POTENSI HIDROKARBON DI KEPALA BURUNG DAN BADAN BURUNG PAPUA, SERTA LAUT ARU DAN SEKITARNYA

Seminar Bidang Sumber Daya Minyak dan Gas Bumi: ”Penguatan Peran Geosains Untuk Menentukan Potensi Hidrokarbon di Kawasan Perbatasan NKRI”

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The Origin of Tertiary Basins mainly relate to:
- Trans-tensional to basin reversal along the major strike slip faults
- Foreland basins in front of the major fold belts
Kofiau Basin: Late Tertiary Tested Clastic Play & Untested Deeper Carbonate (Kais) Play

- NE-SW trending depocenter resulted from two major tectonics episodes controlled by Sorong-Yapen Fault Zone (SYFZ).
  - Early Pliocene followed by
  - mid Pliocene - recent
  - SYFZ is plate bounding fault of the Australian Plate and the Pacific Plate (Decker et al., 2009)
- The Elit-1 and Ajek-1 proved channelized body in 3D-seismic as good sandstones (pure stratigraphic trap) within Late Pliocene.
- However, the net pay count at Elit-1 was non commercial.
- Key failures likely due to the limitations of trap / seal geometry.
Memberamo (Waropen) Basin: Late Tertiary Tested Clastic Play & Untested Deeper Carbonate (Darante) Play

- Niengo-1 (1958) tested 4.6 MMCFPD of C1 gas from a 10m interval.
- Gesa-1 & 2 wells were abandoned after blowing out and did not reach objective.
- McAdoo and Haebig (1999) the basins contain >25,000 feet of Tertiary interval.
- The rocks record are available at the Yapen and Biak islands.
- The oldest rocks exposed on Yapen Island are ophiolites consisting of serpentinites, peridotites and schists.
- These are overlain by Paleogene Auwewa volcanic deposits including porphyritic rocks, tuffs and breccias which are interbedded with some greywackes and shales.
- Eo-Oligocene pelagic limestones, marls which become more reefal to the south.
- Oligo-Miocene Darante reefal limestone with minor volcanics
- Miocene Makats turbiditic and deltaic systems with high organic content (oil prone).
- Late Miocene trans-tensional faults that created thick Plio-Pleistocene ~19,000 feet.
Cendrawasih Basin: Late Tertiary Tested Clastic Play & Tested Deeper Carbonate (Darante) Play

- Late Miocene unconformity marks the base of the Mamberamo Formation and the top of the Makats Formation or older formations.
- Lateral facies changes resulted in locally significant carbonate buildups.
- The underlying sediments are assigned to the Auweva, Darante and Makats Formations.
- E-1 and H-1 wells were unsuccessfully tested the Waipoga foldbelt closures.
- The Elang-1 tested 4-way foreland anticline consists of Plio-Pleistocene Memberamo clastics down to a massive Mio-Oligocene Darante tight-micritic limestone with no hydrocarbon indications during drilling (Noble et.al in 2016).
Akimeugah Basin: Late Tertiary Tested Clastic Play & Tested Deeper Carbonate (Yawee) Play

- Total thickness of Buru Formation towards the north to the Mapenduma Fault creates a foreland-deep basin (Akimeugah).
- Consists of lignite with coarser sands on top, and gradually change to shale deeper.
- Buaya Besar-1 encountered wet Pliocene Buru sandstones and Lt Miocene Yawee limestones.
Akimeugah Basin: Middle - Late Jurassic Clastics Under-explored Play (Flowed Condensate in Iwur/Kau)

- Total thickness of Buru Formation towards the north to the Mapenduma Fault creates **hydrocarbon maturity in a foreland-deep basin** (Akimeugah).
- Most well penetrations in the Arafura Platform and Akimeugah areas **do not penetrate the Middle-Late Jurassic intervals**.
Akimeugah Basin: Middle - Late Jurassic Clastics Under-explored Play (Flowed Condensate in Iwur/Kau)

- Total thickness of Buru Formation towards the north to the Mapenduma Fault creates hydrocarbon maturity in a foreland-deep basin (Akimeugah).
- Most well penetrations in the Arafura Platform and Akimeugah areas do not penetrate the Middle-Late Jurassic intervals.
• Lack of coarser clastics and thin beds of the Late Jurassic to Early Cretaceous in Bintuni Basin differ the area from the Akimeugah-Mapenduma trends, where thicker interval sandstones continue to the PNG region.

• NW Shelf Australia-like Mesozoic rifting-related succession is found in Abadi (Calder graben).

• The real target focus of the Paleozoic stratigraphic target is all over the Arafura platform. A few proven gas discovery is at Bintuni and North Arafura.
Schematic Hydrocarbon Play in The Central Range, Papua

Schematic Hydrocarbon Play in The Bintuni Basin, West Papua

1. Biogenic Steenkool ‘Kido’ Type Play
2. Miocene Kais Reefal Build Up Oil Play sourced by Jurassic Kembelangan
3. Miocene Kais Carbonate Oil Play sourced by Klasafet
4. Eocene-Oligocene Sirga Member Sandstone Coupled Play
5. Paleocene Waripi Deepwater Gas Play sourced by Jurassic Kembelangan
6. Cretaceous Jass Carbonate sourced by Jurassic Kembelangan
7. Middle Jurassic Roabba Gas Play sourced by Jurassic Kembelangan and Permian Ainin
8. Early Jurassic Gas Play sourced by Jurassic Kembelangan and Permian Ainin
9. Permian Ainin Coupled Play

Migration Route:
- : Top Miocene Kais
- : Top Eocene-Oligocene Fauma
- : Top Paleocene Waripi
- : Top Jurassic Kembelangan
- : Top Permian Ainin

Windows:
- Oil Window
- Gas Window
Arafura Platform: Late Tertiary Clastics & Carbonate Tested Plays & Tested Meso-Paleozoic Plays

- Lignite in the upper part
- Fossiliferous Shale with siltstones in deeper part
- Lost circulation no samples
- Sirga Sandstone
- Lignite grey hard crystalline
S-N Chronostratigraphy of Papua New Guinea

**Coral Sea Spread**
- Obduction Sepik Ophiolit
- Mellanesian collision

**Coral Sea Rift onset**
- Break Up unconf.
- Subsolar ends at Kubor

**Kubor & Pasca onlapped**
- Up/Ero Kapa volcanics
- At Kubor anticline
- Extensive Rift Volcanism
- SE of Bosavi

**Rift onset unconf.**

**Figure 12**
- Date: September 1989
Key Wells Drilled in Papua New Guinea
Have we explored our yard enough?..
Summary: North Papua Bird’s Body Region

- **Main reservoirs:**
  - Tested gas: Plio-Pleistocene clastics in R-1, Otus-1, Memberamo-1, and Niengo-1
  - Under explored: Oligo-Miocene carbonate tested in Elang-1
- **Potential unpenetrated**
  - >4 sec. thick Tertiary basins
    - particularly the onshore side; Mervelakte Basin – the forgotten conjugate terrain of PNG
- **Required works:**
  - Acquire regional 2D seismic
  - Land grav/mag??
  - Remote sensing for fault patterns
Summary: Central Range Papua Bird’s Body Region

- Central Range Fore deep and Fold belt are still under explored compared to the PNG side
  - Tested condensate Kau-1 in Jurassic/Early Cretaceous sandstones
  - Oil show: Cross Catalina-1 in Jurassic/E.Cretaceous sandstones
  - A lot of oil seeps

- Required works:
  - Land-gravity data availability
  - Denser 2D seismic grids
  - More detailed (digital) surface geology map

- Non technical issues:
  - Conservation parks
  - Land security i.e. illegal mining
  - Plantations
Summary: Aru Sea Region

- Arafura (Aru) Sea platform
  - Tested gas: Kola-1 in Permian sandstone
  - Under explored: tested Paleozoic in Aru-1 and Merpati Putih-1
  - 2D seismic data coverage in northern Arafura offshore are considered sufficient for regional purpose

- Required works:
  to develop new Paleozoic play concept by:
  - revisiting biostrat at well and outcrops using the seismic data
  - compiling the onshore and offshore gravity/magnetic
  - additional 2D seismic acquisition in the SW offshore and Aru Island
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Back up
Mesozoic Overburden? & Target?

- Cretaceous in the Offshore Seram is the early overburden for the Jurassic to Permian reservoir targets, and is mainly deep-water shale and siltstones.
- Cretaceous and Jurassic in the Bintuni Bay and ASF-1 (South Lengguru) are contrastly much thinner than it is in the Offshore Seram, but can act as good seal (Ayot Marl/Shale).
- Early Cretaceous in Kamakawala-1 and Kembelangan-1 (SE Lengguru) is much thicker (may partly be a repeated section of the over-thrust).
Thermal stress implication on temperature and duration may cause quartz overgrowth on sand.

- Tangguh has less Cretaceous Overburden; so the porosity and permeability is preserved.
- Offshore Seram has significant burial of Mesozoic therefore the reservoir quality decreases.