

PS Locate the Remaining Oil (LTRO) and Predictive Analytics: Application for Development Decisions on Marmul GNR Field, The Sultanate of Oman*

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Search and Discovery Article #42191 (2018)**

Posted March 26, 2018

*Adapted from poster presentation at AAPG Middle East Region Geosciences Technology Workshop, “Decision Based Integrated Reservoir Modeling Middle,” Muscat, Oman, October 30-November 1, 2017. Please refer to very similar article by same authors, [Search and Discovery Article #42190 \(2018\)](#).

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Key Notes and Outline

Some Major Features of Marmul GNR Field

- More than 30 years of production from hundreds of horizontal wells and tens of vertical wells from two main reservoirs
- 20° API oil, with viscosity of 100-1000cP; water-cut greater than 96%

Key Uncertainties

- Production allocation uncertainties
- Subsurface uncertainties
- Permeability, facies distribution, initial oil saturation, viscosity

Fast Track vs. Traditional Workflow

- Opportunity
- Operator’s dilemma

Marmul Full Cycle LTRO and Forecast

- Poseidon (production engineering software) deck definition
- Production allocation
- ROCM (Remaining Oil-Compliant Mapping)
- Handling Poseidon ROCM uncertainty
- Poseidon remaining oil

- Infill opportunity framing
- Predictive analytics history machine learning
- Machine learning full field forecast
- Development scenarios forecast

LOCATE-THE-REMAINING-OIL (LTRO) AND PREDICTIVE ANALYTICS APPLICATION FOR DEVELOPMENT DECISIONS ON MARMUL GNR FIELD, THE SULTANATE OF OMAN

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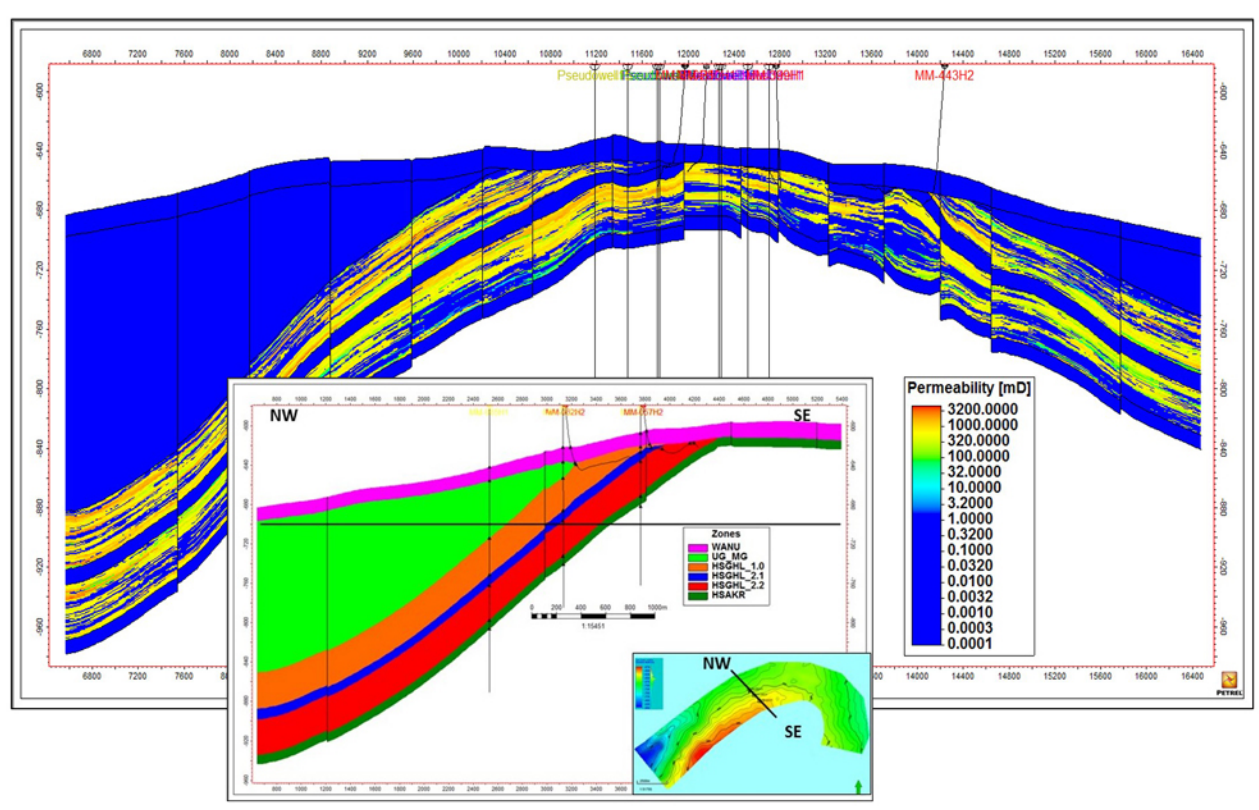
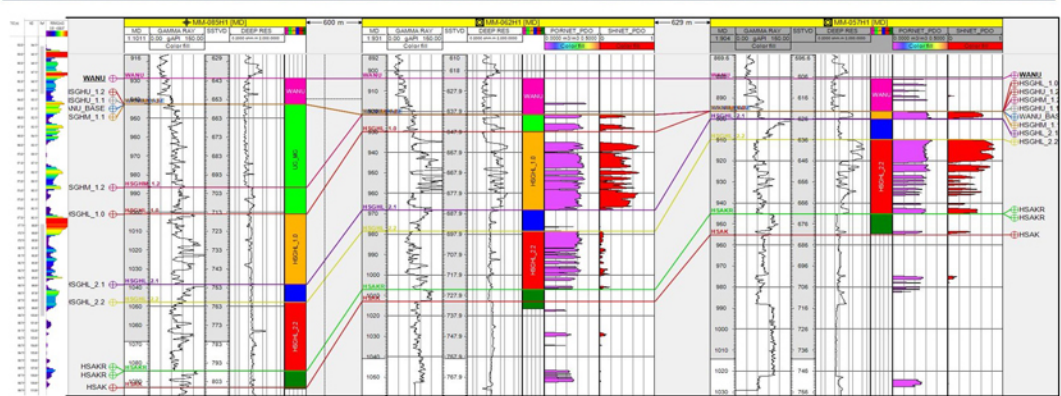
MARMUL GNR

- 30+ years of production
- 100's horizontal + 10's vertical wells
- Two main producing reservoirs
- Recent WI implementation
- Heavy Oil with API = 20
- Viscosity = 100-1000 cP
- Water cut > 96%

PRODUCTION AND DEVELOPMENT HISTORY

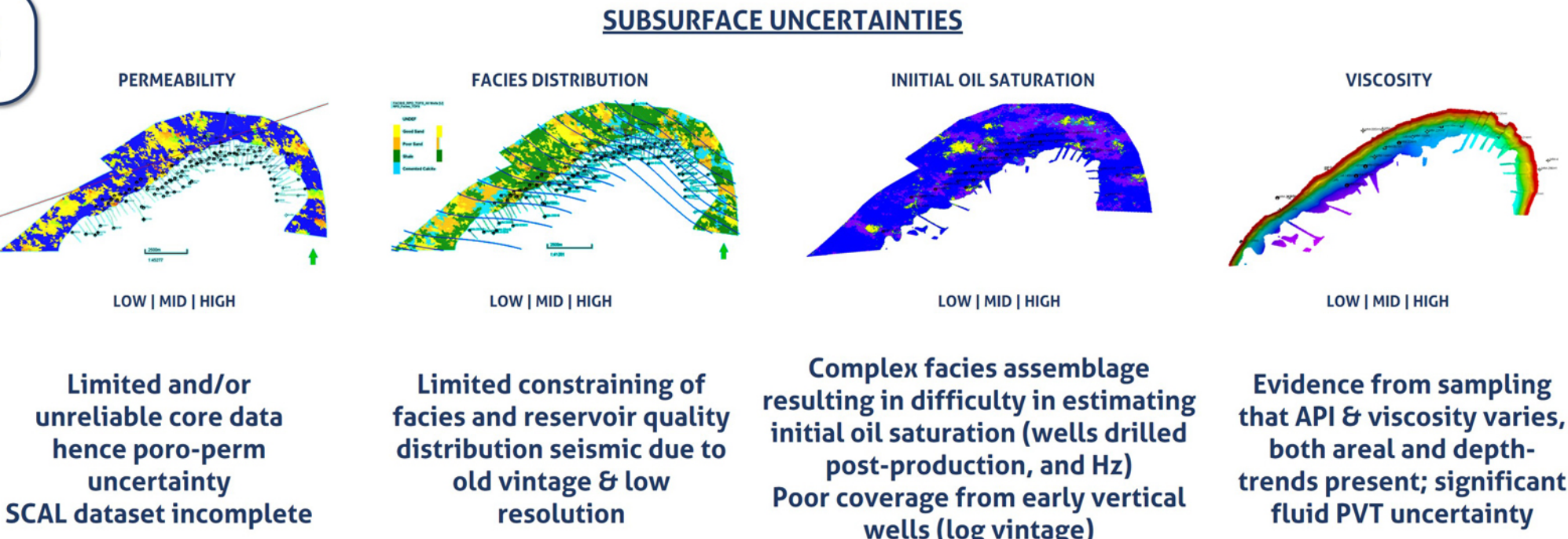


HETEROGENEOUS RESERVOIRS / VERTICAL AND HORIZONTAL WELLS



KEY UNCERTAINTIES

- ### PRODUCTION ALLOCATION UNCERTAINTIES
- ~30% of the total production is comingled
 - Both vertical and horizontal wells are comingled
 - Limited PLT dataset and pressure data
 - Other uncertainties on reservoir pressure, oil API/viscosity distribution and permeability estimation in wellbore



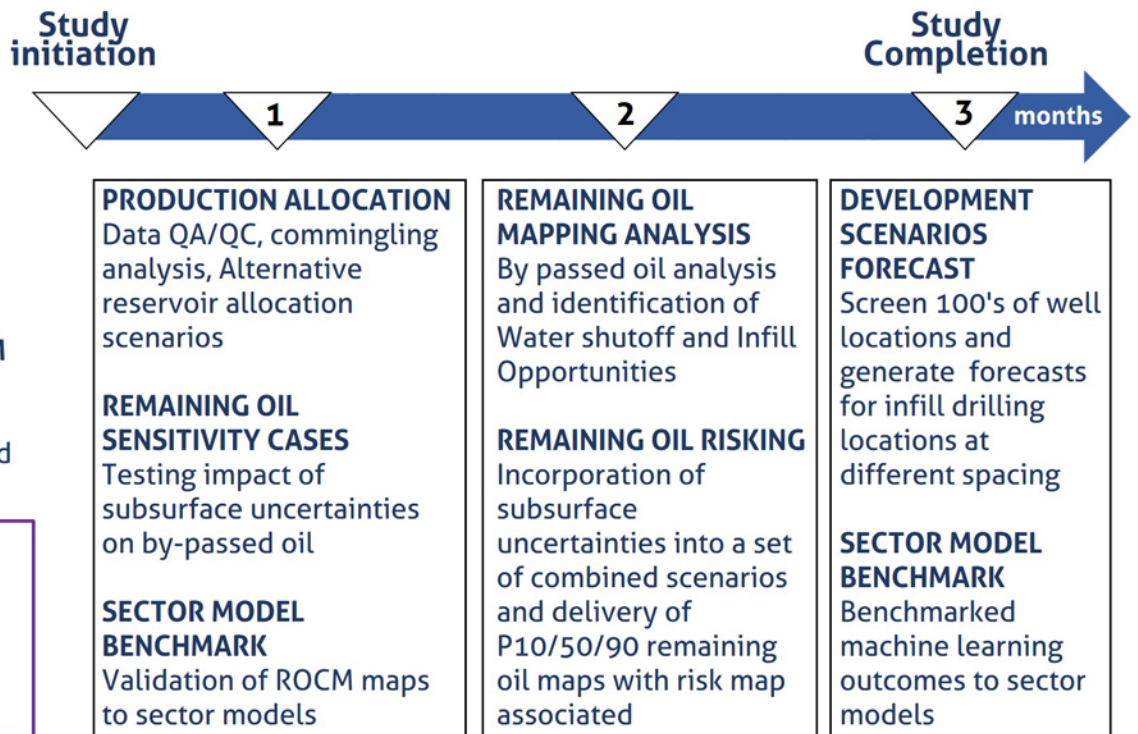
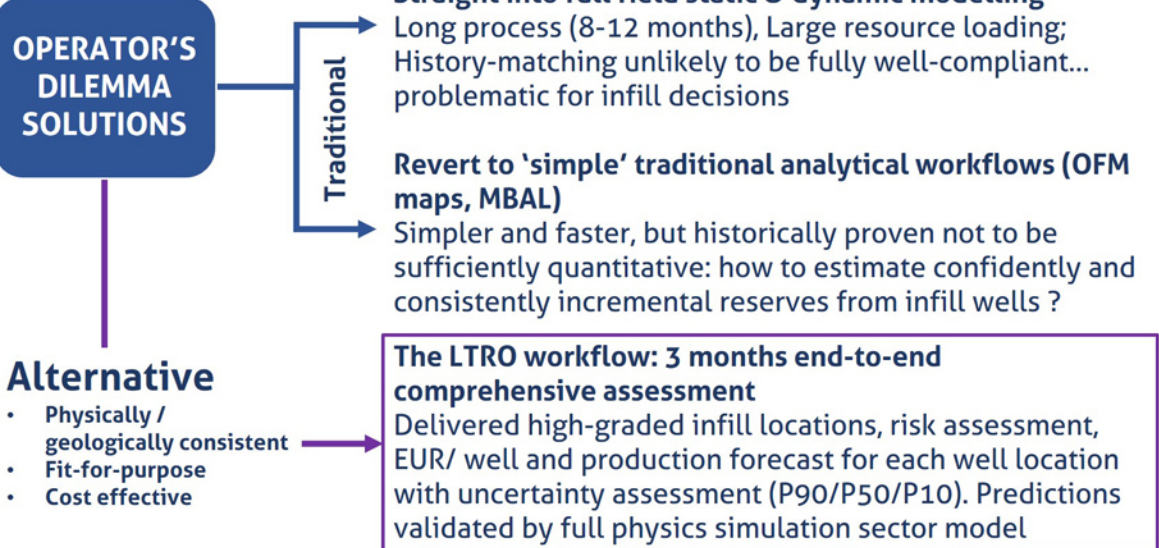
LIMITED TIME AND RESOURCES AVAILABLE

SIGNIFICANT CHALLENGES TO ADDRESS

FAST TRACK VS TRADITIONAL WORKFLOW

THE OPPORTUNITY: A mature field with low recovery factor and potentially significant undrained volumes; can more be economically recovered?

OPERATOR'S DILEMMA: The long road of reservoir simulation with uncertain results vs. traditional analytical methods with limited quantitative capability



MARMUL FULL CYCLE LTRO & FORECAST

