Facies Modeling of Tight Gas Reservoir Using Neural Network: Case Study of NIKANASSIN Formation in Canadian Foothills

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Jurassic-Cretaceous Nikanassin Group in WAPITI field, Canadian foothills is in a fluvial to shallow marine sandstone-dominated depositional environment which contains a total of 9 Lithofacies identified in cored intervals. Facies modeling is the important step in stochastic geostatistical reservoir modeling process. However, due to the limitation of the Monteith (lowest Nikanassin Group) core data, minimizing the Facies distribution uncertainty becomes critical and challenging in Geomodeling process for this unconventional tight gas reservoir. The objective of this study is to develop a systematic workflow of 3D Facies Modeling for a large tight gas pool using Artificial Neural Network approach. Neural Network based Electro Facies interpretation is to predict an appropriate mathematical model function by learning about the data to produce the accurate output. Few key Nikanassin cored wells with reliable suits of key logs are selected as the input for neural network based Electro Facies interpretation. Supervised training used to compute the non-linear relationship between facies and well logs, which is the iterative process of adjusting the weights which defines the model parameters, and turn out to the excellent matching between the model and the core description. Ultimate goal of 3D Facies modeling is to upscale the Electro Facies logs using Sequential Indictor Simulation into the grid cells. It is also a critical basis for the property modeling process. Verification by the history matching in the flow simulation on WAPITI field shows that most selected Nikanassin wells achieve the production matching without altering the static model.

Methodologies

1. Facies classification: 9 Lithofacies identified in cored intervals are further grouped into 4 flow units, which is more practical and reliable for stochastic modeling.
2. Neural network training: Supervised training process is to compute the non-linear relationship between facies and well logs, which make an estimate of the facies log automatically in uncored well or interval.
3. Stochastic modeling: Stochastic modeling using Sequential Indictor Simulation (SIS) to populate the Facies distribution into grid block, which will great preserve the reservoir heterogeneity.
4. Flow simulation and history matching