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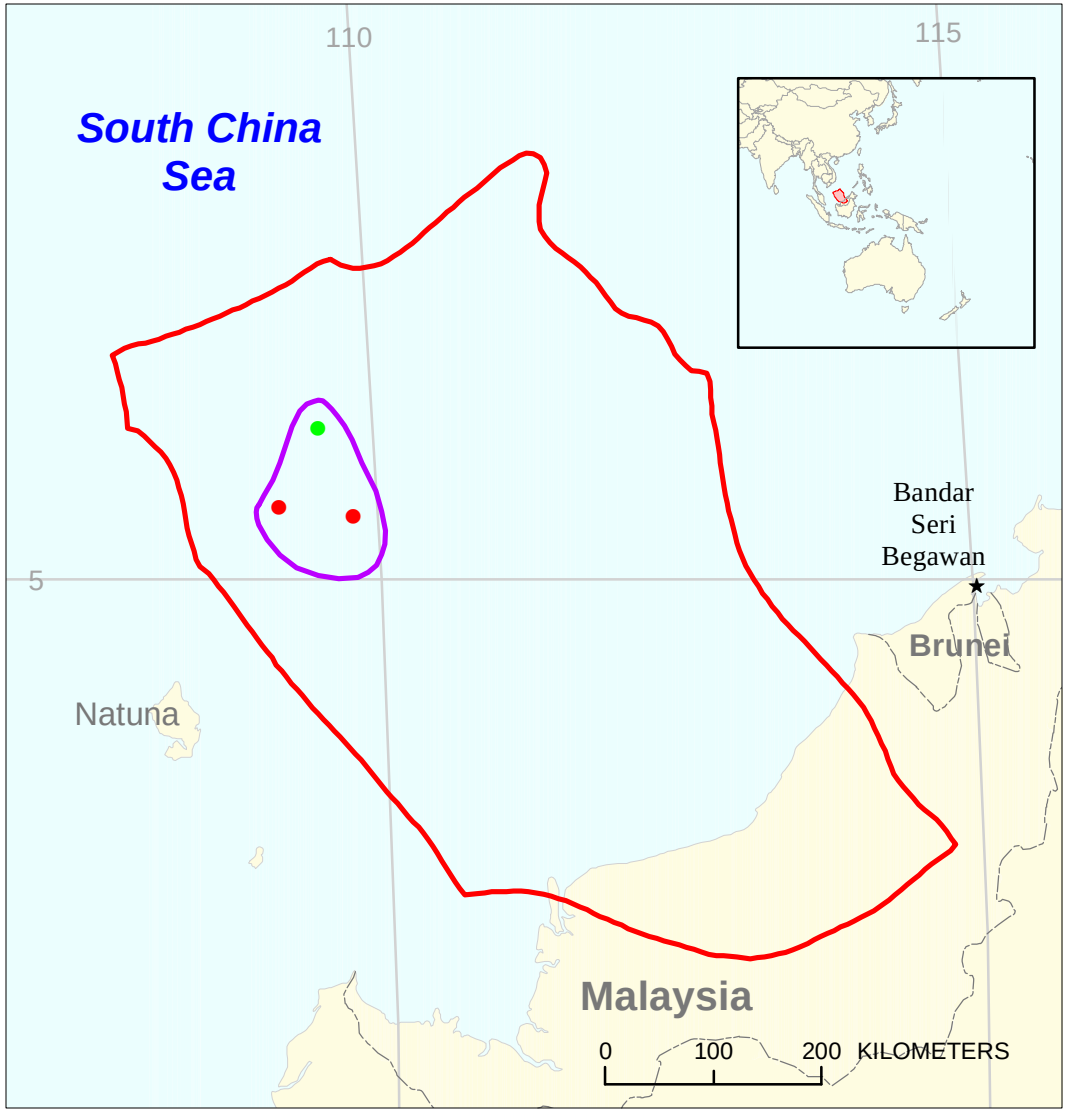
East Natuna
Assessment Unit 37020201



East Natuna Assessment Unit 37020201
Greater Sarawak Basin Geologic Province 3702

Geologic Summary

Detailed map of this assessment unit

Assessment Input Data

Assessment Results
- Assessment Unit Summary
- Detailed Assessment Results
- Undiscovered Field-Size Distributions

USGS PROVINCE: Greater Sarawak Basin (3702) **GEOLOGIST:** P.J. McCabe

TOTAL PETROLEUM SYSTEM: East Natuna (370202)

ASSESSMENT UNIT: East Natuna (37020201)

DESCRIPTION: Reservoirs are in Middle to Late Miocene reefs that are underlain and overlain by deltaic sediments. There is one very large gas field with an estimated 45 TCF of methane but the produced gas contains over 70 percent CO_2, which makes it uneconomic to exploit.

SOURCE ROCKS: The hydrocarbons are interpreted as having been sourced from terrigenous organic matter. Coals and marine condensed intervals in the underlying and surrounding deltaics are probable source rocks.

MATURATION: The area is still undergoing subsidence. Oil and gas generation probably started in the mid-Pliocene.

MIGRATION: Little is known about possible migration paths but as in the Central Luconia province, upward migration of hydrocarbons along faults may have been important.

RESERVOIR ROCKS: Carbonate sands of shallow water deposits of late highstand systems tracts have the highest porosity. It is probable that, as in Central Luconia, dolomitization of reefs during lowstands in sea level was also important in creating reservoirs.

TRAPS AND SEALS: Prodelta to basinal shales of the overlying Pliocene-Pleistocene Muda Shale form a regional seal. The reefs probably are compartmentalized by zones of tight limestone.

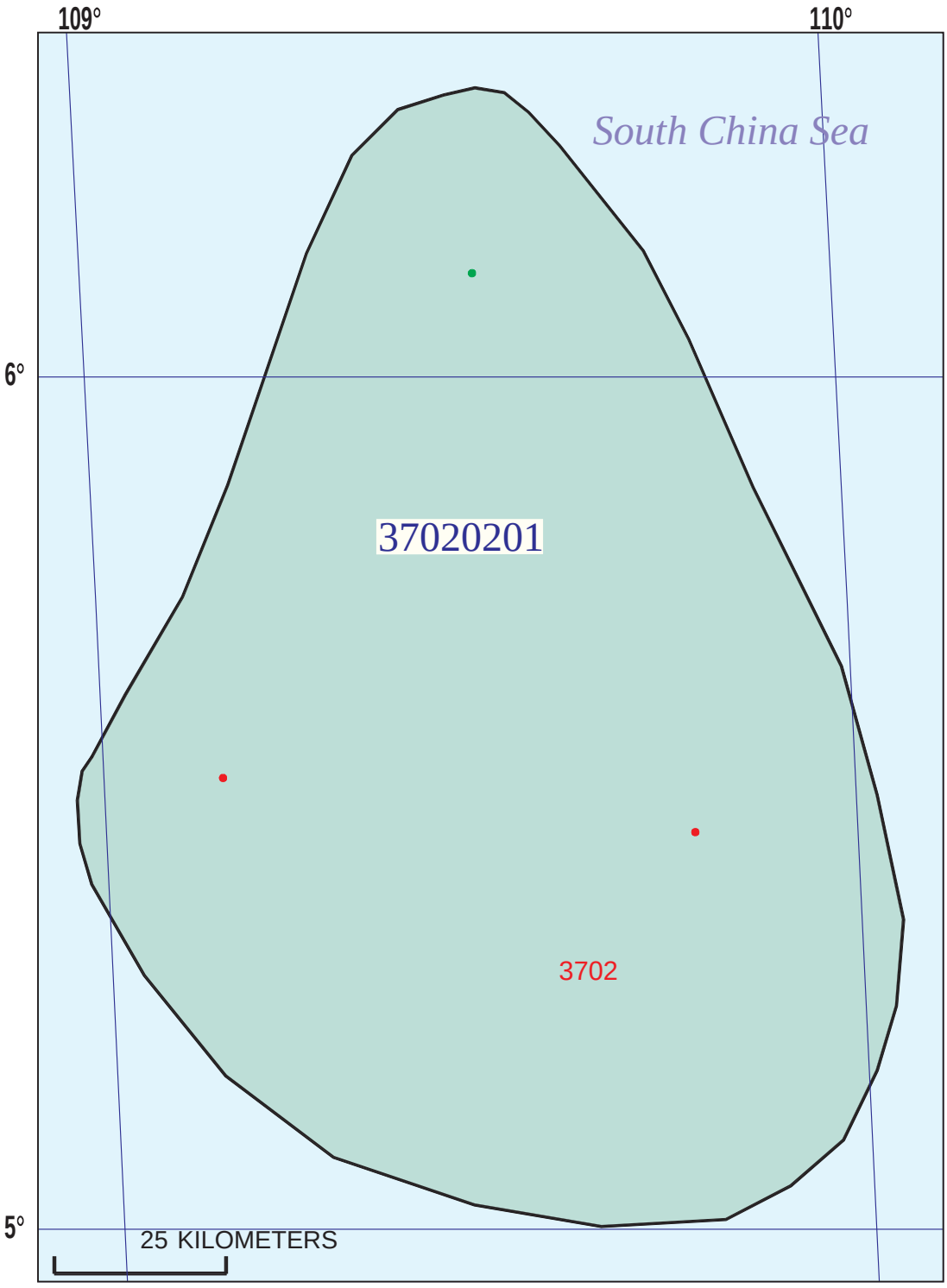
PETROLEUM INDUSTRY ACTIVITY: Industry interest in the area began in the early 1970s. The major gas field was discovered in 1973 but there have only been two small subsequent discoveries. There has been little exploration in the last 15 years because it has not been economic to develop the discoveries to date.

REFERENCES:

Dunn, P.A., Kozar, M.G., and Budiyono, 1996, Application of geoscience technology in a geologic study of the Natuna gas field, Natuna Sea, offshore Indonesia: Proceedings of the Indonesian Petroleum Association, v. 25, p. 117-130.

May, J.A., and Eyles, D.R., 1985, Well log and seismic character of Tertiary Terumbu carbonate, South China Sea, Indonesia: American Association of Petroleum Geologists Bulletin, v. 69, p. 1339-1358.

Rudolph, K.W., and Lehmann, P.J., 1989, Platform evolution and sequence stratigraphy of the Natuna Platform, South China Sea, *in* Crevello, P.D., Wilson, J.J., Sarg, J.F., and Read, J.F., eds., Controls on carbonate platform and basin development: Special Publication Society of Economic Paleontologists and Mineralogists 44, p. 353-361.



East Natuna
Assessment Unit - 37020201

EXPLANATION

- Hydrography
- Shoreline
- 3702 Geologic province code and boundary
- Country boundary
- Gas field centerpoint
- Oil field centerpoint
- 37020201 Assessment unit code and boundary

Projection: Robinson. Central meridian: 0

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

Date:……..	8/17/99		
Assessment Geologist:……..	P.J. McCabe		
Region:……..	Asia Pacific	Number:	3
Province:……..	Greater Sarawak Basin	Number:	3702
Priority or Boutique……	Priority		
Total Petroleum System:……	East Natuna	Number:	370202
Assessment Unit:……	East Natuna	Number:	37020201
* Notes from Assessor	MMS growth function.		

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: 1 Gas: 2
Established (>13 fields) _____ Frontier (1-13 fields) X Hypothetical (no fields) _____

Median size (grown) of discovered oil fields (mmboe):
1st 3rd 29 2nd 3rd _____ 3rd 3rd _____
Median size (grown) of discovered gas fields (bcfg):
1st 3rd 52169 2nd 3rd 29 3rd 3rd _____

Assessment-Unit Probabilities:

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

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…… 1.0

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)	1	median no.	4	max no.	10
Gas fields:……min. no. (>0)	1	median no.	10	max no.	20

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	5	median size	14	max. size	400
Gas in gas fields (bcfg):……min. size	30	median size	100	max. size	3000

Assessment Unit (name, no.)
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AVERAGE RATIOS FOR UNDISCOVERED FIELDS, TO ASSESS COPRODUCTS

(uncertainty of fixed but unknown values)

Oil Fields:	minimum	median	maximum
Gas/oil ratio (cfg/bo)……	1100	2200	3300
NGL/gas ratio (bngl/mmcfg)……	30	60	90

Gas fields:	minimum	median	maximum
Liquids/gas ratio (bngl/mmcfg)……	22	44	66
Oil/gas ratio (bo/mmcfg)……			

SELECTED ANCILLARY DATA FOR UNDISCOVERED FIELDS

(variations in the properties of undiscovered fields)

Oil Fields:	minimum	median	maximum
API gravity (degrees)……	17	34	51
Sulfur content of oil (%)……	0.2	0.4	0.6
Drilling Depth (m) ……	700	1500	3000
Depth (m) of water (if applicable)……	150	200	250

Gas Fields:	minimum	median	maximum
Inert gas content (%)……	1	2.5	5
CO_2 content (%)……	1	3.5	75
Hydrogen-sulfide content (%)……	0.25	0.5	0.75
Drilling Depth (m)……	700	1500	3000
Depth (m) of water (if applicable)……	150	200	250

Assessment Unit (name, no.)
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ALLOCATION OF UNDISCOVERED RESOURCES IN THE ASSESSMENT UNIT TO COUNTRIES OR OTHER LAND PARCELS (uncertainty of fixed but unknown values)

1. Indonesia represents 100 areal % of the total assessment unit

Oil in Oil Fields:	minimum	median	maximum
Richness factor (unitless multiplier):……			
Volume % in parcel (areal % x richness factor):…		100	
Portion of volume % that is offshore (0-100%)……		100	

Gas in Gas Fields:	minimum	median	maximum
Richness factor (unitless multiplier):……			
Volume % in parcel (areal % x richness factor):…		100	
Portion of volume % that is offshore (0-100%)……		100	

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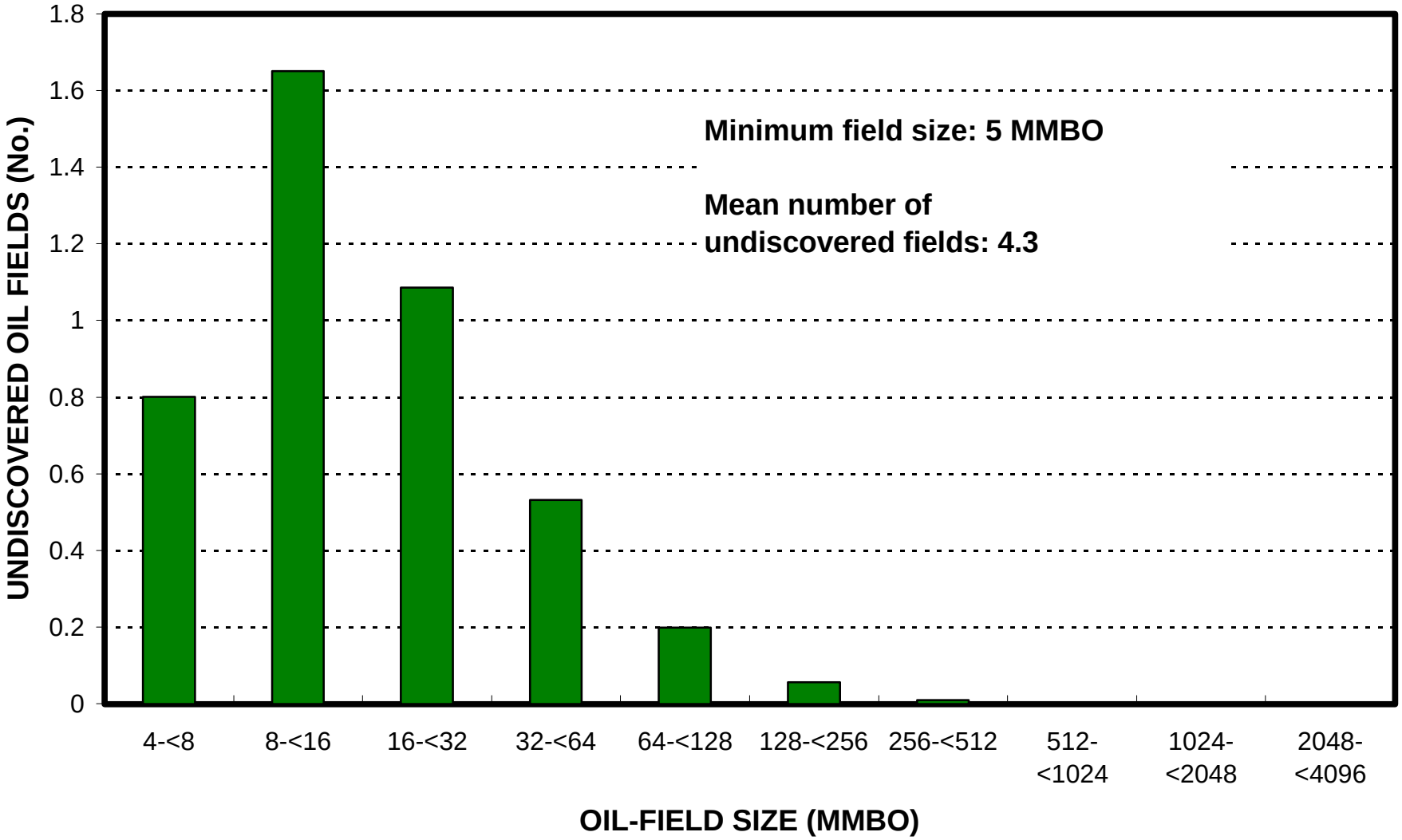
Undiscovered Field-Size Distribution



East Natuna, AU 37020201
Undiscovered Field-Size Distribution