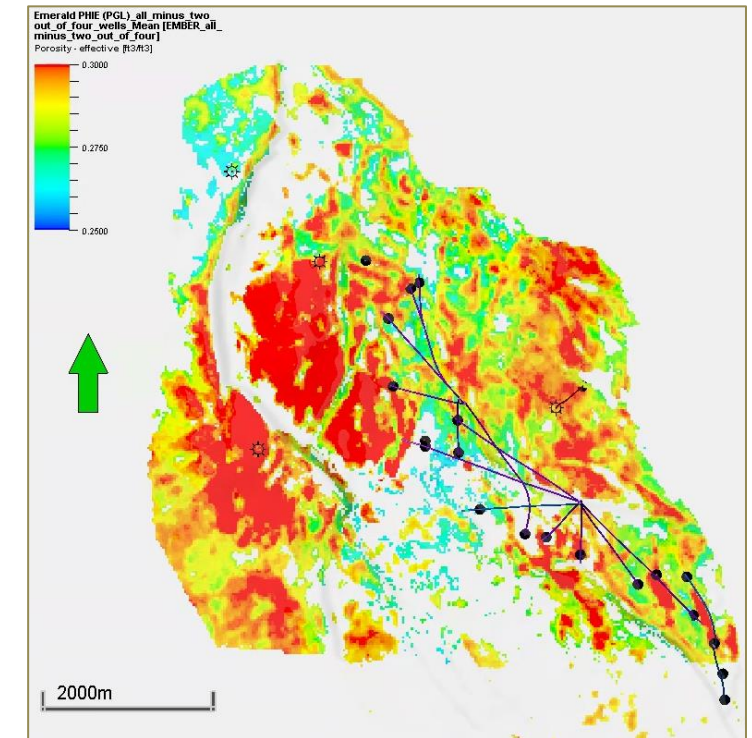


Applying Machine Learning and GPM for Gaining Efficiency and Improved Predictability on the Cheviot Asset

Paul Armitage
Subsurface Manager

Schlumberger Digital Forum
Luzern, 21st September 2022



Acknowledgements

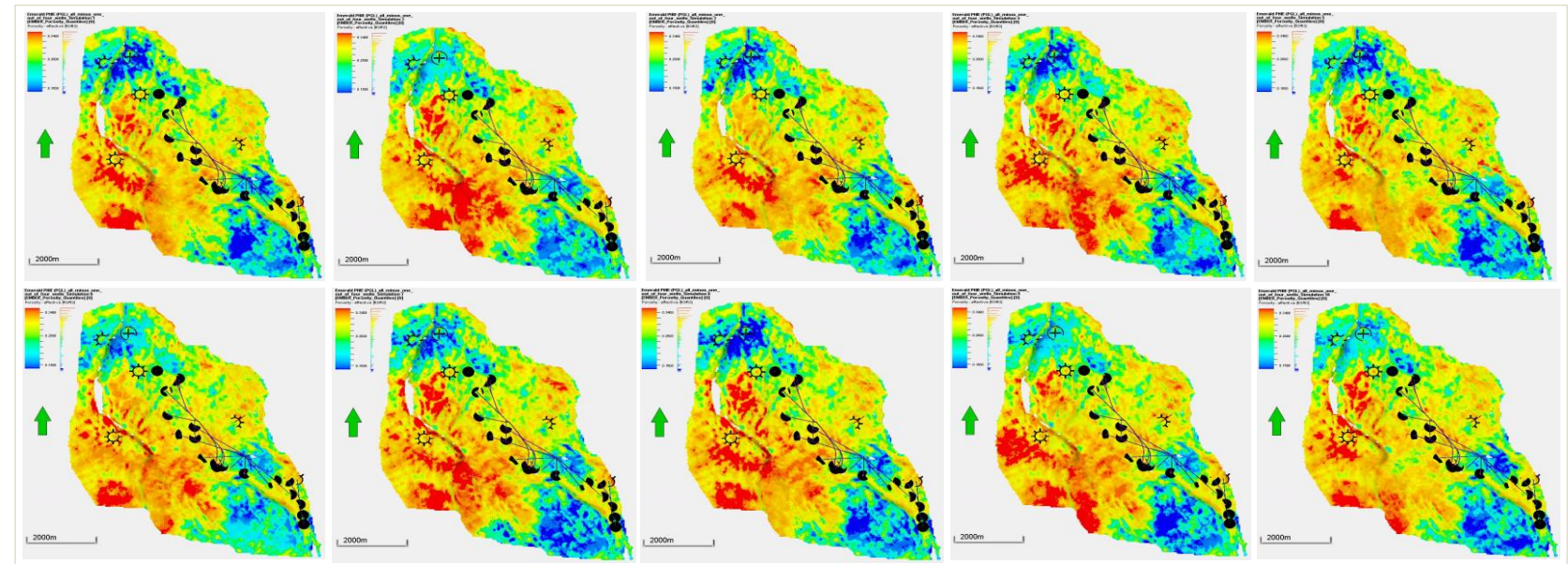
The real workers:

- *Alpha Petroleum*. Iyior Abumere, Penny Milner
- *Schlumberger*. Ammar Ahmad, Sergio Courtade, Klaus Eder, Sonat Kaya

Thanks to the Management of Alpha Petroleum for permission to attend and present.

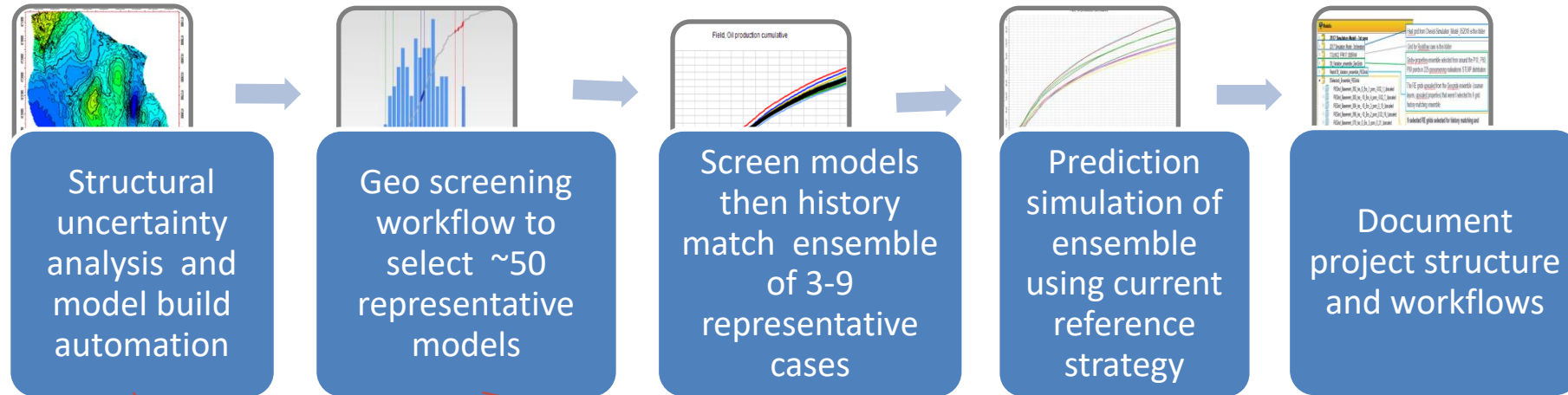
Outline

1. The Cheviot Development Project
2. Current GeoModelling Workflows
3. Study Objectives
4. ML Workflow
5. Results
6. Impact of Geological Process Modelling (GPM)
7. Next Steps

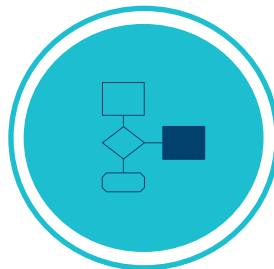


-

Cheviot Field Existing Geomodels

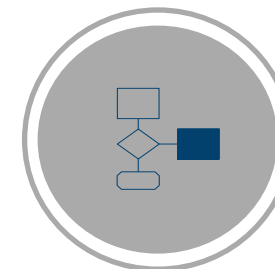


Base Case Workflow



300 lines
~ 10-12 mins to rebuild
geomodel from input
surface

Base Case Workflow with
uncertainty parametrisation



500 lines
2-3 days to build over 300 realisation, and run volumetrics and flow
connectivity calculation on each

Cheviot Field: Objectives and Challenges

Challenge

Is there an improved petrophysical properties correlation to be incorporated into Cheviot Field Geomodels?

Solution

Improving properties correlation using a random forest regression workflow. Also, use additional training feature inputs (seismic and geometrical properties) to check for correlation coefficient improvements

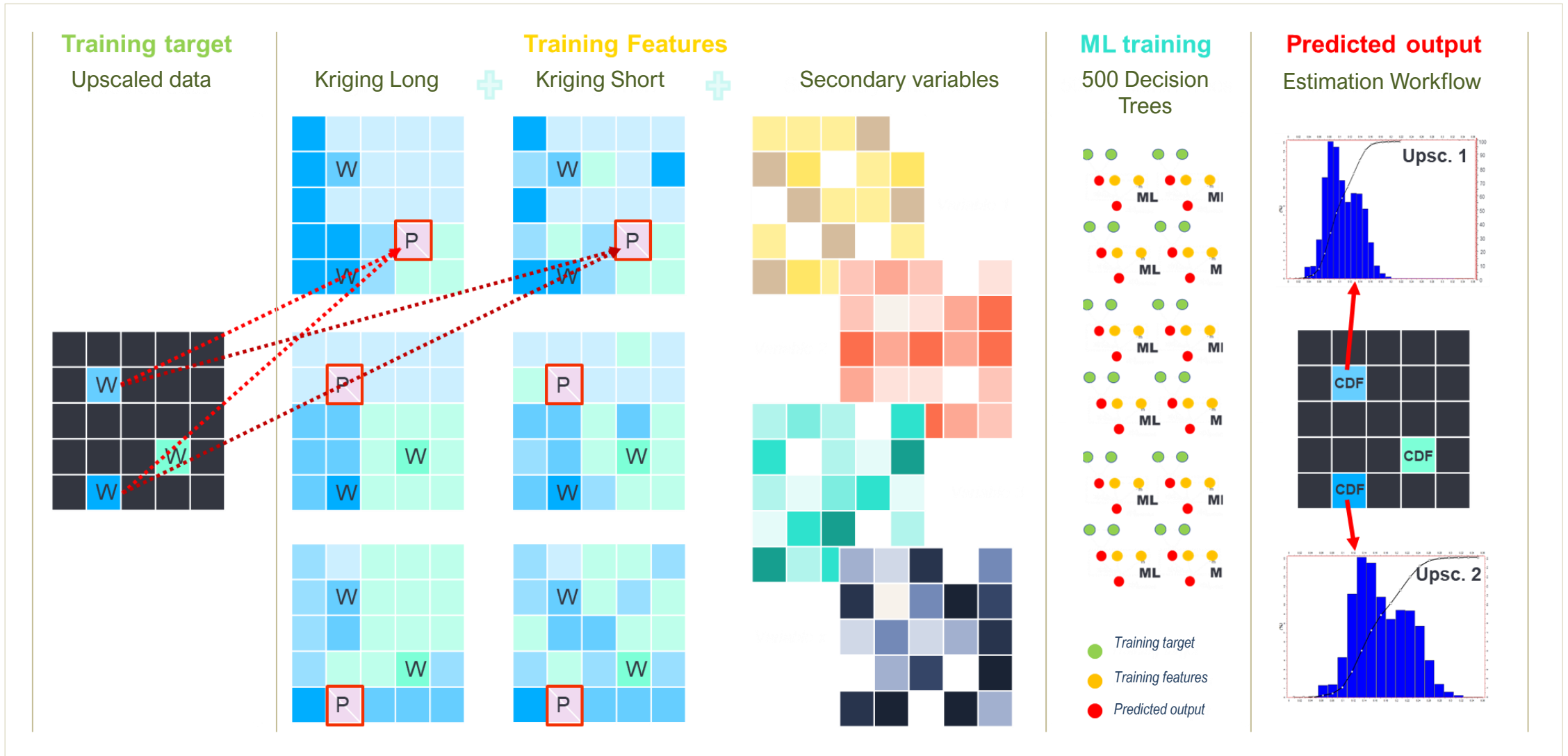
Innovation

Integrating **Geological Process Modeling** workflow to be used as a **training feature** in the ML Property Modeling workflow for conditioning porosity and permeability.

Results

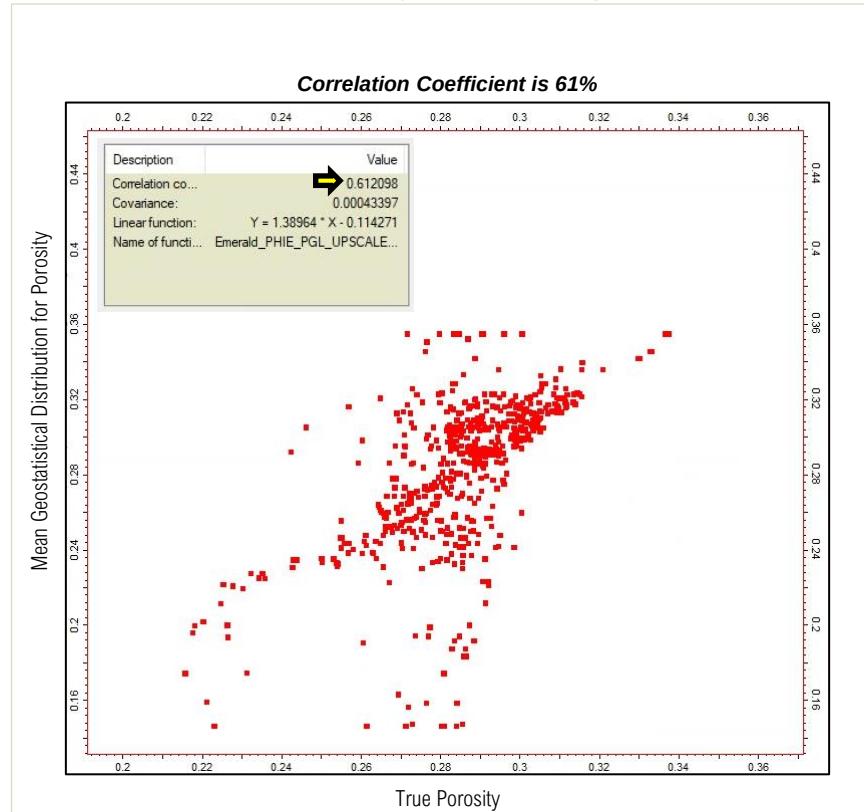
Increased correlation percentage for porosity from 61 to 94% on the blind testing validation workflow.

Cheviot Field: Machine Learning Property Modeling Workflow

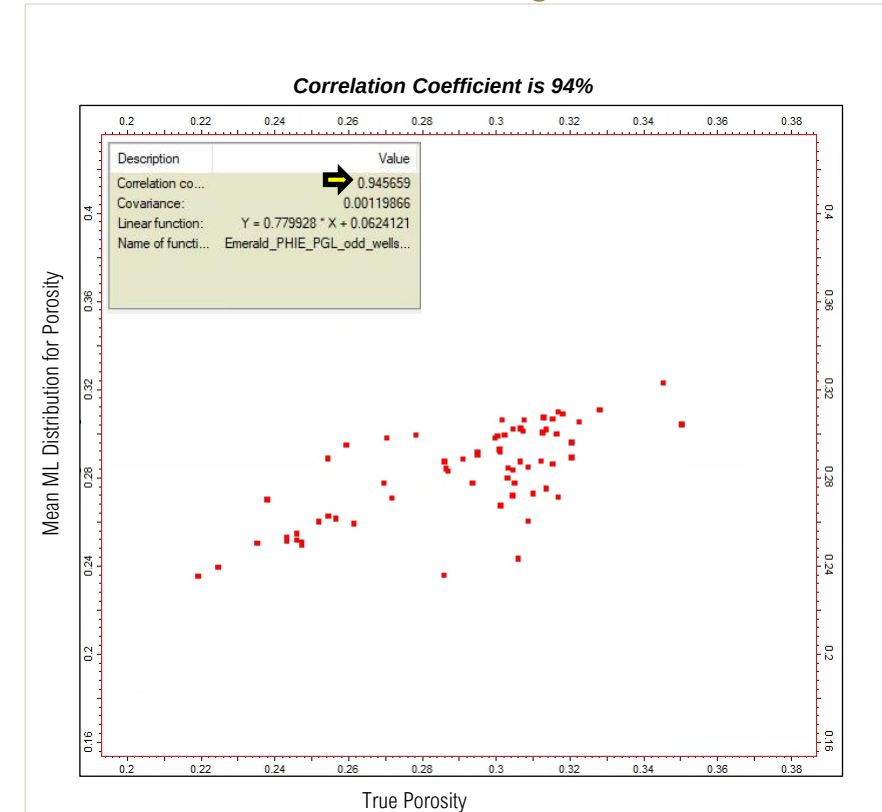


Cheviot Field: Correlation Coefficients for Predicted Porosity

Correlation Coefficient without ML Property Modeling



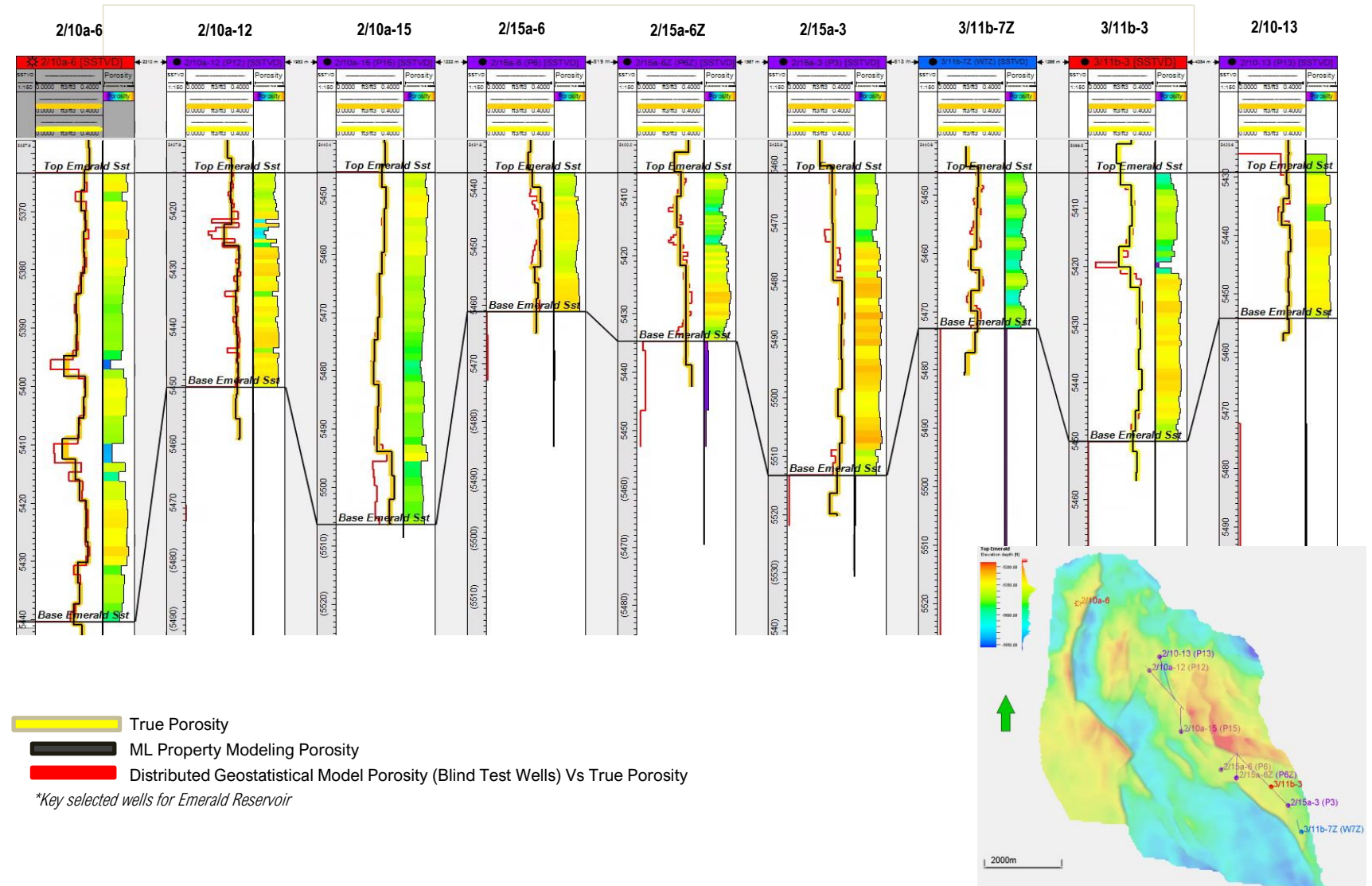
Correlation Coefficient with ML Property Modeling



**Comparison of Correlation Coefficients for Porosity predictions with and without ML Property Modeling Workflow*

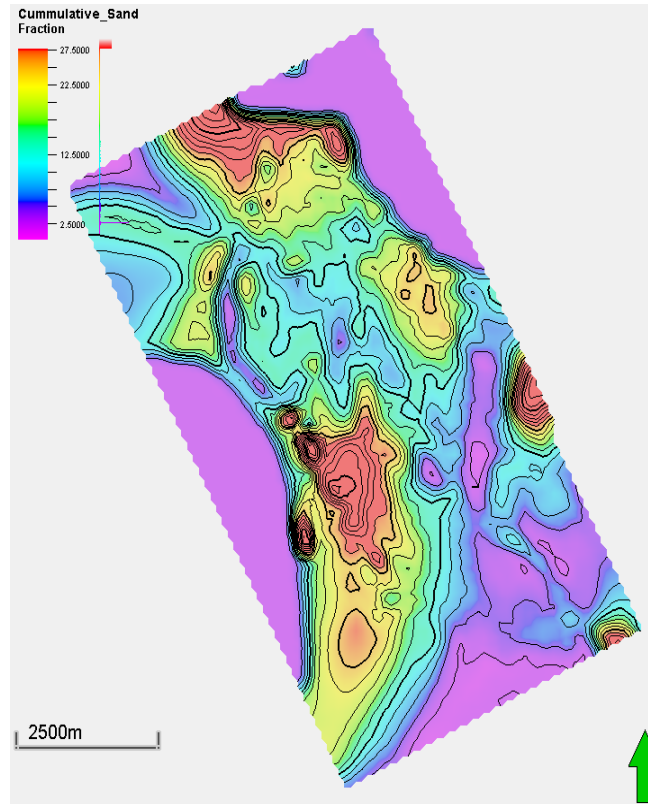
Cheviot Field: Porosity Blind Testing Validation

- QA/QC Blind testing
- Several sets of wells selected in a random order to check for variability on model prediction
- Blind Testing for ML Property Model porosity showed a correlation coefficient of 94.5% vs. 61% for the geostatistical model.

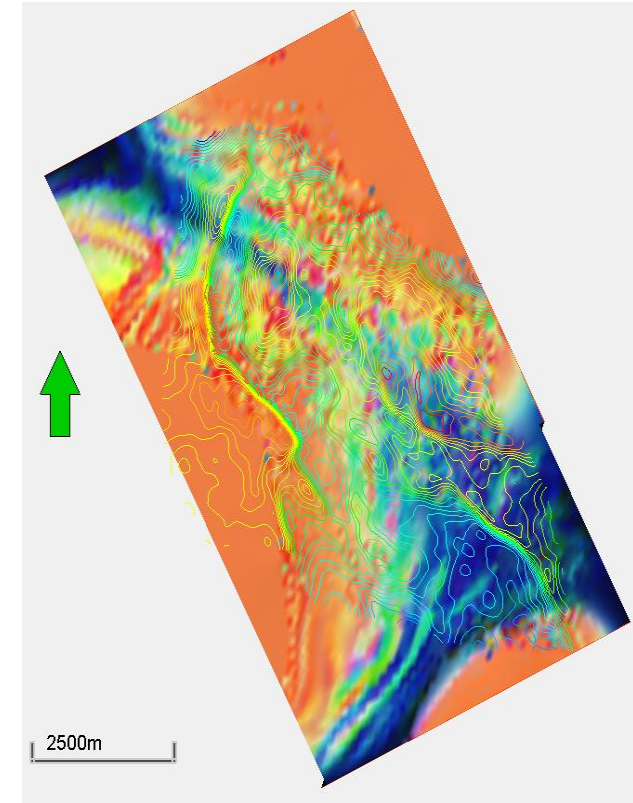


Cheviot Field: Integrating Forward Stratigraphic Modeling

- Additional training feature integrated into the workflow
- Forward Stratigraphic Model generates a property model conditioned to facies framework
- Porosity correlation coefficient improved by additional 5%.



Cumulative Sand Fraction Predicted from GPM Simulations



GPM Simulation Results showing Lithological Units Predictions

Next Steps

Better statistics for correlations achieved, but so what?

1. Improved confidence in model results?
2. Better development plan?

