John Franey — Stratigraphic Framework of Intraslope Growth-Faulted Subbasins

Harry Hull — Geologic Characterization of Shoreface successions for CCS—Field Scale Heterogeneity
Stratigraphic Framework of Intraslope Growth-Faulted Subbains

John Franey (M.S. ‘21)
Gulf Coast Carbon Center

Tiles© Esri — Source: USGS
Can high order stratigraphic interpretation aid in risking seal quality of CO$_2$ injection sites?

- High Quality Sands
- Meets depth requirements
- Near Existing CO$_2$ production sites

Seismic data controlled by SEI. Inc. Interpretation is that of the University of Texas at Austin
Geophysical Processing

- Dip-Steering Seismic Volume
- HorizonCube: Generate set of dense, 3D auto-tracked horizons
- Dip-steering vectors used as weighting parameters

Seismic data controlled by SEI. Inc. Interpretation is that of the University of Texas at Austin
Shale Thickness Analysis

Interval 1
Uniform thickness across the subbasin

Interval 2
Areas of local thinning

Seismic data owned or controlled by SEI Inc. Interpretation is that of the University of Texas at Austin
Key Takeaways

• High Order analysis provides insight to thickness variations of sealing intervals

• Dip-Steering interpretation aids in high resolution interpretation

• Improve risk assessment for CO₂ injections sites
Geologic Characterization of Shoreface successions for CCS—Field Scale Heterogeneity

Harry Hull (M.S. ‘21)
Gulf Coast Carbon Center
Can we demonstrate the controls that geologic processes have over CO$_2$ storage capacity and reservoir heterogeneity?

**Play Scale Characterization**

- Well-based interpretation
- Stratigraphic Framework—HST, LST, TST
- Net Sand Maps
**Geologic Characterization—HRRS Scale**

- Well and Seismic based Interpretation
- Stratigraphic Framework—16 parasequences
- Seismic Stratal Slices

Seismic data owned or controlled by SEI, Inc. Interpretation is that of the University of Texas at Austin.
3D Geocellular Modeling

3D Geological Model Workflow

Petrophysical Curve Creation (Chapter 3)
LAS Curves
Generate Point Sets
HRRS Point Set
PS Point Set

Geologic Characterization (Chapter 2)
Well Tops
Sedimentary Horizons
Previously Mapped Faults
PS Structural Framework
HRRS Structural Framework

3D Geological Model Workflow

High Resolution Reservoir Scale Model

PlayScale Model

Stratigraphic Modeling
Facies Modeling
Porosity Modeling
Static Volumetrics

Stratigraphic Modeling
Facies Modeling
Porosity Modeling
Static Volumetrics

HRRS Porosity Grid
HRRS Storage Capacity Grid

HRRS Reservoir Model
HRRS Stratigraphic Grid
150 Layer Number

HRRS Facies Model
17 km
30 km
17 km
Results

**Play Scale AOI**

- **Storage Capacity:**
  - TST: 3.0
  - LST: 4.0 (Gt)
  - HST: 5.0

- **Transgressive Surface**
- **Sequence Boundary**

**HRRS AOI**

- **Storage Capacity (Mt):**
  - Parasequence 16:
  - Parasequence 15:
  - Parasequence 14:
  - Parasequence 13:
  - Parasequence 12:
  - Parasequence 11:
  - Parasequence 10:
  - Parasequence 9:
  - Parasequence 8:
  - Parasequence 7:
  - Parasequence 6:
  - Parasequence 5:
  - Parasequence 4:
  - Parasequence 3:
  - Parasequence 2:
  - Parasequence 1:

- **Transgressive Surface**
- **Sequence Boundary**
Key Takeaways

• Storage capacity tracts with the observed foreshore and shoreface facies of the strandplain/barrier bar system

• The mapped shore zones at the play scale can store gigatons of CO$_2$ (4-5 Gt per Lower Miocene 2 systems tract)

• The LST within the HRRS AOI can store as much as 350 Mt—enough to store all CO$_2$ produced at point sources in Matagorda, Victoria, Calhoun, and Jackson counties for 35+ years
Obtaining Additional CO₂ Storage and Predicting Plume Stabilization by Utilizing Oil Migration Concepts

Melianna Ulfah (M.S. ‘21)
Can CO$_2$ injection simulations aid in risk assessment and well optimization?
Simulation Comparison

Insights

• Residual Trapping
• Plume Migration
• Changes in Reservoir Pressure
• Storage Efficiency (MT/acre)
## Results

### Average Reservoir Pressure

<table>
<thead>
<tr>
<th>Case</th>
<th>Time of pressure to 2410 psi</th>
<th>Maximum up-dip migration distance</th>
<th>Maximum area contacted by CO(_2)</th>
<th>Storage/Acreage ratio (\text{million tons}/\text{km}^2)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Syncline scenario – 60 MT</td>
<td>58 years</td>
<td>10.74 km</td>
<td>67.73 km(^2)</td>
<td>0.88</td>
</tr>
<tr>
<td>Syncline scenario – 30 MT</td>
<td>20 years</td>
<td>8.69 km</td>
<td>44.84 km(^2)</td>
<td>0.67</td>
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<tr>
<td>Base scenario – 60 MT</td>
<td>77 years</td>
<td>8.23 km</td>
<td>50.27 km(^2)</td>
<td>1.19</td>
</tr>
<tr>
<td>Base scenario – 30 MT</td>
<td>25 years</td>
<td>5.94 km</td>
<td>26.81 km(^2)</td>
<td>1.12</td>
</tr>
</tbody>
</table>
Key Takeaways

- Injection simulations aid risk assessment for top seal failure from injection pressure

- Aid in policy recommendations for acreage leasing timelines

- Optimize injection well placement