CRIMSON PUBLISHERS
Wings to the Research

Research & Development in Material Science

ISSN: 2576-8840

Editorial

A Weight Coefficients Method for Geostatistical Three-Dimensional Modeling

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Submission: December 12, 2017; **Published:** December 18, 2017

Introduction

In the study of Sulige gas field in Ordos Basin, we propose a new method that employs weight coefficients to balance the sandstone and mudstone data from irregular well patterns during stochastic modeling.

The Sulige gas field is located northwest of the Yishan Slope in Ordos Basin, and its main gas-bearing formations are the Shanxi Formation and the Lower Shihezi Formation of Permian age. It is a tight gas field characterized by low porosity, permeability, and pressure, and high heterogeneity. The study area lies in the center of Sulige gas field, and exhibits a gentle and west-inclining monoclinal structure.

The new method is based on SIS and has been developed to quantitatively process the variogram parameters (major range and minor range) during stochastic modeling, and the horizontal wells were integrated to evaluate the quality of the sandstone and mudstone model. To implement this new approach, the target reservoir was first subdivided into several zones according to the well patterns, where areas with different well densities were classified as different zones. Then, all lithofacies (sandstone and mudstone) interpretation data from the directional wells were used to stochastically predict the sandstone and mudstone distribution for each zone to acquire the corresponding variogram parameter set. Subsequently, based on well density, each variogram parameter set was assigned different weight coefficients (Wi) to obtain a variogram parameter set for the target area. And the well density (D) is calculated as:

N-Number of wells

The final variogram parameter set (PS) for the target area was obtained via the following equation:

The variogram parameter set for the entire study area was computed directly rather than via fitting with a spherical, Gaussian, or exponential variogram model. Finally, to evaluate the quality of the sandstone and mudstone distribution models, named "model (PS)", numerous vertical profiles of the predicted sandstone and mudstone models through the horizontal sections were made to compare with the 1-D interpretation models of horizontal sections. Meanwhile, models of sand stone and mudstone of the whole area simulated directly from the SIS method were also conducted, following the same modeling workflow of each sub domain. These kinds of models, named "model (PSs)" in the workflow, underwent the same quality checking process and were compared with model (PS).

The quality of models (PS) was evaluated with the assistance of horizontal wells, for which the1-D sandstone and mudstone data were not up scaled during the stochastic modeling process. However, in this method, workloads are multiplied. Modeling for the same layers but for multiple zones makes the simulation procedure considerably more time consuming. Quality checking of sandstone and mudstone models for the subdivisions of zones is strictly qualitative, and the results therefore lack scientific rigor.

