

2009

SMU Geothermal Project

Andres Ruzo
Southern Methodist University

Elizabeth Corey
Southern Methodist University

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Ruzo, Andres and Corey, Elizabeth, "SMU Geothermal Project" (2009). *Big iDeas 2009 Fall Updates*. 2.
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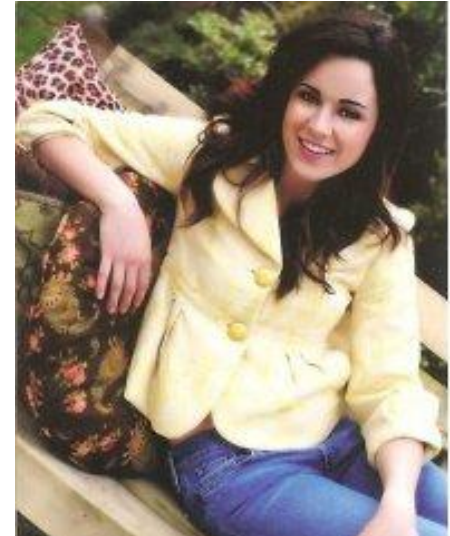
SMU Geothermal Project

About us



Andrés Ruzo

The **SMU Geothermal Project** is a student-led, faculty & staff-mentored, multidisciplinary comprehensive study evaluating the geologic, engineering, legal, and financial feasibility of establishing a binary-cycle geothermal power plant on the SMU Campus.



Elizabeth Corey

Our Mentors



Dr. Jim Quick



Dr. Bob Gregory



Maria Richards



Dr. Dave Blackwell



Michael Paul

QuickTime™ and a decompressor are needed to see this picture.

Bruce Bullock

QuickTime™ and a decompressor are needed to see this picture.

Dr. Jim Smith



Shannon McCall



Feasibility Studies

Geology

- Exploitable Geothermal Resource
- Barnett Shale in Dallas County
- Fracture Zone

Engineering

- Designing Above-Ground Infrastructure
- Plant Schematics
- Structural Design

Financial

- Cost & Profit Analyses
- Economies of Scale
- Funding & Future Investment Planning

Legal

- SMU Mineral Rights
- Drilling Permits
- Zoning & Construction Permits



Geologic Feasibility Results



Dixie Valley Geothermal Power Plant



Geothermal Resources Council Conference
Reno, Nevada



Geologic Feasibility Results



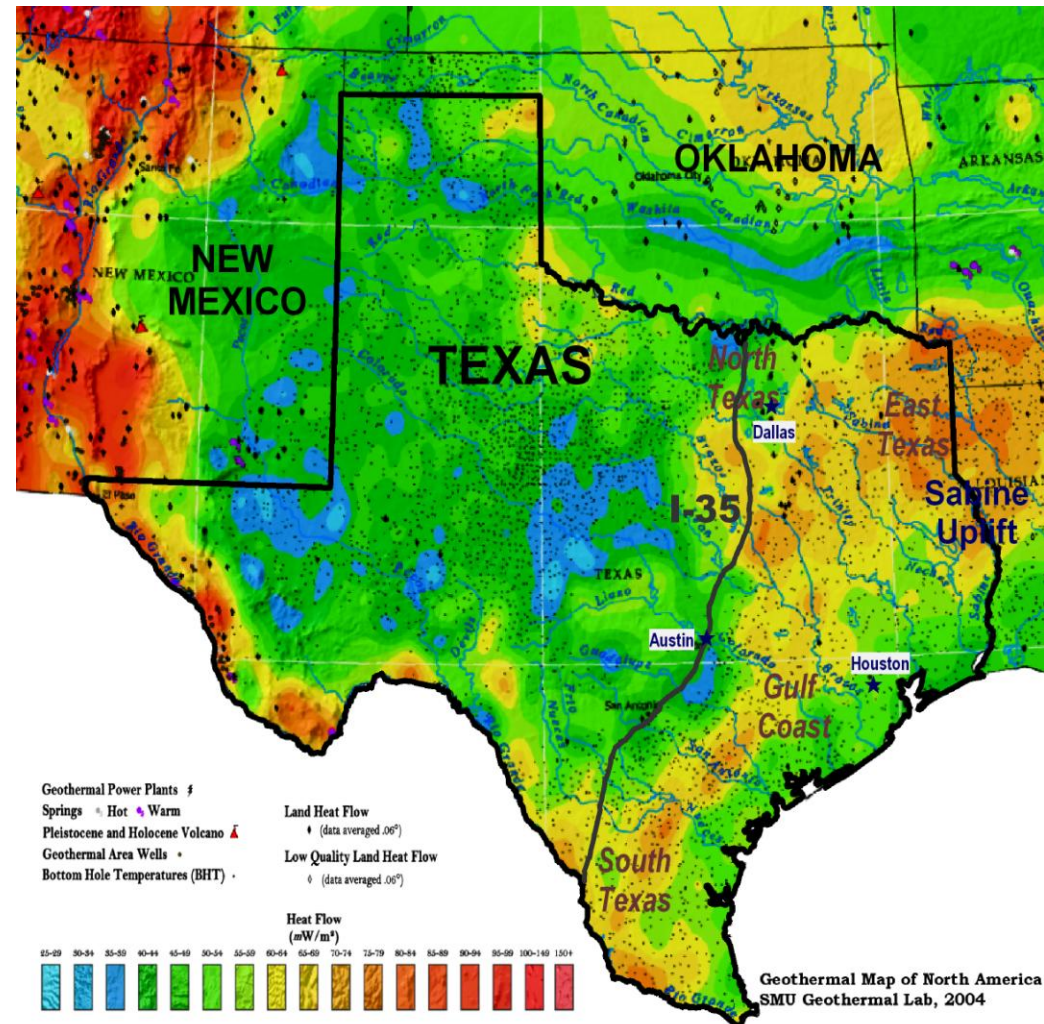
Where the Barnett Ends

*a study of the geothermal potential in
Dallas County, Texas*



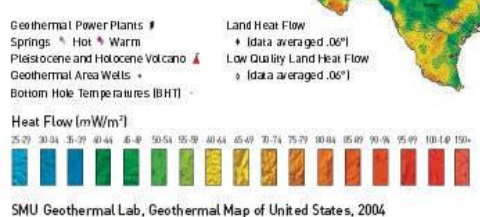
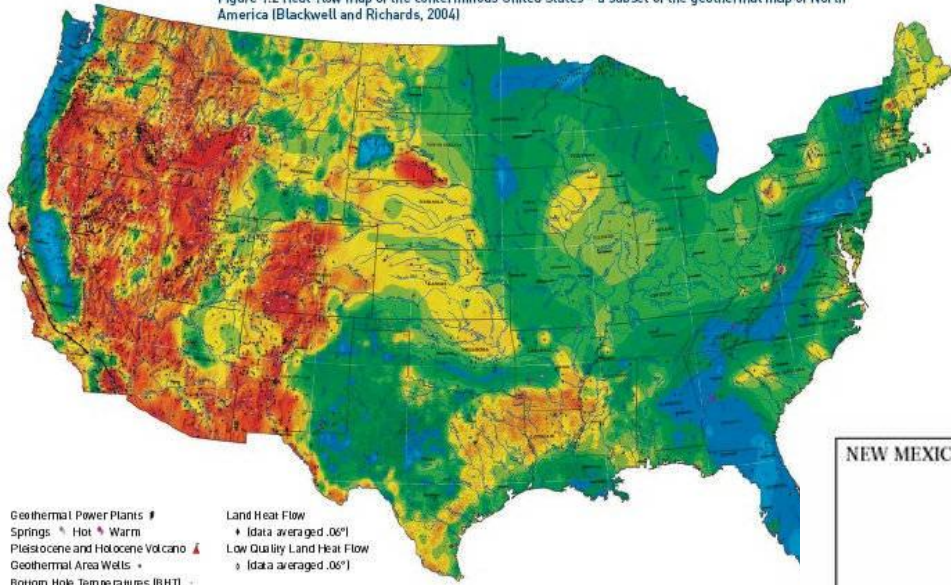
Texas Heat Flow

- East Texas known for high heat flow from BHT data
- Results from high levels of radioactive decay in basement rocks
- Texas energy markets are underlain by geothermal resources

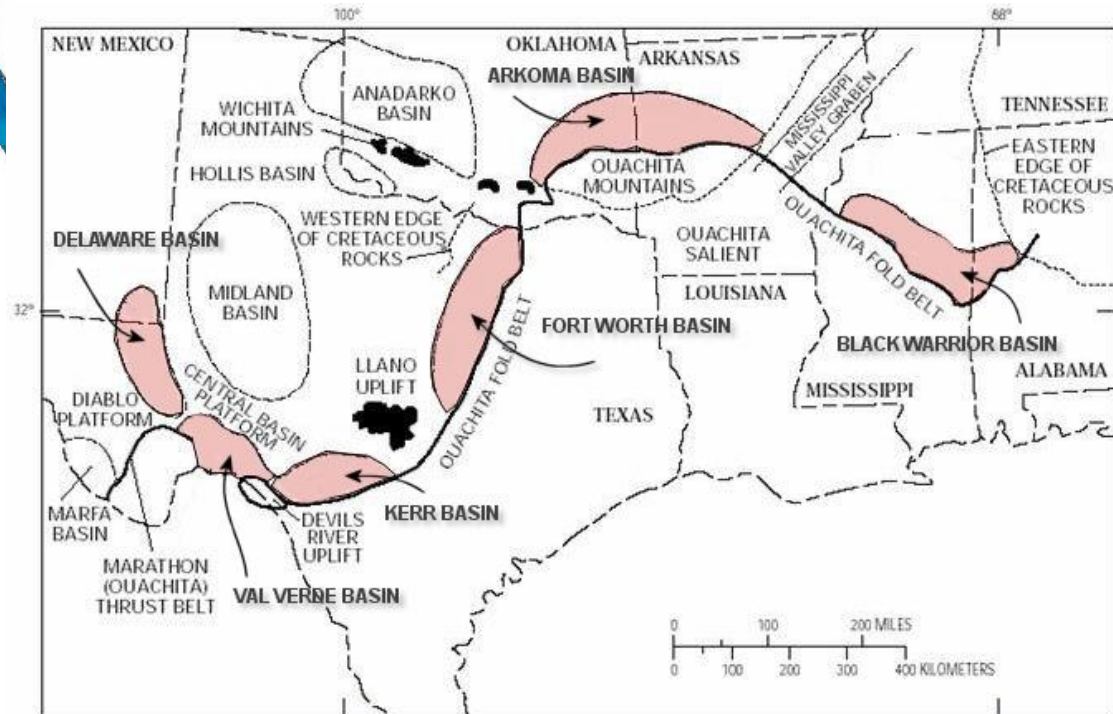


Ouachita Over-thrust Belt

Figure 1.2 Heat-flow map of the conterminous United States – a subset of the geothermal map of North America (Blackwell and Richards, 2004)



- Permian-Triassic Orogenic belt
- Low angle thrust faulting
- Basin formation



- Eroded roots of the Appalachian mountains
- Data still needed

Ouachita Geologic Structure

West

East

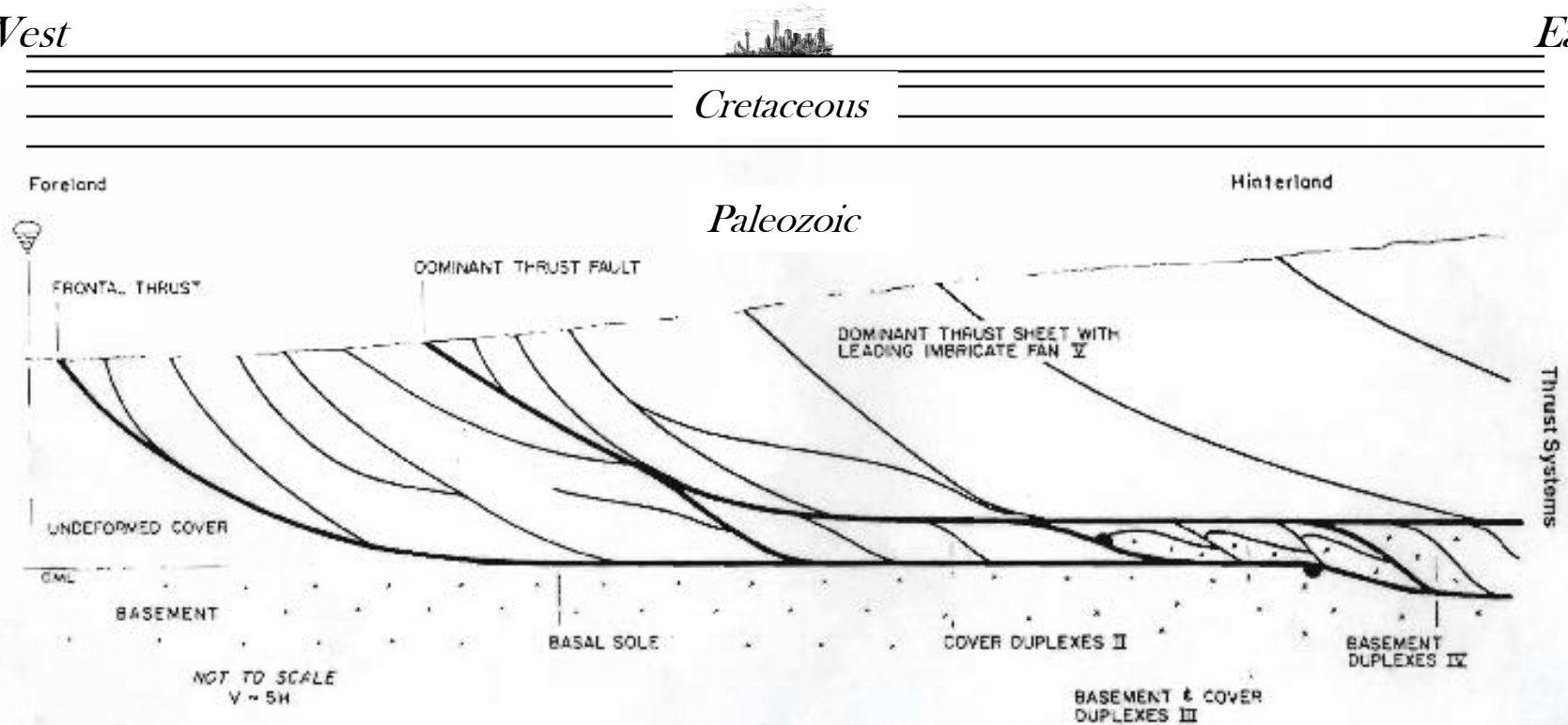
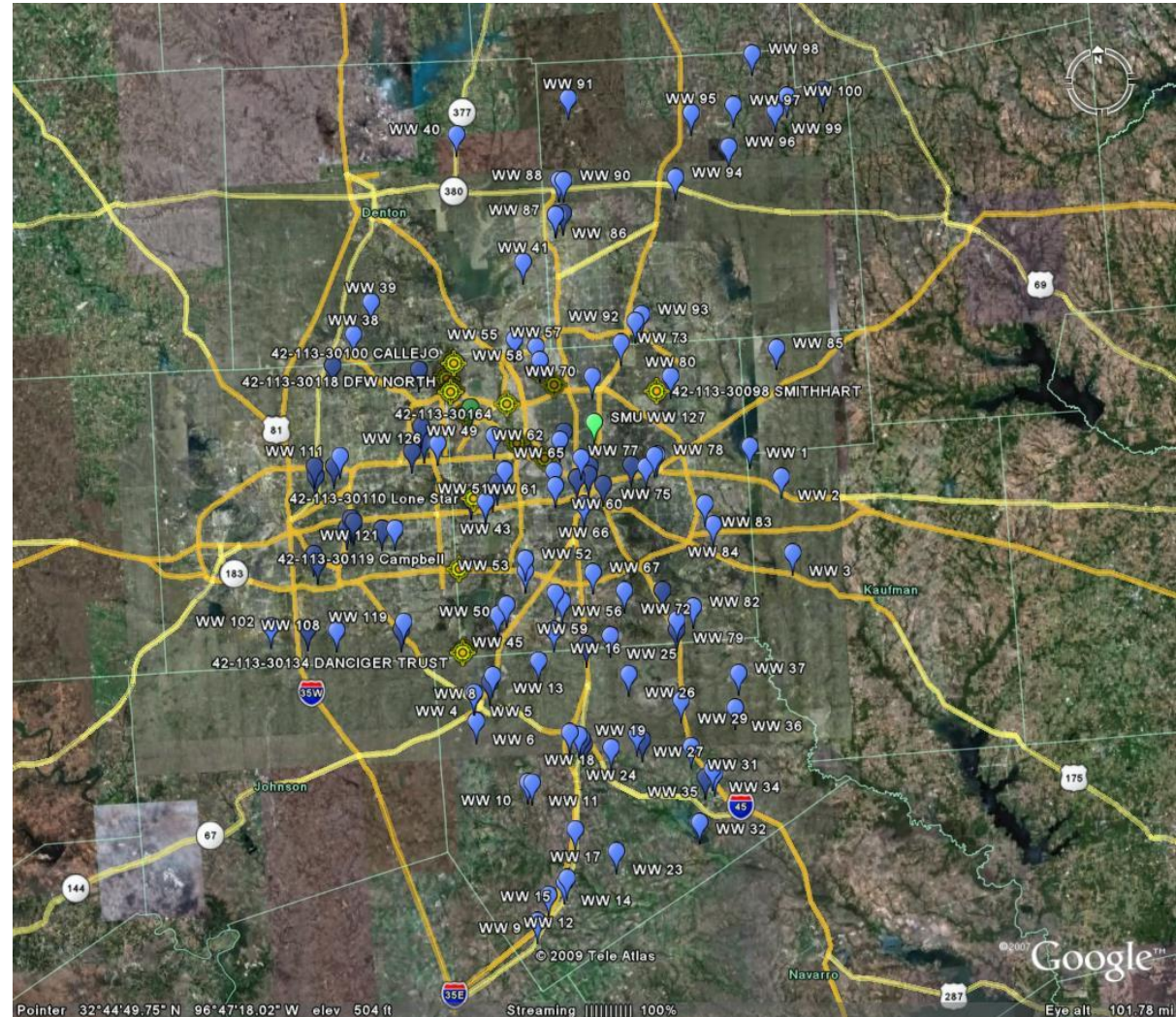


FIG. 30—Idealized sketch of thrust belt with dominant sheet shows five zones, each with characteristic thrust system and degree of basement involvement. Thrust faults at zone boundaries are bold. Vertically exaggerated and not to scale.

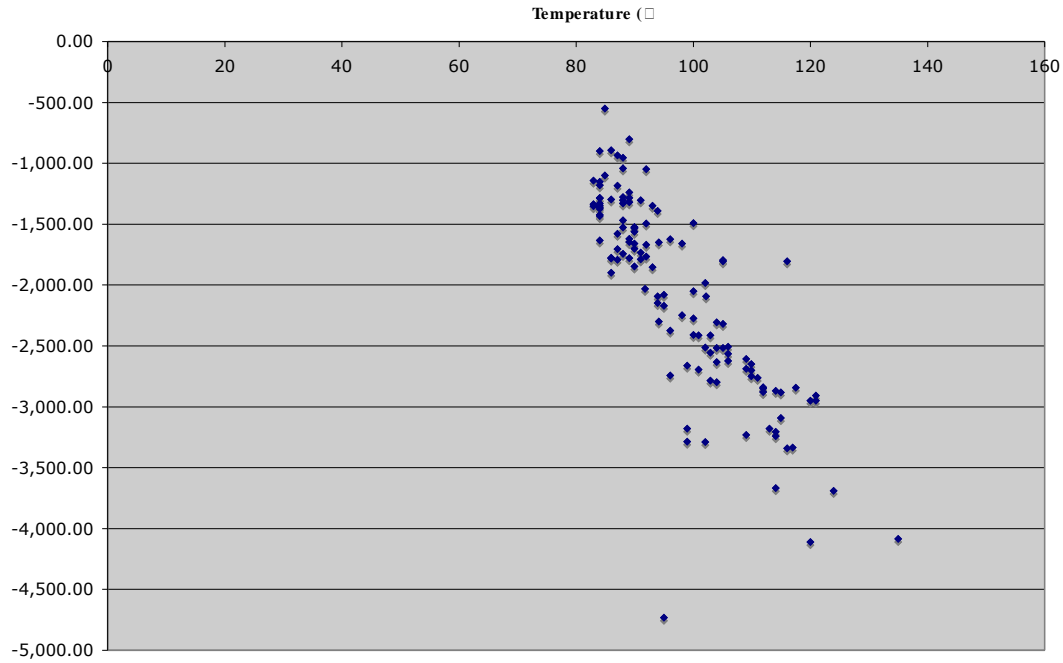
- Typical thrust belt behavior
- Cretaceous-Paleozoic Unconformity

Local Well Sites & Data

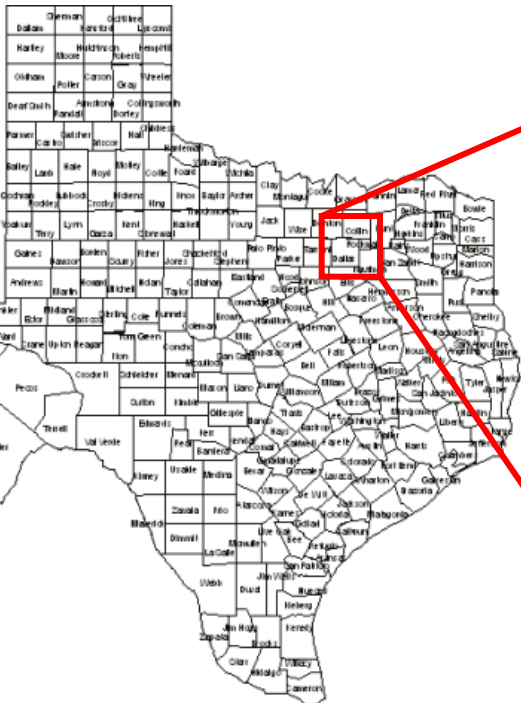
- 146 Wells Total
 - 128 Water wells
 - 18 Oil & Gas wells
- New Data Available
 - 26 new well logs to go
- Looking for:
 - Lithologies
 - Structure
 - Temperature
 - Pressure
 - Anything



Dallas Area Shallow Geothermal Gradients



Temperature vs. Depth Dallas Area Water Wells

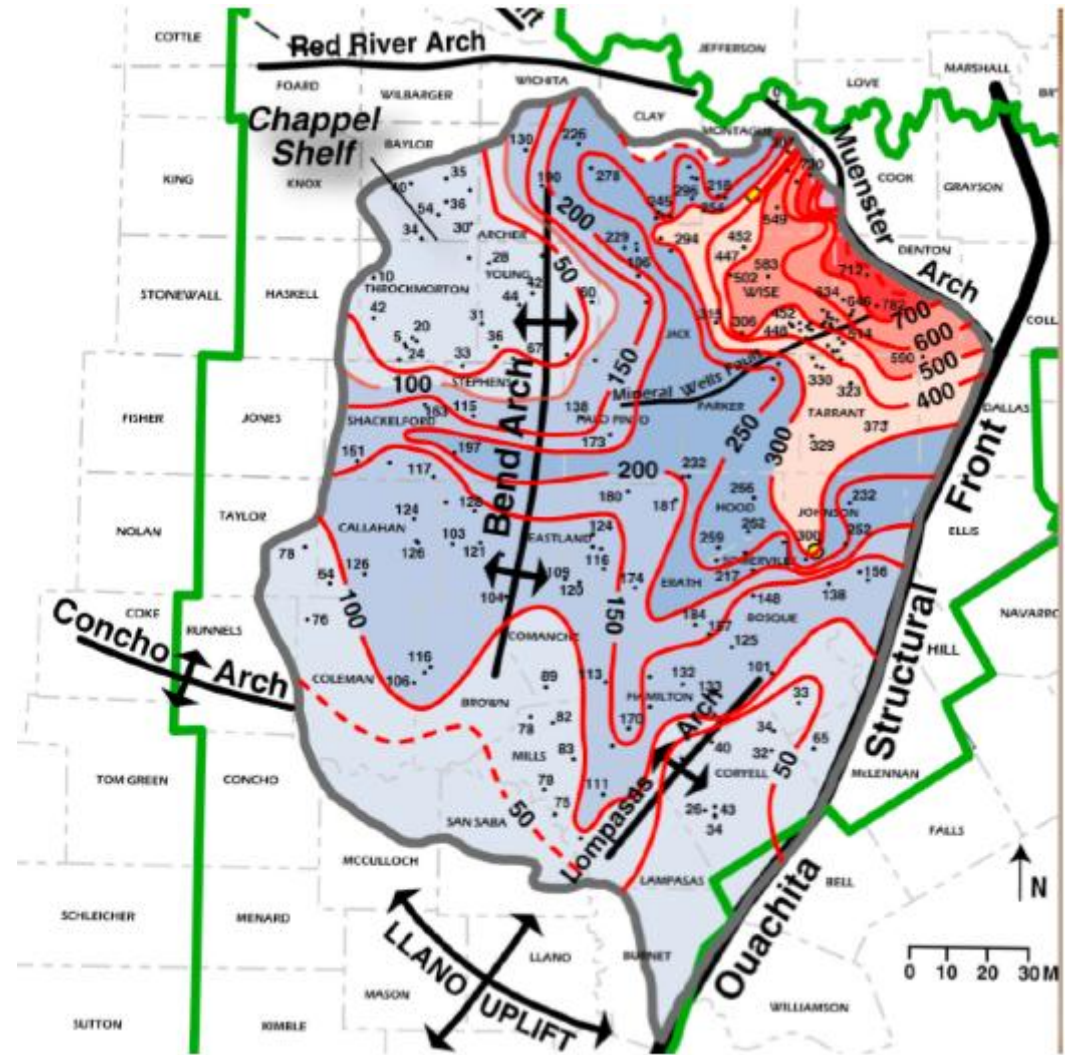
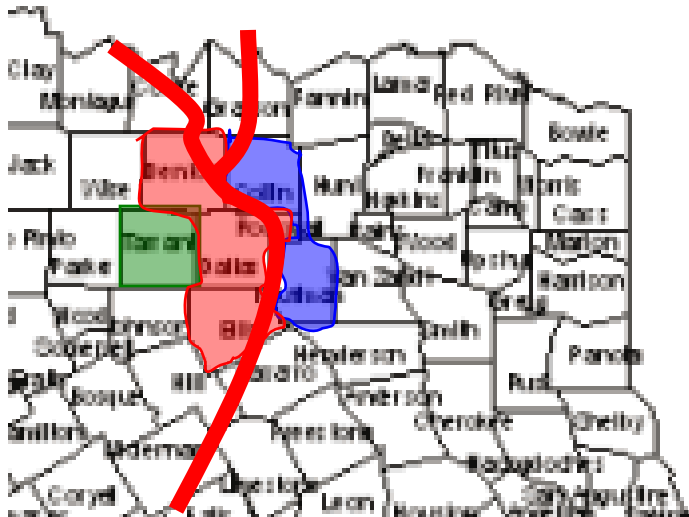


Average County Geothermal Gradients from Water Well Data
County Average Gradient (°F/1000ft)

Dallas	14.9
Kaufman	12.9
Rockwall	14.4
Collin	12.2
Denton	15.1
Tarrant	13.3
Ellis	16.5

Total Average Geothermal Gradient for Area 14.2

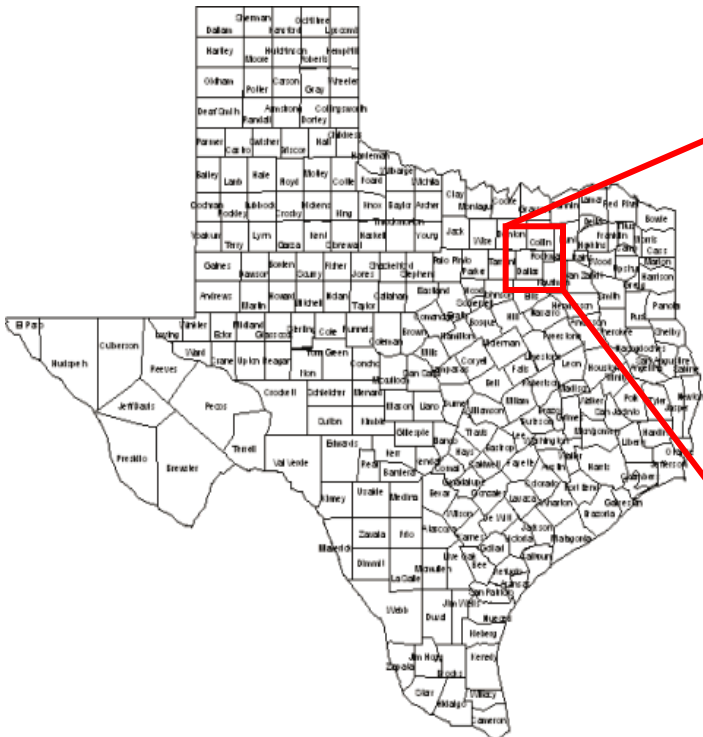
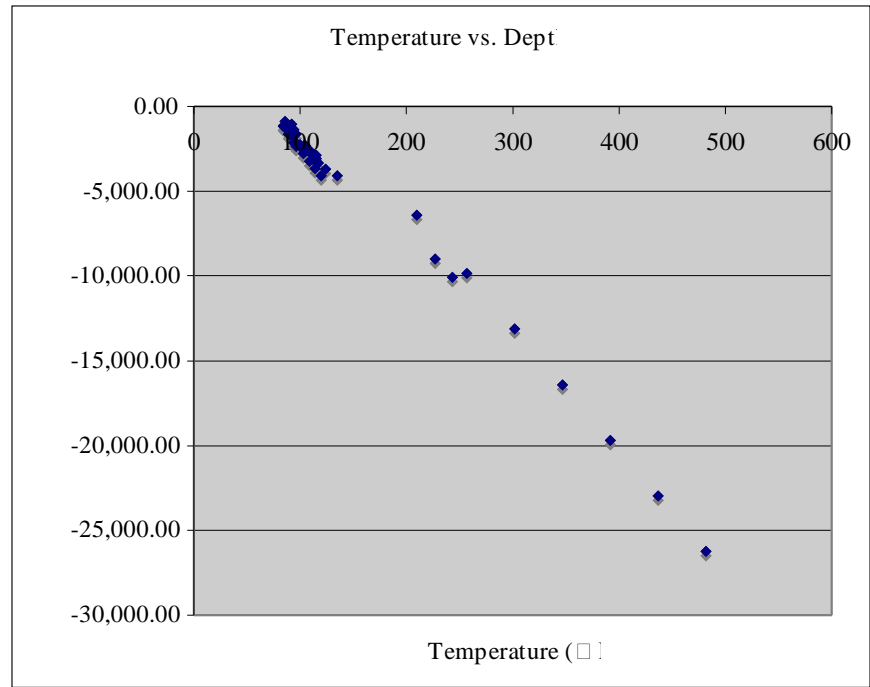
Dallas Area Shallow Geothermal Gradients



Geothermal Gradients from Water Well Data ($^{\circ}\text{F}/1000\text{ft}$)

Tarrant	13.3	Dallas	14.9	Collin	12.2
		Denton	15.1	Kaufman	12.9
		Rockwall	14.4		
		Ellis	16.5		

Dallas Area Geothermal Gradients

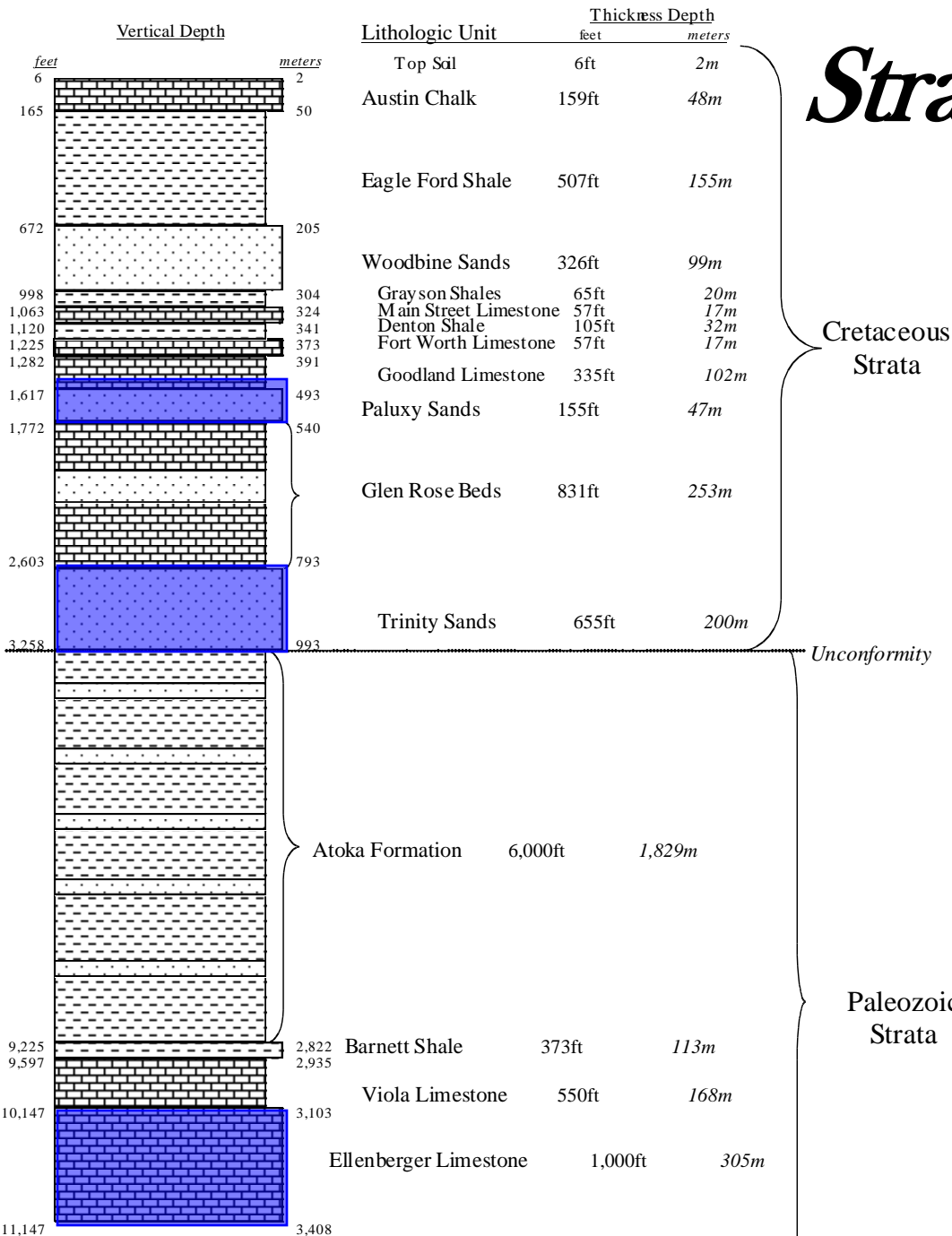


Average Dallas County Geothermal Gradients from:
Water Well and Oil & Gas Well Data, and Values from Negraru,
Blackwell, and Erkan
Source Average Gradient (°F/1000ft)

Dallas Water Wells	14.9
Dallas Oil & Gas Wells	19.1
Negraru et al. Values	17.1

Total Average Geothermal Gradient for Dallas County 17.0

Stratigraphic Column

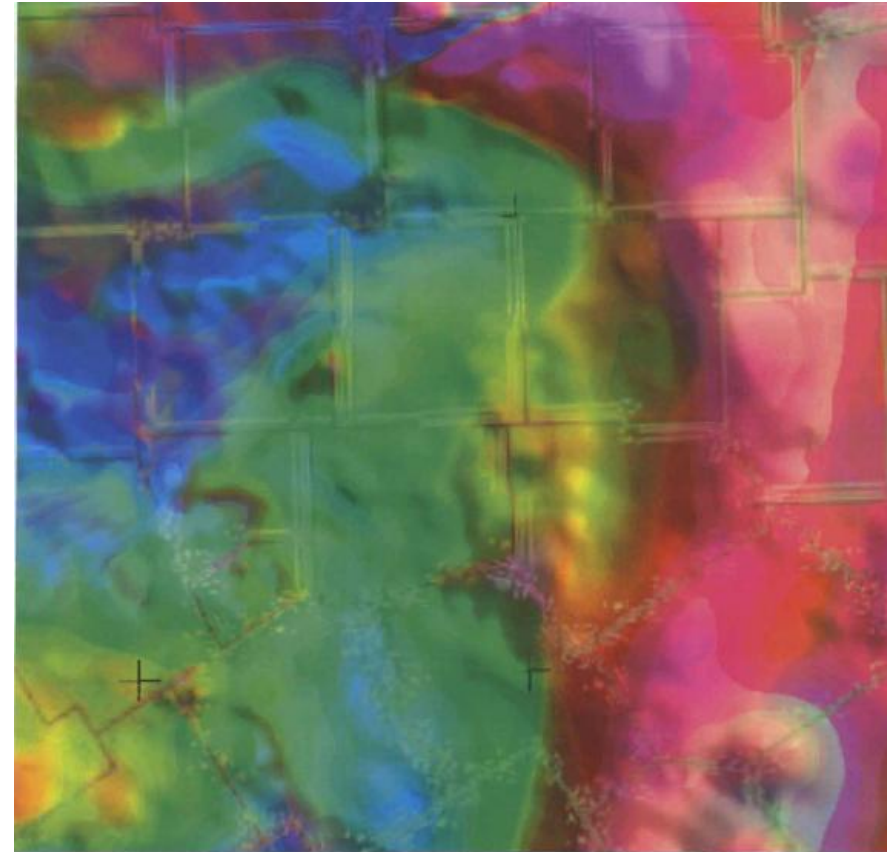
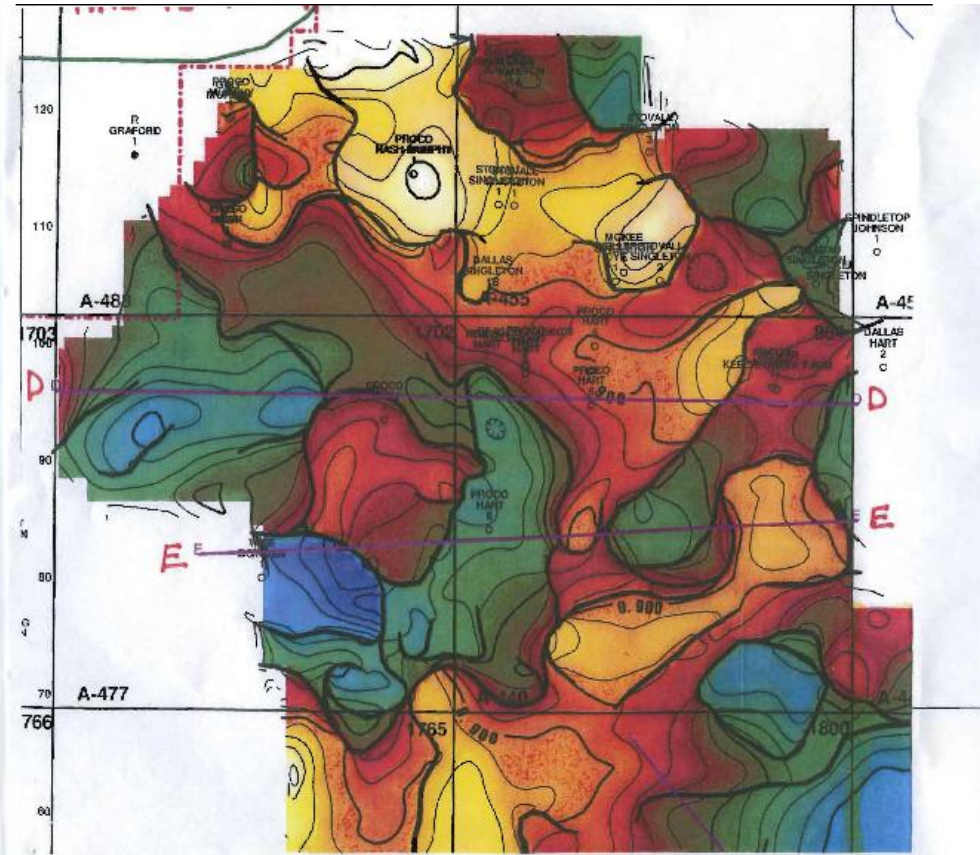


- Hypothetically from the 1925 SMU Water Well Site

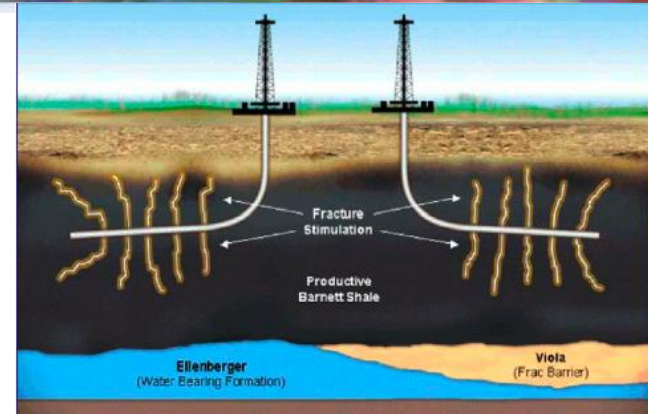
- Oil & Gas well logs were analyzed to create the rest

- Reason to believe that the Barnett Shale doubles over

Access to New Data For the Area

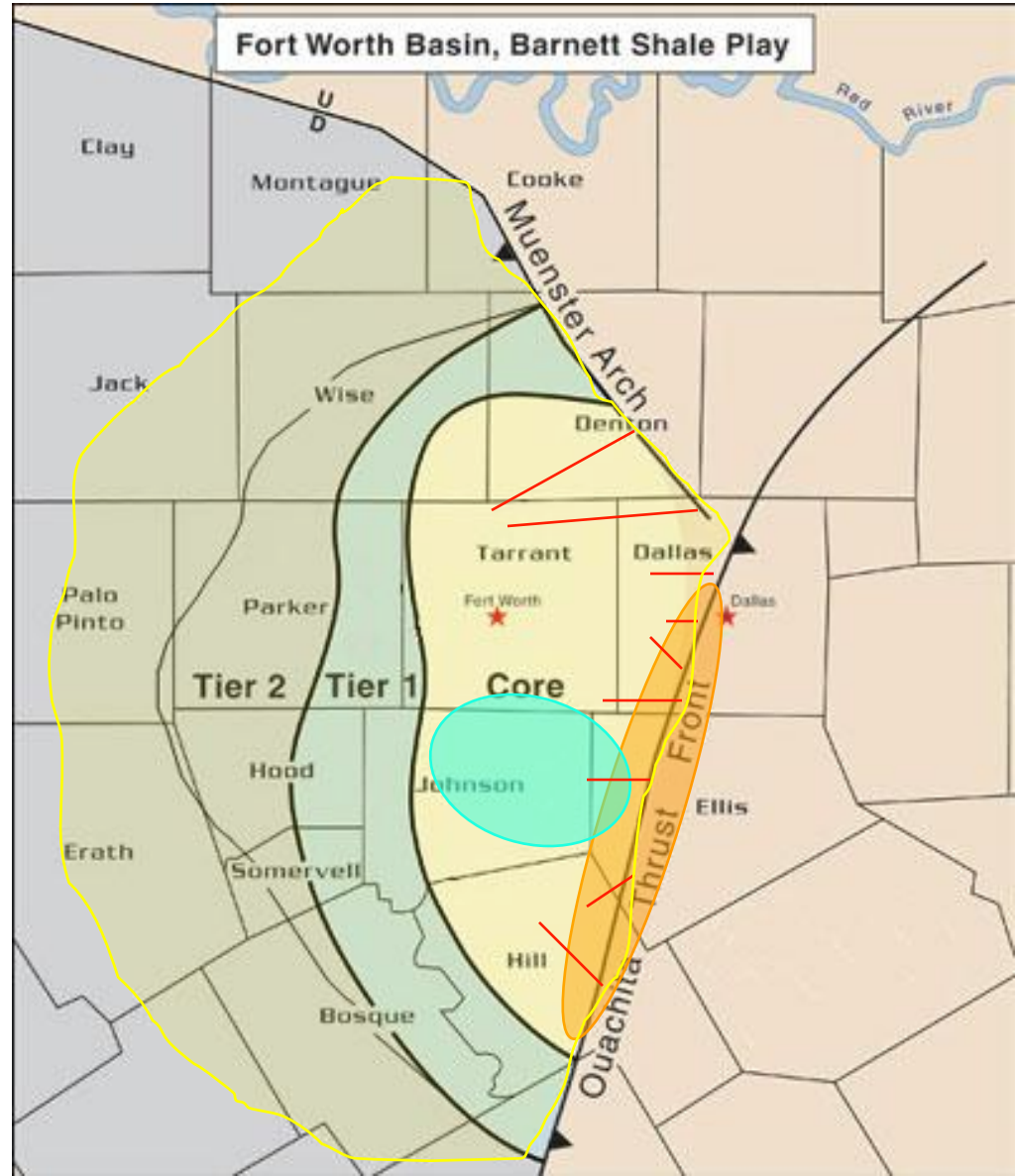


- Karsting in the Ellenberger
- Gravity and Magnetic Anomaly Data
- Well log data
- Water samples



New Hypotheses for Barnett Shale Play

- Barnett Shale Overturned
- Ellenberger as geothermal resource
- Ouachita Fracture Zone
- Johnson County Cave Complex



Ouachita Fracture Zone Geothermal Resource

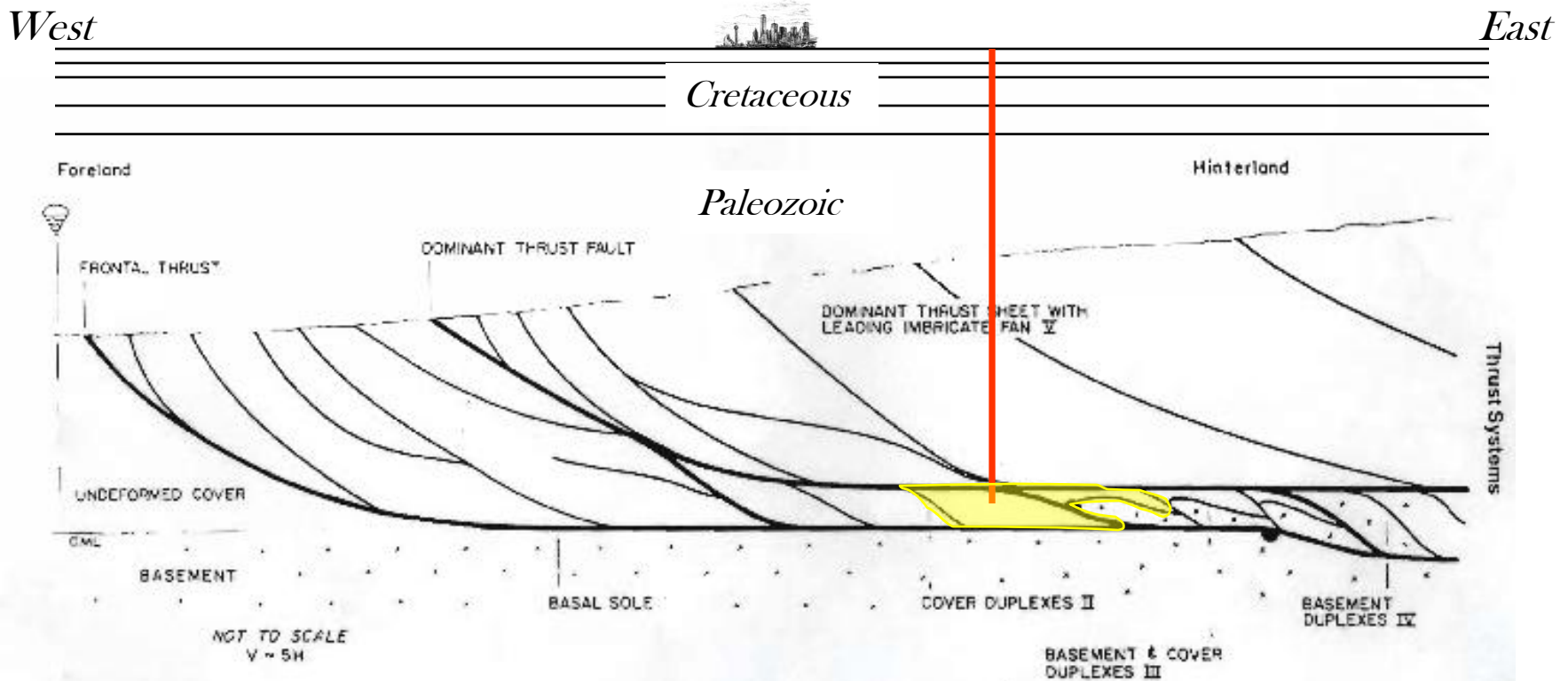


FIG. 30—Idealized sketch of thrust belt with dominant sheet shows five zones, each with characteristic thrust system and degree of basement involvement. Thrust faults at zone boundaries are bold. Vertically exaggerated and not to scale.

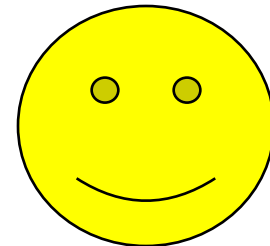
- Faults trend to follow Shales
- Ideal case: Ellenberger being highly fractured

Missing Pieces

- Ellenberger
 - Flow rates
 - TDS in waters
 - Johnson County Cave System
- Barnett Shale
 - Over-turned in some parts
- Ouachita Fracture Zone
 - Regional Fault Map
 - Cross-section

Andrés Ruzo's Research Wish-list

- Dallas Area 3-d Seismic Data
- Permits to drill in Dallas City Limits
- 10,500 ft well drilled (with testing)
- 265° F Temperatures
- Flow rates
- Water Samples (for TDS)
- Binary Cycle Power Plant





Engineering & Legal Feasibility Results



Engineering

- Plant schematics and design were developed to produce 1.2 megawatts of power using UTC Pure Cycle Binary Units and connect it to power destination
- Georgian building at Jack's Pub Site

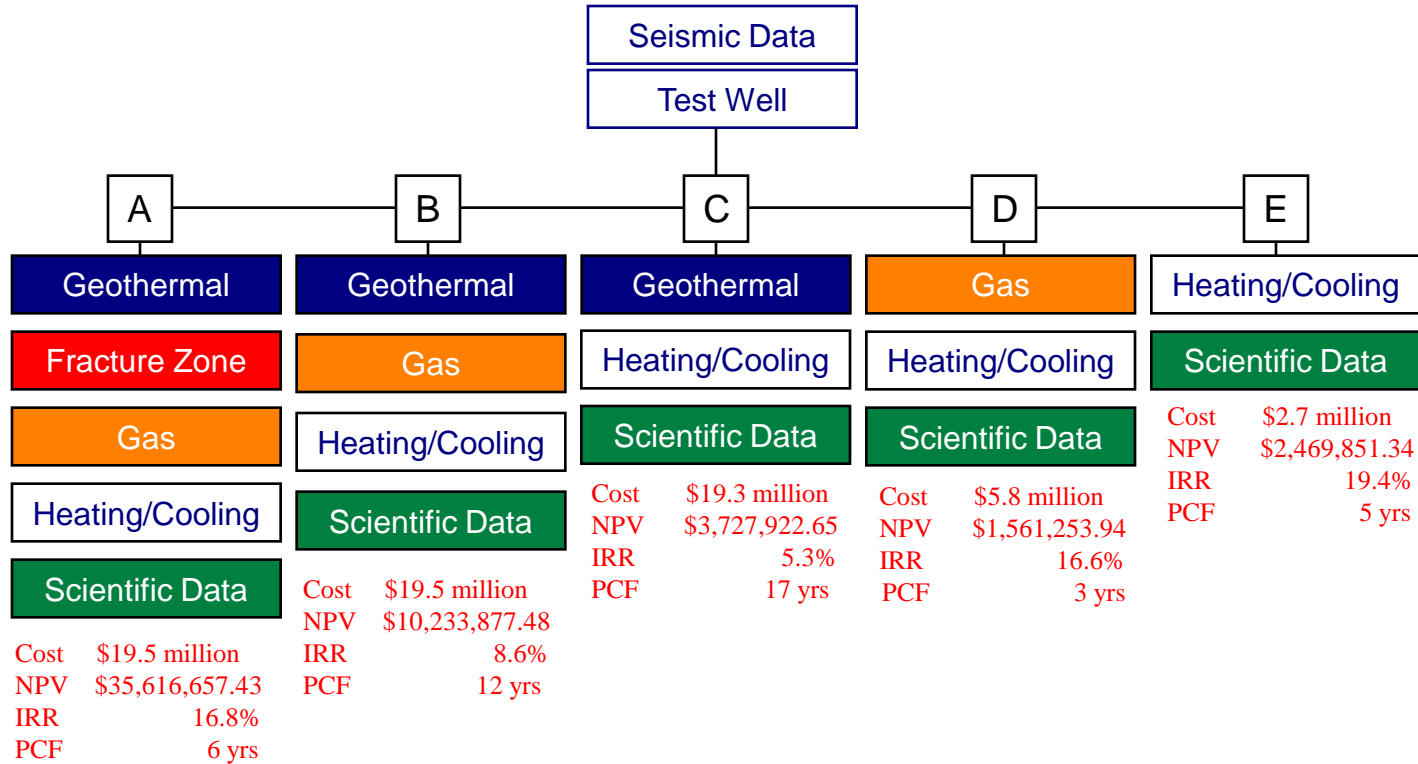


Legal

- Drilling Permits
 - City of Dallas
 - Dallas County
 - Rail Road Commission
- Zoning & Construction Permits
- SMU Mineral Rights



Financial Feasibility Results



Summary of the most likely resource scenarios and their associated financial valuation information. **No** grants or subsidies included.

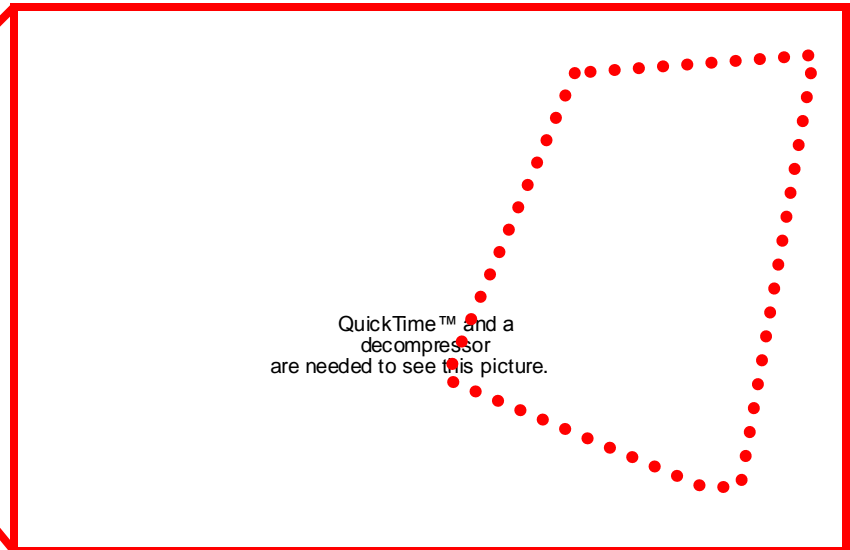
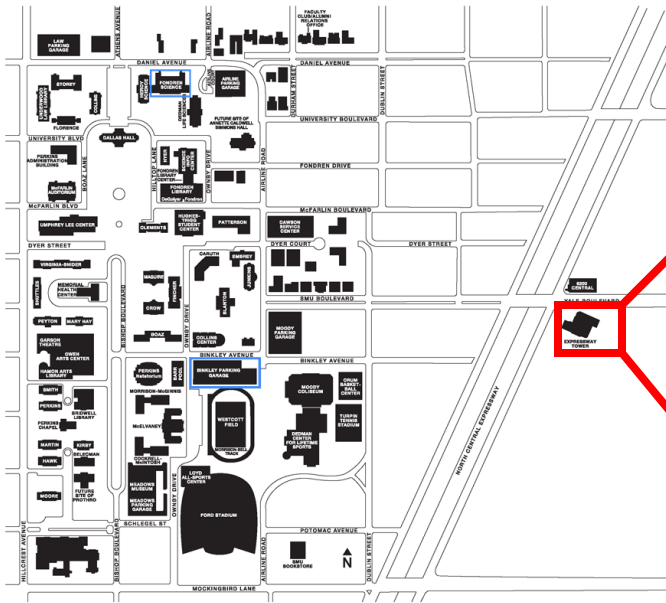


What we originally thought would happen

President Turner's Blessing → US Department of Energy Development Grant

→ Test well → Plant Development →

**SMU Geothermal Plant
&
Energy Research Center**



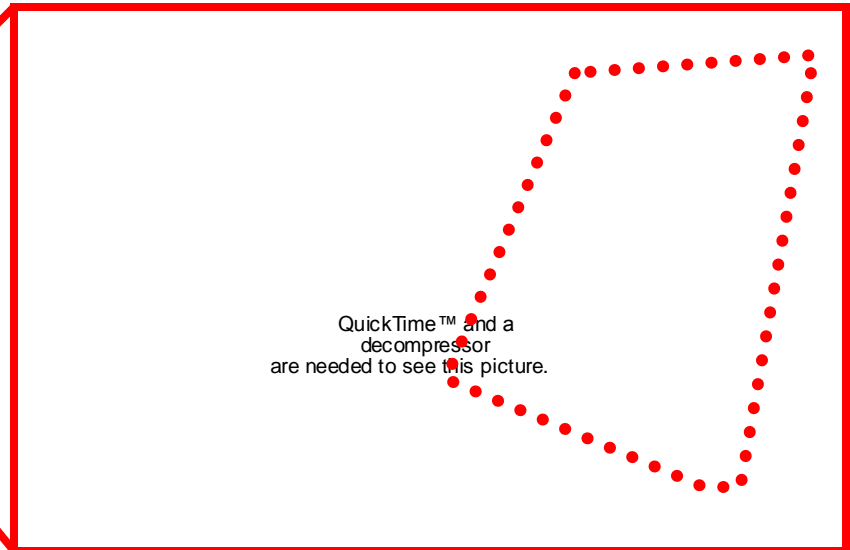


What REALLY happened...

President  Blessing → US Department of  Development Grant

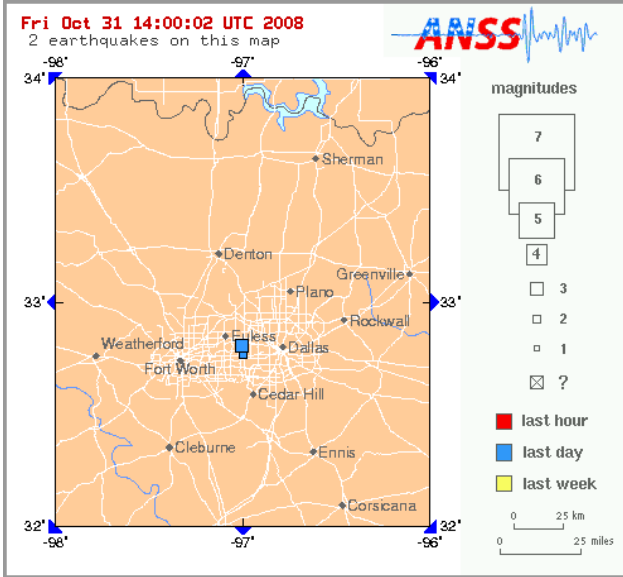
→ ~~Test well~~ → Plan ~~Development~~ →

**SMU Geothermal Plant
&
Energy Research Center**
IOU





What REALLY happened...



QuickTime™ and a decompressor are needed to see this picture.



The battle, but not the war...



SMU Geothermal Plant &
Energy Research Center

IN PLANO.

- Similar geology
- More land (No Shelby)
- Energy need
- Incentives exist
- Legal framework exists
- New friends...

