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## **Integration of geological and geophysical data in effective permeability modeling of a carbonate reservoir influenced by fractures in a giant oil field offshore Abu Dhabi**

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1) Japan Oil Development Co., Ltd.

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**Abstract:** Premature water breakthrough of injection water has been observed in some oil producers under five-spot pattern scheme in a carbonate reservoir of a giant oil field, offshore Abu Dhabi. Preferential water movement has been suspected and its influence on oil production and recovery has been expected. Recent time-lapse saturation surveys suggested significant water movement in upper sub-layers although their matrix permeability was low. Previous matrix-dominated models failed to explain such observed phenomena, which prompted investigation of fracture contribution to flow in these sub-layers. An objective of this study was to construct a reliable permeability model integrated with information related to fractures from well data and seismic data.

A conceptual model of fluid flow system with the contribution of matrix and fractures was constructed incorporating with 'diffused fractures' controlled by layer properties and 'fracture swarms' associated with faults. Various data sources such as curvature analysis of 3D seismic time structure or fracture density from core observations were used for indicators of these fractures.

Based on this conceptual model, following two steps were taken in the actual modeling;  
(1) 2D distribution of flow capacity controlled by well-tests was generated by curvature of time structure surface.

(2) Estimated flow capacity from fractures was decomposed to each layer considering fracture density data from core observations. It could be integrated to a layer-based flow capacity of a matrix model.

In this particular example, characteristics of the reservoir could be controlled by both matrix

and fractures. Therefore, a complex process with successive iterations was required to construct a reasonable permeability model. Its result indicated remarkable improvement in history match with dynamic data from the field in flow simulations.

**Key words:** [fracture](#), [curvature analysis](#), [carbonate reservoir](#), [reservoir model](#), [permeability model](#), [Cretaceous](#), [Shuaiba Formation](#), [Middle East](#)

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