Neural Networks and the Markov Chain Approach for Facies Analysis and Prediction from Well Logs in the Precipice-Evergreen Succession, Surat Basin- Implications for CO2 Storage

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9.29.2020 - 10.1.2020 – AAPG Annual Convention and Exhibition 2020, Online/Virtual

Abstract

Facies analysis is crucial for reservoir evaluation because it affects the prediction of fluid flow and the mechanical properties of strata. Artificial Neural Networks (ANN) are a powerful way to use facies interpretations from core to determine facies in uncored wells. However, ANN do not incorporate information that relates to facies successions. A new method of an integration of Neural Network and Markov Chain Approach is proposed to produce more accurate facies predictions that can be incorporated into reservoir models. Based on data from 8 cored wells in the northern Surat, 20 core facies based on grain size, sedimentary structures, and ichnological characteristics. Using statistical approaches, 20 core facies were simplified into 10 representative wireline log facies (WLF) with unique petrophysical parameters. The significance of vertical facies transitions was then assessed. Finally, neural networks were trained using cored wells under the control of the facies successions determined from the MCA. The results of our analysis show that the accuracy of WLF prediction ranges from 66% to 99% (ca. 83%) with a convergence error of 0.53. The accuracy of facies recognition decreases step wise with decreasing log input data. For facies determination in our application -static reservoir modelling for CO2 storage-a minimum number of input log data were required to achieve meaningful results. The impact of this study is that is shows how accurate and realistic facies distributions can be understood in areas of sparse data by using

uncored well data. It also allows us to establish better parameterized and geologically reasonable static reservoir model. From an academic standpoint, this work yields insights into Lower Jurassic stratigraphy and depositional settings.

AAPG Datapages/Search and Discovery Article # 91200 © 2020 AAPG Annual Convention & Exhibition Online, Sept. 29- Oct. 1.