Use of 3D Seismic Data To Characterize reservoirs - Field B

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Outline

• Introduction
• geological model
• Seismic interpretation
• Specific study
• Conclusion
Seismic reflection: --- impedance contrast
• Seismic Signal

Seismic Attributes
The 3-D cube
Seismic Attributes

- Original Amplitude
- Phase and Polarity of Seismic data
• Frequency Attenuation
• Frequency Envelope
• Geometric Attributes
Field B

Powder River basin
Campbell County, WY
63 wells
Eolian Sandstone

- Minnelusa eolian sandstone

Lawrence, 2009
• Geological feature of Minnelusa Formation

Eolian Sandstone

• Lawrence, 2009
• Geological feature of Minnelusa Formation
• Geological feature of Minnelusa Formation
Well log data

- Within survey: 67 wells (Field B wells: 32)
- Digitized in-house

GR
DT
NPHI
DPHI
SP
PEF
RHOB
Caliper
Well XXXXX  
17 wells have NPHI & DPHI
Well correlation
Well correlation
Well correlation & Well log lithology facies
Subsurface from well top

Opeche

Minnelusa

B Sand top

B Dol top
little confidence about between wells
Seismic survey

Frequency 10:80, Dominant: 45-55.
Data quality: good

No check-shot data
Seismic Data Quality:

Frequency components in Seismic data: 10-80 Hz
Seismic Interpretation

Seismic Well tie, Synthetic Seismogram
Wells with long sonic log which are used to make synthetic seismogram

location:
Line: 208
Xline: 203
Enhanced Oil Recovery Institute

[Image of seismic data and logs]
Top of Minnelusa from Welltie of XXXXXXX

Picking by Z-crossing

Picking by S-crossing

Picking by Peak

XXXxxxxx
Horizon:
Top of Minnelusa
Seismic amplitude horizon slice along top of Minnelusa
Seismic envelop horizon slice along top of Minnelusa
Attenuation horizon slice along top of Minnelusa
Spectral amplitude analysis
14-11 <-> 15-1
14-11 \-> WI-1
15-1 \-> WI-1
*WI-1 isolated
15-5 \-> 15-10
15-5 \-> 15-9
15-5 \-> 15-3
15-5 <-> 15-6
15-1 <-> 15-9
15-1 <-> 14-11
15-1 <-> 15-3

Connectivity Analysis
Notice: some artificial water data, difficult for history match

Mass Balance:
P-liquid: 21093624 bbls; Inj-water: 26787110 bbls
\((\text{Inj-water} - \text{P-liquid})/\text{Inj-water} = 21\%\)
No obvious dolomite separates an upper and a lower B sand.
Only around WI-I has Dolomite which separate an upper and a lower B sand.
Specific study

Between #XX-X and #XX-XX
Oil can not migrate

K < Kmin  Oil can not migrate
Conclusion for this specific area

• Between #XX-X and #XX-XX as well as forward to east, there are very tight zones over upper part of Minnelusa formation.

• And the seismic facies is different from where #XX-X is located at and forward to west.
Local Dolomitic lens

Single sand layer with local tight sand zones

Overview of Field B Reservoir
3D Sand body
Conclusion

• Good quality seismic data is very help to interpret Minnelusa formation, the sand geometry, flow units in this very complicated eolian sandstone.

• Combining with geological data together, Seismic interpretation could build a much better static model than the geological model.

• The seismic interpretation for Field B is still an ongoing project.
Thanks and Questions?
Seismic Interpretation

• Multiple seismic attributes have been generated
  – Amplitude, Envelope, Relative Acoustic Impedance, Attenuation with frequency, spectral amplitude analysis, and others.

• Each attribute provides a different perspective on the data.

• Each attribute contributes to the understanding of reservoir geometry, lithology and quality.