Oilfield Reservoir Modeling for Reserves evaluation

Presenter: Kuo-Feng Chang
Advisor: Prof. Chuen-Fa Ni
Date: 2024/06/07

Abstract

This study construct reservoir model for the Mouroumar structure in the Oryx Oilfield and to estimate the stock tank original oil-in-place (STOOIP) for reservoir simulation and reserves evaluation. Oryx Oilfield is located in Mondou State, southern of the Republic of Chad, Africa. The sedimentary environment is characterized by lacustrine sedimentary basins, and the reservoir properties exhibit significant lateral variability. This study use Structural Framework modeling method for constructing the structural model. The interpreted seismic horizons are converted to depth domain structural maps, which are then depth-corrected using well tops derived from well log analysis. The Mouroumar structure is divided into three reservoirs from top to bottom: Mangara, DST#3, and DST#2. Vertical layering is carried out using the structural maps of Mangara Top, DST#3 Top, DST#2 Top, and Basement. Faults interpreted from seismic data are used as the framework to construct the structural model. The horizontal grid size is 25 m x 25 m, the vertical grid thickness is 1 m, and the total number of grids is about 4 million. Property modeling employs the Sequential Indicator Simulation (SIS) to assign values to the grid, using variogram models established from well log analysis to constrain the distribution and continuity of different attributes. After completing the basic lithofacies and porosity models, 150 different reservoir models were generated through uncertainty analysis to estimate the STOOIP. The calculation results show that the P10, P50, and P90 of STOOIP for the 151 set reservoir models are 166 million, 190 million, and 222 million barrels of oil, respectively.

Keywords: STOOIP, Reservoir modeling, Uncertainty analysis

建立用於油田蘊藏量評估之儲集層模型

報告者：Kuo-Feng Chang
指導教授：Chuen-Fa Ni
報告日期：2024/06/07

摘要

本研究目的是建立奧瑞油田 Mouroumar 構造地下儲集層模型，並計算初始原油地下埋藏量(Original Oil-In-Place, OOIP)以用於後續油層模擬及油田蘊藏量評估工作。奧瑞油田位於非洲查德共和國南部蒙度邦，沉積環境屬於湖相沉積盆地，儲集層屬性之側向變異度較大。本研究採用構造框架建模法進行構造建模，將震測解釋拾取出之等時層面轉換為深度域之構造圖，再利用測井資料分析得出之層頂深度進行構造圖深度校正。使用 Mangara Top、DST#3 Top、DST#2 Top 與 Basement 構造圖進行垂直分層，將 Mouroumar 構造由上而下分為 Mangara、DST#3 與 DST#2 三個儲集層；再以震測解釋斷層作為框架，建構出構造模型。其水平方向網格尺寸為 25 m x 25 m，垂直方向網格厚度為 1m，總網格數約為 4 百萬格。屬性建模採用序列式指示模擬法對網格進行賦值，使用分析測井曲線所建立之半變異函數模型來限制不同屬性的分布及連續性。完成基礎岩相模型與孔隙率模型後再透過不確定性分析生成 150 組不同的屬性模型。計算 151 組靜態模型之 OOIP，其 P10、P50 與 P90 分別為 1.66 億、1.90 億及 2.22 億桶原油。

關鍵字： 初始原油地下埋藏量、儲集層建模、不確定性分析