



South Malay Coaly Assessment Unit 37030201



-  South Malay Coaly Assessment Unit 37030201
-  Malay Basin Geologic Province 3703

USGS PROVINCE: Malay Basin (3703)

GEOLOGIST: M.G. Bishop

TOTAL PETROLEUM SYSTEM: Miocene Coaly Strata (370302)

ASSESSMENT UNIT: South Malay Coaly (37030201)

DESCRIPTION: Offshore gas, condensate and oil sourced from delta plain coals and coaly shales in Neogene anticlines of reservoir rocks associated with a large Mesozoic river delta system and the shoreline of the Mesozoic South China Sea. Assessment unit lies primarily in the waters of Malaysia, and joint Malaysia-Thailand.

SOURCE ROCKS: The gas-prone coal and coaly shale source rocks are of deltaic and coastal plain origin.

MATURATION: Late Miocene time at approximately 1000 to 3500 m burial depth and all potential source rocks are over mature in the center of the basin and under mature at the edges. Condensates and oils have high pristane to phytane ratios, high oleanane content and abundant resinous compounds.

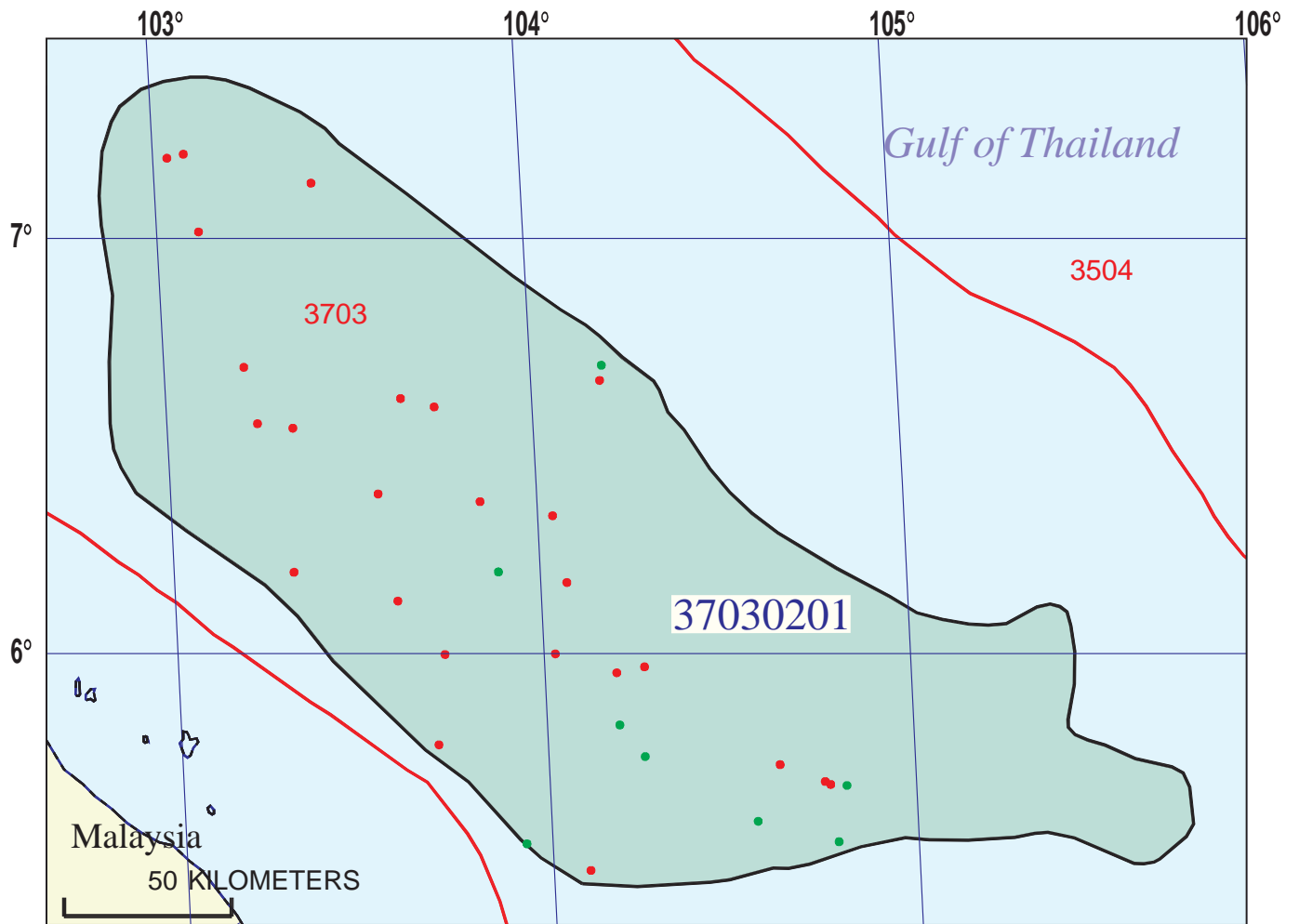
MIGRATION: Primarily vertical.

RESERVOIR ROCKS: The middle to upper Miocene reservoir rocks consist of medium- to very fine grained, deltaic, estuarine, and shallow marine matrix-rich sandstones with as much as 35 percent porosity, and as much as 2000 mD permeability. Bioturbation, burial compaction, and authigenic clays reduce porosity. Secondary porosity due to dissolution of feldspar is locally important.

TRAPS AND SEALS: Hydrocarbons are trapped in Middle to Late Miocene age transpressional folds, drape anticlines, and some stratigraphic traps. Intraformational seals and regional Pliocene marine transgressive shales and marls.

REFERENCES:

- Coen, T.A.L., 1997, Exploration in the Gulf of Thailand in deltaic reservoirs, related to the Bongkot Field, *in* Fraser, A.J., Matthews, S.J., and Murphy, R.W., eds., Petroleum geology of southeast Asia: Geological Society Special Publication, 126, p. 77-87.
- Madon, B. H. M., 1994, Depositional and diagenetic histories of reservoir sandstones in the Jerneh field, central Malay Basin: Geological Society of Malaysia Bulletin 36, p. 31-53.
- Petroconsultants, 1996, Petroleum exploration and production database: Petroconsultants, Inc., P.O. Box 740619, 6600 Sands Point Drive, Houston TX 77274-0619, USA or Petroconsultants, Inc., P.O. Box 152, 24 Chemin de la Mairie, 1258 Perly, Geneva, Switzerland.
- Tjia, H.D., 1994, Inversion tectonics in the Malay Basin—evidence and timing of events: Geological Society of Malaysia Bulletin 36, p. 119-126.



South Malay Coaly Assessment Unit - 37030201

EXPLANATION

- Hydrography
- Shoreline
- 3703 Geologic province code and boundary
- Country boundary
- Gas field centerpoint
- Oil field centerpoint
- 37030201 — Assessment unit code and boundary

Projection: Robinson. Central meridian: 0

**SEVENTH APPROXIMATION
NEW MILLENNIUM WORLD PETROLEUM ASSESSMENT
DATA FORM FOR CONVENTIONAL ASSESSMENT UNITS**

| | | |
|------------------------------|-----------------------------|-------------------------|
| Date:..... | <u>9/28/99</u> | |
| Assessment Geologist:..... | <u>P.J. McCabe</u> | |
| Region:..... | <u>Asia Pacific</u> | Number: <u>3</u> |
| Province:..... | <u>Malay Basin</u> | Number: <u>3703</u> |
| Priority or Boutique:..... | <u>Priority</u> | |
| Total Petroleum System:..... | <u>Miocene Coaly Strata</u> | Number: <u>370302</u> |
| Assessment Unit:..... | <u>South Malay Coaly</u> | Number: <u>37030201</u> |
| * Notes from Assessor | <u>MMS growth function.</u> | |

CHARACTERISTICS OF ASSESSMENT UNIT

Oil (<20,000 cfg/bo overall) **or** Gas (≥20,000 cfg/bo overall):... Gas

What is the minimum field size?..... 5 mmboe grown (≥1mmboe)
(the smallest field that has potential to be added to reserves in the next 30 years)

| | | |
|----------------------------------------------------------|------------------------------|--------------------------------|
| Number of discovered fields exceeding minimum size:..... | Oil: <u>7</u> | Gas: <u>24</u> |
| Established (>13 fields) <u>X</u> | Frontier (1-13 fields) _____ | Hypothetical (no fields) _____ |

Median size (grown) of discovered oil fields (mmboe):

| | | |
|--------------------|-------------------|---------------|
| 1st 3rd <u>180</u> | 2nd 3rd <u>12</u> | 3rd 3rd _____ |
|--------------------|-------------------|---------------|

Median size (grown) of discovered gas fields (bcfg):

| | | |
|---------------------|--------------------|--------------------|
| 1st 3rd <u>1971</u> | 2nd 3rd <u>359</u> | 3rd 3rd <u>170</u> |
|---------------------|--------------------|--------------------|

Assessment-Unit Probabilities:

| <u>Attribute</u> | <u>Probability of occurrence (0-1.0)</u> |
|------------------------------------------------------------------------------------------------------|------------------------------------------|
| 1. CHARGE: Adequate petroleum charge for an undiscovered field ≥ minimum size..... | <u>1.0</u> |
| 2. ROCKS: Adequate reservoirs, traps, and seals for an undiscovered field ≥ minimum size..... | <u>1.0</u> |
| 3. TIMING OF GEOLOGIC EVENTS: Favorable timing for an undiscovered field ≥ minimum size | <u>1.0</u> |

Assessment-Unit GEOLOGIC Probability (Product of 1, 2, and 3):..... 1.0

| | |
|------------------------------------------------------------------------------------------------------------------|------------|
| 4. ACCESSIBILITY: Adequate location to allow exploration for an undiscovered field ≥ minimum size..... | <u>1.0</u> |
|------------------------------------------------------------------------------------------------------------------|------------|

UNDISCOVERED FIELDS

Number of Undiscovered Fields: How many undiscovered fields exist that are ≥ minimum size?:
(uncertainty of fixed but unknown values)

| | | |
|----------------------------------------|----------------------|-------------------|
| Oil fields:.....min. no. (>0) <u>1</u> | median no. <u>10</u> | max no. <u>20</u> |
| Gas fields:.....min. no. (>0) <u>2</u> | median no. <u>20</u> | max no. <u>50</u> |

Size of Undiscovered Fields: What are the anticipated sizes (**grown**) of the above fields?:
(variations in the sizes of undiscovered fields)

| | | |
|---------------------------------------------------|------------------------|-----------------------|
| Oil in oil fields (mmbo).....min. size <u>5</u> | median size <u>8</u> | max. size <u>75</u> |
| Gas in gas fields (bcfg):.....min. size <u>30</u> | median size <u>100</u> | max. size <u>2000</u> |

AVERAGE RATIOS FOR UNDISCOVERED FIELDS, TO ASSESS COPRODUCTS

(uncertainty of fixed but unknown values)

| <u>Oil Fields:</u> | minimum | median | maximum |
|-----------------------------------|---------|--------|---------|
| Gas/oil ratio (cfg/bo)..... | 2400 | 4800 | 7200 |
| NGL/gas ratio (bnl/mmcf)..... | 7 | 14 | 21 |
| <u>Gas fields:</u> | minimum | median | maximum |
| Liquids/gas ratio (bnl/mmcf)..... | 10 | 20 | 30 |
| Oil/gas ratio (bo/mmcf)..... | | | |

SELECTED ANCILLARY DATA FOR UNDISCOVERED FIELDS

(variations in the properties of undiscovered fields)

| <u>Oil Fields:</u> | minimum | median | maximum |
|-----------------------------------------|---------|--------|---------|
| API gravity (degrees)..... | 29 | 40 | 53 |
| Sulfur content of oil (%)..... | | | |
| Drilling Depth (m) | 800 | 1200 | 2600 |
| Depth (m) of water (if applicable)..... | 40 | 60 | 100 |
| <u>Gas Fields:</u> | minimum | median | maximum |
| Inert gas content (%)..... | | | |
| CO ₂ content (%)..... | 1 | 5 | 70 |
| Hydrogen-sulfide content (%)..... | | | |
| Drilling Depth (m)..... | 1000 | 1600 | 2600 |
| Depth (m) of water (if applicable)..... | 40 | 60 | 100 |

**ALLOCATION OF UNDISCOVERED RESOURCES IN THE ASSESSMENT UNIT
 TO COUNTRIES OR OTHER LAND PARCELS** (uncertainty of fixed but unknown values)

1. Malaysia represents 94 areal % of the total assessment unit

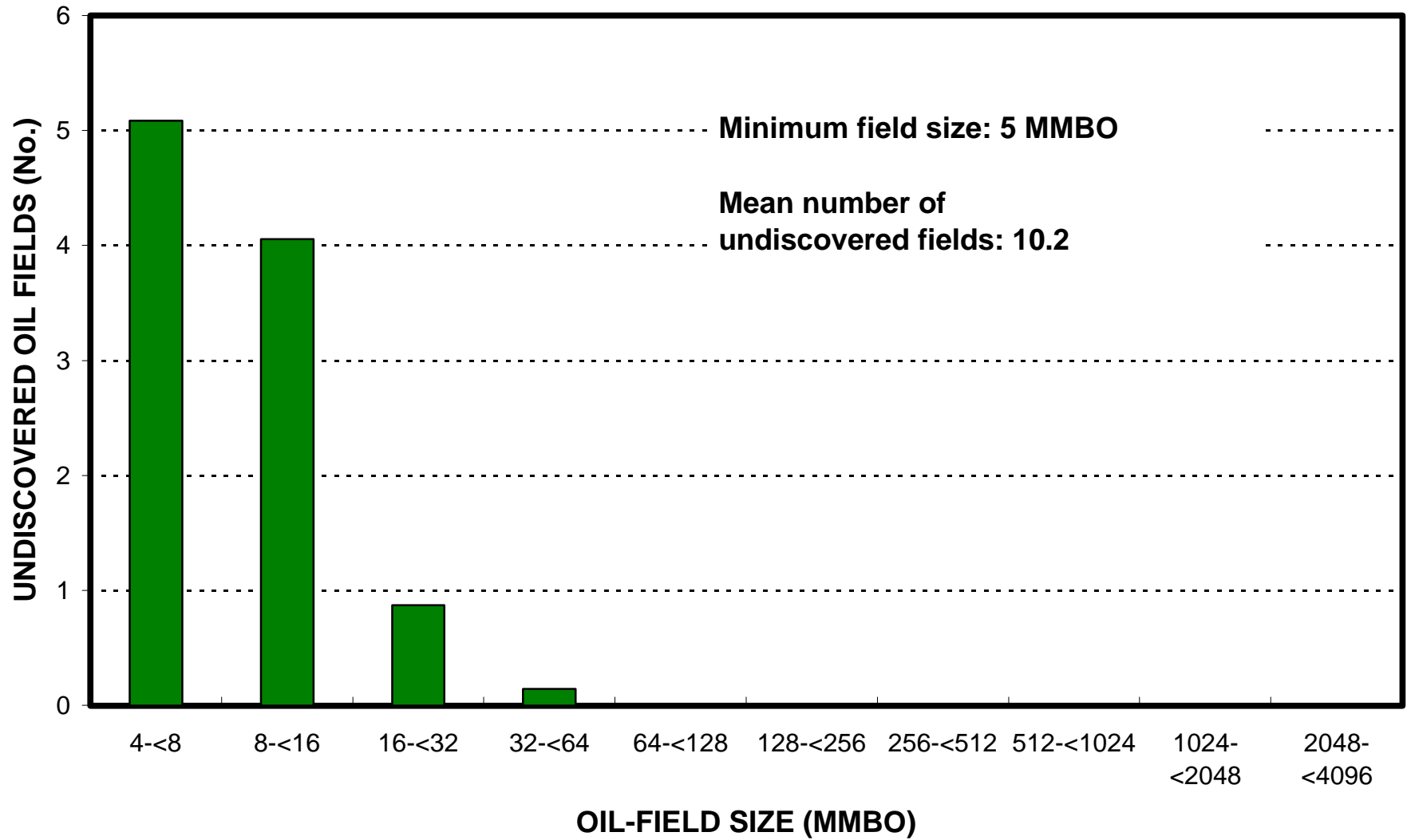
| <u>Oil in Oil Fields:</u> | minimum | median | maximum |
|-----------------------------------------------------|---------|------------|---------|
| Richness factor (unitless multiplier):..... | _____ | _____ | _____ |
| Volume % in parcel (areal % x richness factor):... | _____ | <u>94</u> | _____ |
| Portion of volume % that is offshore (0-100%):..... | _____ | <u>100</u> | _____ |
| | | | |
| <u>Gas in Gas Fields:</u> | minimum | median | maximum |
| Richness factor (unitless multiplier):..... | _____ | _____ | _____ |
| Volume % in parcel (areal % x richness factor):... | _____ | <u>94</u> | _____ |
| Portion of volume % that is offshore (0-100%):..... | _____ | <u>100</u> | _____ |

2. Joint Thailand/Malaysia represents 6 areal % of the total assessment unit

| <u>Oil in Oil Fields:</u> | minimum | median | maximum |
|-----------------------------------------------------|---------|------------|---------|
| Richness factor (unitless multiplier):..... | _____ | _____ | _____ |
| Volume % in parcel (areal % x richness factor):... | _____ | <u>6</u> | _____ |
| Portion of volume % that is offshore (0-100%):..... | _____ | <u>100</u> | _____ |
| | | | |
| <u>Gas in Gas Fields:</u> | minimum | median | maximum |
| Richness factor (unitless multiplier):..... | _____ | _____ | _____ |
| Volume % in parcel (areal % x richness factor):... | _____ | <u>6</u> | _____ |
| Portion of volume % that is offshore (0-100%):..... | _____ | <u>100</u> | _____ |

South Malay Coaly, AU 37030201

Undiscovered Field-Size Distribution



South Malay Coaly, AU 37030201

Undiscovered Field-Size Distribution

