Abstract

We will present results from a 1-km long, 2-D seismic reflection line across the Bennett Thrust Fault in the Indio Mountains of southwest Texas, 34 kilometers southwest of Van Horn at the UTEP (University of Texas at El Paso) Field Station. Active sources used in this survey included 100 one-third-pound explosions and a higher frequency dataset produced from 500 sledge-hammer blows at the same 100 source points (5 blows will be stacked at each source point). Receivers included 200 Reftek 125A (“Texan”) stand-alone seismometers.

The dominant regional lithologies comprise a transgressive sequence nearly 2 km in total stratigraphic thickness, formed by extensional processes. The stratigraphic sequence is an analog for similar areas that are ideal for petroleum reservoirs, such as reservoirs off the coasts of Brazil and Angola. The area is highly faulted with multiple fault generations. The youngest fault is a large northwest striking, southwest-side down normal fault named the Indio Fault. The Indio Fault cuts a number of major thrust belts that formed during the northeast directed thrusting during the Laramide Orogeny. We will be imaging the Bennett Thrust Fault, a northwest striking fault with a dip to the northeast. We aim to determine the near-surface geometries of the Bennett Thrust Fault and accompanying rock units. While there are no petroleum plays in the Indio Mountains region, imaging and understanding subsurface structural and lithological geometries and how that geometry directs potential fluid flow has implications for other regions with petroleum plays.
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We will present results from a 1-km long, 2-D seismic reflection line across the Bennett Thrust Fault in the Indio Mountains of southwest Texas, 34 kilometers southwest of Van Horn at the UTEP (University of Texas at El Paso) Field Station. Active sources used in this survey included 100 one-third-pound explosions and a higher frequency dataset produced from 500 sledgehammer blows at the same 100 source points (5 blows will be stacked at each source point). Receivers included 200 Reftek 125A ("Texan") stand-alone seismometers.

The dominant regional lithologies comprise a transgressive sequence nearly 2 km in total stratigraphic thickness, formed by extensional processes. The stratigraphic sequence is an analog for similar areas that are ideal for petroleum reservoirs, such as reservoirs off the coasts of Brazil and Angola. The area is highly faulted with multiple fault generations. The youngest fault is a large northwest striking, southwest-side down normal fault named the Indio Fault. The Indio Fault cuts a number of major thrust belts that formed during the northeast directed thrusting during the Laramide Orogeny. I will be imaging the Bennett Thrust Fault, a northwest striking fault with a dip to the northeast. I aim to determine the near-surface geometries of the Bennett Thrust Fault and accompanying rock units. While there are no petroleum plays in the Indio Mountains region, imaging and understanding subsurface structural and lithological geometries and how that geometry directs potential fluid flow has implications for other regions with petroleum plays.

Objectives
1. Process, analyze and interpret the structural and lithological geometries of the Bennett Thrust Fault and accompanying rock units.
2. Identify additional imbricate faulting, as mapped previously unknown imbricate faults in the area at the surface.

Field Methods
1. Deploy 200 4.5 Hz seismometers attached to Reftek Texas Data Recorders at a sampling rate of 2 ms along the 1.0 km line at 5.0 m intervals.
2. Deploy 100 one-third-pound Trojan Booster explosives along the 1.0 km line at 10.0 intervals at approximately 1.0 m below the surface, and 5 sledge hammer blows at each shot location prior to detonation.

Study Area and Regional Geology

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**Thrust Fault Overturned Bed**
**Overturned Bed**
**Throw Direction**
**Marker Bed**
**Crystalline Basement**
Indio Mt.**
El Paso, TX**

**Legend**

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**Study Area and Regional Geology**

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**Legend**

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**Modified from Carciunaru and Ortega, 2008**
**Modified from Page, 2011**
2-D Seismic Reflection Imaging of the Bennett Thrust Fault in the Indio Mountains of West Texas

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Processing Workflow

1. Geometry Assignment
2. Trace Editing and Parameter Selection
3. Elevation Static Corrections
4. Velocity Analysis
5. Normal Moveout Corrections (NMO)
6. Create Database Files
7. Dip Moveout Corrections (DMO)
8. PostStack Signal Enhancement
9. Velocity Manipulation
10. Time to Depth Conversion

2. Trace Editing and Parameter Selection

- AirWave Mute
- Top Mute
- Decon Gate
- Killed Traces

3. Elevation Statics

4. Velocity Analysis

5. Normal Moveout Corrections (NMO)

6. Create Database Files

7. Dip Moveout Corrections (DMO)

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- Process the higher frequency dataset comprising of the sledge hammer blow using the processing flow described.
- The region lacks a weathered-layer, therefore statics corrections may not be a necessary process. However, refraction statics could better constrain a subsurface image.

Selected References


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