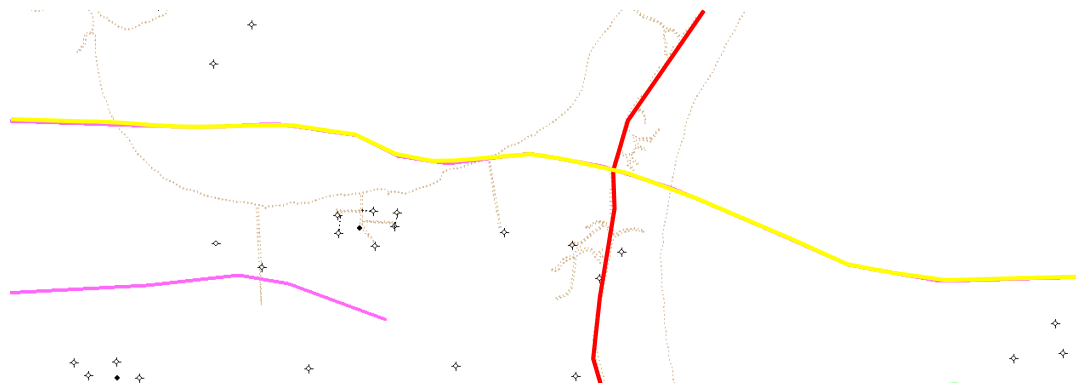
ZINNI, E.V., 1995, Subsurface fault detection using seismic data for hazardous-waste-injection well permitting

Shallow Fault Expression



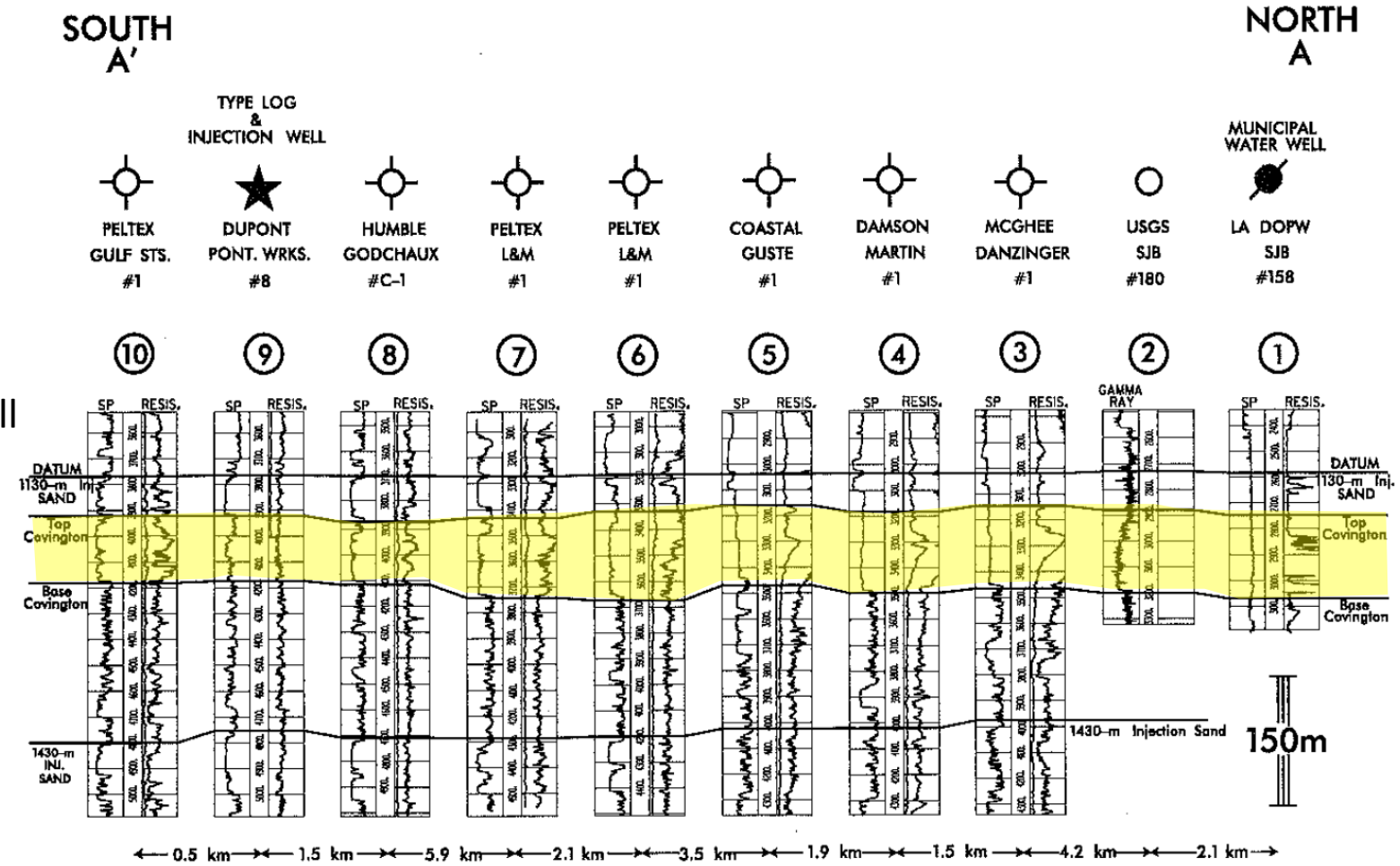
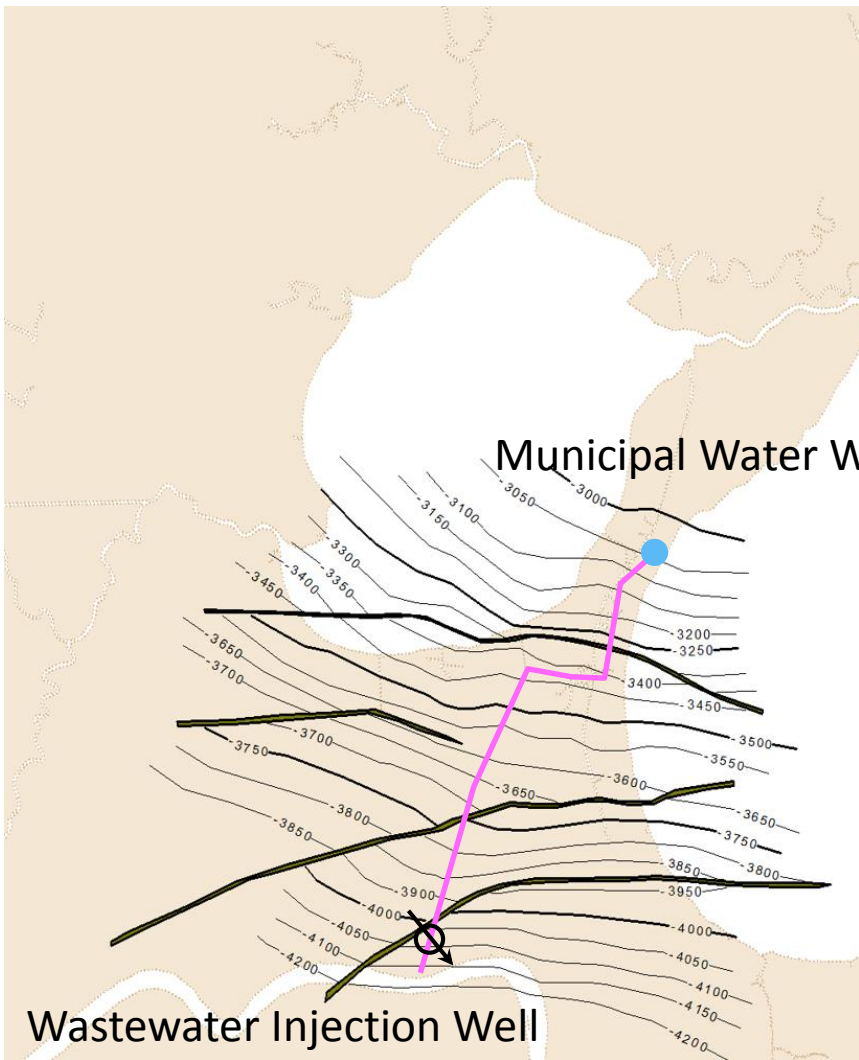
ZINNI, E.V., 1995, Subsurface fault detection using seismic data for hazardous-waste-injection well permitting

Shallow Fault Expression



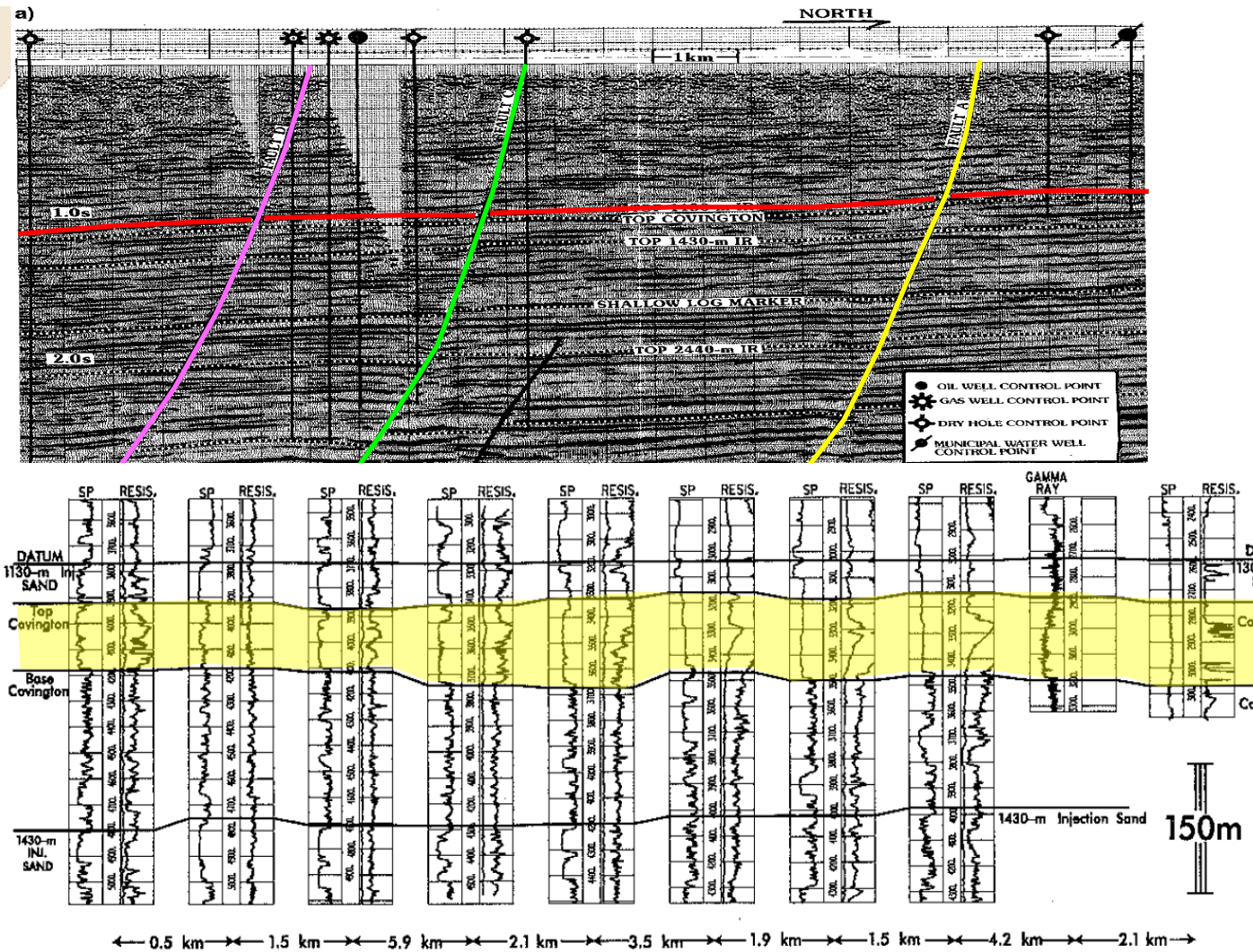
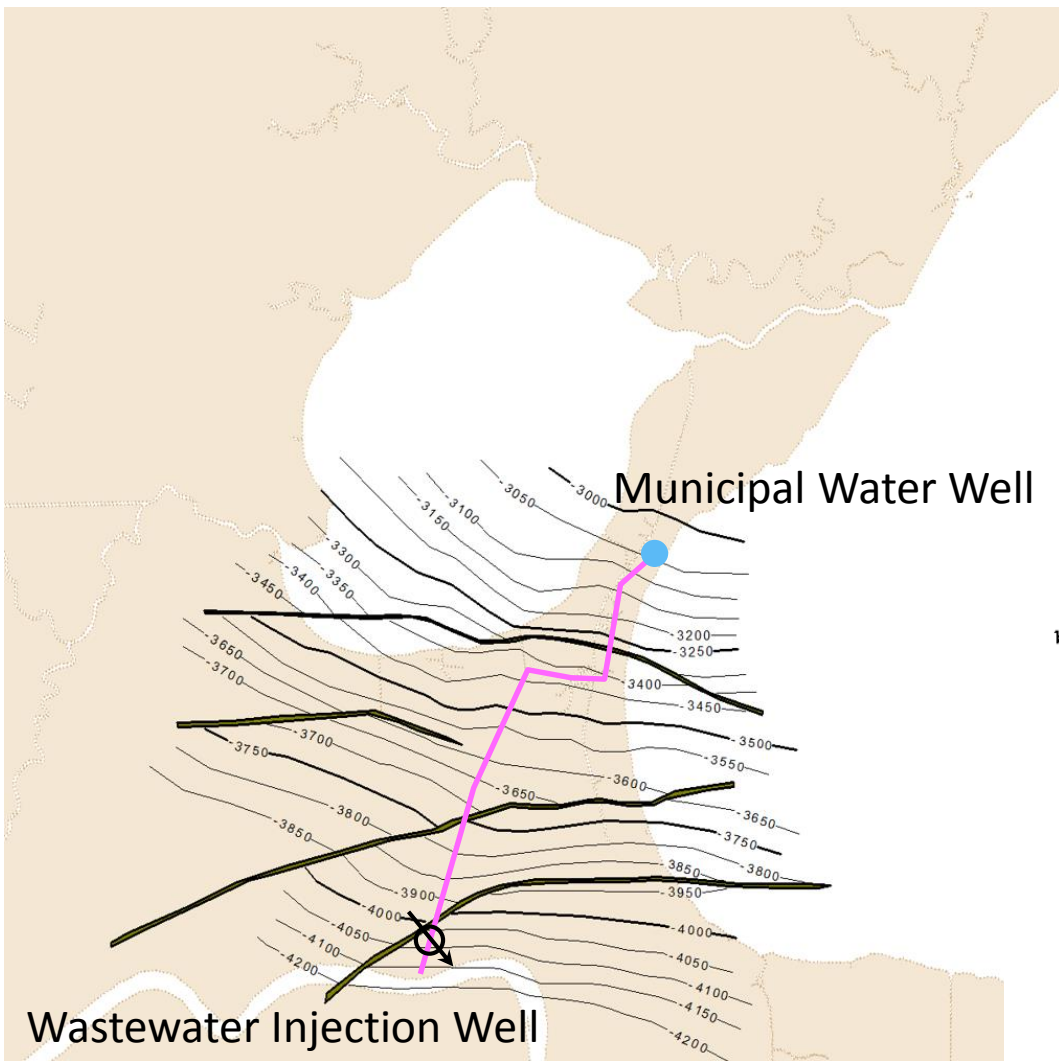
USACE, 1990, Lower and Middle Mississippi Valley Engineering Geology Mapping Program

Fault Transmissivity?

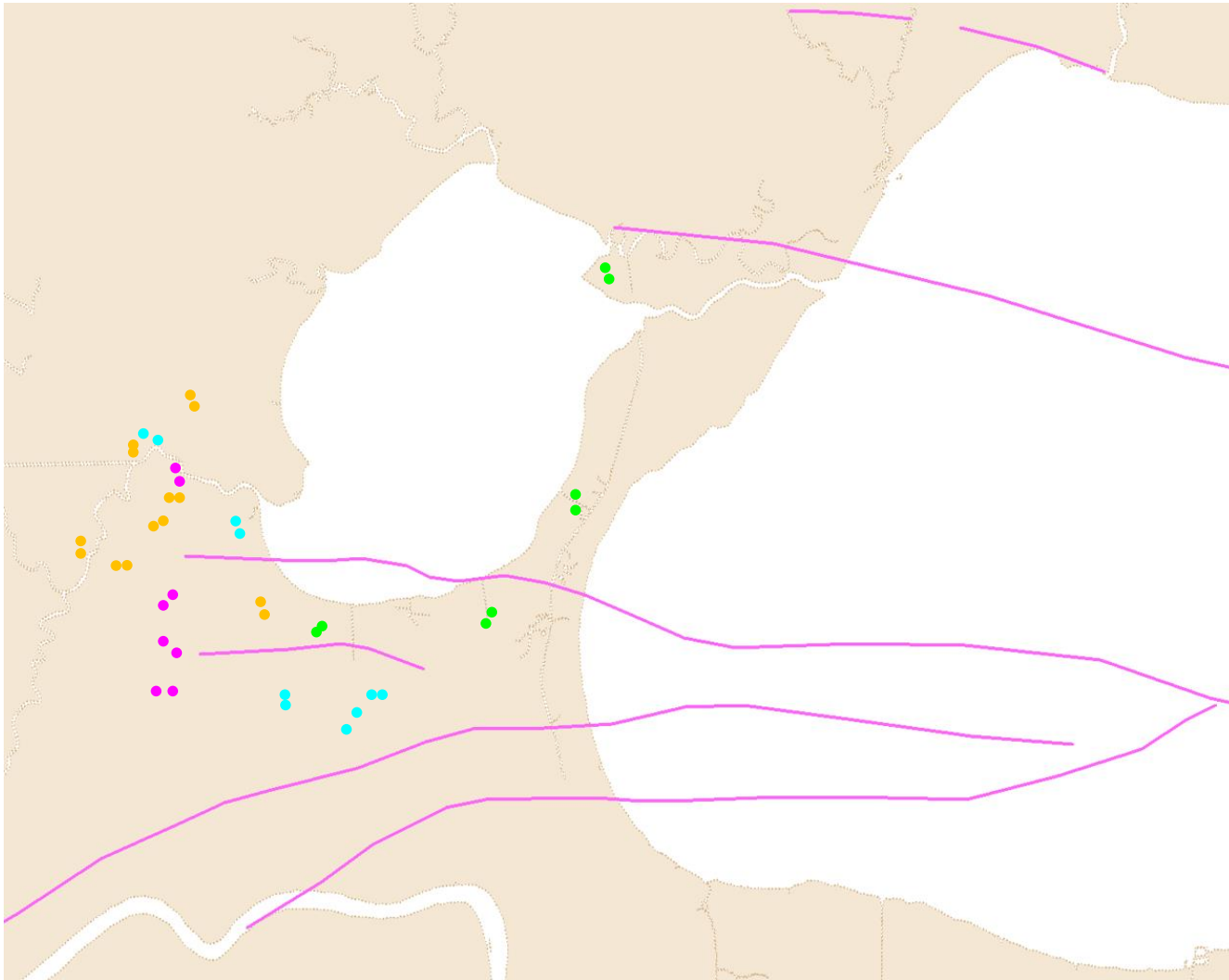


ZINNI, E.V., 1995, Subsurface fault detection using seismic data for hazardous-waste-injection well permitting

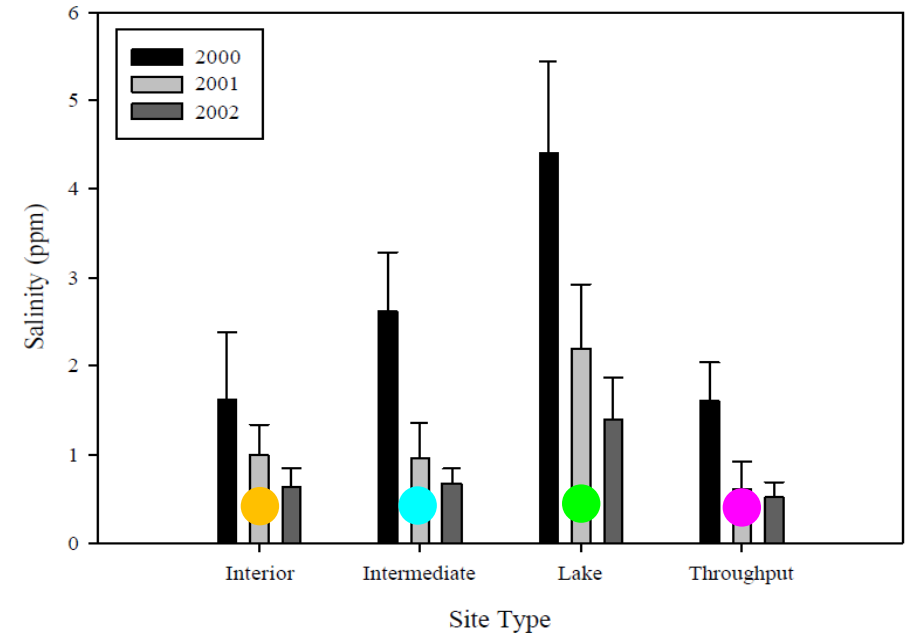
Fault Transmissivity?



Salinity Anomalies

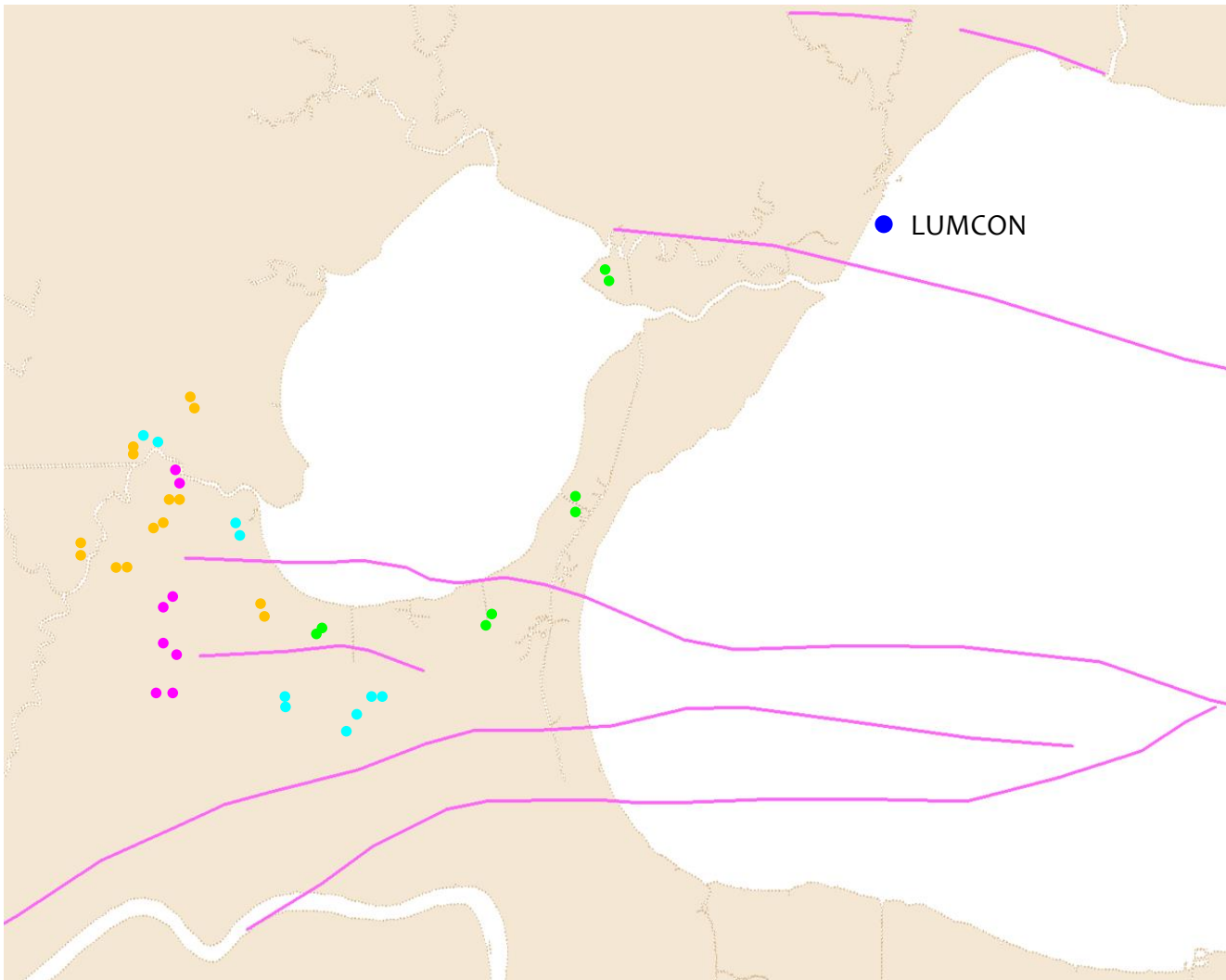


**Maurepas Well Salinity 2000-2002
by Site Type and Year**



SHAFFER, G.P., et al, 2003, Ecosystem Health of the Maurepas Swamp: Feasibility and Projected Benefits of a Freshwater Diversion

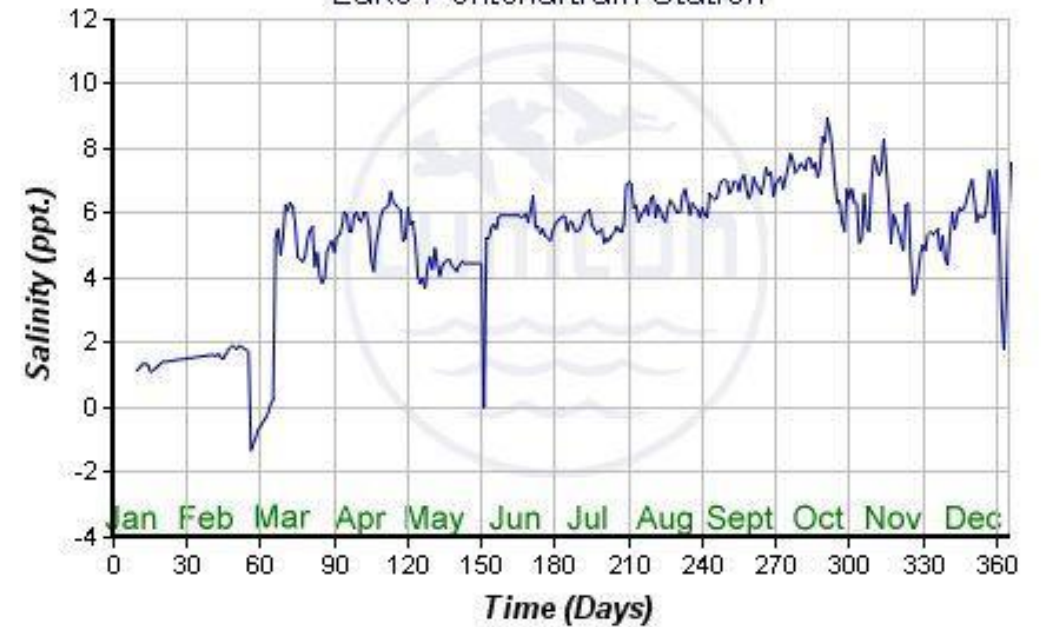
Salinity Anomalies



2006

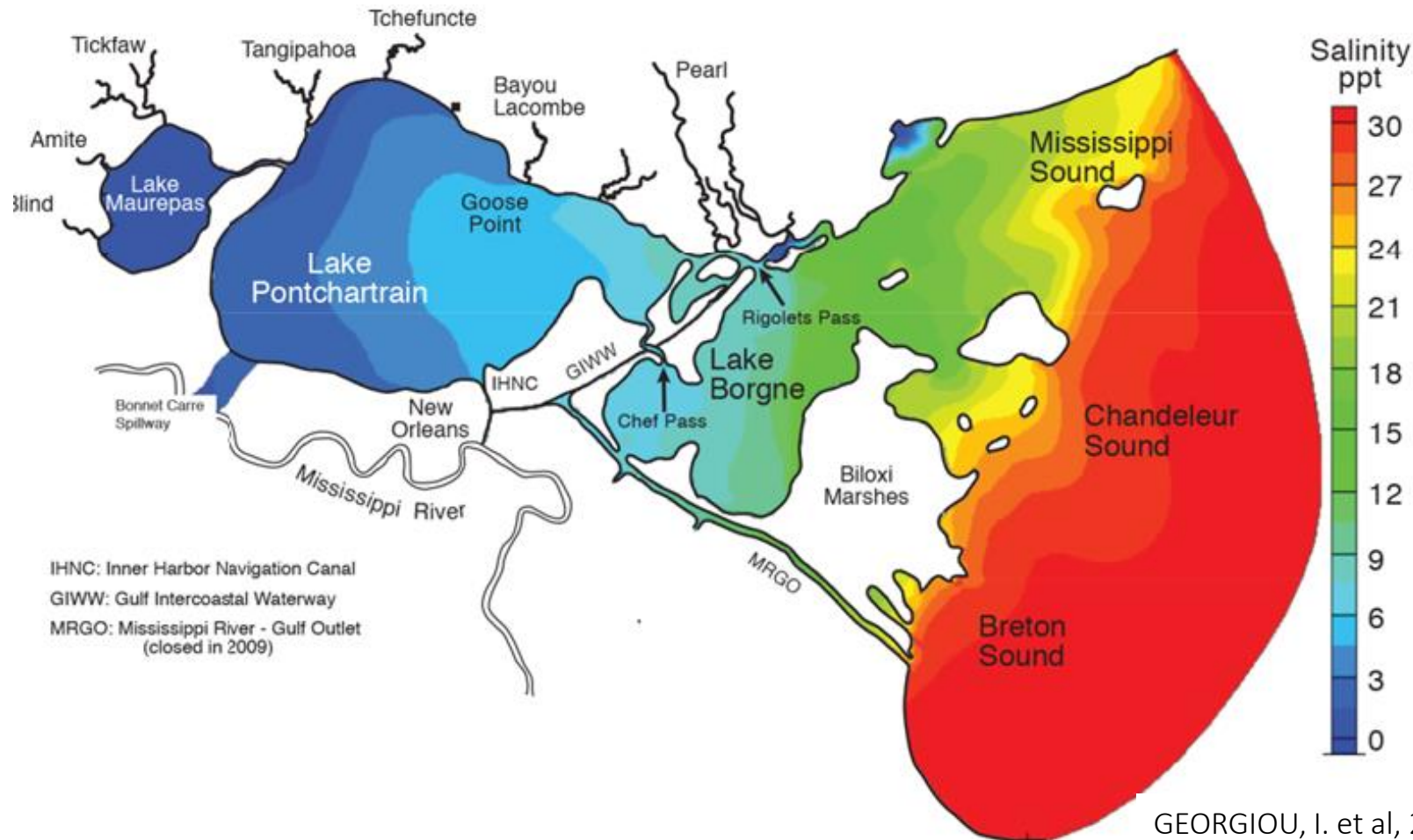
Average Daily Salinity

Lake Pontchartrain Station



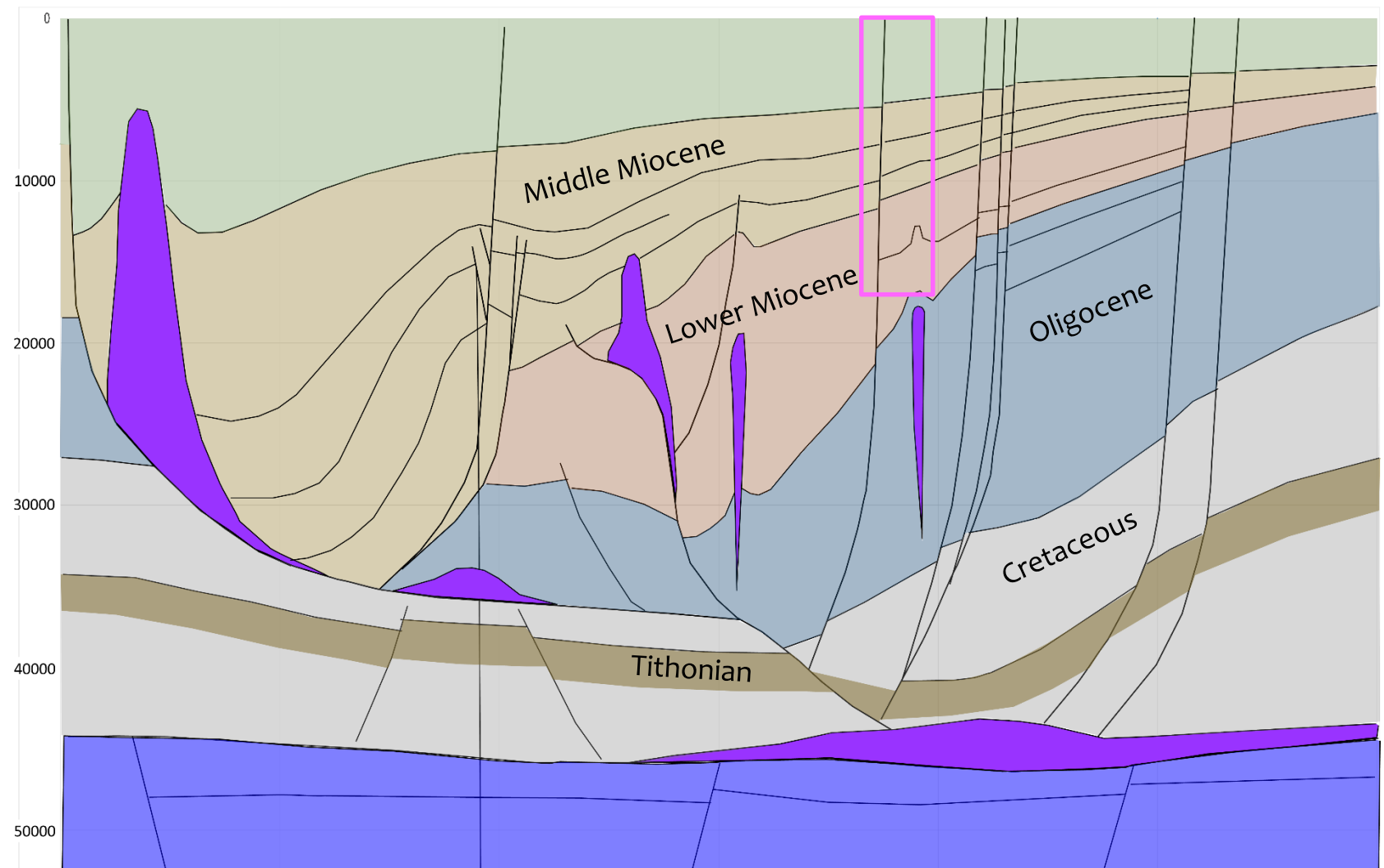
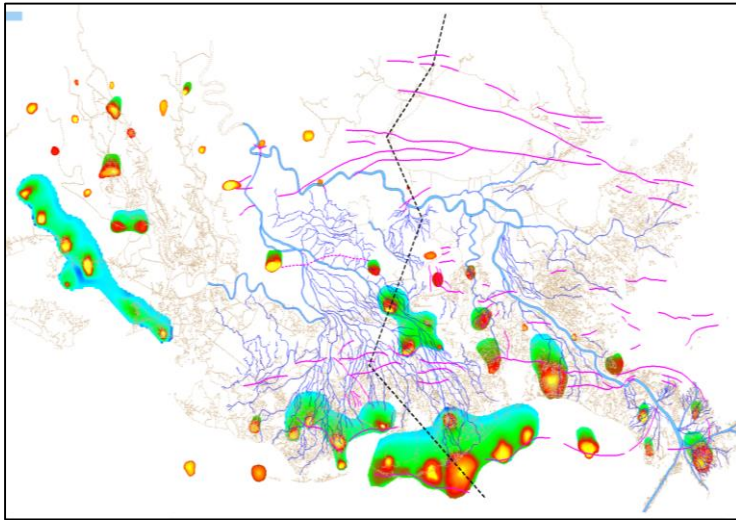
LUMCON

Normal Salinities

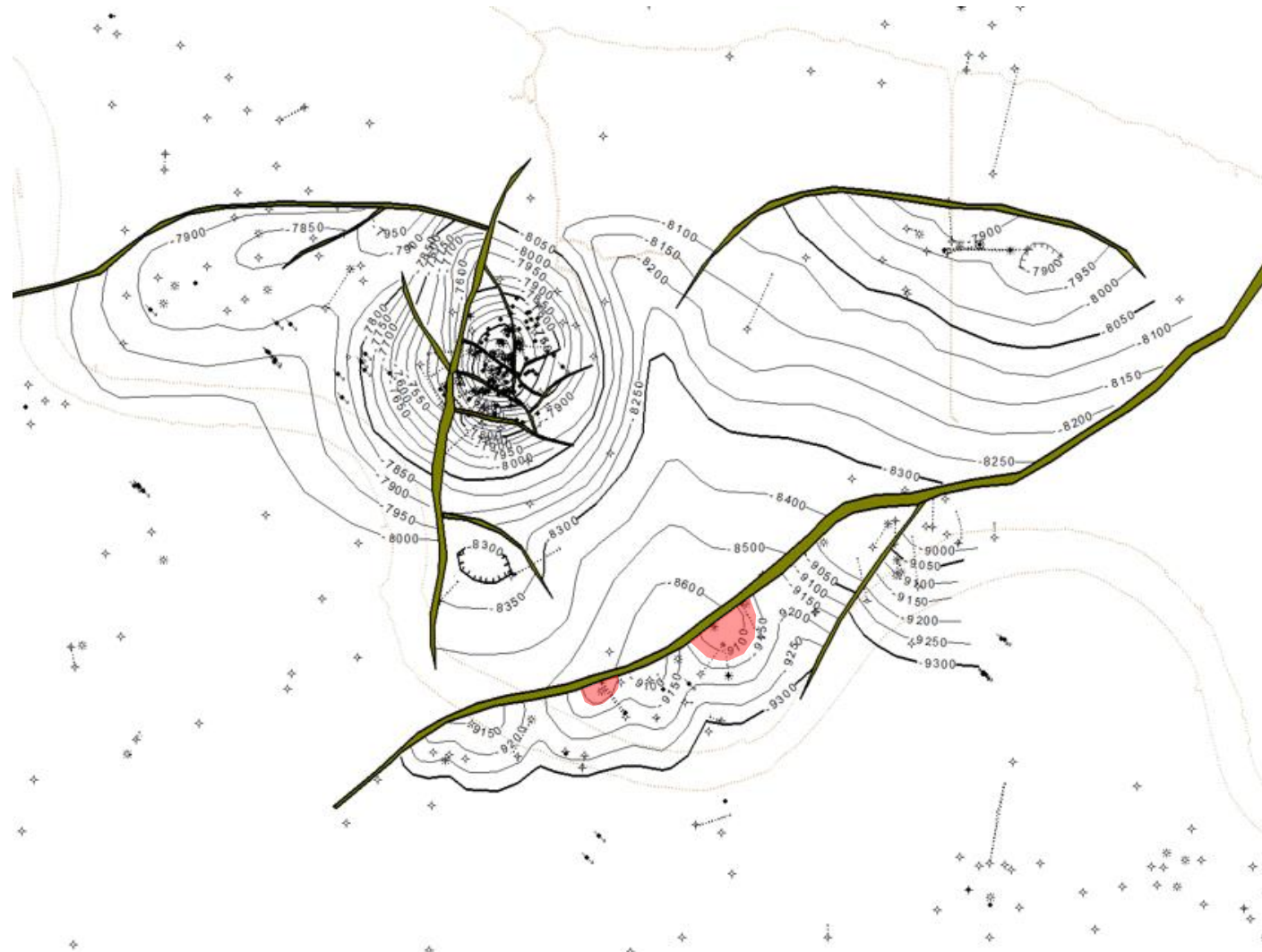


GEORGIU, I. et al, 2007, Hydrodynamic and Salinity Modeling in the Lake Pontchartrain Basin: Assessment of Freshwater Diversions at Violet with MRGO Modifications

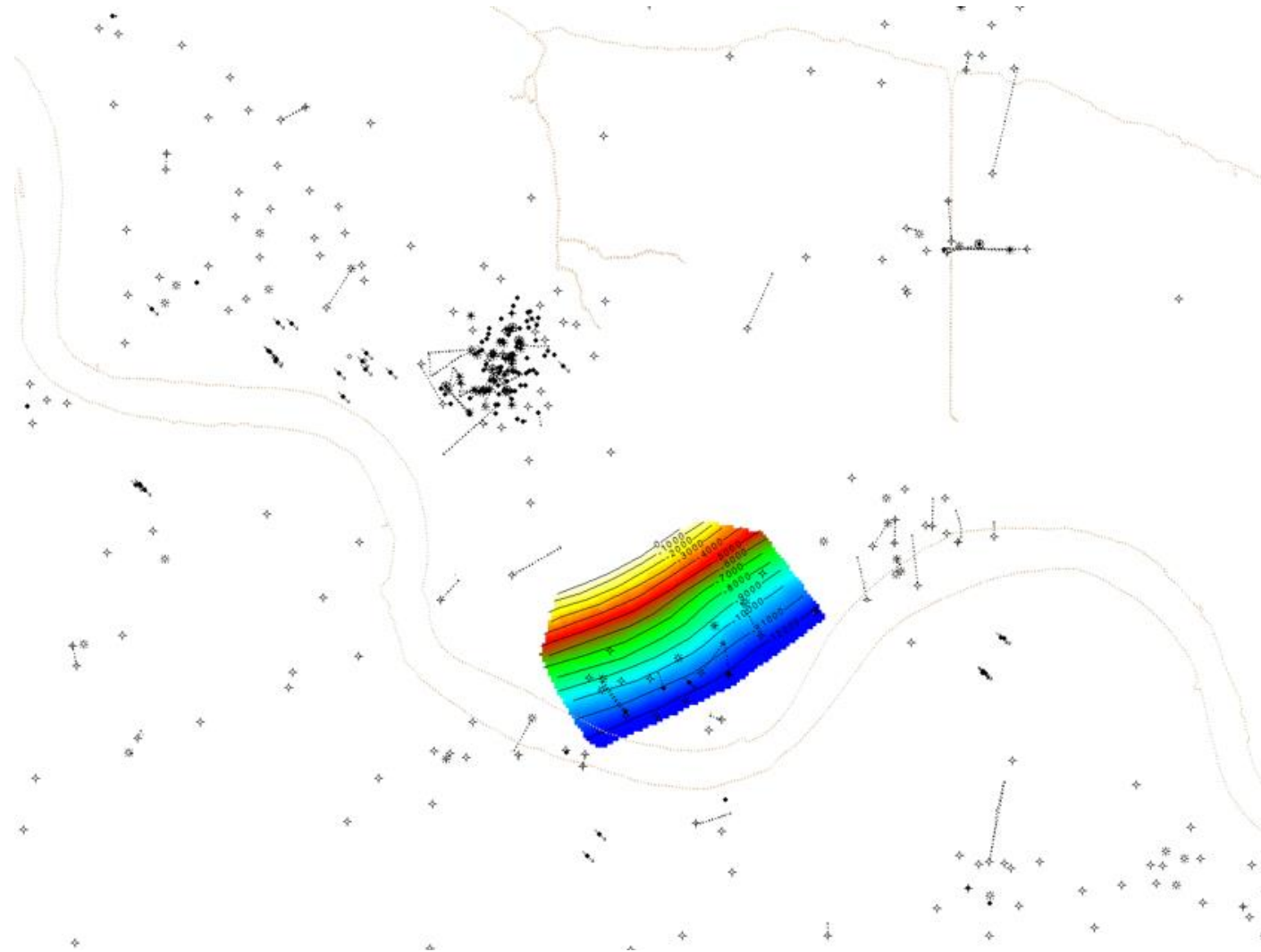
St. Rose Field



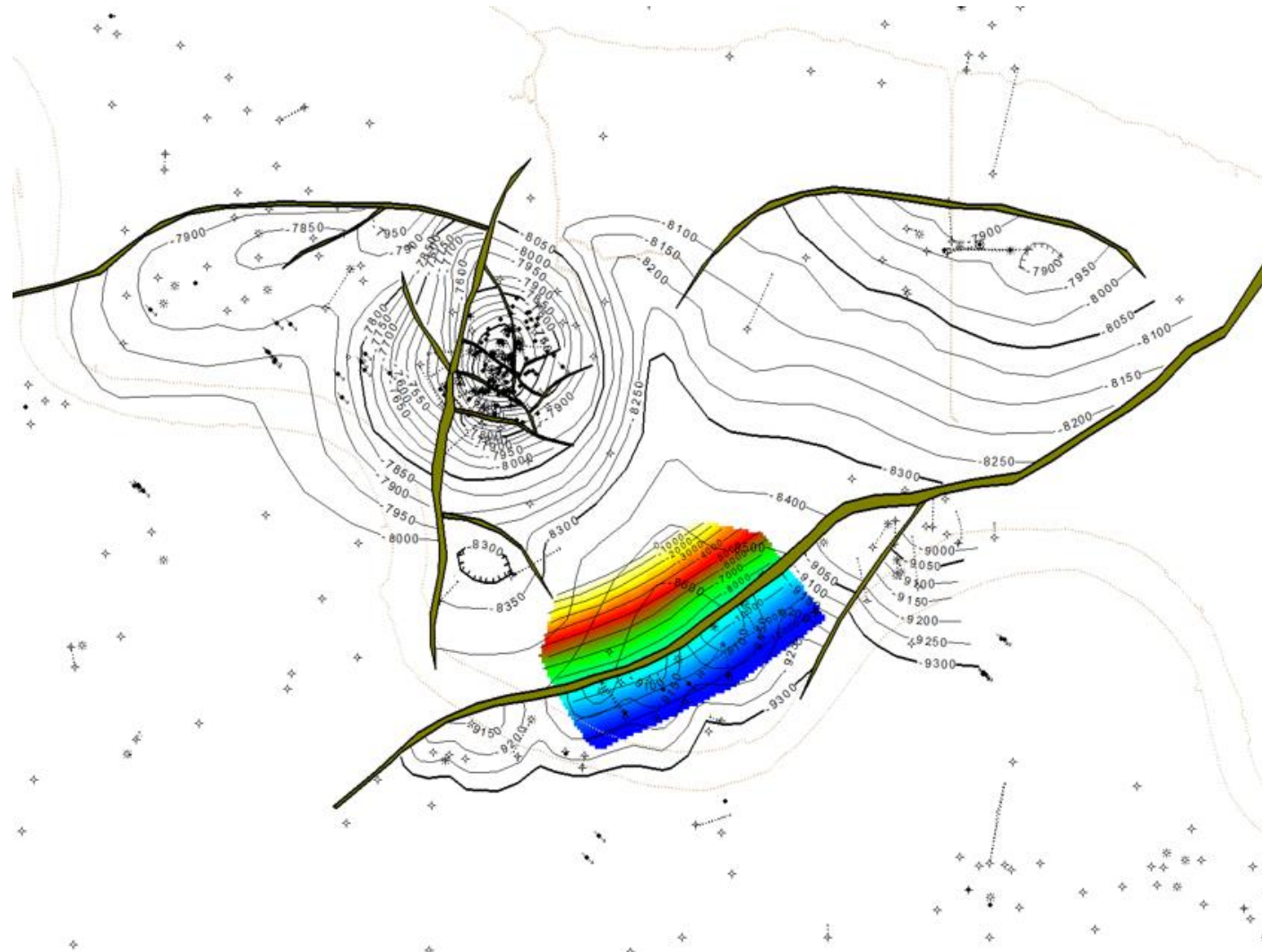
St. Rose Field



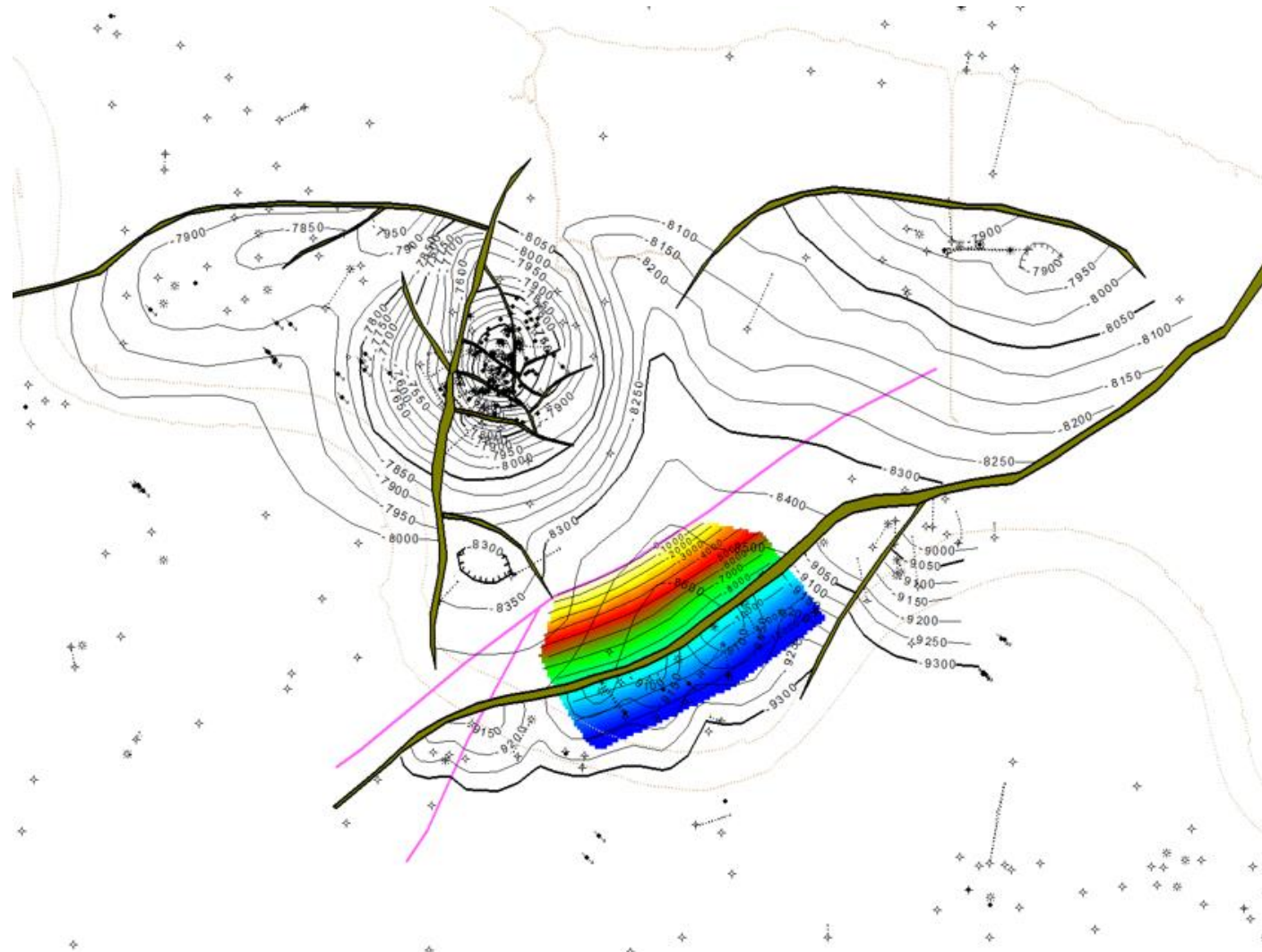
St. Rose fault



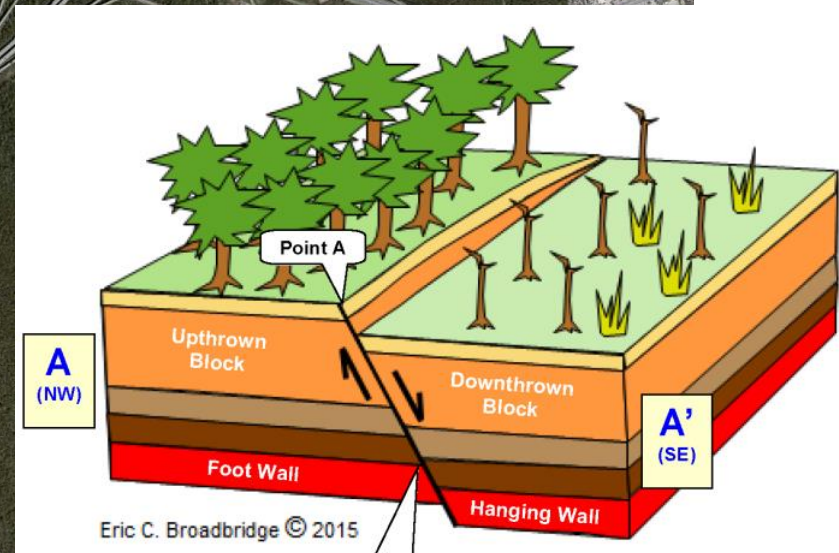
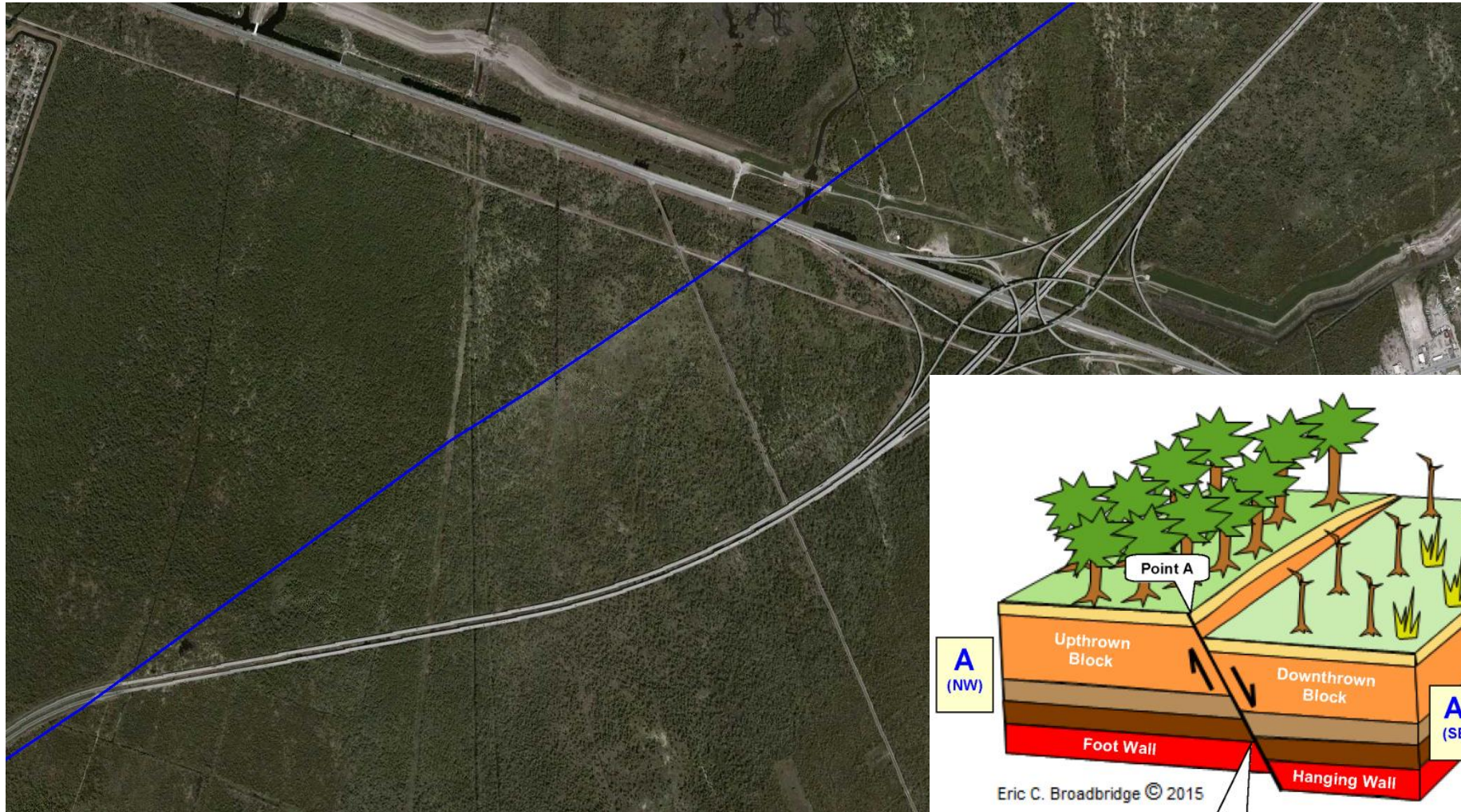
St. Rose fault



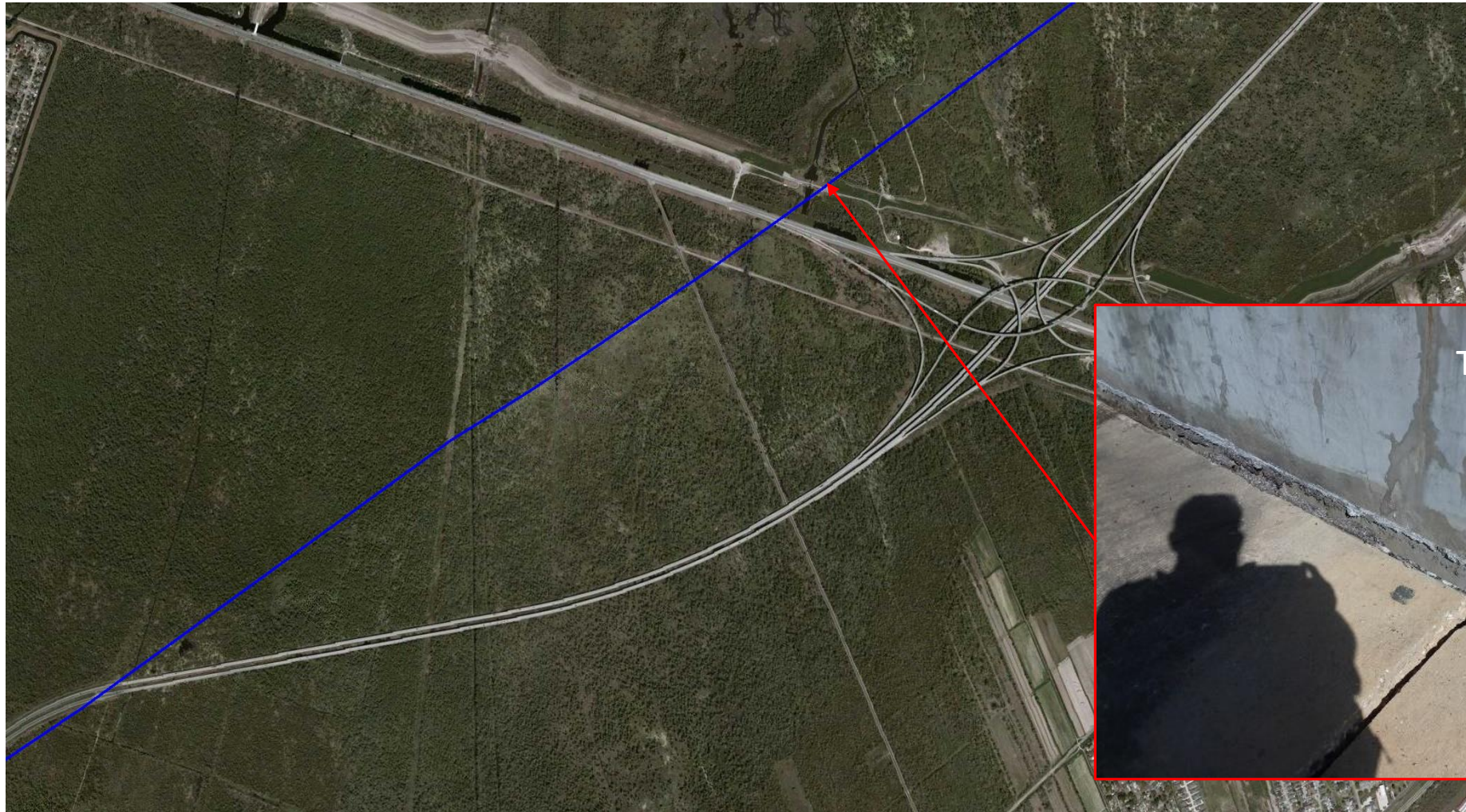
St. Rose fault



St. Rose fault

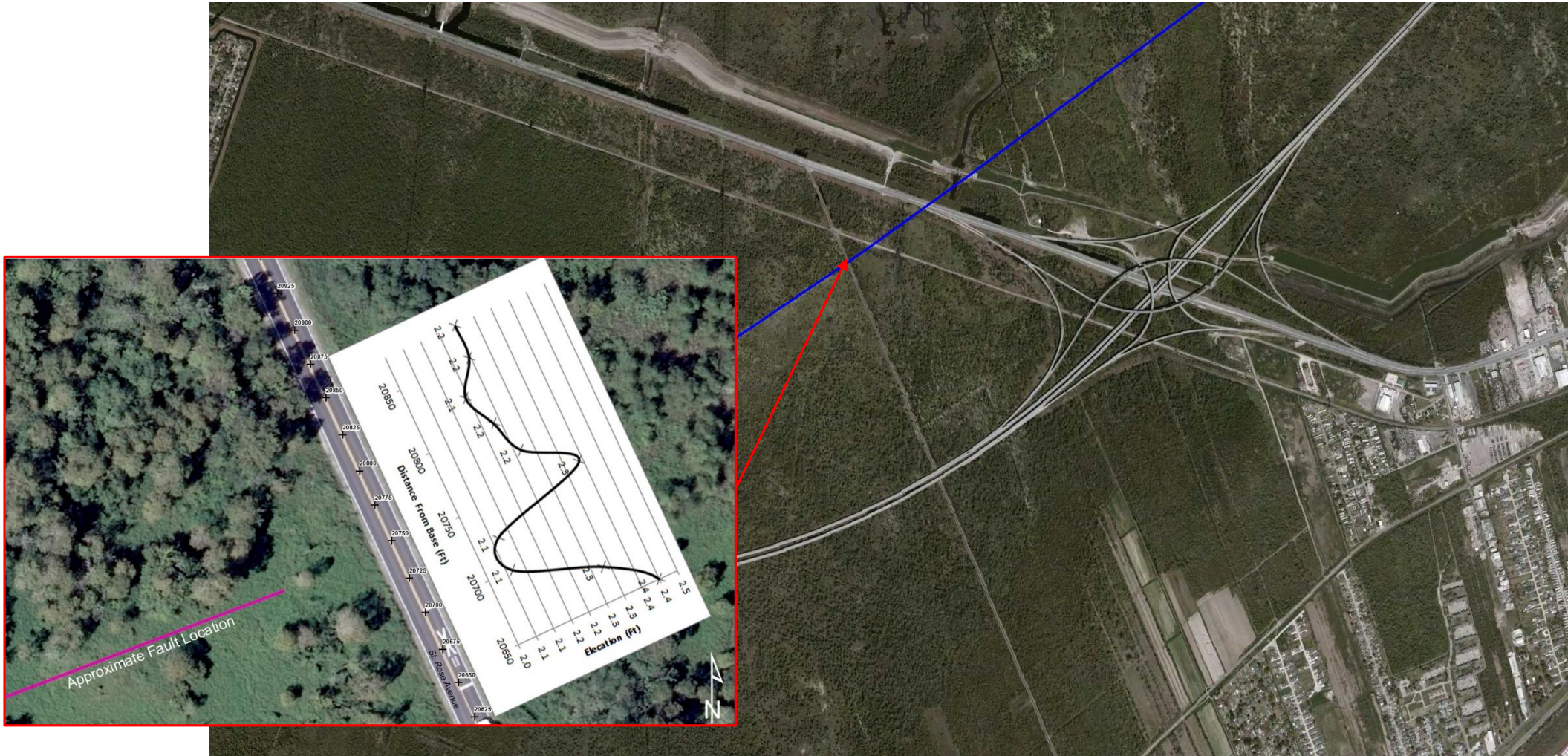


St. Rose fault



T-Wall failure

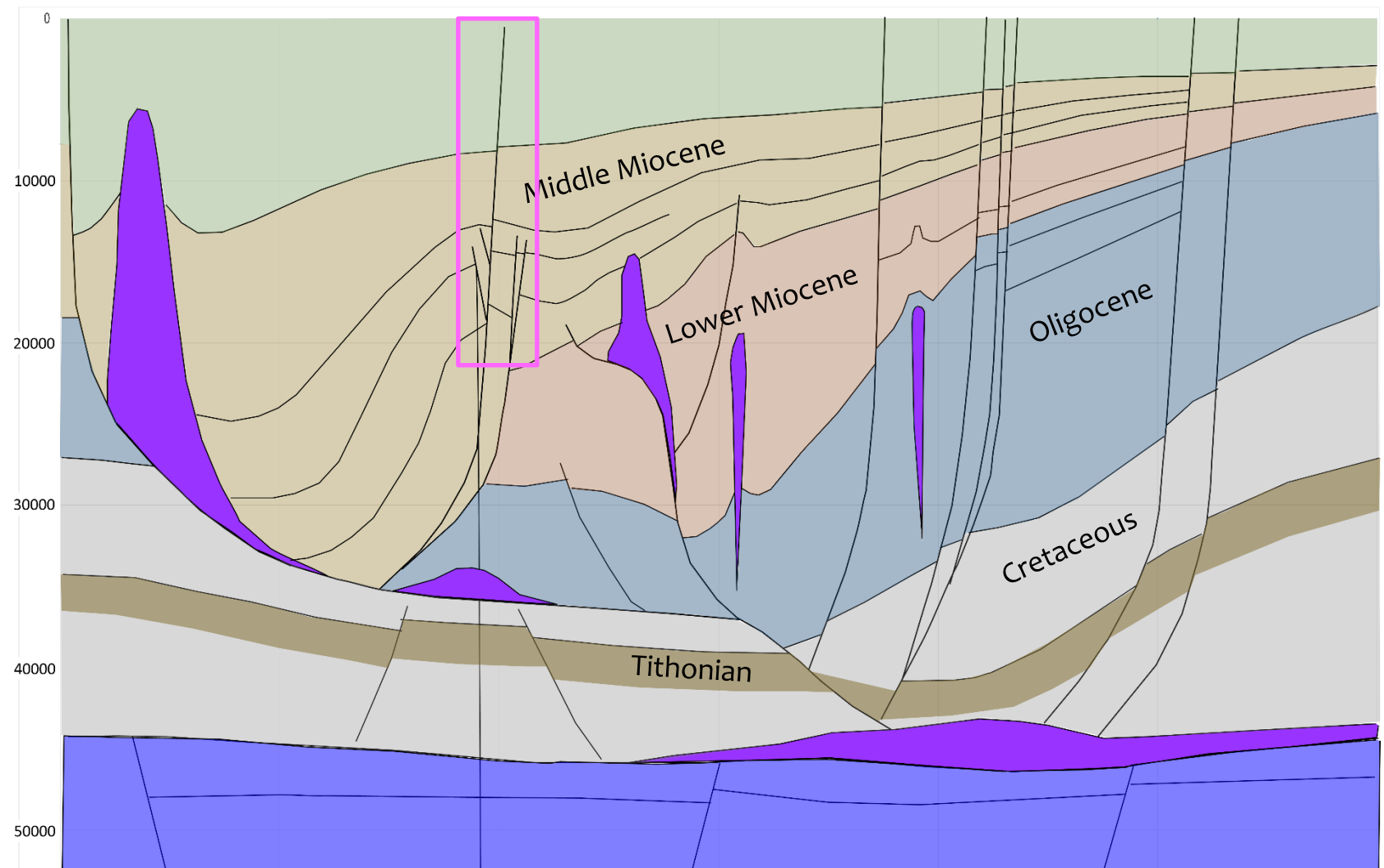
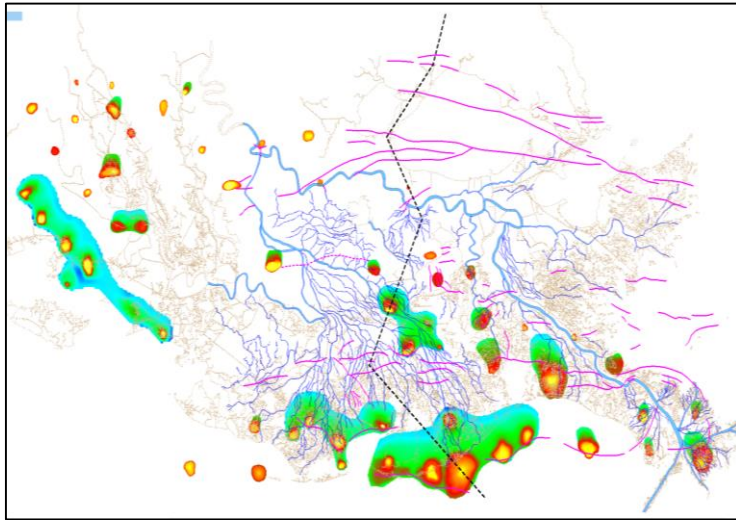
St. Rose fault



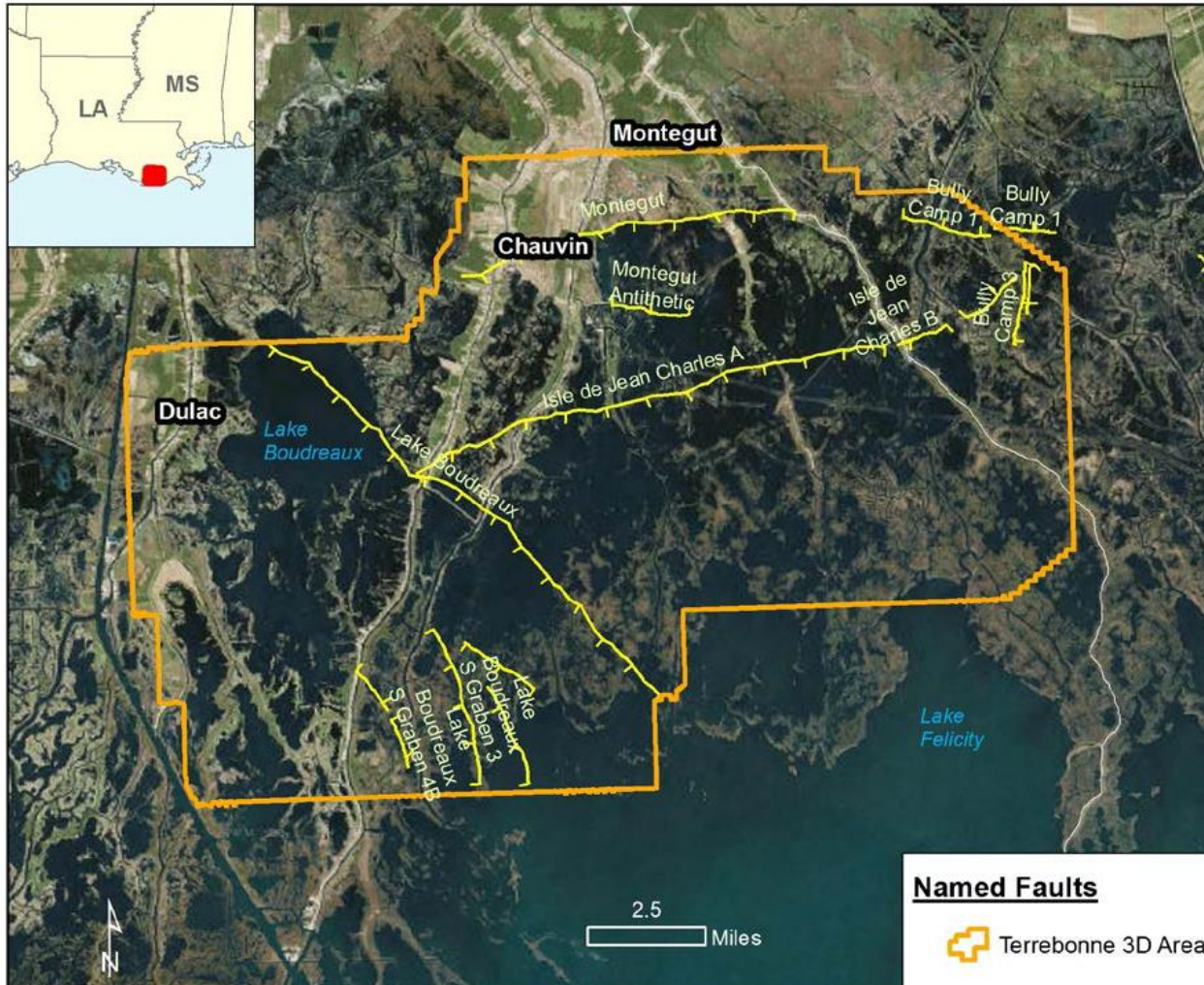
St. Rose fault



Lirette Field – Montegut fault



Lirette Field – Montegut fault



Transportation Consortium of South Central States

Solving Emerging Transportation Resiliency, Sustainability, and Economic Challenges through the Use of Innovative Materials and Construction Methods: From Research to Implementation

Synthesis of Fault Traces in SE Louisiana Relative to Infrastructure

Project No. 17GTLSU12

Lead University: Tulane University

Collaborative Universities: University of New Orleans, University of Louisiana at Lafayette

David Culpepper

Elizabeth Chinn McDade

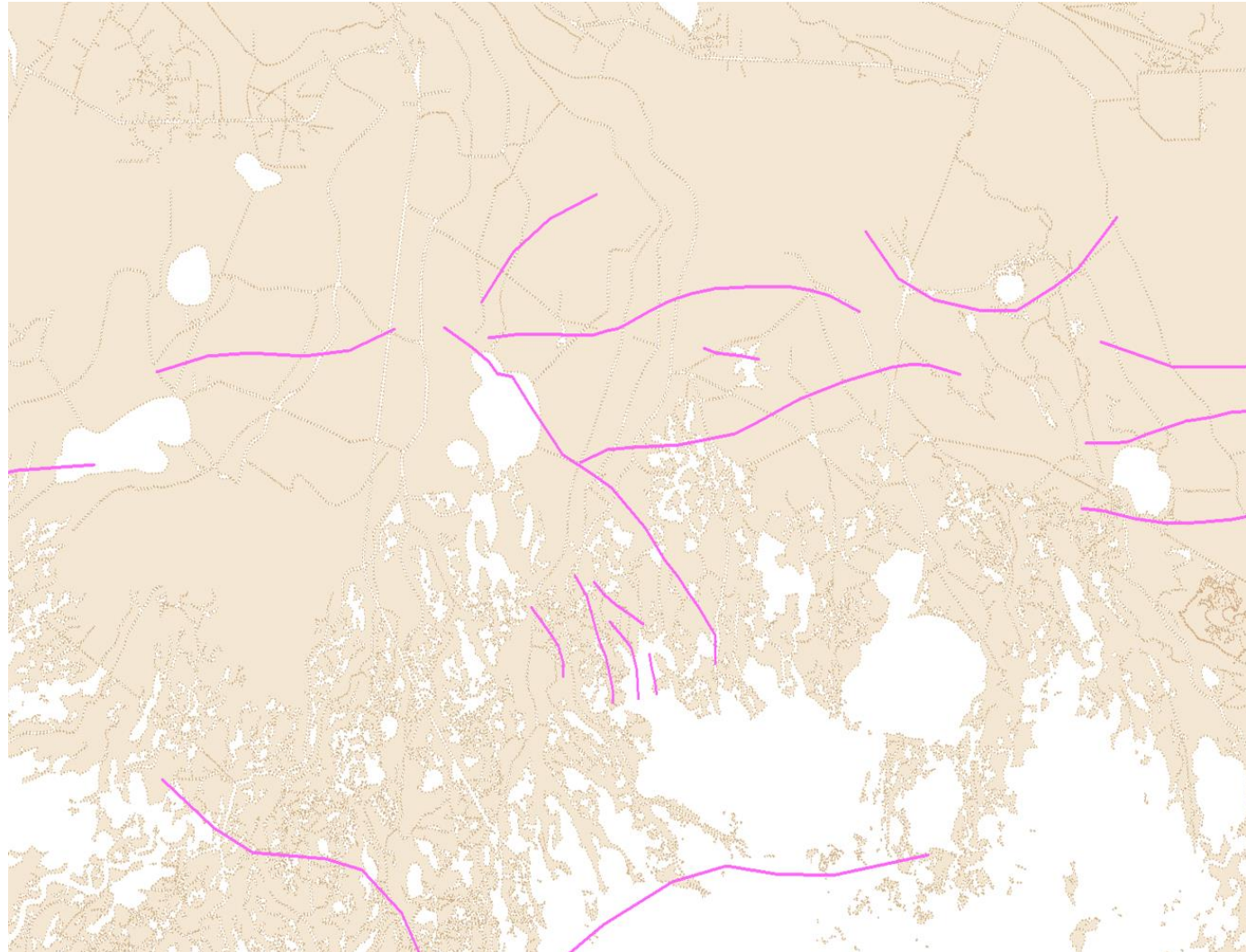
Nancye Dawers

Mark Kulp

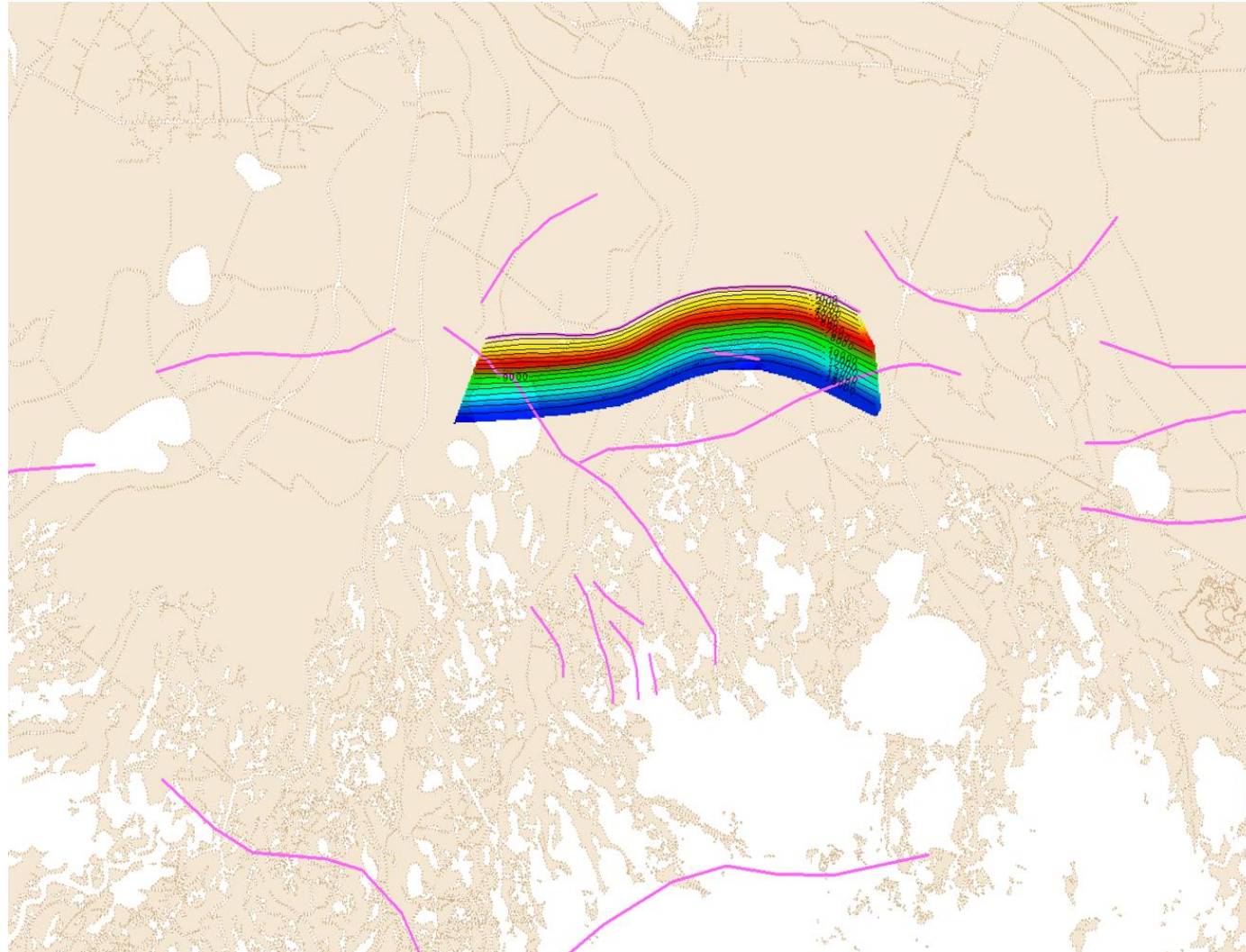
Rui Zhang

Final Report
 January 2019

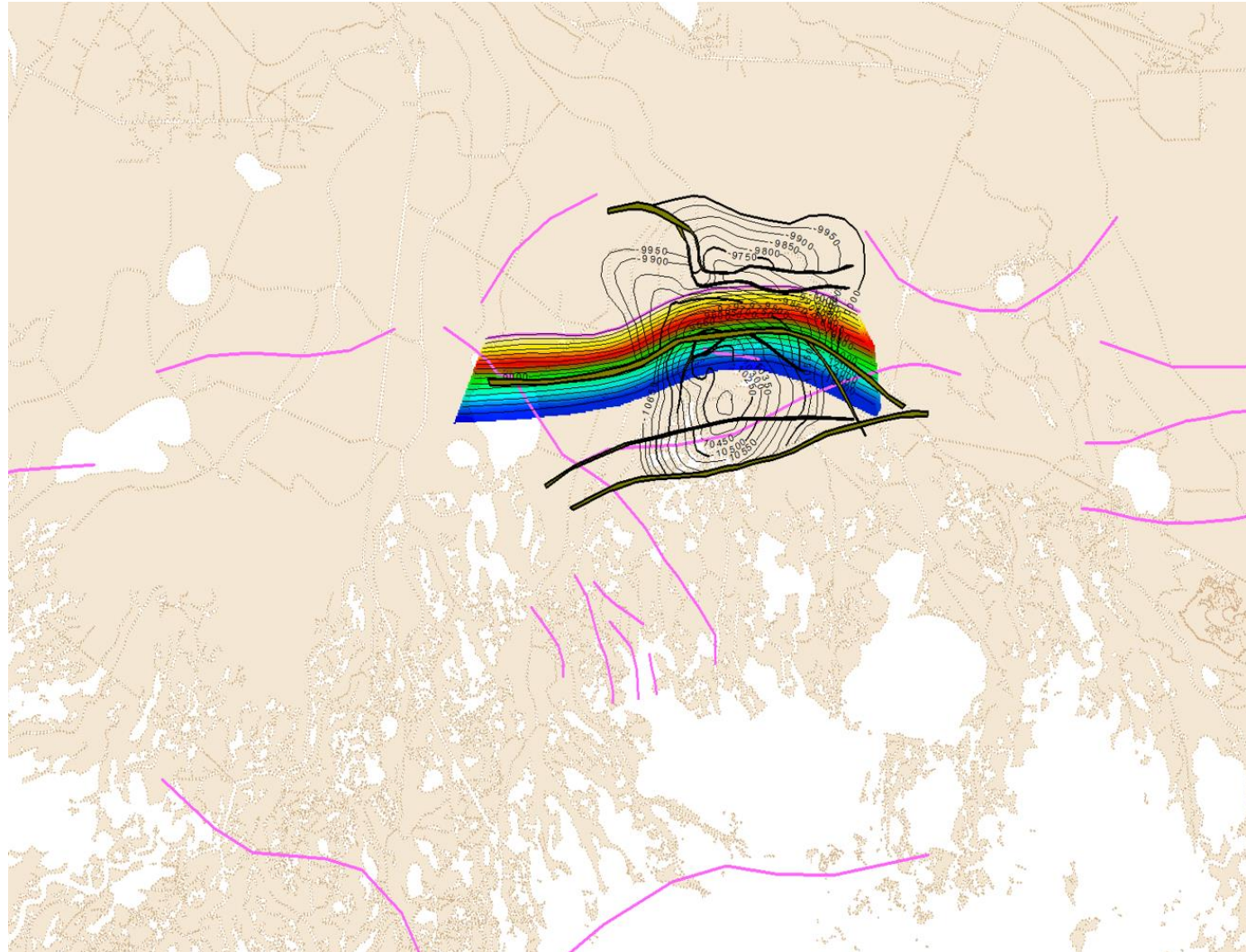
Lirette Field – Montegut fault



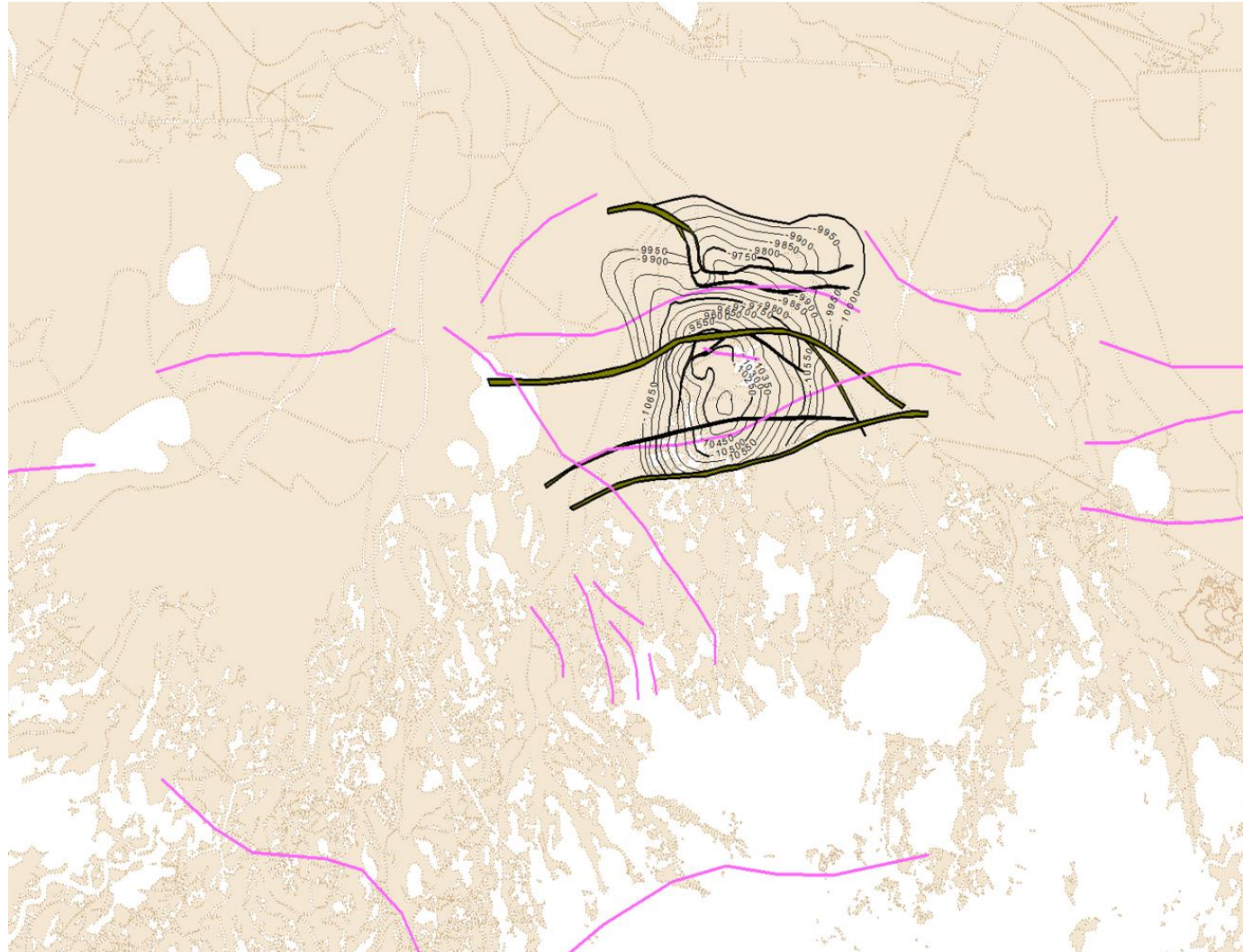
Lirette Field – Montegut fault



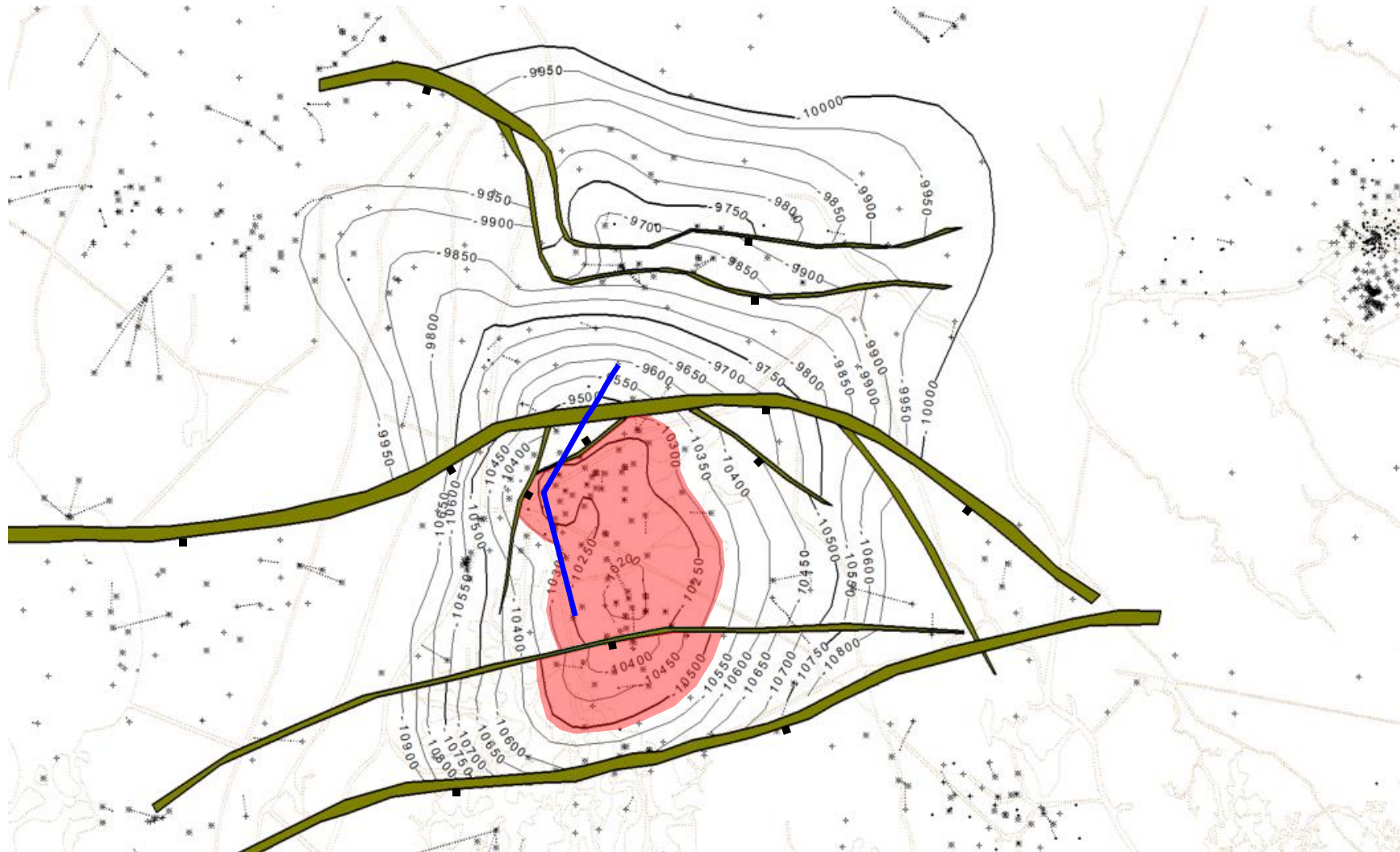
Lirette Field – Montegut fault



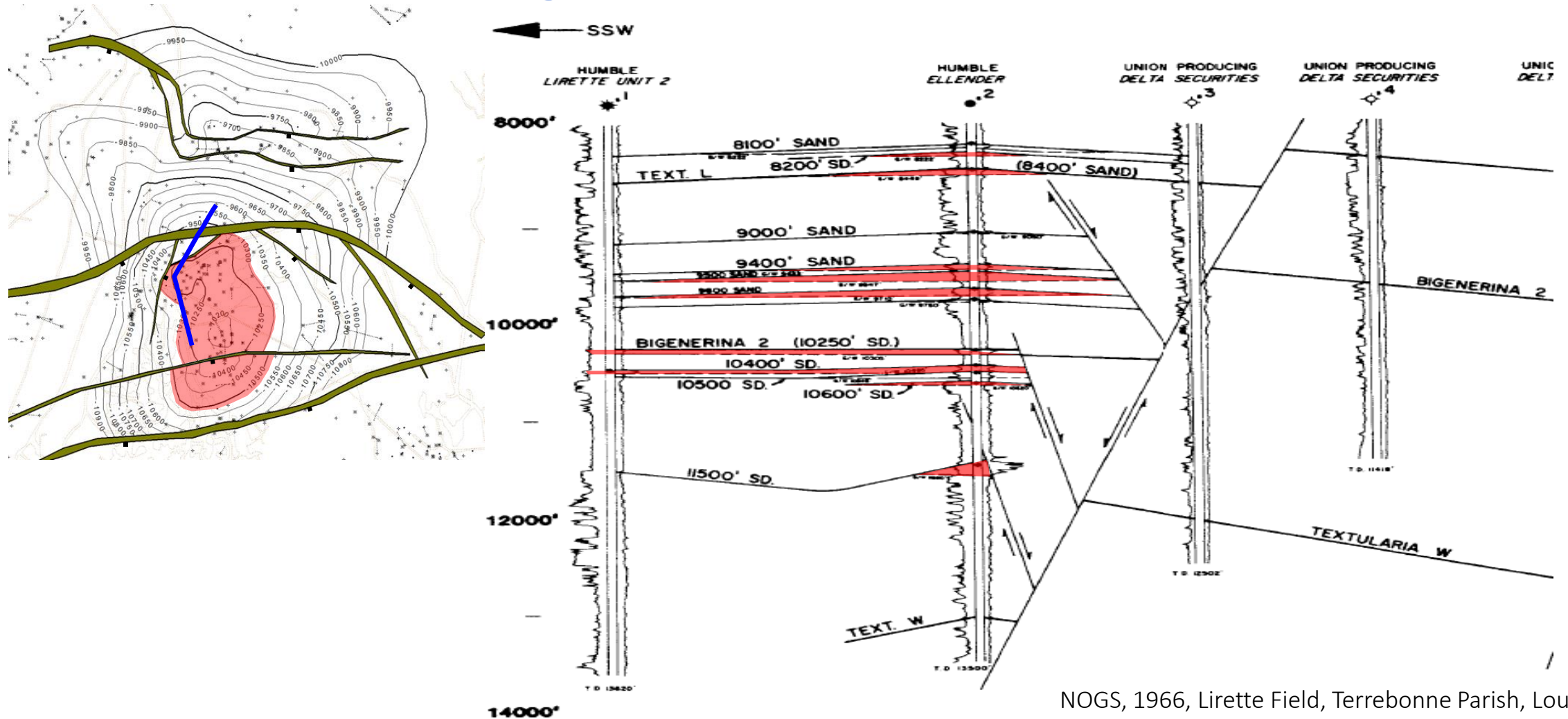
Lirette Field – Montegut fault



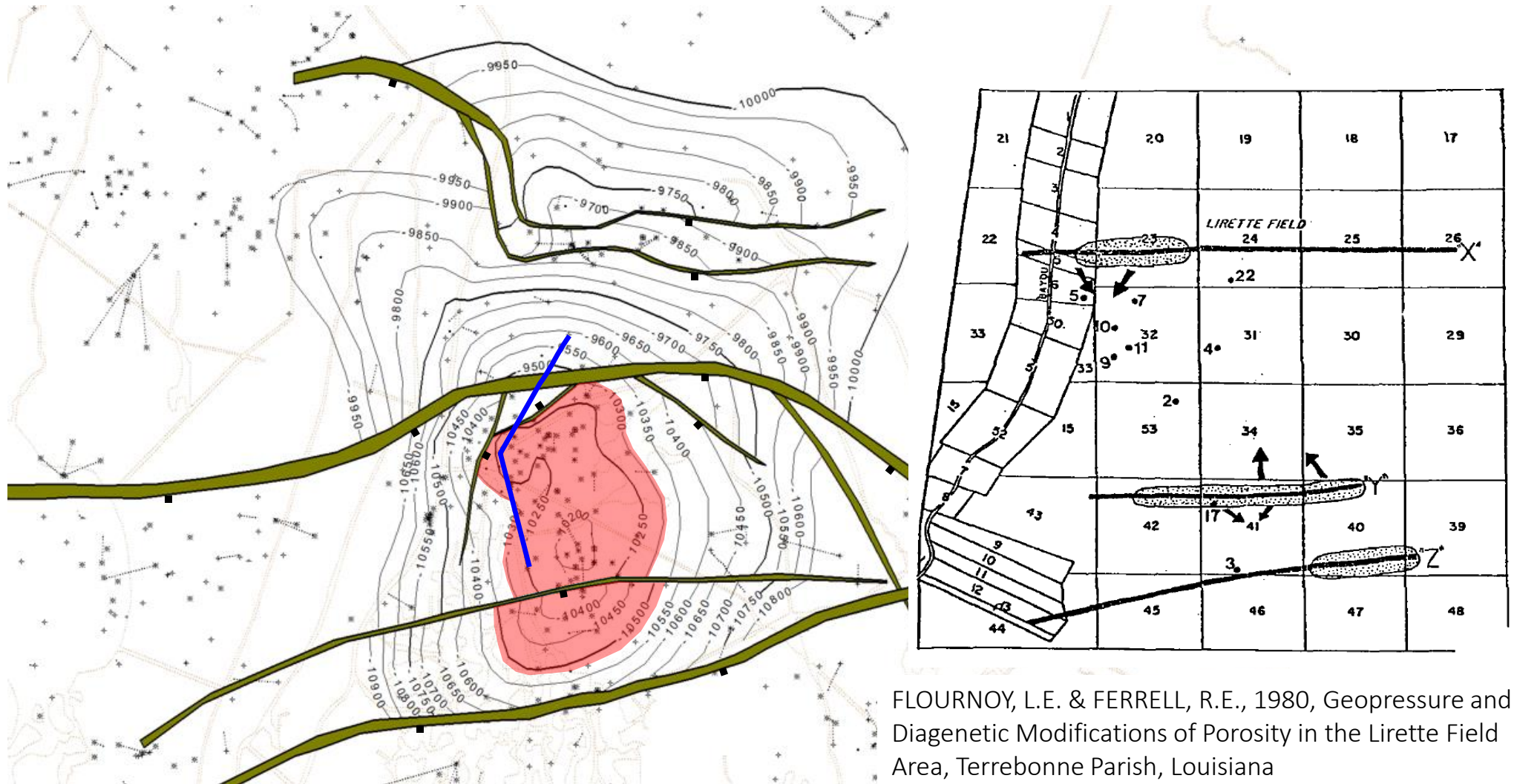
Lirette Field – Montegut fault



Lirette Field – Montegut fault



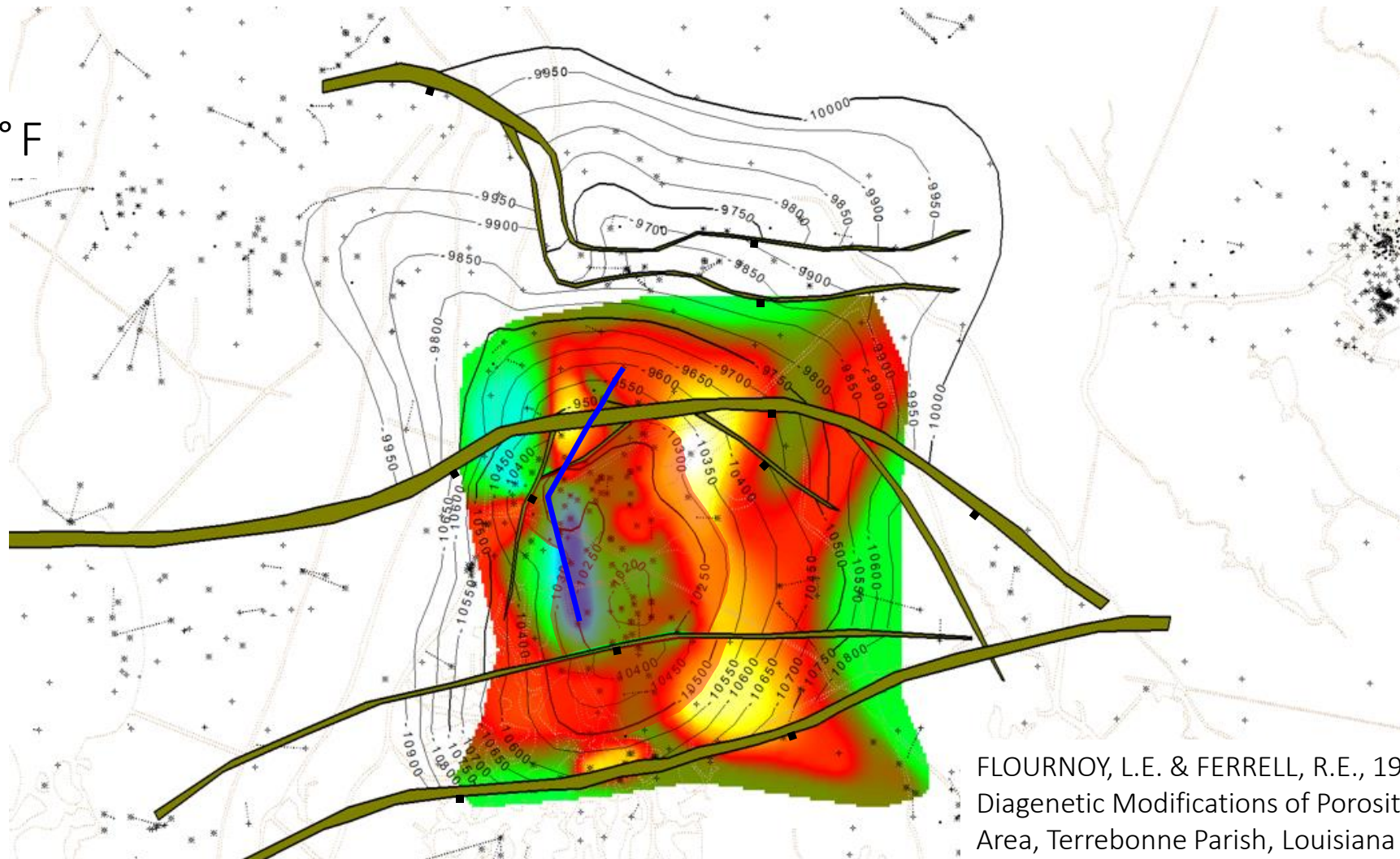
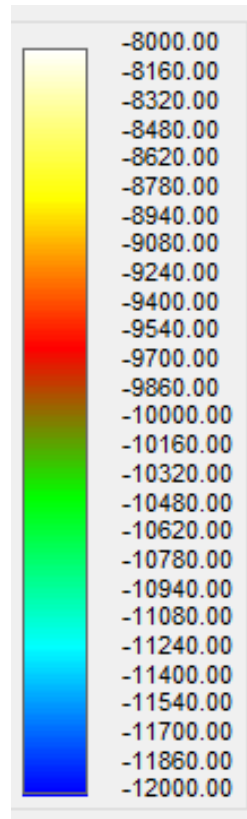
Lirette Field – Montegut fault



FLOURNOY, L.E. & FERRELL, R.E., 1980, Geopressure and Diagenetic Modifications of Porosity in the Lirette Field Area, Terrebonne Parish, Louisiana

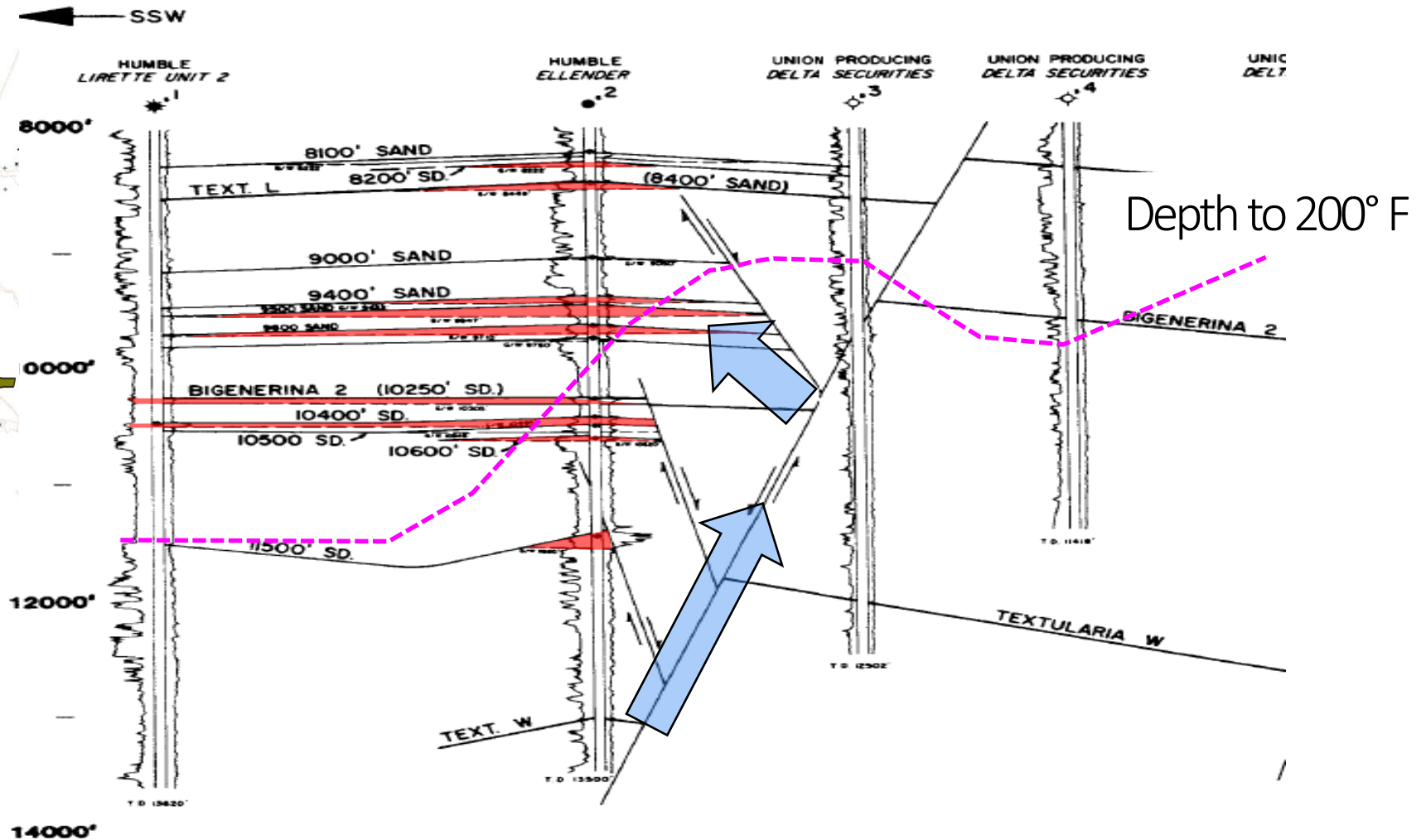
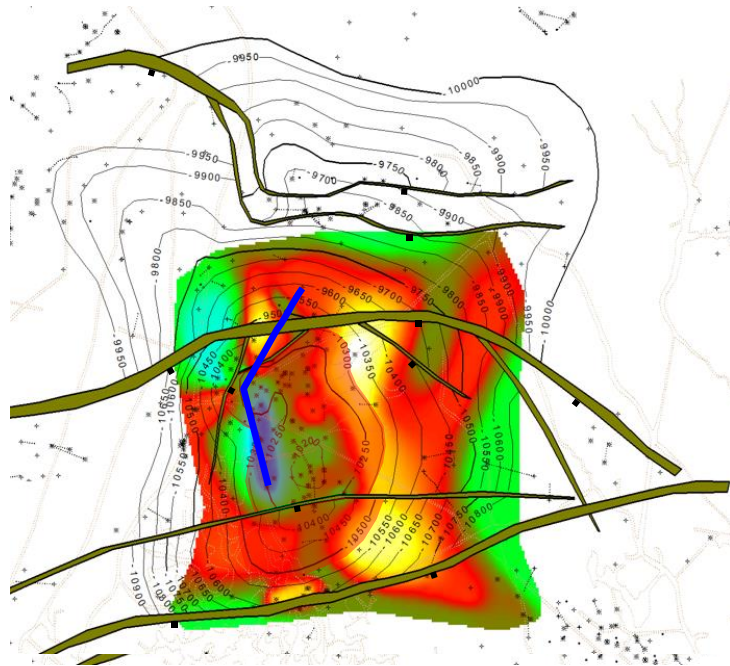
Lirette Field – Montegut fault

Depth to 200° F

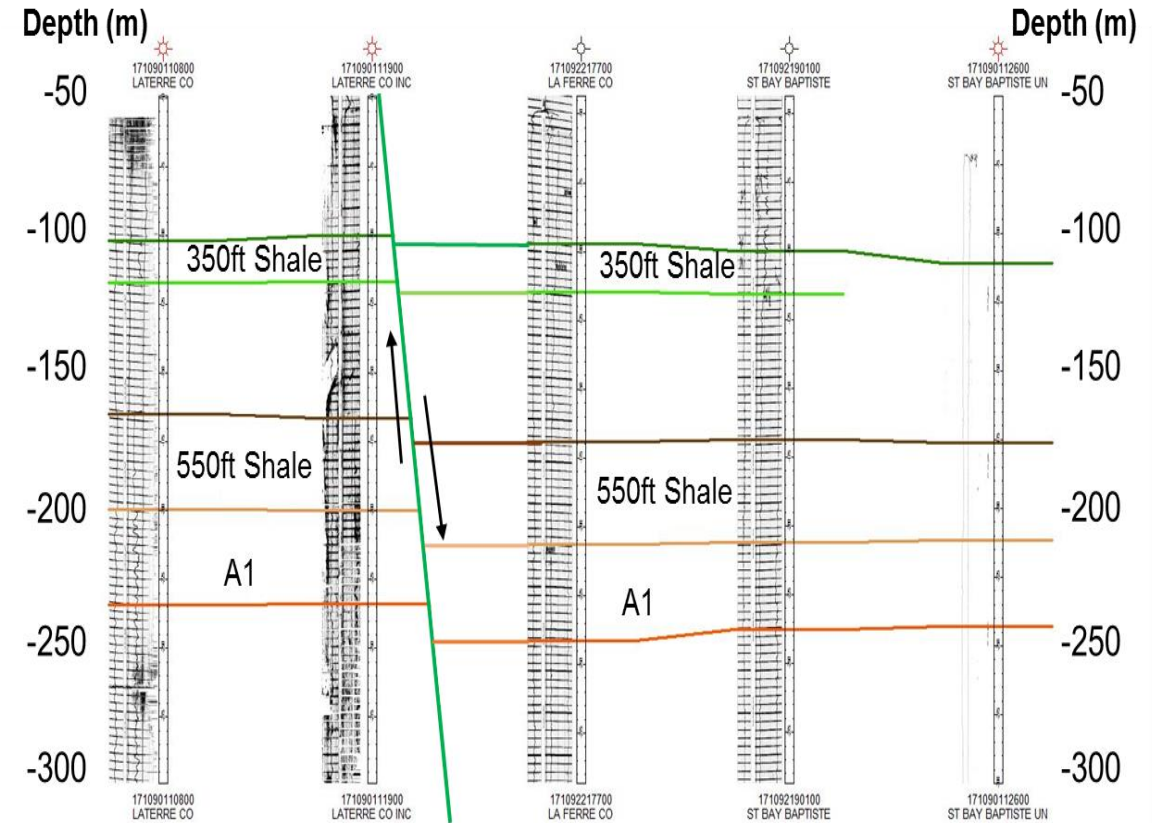
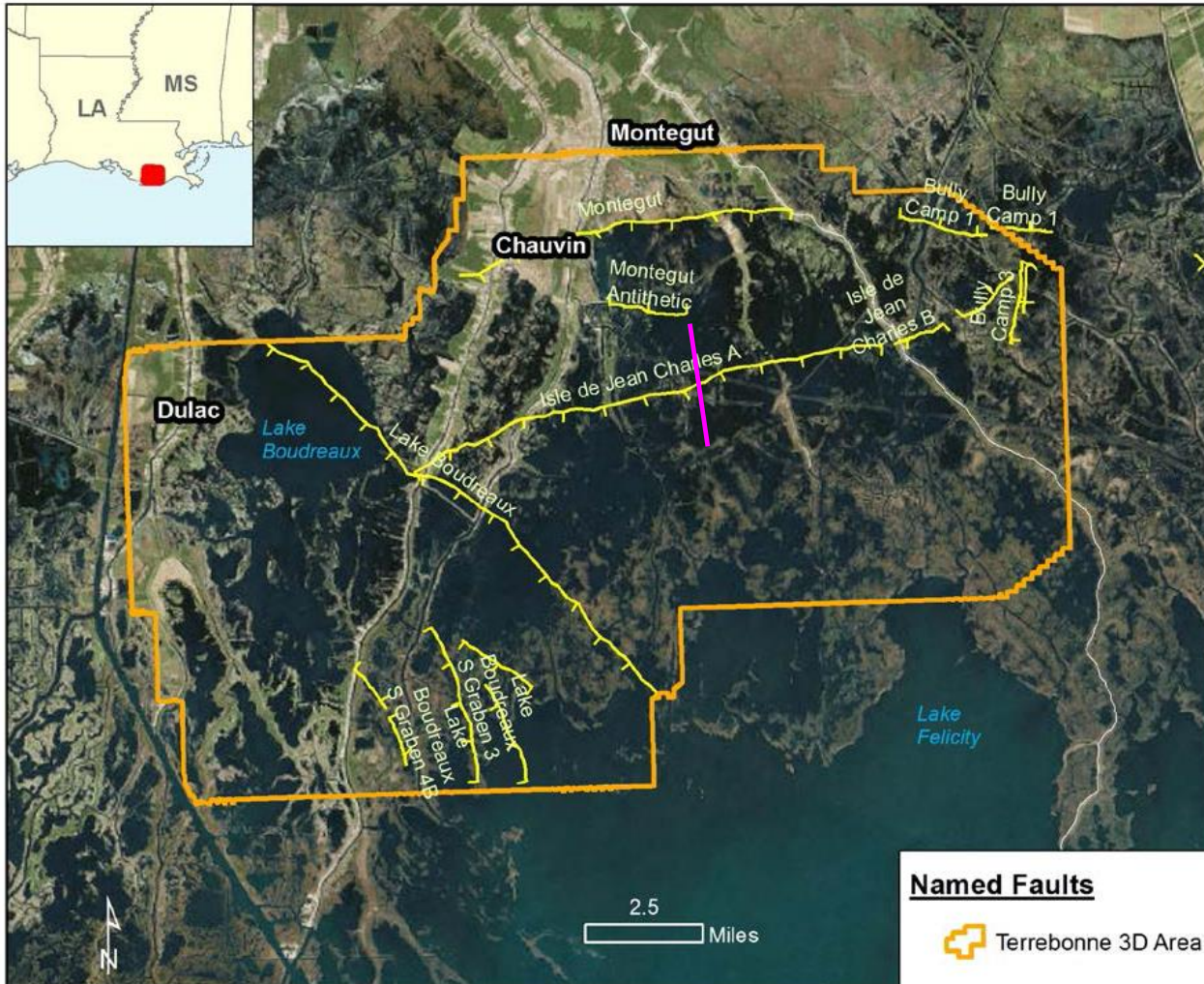


FLOURNOY, L.E. & FERRELL, R.E., 1980, Geopressure and Diagenetic Modifications of Porosity in the Lirette Field Area, Terrebonne Parish, Louisiana

Lirette Field – Montegut fault

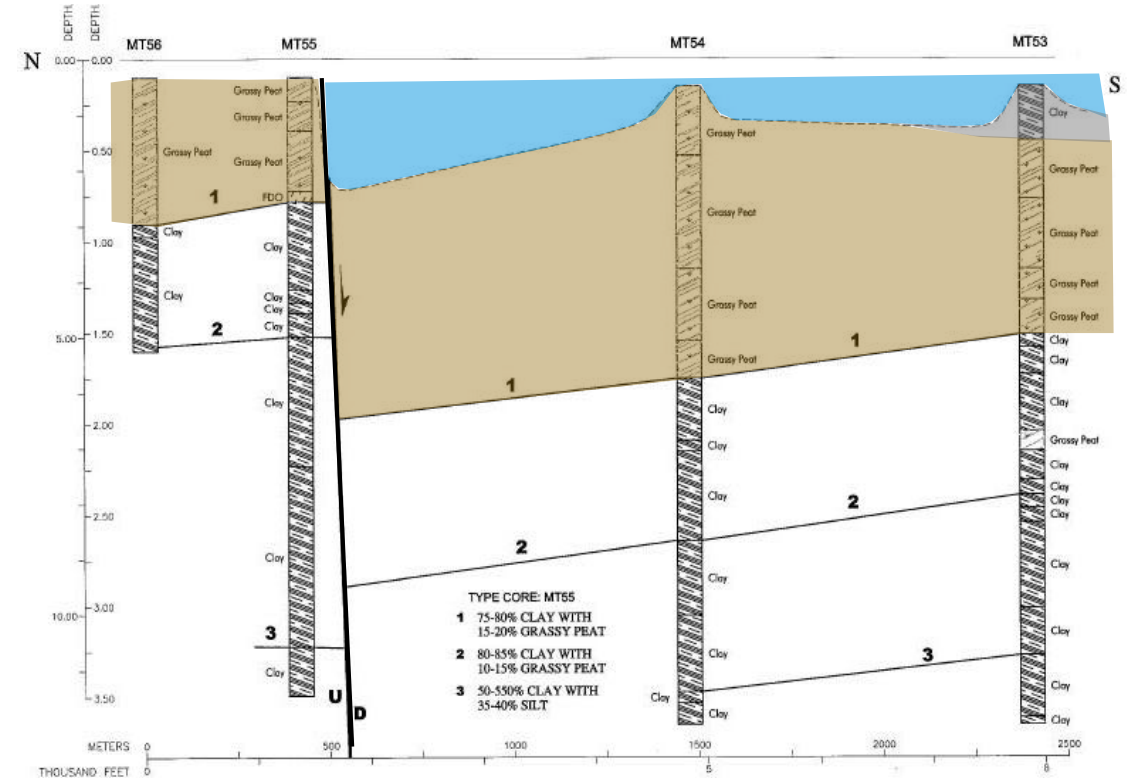
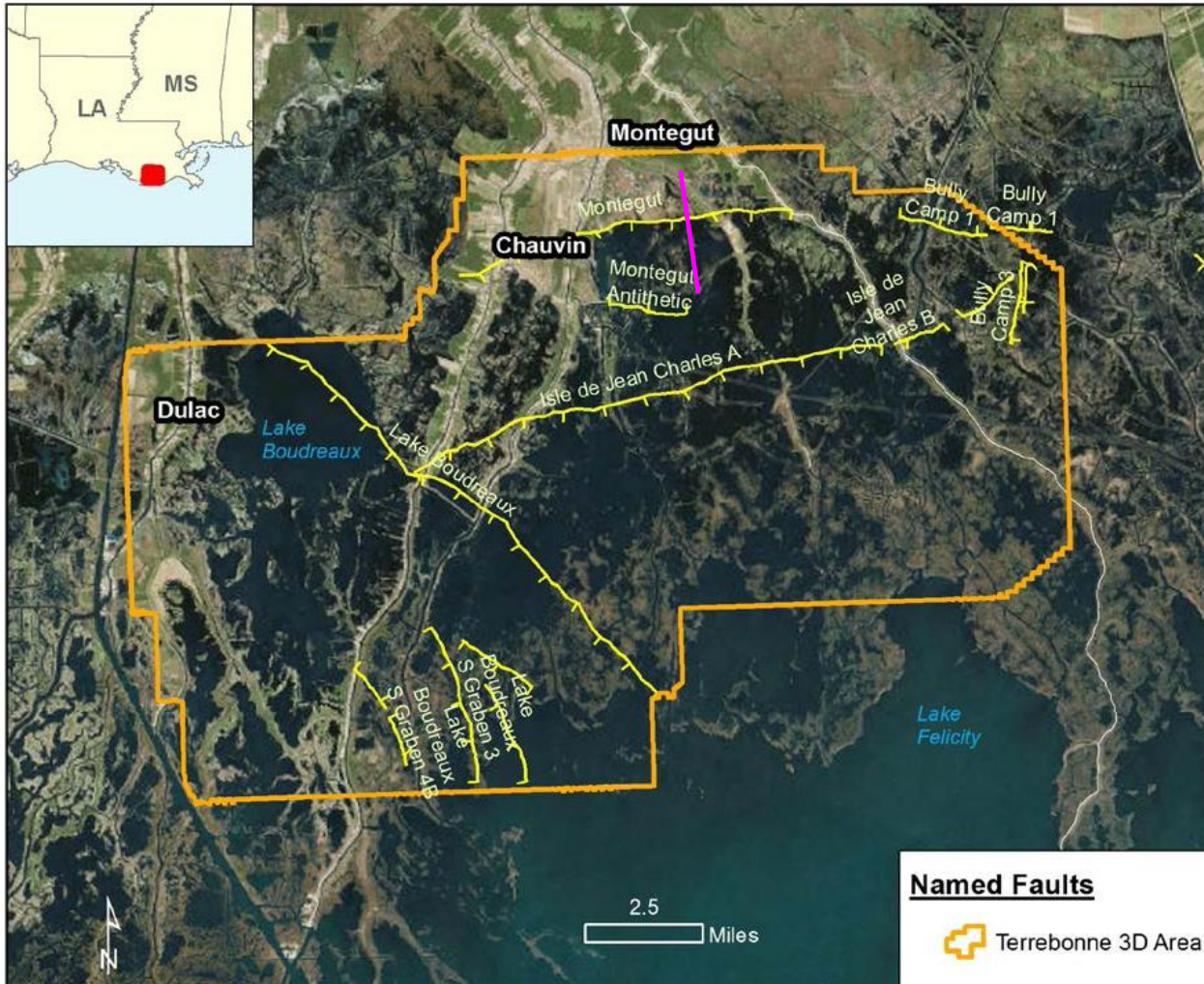


Lirette Field – Montegut fault



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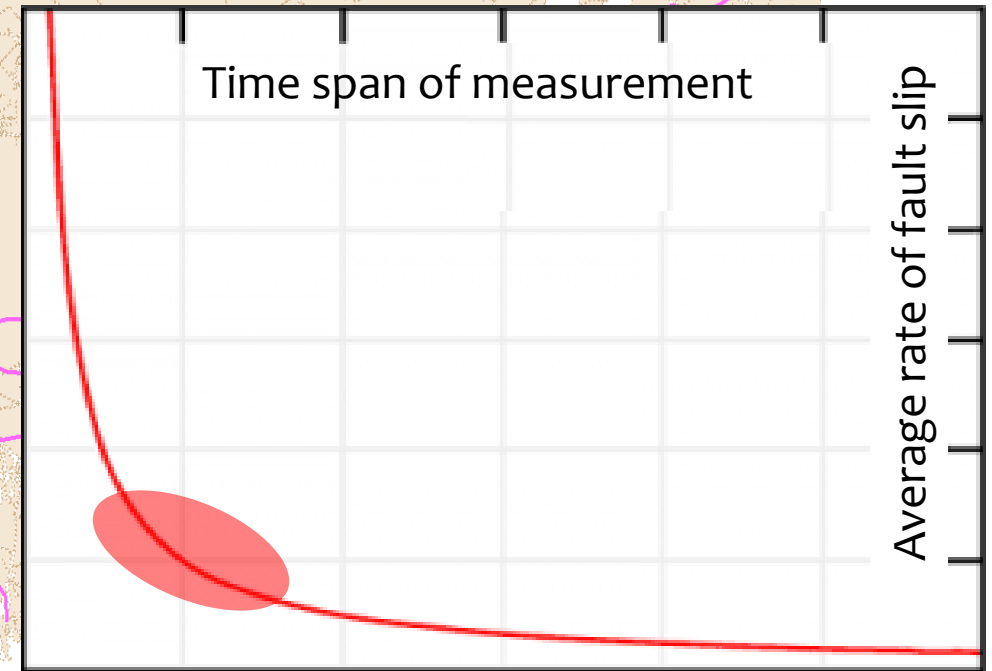
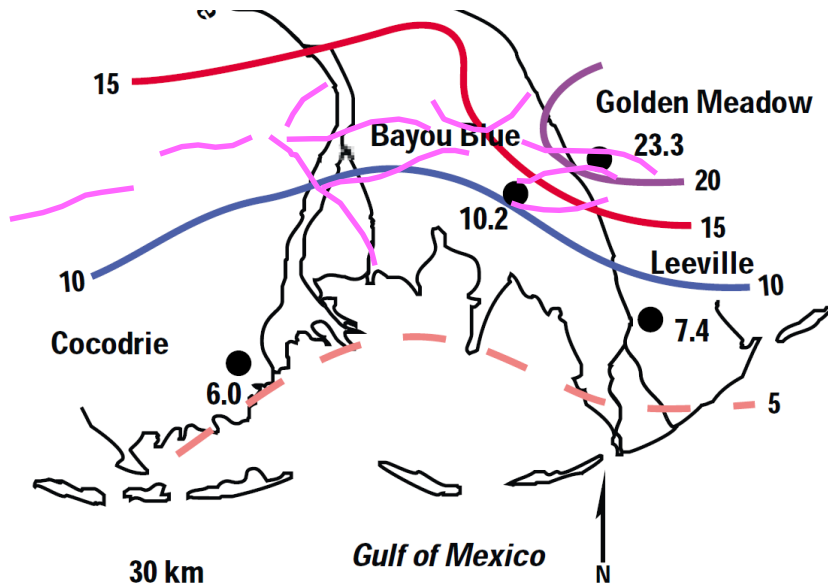
Lirette Field – Montegut fault



GAGLIANO, S.A., et al, 2003. Active Geological Faults and Land Change in Southeastern Louisiana

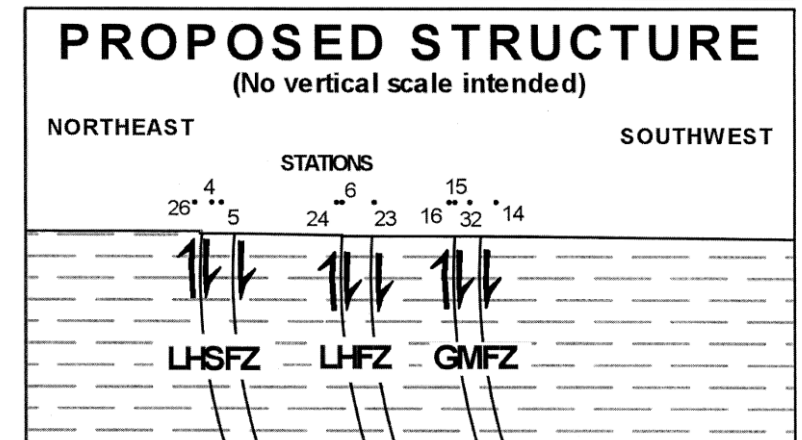
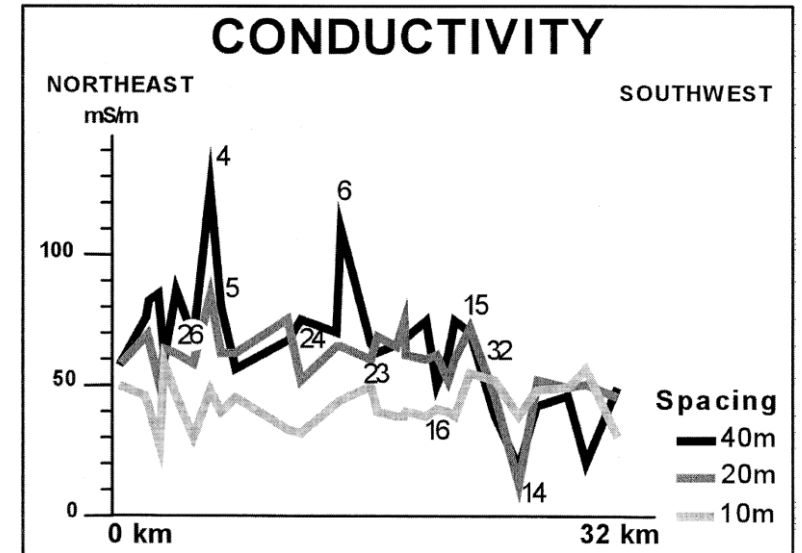
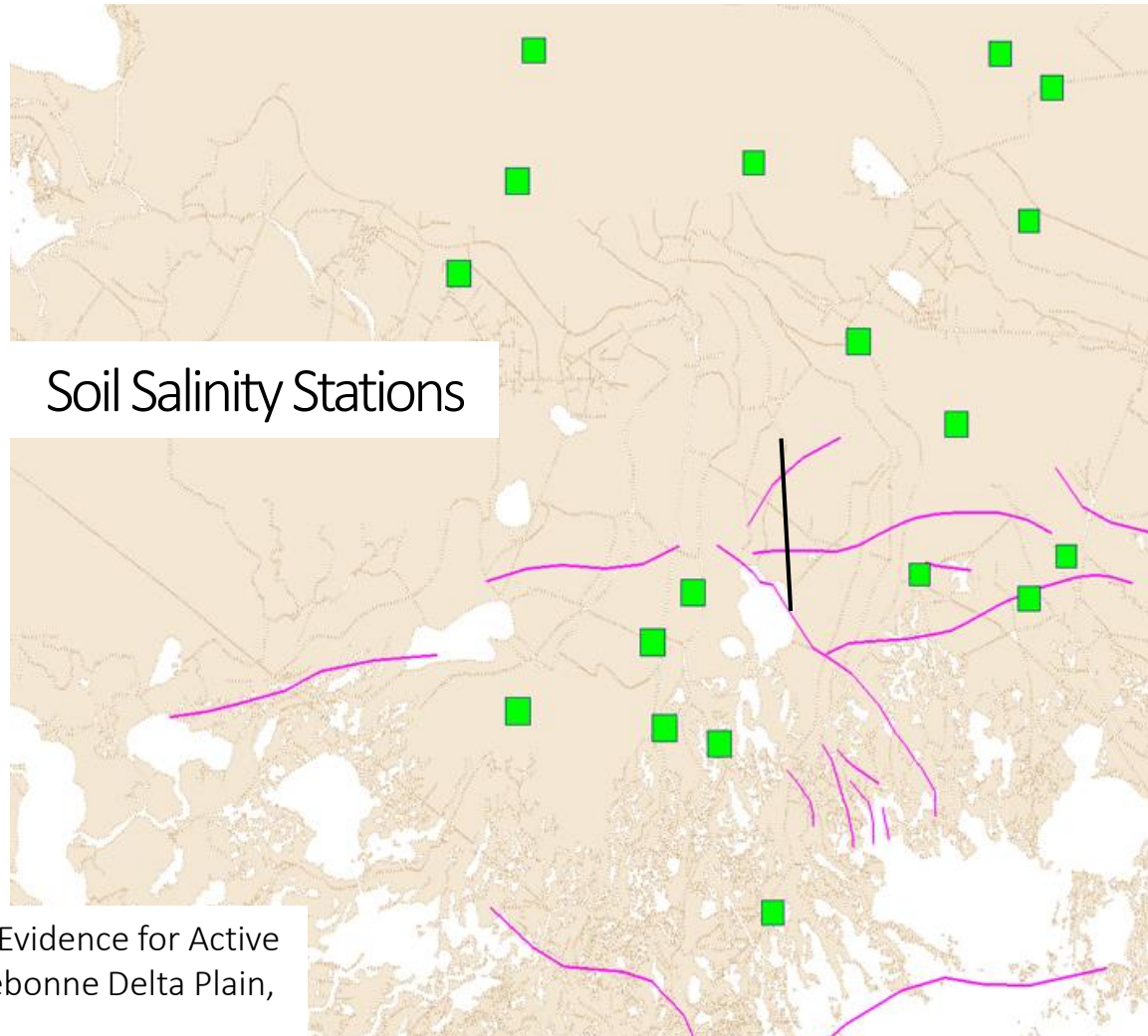
Lirette Field – Montegut fault

Relative Sea Level Rise from Tide Gauge Data



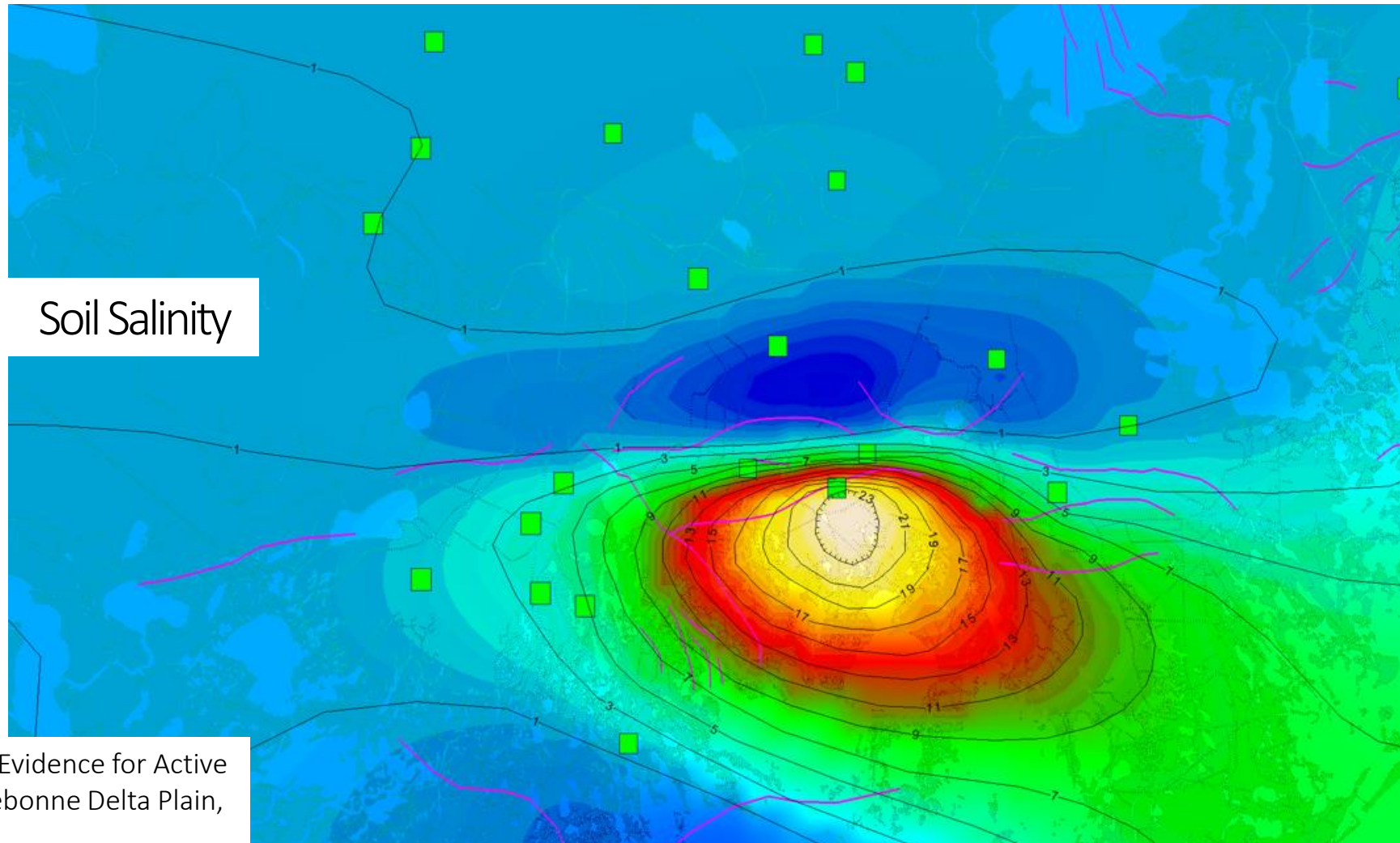
MORTON, R.A., et al, 2002, Subsurface Controls on Historical Subsidence Rates and Associated Wetlands Loss in Southeastern Louisiana

Lirette Field – Montegut fault



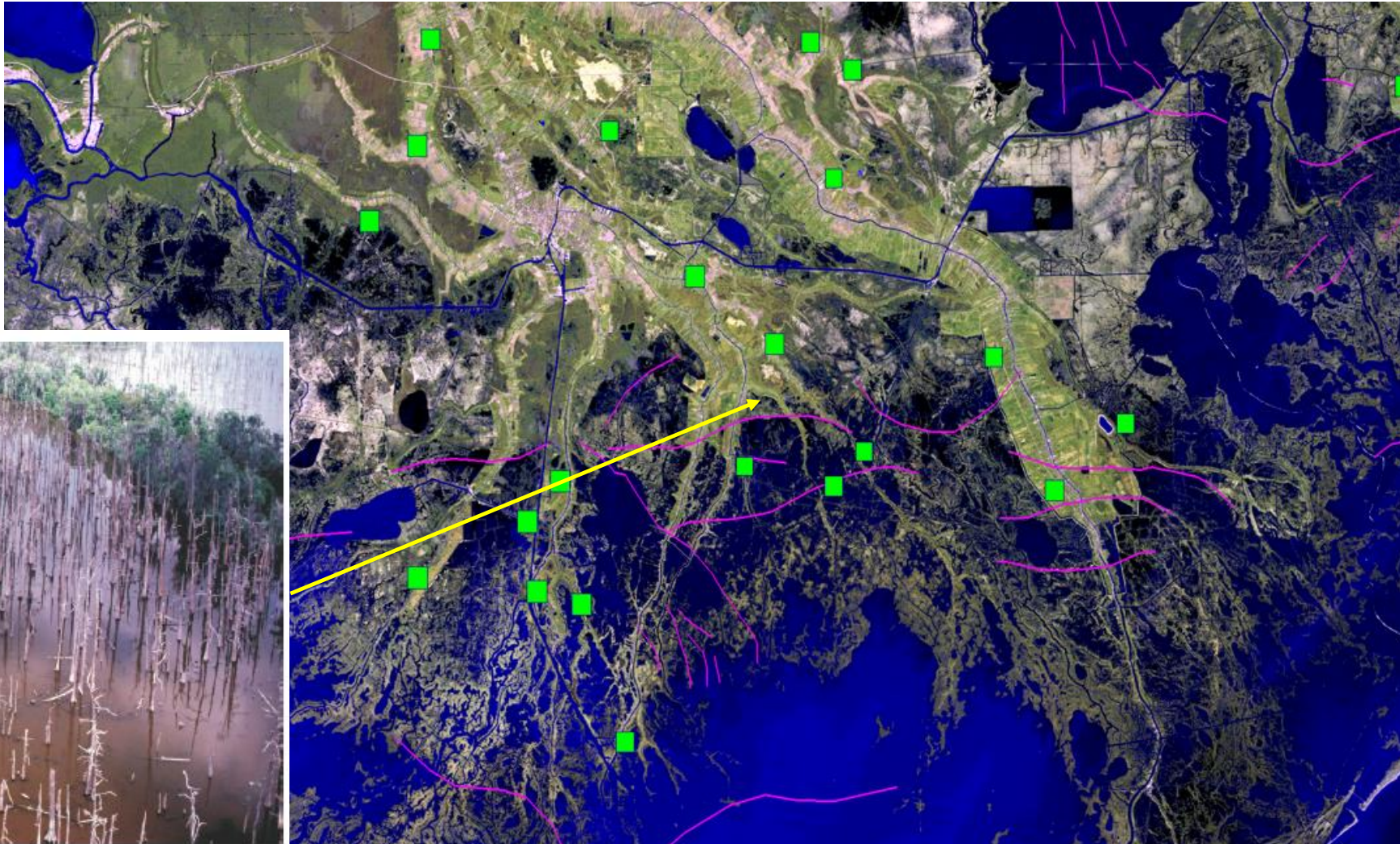
KUECHER, G.J., et al, 2001. Evidence for Active Growth Faulting in the Terrebonne Delta Plain, South Louisiana

Lirette Field – Montegut fault

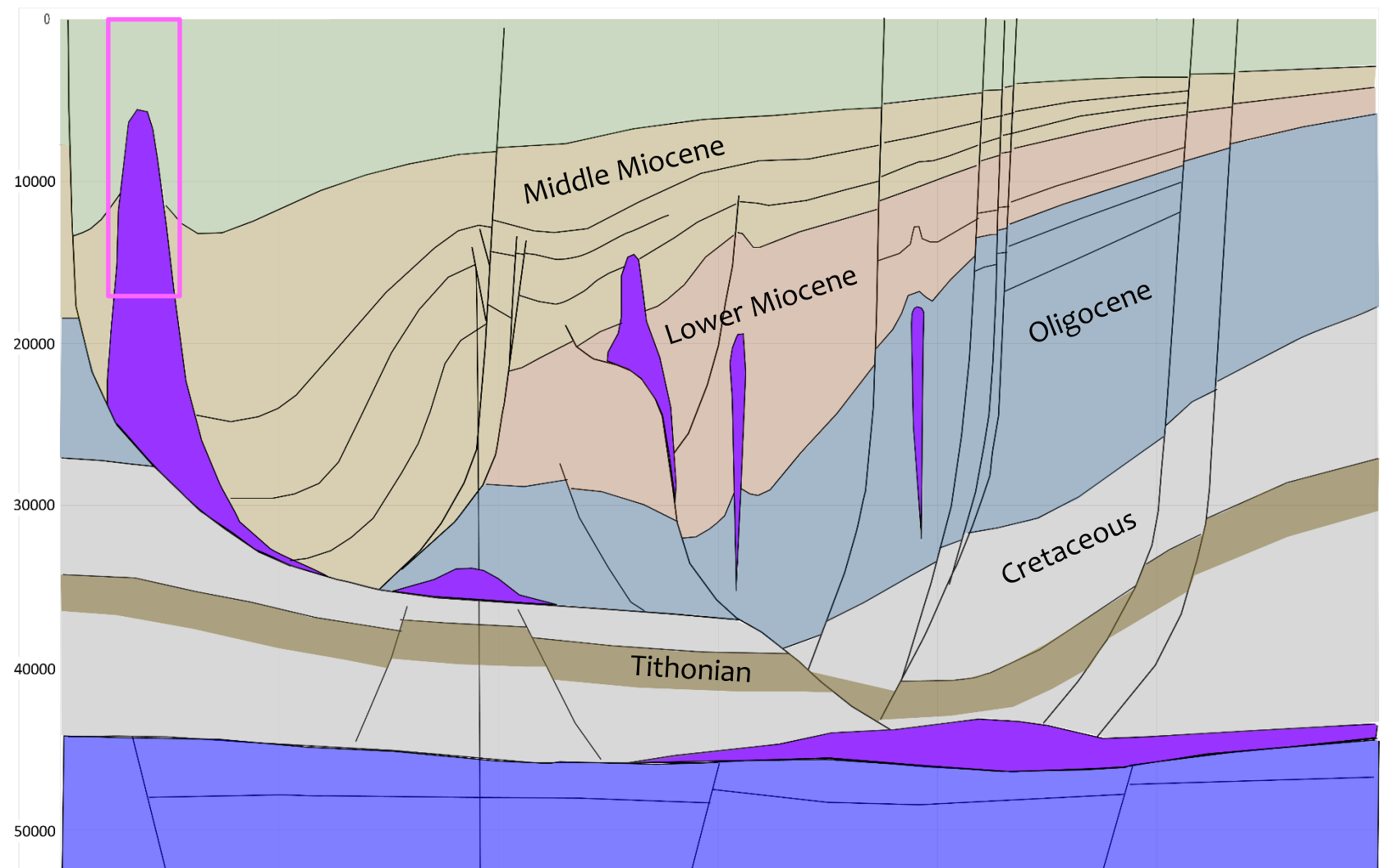
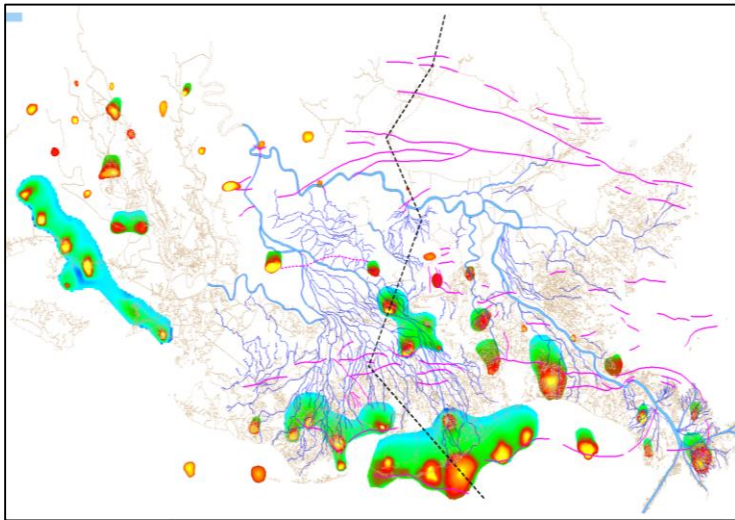


KUECHER, G.J., et al, 2001. Evidence for Active Growth Faulting in the Terrebonne Delta Plain, South Louisiana

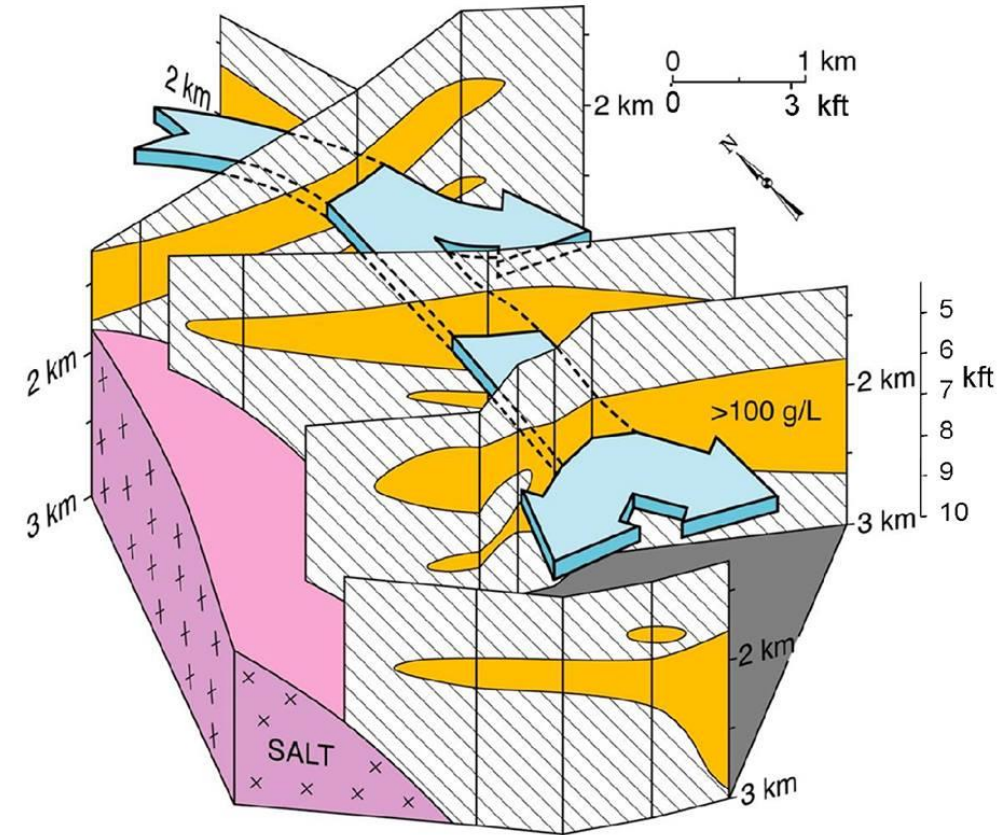
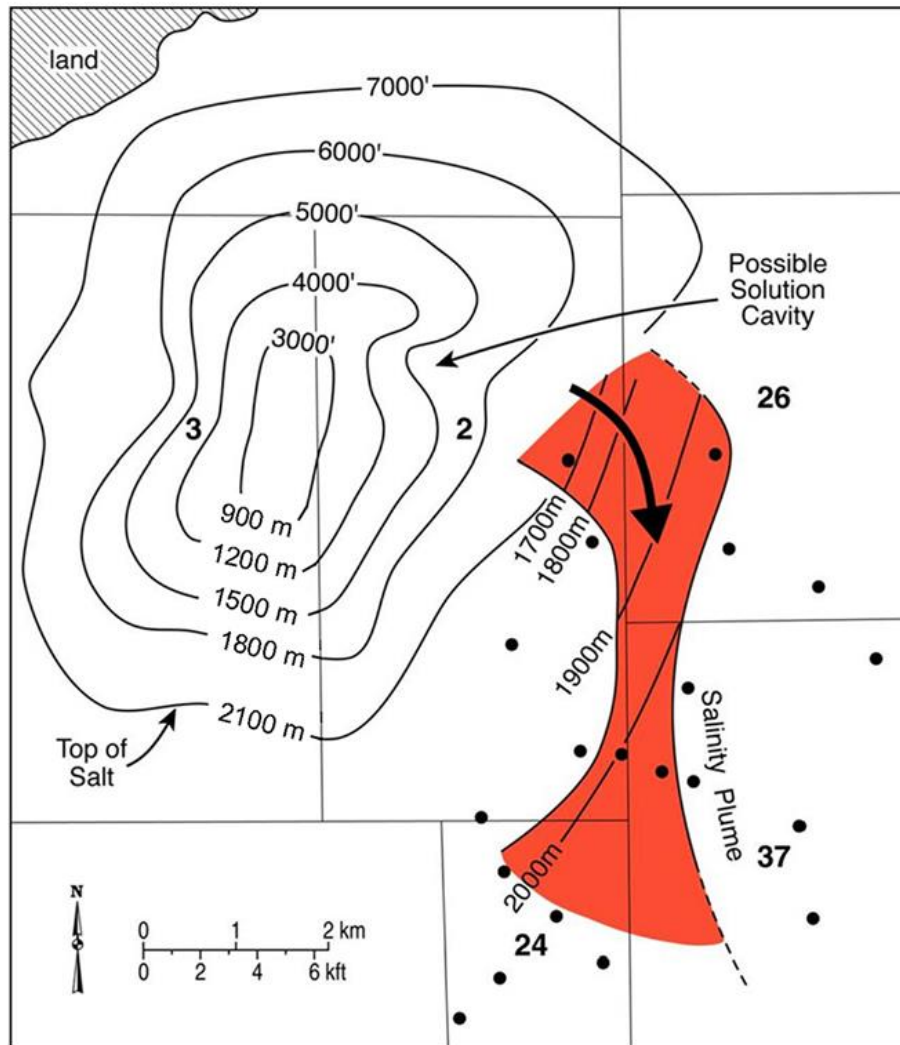
Lirette Field – Montegut fault



Bay Marchand salt dome

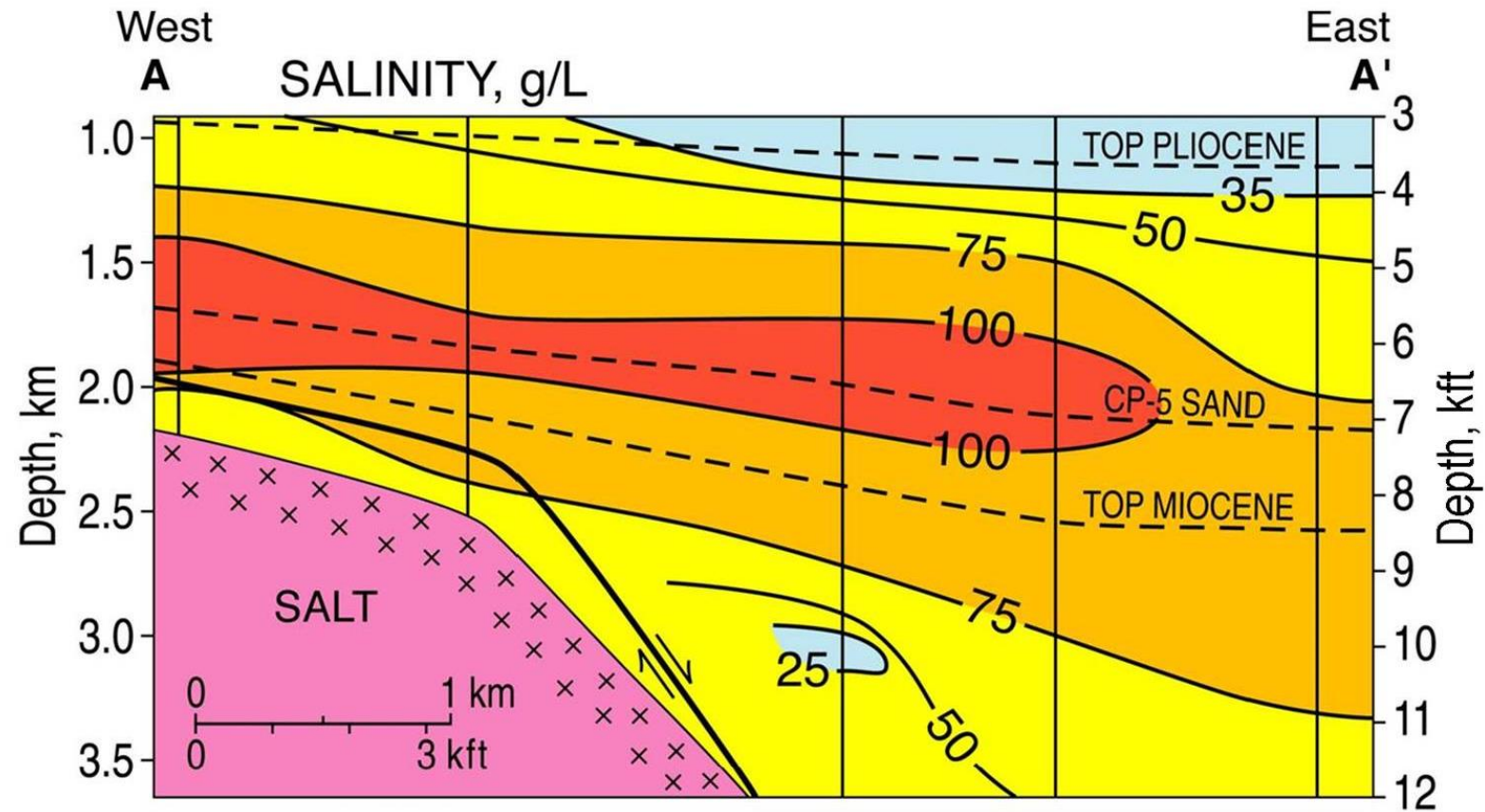


Bay Marchand salt dome



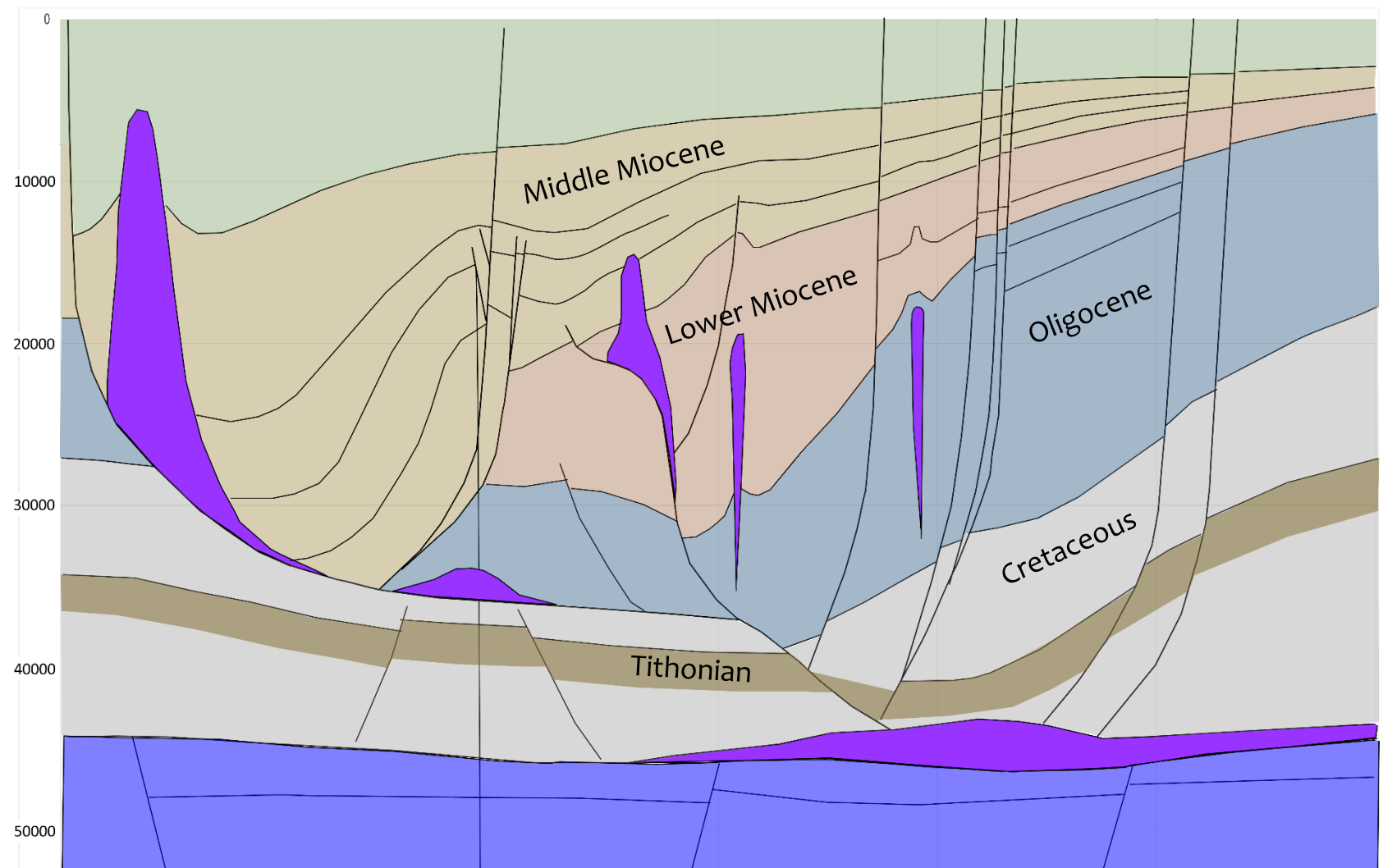
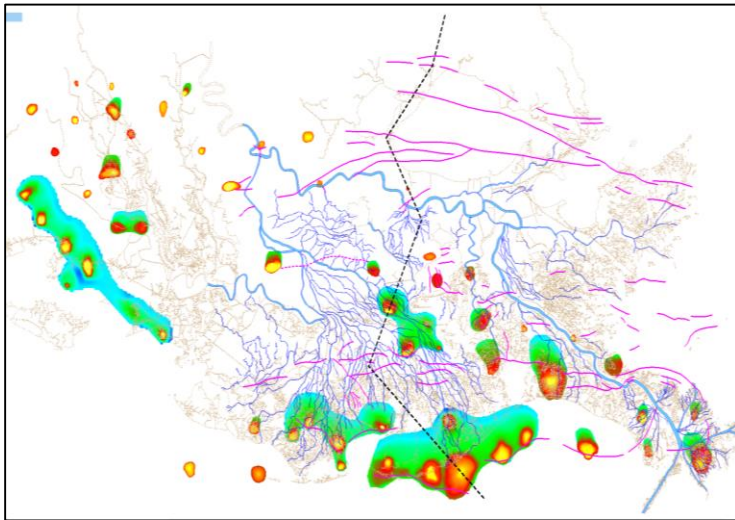
HANOR, J.S. & BRUNO, R.S., 2014, Dissolution of Salt and Perturbation of Subsurface Temperatures by Salinity-Driven Free Convection at Bay Marchand Field, Offshore Louisiana

Bay Marchand salt dome



HANOR, J.S. & BRUNO, R.S., 2014, Dissolution of Salt and Perturbation of Subsurface Temperatures by Salinity-Driven Free Convection at Bay Marchand Field, Offshore Louisiana

Summary

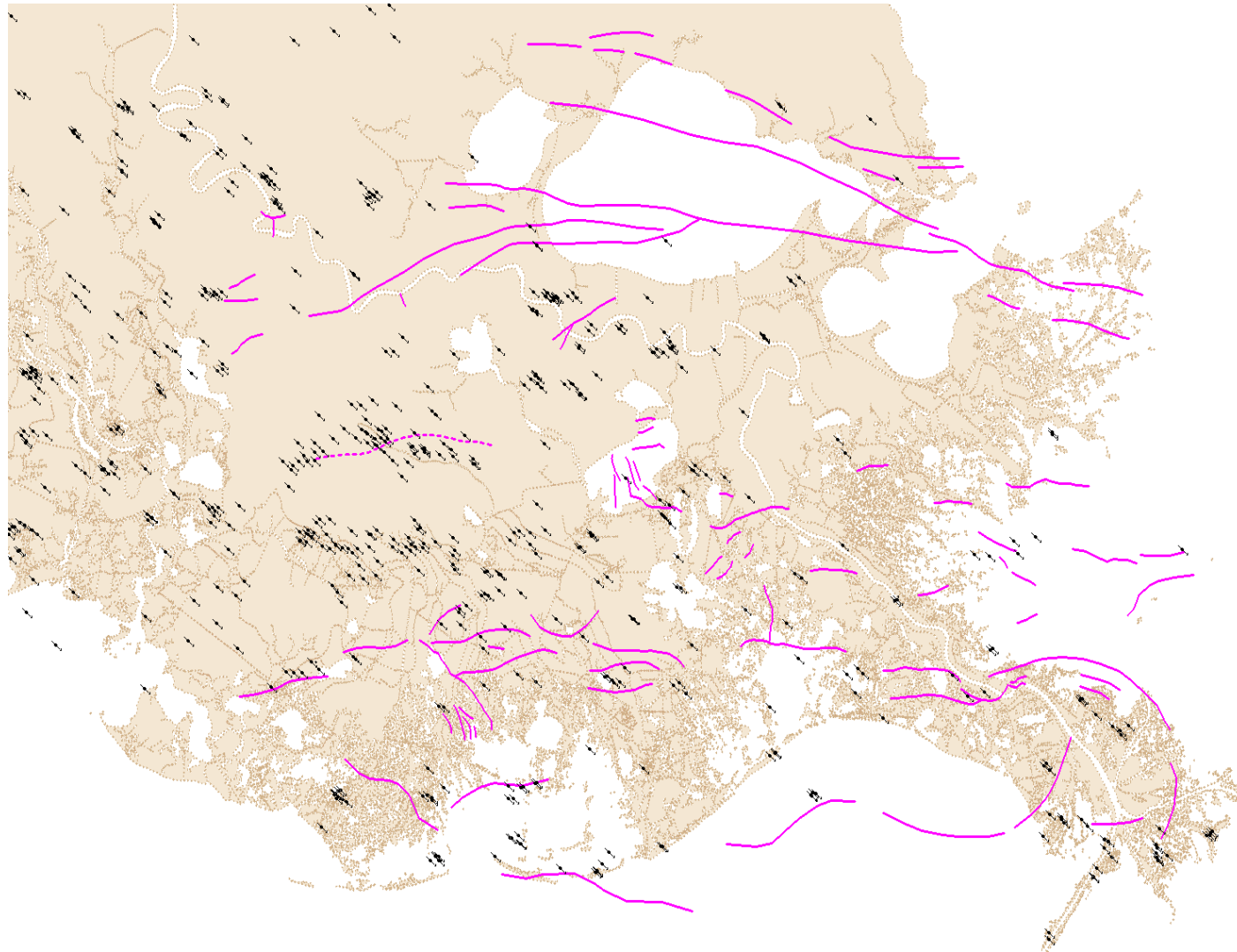




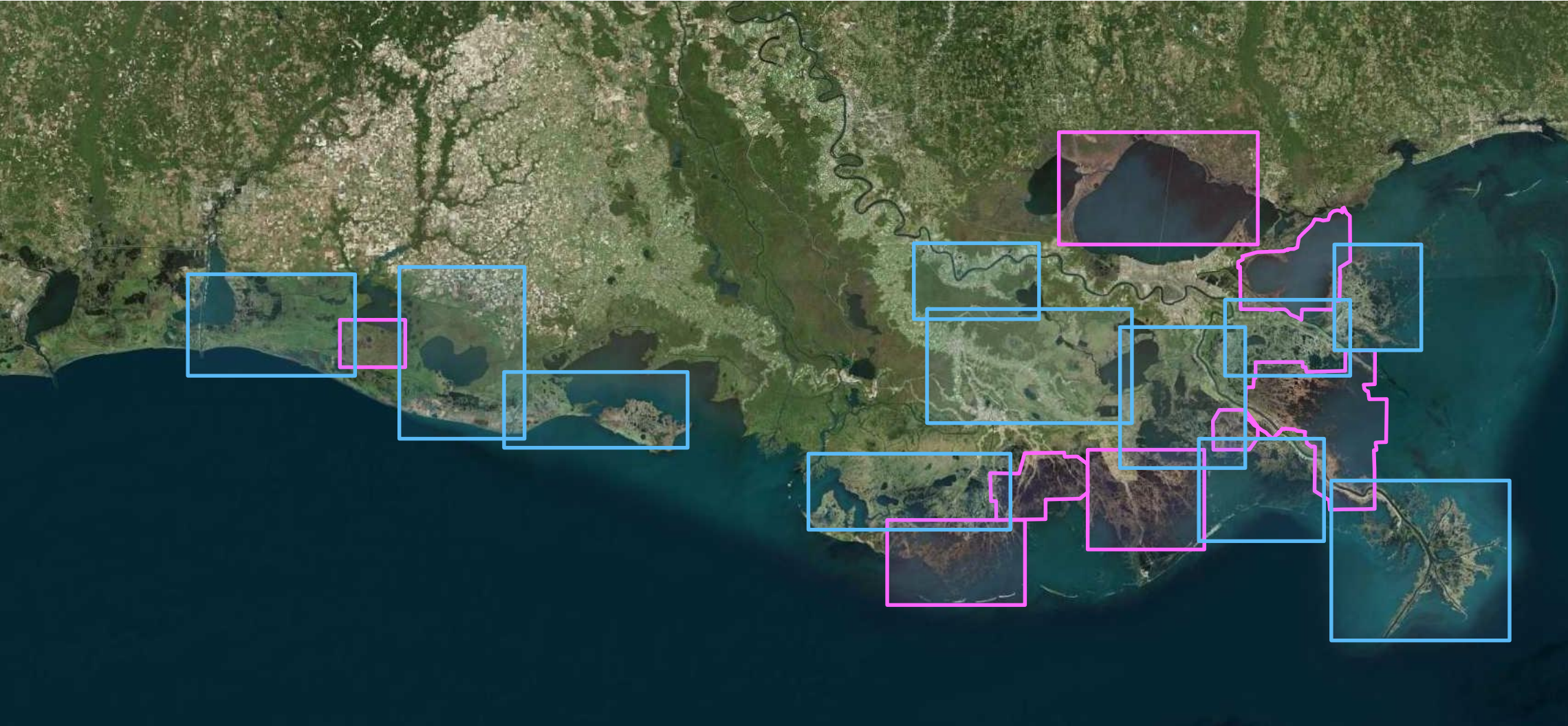
Title 33
Environmental Quality
Part V. Hazardous Waste and Hazardous Materials
Section 517 Part II

“... no faults which have had displacement in Holocene time are present, or no lineations which suggest the presence of a fault (which have displacement in Holocene time) within 3,000 feet of a facility are present

... no faults may pass within 200 feet of the portions of the facility where treatment, storage, or disposal of hazardous waste will be conducted”



Coastal Geohazards Atlas





Thank-you Questions?

chris_mclindon@att.net

504-756-2003