ORAL PRESENTATION

Day 2: 4th April 2019

Session 7: Indonesia Revisited #2 – Offshore Heartlands

Chair: Peter Woodroof – HyOil, Chandra Tiranda – Mandala Energy

13:30	Creative Exploration in a Mature Basin: Jangkrik and Merakes Discoveries (Kutei Basin, Indonesia)	Lorenzo Meciani	ENI Spa
13:55	The Next Big Discovery in West Natuna, Indonesia	Amir Mahmud	Conrad Petroleum
14:20	New Data Brings New and Deeper Play Insight for North Madura, Indonesia	Maz Farouki	PGS

The Seapex Exploration Conference
SEC2019
For the Industry : By the Industry

SEAPEX Exploration Conference
Fairmont Hotel, Singapore
2nd – 5th April 2019

ORAL PRESENTATION

Creative Exploration in a Mature Basin: Jangkrik and Merakes Discoveries (Kutei Basin, Indonesia)

Lorenzo Meciani[1], Marco Orsi[1]

[1]Eni Spa, Italy

lorenzo.meciani@eni.com

The Kutei Basin is located on the East coast of the large Kalimantan Island, in central Indonesia. The prospective sequence is Eocene to present in age and is predominantly composed of the Mahakam river fluvio-deltaic to deep water sediments, deformed by regional compressional tectonic movements.

The Kutei Basin is one of the longest-explored petroleum basins in the world, with 125 years of onshore and offshore hydrocarbon exploration and exploitation and more than 850 exploration wells drilled. It can definitely be considered as an historical, mature basin. From the initial discovery of Sanga Sanga oil field, made in 1896, more than 13 Bboe of recoverable oil and gas resources have been discovered.

Eni (re)entered Indonesia and the Kutei basin in 2000 as a result of the acquisition of Lasmo, who at the time held several assets in the country. Eni then reinforced its position in the Kutei basin with the award of other blocks. Among them, Muara Bakau PSC (2002, Eni operator, today with Neptune Energy and Saka Energy Indonesia as partners), where Jangkrik and Jangkrik NE discoveries were made in 2009-11, and East Sepinggan PSC (2012, Eni operator, with Pertamina), where Merakes was discovered in 2014 and Merakes East in 2018.

The discoveries are located in the Southern part of the Makaham delta, in a water depth of 450 m (Jangkrik) and 1350-1600 m (Merakes).

Both discoveries are characterized by creative and innovative exploration thinking associated with the use of state-of-the-art technology.

In the Kutei basin the exploration both in shallow and deep water was historically aimed at Miocene targets, with limited attention to the Pliocene, where the only discovery was made on a structural trap (Sadewa field). Jangkrik gas discovery pursued an innovative trapping concept made by Pliocene slope channels and the concept was further validated by Jangkrik NE that proved a significant extension of the discovery. Jangkrik complex (Jangkrik Main & NE) today exceeds 2.5 Tcf as a cumulative OGIP, and is composed of many separated channels, mainly not juxtaposed. The size of each individual channel is relatively modest, and even the largest individual pool would not be able to be economically produced. The project commerciality was generated by a delineation campaign with a 100% drilling Rate of Success, supported by seismic amplitude indications.

The limited lateral extension of each individual channel has required the acquisition of a new dedicated 3D survey and the optimization of drilling trajectories. A multidisciplinary, integrated team effort was essential for the success of the entire project, from the delineation to the development drilling.

The production from the Jangkrik field started in May 2017, three and a half years from sanctioning of the development project. The gas is processed on a dedicated Floating Production Unit, then flowed to shore via a 79 km dedicated pipeline to the East Kalimantan Transportation System, finally reaching the Bontang gas liquefaction plant.

The Merakes gas discovery is also within the previously neglected Pliocene sequence, but located in a more basinal environment, where the Pliocene turbidites form a large fan lobe at the base of the slope. Remarkably, the well Gambah-1, drilled by a previous operator in 1999 missed the Merakes fan by few hundred meters. The well, aimed also at deeper Miocene targets, was dry and therefore the area was later relinquished. Merakes pre-drill assessment identified that Gambah-1 had

drilled a large canyon filled by a mixture of re-sedimented carbonate and shale that had cross-cut and eroded the previously deposited Merakes Fan. Merakes-1 successfully verified this hypothesis, finding a significant gas accumulation with estimated 2 Tcf OGIP.

Merakes-2, drilled in 2017 to test the part of Merakes lobe on the opposite part of the Gambah mud-filled channel, successfully found gas hydraulically separated from Merakes-1, confirming the quality of the discovery and the model.

In December 2018 Merakes East-1 discovered additional volumes in deeper Miocene targets, just 3 km from Merakes. The reservoirs have excellent deliverability of gas and associated condensate.

The FID for Merakes was approved in December 2018, and development activities are in progress.

In summary, Merakes and Jangkrik have again proved that in a mature basin creative ideas and exploration approaches can still lead to discoveries. More than 4.5 Tcf OGIP in excellent quality reservoir sands have been discovered by pursuing a previously neglected sequence (the Pliocene) with innovative ideas (clustering many small channels, pursuing previously drilled areas).

The creative exploration ideas would not have generated the Jangkrik and Merakes successes without the fundamental support and integration of top-class contributions from many disciplines such as sedimentology, geophysics (DHI identification, seismic acquisition and processing), drilling, reservoir modelling and others, and an effective project coordination and management.

The authors are grateful to the Indonesian authorities and to the Joint Ventures' partners for having granted permission to present this paper.

SPEAKER BIOGRAPHY

Lorenzo Meciani has more than 25 years' experience in the industry, entirely spent with Eni exploration in different locations: Milano, London, Cairo, Delhi, Stavanger. He currently is Exploration Strategies Manager, while previous positions were Exploration Manager and Advisor within the Eni peer review team. His list of talks and publications includes more than 20 titles on various exploration related subjects.

The Seapex Exploration Conference
SEC2019
For the Industry : By the Industry

SEAPEX Exploration Conference
Fairmont Hotel, Singapore
2nd – 5th April 2019

ORAL PRESENTATION

The Next Big Discovery in West Natuna, Indonesia

Amir Mahmud[1], Miltos Xynogalas[1]

[1]*Conrad Petroleum Ltd, Indonesia*

amir@conradpetro.com

The West Natuna Basin is located between the basement highs of the Sunda Shelf to the south, the Natuna Arch to the east and the Khorat Swell to the north, in the West Natuna Sea, Indonesia. The basin has had a complex structural history comprising microplate collision, intrusion, extension, inversion and wrenching. The basin can be viewed as the south-eastern extension of the Malay Graben and was initially formed as a series of separate half grabens, that with increasing post-rift subsidence eventually formed the overall basin.

Until recently, shallow biogenic gas in the West Natuna Basin was deemed to be a shallow drilling hazard. With a strong demand for natural gas, the shallow accumulations have been reconsidered as exploration targets. West Natuna Exploration limited (WNEL) the operator of Duyung PSC, recently proved the presence of a large resource of biogenic gas within the sands of the Muda Formation in the eastern portion of the PSC. The structure is a flat-topped anticline, with an extent of approximately 490 km2, located above the inverted Anambus Graben in the centre of the West Natuna Basin. This play has given a new life to the declining activity in the region. Further to that, recently reprocessed seismic has revealed large prospects just below the Muda unconformity. These are large NE-SW trending syn-inversion structures with potentially Lower Gabus sequences providing good quality reservoirs.

Inversion in the West Natuna Basin is considered as diachronous, ranging from 27 Ma to 18 Ma, with peak inversion ranging from 21 to 15 Ma. It is thought to be associated with a change in the rate of opening of the South China Sea.

This paper will present updates on the shallow Mako Gas field development and discuss the results of newly reprocessed seismic with the syn-inversion structures identified just below the Muda Unconformity.

The Seapex Exploration Conference
SEC2019
For the Industry : By the Industry

SEAPEX Exploration Conference
Fairmont Hotel, Singapore
2nd – 5th April 2019

ORAL PRESENTATION

New Data Brings New and Deeper Play Insight for North Madura, Indonesia

Maz Farouki[1], Adriana Sola[1], Jo McArdle[1]

[1]*Petroleum Geo-Services, Malaysia*

maz.farouki@pgs.com

INTRODUCTION

North Madura has never lacked drillable prospects; however, results have had variable success. Understanding where the main kitchen is located and the potential migration paths have been the main challenge, largely due to vintage seismic with limited offset, depth and old conventional recording techniques, which has made it difficult to map and to differentiate one kitchen from another.

REVEALING NEW DEEPER PLAYS

New recording and imaging techniques have been introduced to Indonesia for the first time. Broadband seismic via dual-sensor acquisition delivers the potential to record deep, low frequency data, and Full Waveform Inversion (FWI) allows the complex geology in the shallow section to be addressed, resolving gas and channel affects to ensure that deeper structure can be imaged correctly. In North Madura, intra-carbonate reflectors have brought improved porosity estimations for the Kujung (Mid Miocene) level, where there are still a number of untested leads. More importantly however, is the detailed imaging under the carbonates and opening up of the deeper Ngimbang play as well as the potential basement play. The potential in the Ngimbang has been proven by the recent Sidayu well and this new play is prevalent across the area, as evidenced in the deep recorded dual-sensor data. The kitchen area and migration paths into the potential shallower reservoirs are better understood and the plays in the self-sourcing Ngimbang are revealed for the first time.

The North Madura Platform and its associated grabens is an area previously thought to be understood, however it is clear that new technologies both in acquisition and imaging have provided new insights to mature areas and can open new plays and near field exploration. Early observation suggests the existence of several mini-basins beneath the deeper carbonates level.

SPEAKER BIOGRAPHY

Maz Farouki has a BSc degree in Physics from Manchester University, UK, and over forty years industry experience with seismic contractors, mostly on overseas assignments. He has lived and worked in UK, Zaire, Pakistan, Algeria, Egypt, USA, Australia, Norway, Singapore and Malaysia, holding technical and management positions in data processing, imaging, and marine geophysics. Most of his tenure has been with two employers: the Seismograph Service Companies from the late 1970s, and Petroleum GeoServices (PGS) from the 1990s. For a number of years, he specialized in velocity model building and depth imaging, at a time when the discipline was in its infancy in the industry. His current position is Geophysical Advisor for PGS Asia Pacific Marine Contract, based in Kuala Lumpur, Malaysia. He is an active member of SEG and EAGE, and has received 'best paper' awards at industry regional conferences and workshops.