Classification of Rock Property Trends in the Gulf of Mexico using GDC Data in DecisionSite

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Business Issue: Geophysical Development Corporation has developed an extensive geophysical rock property database for the U.S. Gulf of Mexico over the last 20 years. This database provides a window into what type of seismic response to expect from new gas and oil fields and is being effectively mined by oil and gas companies.

Spotfire Approach: DecisionSite allows real-time database quality control (QC), evaluation, correlation, and pattern finding from all of the derived geophysical rock properties from all 5500+ wells in the Gulf of Mexico database. Data clusters and trend lines are providing insights into where new plays are, what geophysical rock property attributes are key for identifying new fields, and which trends hold the most promise for ongoing exploration, in order to find new gas and oil fields in the Gulf of Mexico.

The Result: DecisionSite provides a new way to quickly QC the raw data, a new way to browse through the data and look for trends, a new way to quickly create patterns and classify the data into trends, and a new way to identify and qualify new exploration opportunities.

Examples from Interactive Presentation:
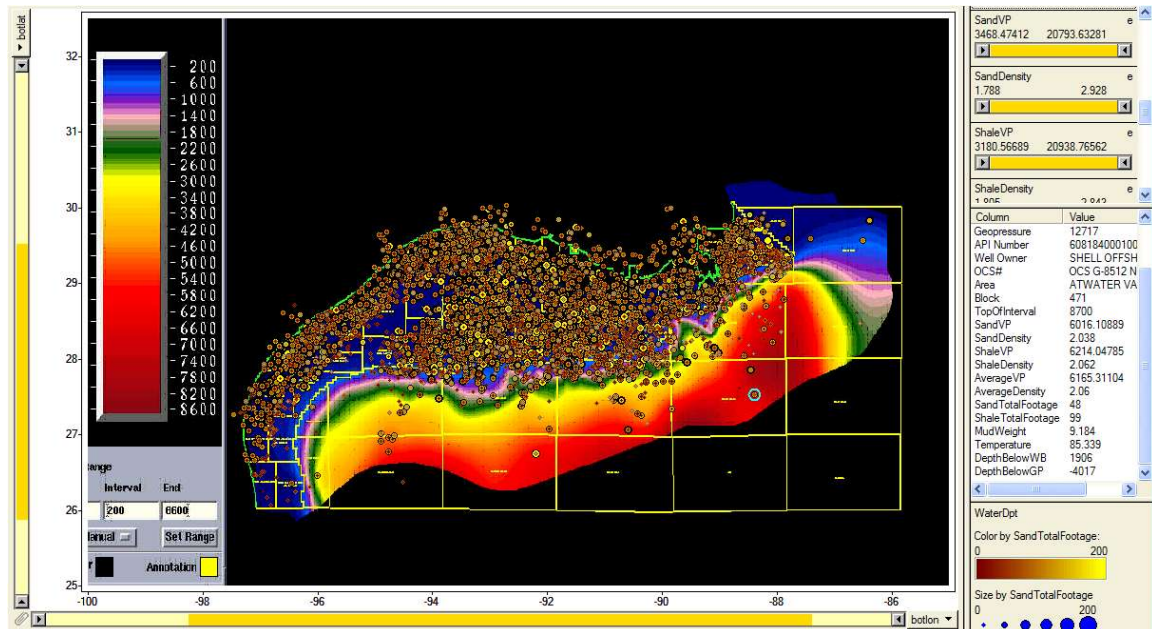
1. GDC_Rock_Property_Database.tif: Map showing extent of the GDC Rock Properties Database overlaid on a Bathymetry Map.
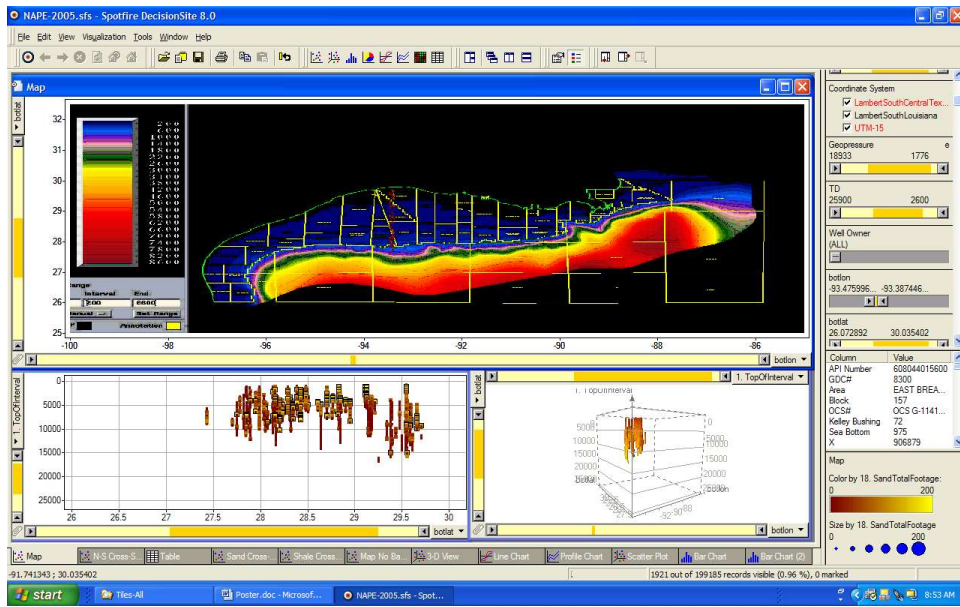
2. WestCameronCrossSection.tif : The map, cross-section, and 3-D display show how DecisionSite allows real-time review of GDC's large rock property database. A screen capture of bathymetry for the Gulf of Mexico is placed as a background for the map to provide context. The Bottom Hole Longitude range is set on the scroll bars, and then moved across to step through cross-sections of the rock property Total Sand Footage, with this image centered on the West Cameron Area.
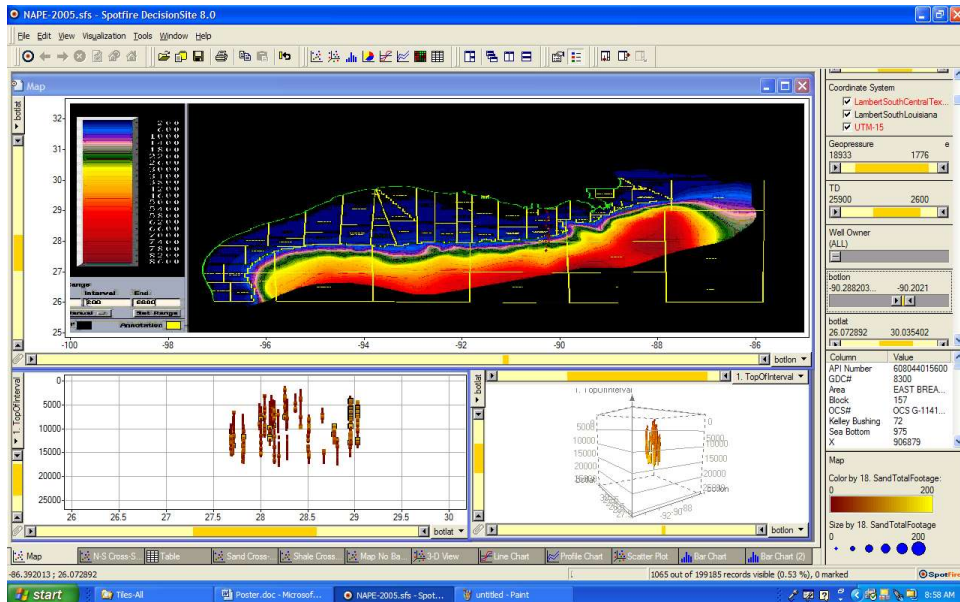

3. SouthTimblierCrossSection.tif: The same map as above shows the change in cross-section location to the South Timblier Area of the Gulf of Mexico. Note how there are fewer good sands, and they are deeper closer to the coastline (to the left on the cross-section). DecisionSite's intereactive updating provides real-time understanding of complex multi-dimensional relationships.
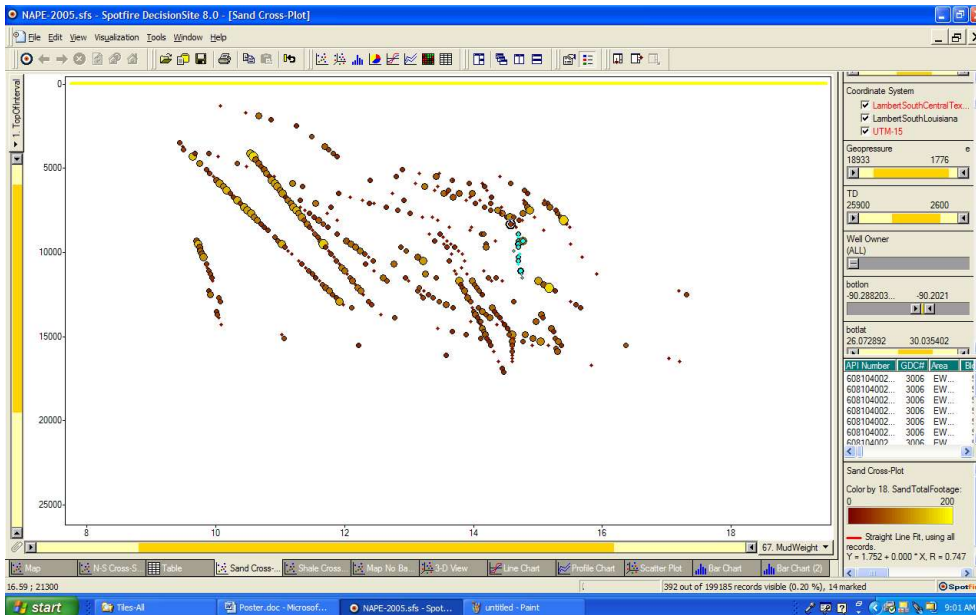
4. MudWeight_QC.tif: The data for the South Timbalier Area are then displayed in a cross-section showing depth vs. mudweight. Notice the constant mudweights which have been highlighted with the marker (colored cyan), and which provide an example of how easy DecisionSite makes it to quality control large databases. This means mudweight values in the well with GDC number 3006 needs to be checked out.
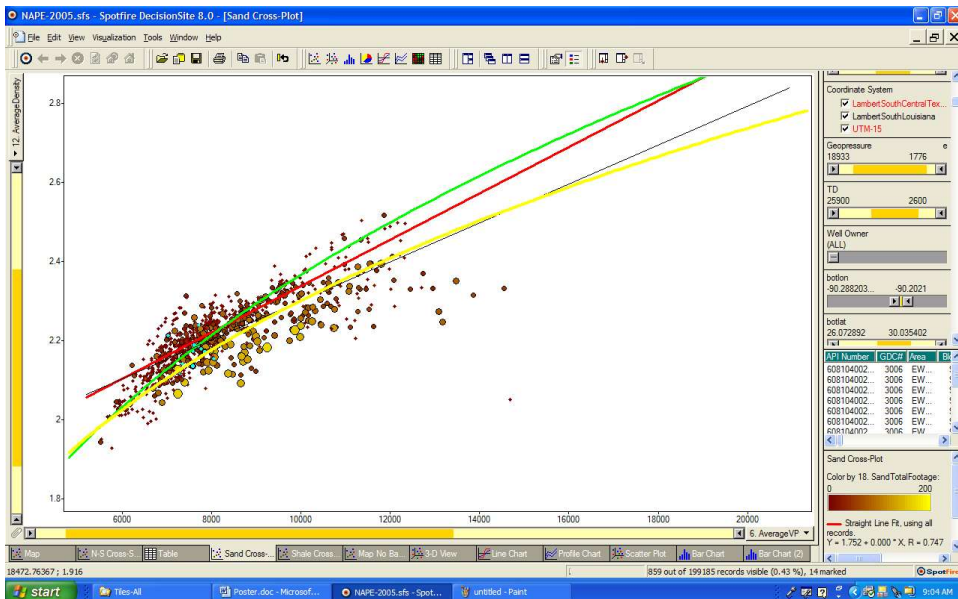
5. AvgDenAvgVel_So_Tim.tif: These same South Timbalier Area data are then displayed showing Average Density vs Average Velocity. The green curve is Gardner's equation (f(x)=0.23*x^0.25), the yellow curve is a modification published by BP (f(x)=0.152*x^0.298), the red straight line fit is to all data in the GDC rock property database, and the black straight line fit is to data in the cross-section strip of wells through the South Timbalier Area.
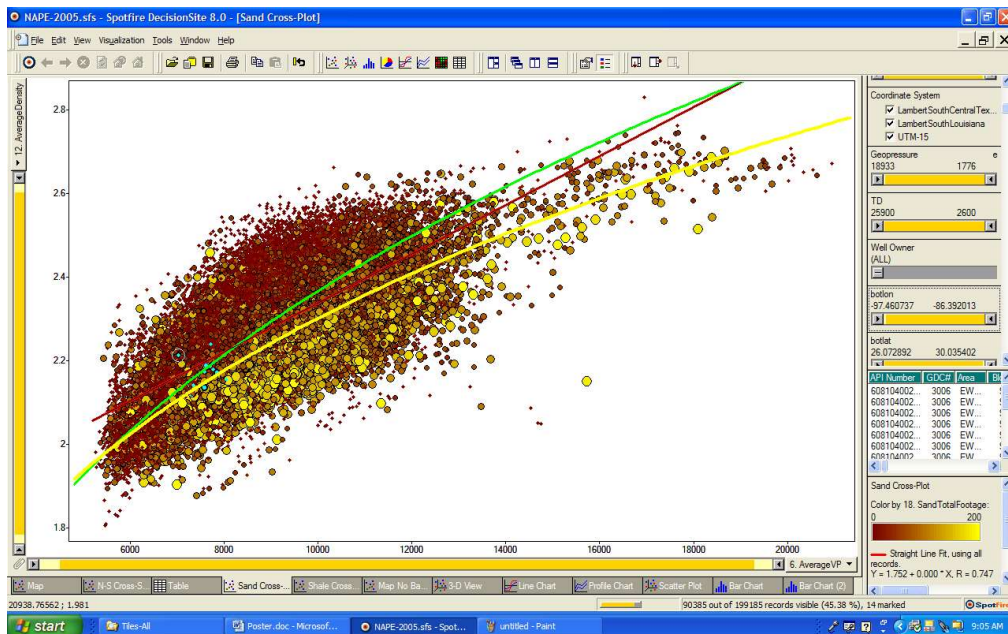
6. AvgDenAvgVel_All.tif: The Average Density vs Average Velocity plot for the entire GDC rock property data set shows relationships between the four curves described above and the QC issue identified from looking at depth vs mudweight. Note that the red and black straight line fits overlay each other because they are fitting the same data.
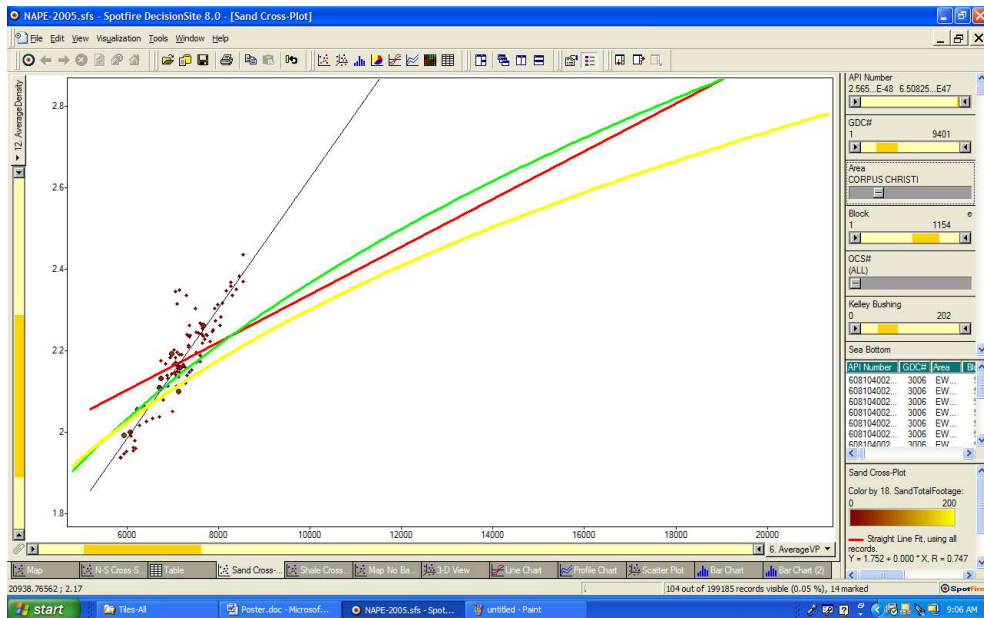
7. AvgDenAvgVel_Corpus.tif: Moving to the western edge of the Gulf of Mexico and showing the same plot shows that for the shallow wells that have been drilled in the Corpus Christ Area, there are few sands, and neither the Gardner equation, nor the BP equation provide an accurate representation of compaction and velocity relationships. Possibly the rocks have more volcanic content from the Big Bend Area, and thus the velocities are faster than predicted by the equations.