

GEOLOGY ZONES

QUICKLY IDENTIFY WELLBORE LANDING ZONES

CLEARFORK

UPPER
SPRABERRY

LOWER
SPRABERRY

WOLFCAMP A

WOLFCAMP B

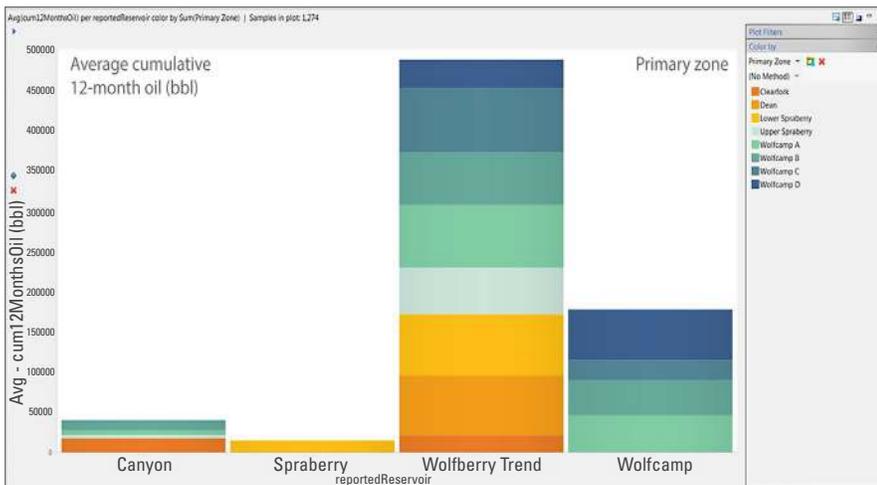
WOLFCAMP C

WOLFCAMP D



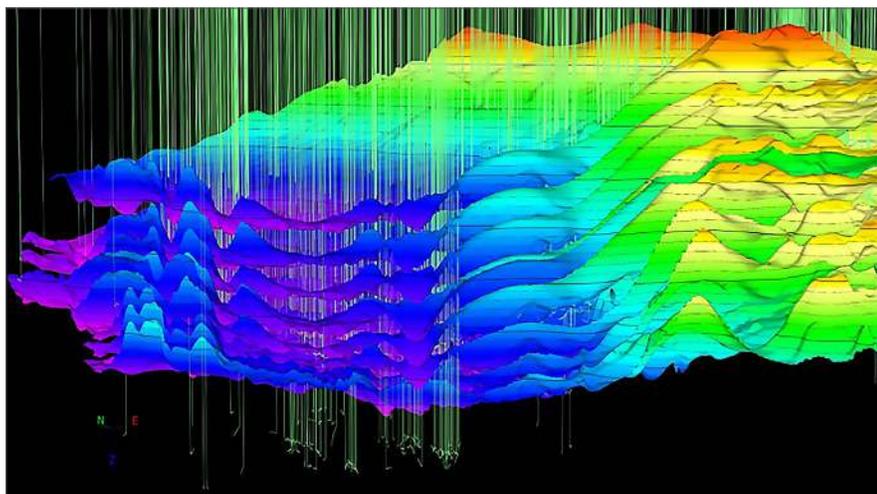
GEOLOGY ZONES: White Paper

Introduction



A common challenge for any discipline in the E&P industry is the ability to identify wellbore landing zones. The reported reservoirs that operators submit to state regulatory agencies are typically vague and unspecific. To analyze completion techniques and production by zone, Drillinginfo has provided “Geology Zone” assignments for wells in some of the most prolific unconventional basins in the U.S. This white paper will go over the methodology used to make these assignments.

Figure 1: This bar chart displays the number of wells by reported reservoir in the Midland Basin Play Assessment. It is colored by DI-assigned Geology Zone. In this case, the Wolfberry Trend can be reported for wells landing in almost every zone in the Midland Basin Play Assessment.



Stratigraphic Context

To locate where wellbores landed, we first need to have a stratigraphic framework built for our area of focus. DI Play Assessments include basin-wide maps based on digitized well logs and formation picks. Our team of geologists uses structural modeling techniques to create a self-consistent, three dimensional representation of the subsurface. Stratigraphic pinch-outs, unconformities, and faults can all be represented in the model.

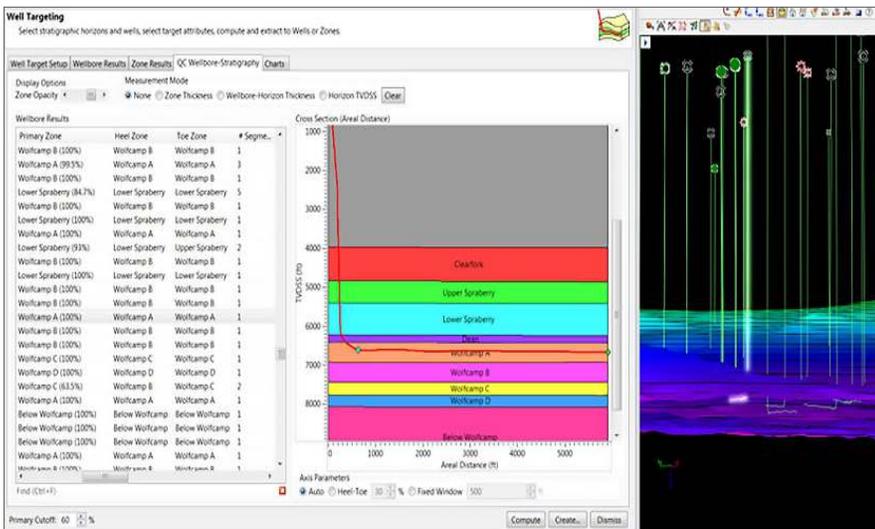
Figure 2: Mapped horizons in the Midland Basin Play Assessment displayed in the 3D scene in DI Transform. The intervals displayed include the Clearfork, Upper and Lower Spraberry, Dean, Wolfcamp A, B, C, D benches, and the Strawn. Horizontal wellbores are in green.

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Digitized Wellbores

Next we address the horizontal well bores and their directional surveys. This analysis is performed on single-trajectory wellbores which are hand-selected and quality controlled by the geologists to make sure the correct wellbore/survey is used and that non-productive wellbores are excluded from the calculations.



Well Targeting in DI Transform

Once the subsurface model is built and the well bores have been quality controlled, the data are ready for the Well Targeting workflow. The Well Targeting workflow in DI Transform is an automated tool that locates wellbore landing zones and calculates the geometric attributes of wellbores, such as length within a formation, heel/toe difference, tortuosity, and much more. Because it is an automated process, 10's or 100's of wells can be assigned at once.

Figure 3: The QC Wellbore-Stratigraphy tab in the Well Targeting workflow in DI Transform is used to visualize the results of the calculations performed. The selected well landed 100% in the Wolfcamp A Bench. The cross-section view shows in detail how the well was drilled through the section. In the 3D scene, the horizontal portion of the wellbore is located between the Wolfcamp A and B horizons.

3 STEPS

to create the Drillinginfo Geology Zone assignments:

#1

The Geology Zones are defined by using the mapped horizons in each project.

#2

Wellbores must have an inclination of 70 degrees or greater to be included in the analysis, which is used to define the completed interval.

#3

At least 60% of the completed interval must be within a Geology Zone to be assigned to that zone.

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Conclusion



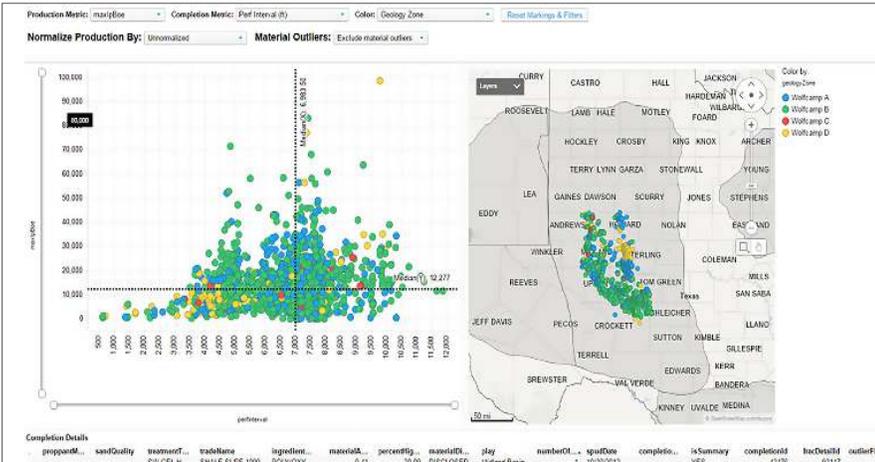
Geology Zones are found in DI Play Assessments and DI Analytics modules including Production Analysis, Productivity Analysis, Grading and Best Practices, Production Scenario Analysis, and DI Engineering Explorer.

Figure 4: Well Map tab in DI Analytics Productivity module filtered to wells with Geology Zone assignments. The well spots are colored by geology zone.



In DI Play Assessments, the Primary Zones/Geology Zones are saved to the DI Transform project database as wellbore attributes along with the other attributes calculated in the workflow. This allows users to perform exploratory analysis with the attributes using univariate and bivariate plots in the data analyses tools. Furthermore, these attributes can be included in multivariate statistical models, such as nonlinear regression non linear regression, for more in-depth analyses.

Figure 5: Plots from the Data Analysis tool in DI Transform. The top cross-plot depicts the producing interval length in feet versus 3-month cum oil production; data points are colored by DI-assigned producing interval. As expected, the overall trend indicates longer producing intervals have higher production yields. The large scatter in the data highlights that many wells have low production regardless of interval length, thus the producing interval length is not the only factor controlling larger hydrocarbon yields. The bottom bar chart depicts the average 3-month cum oil production for an average well in each geology zone. The Lower Spraberry and the Wolfcamp A average the most production per well in the play; the Dean and the Clearfork the lowest.



In DI Analytics, the Geology Zone is provided as a filter option in the web player that allows users to analyze production and completion trends at the reservoir level. This powerful dataset saves time and effort spent in conditioning the data to make it ready for further analysis. Consequently, well performance can be easily normalized to the geology zone or producing interval, and various geology zones can be compared and evaluated for producibility and engineering practices.

Figure 6: Production and Completion Comparison tab in DI Engineering Explorer. The cross-plot on the left compares max IP BOE to Perforation Interval Length for wells in the Midland Basin. Wells are filtered and colored by Wolfcamp A, B, C, and D Geology Zones.

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