

# Extending ArcGIS for E&P Subsurface Workflows

## The Petroleum Extension



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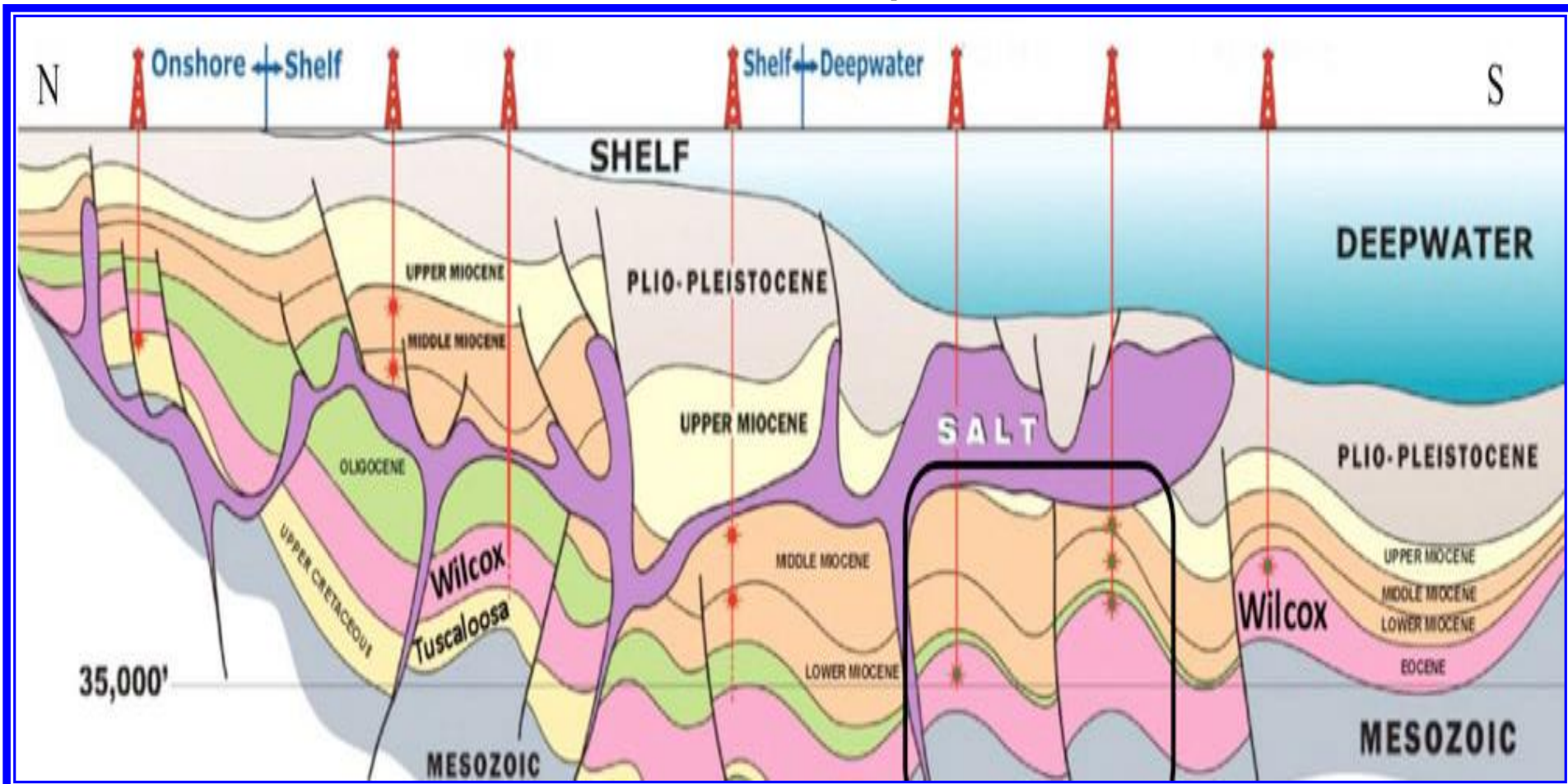
PUG Houston  
Lightning Talks  
March 26, 2014



# Stratigraphic Model

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- Many, complex, sub-surface horizons
  - Starts with Seismic Interpretation



# Well Database

## Custom Success/Failure Analysis

The screenshot shows the ArcView interface with a map of well locations. Each well is represented by a colored bar chart. The 'Attributes' window for well 79-5 is open, showing the following data:

OBJECTID	53
WellName	79-5
Trap	1
Charge	0
Sand	1
Seal	0
Flow	1
Discovery	0
Result	Success

The 'Result' dropdown menu is currently open, showing options: <Null>, Failure, and Success (selected).

The map shows wells with the following IDs and bar chart colors:

- 77084: Pink, Green, Blue
- 84-7: Pink, Green, Blue
- 84-5: Yellow, Green, Blue, Red
- 79-3: Yellow, Green
- 79-1: Yellow, Green, Blue, Red
- 77043: Yellow, Green, Blue, Red
- 43-8: Yellow, Green, Blue, Red
- 77079: (No bar chart)
- 79-5: Yellow, Green, Blue, Red (highlighted with a blue star)
- 77077: Yellow, Green, Blue, Red
- 79-6: Yellow, Green, Blue, Red

# Geology Polygons (GDE)

Best Practices: GDB, domains, styles, joins, mash, etc.

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The screenshot displays the ArcView interface with a map of Geology Polygons (GDE). The map shows various geological features such as Basin, Basin\_Floor\_Fan, Shelf, Slope, Delta, and Fluvial. A scale of 1:125,000 is indicated. The interface includes a menu bar, a toolbar, and a Table of Contents panel on the left. The Table of Contents shows the following layers:

- Well\_Results
- Top Layers
- Target\_GDE
  - Target\_GDE\_Valu
- Score
  - 100
  - 70
  - 50
  - 40
  - 30
  - 10
  - 0
- Target\_GDE\_poly
- POWER Risk Optimizer
- Power\_Grid\_Processo
- POWER6 Data Portal I
- Load\_V1
  - SW\_Amplitude
  - Horizon\_A
- SW\_\_Target.r
- SeisWorks\_Wh
- SeisWorks\_So
- SeisWorks\_Pr
- SeisWorks\_Fa

Two callouts highlight key features:

1. Custom Symbology for Your Editing Template (pointing to the Target\_GDE\_poly layer in the Table of Contents)
2. Assign value For Score in the Attribute Table (pointing to the Score legend)

The right side of the interface shows the 'Create Features' panel with a legend for 'Target\_GDE\_poly' and a 'Construction Tools' panel. The legend includes:

- Absent
- Basin
- Basin\_Floor\_Fan
- Delta
- Fluvial
- Marginal\_Marine
- Shelf
- Slope

The Construction Tools panel includes:

- Polygon
- Rectangle
- Circle
- Ellipse
- Freehand
- Auto Complete Polygon

The status bar at the bottom indicates coordinates: 713794.189 399440.578 Feet.



# Prospect Inventory

- Contours: fine & bold
- Perimeter outline (edge)
- Quantile classification
- Custom map surrounds
- Traps w. attributes

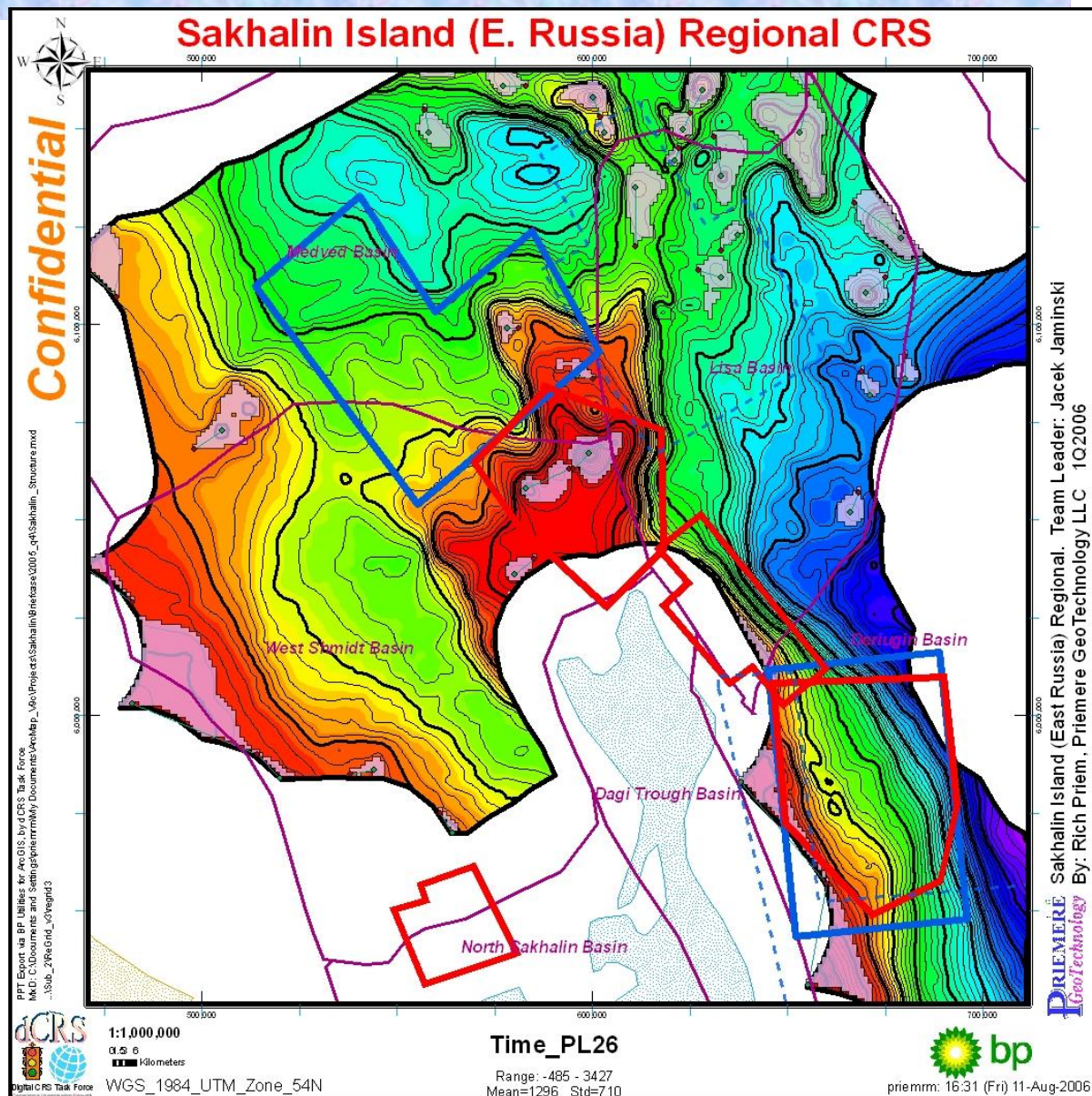
**Identify Results**

Layers: <Top-most layer>

[-] Trap Polygons

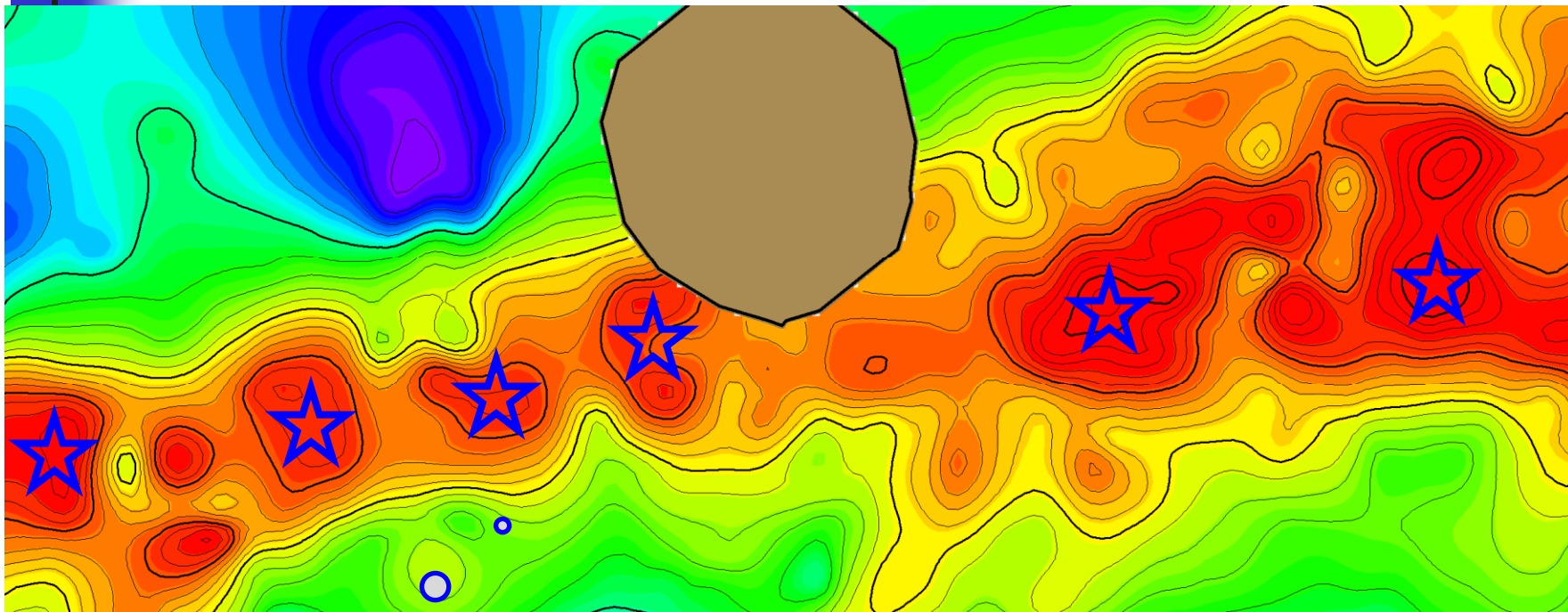
[+] Trap\_30

Field	Value
Location:	(504802.588235)
FID	30
Shape	Polygon
Crest (Feet)	12915.202148
Spill (Feet)	13015.666992
Column (Feet)	100.464844
Area (Percent)	0.426566
Volume (Cu_Feet)	43766241096.4
Shape (%)	30
Label	Trap_30
RMP_QC	Yea
<b>GDE</b>	Basin Floor Fan
Crit_Risk	Charge
CRS	50
SeaFloor	5313
DBML	7641
Porosity	23.6
KoverMu	24.8
Thickness	2134
NTG	52
Sub_Salt	85
Salt_Iso	4321



# Evaluating Reserves

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Which Prospect  
is Better?

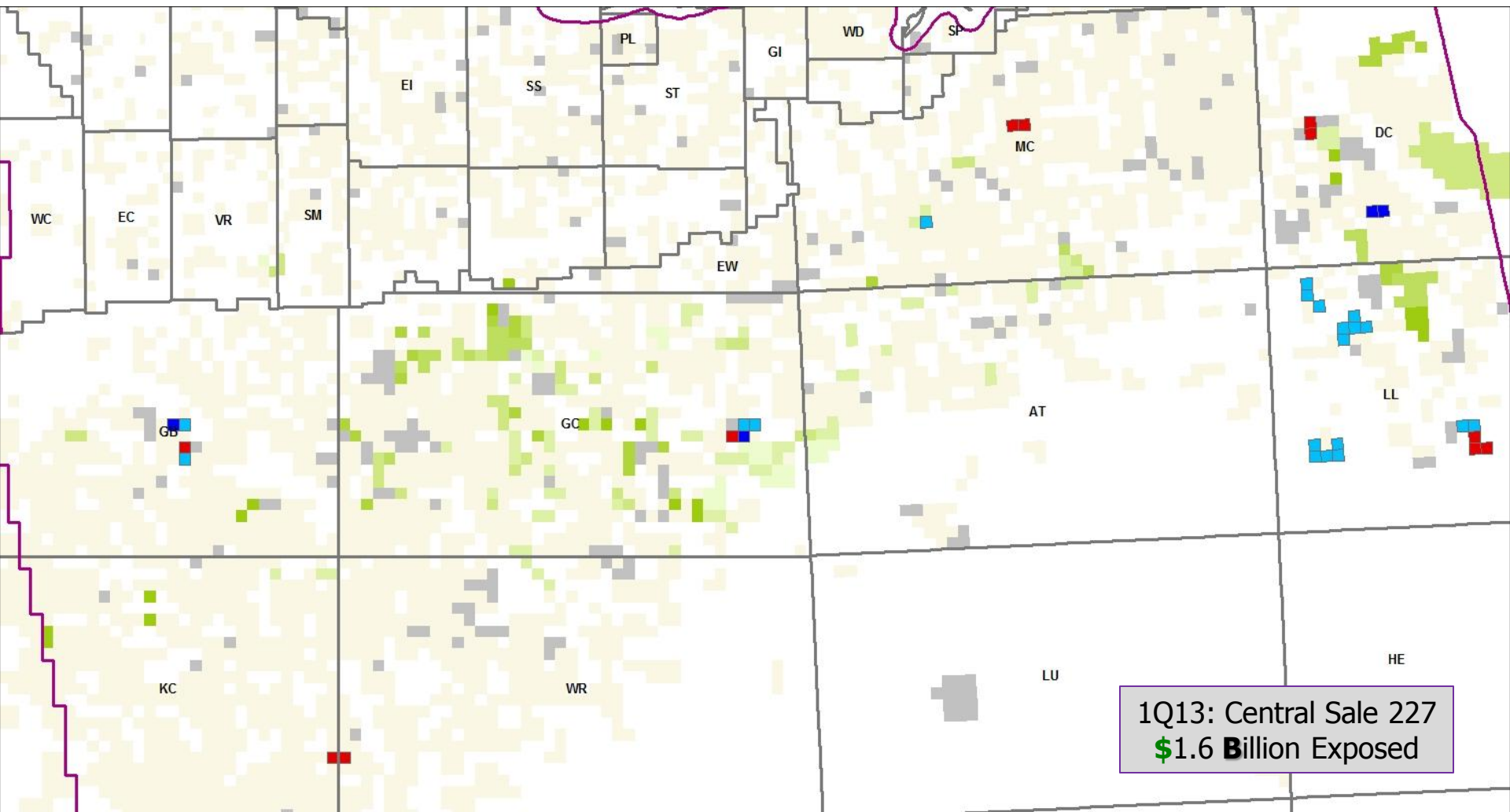
What is our  
Equity?

Sum of Volume			Case <input type="button" value="v"/>		
Owner	Prospect	Target	Max	Mid	Min
<input type="checkbox"/> MC-746	<input type="checkbox"/> North	Peach	5.003	3.651	1.952
		Brown	5.450	3.413	1.175
	<input type="checkbox"/> Thunder	Peach	5.425	3.184	1.635
		Brown	5.027	4.466	1.768
MC-746 Total			20.904	14.715	6.529
<input type="checkbox"/> MC-747	<input type="checkbox"/> Thunder	Peach	5.520	3.503	1.003
		Brown	5.569	3.110	2.024
MC-747 Total			11.089	6.614	3.027
Grand Total			31.993	21.328	9.556



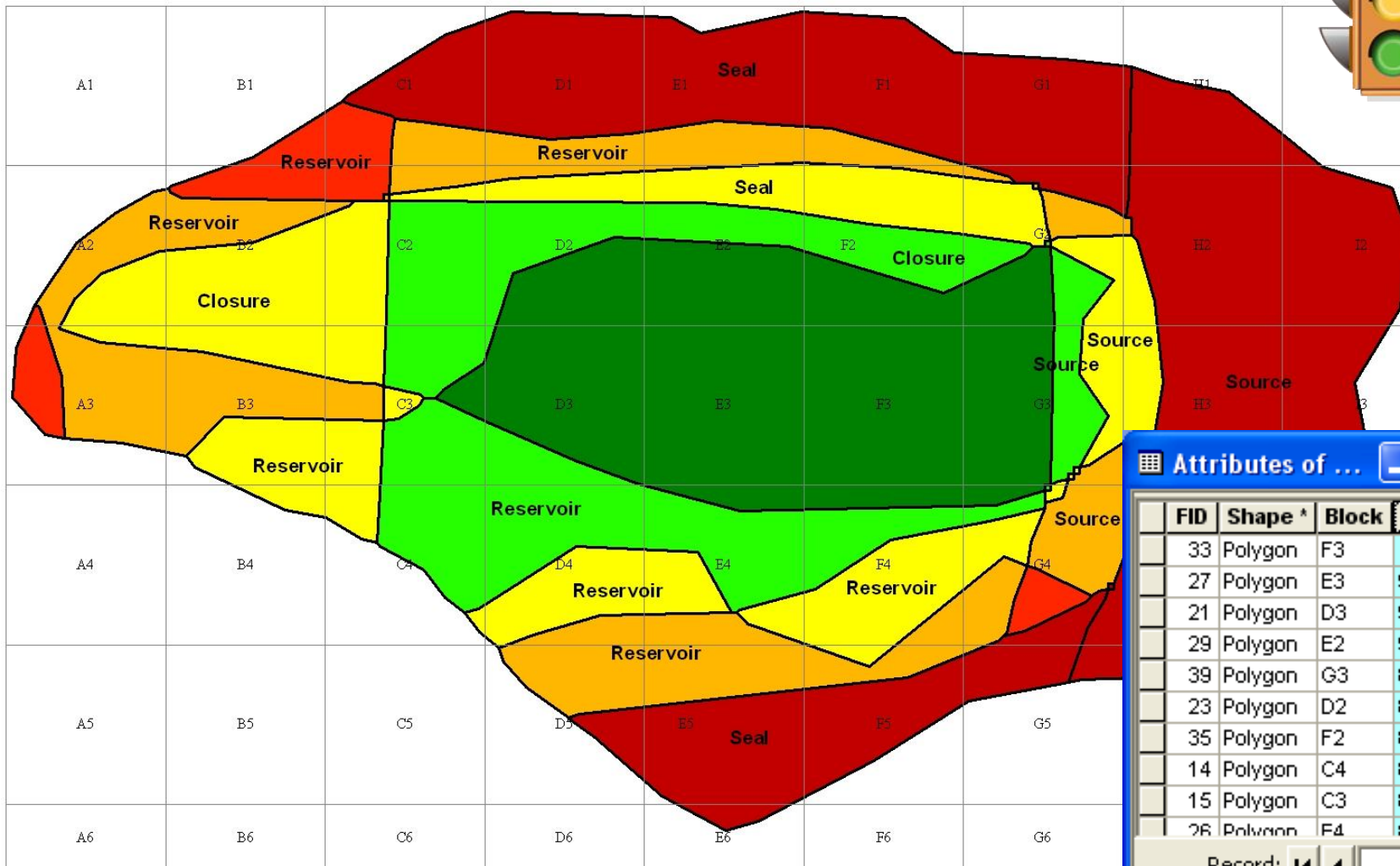
# GoM Lease Sale Result\$

- Bids **Won/Lost/Uncontested**
- Company **Leases** by age
- Blocks Bid in Sale (grey)
- Active Lease Blocks (yellow)



# Play Based Exploration

Decision Support, Focusing Opportunities, Suitability Analysis



Attributes of ...

FID	Shape *	Block	Risk
33	Polygon	F3	100
27	Polygon	E3	99.950
21	Polygon	D3	96.664
29	Polygon	E2	90.344
39	Polygon	G3	89.822
23	Polygon	D2	88.135
35	Polygon	F2	87.107
14	Polygon	C4	84.524
15	Polygon	C3	81.285
26	Polygon	F4	80.757

Record: 0



# Play Fairway Analysis

first published by BP: Grant, et. al, 1996

## ■ Overlay of Petroleum System Elements

- 1. Source Rock: presence & effectiveness
- 2. Charge Access: maturity & migration
- 3. Reservoir: presence & effectiveness
- 4. Seal: presence & capacity

## ■ Composite Risk

- Convolv individual risk elements
- Critical Risk Factor diagnostics
- Common Risk Segment polygons

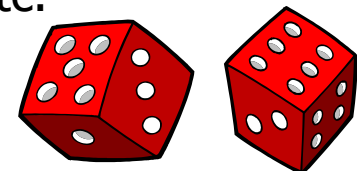
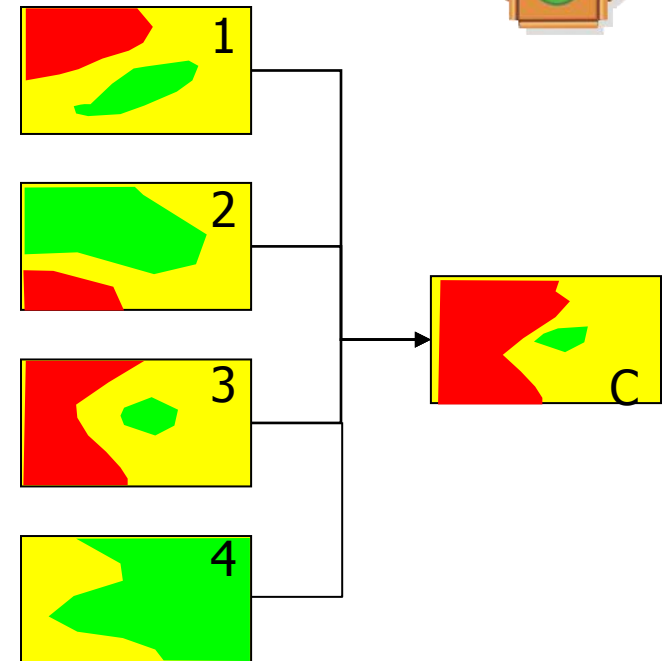
## ■ Calibration: statistical probability

### ■ Bottoms-Up Models

- seismic interpretation, amplitudes, potential fields, basin models
- geology, depositional environment, tectonic elements, etc.

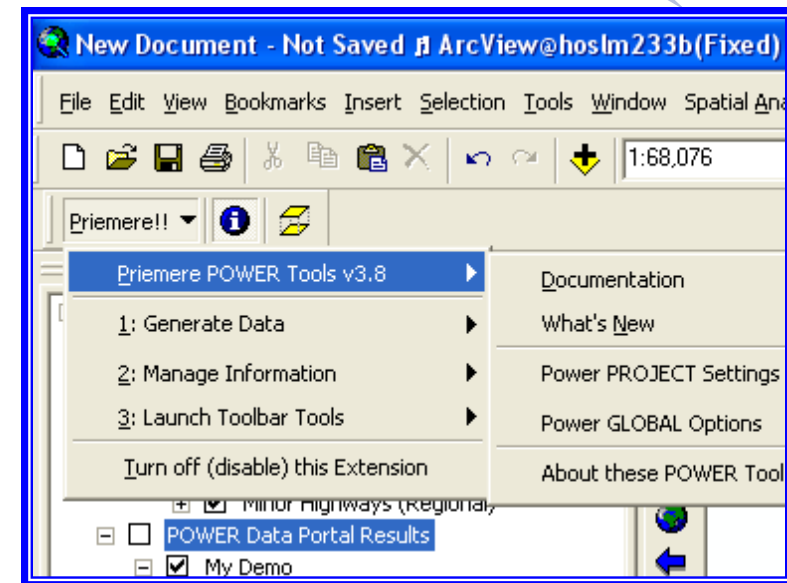
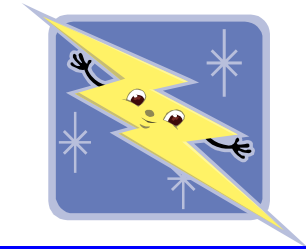
### ■ Tops-down Observations

- well control, fields, seeps, etc.



# Putting in the Power!

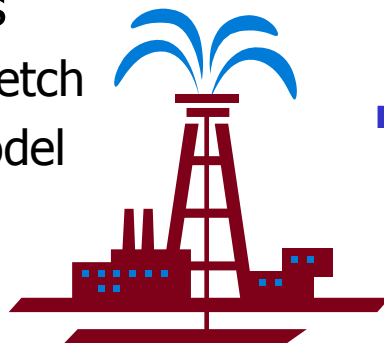
- Floating Toolbar
  - Custom extension (add-in)
  - Menu of Tools
- **Value** added to basic GIS
  - G&G processes & work flow
  - Familiar Terminology
  - Priemere Algorithms
- Batch Processing
  - Operate on **Groups** of Data
  - Intelligent Defaults
    - Minimize key strokes for parameter selection
- Attention to Details
  - Symbology, Metadata, etc.



# Something for Everyone

## ■ GeoScience Analysis

- Risking & Ranking
  - Regional or Local
  - Calibration to S/F analysis
- Structural Analysis
  - Traps, Basins, Fetch
  - Stratigraphic Model
- Volumetric\$



## ■ Data Access

- Many G&G applications (i/o)

## ■ Subsurface Mapping

- Gridding & Contouring
- Thickness, Reconstruction
- Trend/Residual, Grid Algebra
- Cross-section Viewer

## ■ Technical Support

- PowerPoint Slides ♥
- Context Menus (batch)
- Hover ID, Docking Toolbars
- Bookmarks, Recent Docs

## ■ IT Administration

- Metadata + Ancestry
- Inventory & Repair

## ■ Surveying

- Geodetic Integrity
- Footage Calls

## ■ Management

- Batch Processing
- Fast!



# Power Data Portal

Transfer between popular GeoScience Applications

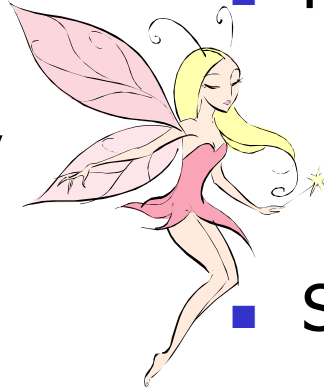
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## ■ GeoScience Data

- Grids, Polygons
- Wells, deviated survey
- Seismic Navigation
- Horizon interpretation
- Attribute extractions

## ■ Priemere Features

- Batch processing
- Half-links, neutral files
- Multi-select, drag/drop
- Efficient: very fast & clean
- **Auto-detect**: 70+ formats
- Export: 50+ formats
- Evolving: add your favorites



## ■ Halliburton/Landmark

- SeisWorks, OpenWorks
- StratWorks, PetroWorks
- Geographix, Zmap+

## ■ Schlumberger/GeoQuest

- Petrel, CPS3, IESX
- GeoFrame, PetroMod

## ■ Paradigm

- SeisEarth, GoCad

## ■ IHS: Petra & Kingdom

## ■ Trinity, EarthVision, Excel

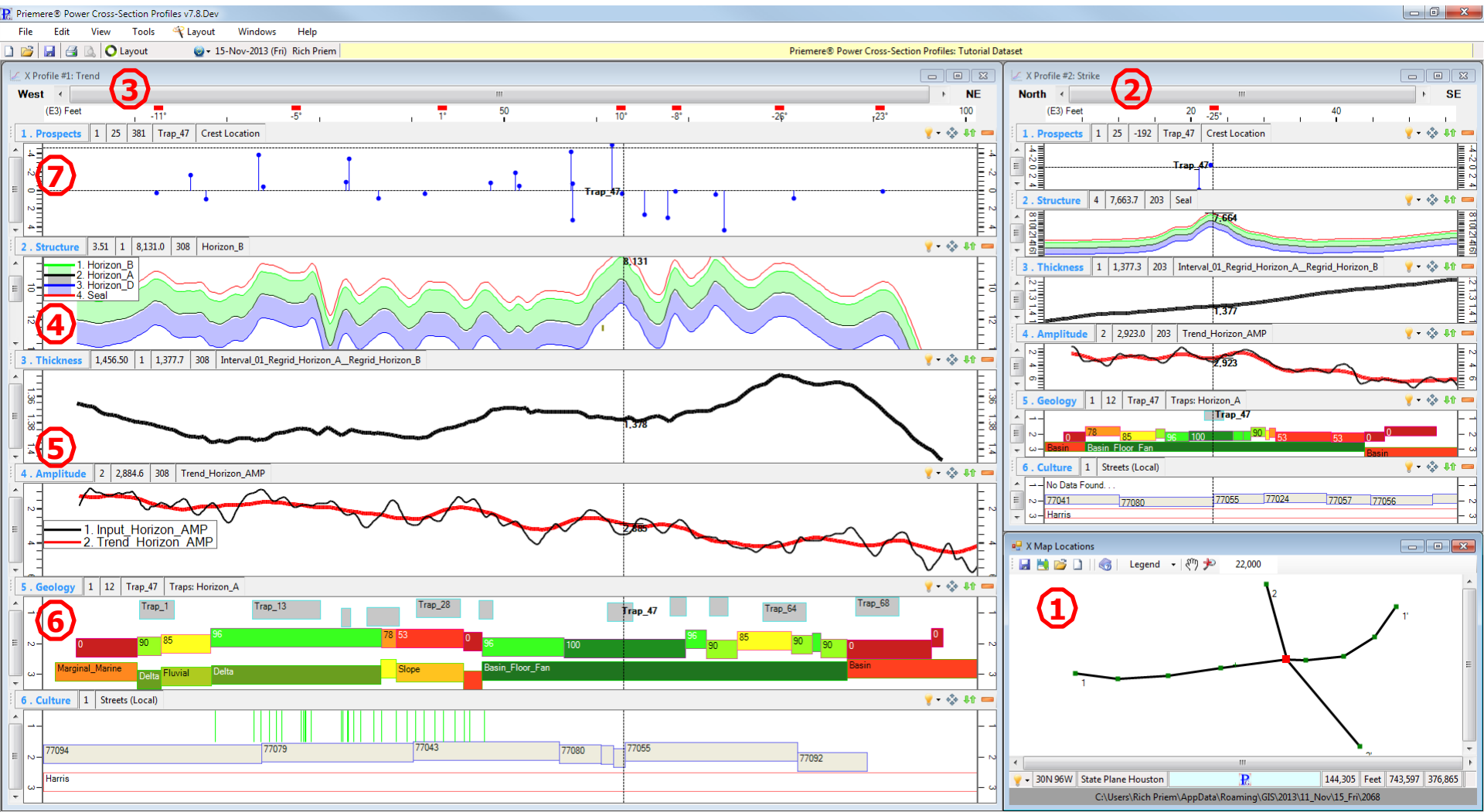
## ■ R&A: monte carlo models

## ■ Ascii: delimited columns



# Cross-Section Profiles

- When a Map is not enough, but 3D is just too much!



# MetaData Lineage

- Automatic capture, complete Ancestry!

**POWER Lineage**

- RISK\_01
  - Regrid\_Horizon\_A
    - Horizon\_A
- RISK\_02
  - Regrid\_Horizon\_C
    - Horizon\_C
- RISK\_03
  - Seis\Works\_Source\_Rc
- RISK\_04
  - Interval\_01\_Regrid\_Hc
  - Regrid\_Horizon\_B
    - Horizon\_B**
  - Regrid\_Horizon\_A
    - Horizon\_A

**Lineage Tags**

- Describe
- DataSource
- Description
  - abstract
  - purpose
- Lineage**
  - Document
  - Process
    - InFile
    - Format
- Keywords
- Citation
  - pubdate
  - origin
- Contact

/Esri/DataProperties/lineage/Inputs/In\_04/Lineage/Inputs/In\_01/Lineage/Inputs/Gri

RASTER: Workspace = C:\DATA\Rich Priem\ArcGIS\POWER\_Tools\2009.02.25\_

Horizon_B
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Rich Priem
Lineage Tags\Lineage

Power Data Portal Version 3.6.17  
Compiled: 20-Feb-2009 (Fri) 11:45 AM (5.24 Days ago)  
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