Imaging Overturned Fold Limbs Using the Experimental 2D Seismic Line LOFF 8

By A. C. Newson B. Sc P. Geol
Moose Oils Ltd
• **Overview**

• LOFF 8 PSDM velocity anomaly identified

• LOFF 8 re interpretation using RDA SCAT and MVE down plunge projection

• Resolution of the anomaly

• Where to from here?
### Foothills Stratigraphy

<table>
<thead>
<tr>
<th>Age</th>
<th>m.</th>
<th>Lithology</th>
</tr>
</thead>
<tbody>
<tr>
<td>Tertiary</td>
<td>700 / 1200</td>
<td>Sands with minor shales</td>
</tr>
<tr>
<td>Upper Cretaceous</td>
<td>700 / 1500</td>
<td>Sands with minor shales</td>
</tr>
<tr>
<td></td>
<td>800</td>
<td>Shales with minor sands &amp; conglomerates</td>
</tr>
<tr>
<td>Lower Cretaceous</td>
<td>400</td>
<td>Sands shales &amp; coals</td>
</tr>
<tr>
<td>Triassic</td>
<td>250 / 500</td>
<td>Limestone sands &amp; shales</td>
</tr>
<tr>
<td>Permian to</td>
<td>0 / 120</td>
<td>Sand &amp; shale</td>
</tr>
<tr>
<td>Pennsylvanian</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Mississippian</td>
<td>400</td>
<td>Dolomitised limestone</td>
</tr>
<tr>
<td>Devonian</td>
<td>600</td>
<td>Igneous &amp; metamorphic</td>
</tr>
<tr>
<td>Cambrian</td>
<td>500</td>
<td></td>
</tr>
<tr>
<td>Pre-Cambrian</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

- **Cardium**
- **Viking**
- **Pardonet / Baldonnel**
- **Taylor Flats**
- **Turner Valley / Debolt**
- **Palliser**
- **Beaverhill Lake**
Alberta Foothills Cross Section

Front Ranges

McConnell Thrust

Foothills

Plains

Triangle Zone

Sea level

Cretaceous Age
Mississippian Age
Devonian Age
Cambrian Age

Fold and Thrust Belt

10 kms
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LOFF 8 Structures and Fields

Palaeozoic hanging wall cutoff:
- McConnell Thrust
- Moose Thrust
- Brazeau Thrust

Field trip route
Field trip stops
LOFF8 and Cross Section D-D’ in detail
Brute stack and AGS Section

LOFF 8 long offset high intensity line

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Long offset acquisition parameters

1. LINE LOFF-8
2. Year 2005
3. N. SP (dynamite) 587
4. SP Int. (dynamite) 90m
5. CDP 203-7245
6. CDP. Int. (m) 7.5m
7. Trace Int (m) 15m
8. N. Ch. 1600
9. Max. offset 12000m
**Long offset PSDM workflow**

1. FB picking (up to maximum available offset)
2. Turning ray tomography
3. Long Offset-PSDM,
   - type: maximum amplitude travel-time arrivals
   - depth int. = 10m
   - migration aperture = 6000m
   - DP2000m a.s.l.
4. Interface picking on depth migrated stack section
5. Migration velocity analysis (CIG flattening analysis)
6. Velocity field update (CIG tomography and velocity scan)
7. Iteration of steps 3. to 6. to end of section
8. FK filter
9. BP filter
10. Top Mute and Surgical Mute
11. RMS gain
First PSTM

Time Migrated Section

<table>
<thead>
<tr>
<th>Time</th>
<th>0</th>
<th>7000</th>
<th>6500</th>
<th>6000</th>
<th>5500</th>
<th>5000</th>
<th>4500</th>
<th>4000</th>
<th>3500</th>
<th>3000</th>
<th>2500</th>
<th>2000</th>
<th>1500</th>
<th>1000</th>
<th>500</th>
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First PSTM with velocite model
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GEOSCOUT July 2014 Wells

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10 kms

9-13-39-16W5M
Revised well analysis and projection
MVE Move Down Plunge Projection
SCAT by Bengston

Statistical Curvature Analysis Technique (SCAT).
C. A. Bengston AAPG 1980
RDA Interactive 3D Dip Modelling

RDA SCAT
RDA SCAT

Moose Oils Ltd.
RDA Interactive 3D dip modelling
MVE Move Down Plunge Projection
Moose Oils Ltd.

9-13 B Sub Brazeau Thrust Mr USD

Measured Depth 25m intervals

Measured Depth 50m intervals
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9-13 C Regional Mr RWU

Measured Depth 50m intervals

Measured Depth 25m intervals
9-13 A, B and C TST RWU

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Revised velocity field on PSDM
Velocity field on PSDM Stack
Sum Up

• 2D data acquired in rough terrain with major velocity inversions ie typical Foothills data

• Illustrates that with a high effort seismic line and advanced seismic processing it is possible to image 30 to 50 degree dipping beds, even in the fault shadow of a major thrust
Where to from here?

- Extend this technique to other targets on LOFF8 eg the Paleozoic in the Nordegg and the Stolberg field

- Re-processes data using more of the offsets to increase the quality of the image and define the steeply dipping Mesozoic structures in other triangle zone fields Stolberg, Cordell, Brown Creek Basing Shaw etc etc.
Contributors

- Seismic by Seis Ventures Resources Ltd, Calgary
- Processing by GEOSYSTEM s.r.l. Via Clericetti 42/A Milan 20133 Italy
- Interpretation by Moose Oils Ltd, Calgary
- Software used
  - RDA SCAT analysis for dipmeter analysis, Houston
  - MVE Move for down plunge projection of wells, Glasgow
  - Geoscout for current up to date drilling activity, Calgary