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Title **Successful History Matching of Chaunoy Field Reservoir Behavior Using Geostatistical Modeling**
Authors Lemouzy, P.M., IFP; Parpant, J., ESSO REP; Eschard, R., IFP; Bacchiana, C., ESSO REP; Morelon, I., IFP; Smart, B., ESSO REP

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Preview Abstract

An integrated study combining sedimentological and sequence stratigraphy analysis, geostatistical simulations and validation by production history simulation has been performed in the Chaunoy field reservoir. The reservoir is a part of a distal alluvial fan system, in the Keuper series of the Paris Basin (France). RFT surveys suggest a layered behavior. Nevertheless, the low extension of reservoir bodies (small ribbon channels interbedded with flood-plain and lacustrine mudstones) made it difficult to set ut a satisfactory correlation scheme in the past studies, resulting in difficulties in matching the production history.

Core and log analysis yielded the conceptual geological model. Geostatistical analysis enabled to its validation and quantification. Inside each genetic unit, repartition of lithotypes and of petrophysical properties were modelled by geostatistical simulations. As the horizontal variogram ranges proved to be below the average well spacing, three high resolution models were built, with different horizontal variogram ranges, all smaller than well-spacing (1/8, 1/2 or 1 times the well spacing). After scaling-up of the resulting petrophysical models, simulations of the ten-year production history were performed - in each model. By comparing the simulated production data with the field production history, the characterization study was validated. A satisfactory match was obtained on the main zone of the reservoir, validating the correlation scheme and explaining the observed layered behavior.

Introduction

In the recent years, the oil industry has focused on reservoir characterization as a key to better reservoir management. Progresses has come from the geology (sequence stratigraphy and numerical simulation of geology) and from the development of 3-D seismic. Geological simulations are mainly obtained through geostatistical techniques, though deterministic methods also exist. In the scope of reservoir engineering, up-scaling techniques and use of probabilistic methods have accompanied the progress of geological descriptions. These advances, coupled with the availability of powerful and relatively inexpensive computer stations, and of data-base and visualization software, drive the industry towards a better integration.

Refs. 1 to 4 present examples of recent studies incorporating the new geological techniques which proved to be efficient in going directly to history-matched reservoir models. Emphasis is put on the role of a good geological characterization to get a predictive reservoir model.

The present field case goes from the geological analysis of cores and logs through the building of high-resolution geological models to the validation of reservoir models, within an integrated framework.

The geological modelling of complex reservoirs requires a combination of conceptual stratigraphic models and probabilistic simulations. The first approach enables one to predict the reservoir geometry and extension within a deterministic framework. High resolution sequence stratigraphy has considerably improved our understanding of the genetic unit architecture in function of accommodation variations. Its application at the reservoir scale provides the correlation scheme of the reservoir. Furthermore, these conceptual models are able to predict the reservoir extension and architecture up to a certain level: estimation of the channel amalgamation, or of shore-face sequence extensions are a few examples amongst many others. Even sand/shale ratios, and then gross reservoir quality can be predicted with such an approach.

However, in many cases, if such conceptual models are essential at reservoir scale, their accuracy often remains insufficient to predict realistically the distribution of internal heterogeneities within reservoir units. Furthermore, fluid- flow modelling requires a representation in terms of petrophysical properties. For that purpose, the stochastic approach is more and more applied in subsurface to simulate the distribution of either small-scale sedimentary bodies or the internal reservoir heterogeneity. Another advantage of stochastic approach is to provide equiprobable realizations of the heterogeneity distribution.