Creative Thinking Led to 40 Years of Success in Mahakam, Indonesia*

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Key Points

- First Period of Exploration and Development
  - Hunting for the Structural Play ...and more than that
- Second Period
  - Rethinking the Petroleum System
  - Finding a New Giant
- Third Period
  - Follow-up, still in progress...
    - Establishing a New Field Model
    - Improved Seismic Resolution
    - Hydrodynamics at Work in the Mahakam---and Elsewhere

Main Drivers of Success

- The "Hard Skills"
  - Regional perspective, re-questioning of the petroleum system & field model
  - Out-of-the-box thinking with relativistic view of past “dry” wells
  - Creative “what if” approach
  - Well focused application of technological advances
- The “Soft Skills”
  - Tenacity & power of conviction
  - Fundamental optimistic attitude
  - Strong team spirit
  - Proactive management that really wants to drill exploration wells
References


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Bernard DUVAL
A Hundred-Year-Old Petroleum Exploration History...
First Period

- Hunting for the Structural Play

...and more than that
First Published Facies Map of the Mahakam Delta PSC

from J. Gérard, 1972
Original Structural Map of the Bekapai Structure

from J. Gérard, 1972
Seismic Line 408
Column Illustration of Depositional Environments, Confirming the Model

from M.de Matharel et al, 1980
Cross-section of Bekapai Field
The Mahakam Delta: a Province of Giants

- East coast of Kalimantan (Borneo), Indonesia
- Hydrocarbon reserves of over 3 \(10^9\) bbl of oil and 25 tcf of gas, mostly in deltaic reservoir rocks
Seismic Operation in the « Onshore » Area
Drilling for Seismic in the Delta
Preparing for Drilling in the Delta
Transition Zone Seismic Activities
Bridging & Jetty Construction

Courtesy Total
The Mahakam Marina Bay Sands...
Field visit by a Human Resources Director...
The Mahakam Delta: a Province of Giants

- East coast of Kalimantan (Borneo), Indonesia
- Hydrocarbon reserves of over $3 \times 10^9$ bbl of oil and 25 tcf of gas, mostly in deltaic reservoir rocks
Cross-Section of Handil Field
Offshore Production Trend in the Mid-Eighties

* Total’s Operating Share
Second Period

- Rethinking the Petroleum System
- Finding a New Giant
The First Model of Petroleum System
The Mahakam delta oil machine

from B.C. Duval et al., 1992
Structural framework of the Mahakam delta
PECIKO : Time Map at MF8

from Y. Grosjean
Gas Filling and Hydrodynamics

Mapping the Peciko gas traps

(from Grosjean, Y, Choppin de Janvry, and Duval, B.C., 1994)
Third Period: Follow-up, still in progress...

- Establishing a New Field Model
- Improved Seismic Resolution
- Hydrodynamics at Work in the Mahakam...and Elsewhere
The Mahakam Petroleum System - The Renewed Model

from B.C. Duval et al., WPC, 1998
Mouth Bar of the Modern Delta
Seismic lines: Comparison on Tunu Field
2D line 1985 vs 3D 2011

**2D Line 1985**

- Very Noisy, poor continuity at reservoir level

**CT3D 2011 Full stack**

- Better continuity and S/N ratio at reservoir level

- Recently developed reservoirs (poorly imaged and mapped with 2D)

*Main Tunu Reservoir Interval*

*Courtesy of Total E&P Indonésie*
Extending the Model to South Mahakam

from Y.Grosjean et al, 2009
Total Operated Production in Mahakam PSC (BOED)

- Gas (BOE) w/o BRC
- Condensate + BRC
- Oil

**START UP SISI NUBI**

**START UP PECIKO**

**MOSTLY TUNU**

**GAS**

**OIL**

**CONDENSATE**

*Courtesy of Total E&P Indonésie*
Elsewhere--The Absheron Prospect in the South Caspian

Inferred lateral drainage of compaction waters (after Bredehoeft, 1988; Düppenbecker, 2008)

from Y.Grosjean et al, 2009
Absheron: from Concept to Discovery

Azerbaijan: Absheron X-2

- Total (op.): 40%
- Large delta
- Deep reservoir, new pressure concept
- Elephant-size gas and condensate discovery
- 500 feet net pay
- Giant structural closure: approx. 270 km²
- Next step: deeper drilling, test, side track and delineation

Hydrodynamic gradient with permeability restriction across main fault

Successful example of high risk, high reward exploration
Main Drivers of Success: the "Hard Skills"

- Regional perspective, re-questioning of the Petroleum system & field model
- Out-of-the-box thinking with relativistic view of past “dry” wells
- Creative “what if” approach
- Well focused application of technological advances
And the “Soft Skills”!

- Tenacity & power of conviction
- Fundamental optimistic attitude
- Strong team spirit
- Proactive management that really wants to drill exploration wells
Prague, March 2012
« Exploration is Hard Work, Smart Work and ... an ART »

John Masters
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