Introduction

The conceptual geological model reflects the features of the structure of the field and the distribution of hydrocarbons in it, including the history of the geological development of the region and the processes of sedimentation that took place in it. The model is created using an integrated multidisciplinary approach to data analysis. It includes study in all scales of available data. From a "micro" level data – thin sections, core to "macro" level data – seismic studies etc. Based on all analytical data conceptual static reservoir model is constructed. This approach makes possible confident prediction of reservoir filtration properties as in a vertical direction as an over the area.

In our company has developed and successfully applied a standardized algorithm for the study of carbonate reservoirs. it includes the analysis of petrographic studies, work with core data, interpretation and analysis of seismic data and as a result the creation of a conceptual geological model. The aim of this work was to create a reliable geological model for confident forecasting of new wells productivity.

Method

As the first step a "micro" scale reservoir study is performed – the analysis of the results of petrographic data. It includes an assessment of the genetic types of reservoir porous media and the numerical determination of the degree of presence of secondary transformations and their impact on the filtration-capacity properties of the rock.

At the next stage, the dependencies and features identified on a "micro" level are correlated with the wells log data and/or with the seismic data. Aim of transferring obtained dependences from "micro" to "macro" level is obtaining trends for prediction of properties distribution in the vertical and lateral directions. Based on all results of analysis conceptual geological model is created.

Example

The present study describes application of described approaches on example of field B. Field is located in the foreland basin of the Zagros fold and thrust belt. [2] The main object is the Mauddud formation of upper Cretaceous age. One of the main geological features of this formation is a significant depth (avg~ -4500m). As a consequence, the rocks composing the reservoir underwent significant transformations due to the diagenetic processes that took place in them. Another feature is a lack of hard data for analysis. Average formation thickness is about 400m. In total, the core was recovered in three wells, with average length ≈50m, less than third part of formation is described by core data.

Comparison of thin sections analysis data and results of routine core tests showed that sedimentary facies have a poor control of reservoir properties and the main control of filtration-capacitive parameters related to secondary rock transformations. Hence determination of sedimentary facies distribution not predict reservoir properties. Diagenesis controls reservoir quality and plays both a constructive and a destructive role. The dissolution is the major process that improves porosity and then permeability, Permeability is decreased by cementation, which fills primary porosity, while compaction decreases porosity by establishing tighter intergrain contacts.

At whole core data thickness of vuggy core layers is a 30-40 cm. It is not enough thickness to distinguish it from other types of reservoir lithofacies at logs.

According to the analysis of seismic data – spectral decomposition (Fig. 1) anomalous zones were identified. Based on the conclusions about the genetic origin of porosity, these anomalies are likely to be leaching zones, which are characterized by increased filtration properties. This map is used as a trend in the distribution of the porosity field in the inter-well space.

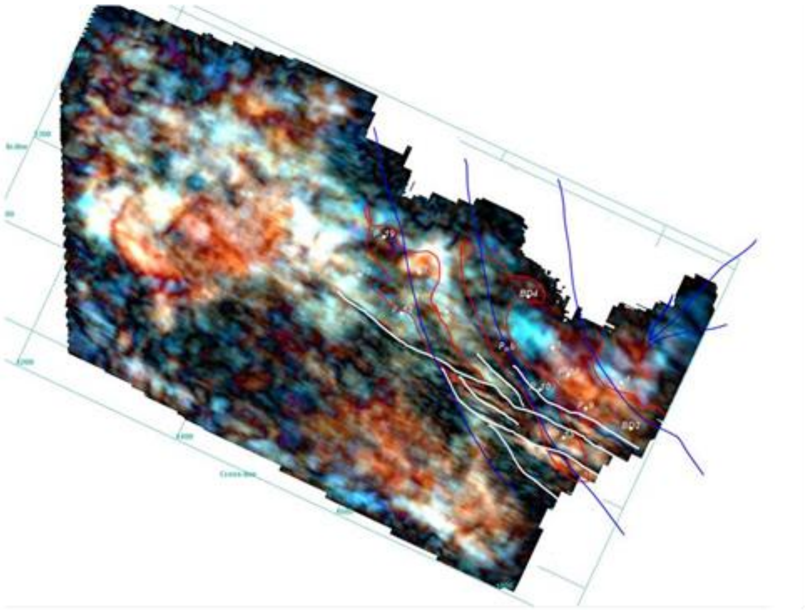

Figure 1. Spectral decomposition map.

The results of the analysis were used to create a geological model of the reservoir, which was then used for dynamic modeling. Described approach made it possible to obtain a good combination of the actual and model parameters of the dynamic model and did not require the use of additional settings (permeability multipliers, productivity modifications, etc.).

The accuracy of conceptual geological model and reservoir properties distribution confirmed by the results of new wells drilling and testing.

Conclusions

In carbonate rocks restoration of sedimentary facies not allow to fully predict reservoir properties. It is essential to take into account diagenetic rock changes and create complex lithological model. Algorithm of multidisciplinary reservoir study and example of it's application presented. The accuracy of conceptual geological model and reservoir properties distribution confirmed by the results of new wells drilling and testing.

References

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2. McQuarrie, N., 2004, Crustal scale geometry of the Zagros fold-thrust belt, Iran: Journal of Structural Geology