Assessing new opportunities in an old oil province

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Why are we doing this?

Evolving play concept

Net reservoir ft > 7% φ

Net reservoir ft > 3% φ

Re-defining “net reservoir” reveals previously unrecognized, potentially significant trends
In light of the evolving pay criteria and completions approach, The Discovery Group performed an updated assessment of a 5200 mi$^2$ area in SE Illinois. Our work suggests widespread new opportunities may exist in the lower Middle Mississippian.

**In this talk:**
An overview of the assessment methodology using the Griffin/New Harmony trend as a case study.
Assessment methodology

- Uses a quantitative, map-based approach to create composite “stop-light” or Common Risk Segment (CRS) maps
- Each play can be reduced to a set of elements which determine the success or failure of that play
- Examples:

```
9 elements:
<table>
<thead>
<tr>
<th>Container</th>
<th>Fluids HC System</th>
</tr>
</thead>
<tbody>
<tr>
<td>Reservoir Facies</td>
<td>Reservoir</td>
</tr>
<tr>
<td>Reservoir Quality</td>
<td>Trap &amp; Seal</td>
</tr>
<tr>
<td>Trap Closure</td>
<td>Source</td>
</tr>
<tr>
<td>Trap Seal</td>
<td>Migration</td>
</tr>
<tr>
<td>Source Richness</td>
<td>Hydrocarbon Quality</td>
</tr>
<tr>
<td>Source Maturation</td>
<td>Migration Timing</td>
</tr>
<tr>
<td>Migration Pathways</td>
<td>Hydrocarbon Recovery</td>
</tr>
</tbody>
</table>
```

or...

```
5 elements:
| Reservoir |
| Trap & Seal |
| Source |
| Migration |
| Hydrocarbon Quality |
```
Assessment methodology

- Play elements are evaluated and mapped individually
  - Probability of occurrence ("chance of adequacy")
  - Risk severity
  - Relative quality

(Rose, 2001)
• Element maps are combined to form a composite map that incorporates all of the constituent elements.

• Elements may be weighted based on perceived importance.

• Can provide a “play chance of success” or simply separate better from worse.

• Provides an efficient and objective assessment of a given area.
This “map-stacking” approach is typically done by manipulating layers of polygons within GIS software.

However, because we do most of our work in Petra, we found it cumbersome and time consuming to incorporate an external GIS package.

Instead, we developed a grid-based approach that requires only Petra and Excel which turned out to be easier and faster.
IL basin survey

- The number of key elements was reduced to 3:

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<td>Migration Pathways</td>
</tr>
<tr>
<td>Trap Seal</td>
<td>Migration Timing</td>
</tr>
<tr>
<td>“Chance of adequacy” = 1</td>
<td></td>
</tr>
<tr>
<td>Low-porosity (3-7%) net reservoir</td>
<td></td>
</tr>
<tr>
<td>Positive structural features</td>
<td></td>
</tr>
<tr>
<td>Production, DST rec., shows, etc.</td>
<td></td>
</tr>
</tbody>
</table>

- Each element was mapped for 6 intervals: U St Louis, L St Louis, U Salem, M Salem, L Salem, & U Warsaw
Case study

Griffin/New Harmony trend
Reservoir element

- Standard net reservoir maps normalized to 0-1 based on the cumulative percentage curve of all net reservoir values

L St. Louis, 3-7% net reservoir
• 3rd order residual map defines positive and negative structural features
  – Positive structure deemed more favorable due to historical production trends

Barlow structure

3rd order derivative

Ranked derivative (0-1)
Fluids element

- Hydrocarbon indicators in the interval of interest: production, DST’s, shows, etc.
  - Appears to be scale-dependent in the IL basin
  - Ultimately decided on a large-scale, binary system

Areas lacking HC indicators were delineated

Values of 1.0 and 0.25 were assigned to appropriate grid nodes
Then we combine the element maps to create a composite map for each of the 6 intervals...
Individual elements may be weighted based on perceived significance.

All elements weighted equally

Structure element weighted 50%
Composite map (net reservoir + structure + HC presence): St. Louis - Warsaw
Conclusions

• Map-based approach utilizing “stacked” play element maps effectively provided an efficient and objective assessment of a very large geographic area.

• The basic, 3-component assessment produced maps that correctly predicted most established fields

• These same maps suggest numerous previously unrecognized opportunities in the lower Middle Mississippian
References
