[PS]Utica-Pt. Pleasant Condensate Yield Prediction Using 3-D Maturity Modeling*

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Abstract

The Utica-Pt. Pleasant unconventional play produces gas and condensate in eastern Ohio and western Pennsylvania. Condensate yield is important to the commercial success of the play, so there is an interest in improving the pre-drill prediction of this parameter. In general, measured and modeled maturity can be used as a predictive tool to distinguish areas prospective for oil, wet gas, and dry gas for unconventional plays. Usually oil is found in the 0.6–1.1 Ro range, wet gas from 1.1–1.7, and dry gas over 1.7. In this case we attempt to predict condensate yield rather than just wet gas based on a range of modeled maturity. A 3D maturity model of the Utica-Pt. Pleasant Basin was constructed in order to predict maturity (vitrinite reflectance equivalence or VRE) for multiple stratigraphic horizons. The horizons modeled were the Berea, Marcellus, Top Ordovician, Utica, Top Knox, Base Knox, and Basement. In addition to structural horizons a map estimating late Paleozoic erosion was constructed. An uncorrected temperature gradient map from bottom hole temperatures from nearly 1500 wells was also made. This map was adjusted to correlate the Utica-Pt. Pleasant modeled maturity to the rock maturity for this interval. Utica-Pt. Pleasant model maturity to rock maturity correlation coefficient was about .50. This calibrated temperature gradient map was then used to model the other six horizons. Condensate yield was calculated from Utica-Pt. Pleasant production data for 256 wells provided by the Ohio Department of Natural Resources. These condensate yields were correlated to Utica-Pt. Pleasant modeled maturity and a good correlation (R2 = .76) was found between these data sets. The Utica-Pt. Pleasant modeled maturity map was then transformed to a condensate yield map by means of the equation. It was observed that there was a geographic difference between the relative condensate yield at a given maturity. Wells in Guernsey, Noble, and Washington Counties have a higher condensate yield than wells to the north of this area in Harrison, Carroll, and Columbiana Counties. Therefore, one function from maturity to condensate yield for the entire eastern Ohio area was not sufficient. One function with relatively lower condensate yield was used for the northern area and another was used for the southern area. This technique has proven successful in other North American unconventional plays.

Utica - Pt. Pleasant Condensate Yield Prediction Using 3D Maturity Modeling -

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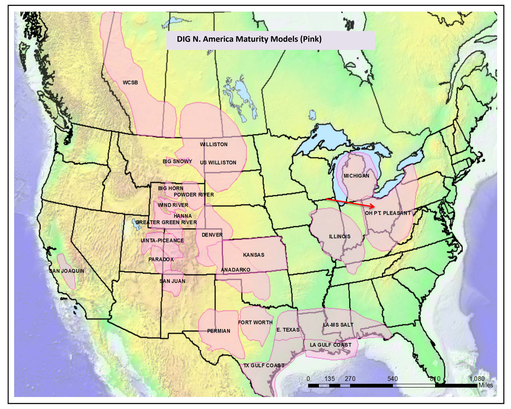
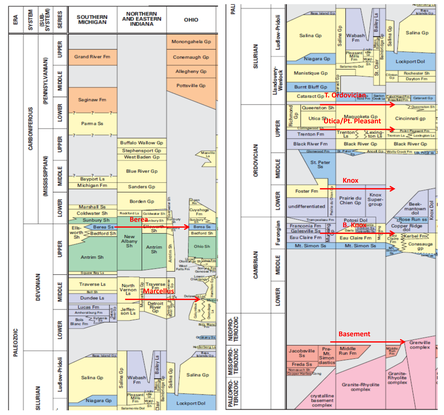
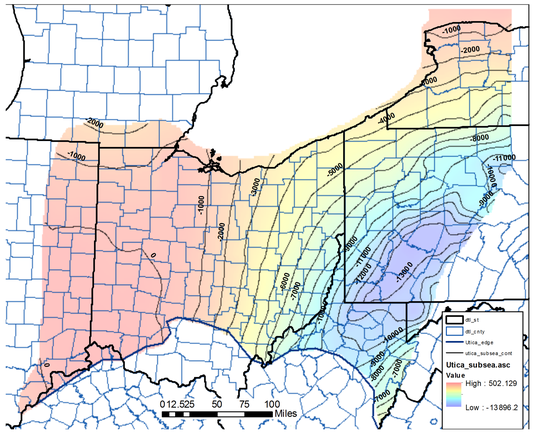
Pt. Pleasant Basin



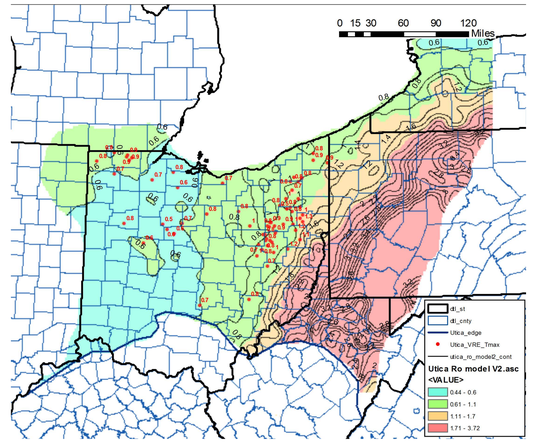
Stratigraphic Column



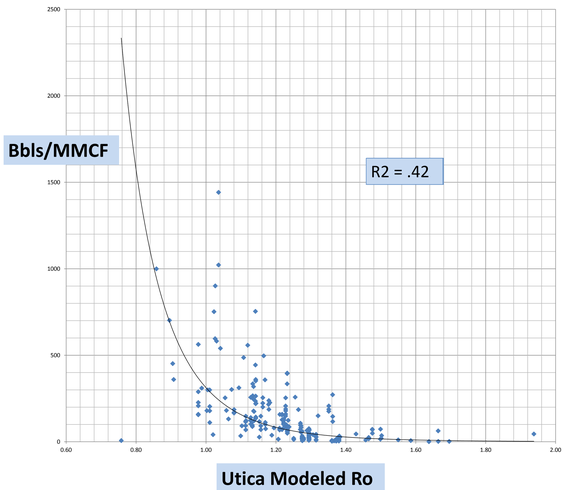
Utica Structure



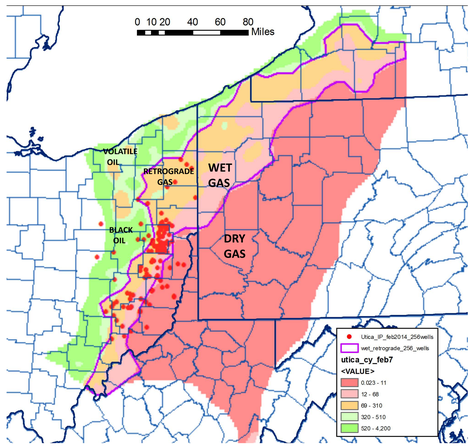
Utica Ro Model



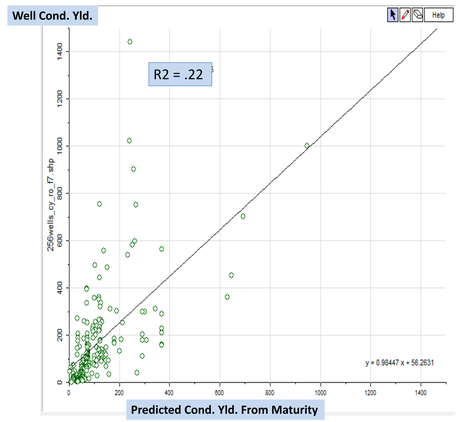
Utica Condensate Yield Vs Ro Model



Utica Predicted Condensate Yield

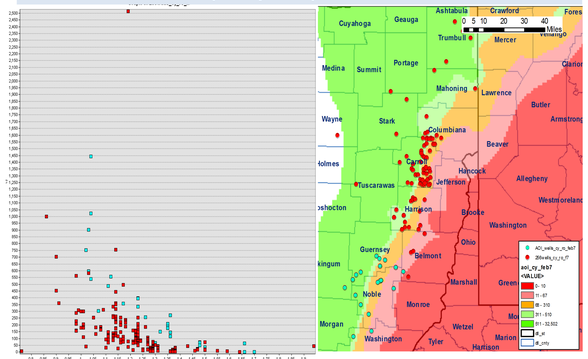


Well Vs Predicted Condensate Yield

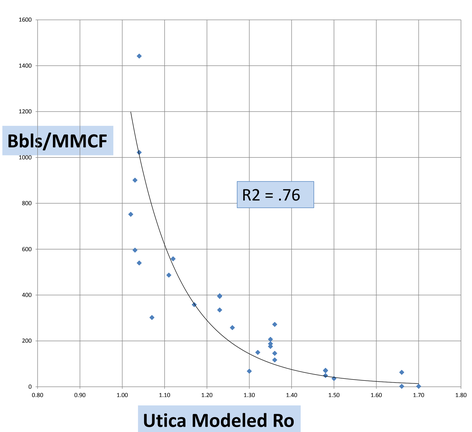


Northern Vs. Southern Wells Difference

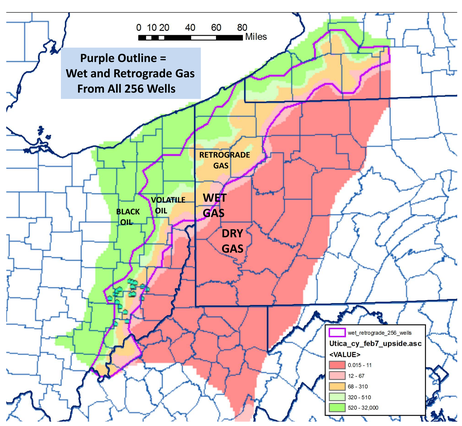
Southern wells show higher condensate yields for a given maturity than northern wells. A sensitivity case based only on the 29 southern wells (blue points) was run.



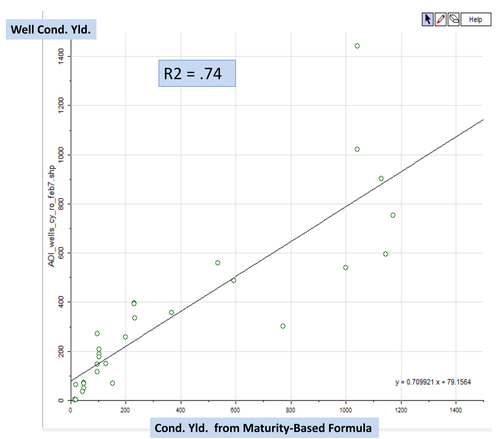
Southern Wells Utica Cond. Yld. Vs Ro Model



Utica Predicted Condensate Yield Based on Southern Wells (Blue Dots)



Well Vs Predicted Condensate Yield Based on Southern Wells



Utica-PP Condensate Yield Prediction

- The Utica – PP is primarily a gas and condensate play and condensate yield prediction is an important factor in ranking potential well locations.
- Maturity predictions for the Utica – PP horizons were completed.
- A condensate yield prediction for the Utica-PP play area was requested.
- Utica-PP condensate yield from 256 wells was related to predicted maturity over the play area but the correlation coefficient was fairly low (R2 = .22).
- The correlation was improved by breaking out the wells geographically.
- Higher condensate yields were noted in wells to the south at similar maturities.
- The geologic cause of this difference is uncertain. One possibility is that downdip dry gas has preferentially migrated into the northern area lowering the condensate yield in that area compared to the southern area.
- This hypothesis could be tested by comparing gas isotope with rock maturities in the two geographic areas.