

## **Production and Reserves Analysis of the Multi-Zone Pembina Field, Alberta - A Look at an Old Area with a New Tool**

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### **Introduction**

Within a maturing oil and gas industry in Western Canada the efficient exploitation of existing discovered resources is very important. The identification and framing of unexploited potential within and around existing fields and pools is both necessary but increasingly difficult. Tens of thousands of wells in multizone oil and gas rich areas have significant supporting and historical data that can be used to assist exploitation efforts if it can be readily analyzed effectively. In-depth contextual analysis can be very time consuming and often is not easily updatable, making it difficult to detect and assess potential opportunities.

New information visualization technology and strategies have the potential to increase the speed, breadth and effectiveness of the analysis process. By enabling large multivariate data sets to be creatively viewed and analyzed new patterns can be noticed and hypotheses worked or reworked opening up the possibility of adding new insights regarding go-forward opportunities.

The authors have investigated multizone oil and gas production, reserves and hydrocarbons-in-place data using visual analytics tools, DecisionSite (DS) and DXP, from Spotfire Inc. The test data consists of 50+ years of oil and gas production data for the Pembina field and it's published remaining reserves as of 2006-01-01. Both are used in the context of assessed original-hydrocarbons-in-place to frame the area's remaining potential. The Pembina field consists of over ten thousand wells and 6000 square kilometres of land. DS and DXP are highly interactive and adaptive software tools allowing creative, in-depth analysis to be conducted with reasonable effort. This flexibility can assist in building a framework and work flow that can provide geoscientists and engineers with new insights, confidence with existing ideas, etc. allowing them to maximize remaining un-harvested value.

## The Process

Data for the Pembina field was sourced from commercial data providers and government. The software packages allow a user to input large amounts of multivariate data from a number of data sources including databases, text files and spreadsheets.

Using a simple and effective interface Spotfire allows the user to filter, sort and manipulate data which can then be displayed in many different visualization formats such as scatter plots, profile charts, bar charts, tables, trellis charts. It is the dynamic and interactive nature of these visualizations that can be used to provide insightful and otherwise unrealizable conclusions to the client. Figure 1 illustrates one of the visualizations that allows for easy comparisons of trends across multiple categories of data.

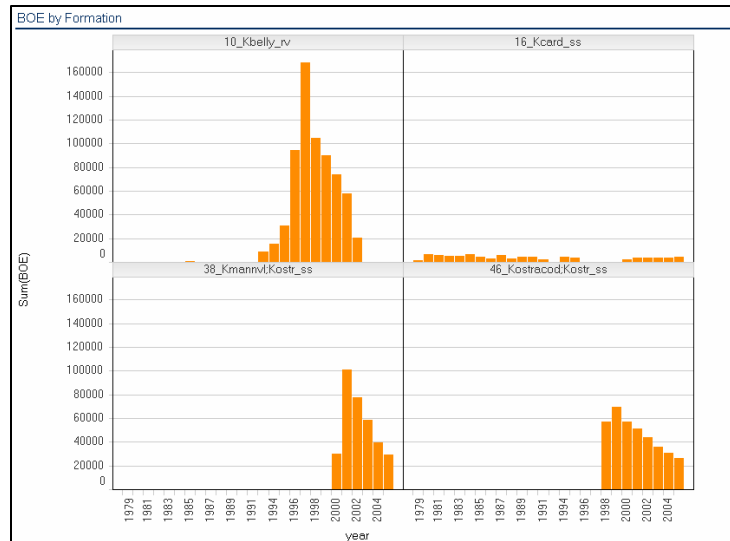


Figure 1. Production by formation

Another powerful feature of DecisionSite is its ability to interactively link with ESRI's ArcMap. As an example, data selected based on Spotfire visual analysis can be viewed spatially to determine any spatial clustering or trends. The reverse is also available, that is, selecting data based on their spatial location and then quickly see any analytical trends exposed by the Spotfire visualizations. Figure 2 illustrates the results of a dynamic selection of wells from a map and a connected visualization.

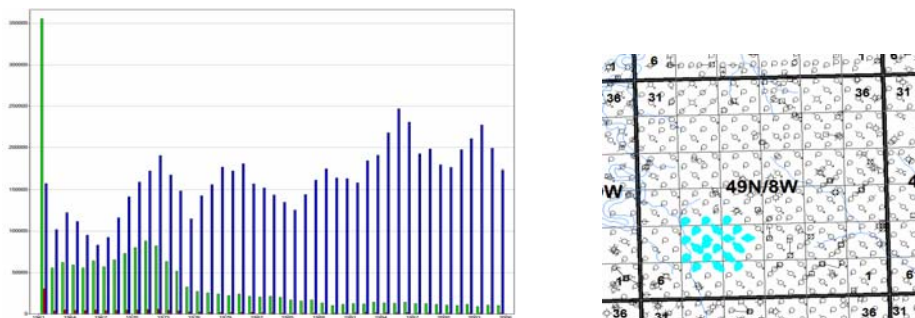


Figure 2. DecisionSite and ArcMap interconnectivity sample

The analysis can be dynamically linked to ever changing data, allowing the user to repeat any process with new data creating an analytical time series. The result is repeated analysis taking a fraction of the time of the original analysis, increasing the speed of decision making and allowing opportunities to be seized. The workflow can also be easily captured and reapplied to a new set of data from a different field.

### Preliminary Results

Using the Spotfire software tools, the authors analyzed production, published remaining reserves 01-Jan-2006, and unexploited hydrocarbons-in-place data by township (36 mi<sup>2</sup>) and section (1 mi<sup>2</sup>) within the Pembina Field area. The study analyzes available data by stratigraphic layering (pool) to the extents allowed by data source, vintage, and definition. In our analysis of townships and sections by the above attributes, the authors looked at existing wellbore densities and analyzed the data to suggest areas where additional drilling might be investigated. Example figures (3-5) are shown below illustrating some attributes of interest.

The resulting analysis of reserves, production, well performance, etc. then sets up a set of secondary questions that have to be analyzed in the context of, and with an understanding of, the area's geology - both stratigraphy and structure. Hypotheses regarding future opportunities must be validated, tested and further ranked.

This study demonstrates a repeatable analytical work flow and data framework that can be applied to any data-rich environment in the Western Canada Sedimentary Basin.

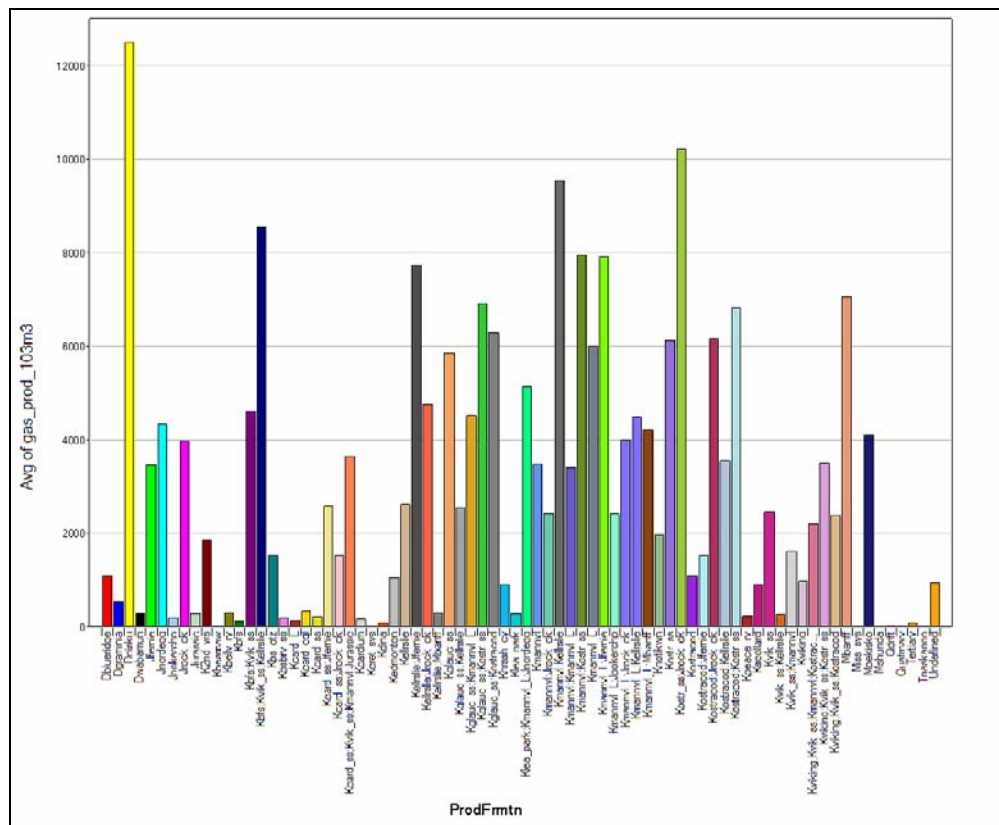
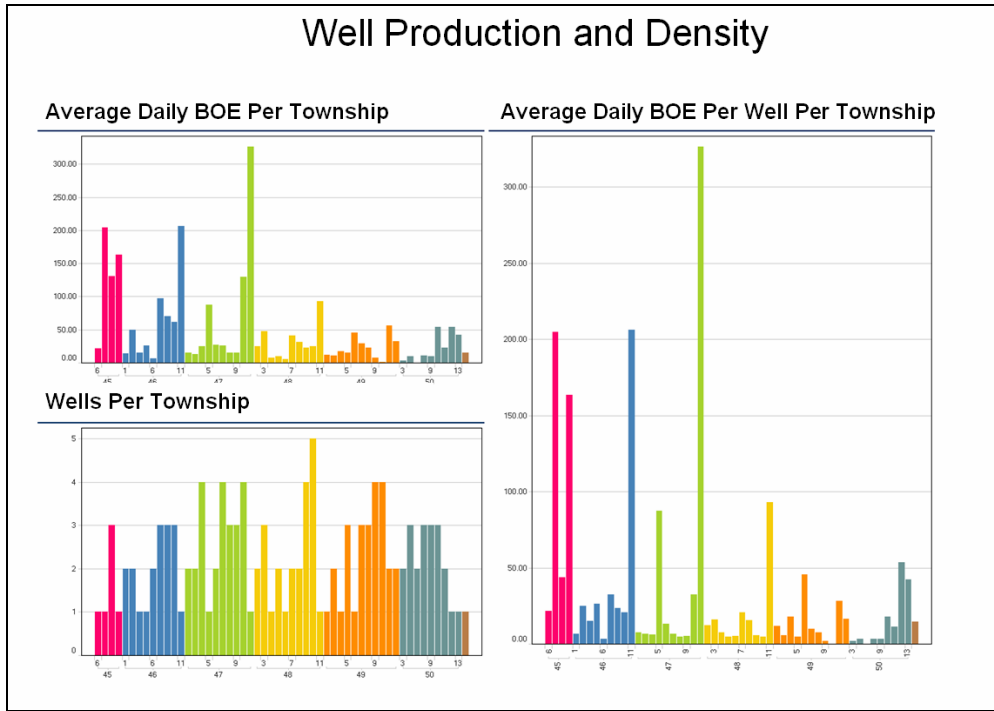
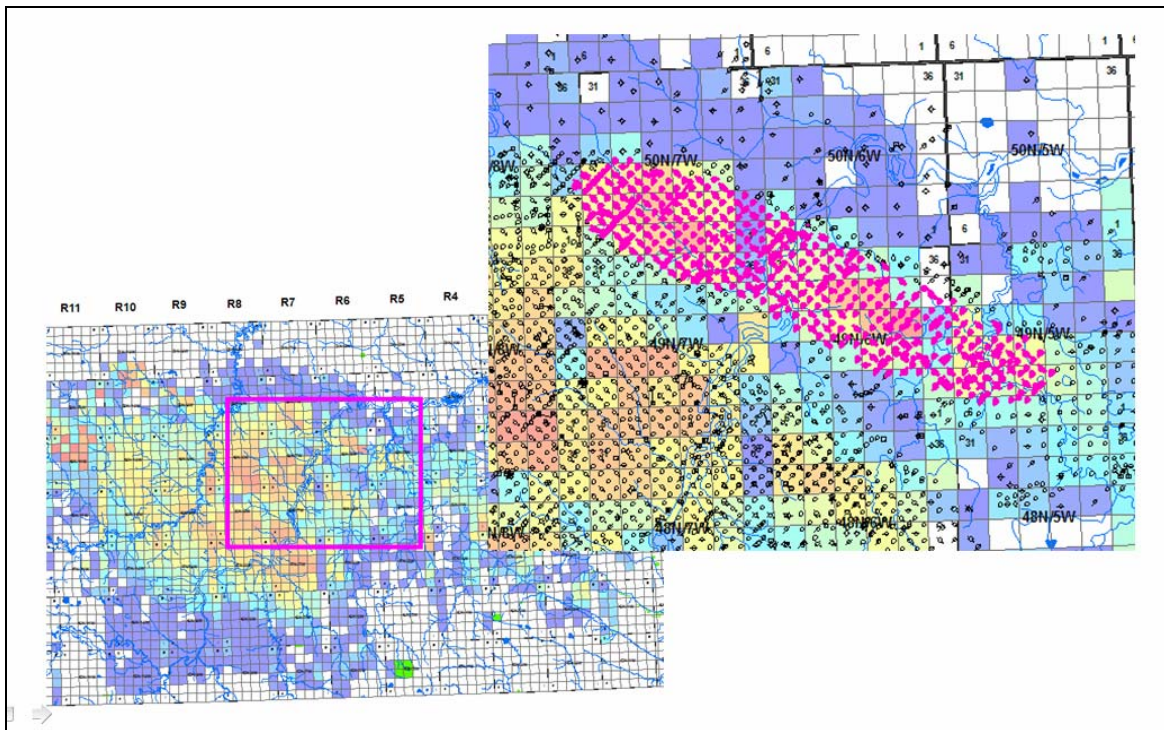


Figure 3. Sample Analysis Chart- Average Production by Formation



**Figure 4.** Sample Analysis Chart- Normalized Production by Density Organized by Township



**Figure 5.** Spatial interactivity using the Spotfire – ESRI connection

#### References

Spotfire Inc, 2005, Spotfire Drills Deep with Multivariate Well Data;  
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