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Geo-modelling approach to unconventional plays: workflow and examples from Canadian Deep Basin and Duvernay Formation

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Summary

In shale gas plays, sweet spots are defined as target locations or areas within a play or a reservoir that represents the best production or potential production. Geoscientists and engineers attempt to map sweet spots to enable wellbores to be placed in the most productive areas of the reservoir. Sweet spots in shale reservoirs are defined by source-rock richness or thickness, by natural fractures, or by other factors, using geological data such as core analysis, well log data, or seismic data. Extra effort shall be focused on identifying sweet spots from data analysis.

Property modelling in 3D using trends and geostatistics is now an industry standard to estimate and predict reservoir behavior. Geomodellers try to combine geophysics, geology and reservoir engineering (e.g. production data) to estimate optimal reservoir properties, both at local and regional scales.

In unconventional, long life field analogues rarely exist and so a pilot appraisal project combined with competitor activity is typically used to generate play metrics and forecasts. However, diligent reservoir characterization is the key for economic success in most unconventional plays. Reservoir characterization through numerical models will help accelerate data assimilation into a predictive model.

Examples

We will present an example from the Canadian Deep Basin (Basin centered ultratight-sand plays) and an example for the Duvernay Formation (unconventional resources plays). Investigation of important properties for both plays has been carried out. For instance, mapping of the overpressure is important for the Deep Basin (Cretaceous Wilrich tight sand play in the Western Canadian basin), and for the Devonian Duvernay URP, the liquid yield per mmscf is of paramount importance. Additional modelling parameters included: e.g. Pressure, TOCpresent day, TOCoriginal, Elastic Properties, mineralogy might be necessary. At an early stage of development, modelling is helping to define the key properties driving the play, along with data/statistical analysis tools.

Conclusions

This integrated approach can be improved even further thanks to an advanced data analysis tool specifically designed to get the best out of large input datasets. Modern geomodelling tools allow for quick turnaround when new data is integrated and output usable results for comparing production data with reservoir characteristic data. Risk and uncertainty analysis might be performed as well. “Sweet Spot” mapping can be derived from a combination of properties.

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