Seismic Exploration Breakthroughs

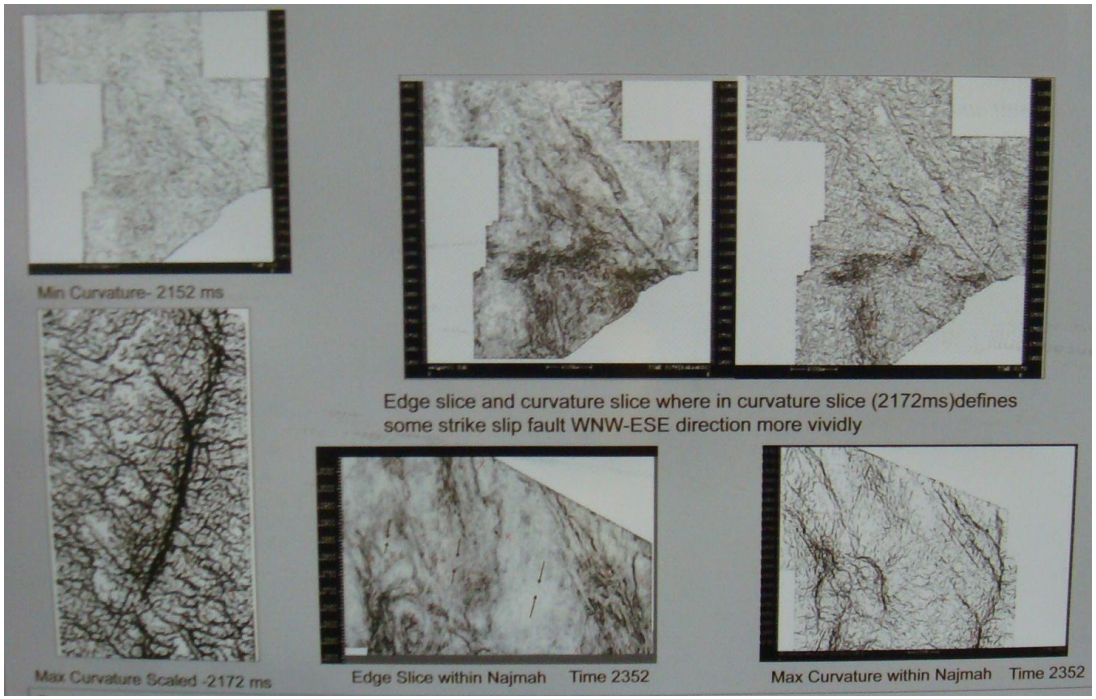
H. Roice Nelson, Jr.

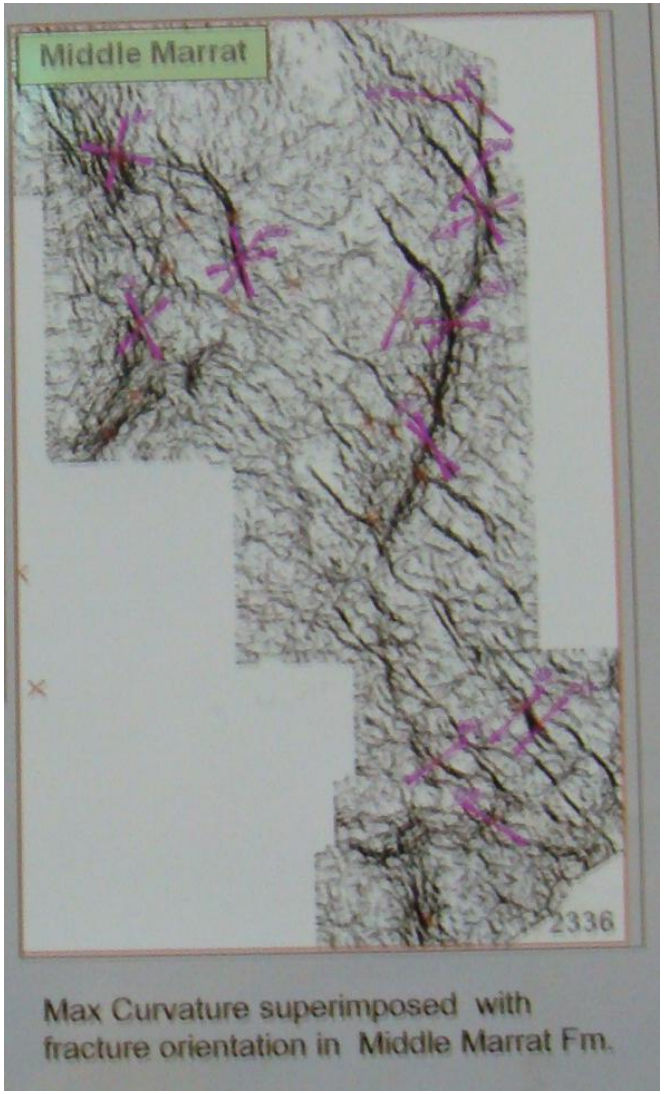
Day 3 Session 6

- Seismic exploration breakthroughs
  - 2-D seismic
  - 3-D seismic
  - 4-D seismic
  - Workstations and visualization
  - Network training and support
- Reservoir evaluation breakthroughs

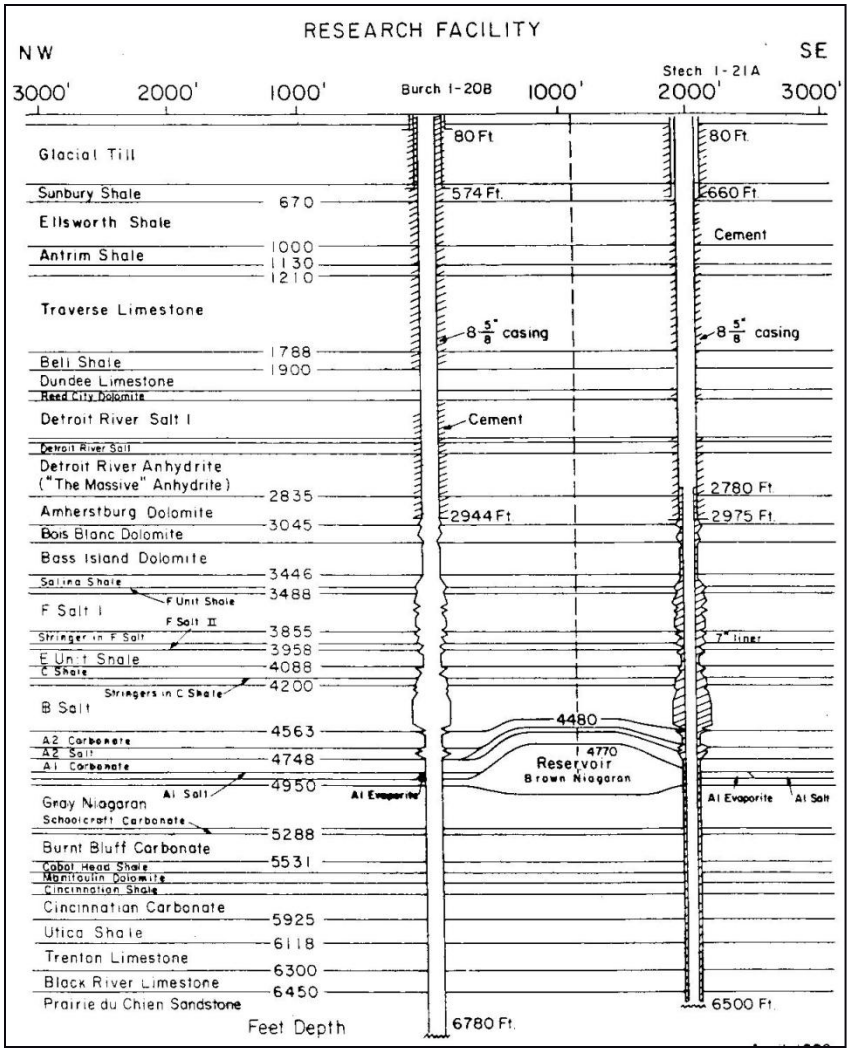
Seismic Exploration Breakthroughs

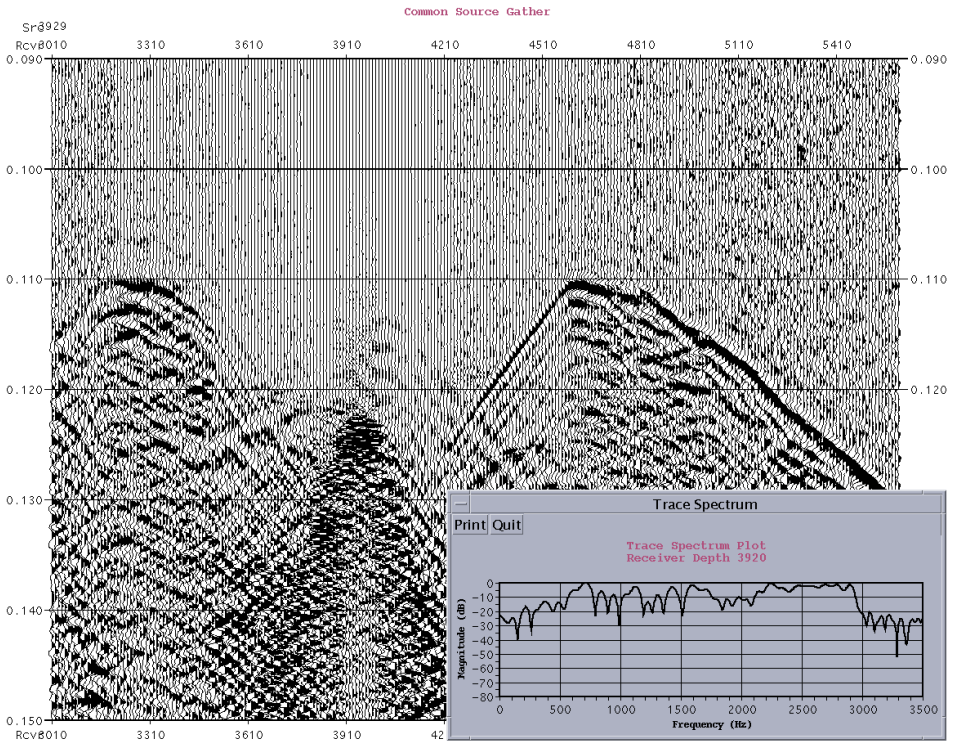
Fracture Definition on 3-D Seismic Surveys
In ADNOC EAGE Advertisement





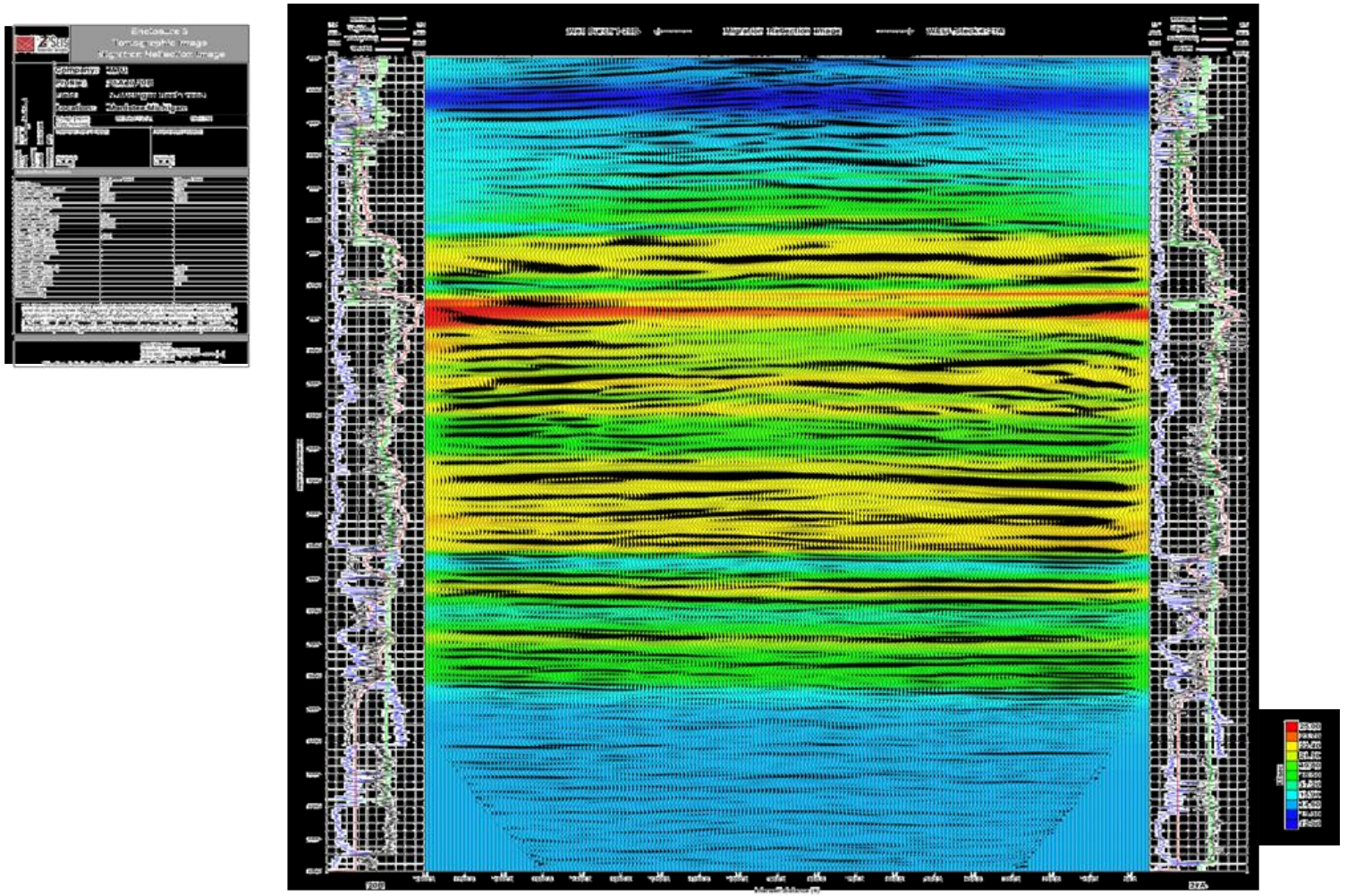
Cross-Well Tomography





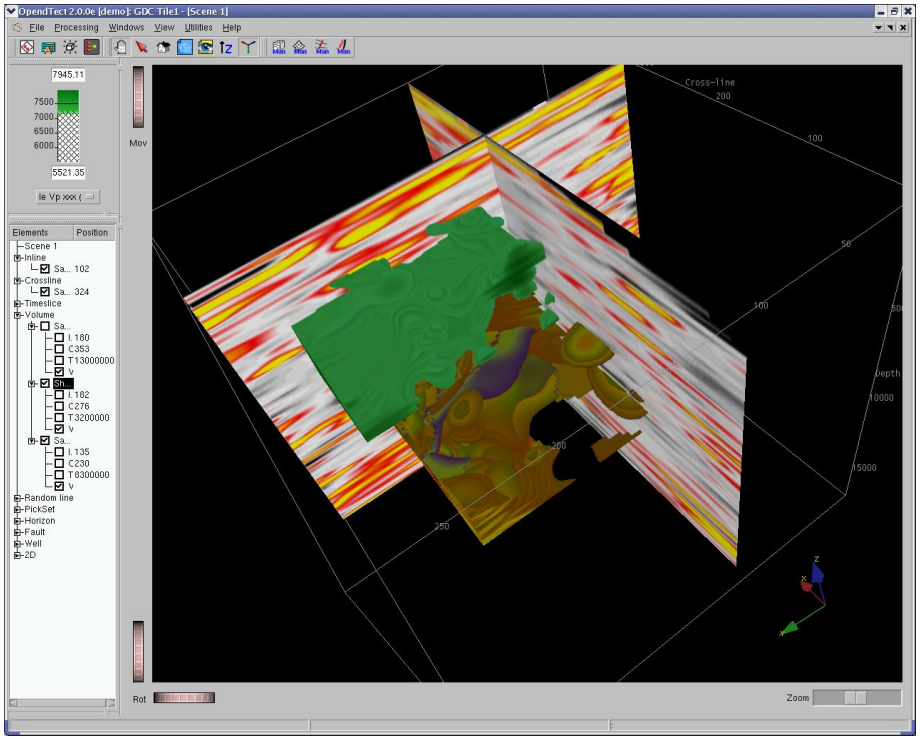
Roger Turpening, **University of Michigan**, Personal Communication.

Cross-Well Tomography

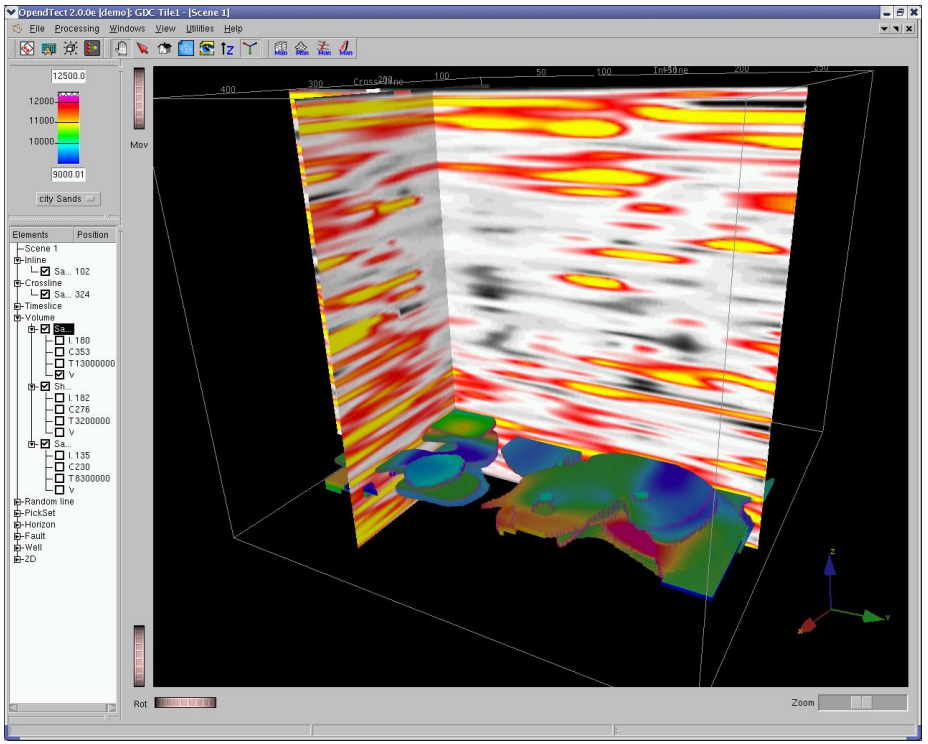


Roger Turpening, **University of Michigan**, Personal Communication.

Test Using OpendTect to Merge Sand Vp, Shale Vp, and Amplitudes



Sand, Sand and Shale Vp

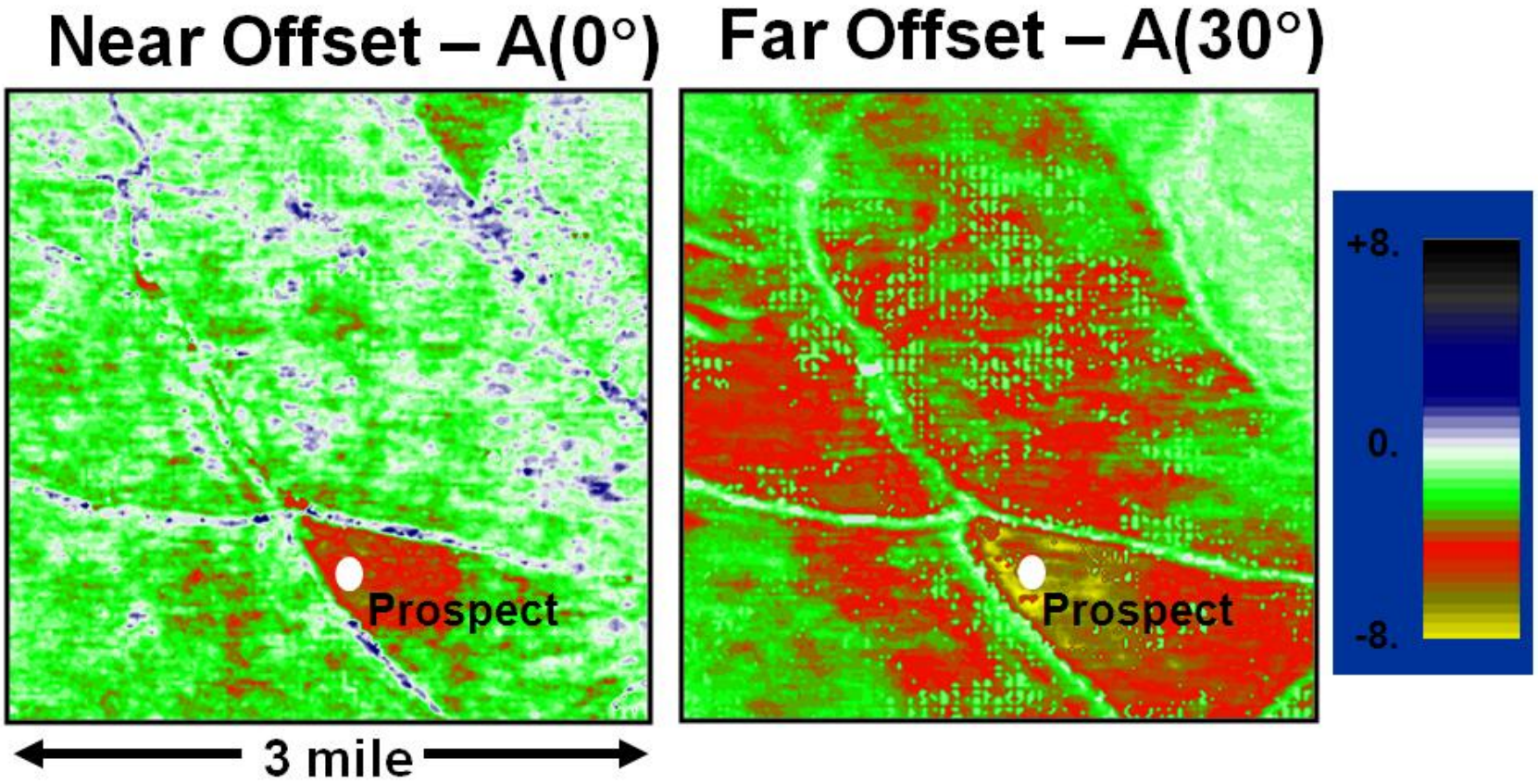


Sand with Sand Vp Color

H. Roice Nelson, Jr., Exploring for Hidden Pay with Rock Properties, **GDC**.

AVO to Reduce Risk of Drilling Fizz

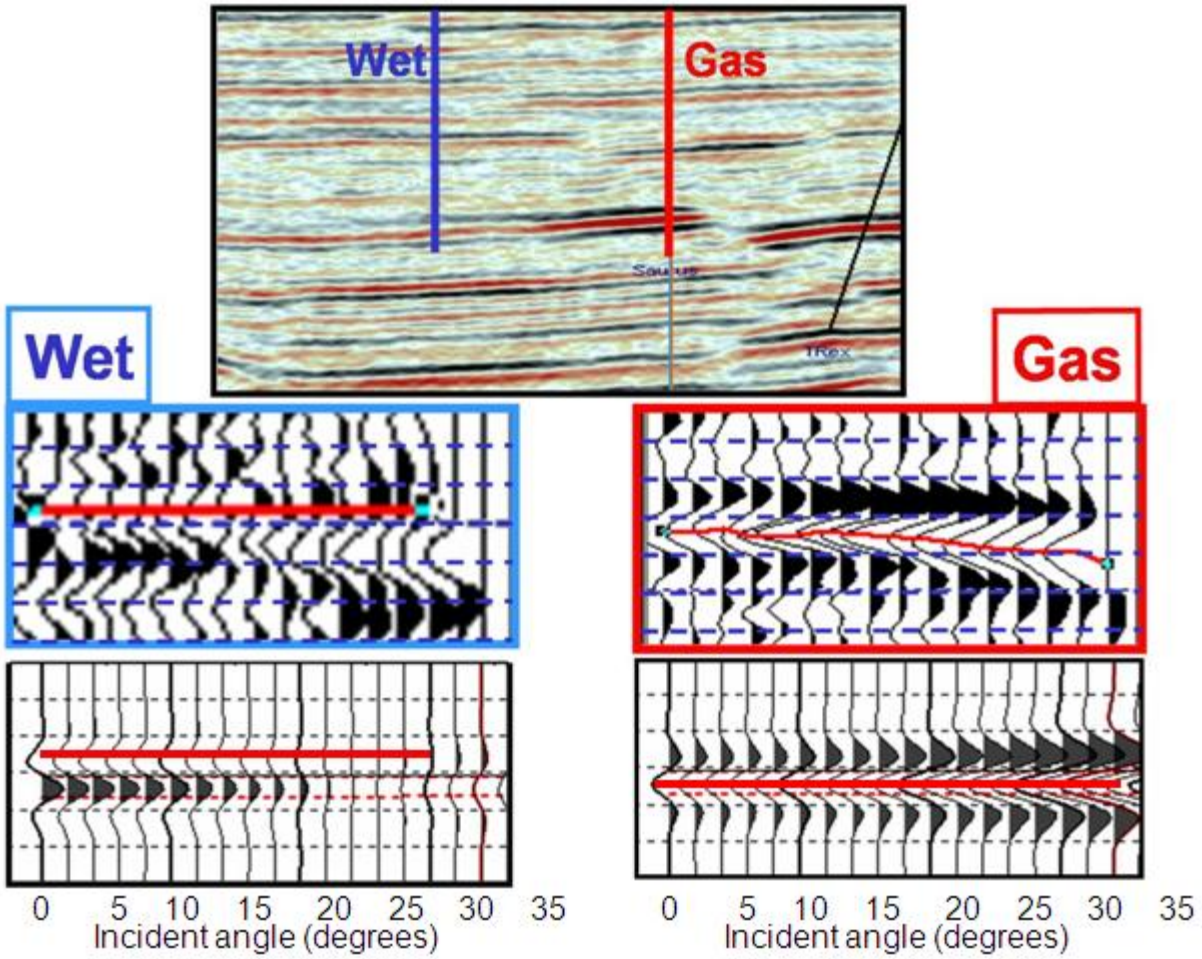
Seismic and Rock Property Trends



Fred Hilterman and students, **UH Reservoir Quantification Lab**, 19 January 2006

Local Seismic Calibration

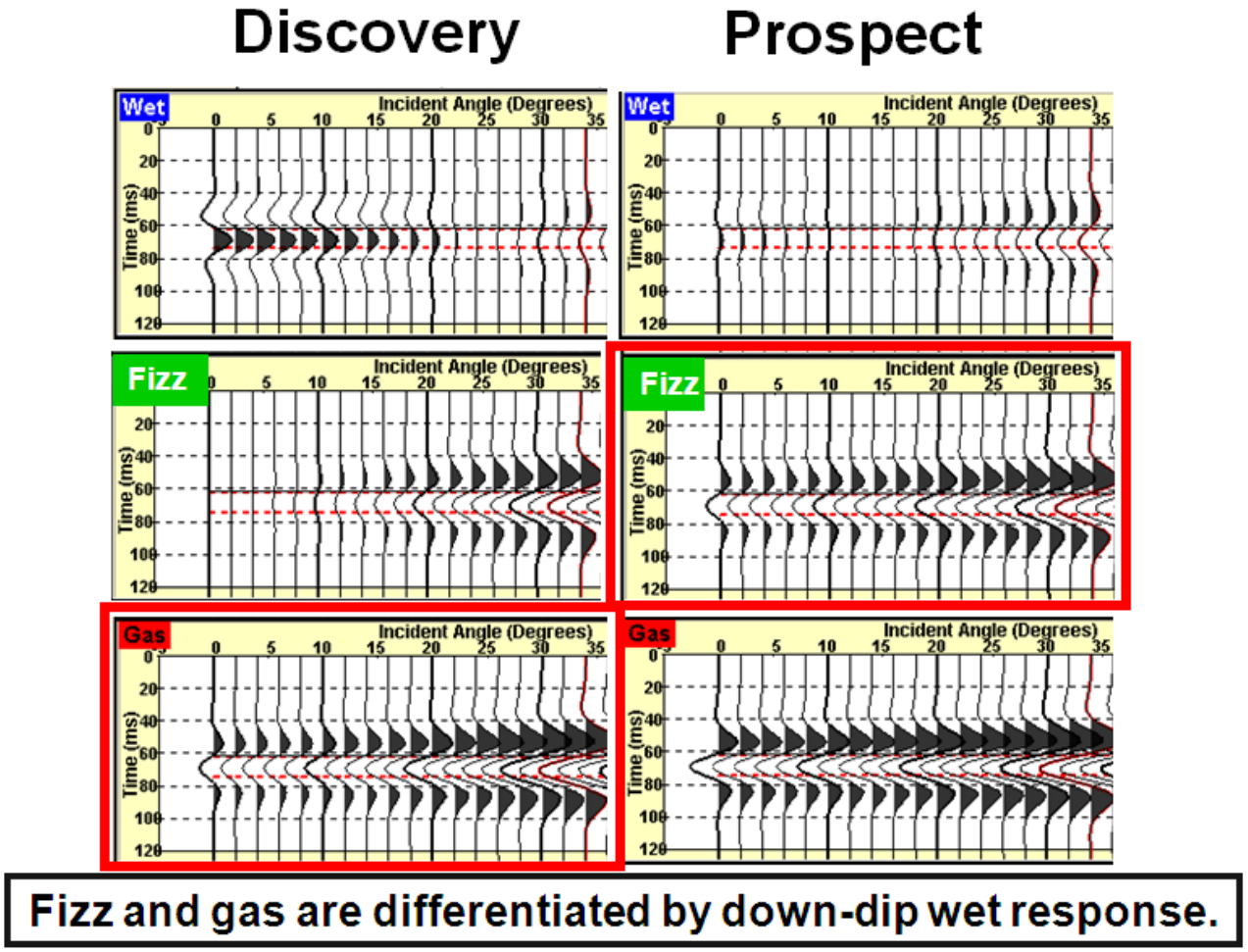
from Seismic and Rock Property Trends



Fred Hilterman and students, **UH Reservoir Quantification Lab**, 19 January 2006

Fizz and Gas Can Be Differentiated

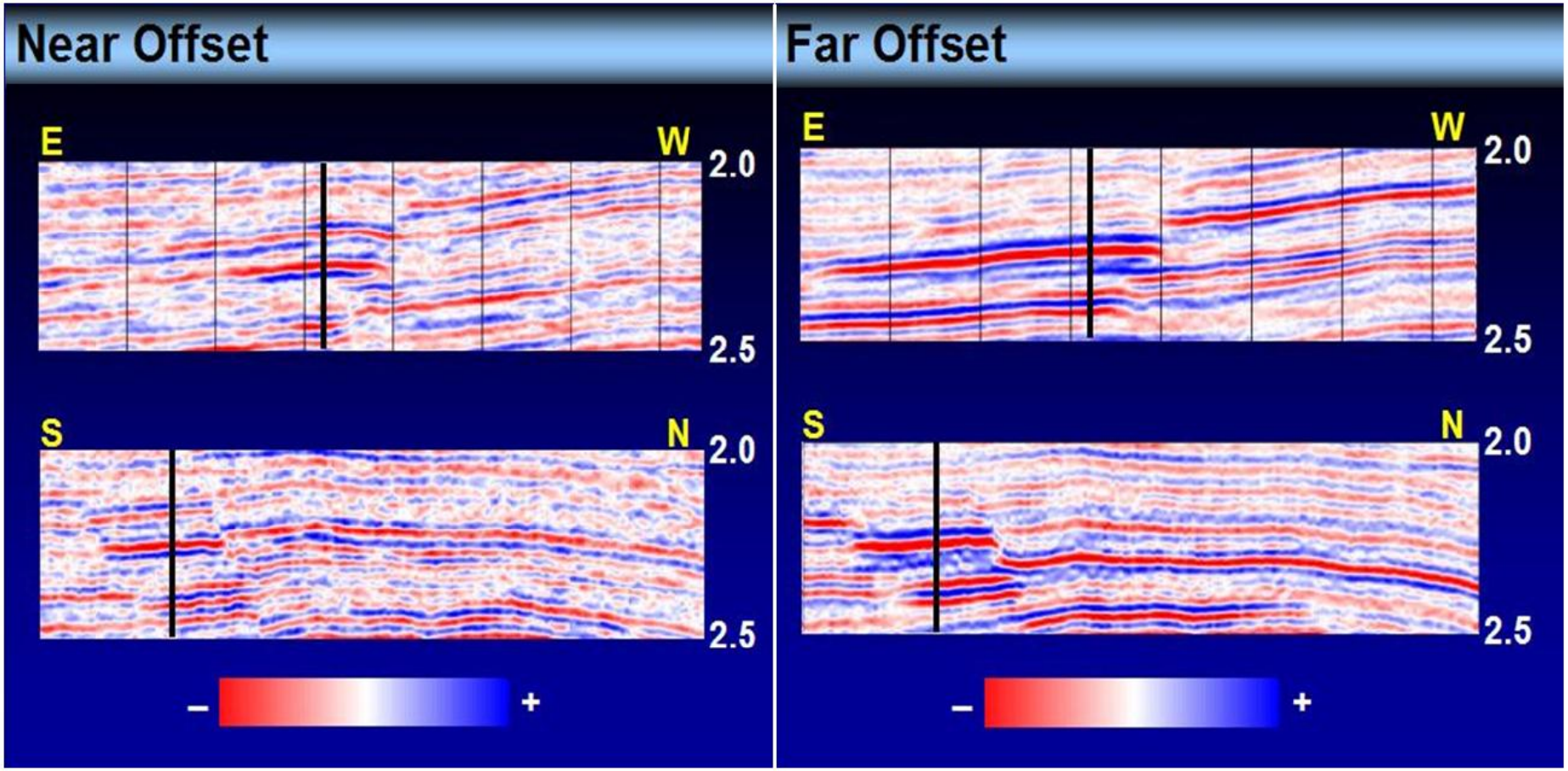
Seismic and Rock Property Trends



Fred Hilterman and students, **UH Reservoir Quantification Lab**, 19 January 2006

Fairfield Provided Seismic Data

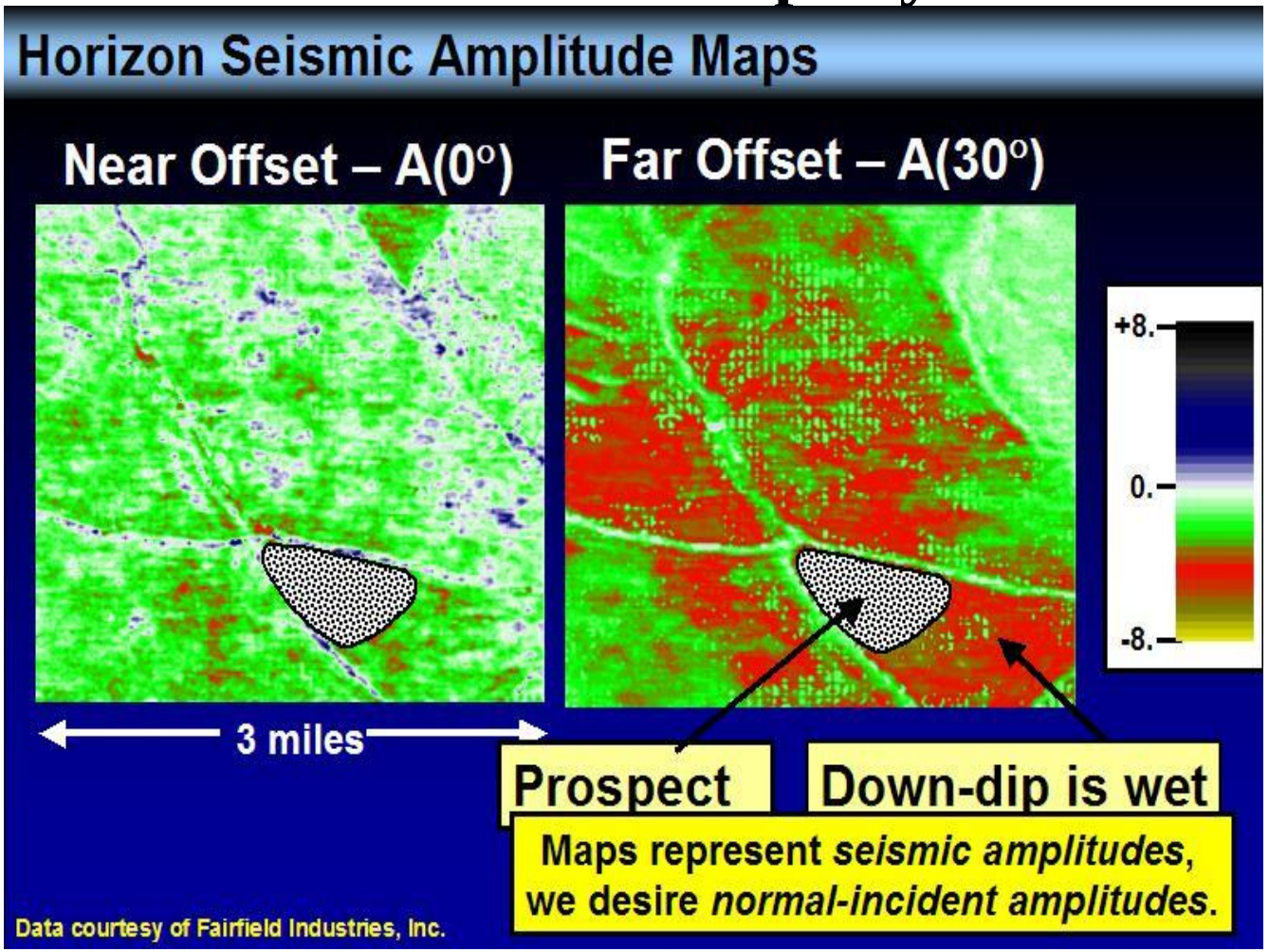
Seismic and Rock Property Trends



Fred Hilterman and students, **UH Reservoir Quantification Lab**, 19 January 2006

Extract Amplitudes Near and Far Offsets

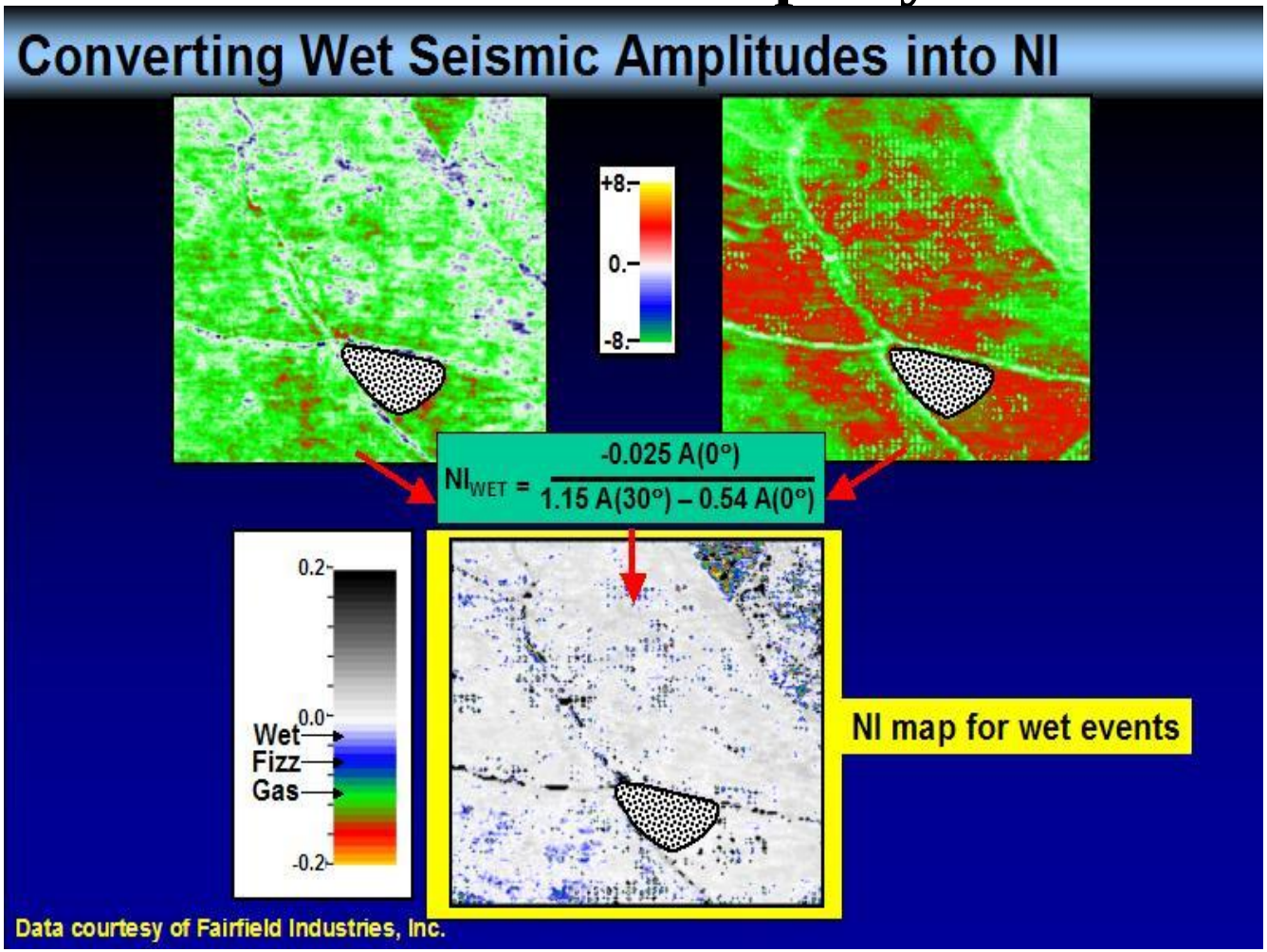
Seismic and Rock Property Trends



Fred Hilterman and students, **UH Reservoir Quantification Lab**, 19 January 2006

Convert Wet Amplitudes to Normal Incidence

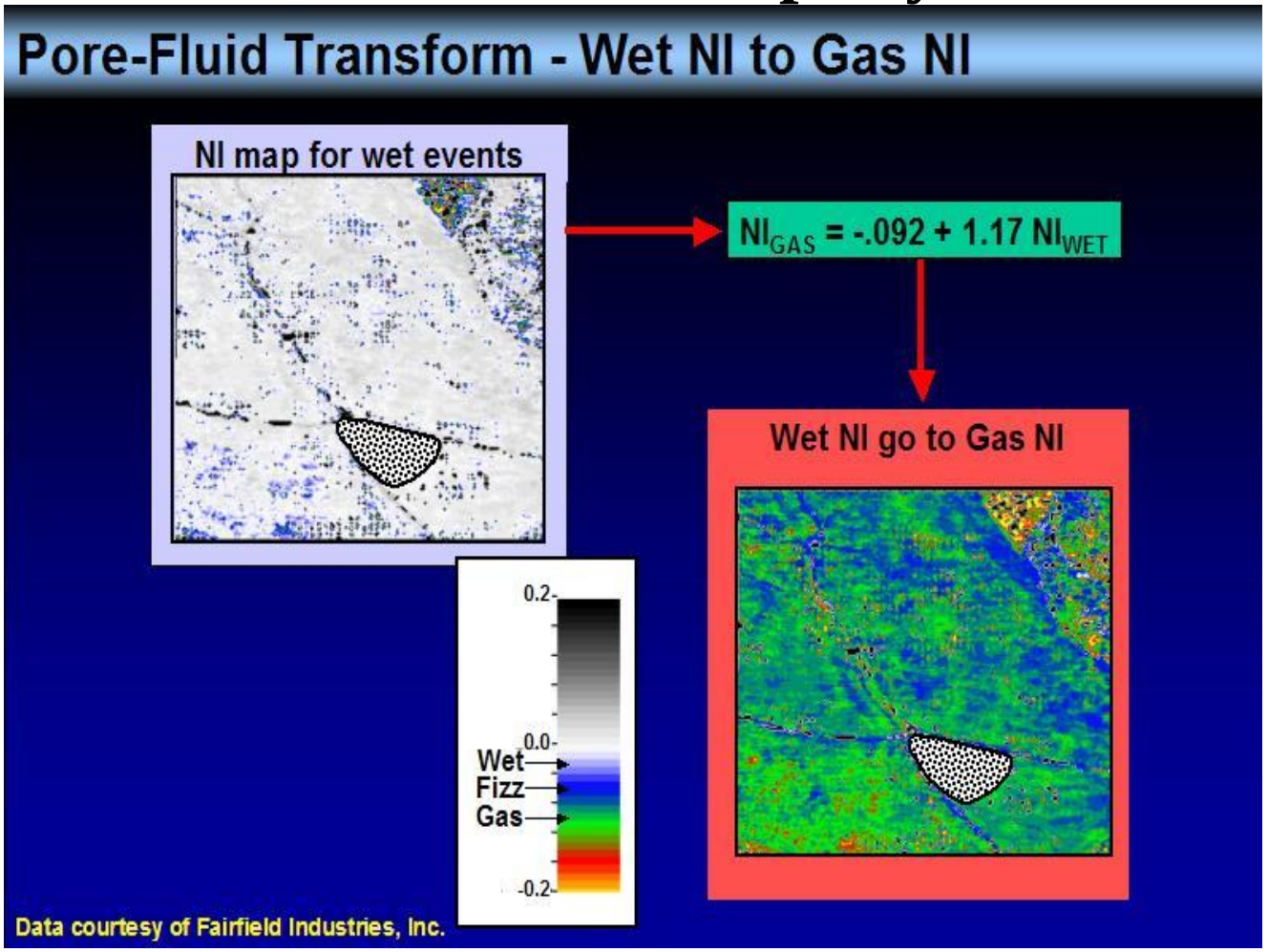
Seismic and Rock Property Trends



Fred Hilterman and students, **UH Reservoir Quantification Lab**, 19 January 2006

Convert Wet Normal Incidence to Gas NI

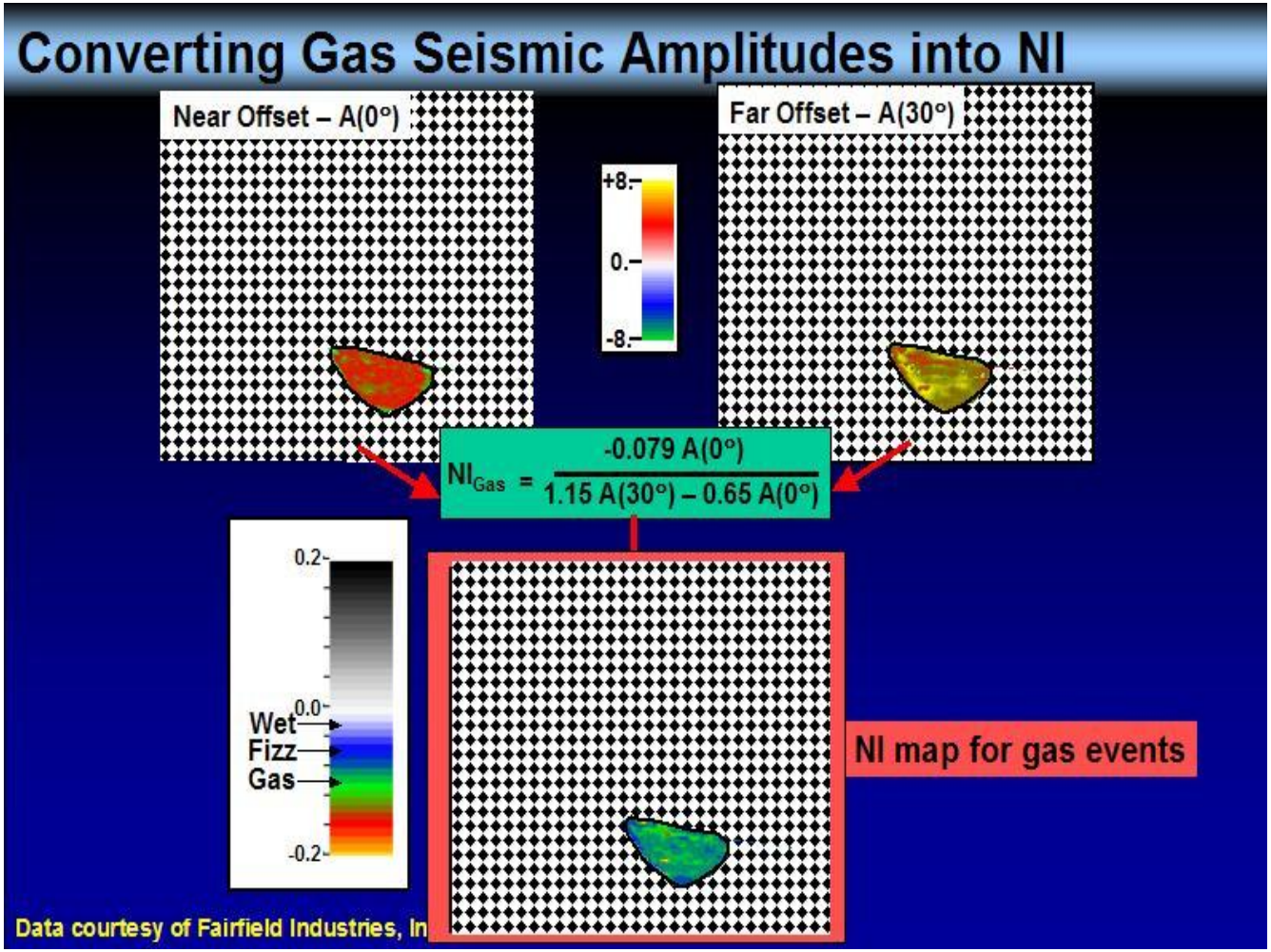
Seismic and Rock Property Trends



Fred Hilterman and students, **UH Reservoir Quantification Lab**, 19 January 2006

Convert Gas Amplitudes to Normal Incidence

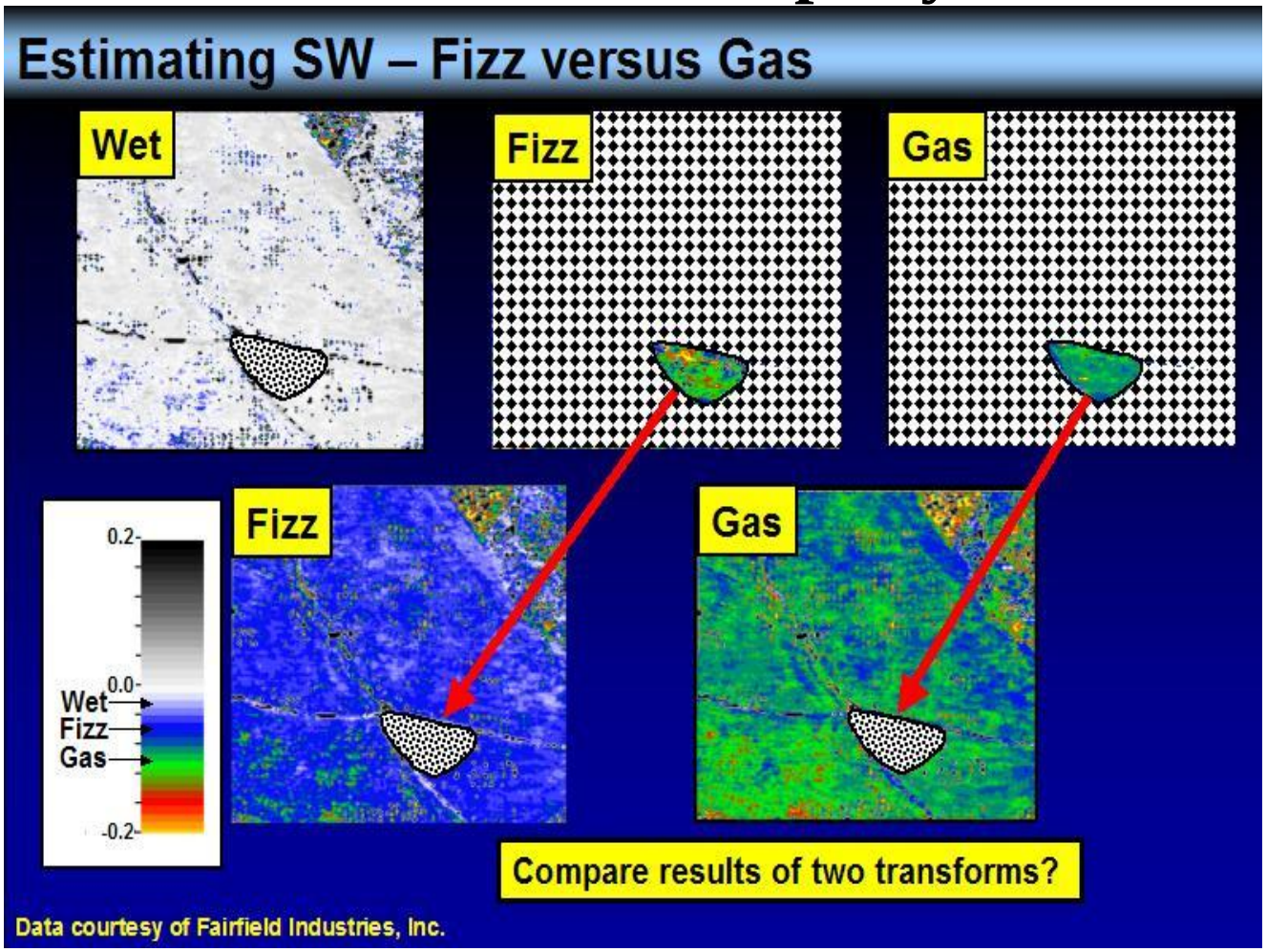
Seismic and Rock Property Trends



Fred Hilterman and students, **UH Reservoir Quantification Lab**, 19 January 2006

Estimate Water Saturations – Fizz vs. Gas

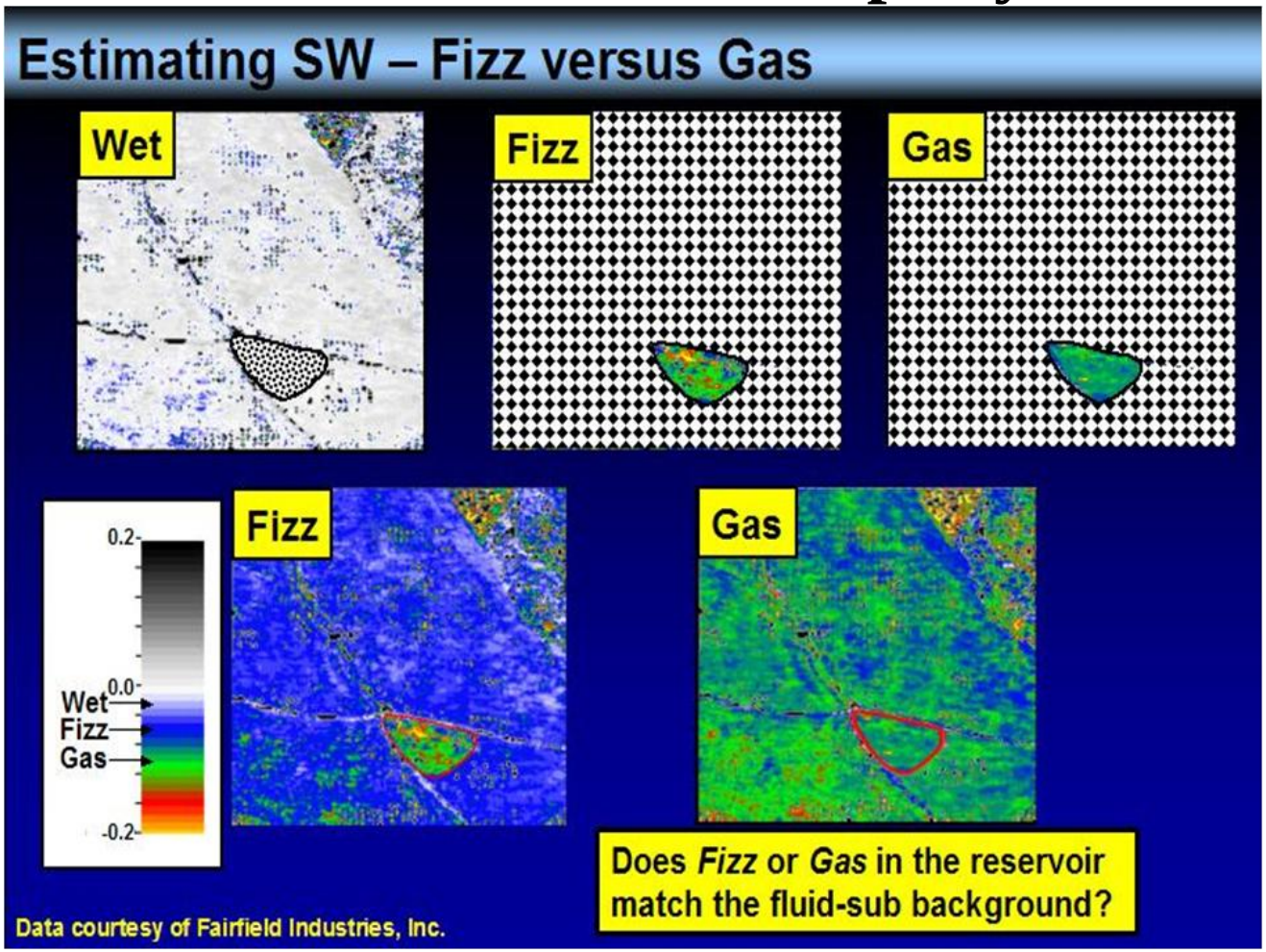
Seismic and Rock Property Trends



Fred Hilterman and students, **UH Reservoir Quantification Lab**, 19 January 2006

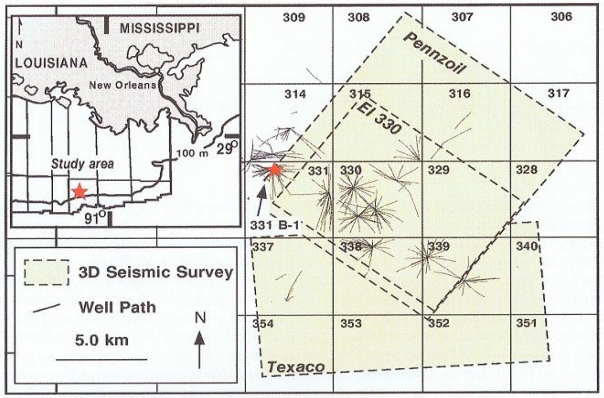
Compare to Fluid Substitution Background

from Seismic and Rock Property Trends

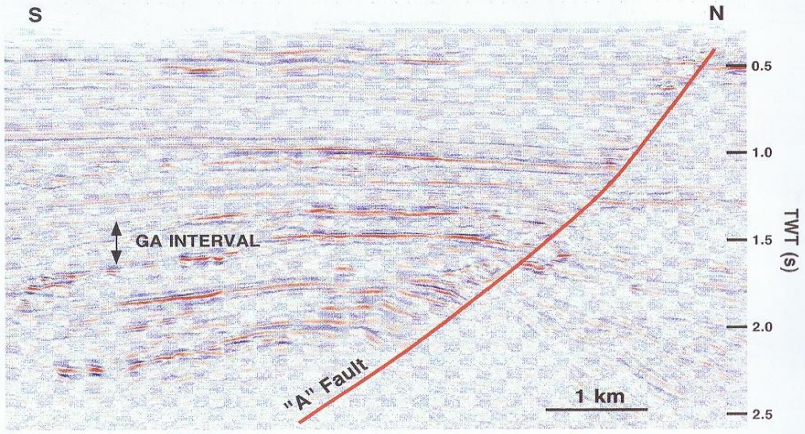


Fred Hilterman and students, **UH Reservoir Quantification Lab**, 19 January 2006

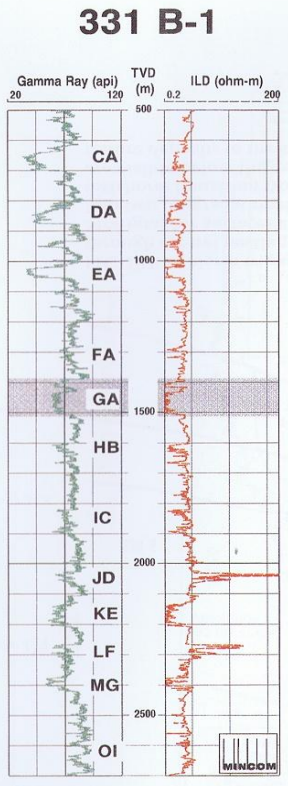
Location (A), Seismic (B), Log (C), and Structure (D) of EI-330 4-D Study Area



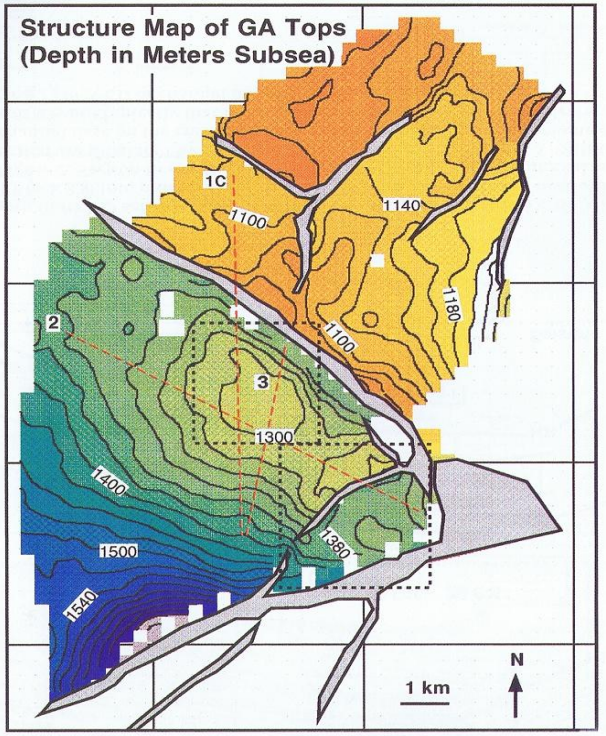
A



B



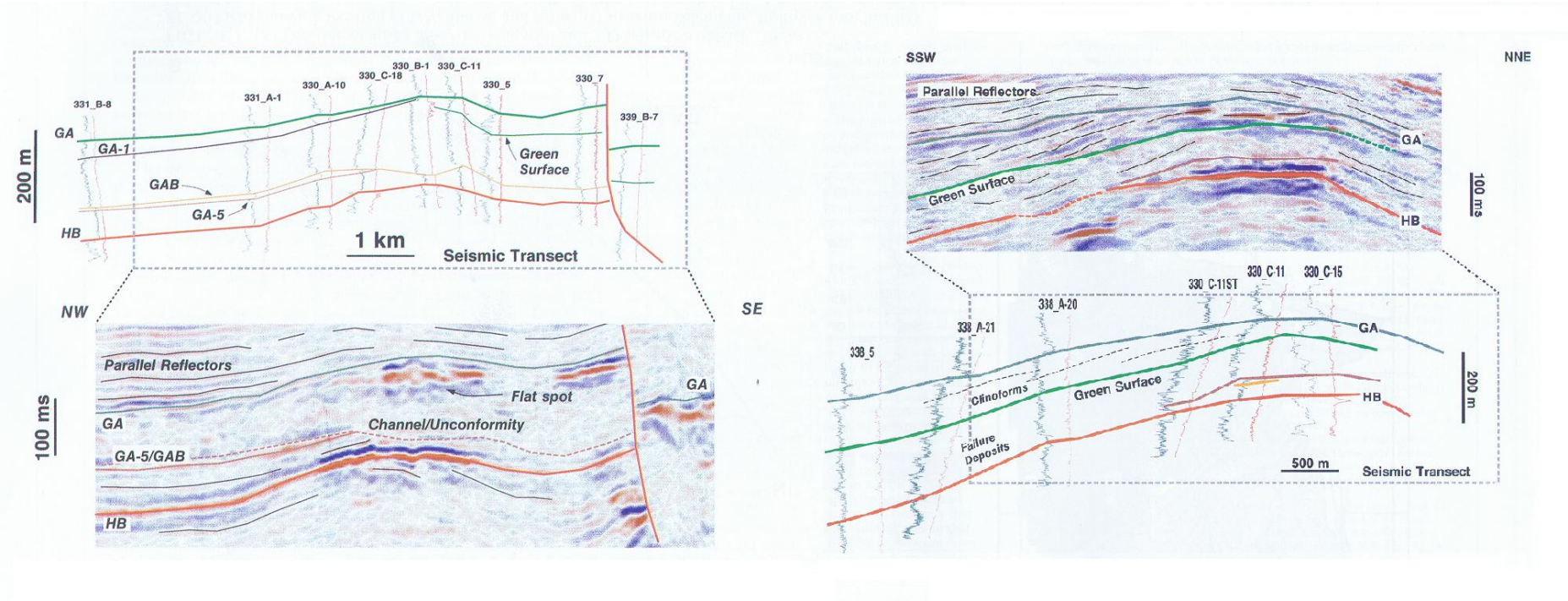
C



D

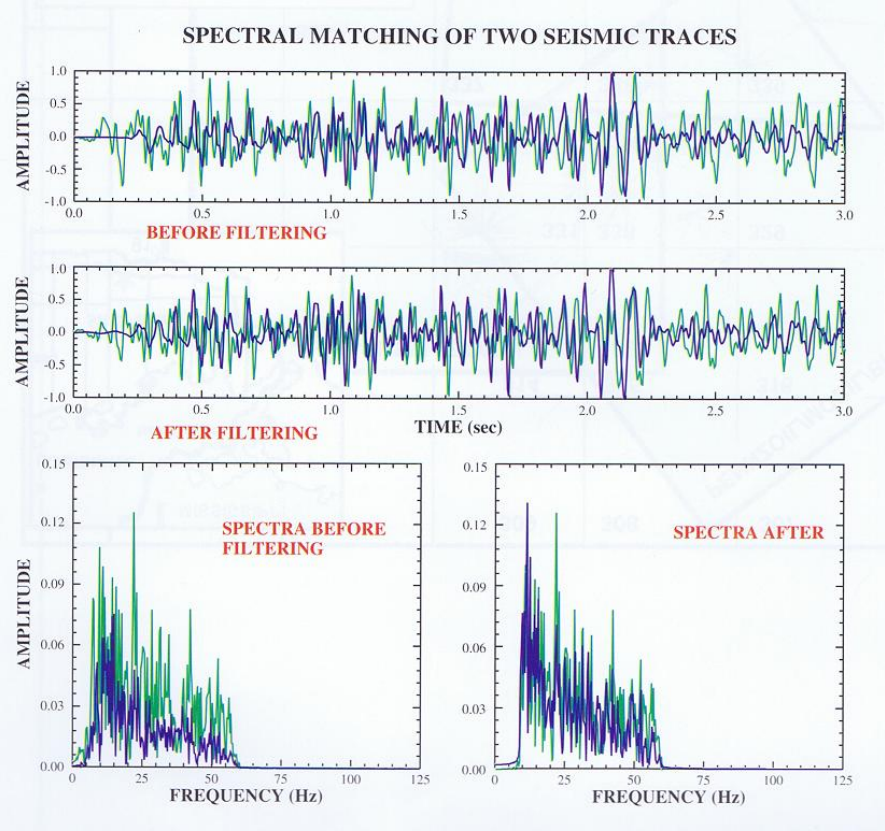
Bruce S. Hart, et. al. in **Application of 3-D Seismic Data to Exploration and Production**, page 21, data from EI-330 Study.

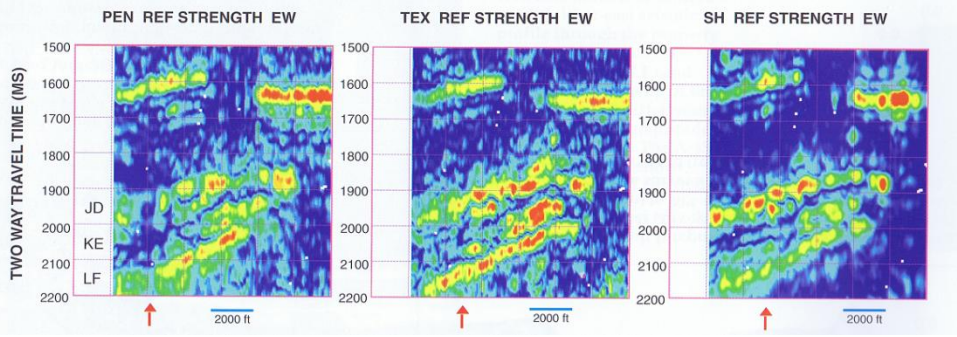
EI-330 Crest Channel Incision and Clinoforms on Seismic and Logs

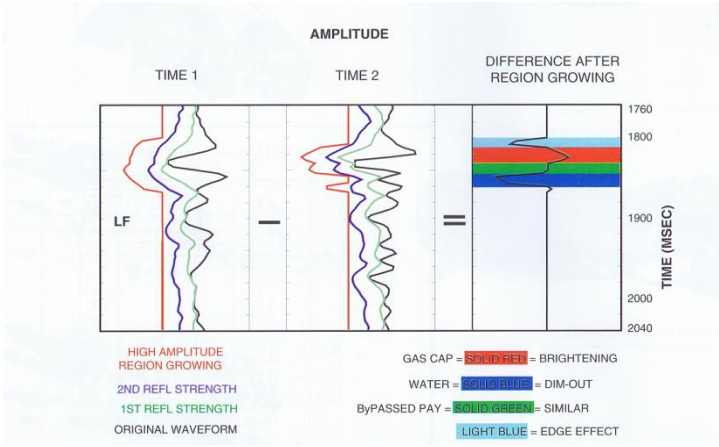


Bruce S. Hart, et. al. in **Application of 3-D Seismic Data to Exploration and Production**, page 24, data from EI-330 Study.

Matching and Differencing Seismic from Pennzoil, Texaco, and Shell at EI-330

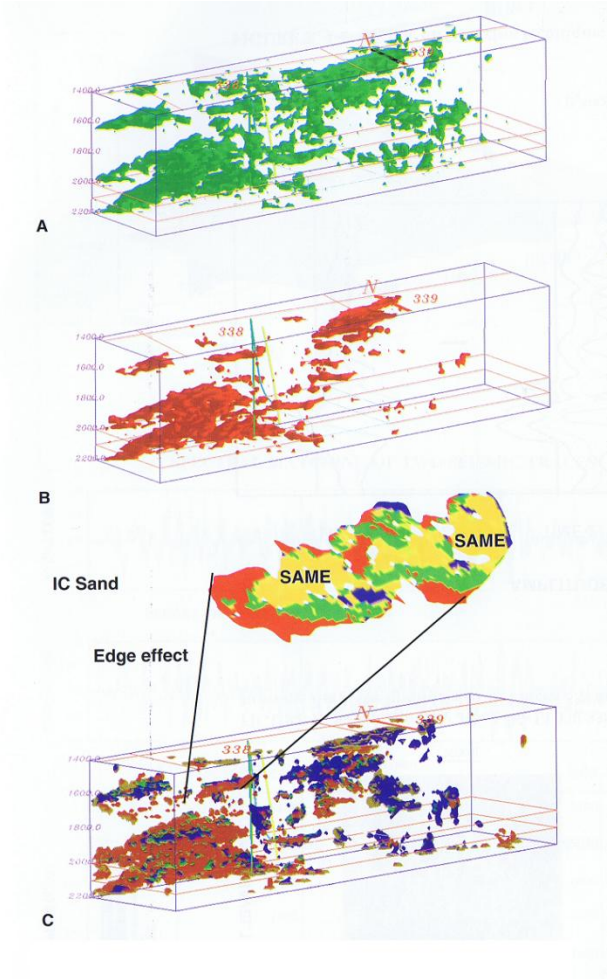


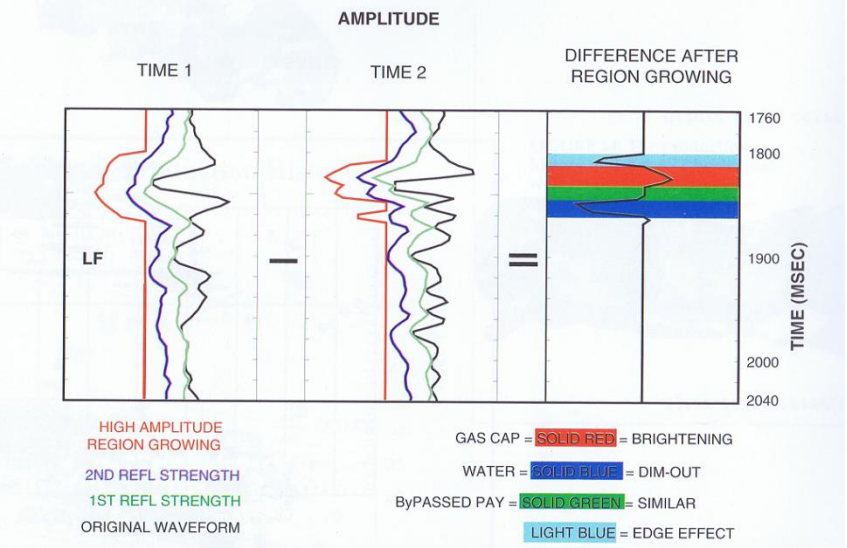




Roger N. Anderson, et. al. in **Application of 3-D Seismic Data to Exploration and Production**, pages 14-15, data from EI-330 Study.

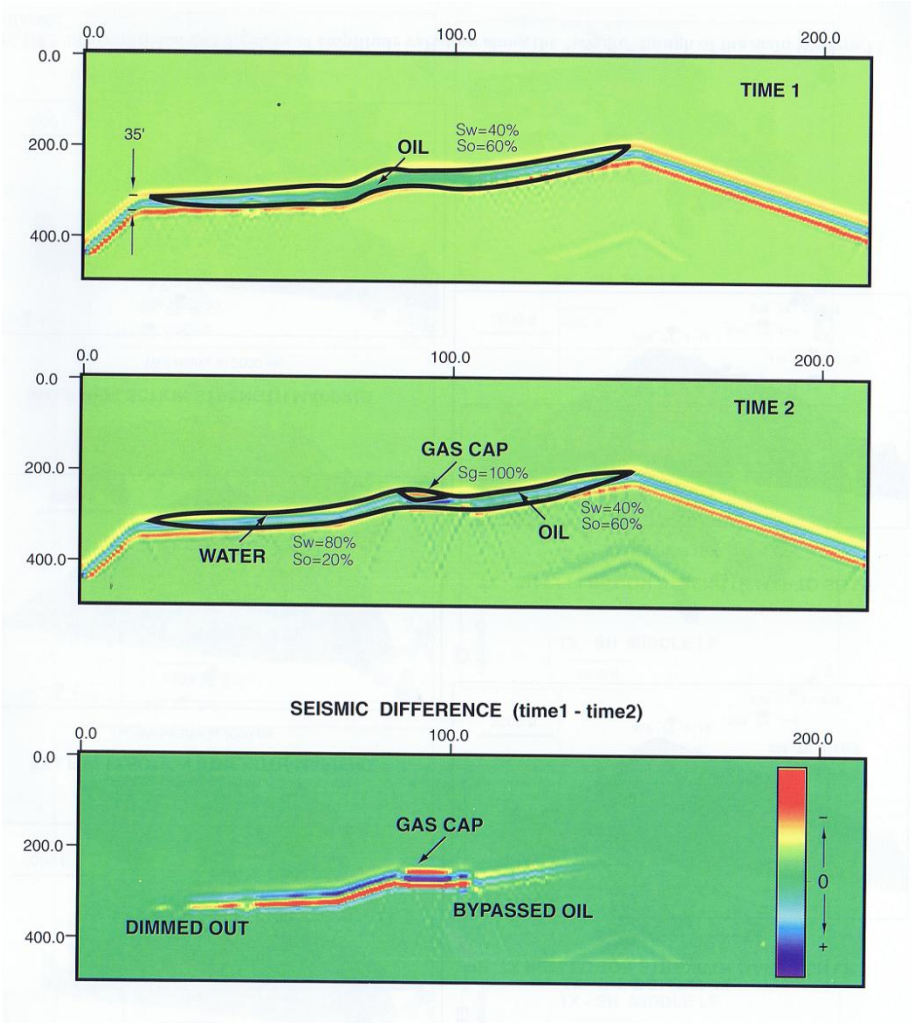
Growth of High Amplitude Area From Time 1985 (A: Pennzoil) to 1988 (B: Texaco)

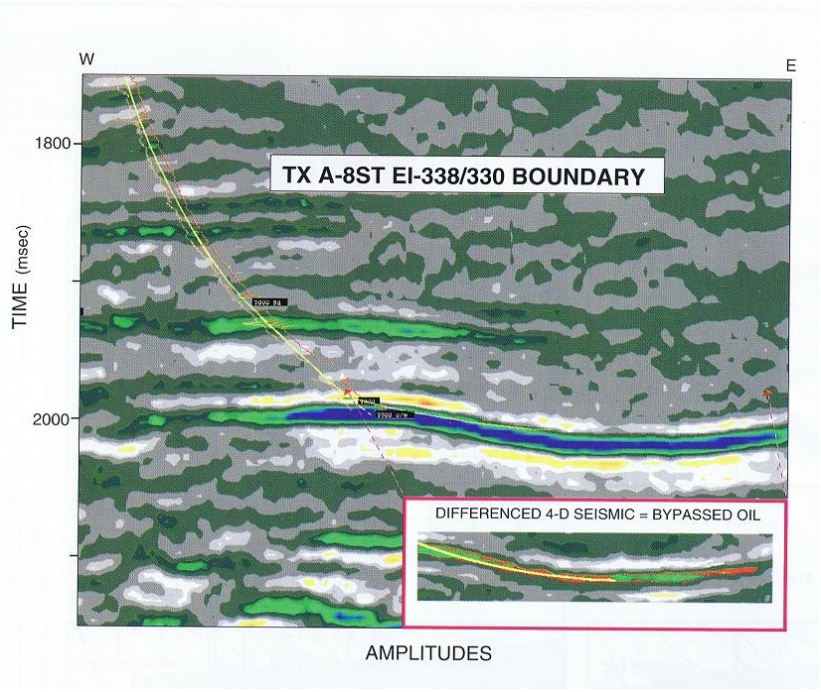




Roger N. Anderson, et. al. in **Application of 3-D Seismic Data to Exploration and Production**, pages 15-16, data from EI-330 Study.

By-Passed Oil Modeled and Interpreted From Time 1985 (A: Pennzoil) to 1988 (B: Texaco)

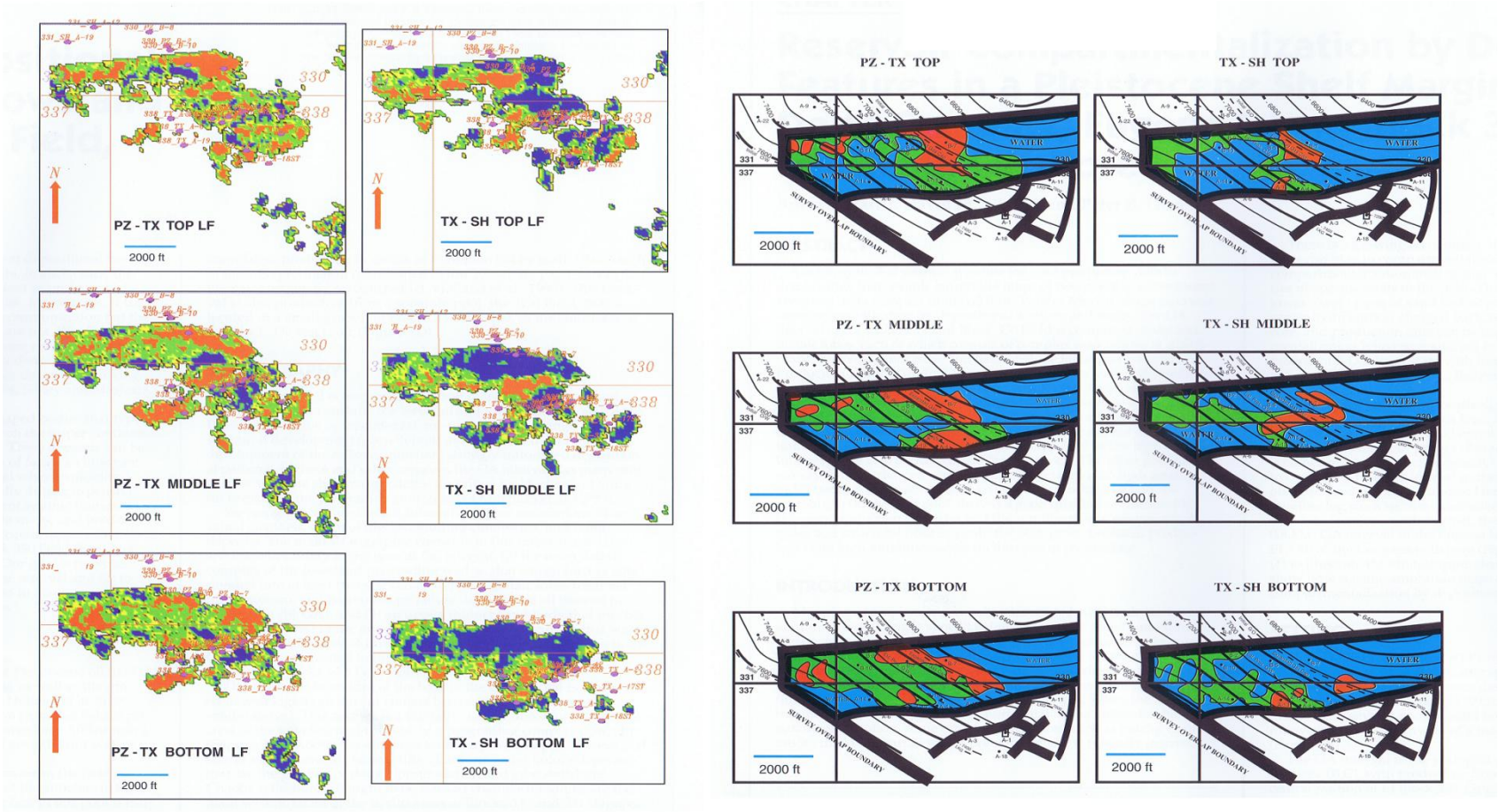




Roger N. Anderson, et. al. in **Application of 3-D Seismic Data to Exploration and Production**, page 17, data from EI-330 Study.

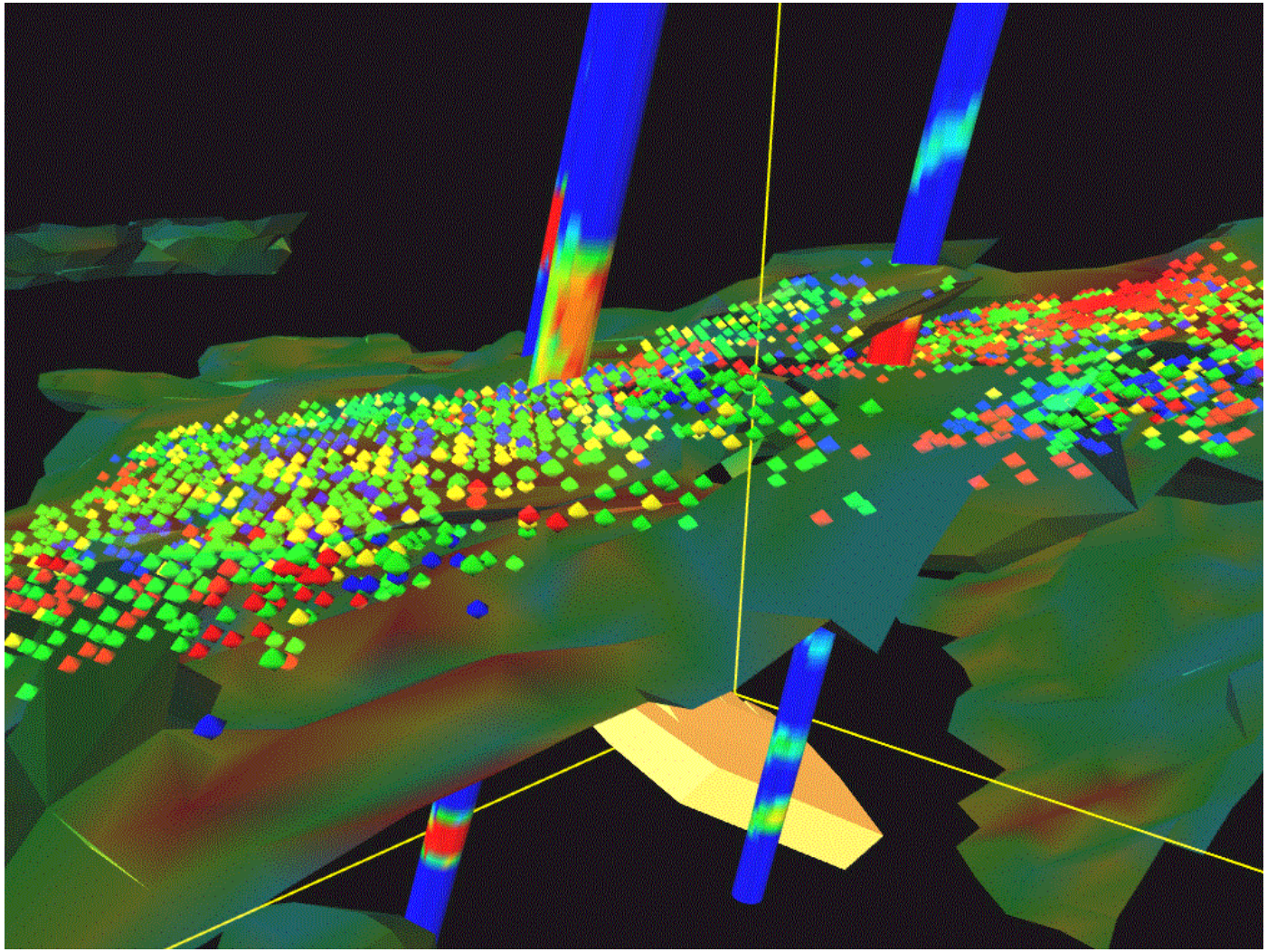
4-D Volumetric Analysis

from Difference Images to Predict Fluid Contacts



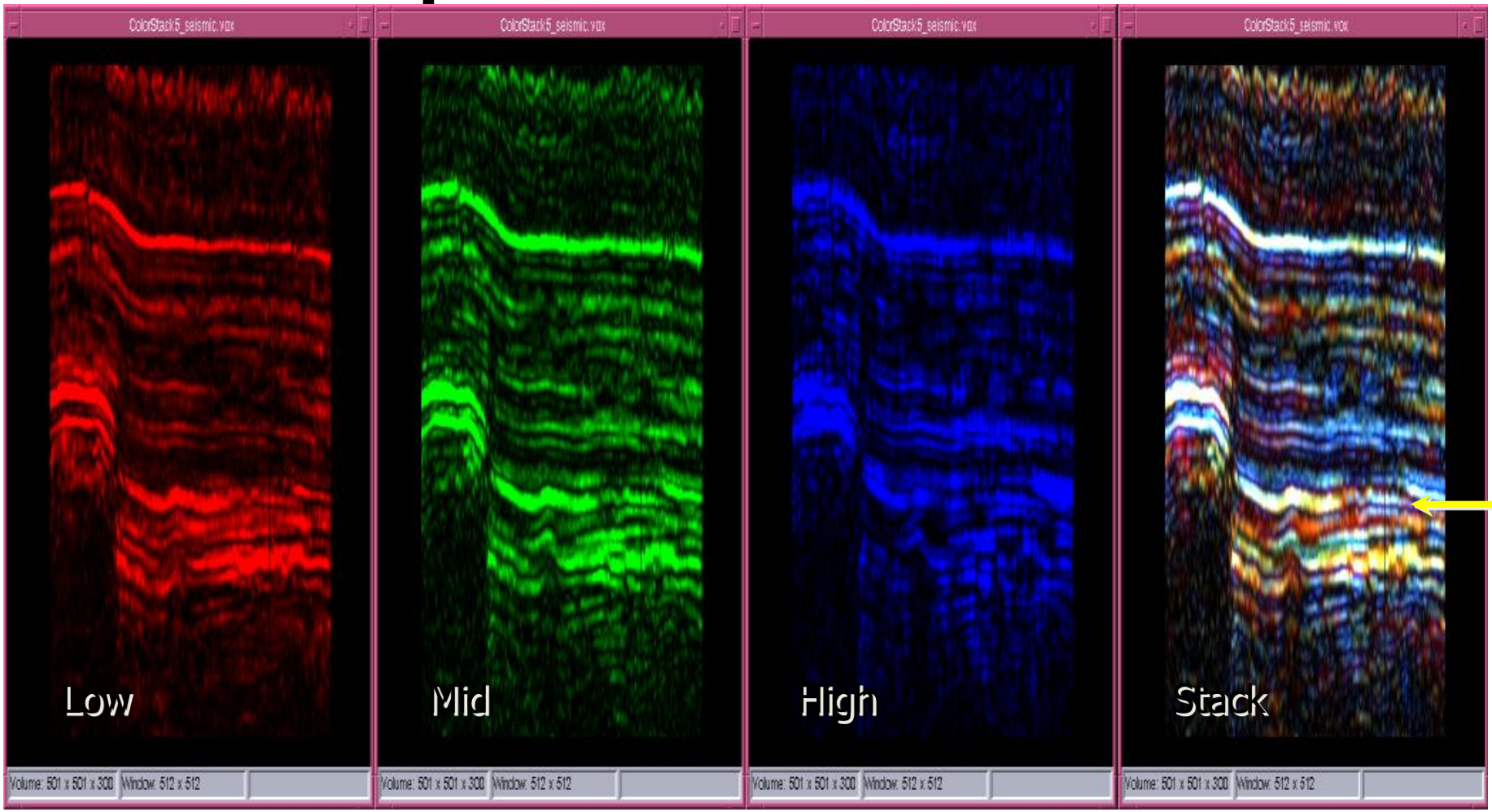
Roger N. Anderson, et. al. in **Application of 3-D Seismic Data to Exploration and Production**, page 19, data from EI-330 Study.

Fluid Flow Visualization



Roger N. Anderson and Albert Boulanger, EI-330 Study, Personal Communication.

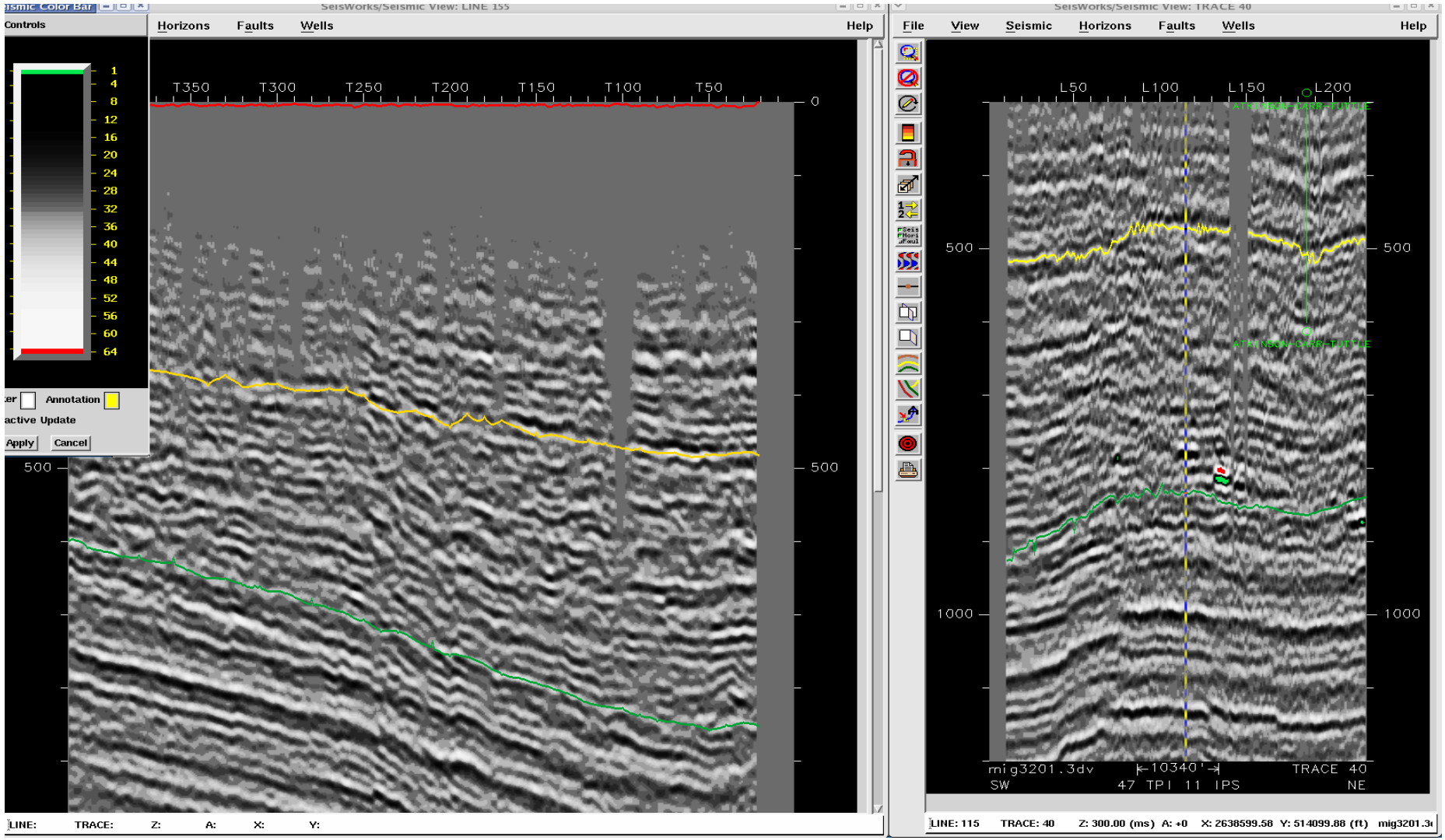
Low, Mid, High Frequency Decompositions and Color Stacks



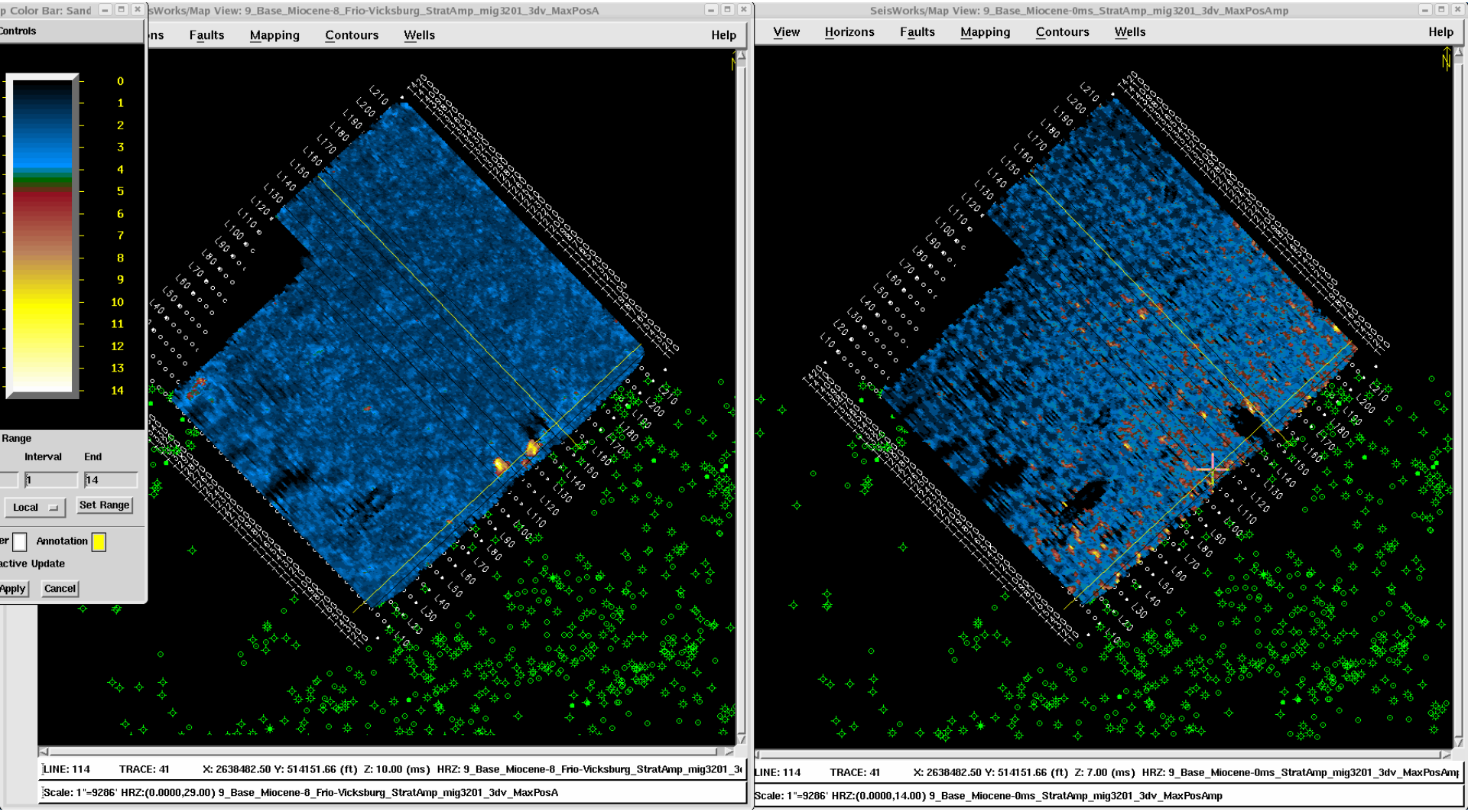
Tracy Stark, **Stark Research**, Personal Communication

Miocene Yellow – Frio Green

Texas Gulf Coast

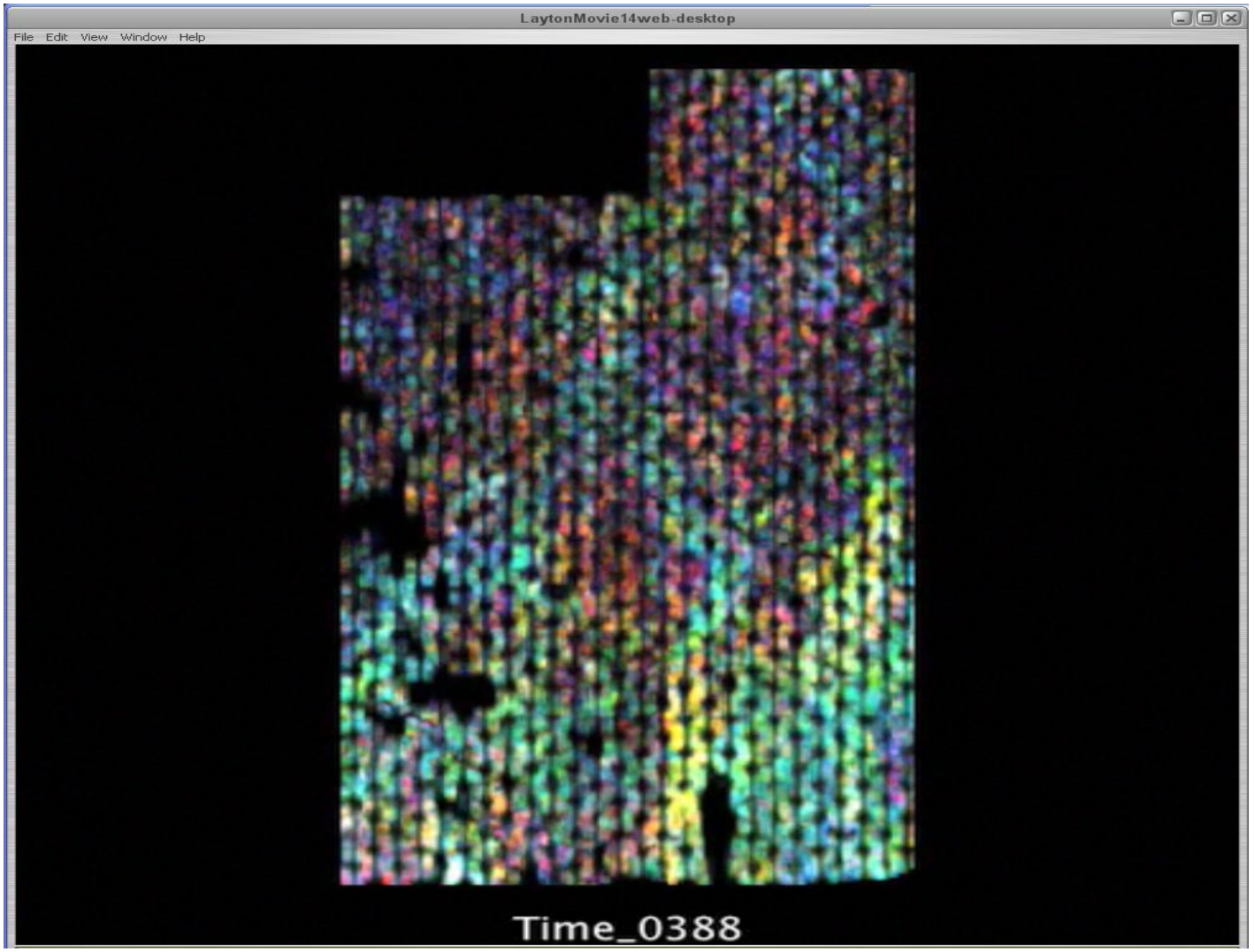


StratAmp: Miocene-Frio (left) 0-Miocene (right)
Texas Gulf Coast



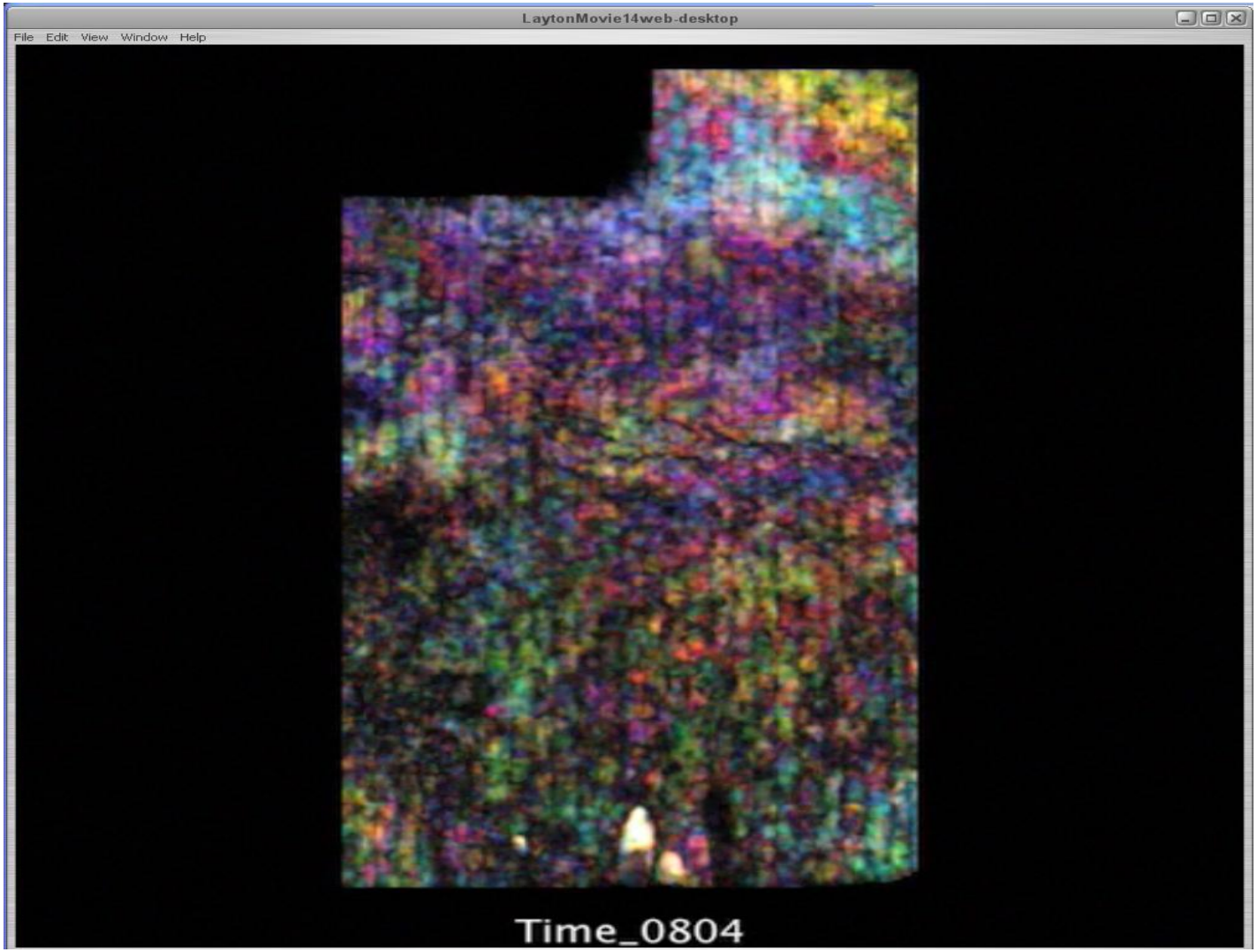
Miocene Channel (yellow)

Texas Gulf Coast



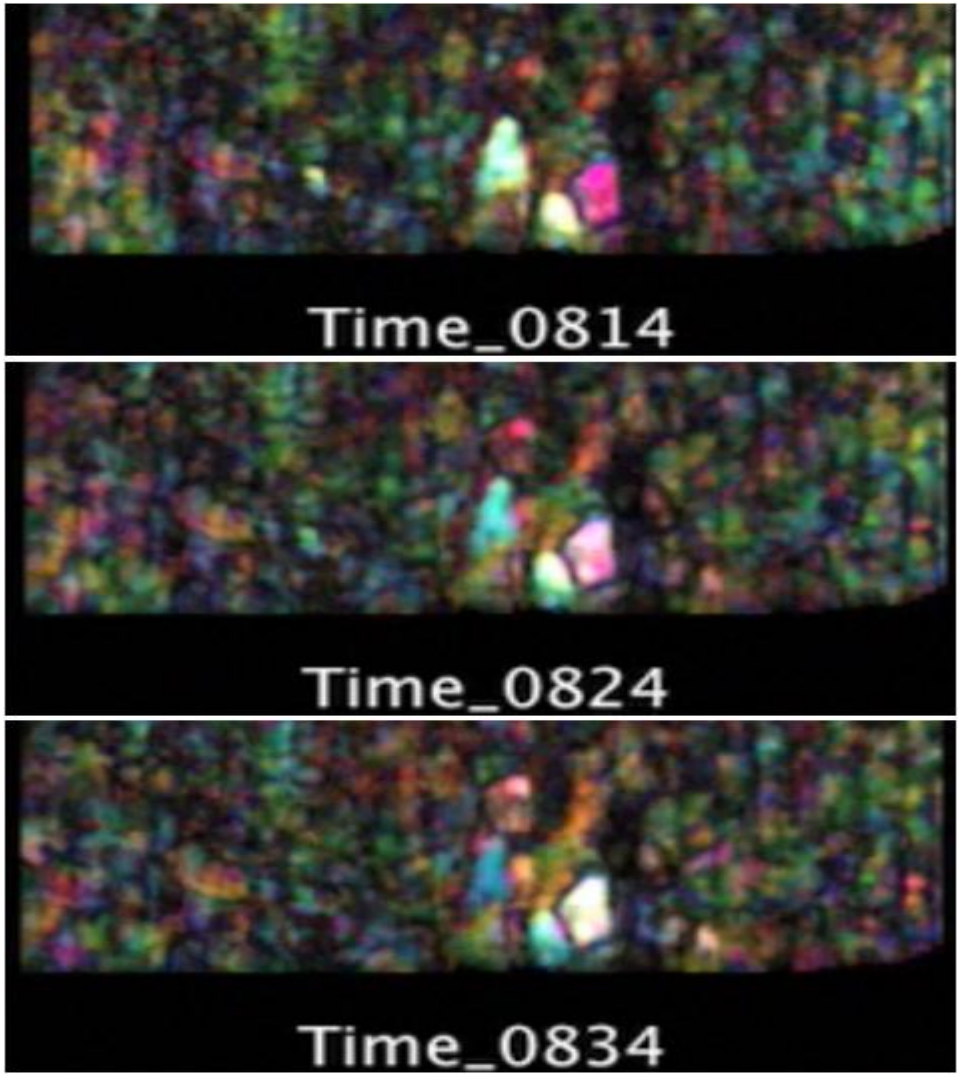
Frio Point Bars (white)

Texas Gulf Coast

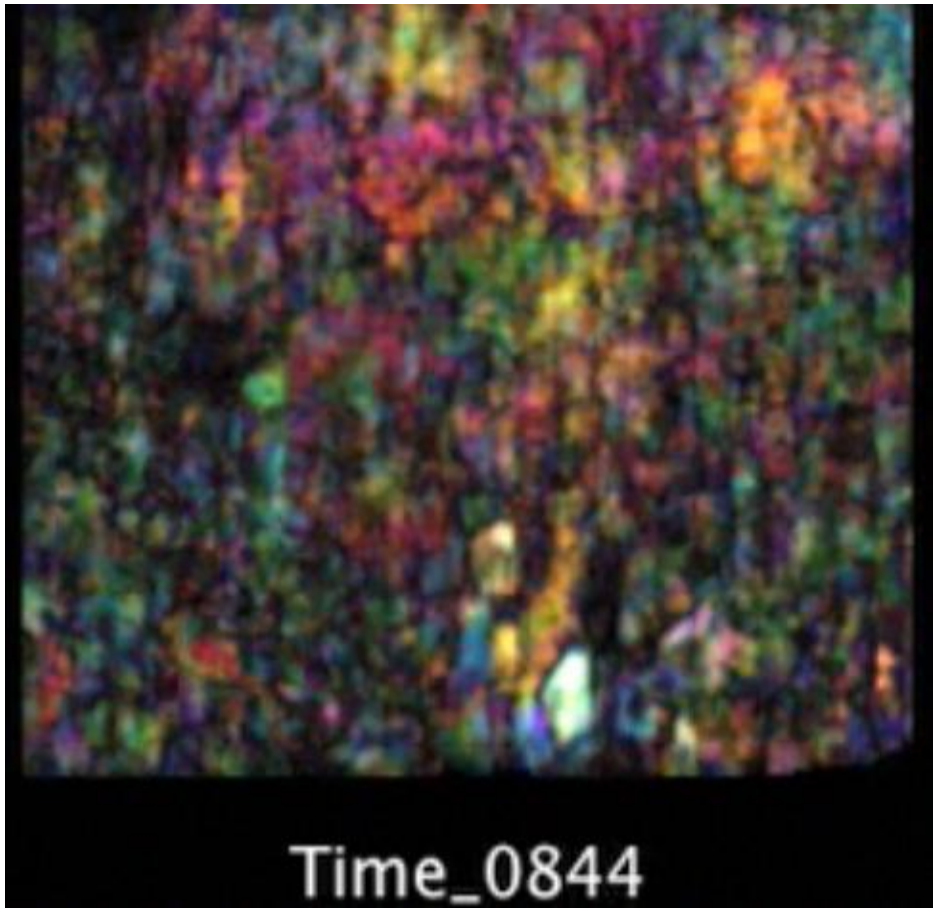


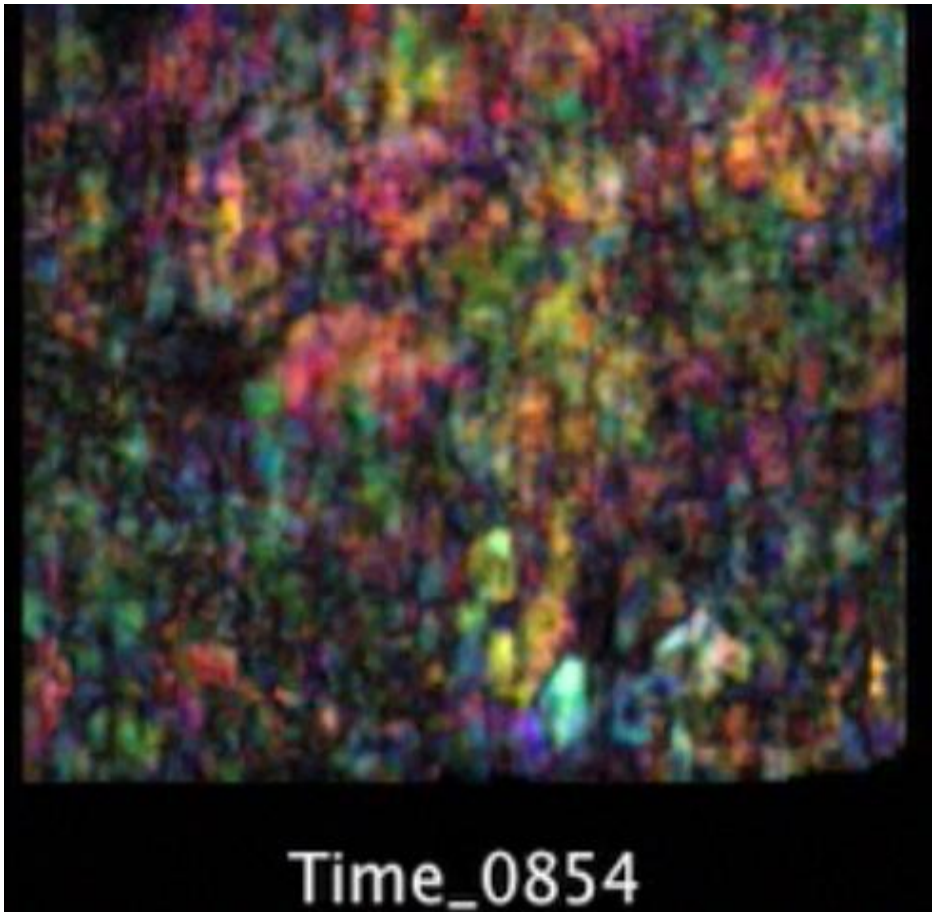
Frio Point Bars (white, pink, blue)

Texas Gulf Coast



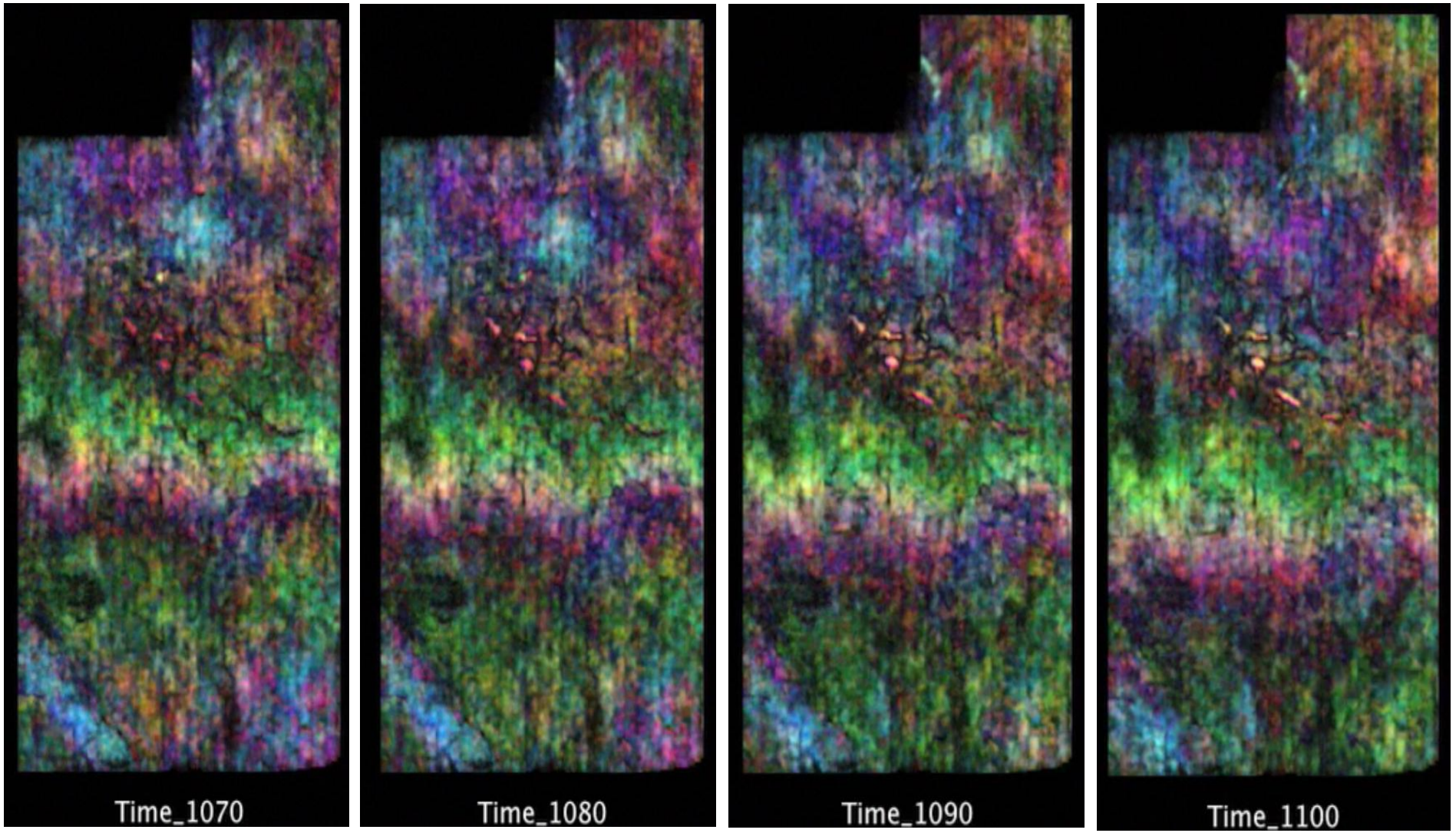
Frio Point Bars (white, pink, blue)
Texas Gulf Coast





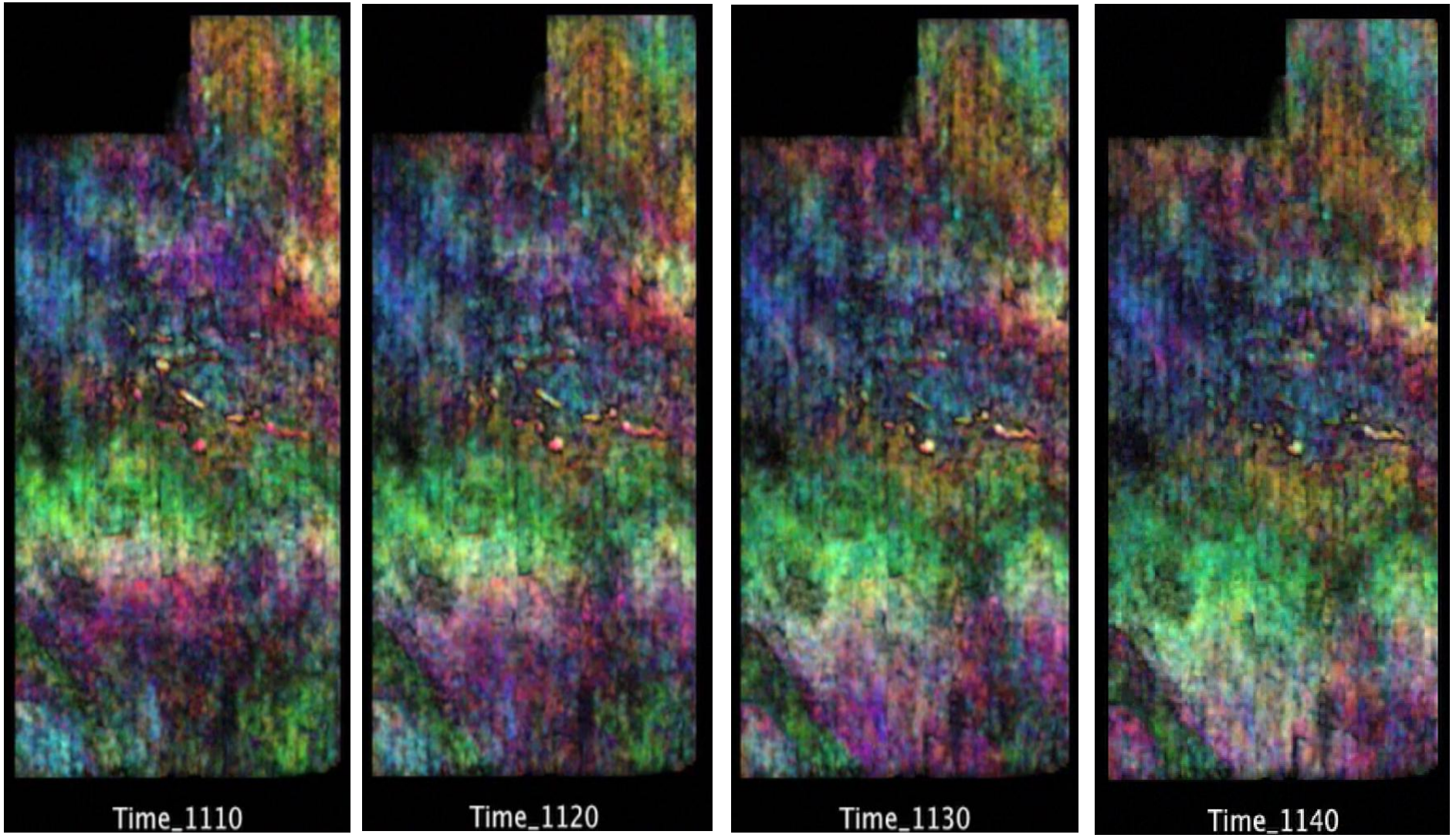
Yegua Point Bars (pink) Channel (green)

Texas Gulf Coast



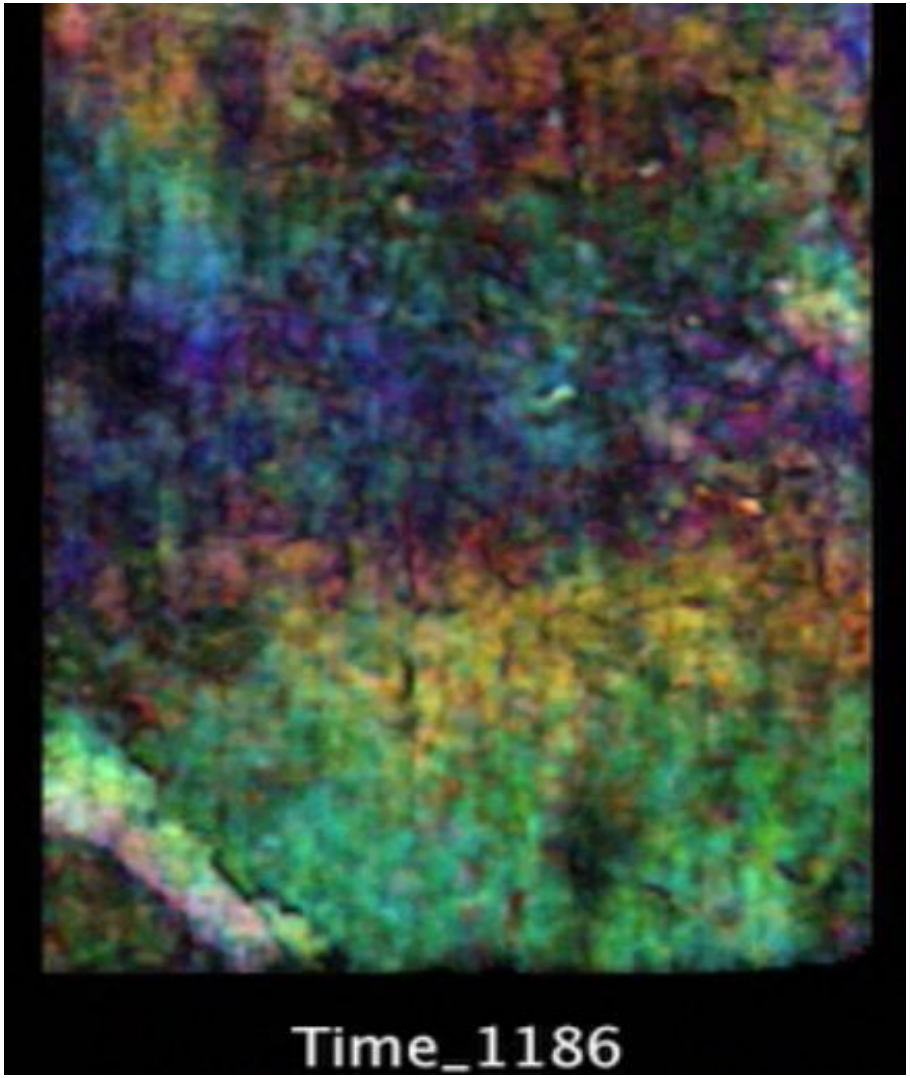
Yegua Point Bars (pink) Channel (green)

Texas Gulf Coast



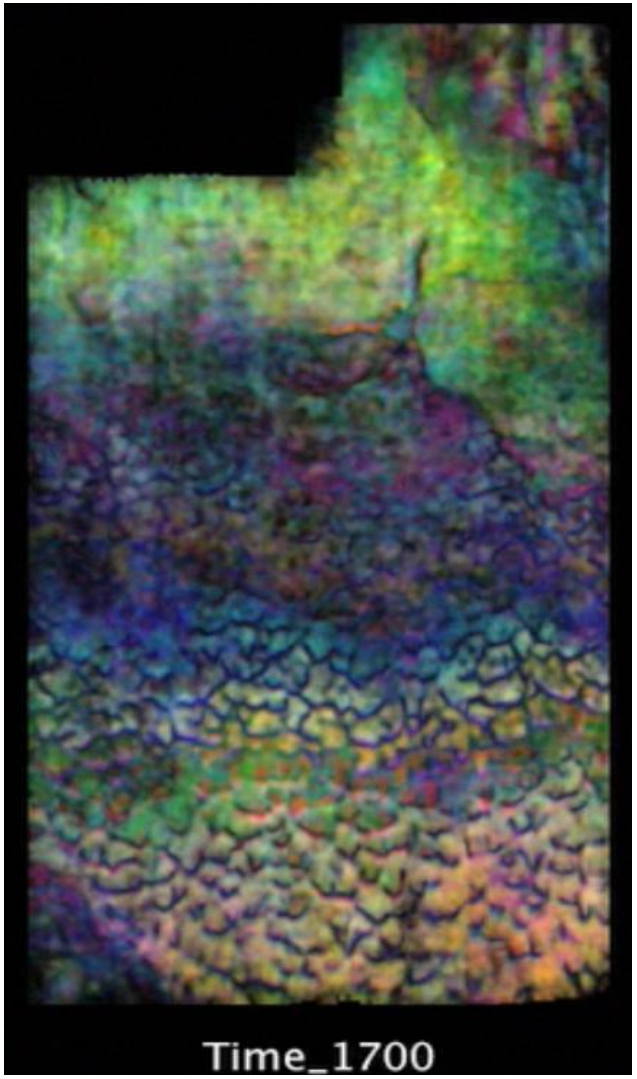
Yegua Channel (white)

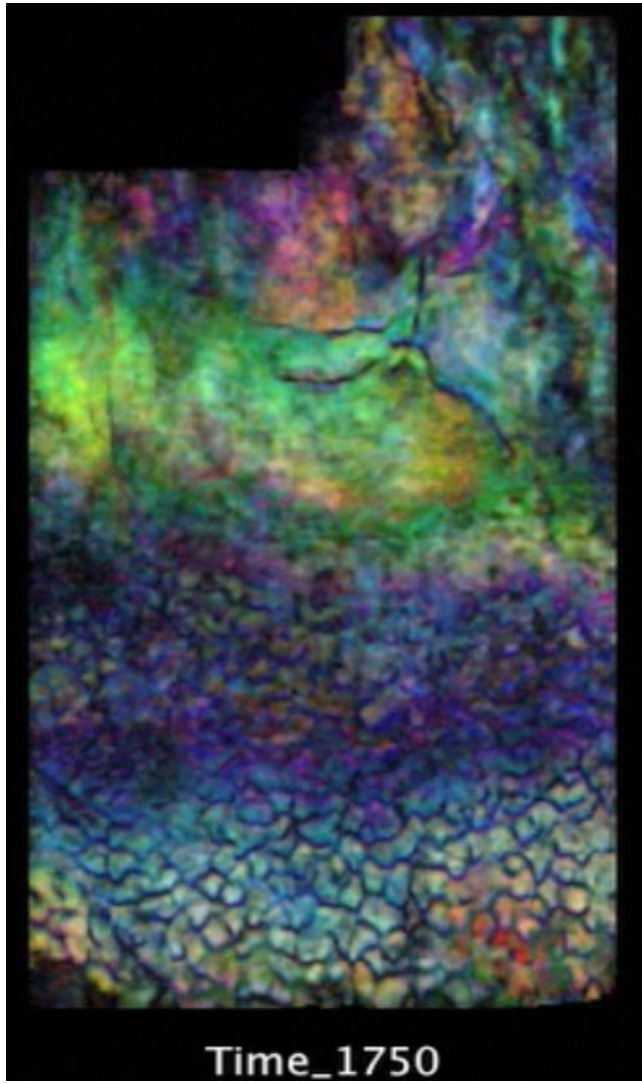
Texas Gulf Coast



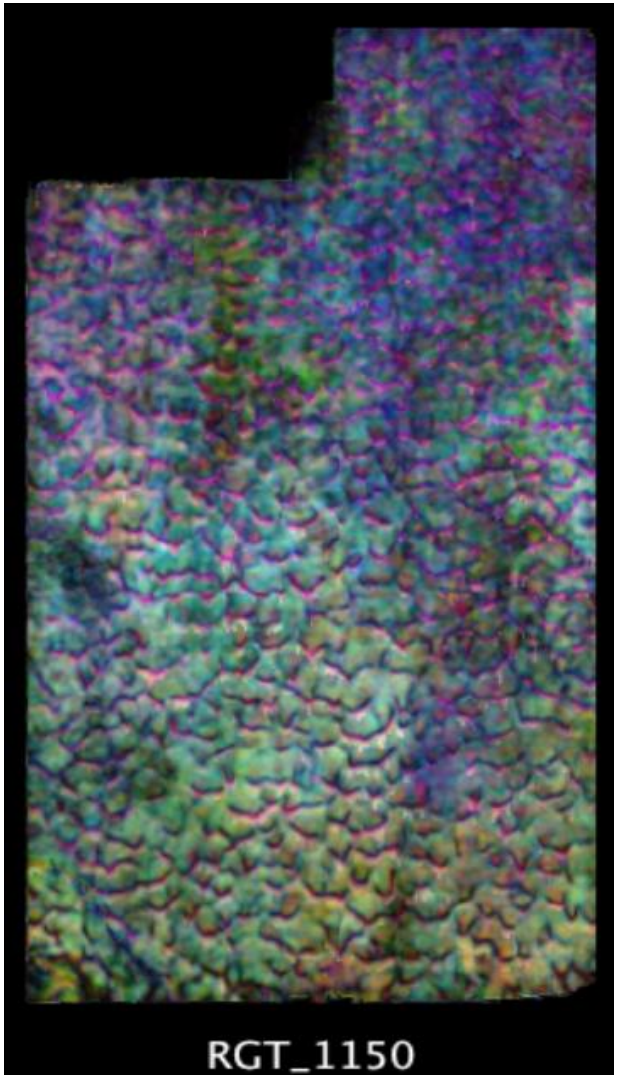
Base Yegua Clinoforms

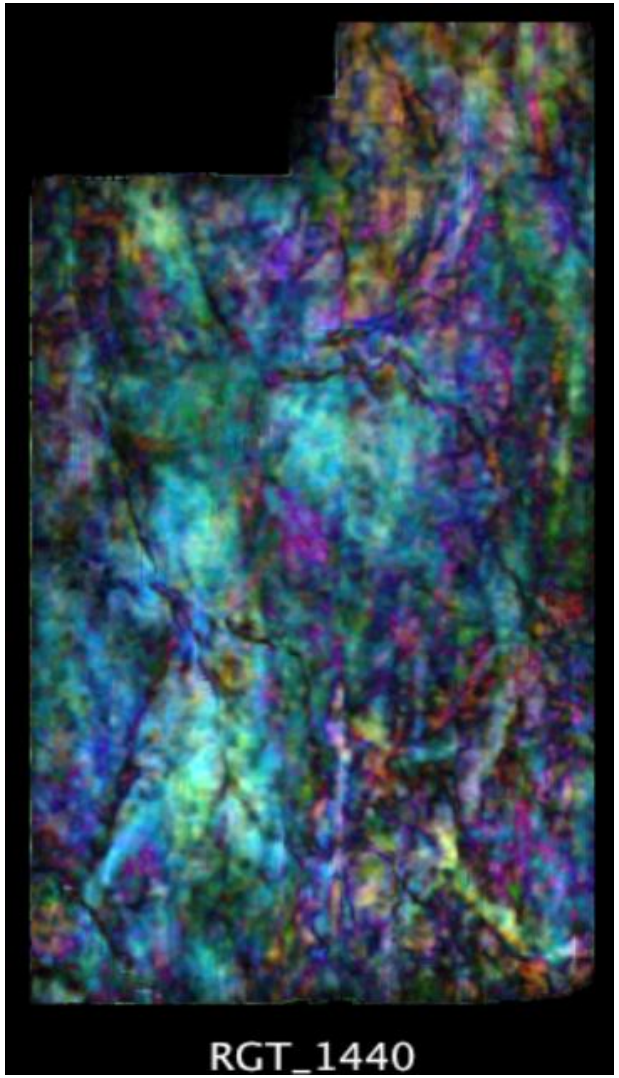
Texas Gulf Coast





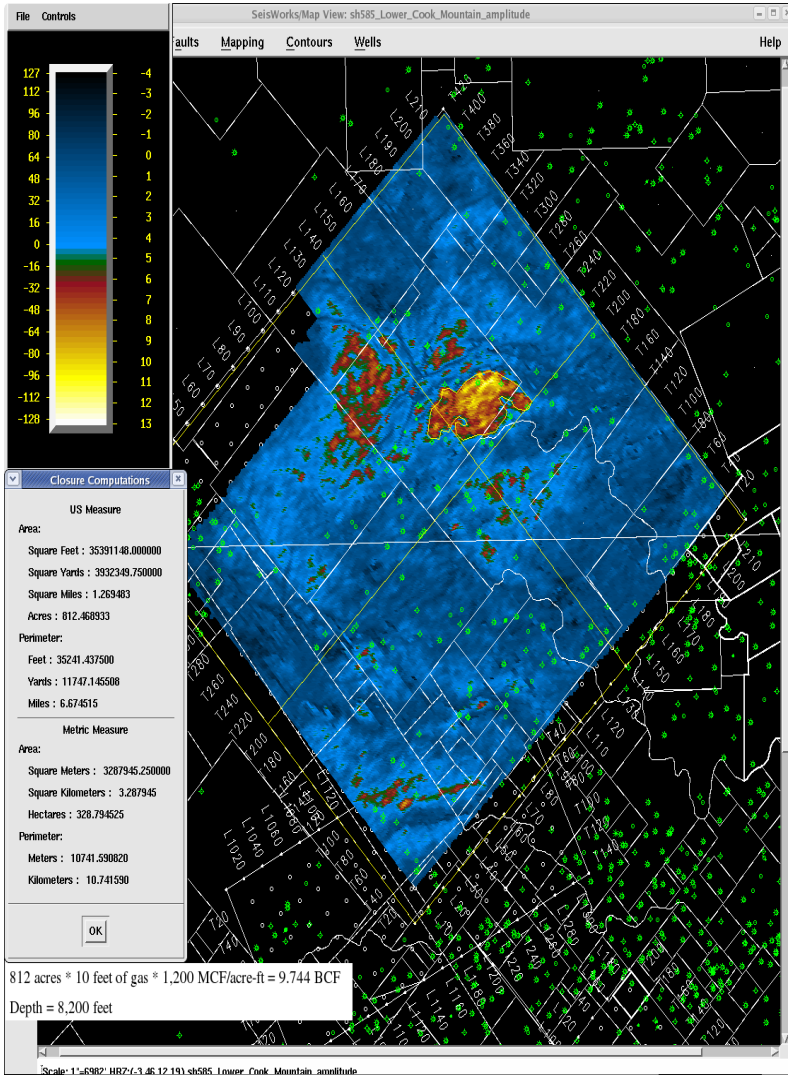
Base Yegua Clinoforms at Age Surface (Left) Crossing Channels in Age Volume (Center Right)

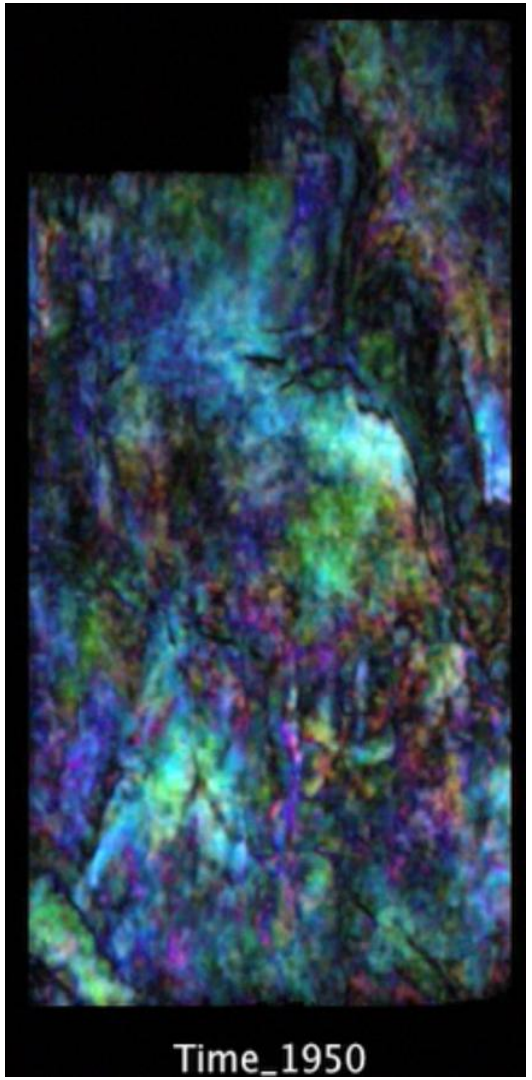




Lower Cook Mountain

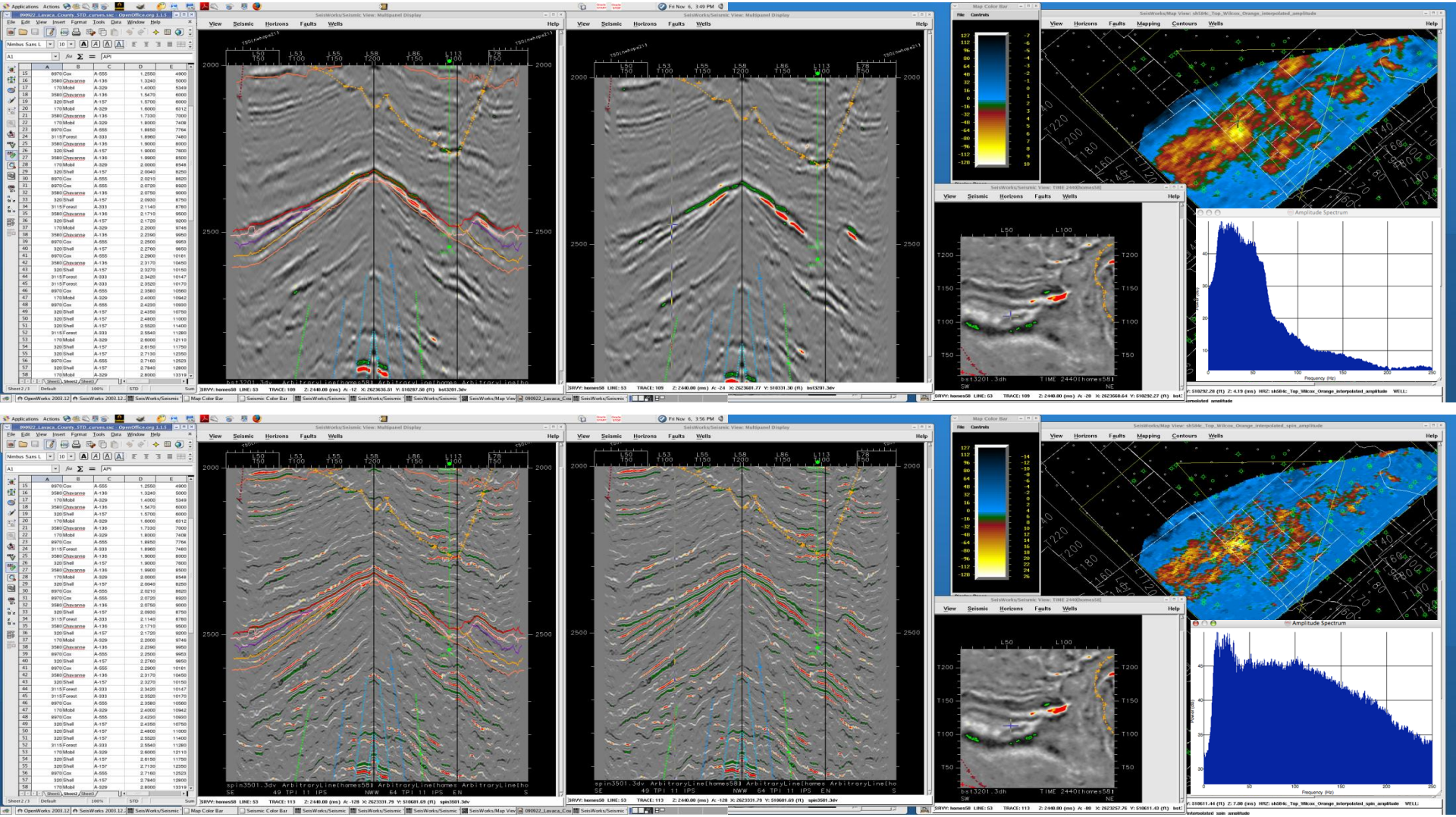
Texas Gulf Coast





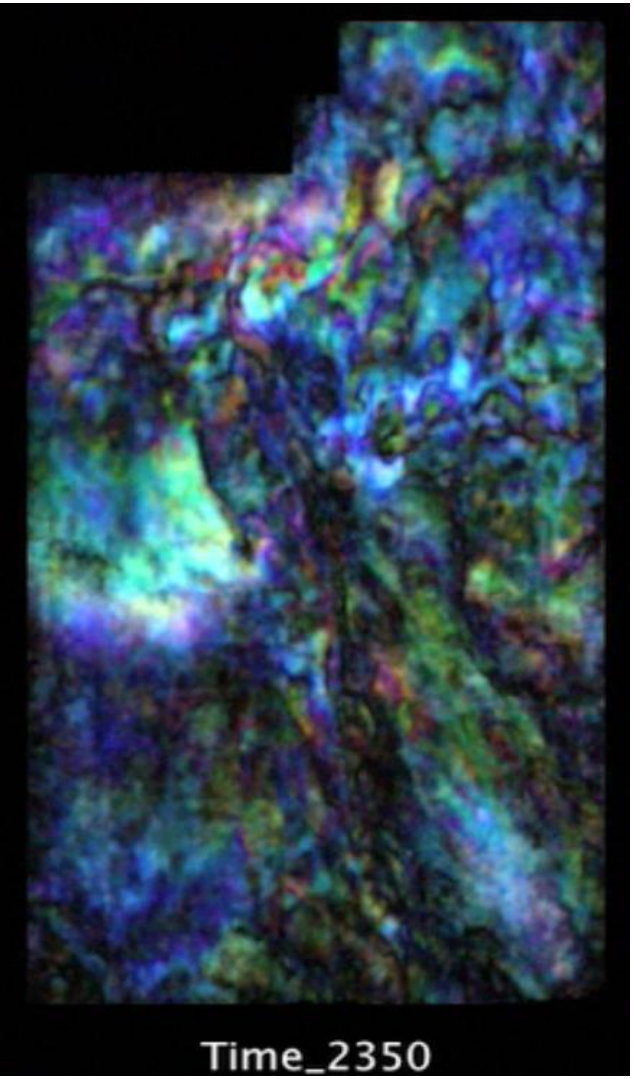
Wilcox Truncations with Higher Frequency

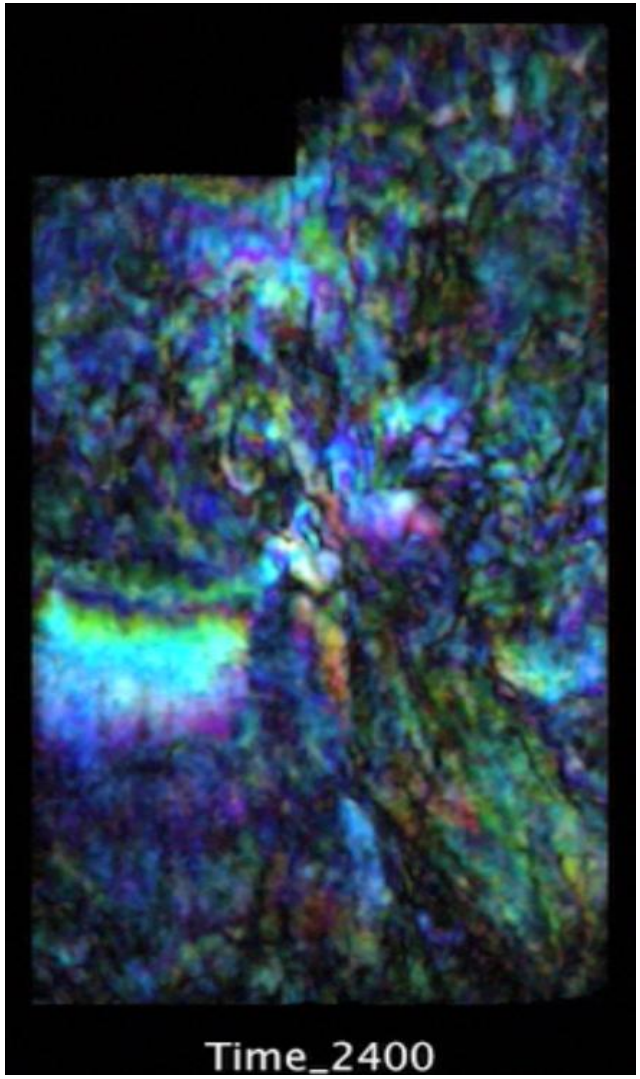
Texas Gulf Coast

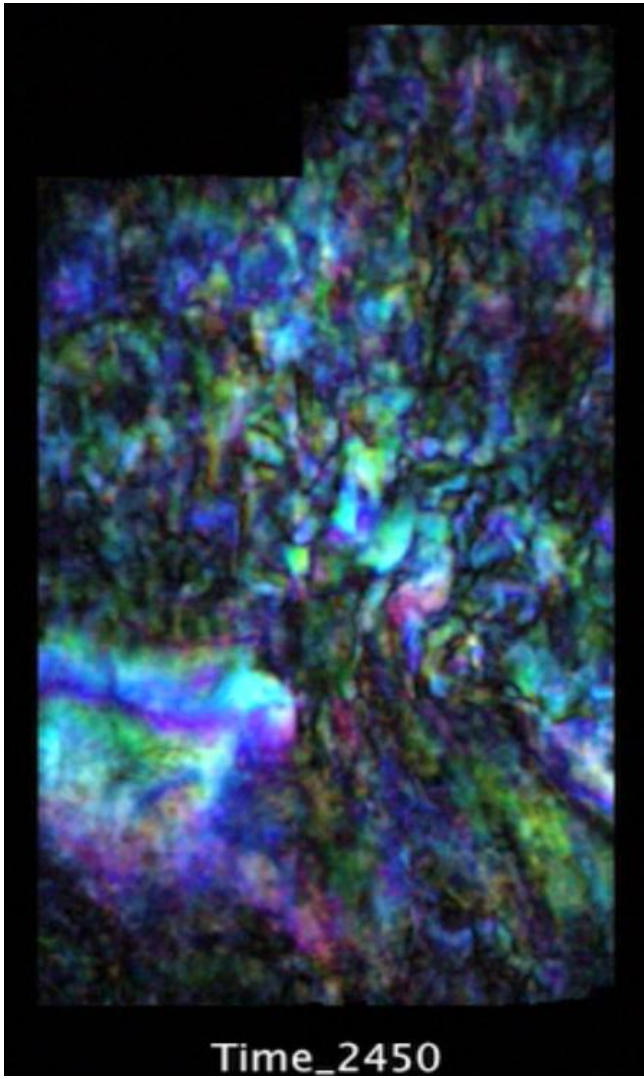


Wilcox Truncations

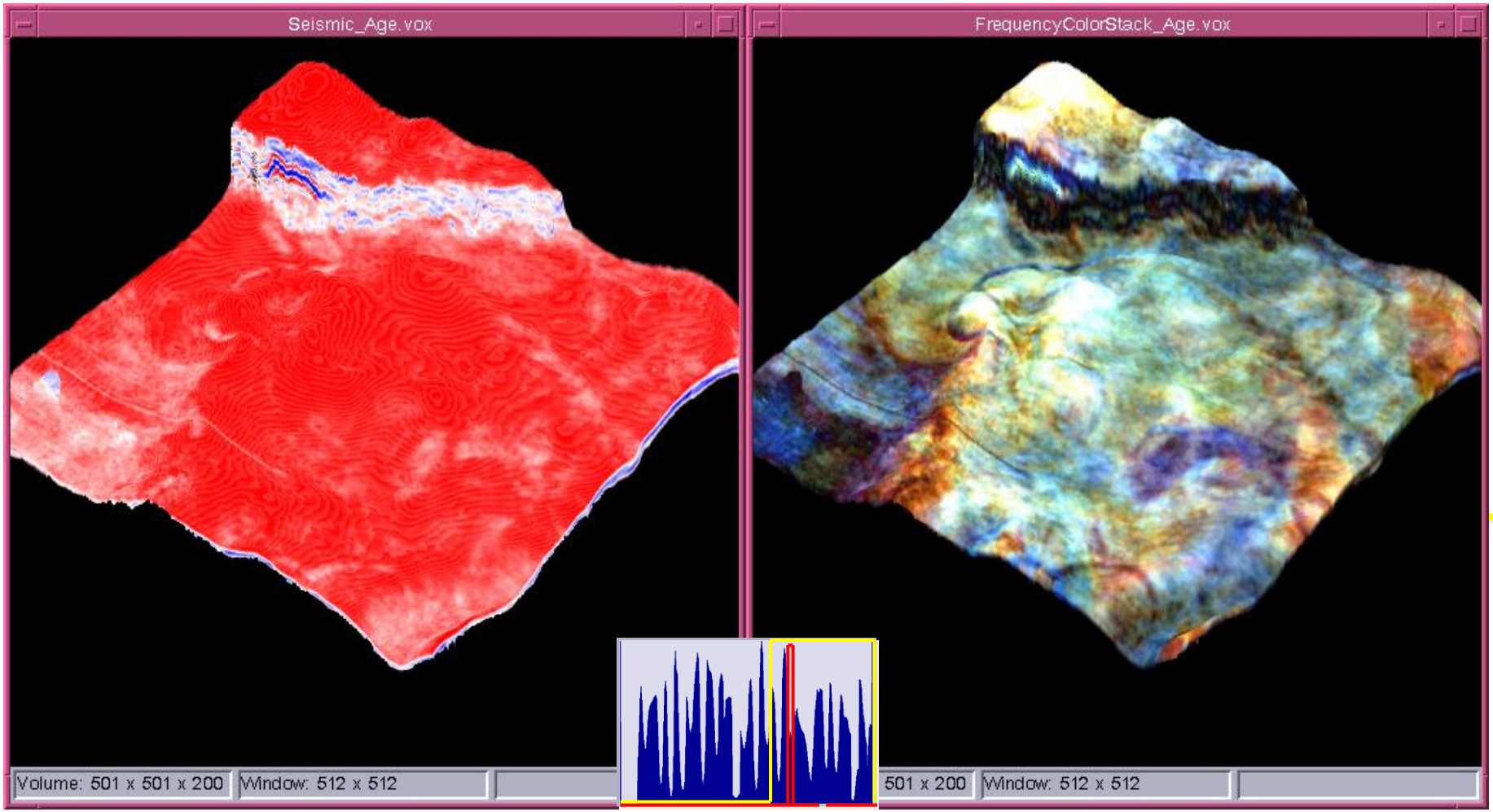
Texas Gulf Coast





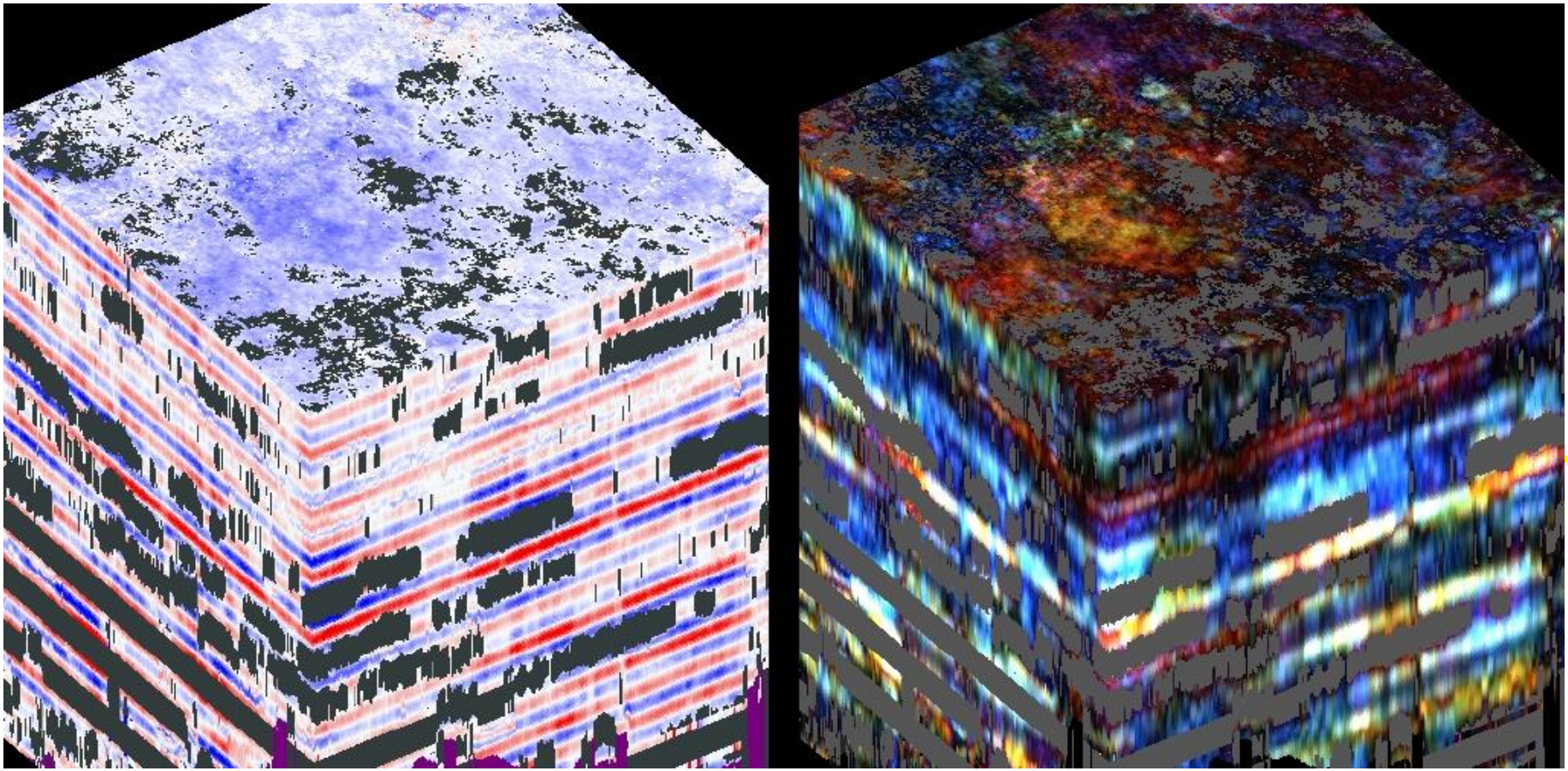


Standard and Color Stacked Stratal-Slice



Tracy Stark, **Stark Research**, Personal Communication

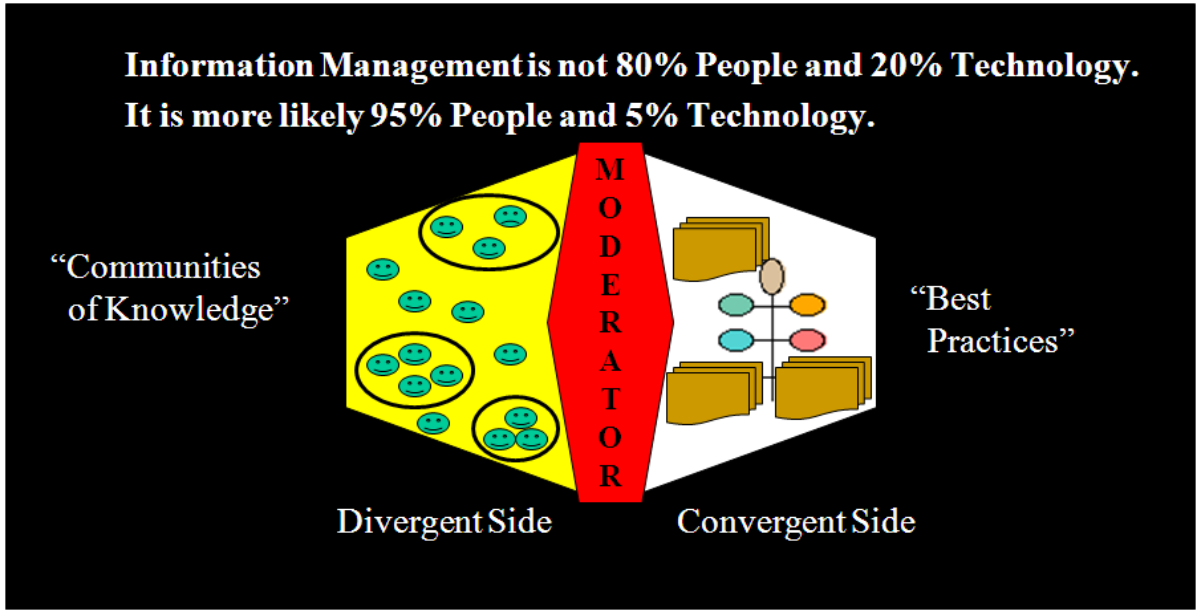
Wheeler Volume Comparisons



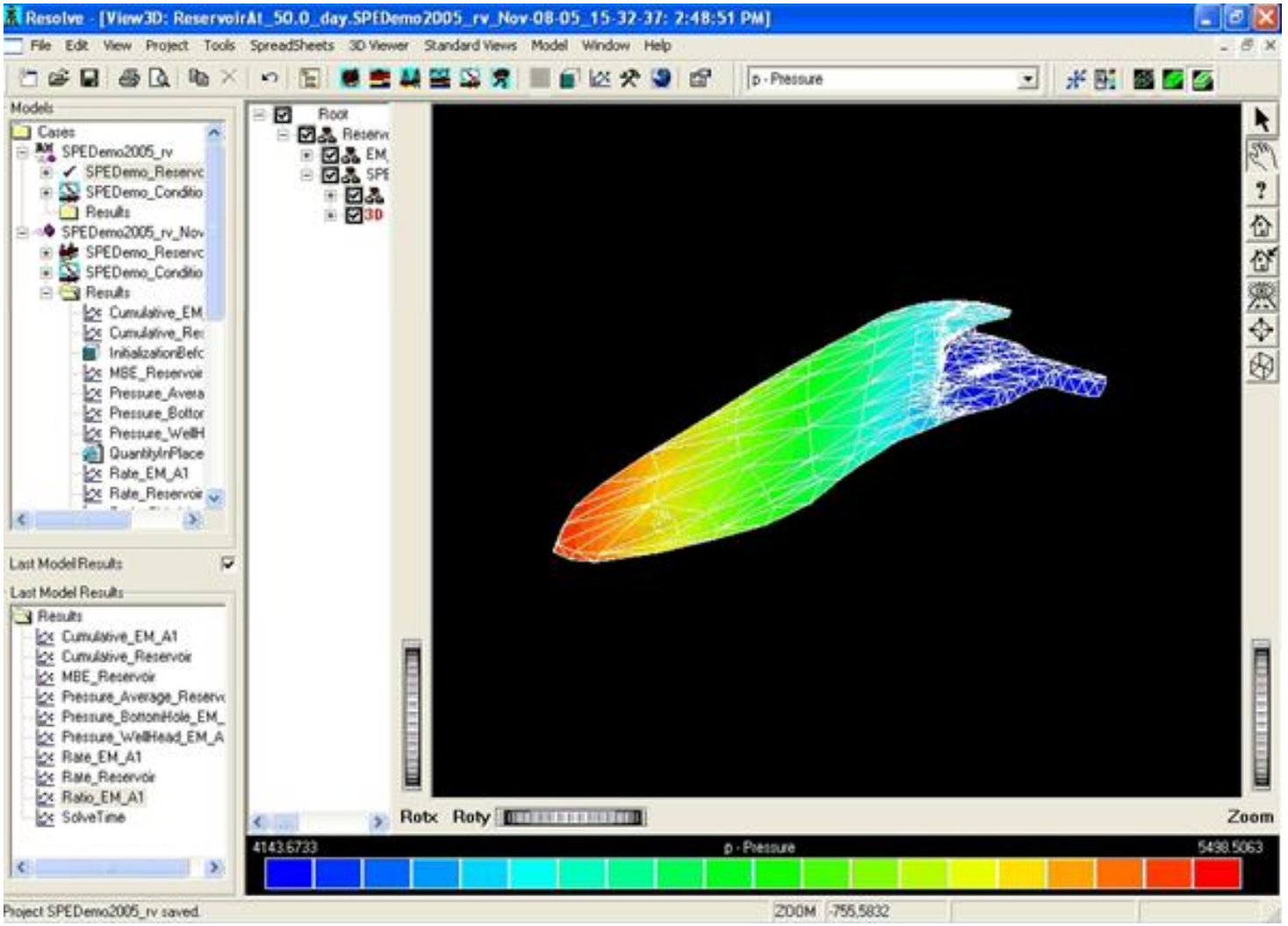
Tracy Stark, **Stark Research**, Personal Communication

Breakthroughs – Network, Training, and Support

- Everybody is smarter than anybody.
- The Internet allows anyone to be in your community of knowledge, and the key is to identify Best Practice.



Breakthroughs – Reservoir Modeling



John Mouton, **Object Reservoir**, Personal Communication

What This Course Presented

Day 1

Session 1: **Introductions, Need, Workflow, & Data**

The Brain Exercise: **Workflow Design Exercise**

Session 2: **Acquisition-Processing-Interpretation ties to Subsurface Properties**

SketchUp Exercise: **Freeware 3-D Models of Legacy Data for Interpretation**

SALNOR Workshop: **3-D seismic interpretation of North Sea physical model data**

Day 2

Session 3: **Interpreting structure, stratigraphy, salt, fault shadows for exploration, reservoir delineation, documentation, and display**

Contouring Exercise: **Importance of 3-D when contouring**

Carbonate Outcrop Workshop: **Importance of Outcrop Analogs to guide interpretation**

Carbonate Patterns Workshop: **Analog Examples to Guide Interpretation**

Session 4: **Seismic Attributes tie to structure, stratigraphy, reservoir delineation**

ResolveGeo Exercise: **SeisShow Interactive Attribute Analysis Center Field, WY**

Day 3

Session 5: **Reservoir Characterization and Advanced Interpretation**

Session 6: **Seismic Exploration and Reservoir Evaluation Breakthroughs**

Thanks