OUTLINES

• INTRODUCTION
• GEOLOGY OF NORTH SUMATERA BASIN
• PETROLEUM SYSTEM
• HYDROCARBON POTENTIAL
• SUMMARY
The Mergui – North Sumatera Basin occupies an area of cross-border among 4 Countries: Thailand, Malaysia, Indonesia, Myanmar.

North Sumatera Basin is located in the Southern part of the larger Mergui – North Sumatera basin.
The Mergui – North Sumatera basin is bounded by convergence of Mergui Ridge with continental crust of Sunda Craton to the north, Asahan Arch to the east, Barisan Mountain to the south, and the Mergui ridge to the west.

The main tectonic elements dominated by relatively N-S and NW-SE trending highs and deeps.

These highs and deeps divide the larger basin into several sub-basins.

Andreason, et. Al., 1997
GEOLOGY of the NORTH SUMATERA BASIN
North Sumatera basin is a back-arc basin that occupies an area of 60,000 sq. km in the offshore and onshore area of the Northwestern part of Sumatera island. This basin is known as prolific hydrocarbon bearing basin in western Indonesia and produces oil and gas. Hydrocarbon Exploration history began in the late 19th century. The first oilfield in the North Sumatera Basin is Telaga Said oilfield (1885). The discovery was followed by Darat oilfield (1889), Perlak (1900), Serang Jaya (1926), Rantau (1929), Gebang (1936) and Palu Tabuhan (1937). The most significant field in the basin today is Arun gasfield which was discovered in 1971. Total initial reserves of this field was estimated to be 17 TCF.
The main structural elements are dominated by N-S and NW-SE trending direction.

Three tectonic events occurred in the basin: Initial extension phase in the Late Eocene – Early Oligocene; Wrench tectonism in Mid Miocene; and Compressional tectonism during Plio-Pleistocene. The N-S trends represent Pre-Miocene Structure, and the NW-SE are Post Miocene structures.
In the southwestern part of the basin, the sediments were highly folded and faulted due to Barisan uplift.
Initial deposition of sediments began in Late Eocene -Early Oligocene time in very limited Area as initial syn-rift infill.

Main sedimentation in the basin took place during Late Oligocene to Pleistocene.

Maximum sedimentary rocks thickness is up to 6,000 m in the deepest part of the basin.
Western Indonesia Paleogene Rift-Basins

- During paleogene Time, sediment deposition in the North Sumatera Basin occurred within some N-S trending Rift basin.
Sedimentation widely spread during Neogene Time. Thick sedimentary sequence and basin outline were formed during this period.
PETROLEUM SYSTEM REVIEW
REGIONAL HEAT FLOW MAP  
(Modified from Kenyon & Beddoes, 1977)

Average Heat flow in the North Sumatera basin is relatively high ( > 2 HFU). It is suitable for source rock maturation.
SOURCE ROCK POTENTIAL

Shales & mudstone of Bampo Formation and Peutu Formation. Outer neritic shale of Lower part Miocene Baong Formation.

Shales & mudstones of Bampo & Peutu Formation were dominantly type III kerogen with TOC range from 0.5 % to 3 %.

RESERVOAR POTENTIAL

- Early Miocene Belumai sandstone
- Miocene reefal carbonate (Arun limestone, Malacca carbonates)
- Miocene turbidites of Baong sandstone
- Upper Miocene to Pliocene Keutapang sandstone
- Pliocene Seurula sandstone

Abdullah & Jordan (1987)
**SEAL POTENTIAL**

- Impermeable shales of Belumai, Baong, and Keutapang Formations

### Lithostratigraphy

<table>
<thead>
<tr>
<th>NSO Extension</th>
<th>Peusangan Western High</th>
<th>‘B’ &amp; Pase</th>
<th>Malacca Shelf Asamera Pertamina</th>
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</table>

**Legend**

- **Julu Rayeu**
- **Keutapang**
- **Baong**
- **Seumpo**
- **Seurula**
- **L. Baong Ss**
- **Malaka**
- **Tampur**
- **Parapat/Bruksah**
- **Bampo**
- **Arun**
- **Belumai**
- **Peutu**
- **Peunulin**
- **Sligi**
- **Meucampi**
- **(Possible Diorite)**
TRAP POTENTIAL

- Structural trap
- Stratigraphic trap (Reefal Carbonate and clastic)
- Combination structural/stratigraphic trap
**HYDROCARBON GENERATION & MIGRATION**

- First Hydrocarbon generation was suggested at Middle Miocene Time
- Critical moment occurred around Plio-Pliocene
- Migration pathway occurred through up-dip and vertical faults

![Petroleum System Diagram](image)

HYDROCARBON PLAYS

- Early Miocene Belumai sandstone Play
- Miocene reefal carbonate Play
- Miocene Baong sandstone Play
- Mio-Pliocene Keutapang sandstone play
- Pliocene Seurula sandstone play
HYDROCARBON POTENTIAL
## Oil Companies in the North Sumatera Basin

<table>
<thead>
<tr>
<th>No.</th>
<th>Company</th>
<th>Block</th>
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<tr>
<td>39</td>
<td>ENI KRUENG MANE LTD</td>
<td>BULUNGAN</td>
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<tr>
<td>134</td>
<td>PT ZARATEX NV</td>
<td>LHOKSEUMAWE</td>
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<td>43</td>
<td>EXXON MOBIL</td>
<td>NSO/NSO -EXT</td>
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<td>TRANSWORLD SERUWAI</td>
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<td>PASE</td>
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<td>PT MEDCO E&amp;P MALAKA</td>
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<td>TELAGA BINJAI ENERGI</td>
<td>BINJAI</td>
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<td>GEBANG</td>
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<tr>
<td>P25a</td>
<td>PERTAMINA</td>
<td>NAD-2</td>
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The seismic sections and well data are available in Patra Nusa Data (PND).

Total: 43559 Km seismic lines
1031 wells

EXISTING SEISMIC SECTION S& WELLS MAP
(PND, 2008)
HYDROCARBON EXPLORATION

33 Oil & Gas fields. Almost of them are located in onshore areas.

Challenges to find oil & gas in offshore area.

GAS & OIL FIELDS MAP (PND, 2008)
**HYDROCARBON POTENTIAL**

**RESERVES & RESOURCES**

- Oil reserves: 257.76 MMSTB (Status 1 Januari 2008)
- Gas reserves: 5.03 TCF (Status, Januari 2007).

**SPECULATIVE REMAINING RESOURCES**

<table>
<thead>
<tr>
<th>RESOURCES</th>
<th>IN PLACE</th>
<th>RECOVERABLE</th>
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<tr>
<td>Oil (MMBO)</td>
<td>1,357.5</td>
<td>407.4</td>
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<tr>
<td>Gas (BCF)</td>
<td>3,067.1</td>
<td>1,355.7</td>
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Lemigas, 2007
The Larger Mergui – North Sumatera Basin is an extensional basin that initially formed in Late Paleogene and mostly developed during Neogene time. The North Sumatera back-arc basin itself is the southern part of the larger Mergui – North Sumatera basin.

Most tectonic elements in the North Sumatera Basin has relatively N-S and NW-SE trends as product of three tectonic events. Early Tertiary tectonism, Mid-Miocene Tectonism, and Plio-Pleistocene tectonism. The N-S trends represent Pre-Miocene Structures and the NW-SE trends are Post Miocene structures.

The Petroleum system indicates that the deeper sub-basins of the North Sumatra basin were suitable for kitchen area. Early hydrocarbon generation began in Mid-Miocene and critical moment occurred in Plio-Pleistocene. Generated hydrocarbon accumulated into available plays such as:

- Early Miocene Belumai sandstone Play
- Miocene reefal carbonate Play
- Miocene Baong sandstone Play
- Upper Miocene to Pliocene Keutapang sandstone play
- Pliocene Seurula sandstone play

Today more than 14 Oil Companies have working areas in this basin, and most of oil & gas fields located in the onshore areas. Total hydrocarbon reserves recently are 257.76 MMSTB oil and 5.03 TCF gas. There is still more opportunity to find oil & gas in this basin, especially in the offshore area.
TERIMA KASIH
THANK YOU