

Brazil Exploration Opportunities

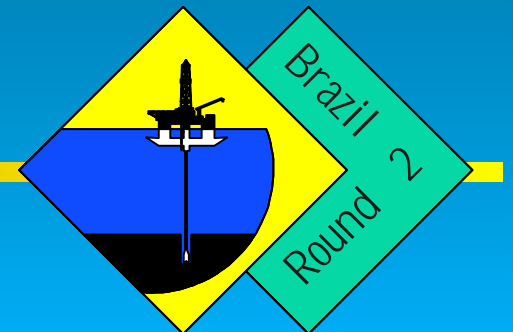
Size Does Matter

Agência Nacional do Petróleo - ANP

Ivan Simões

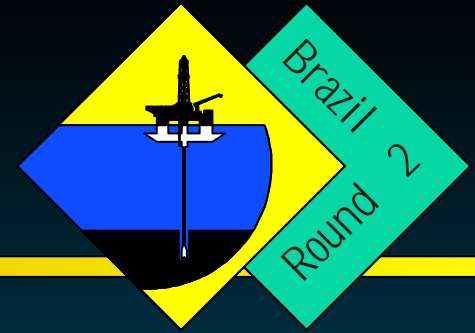
Fábio Pinto

Sandro Mercio



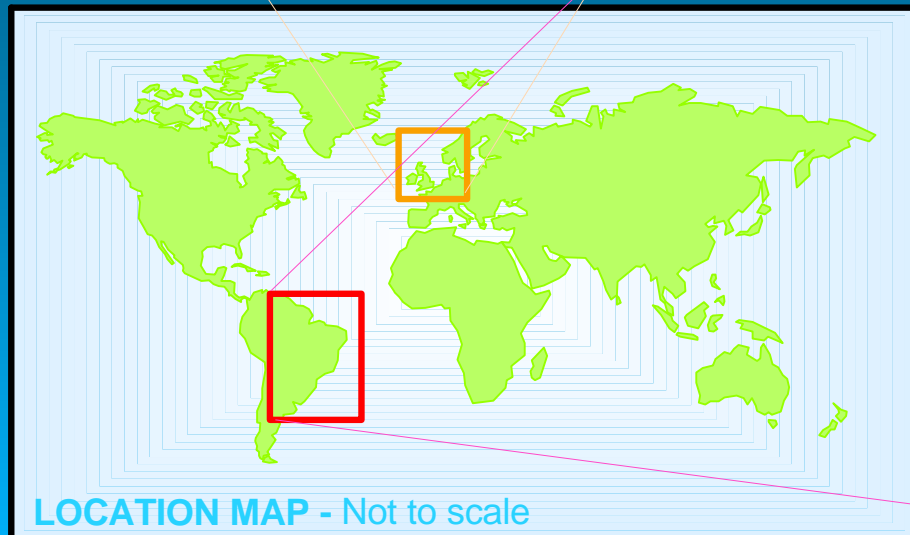
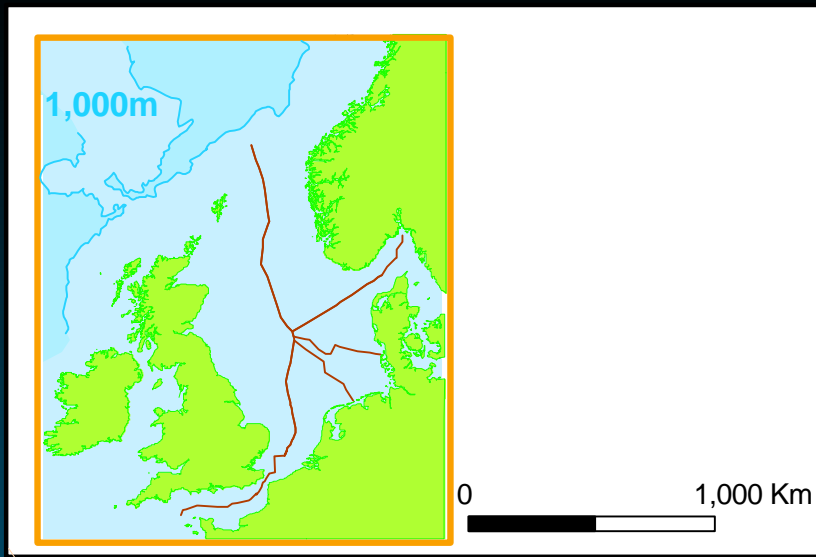


Brazilian Exploration Opportunities

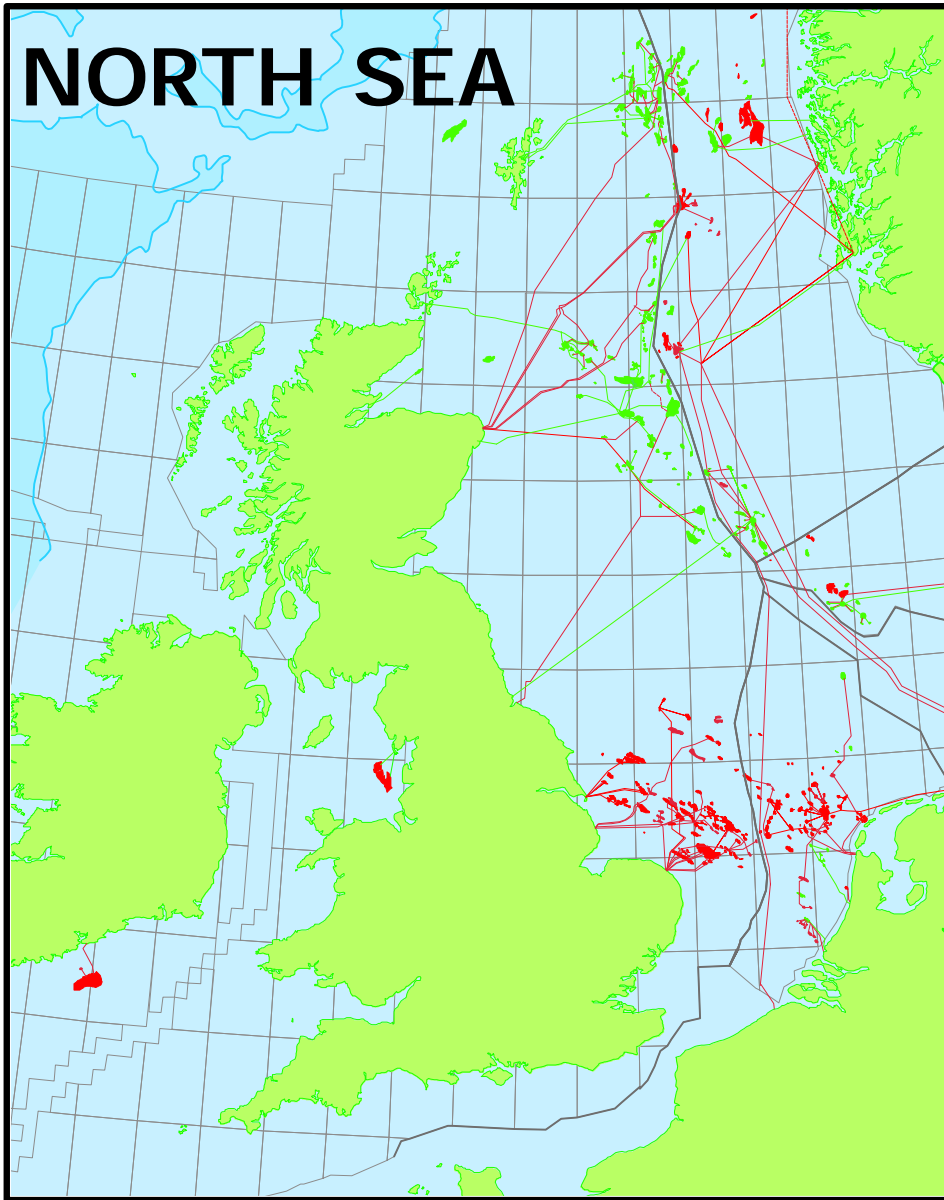


- Brazil statistics
- **E&P History**
- Brazil geological settings
- **Brazil - Round 2 opportunities**

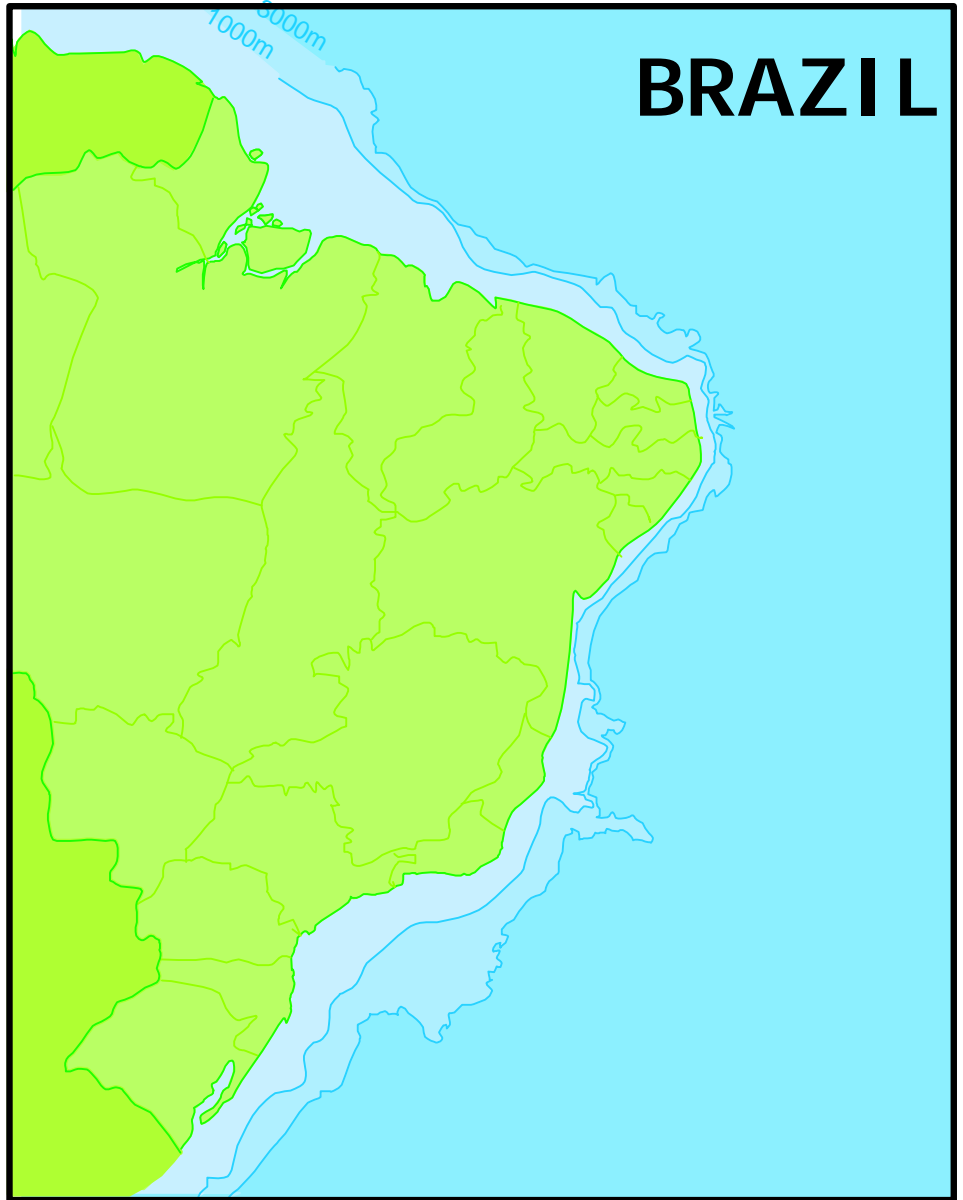
UK North Sea & Brazil



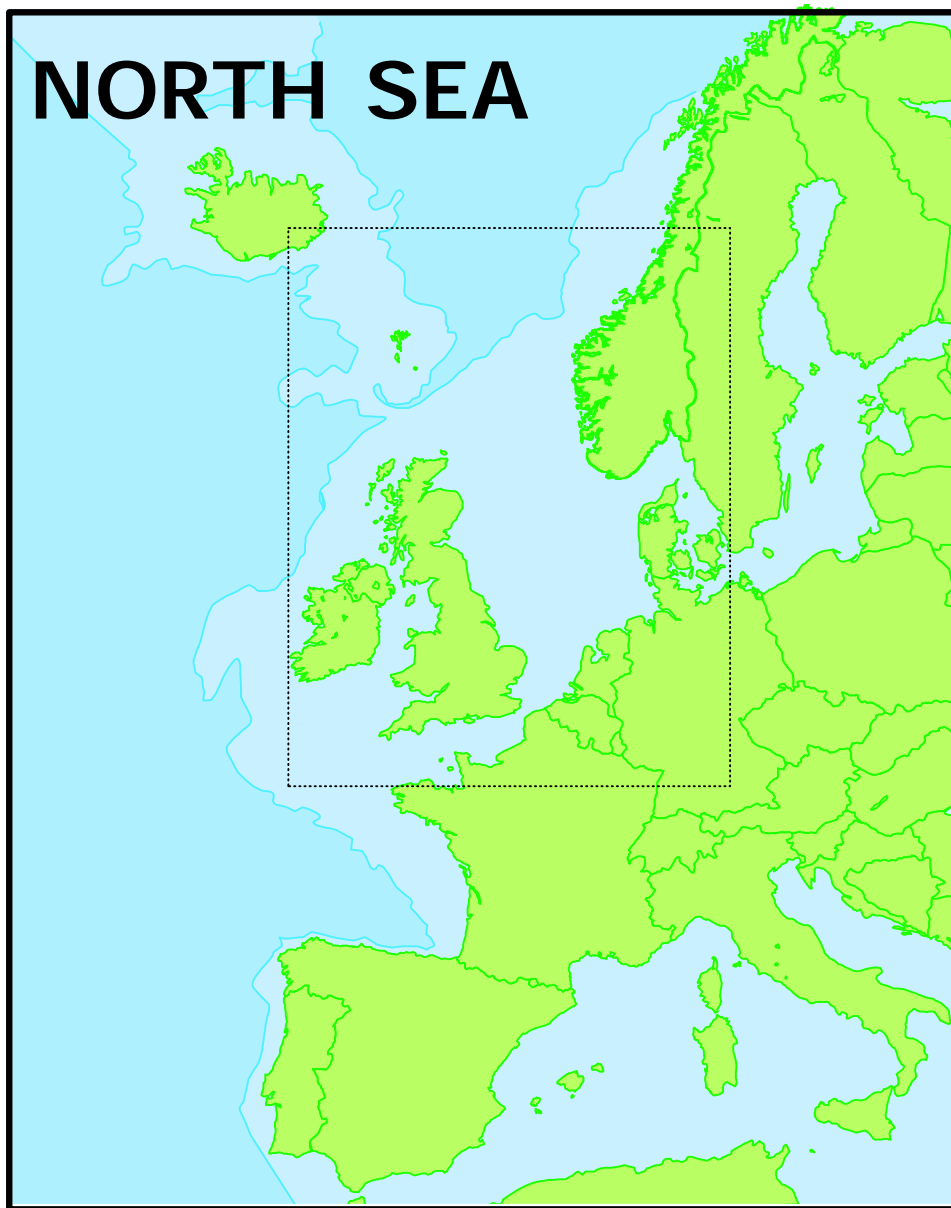
NORTH SEA



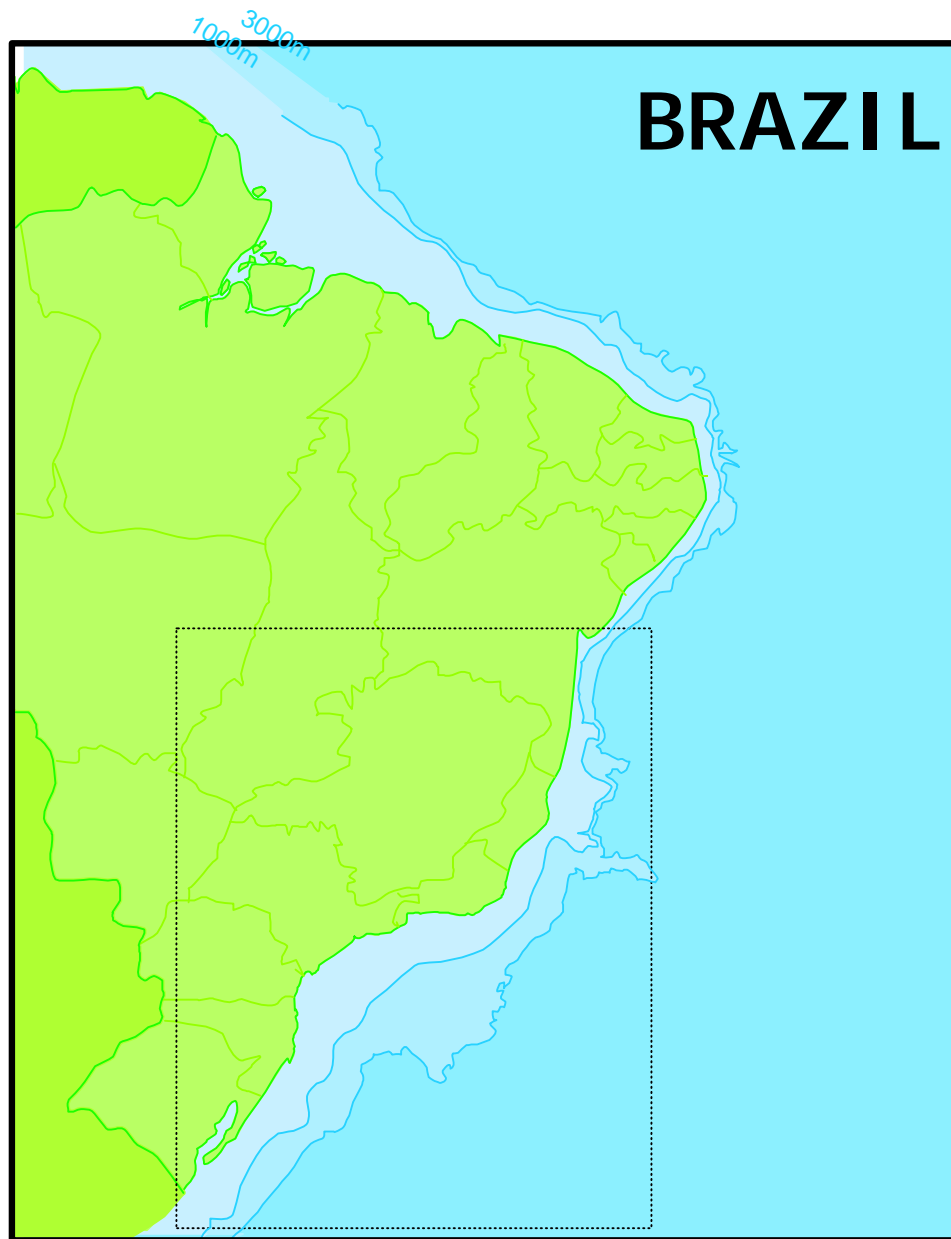
BRAZIL



NORTH SEA

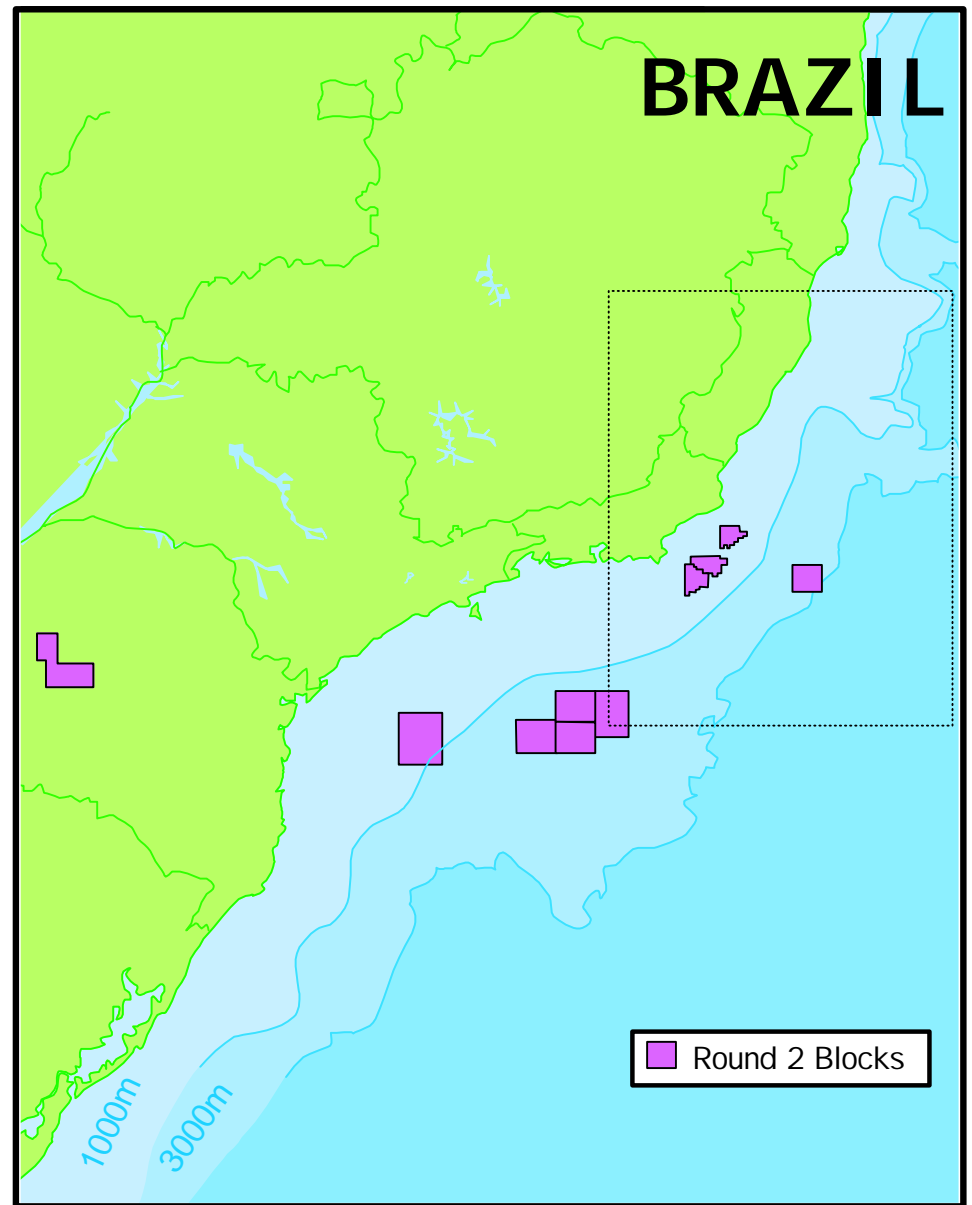
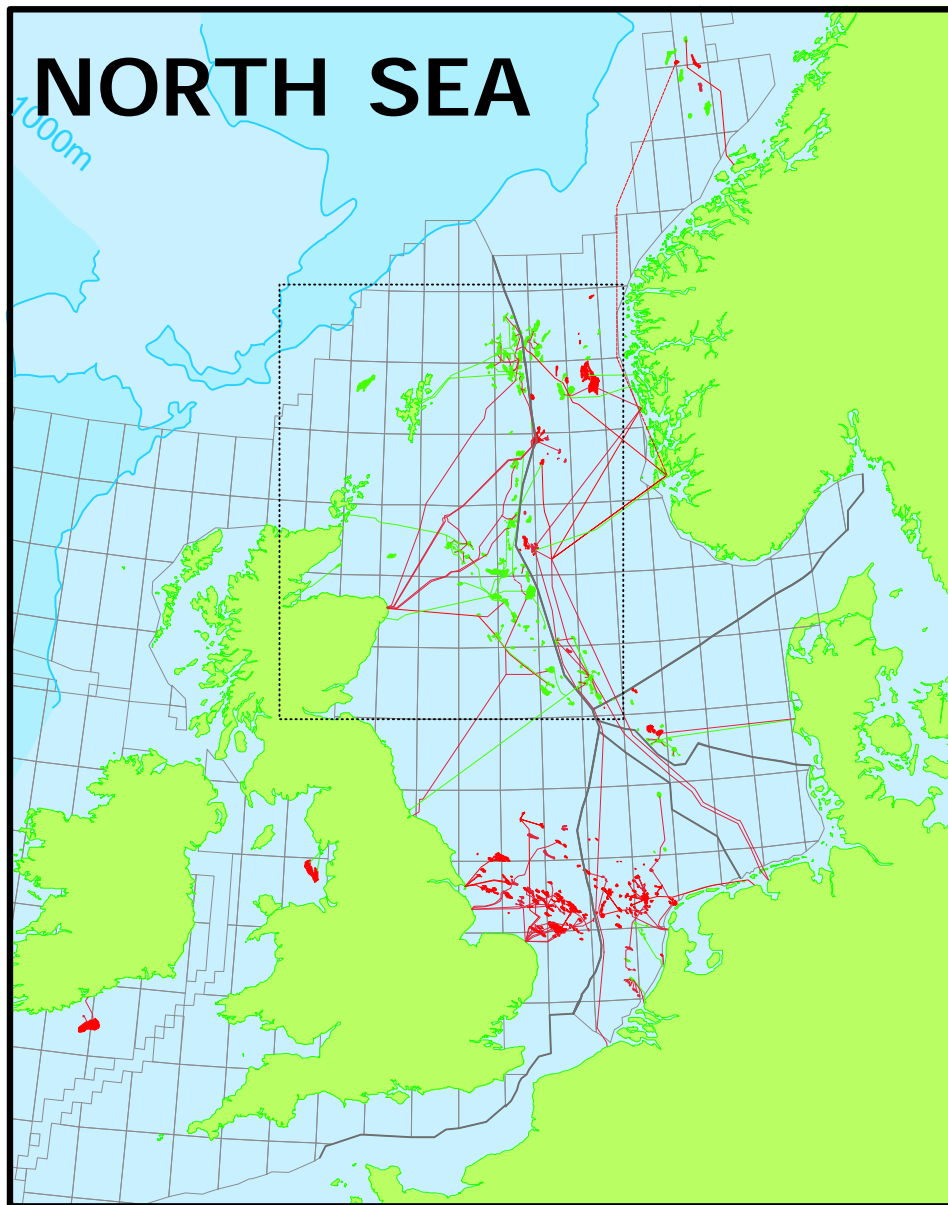


BRAZIL



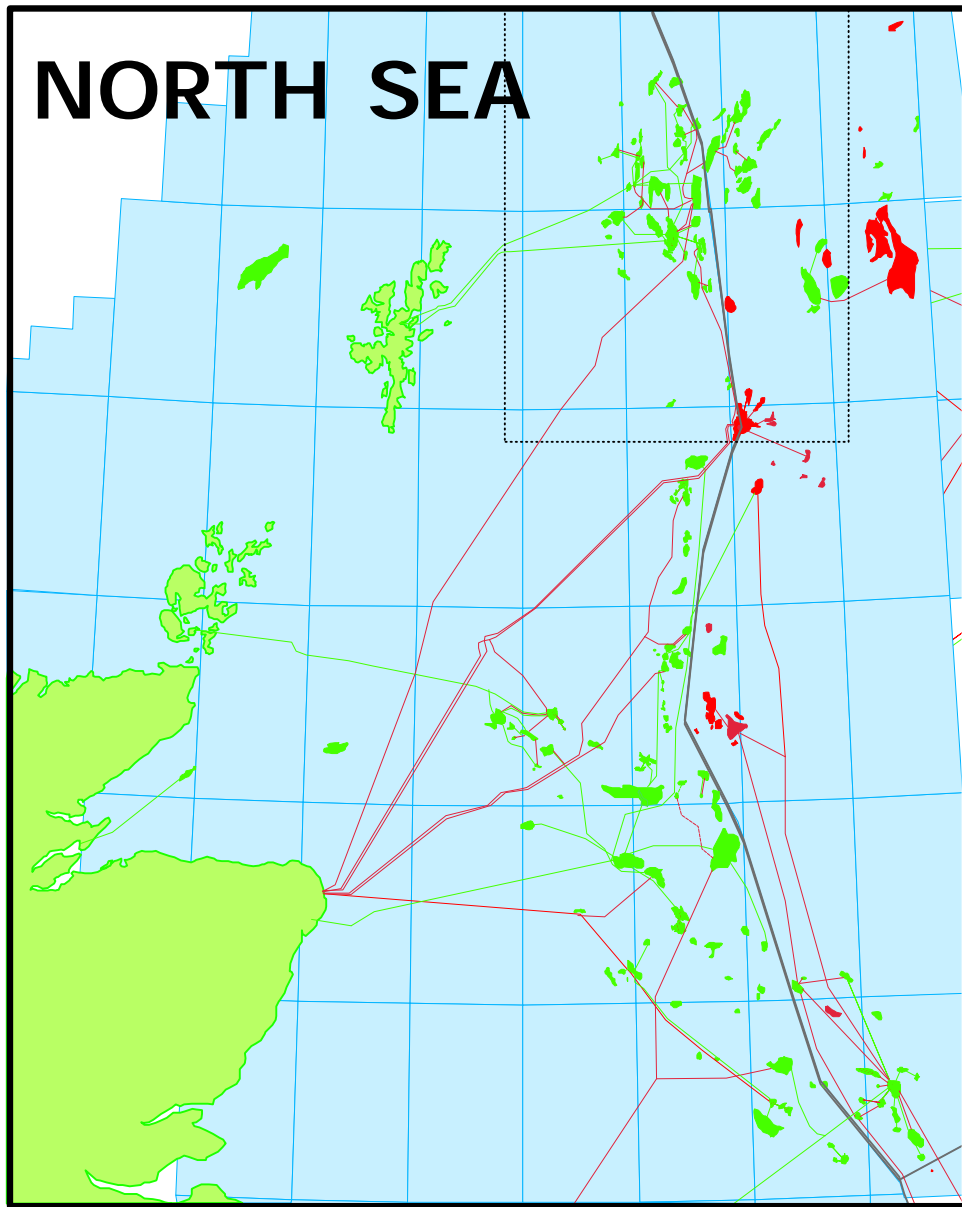
0 1,000 Km



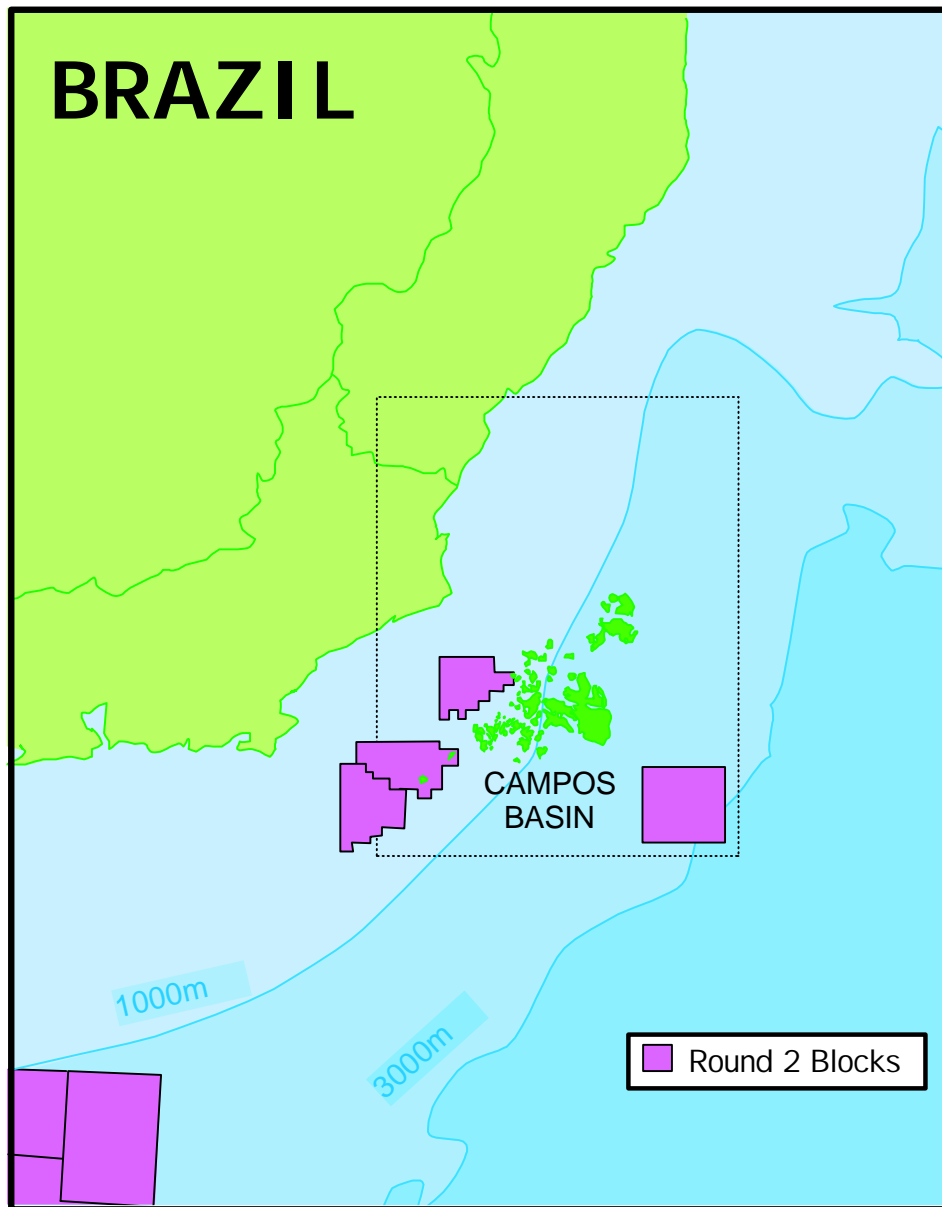


0 500 Km

NORTH SEA

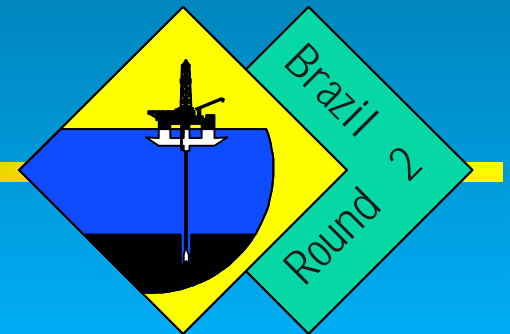


BRAZIL

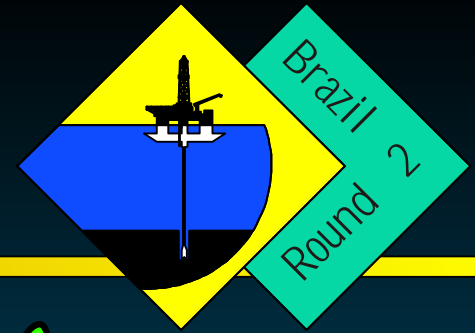


0 200 Km

Brazil Statistics



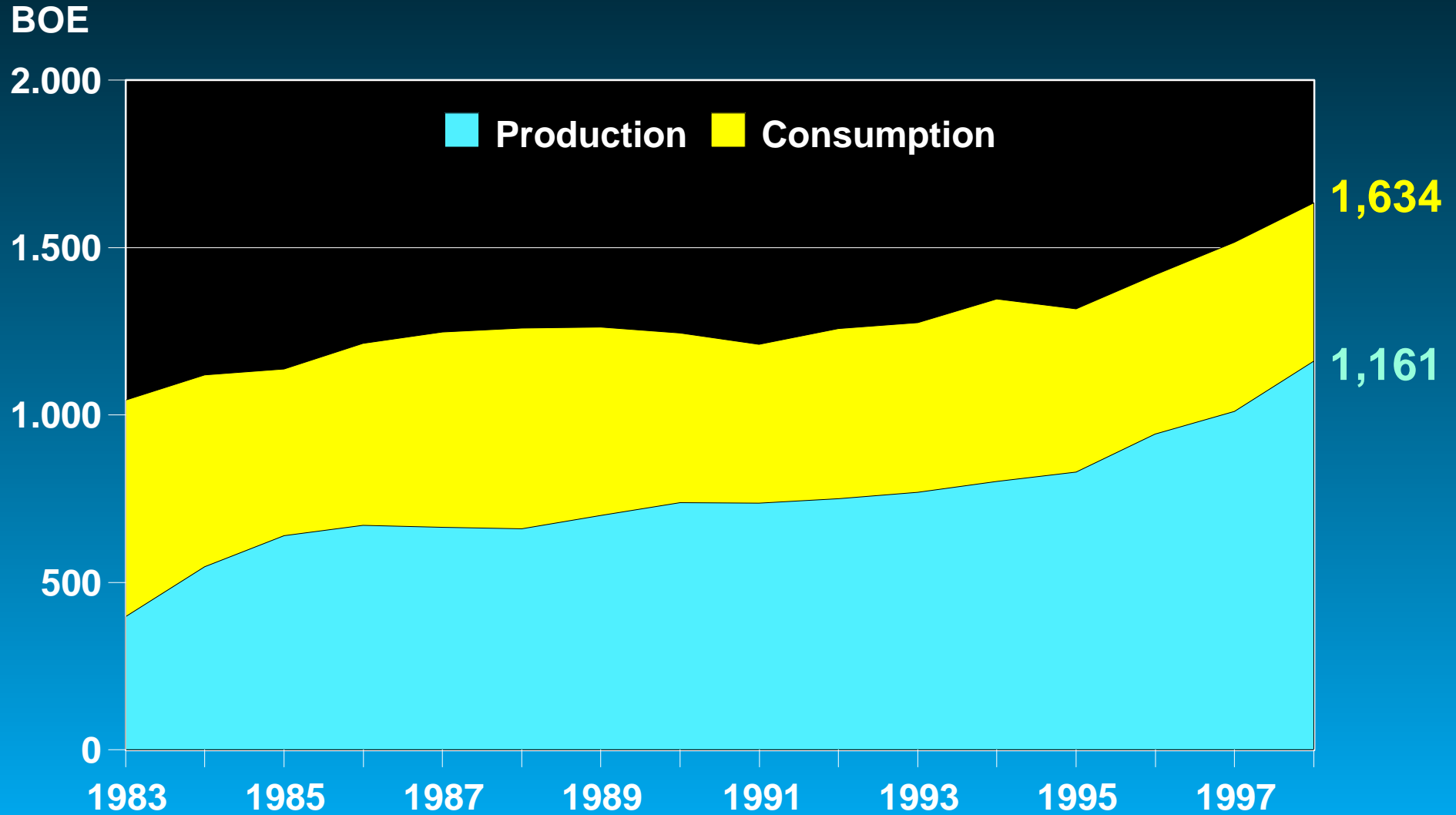
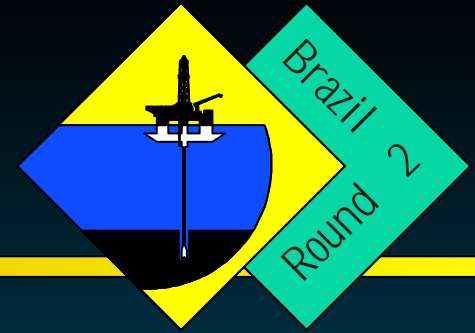
Brazil Statistics

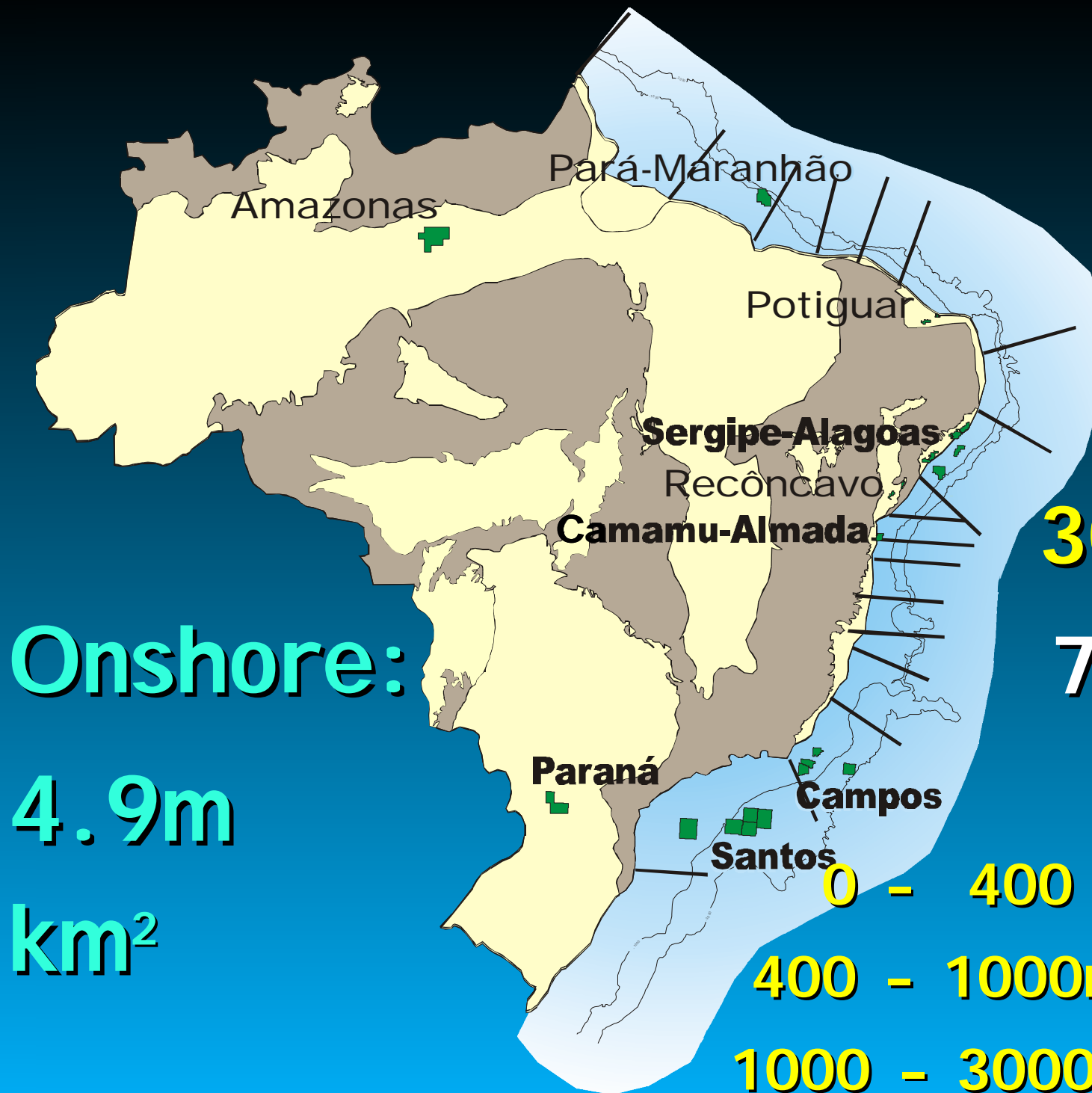


- 8,500,000 km²
- Population: 160 million
- GDP per capita:
 - ▶ US\$ 5,000



Production & Consumption





Onshore:
4.9m
km²

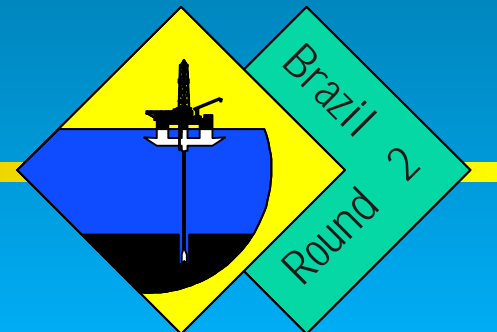
Offshore:
1.5m km²

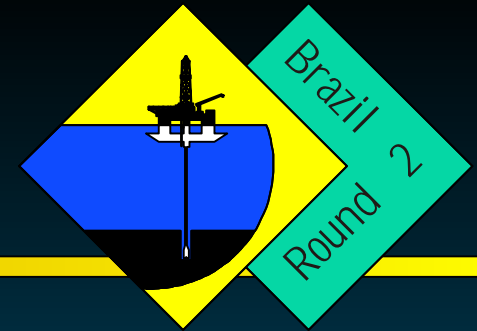
30+ basins

7 Productive

- 0 - 400 m: 776,460 km²**
- 400 - 1000m: 88,710 km²**
- 1000 - 3000m: 672,980 km²**

E & P History





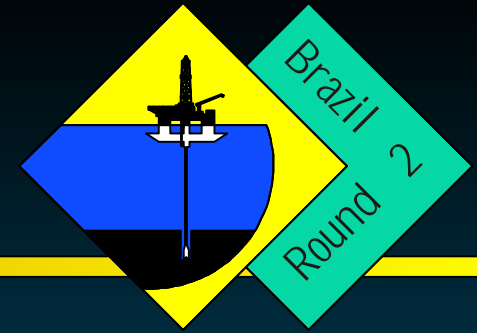
- SGMB and CNP
- 1953 - State monopoly through Petrobras
- 70's & 80's - Risk contracts
 - ▶ 16 companies
- 1997 - Oil Law & Opening
 - ▶ Petrobras awarded 397 E&P concessions
 - ▶ JVs
 - ▶ Licensing Rounds



- 33 companies actively present in Brazil
 - ▶ 11 Brazil Round 1 concessionaires
 - ▶ 13 companies in approved JVs
 - ▶ 9 companies negotiating JVs
- 37 other companies at Brazil Round 1:

- Result: Over 70 companies actively involved with E&P in Brazil

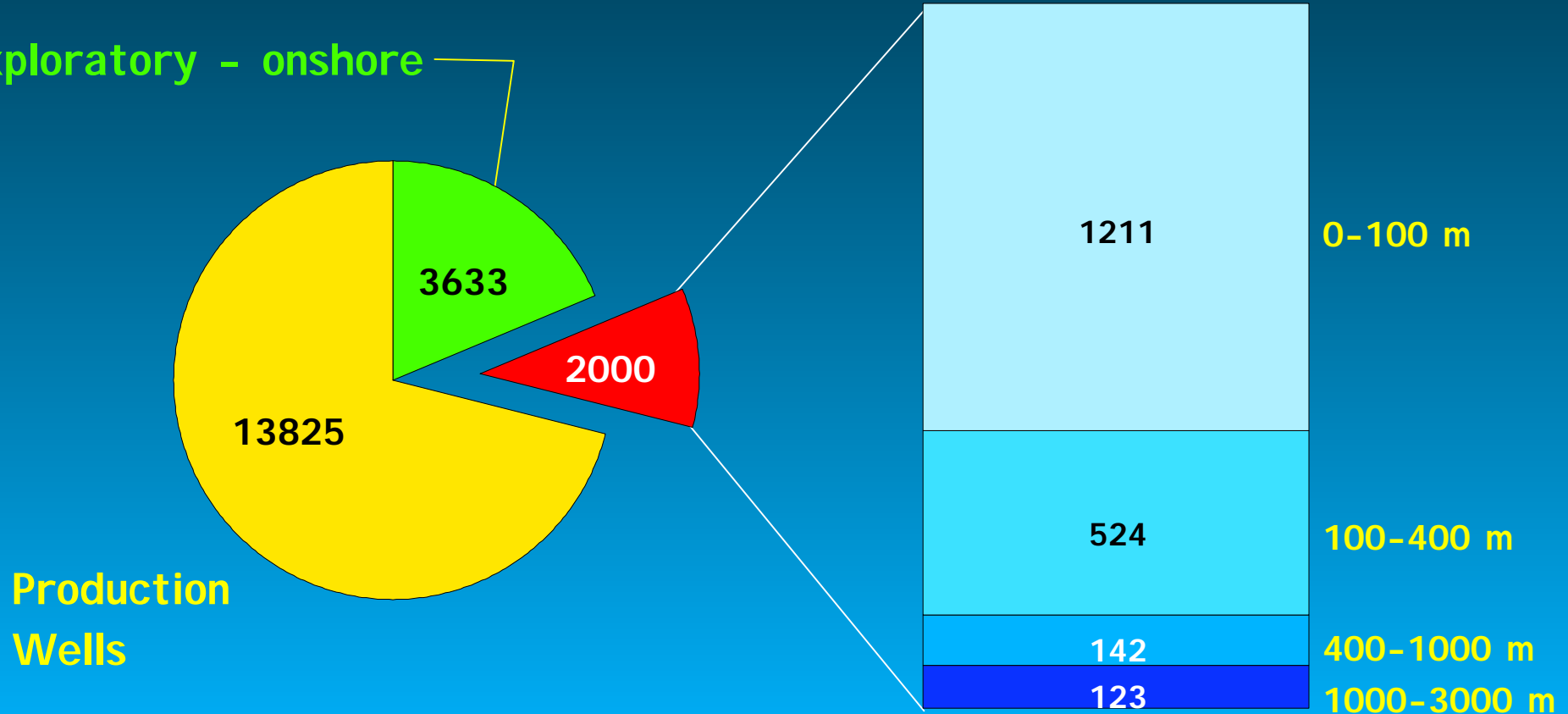
E&P History

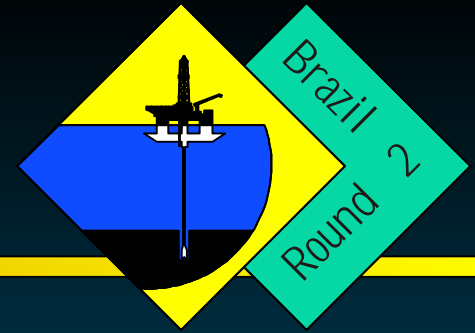


- Wells drilled: **19,458**
- Exploratory wells: **5,633**

Exploratory - offshore:

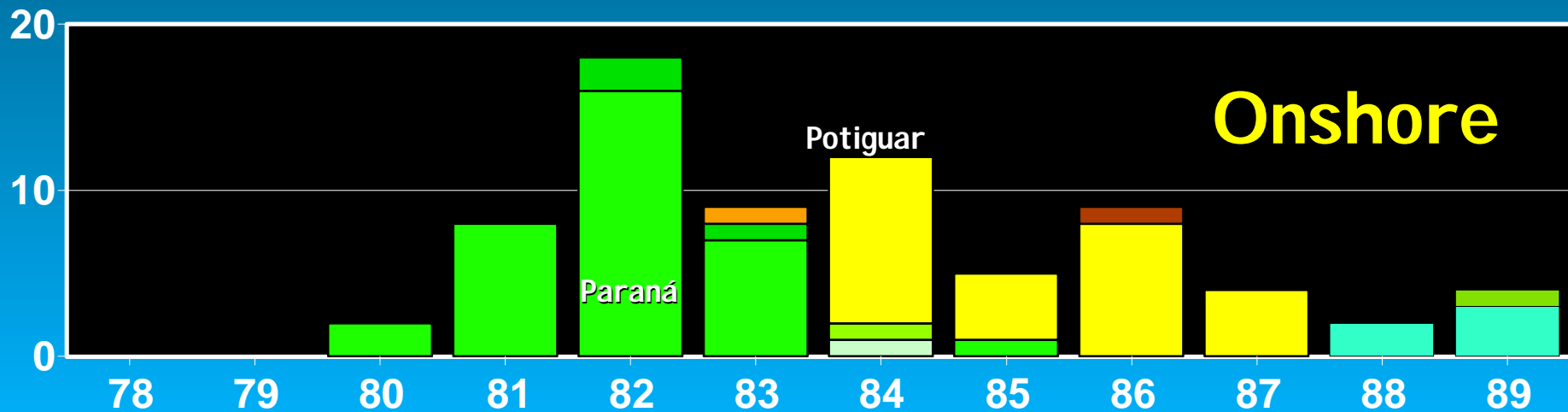
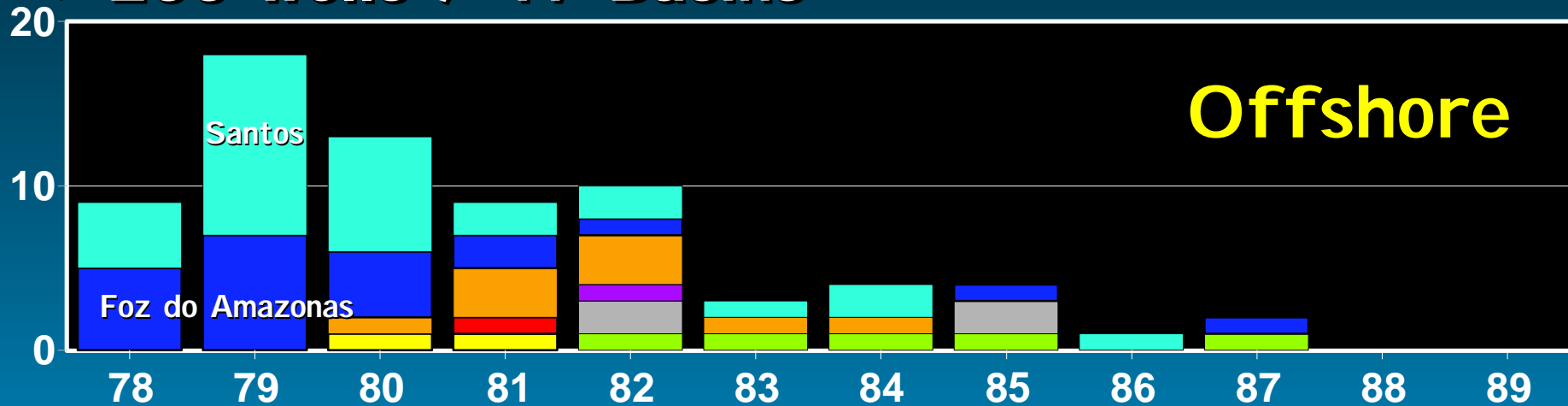
Exploratory - onshore

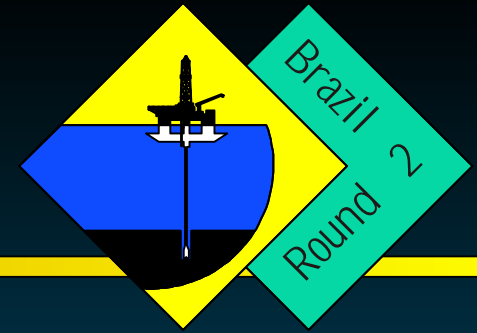




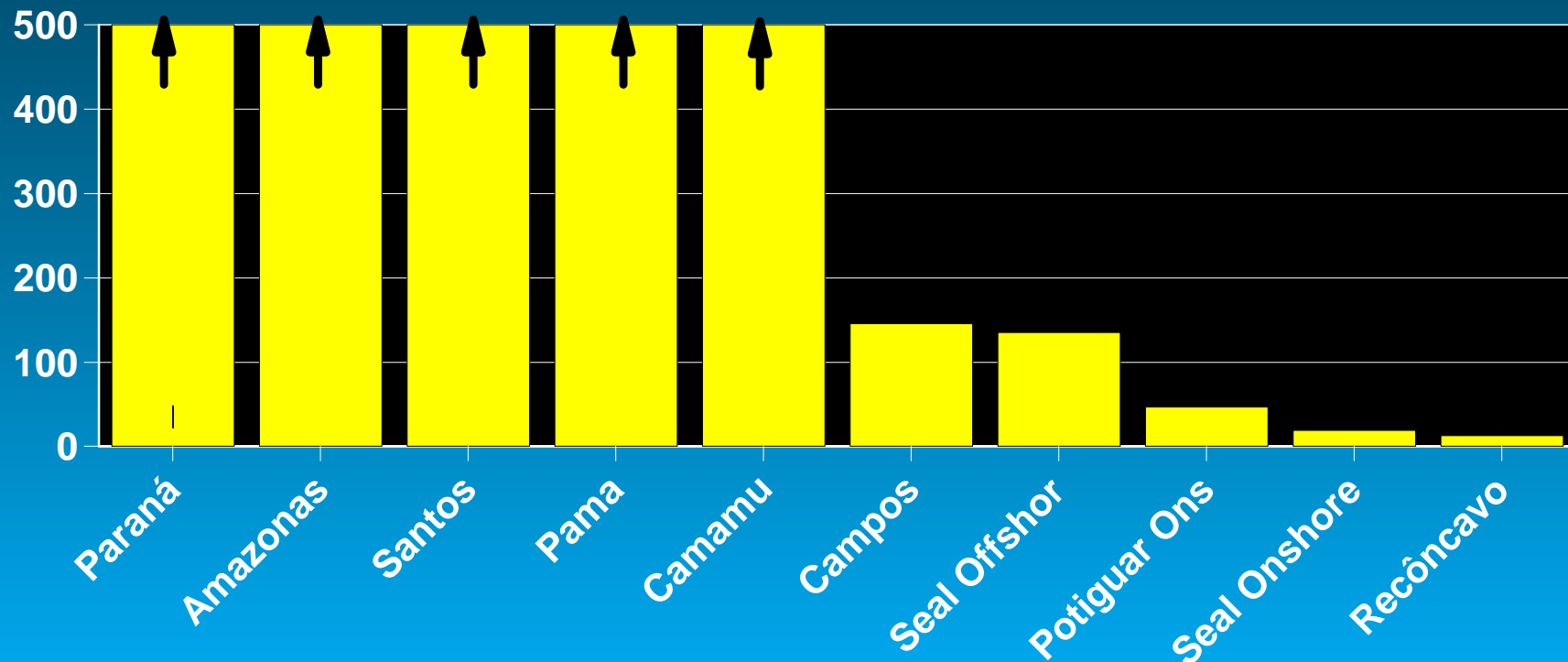
■ 16 Risk Contractors

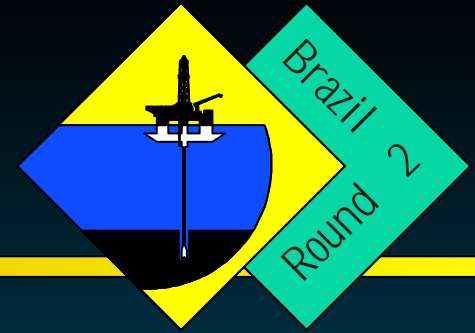
► 200 wells / 17 Basins





- Very low well density in general
 - ▶ Central and Western GOM - 32 km² / well
 - ▶ VG and Northern North Sea - 35 km² / well

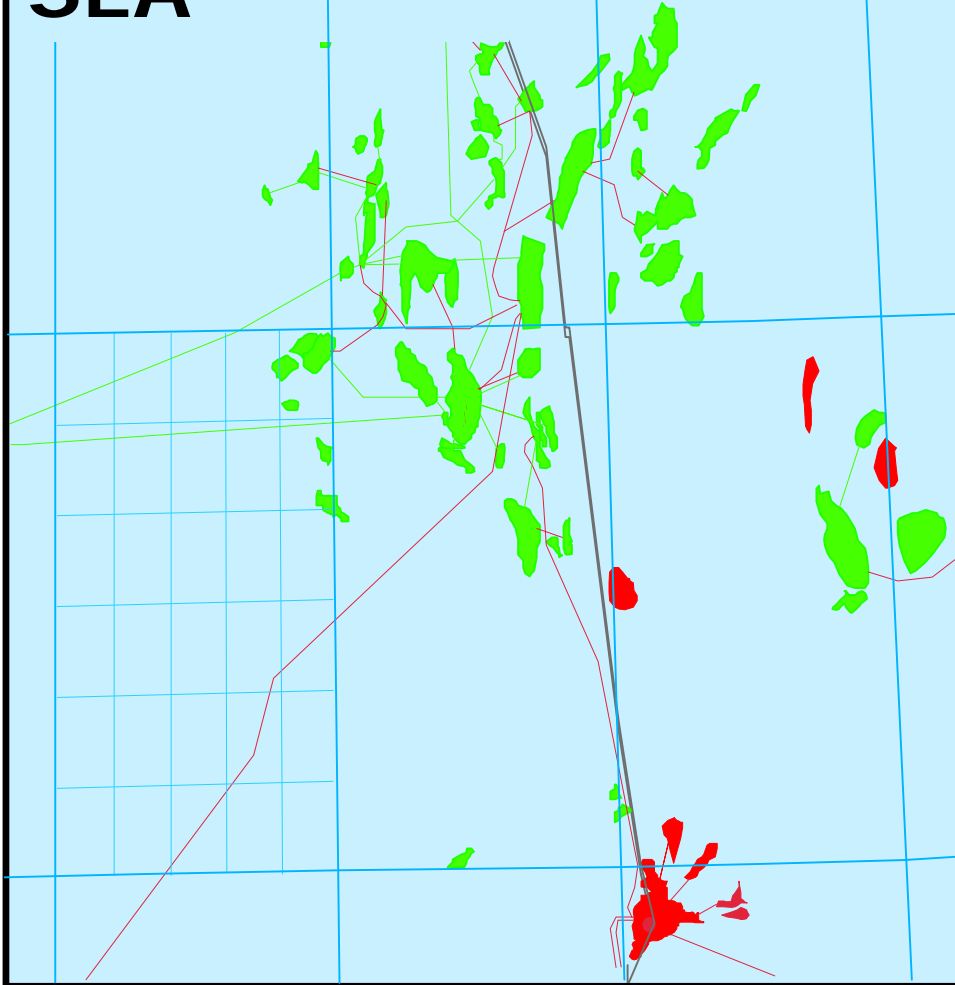




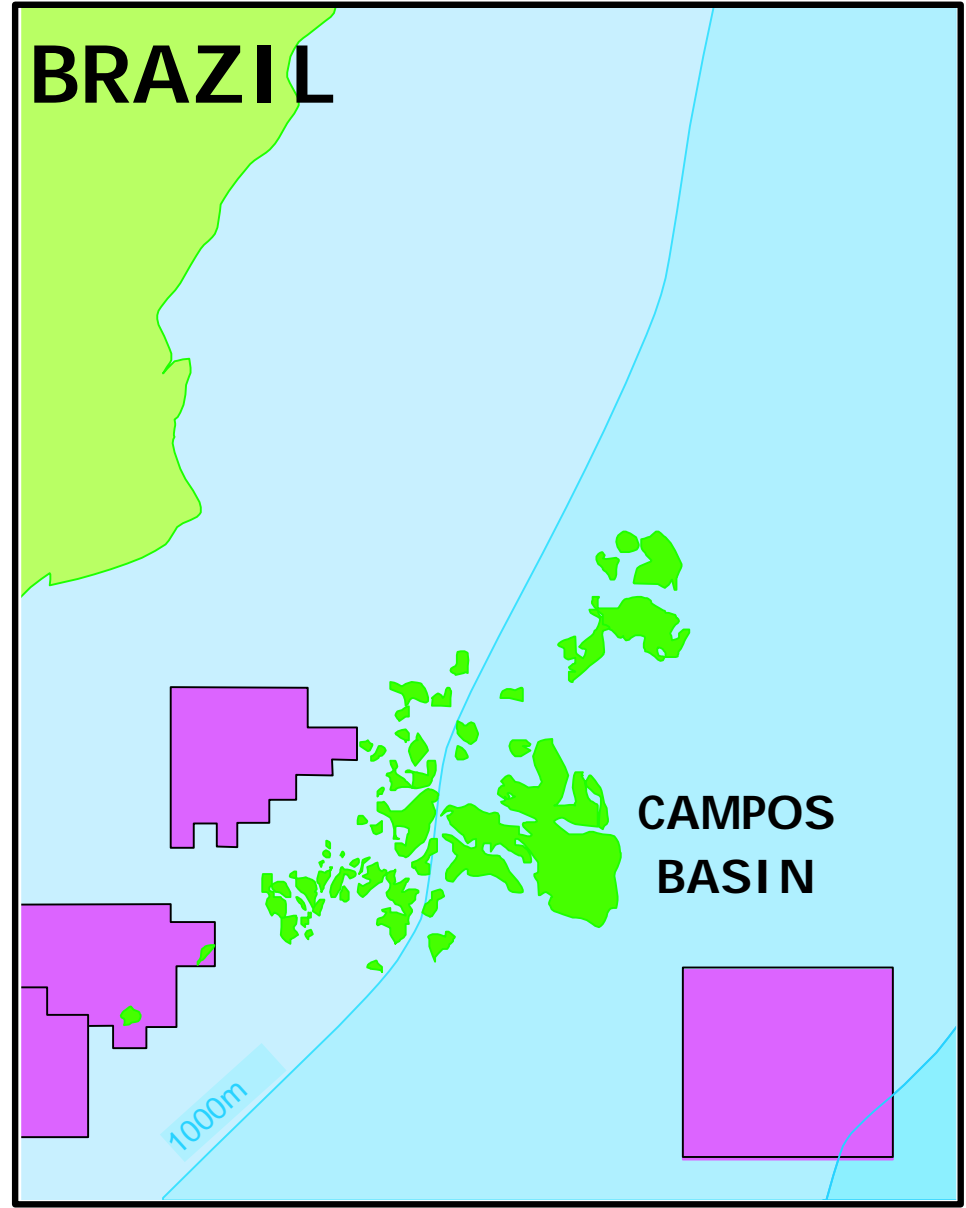
■ Brazil-Round 2 average areas:

- ▶ Offshore: 3,000 km²
- ▶ Mature onshore: 600 km²
- ▶ New frontier onshore: 8,000 km²

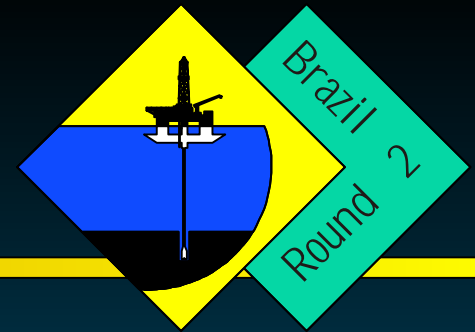
NORTH SEA



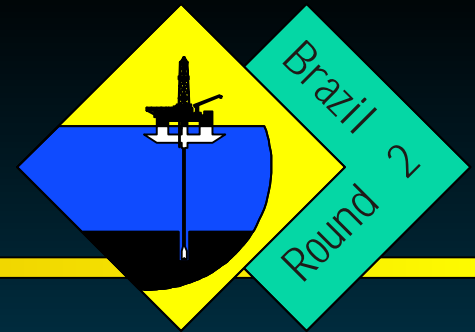
BRAZIL



0 100 Km



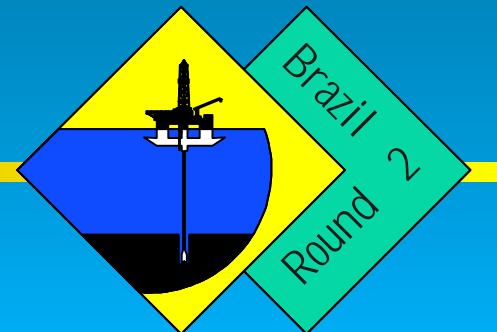
- Seismic acquired in Brazil until 1998:
 - ▶ 2D - 1,195,000 km
 - ▶ 3D - 47,700 km²
- **About 50 % during last 10 years**
- Concentrated
 - ▶ Onshore: Potiguar, Sergipe-Alagoas, Recôncavo
 - ▶ Offshore: Campos, Sergipe-Alagoas, Potiguar



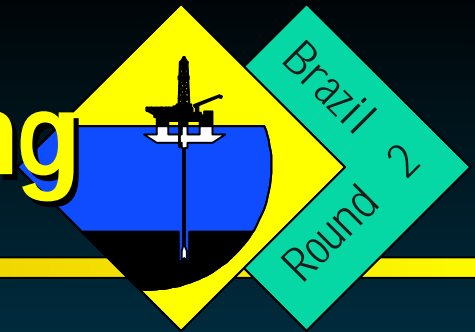
NEW DATA

- **7 companies authorized to acquire 2D seismic**
 - ▶ + 320,000 km / 27 % of current data
- **4 companies authorized to acquire 3D seismic**
 - ▶ + 60,000 km² / **127 %** of current data
- **Geochemical surveys in 9 basins**
- **Grav & Mag surveys**
 - ▶ Airborne data in 4 basins
 - ▶ Ship based in 5 basins

Brazil Geological Studies



Brazil Geological Setting



3 main basin types

▶ Atlantic Eastern Margin Basins

- Santos
- Campos
- Camamu-Almada
- Recôncavo
- Sergipe-Alagoas

▶ Atlantic Equatorial Margin Basins

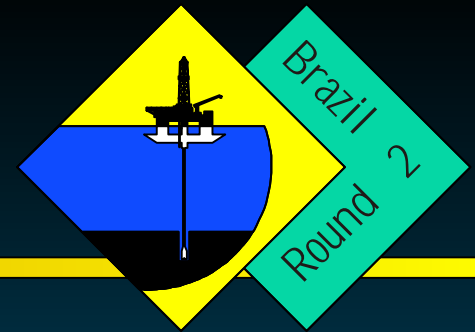
- Potiguar
- Pará-Maranhão

▶ Paleozoic basins

- Amazonas
- Paraná



Atlantic Eastern Margin Basins



Related to the opening
of the south Atlantic

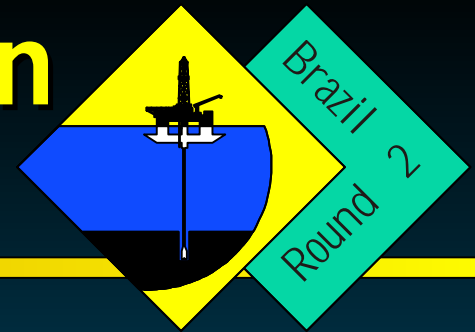
85 % of Brazil's production

93 % of Brazil's proved
reserves

▶ 6.8 billion bbl

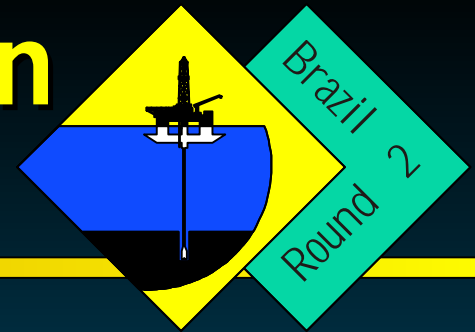


Atlantic Eastern Margin Basins



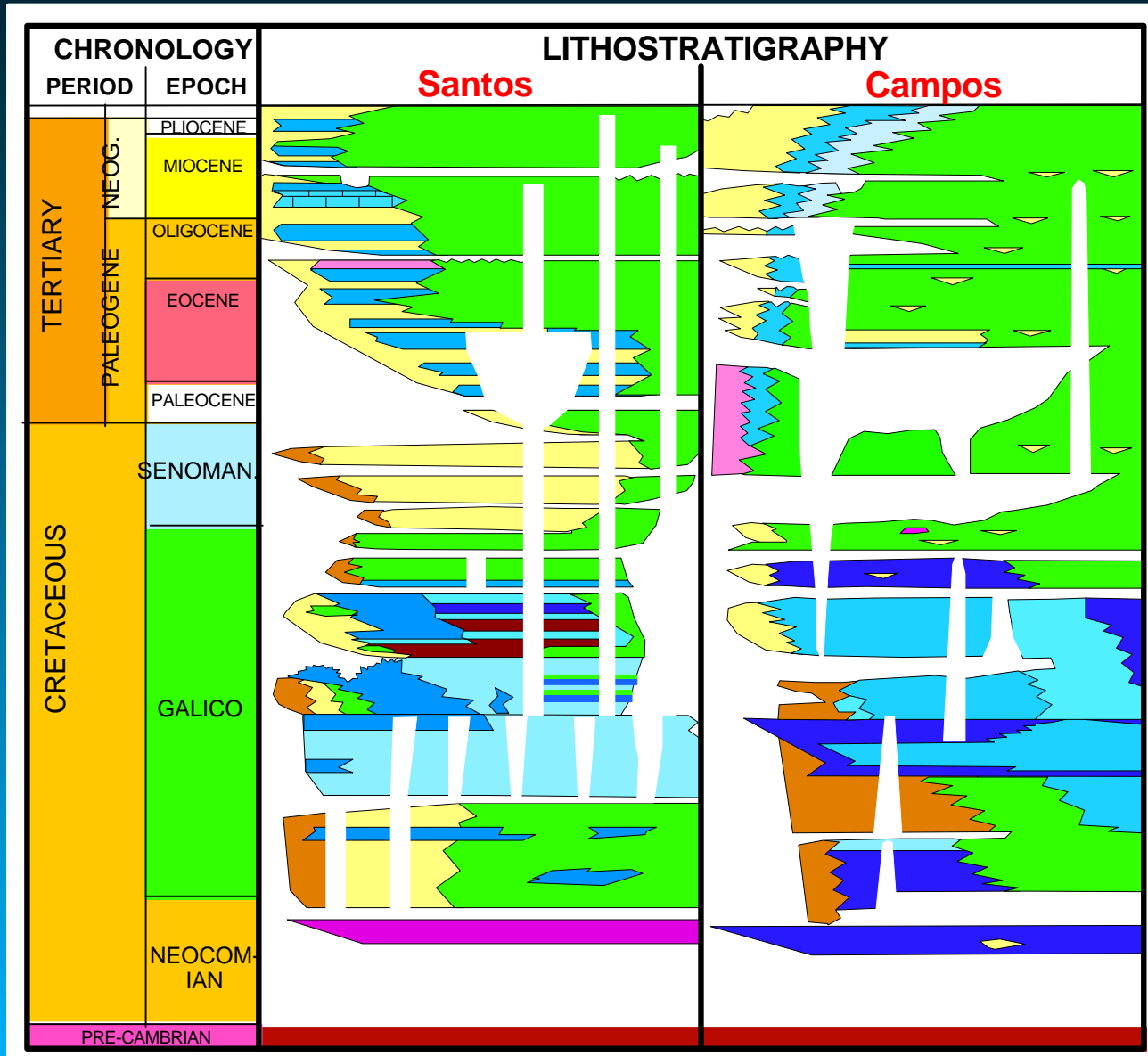
- 3 or 4 stratigraphic sequences
 - ▶ Pre-Rift
 - NE Brazil only
 - Permian & late Jurassic / early K
 - Intracratonic sag
 - marine regressive, continental
 - ▶ Rift
 - early Cretaceous / non-marine
 - ▶ Transition
 - Aptian / transitional evaporitic
 - ▶ Drift
 - Albian to recent / marine
 - Salt tectonics

Atlantic Eastern Margin Basins

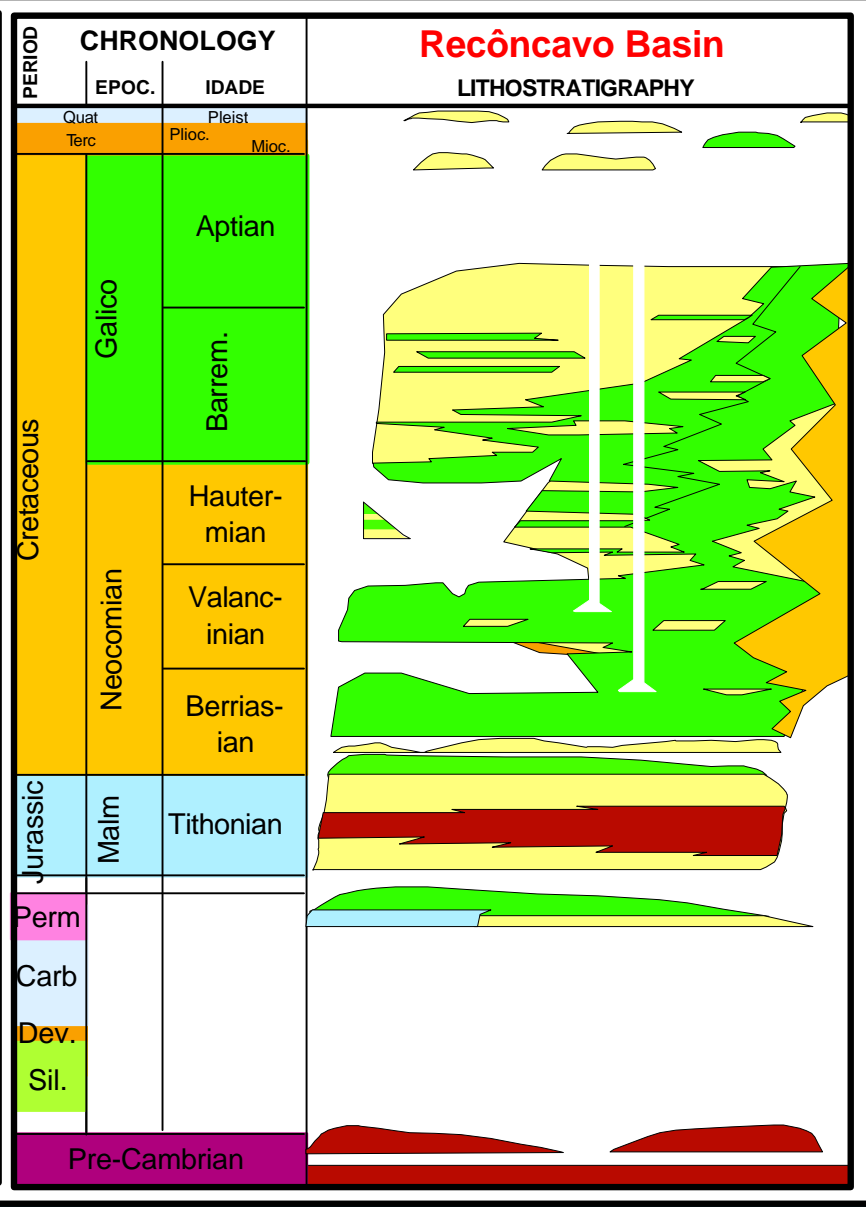
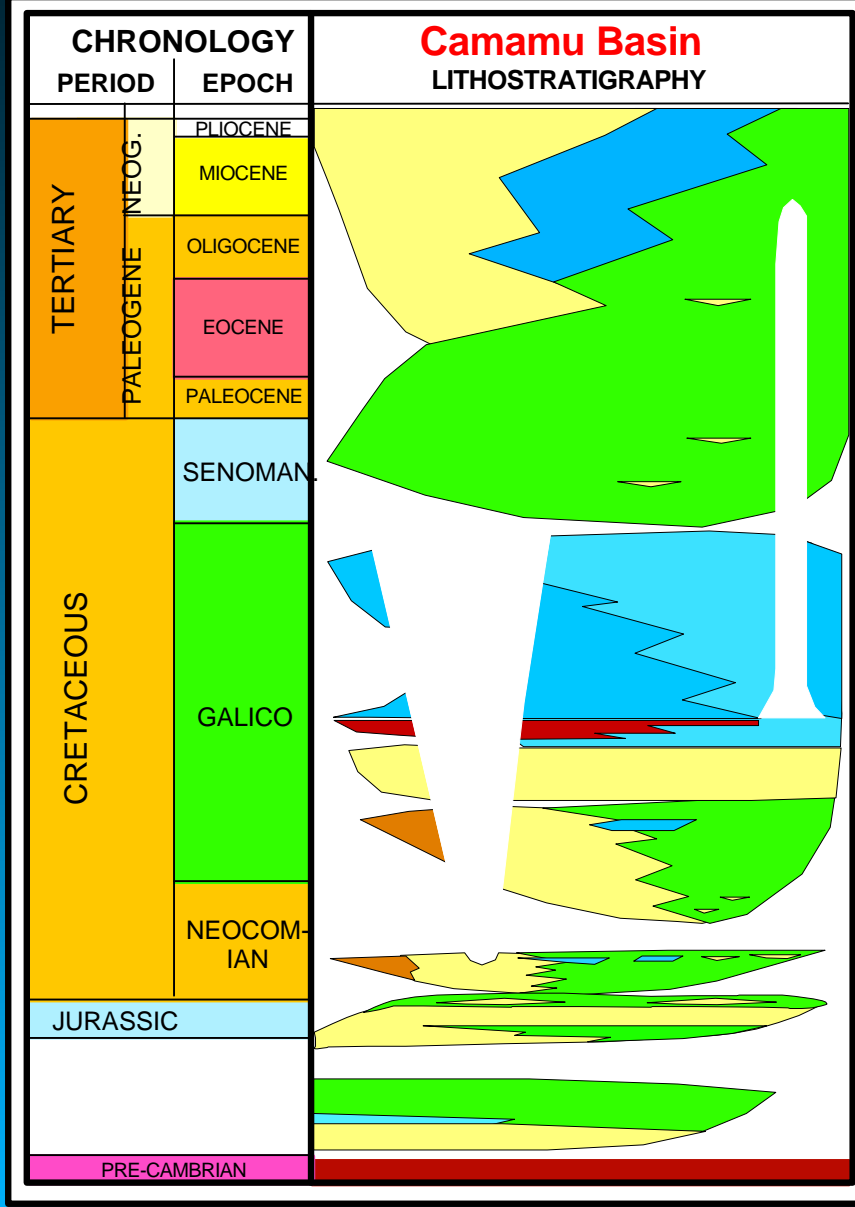
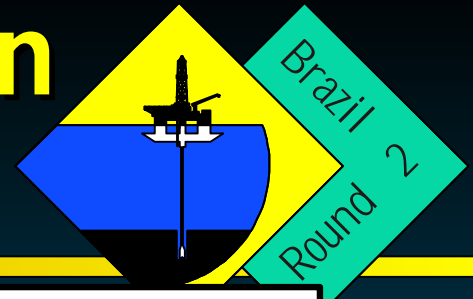


- Source rock
 - ▶ Rift phase, lacustrine shales
 - ▶ Turonian, marine shales
 - ▶ Rift, fluvial-deltaic shales
- TOC: 2 - 5%
- Plays
 - ▶ Pré-rift sandstones
 - ▶ Rift sandstones and carbonates
 - ▶ Rift and Drift turbidites

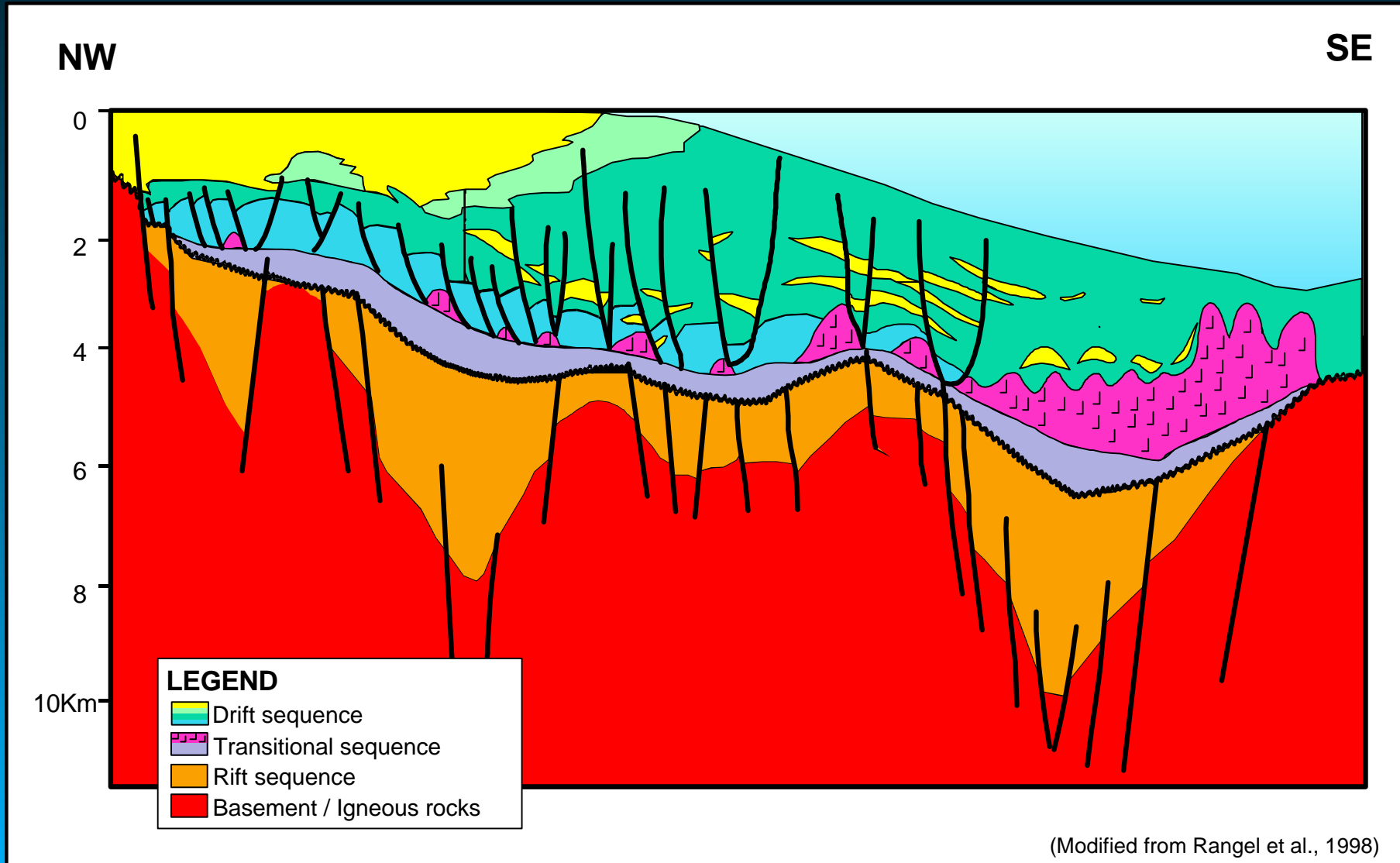
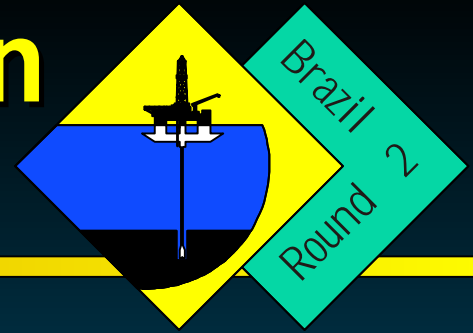
Atlantic Eastern Margin Basins



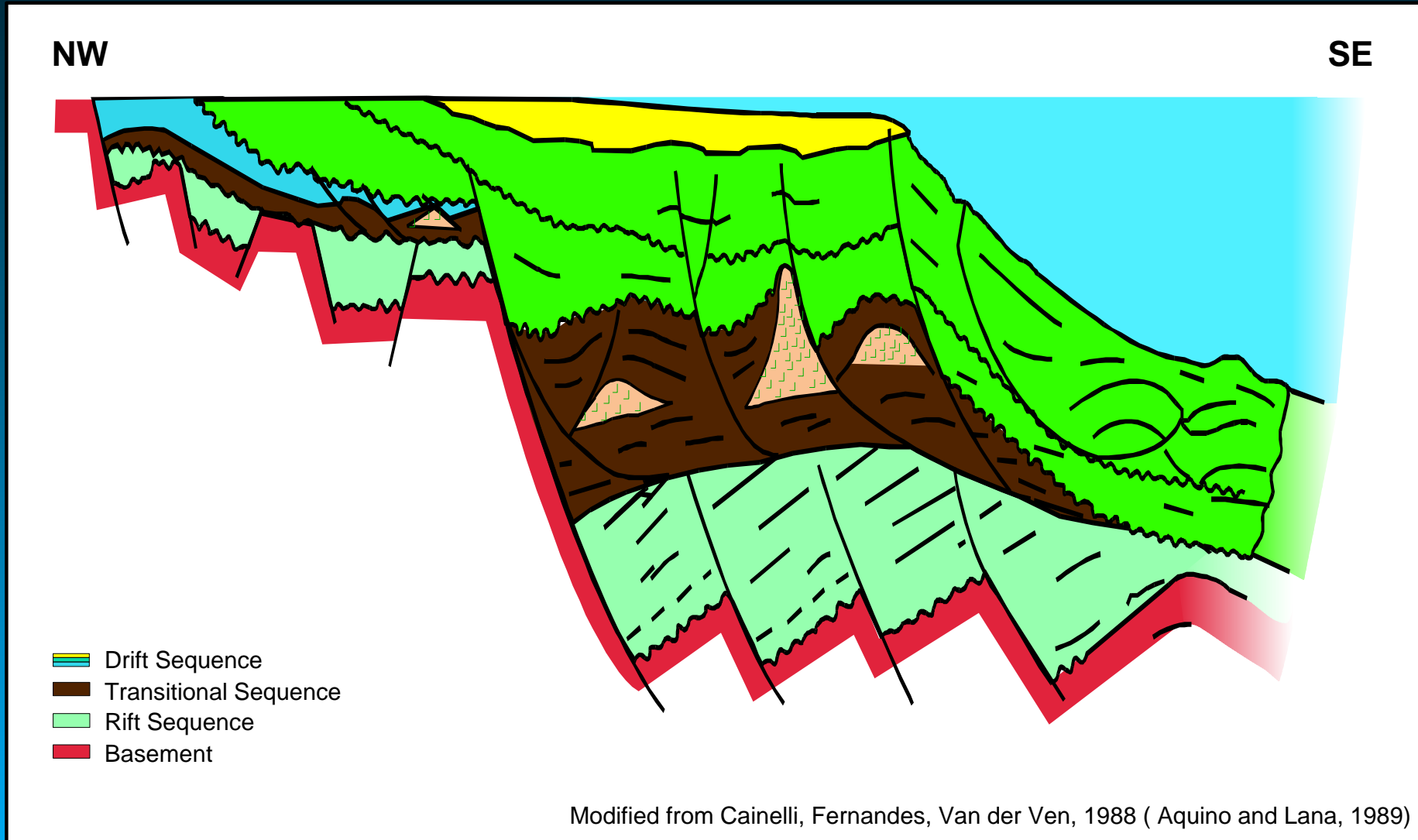
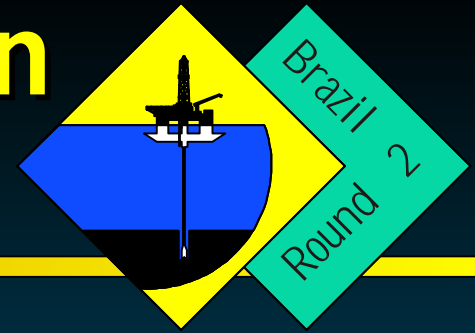
Atlantic Eastern Margin Basins



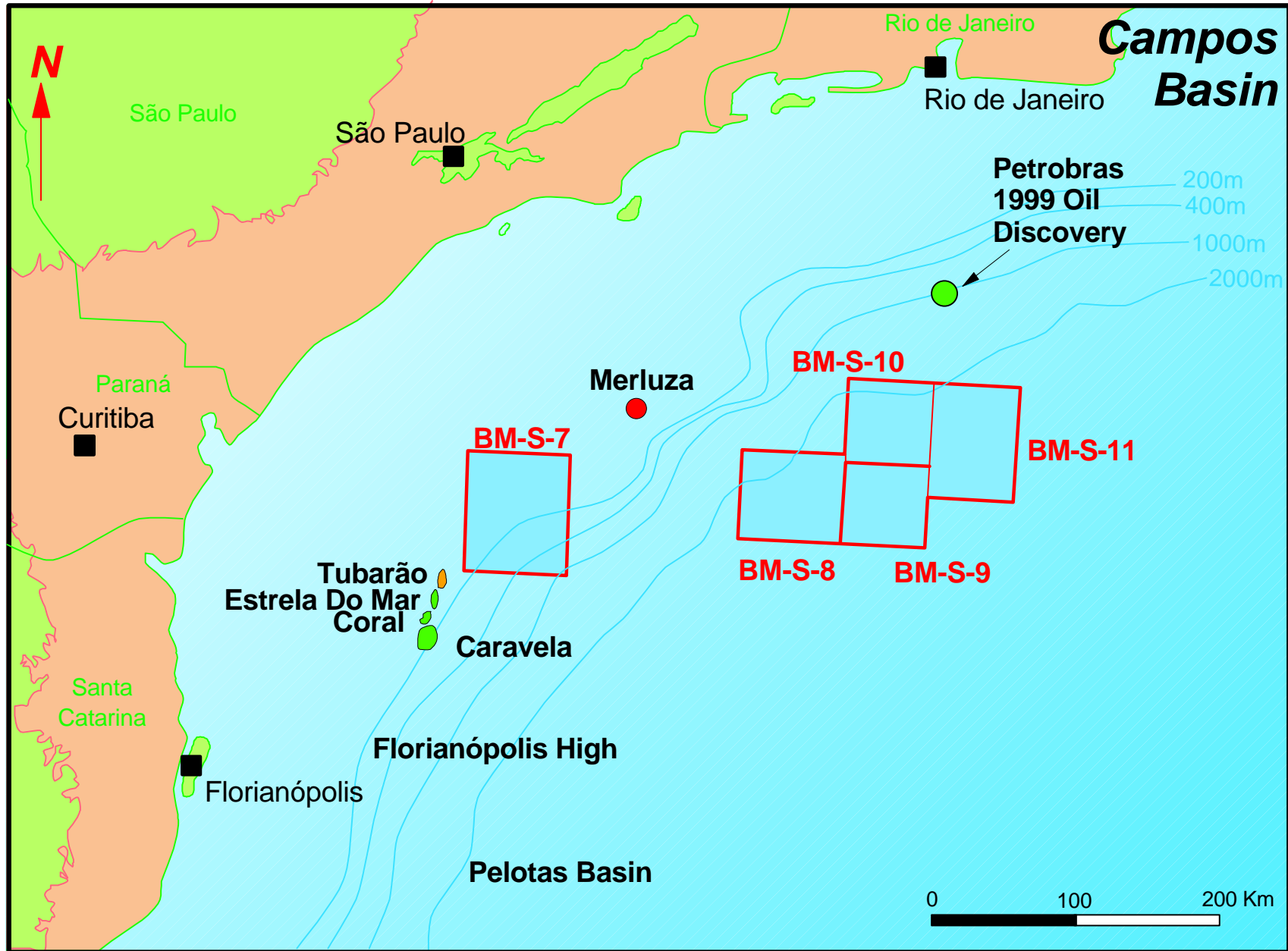
Atlantic Eastern Margin Basins - Campos Basin



Atlantic Eastern Margin Basins - Sergipe Basin

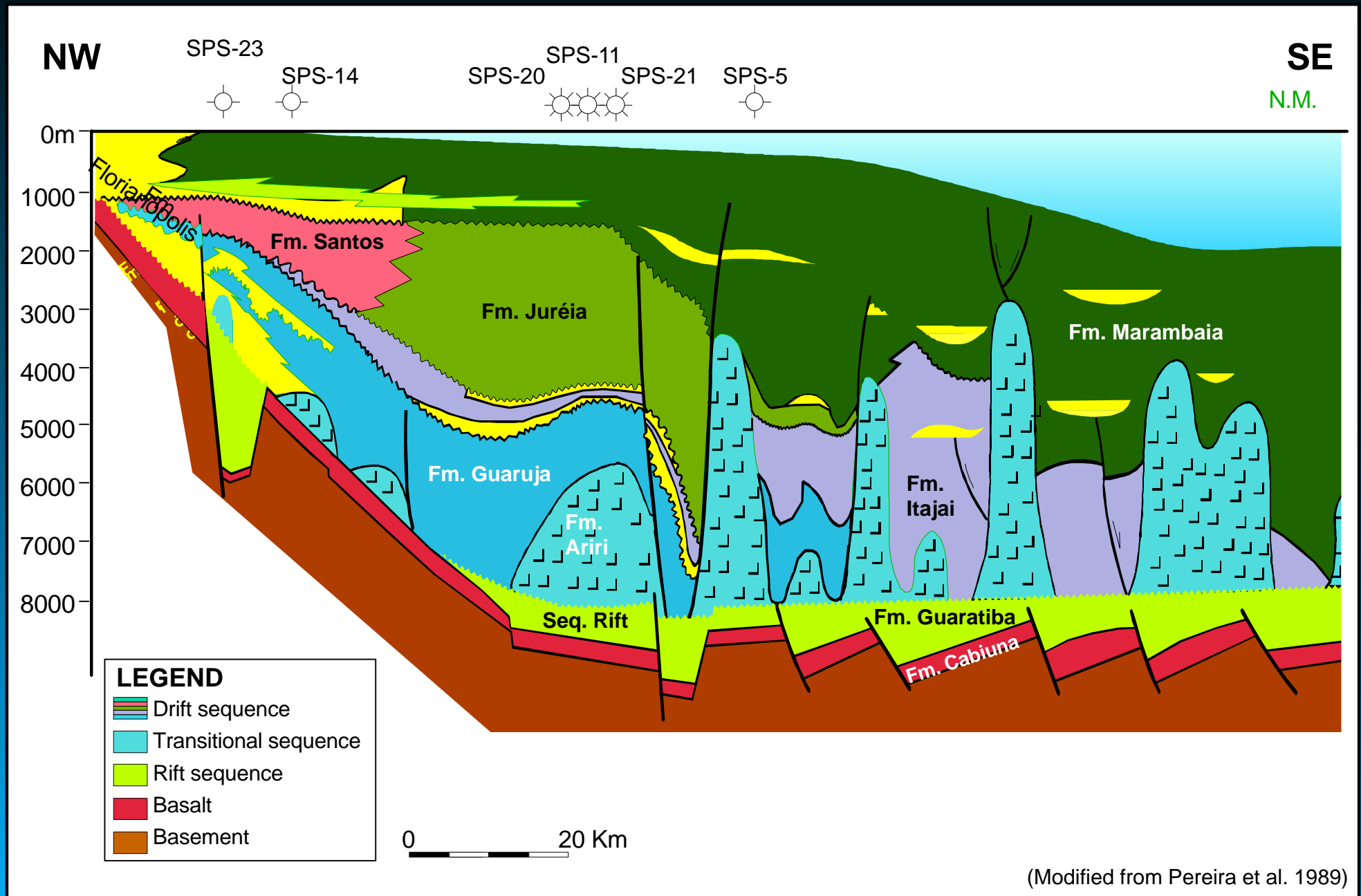


Santos Basin

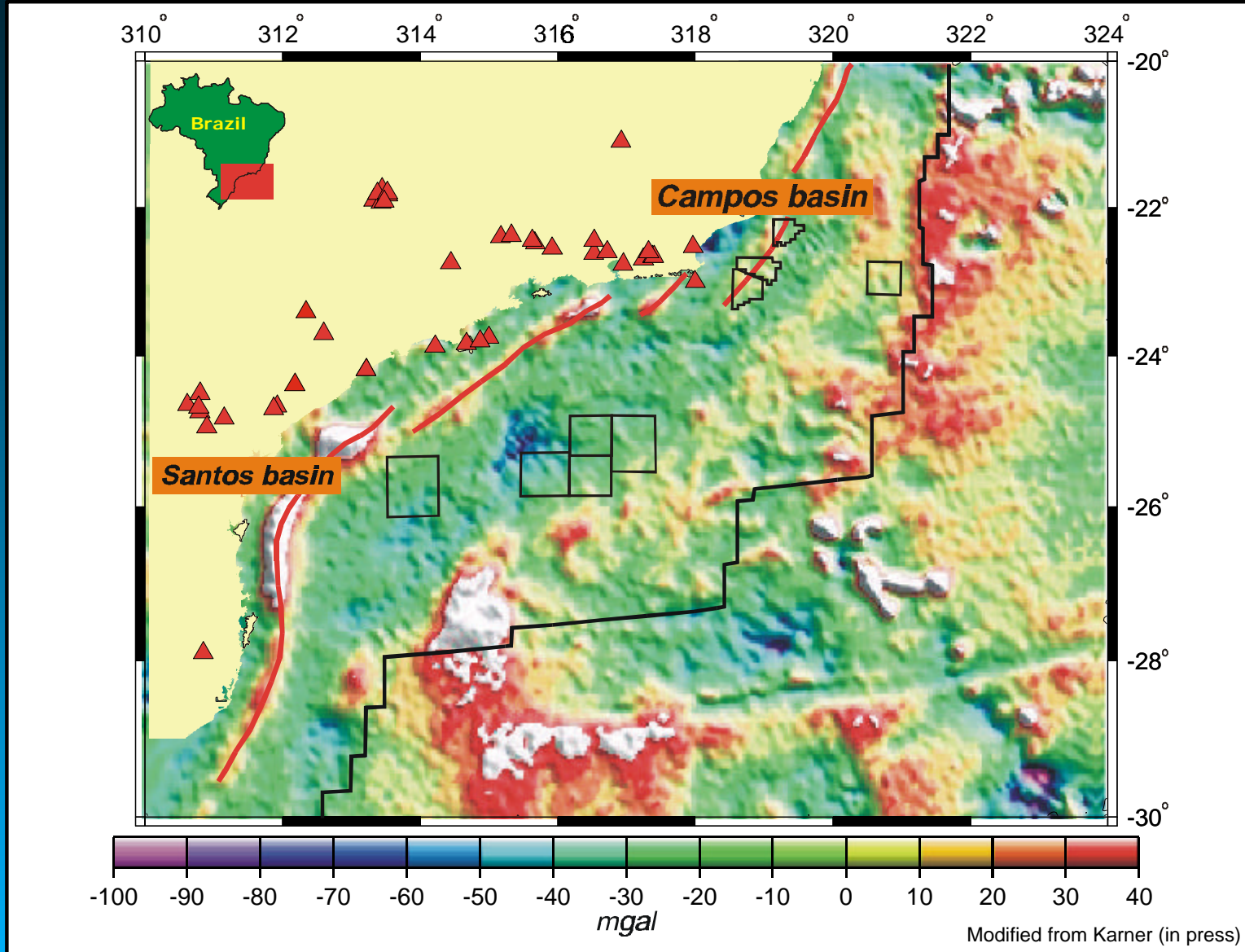
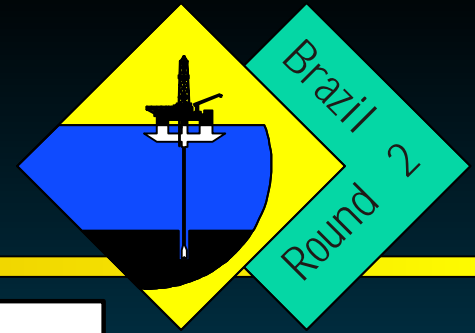


(Modified from Pereira et al., 1990)

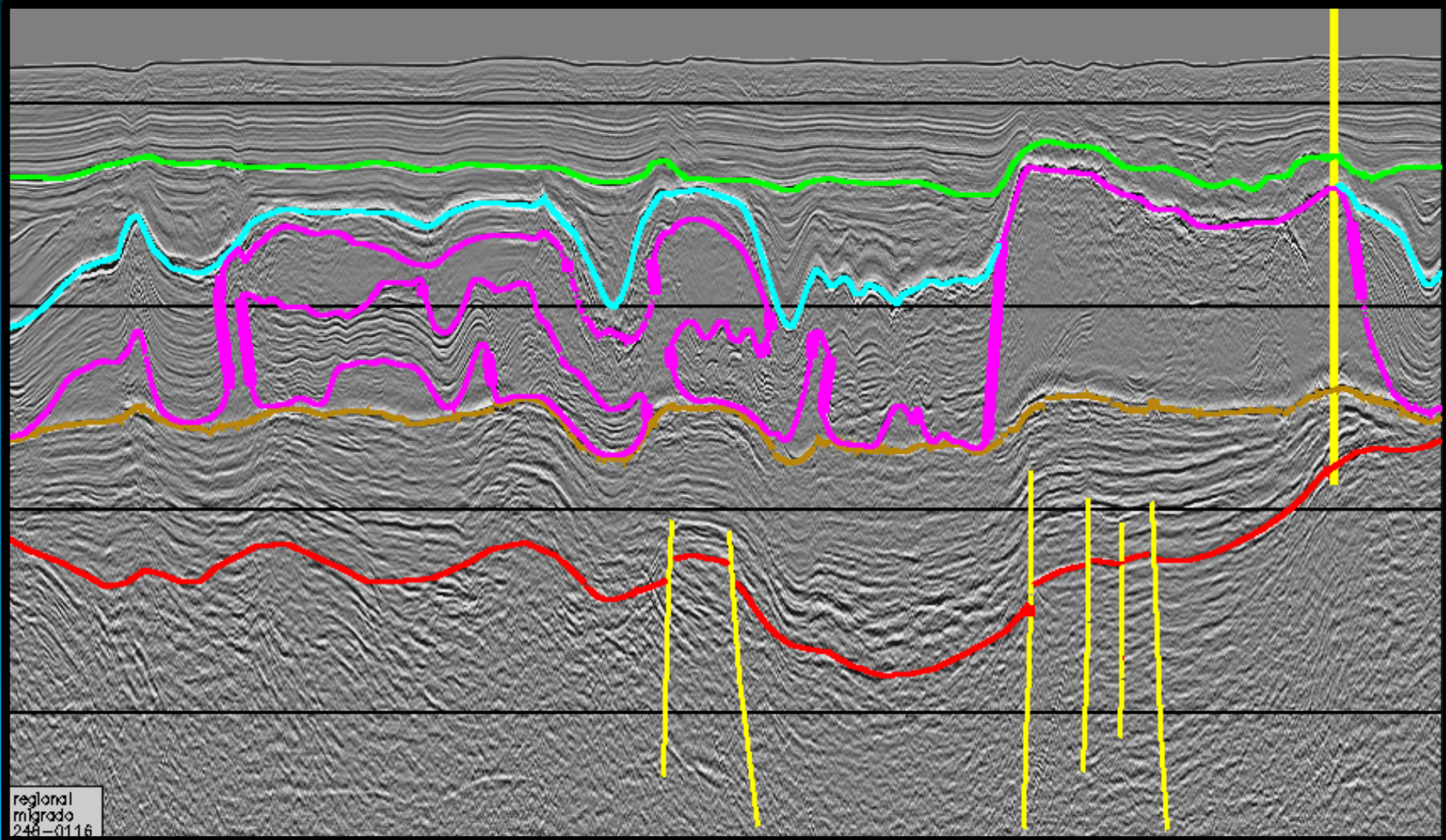
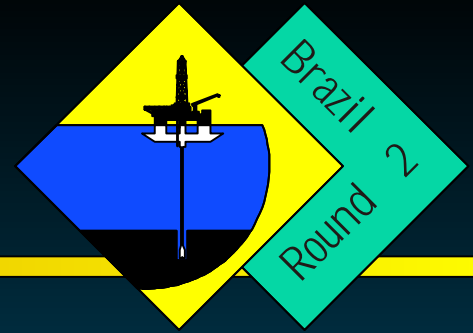
Santos Basin



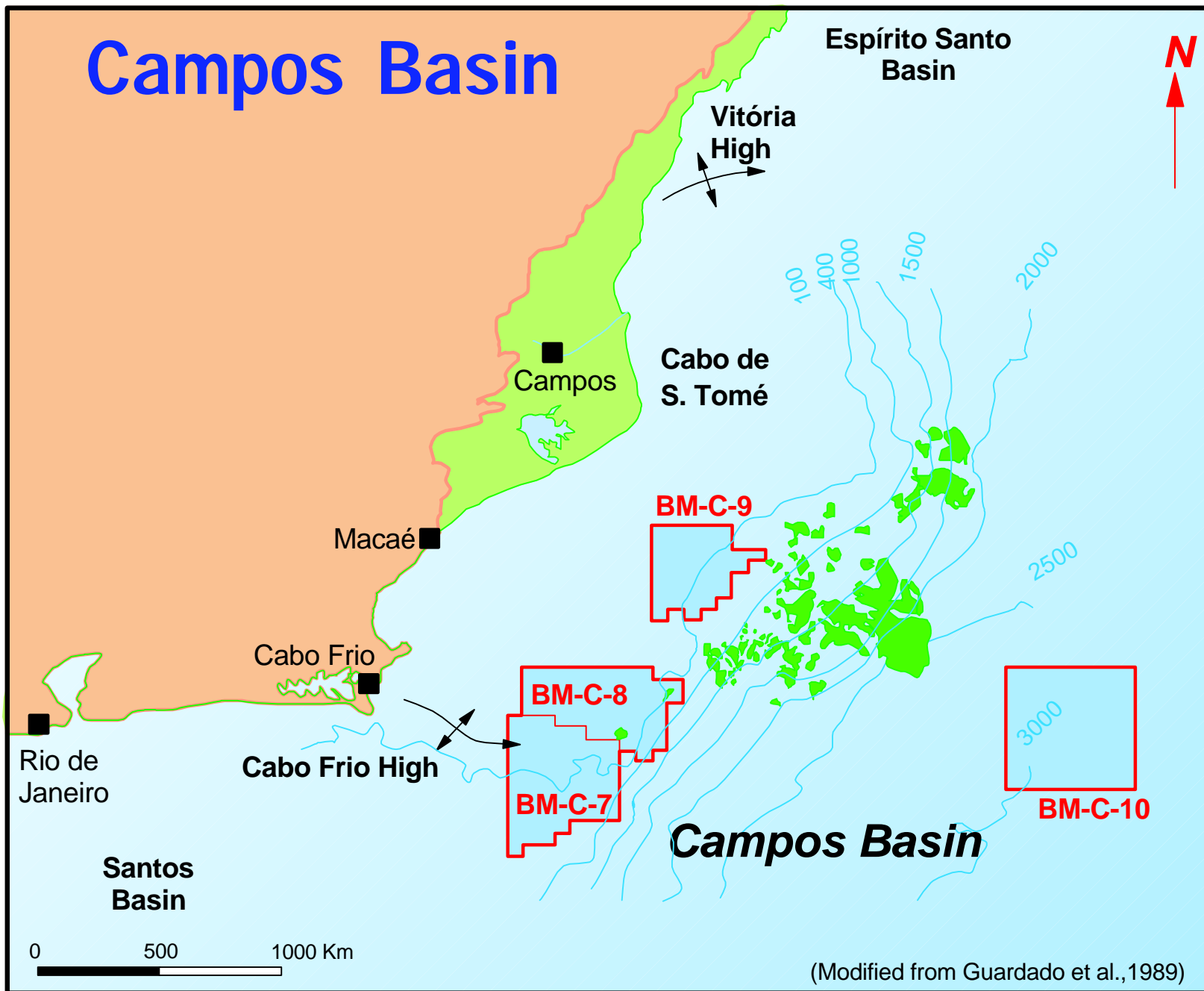
Campos and Santos Basins



Santos Basin

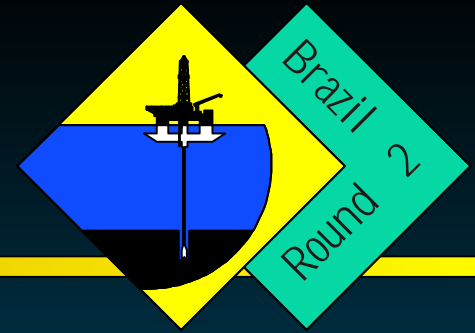


Campos Basin



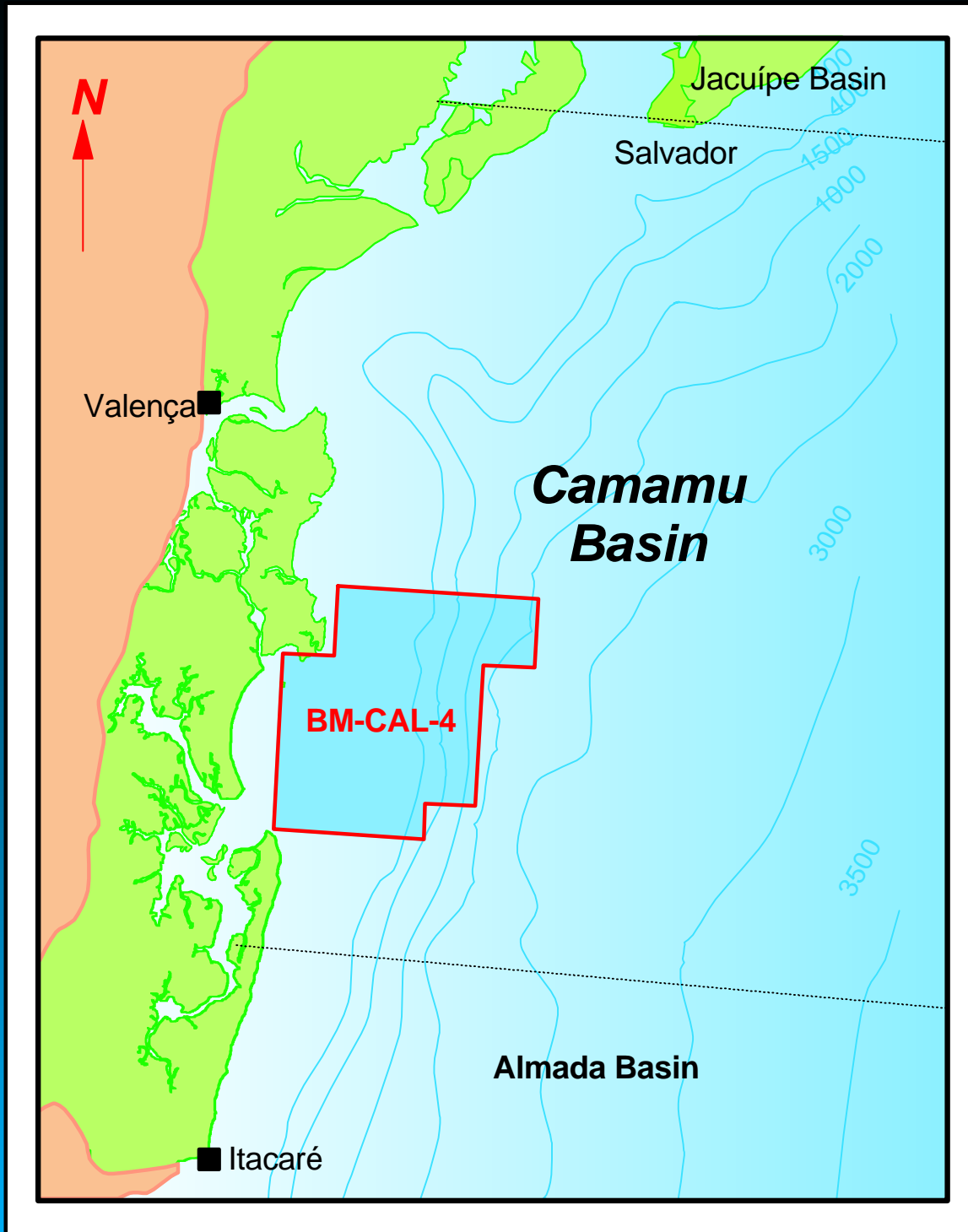
(Modified from Guardado et al., 1989)

Campos Basin

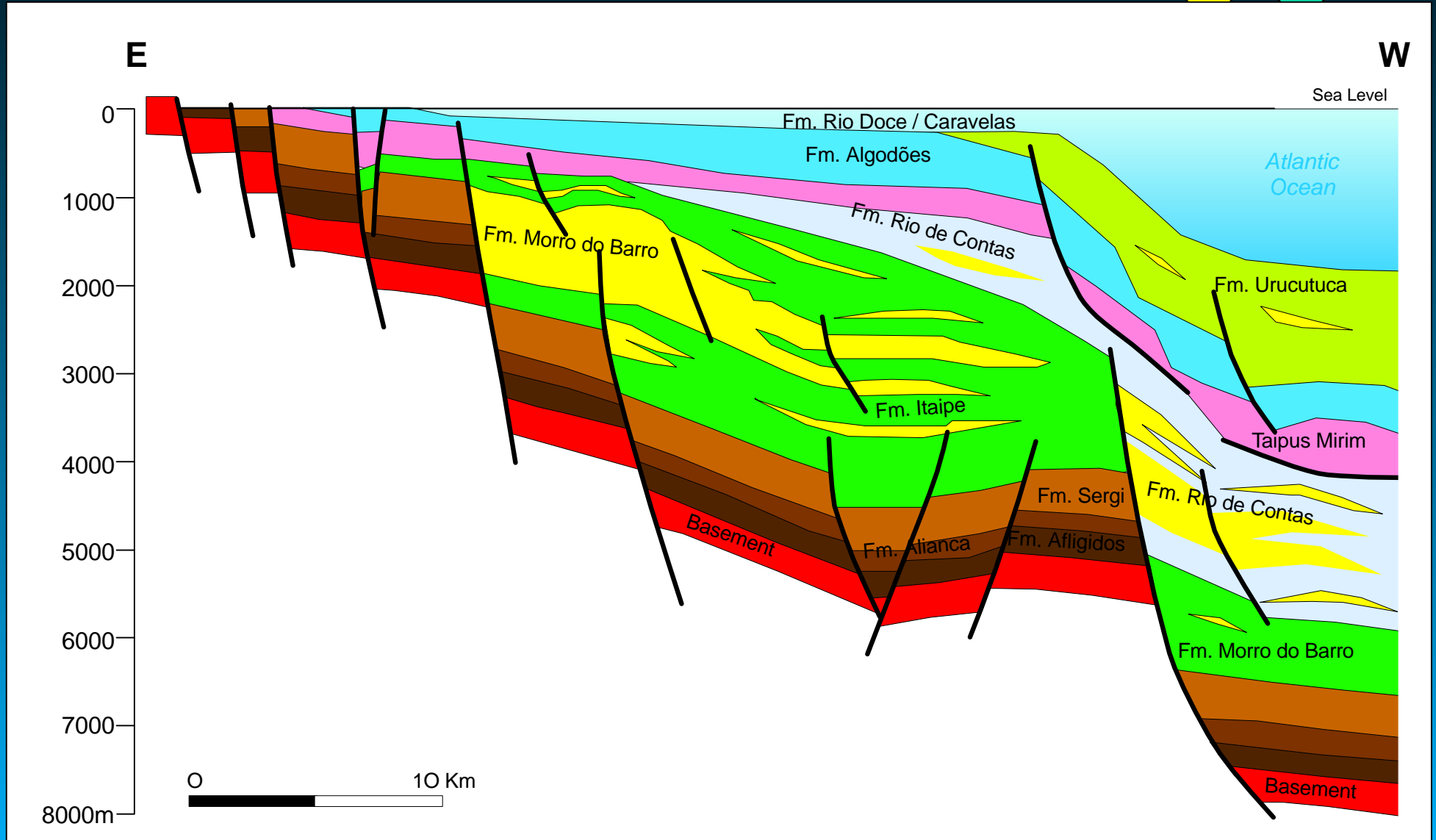
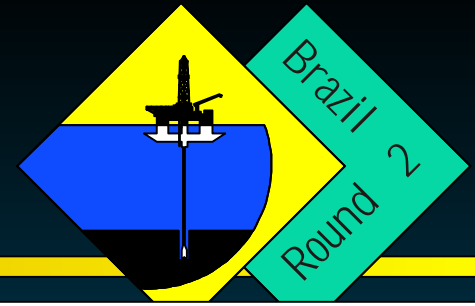


- Discoveries in BM-C-8
- Guarajuba
 - ▶ 19° API oil / 61 million bbl oip
 - ▶ 14 km² / 2 pay zones
 - ▶ porosity - 27%
 - ▶ "sub-economic"
- 1-RJS-485
 - ▶ 20,5° API oil / 44 million bbl oip
 - ▶ 14 Bcf gas
 - ▶ "low recovery factor"

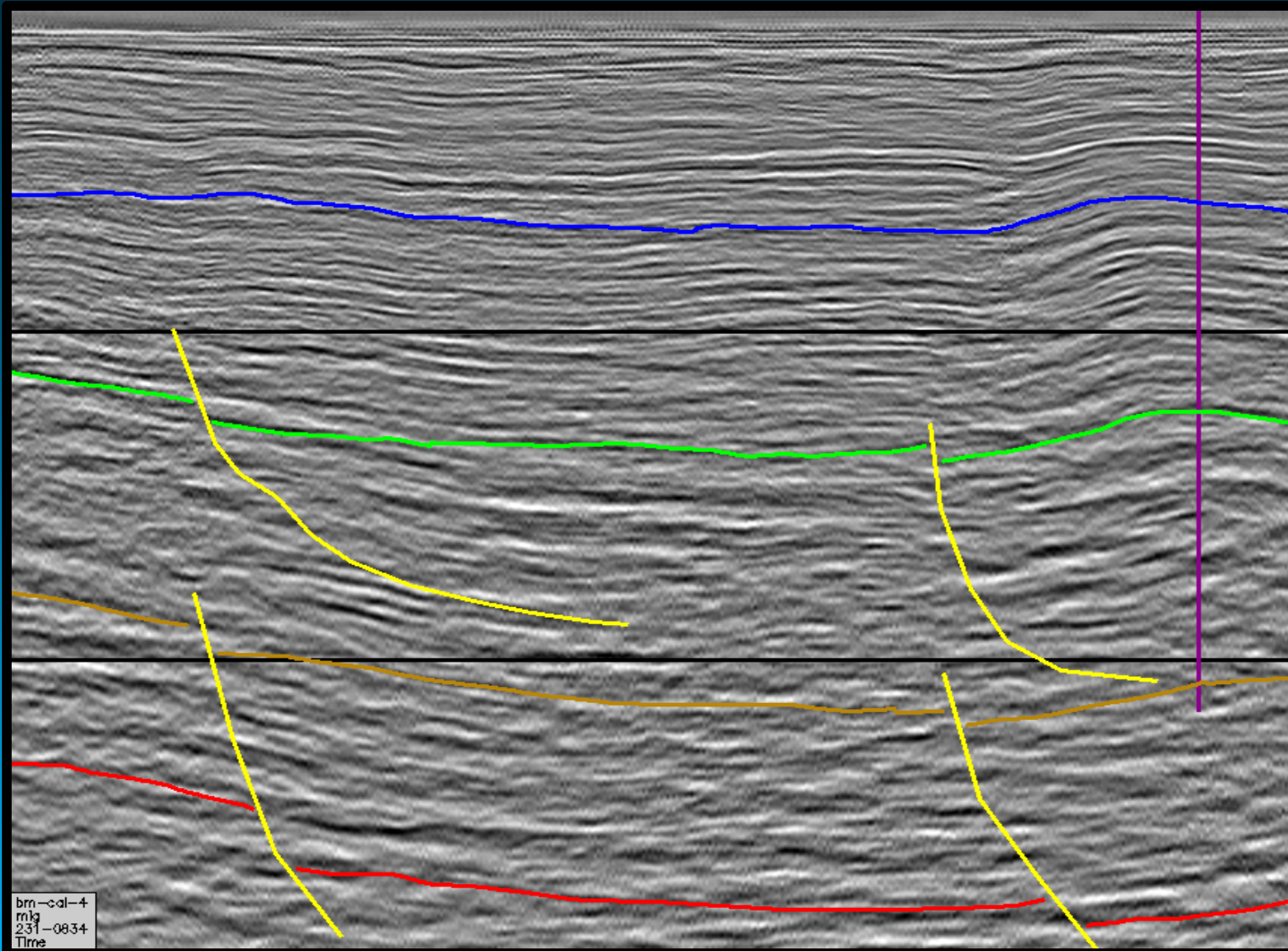
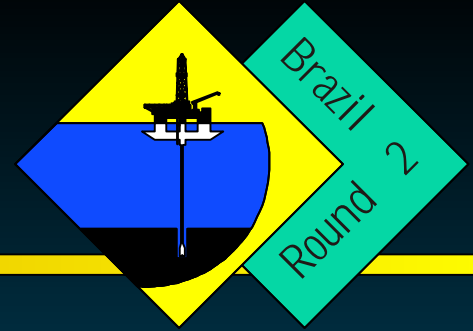
Camamu Basin



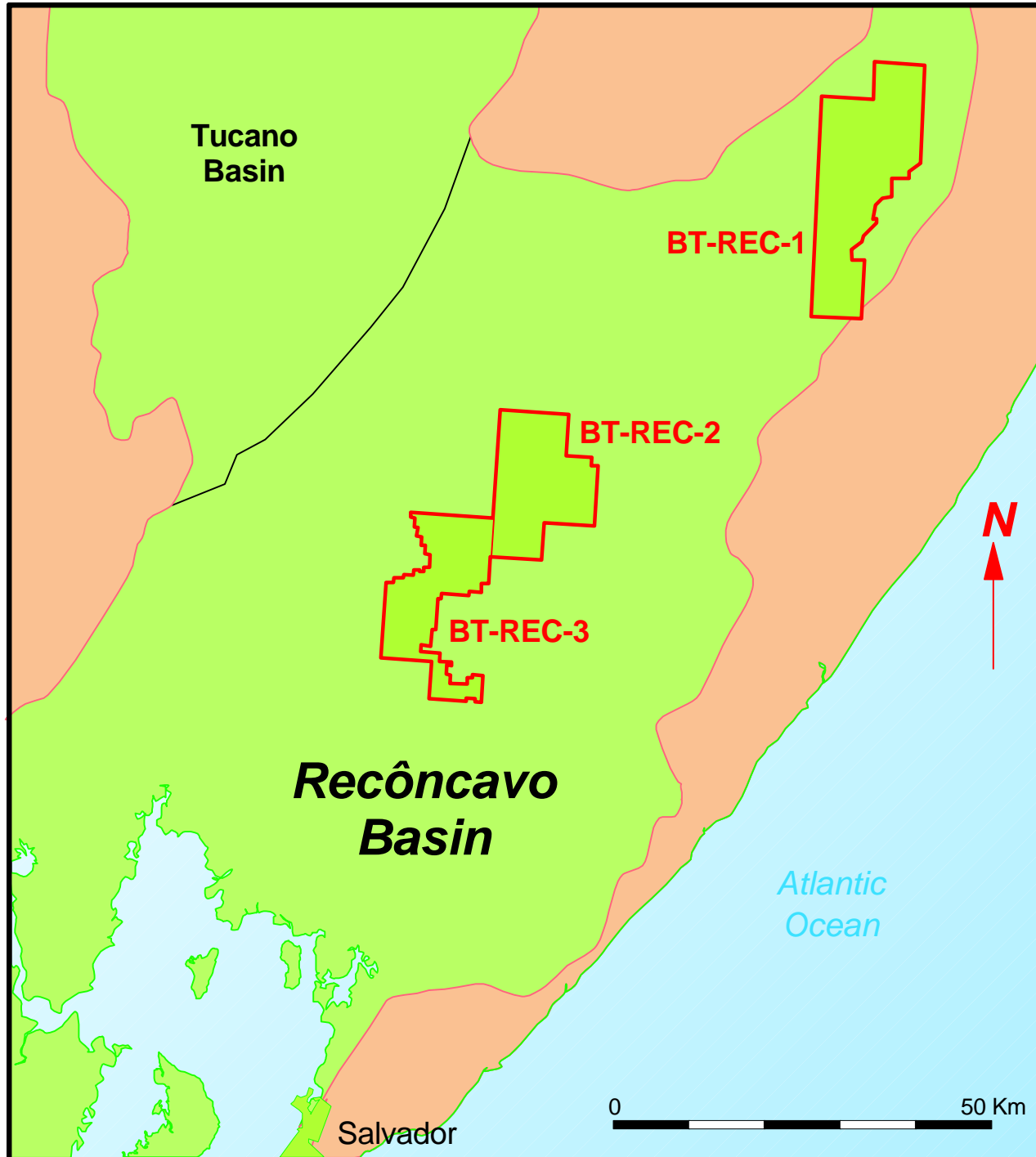
Camamu Basin



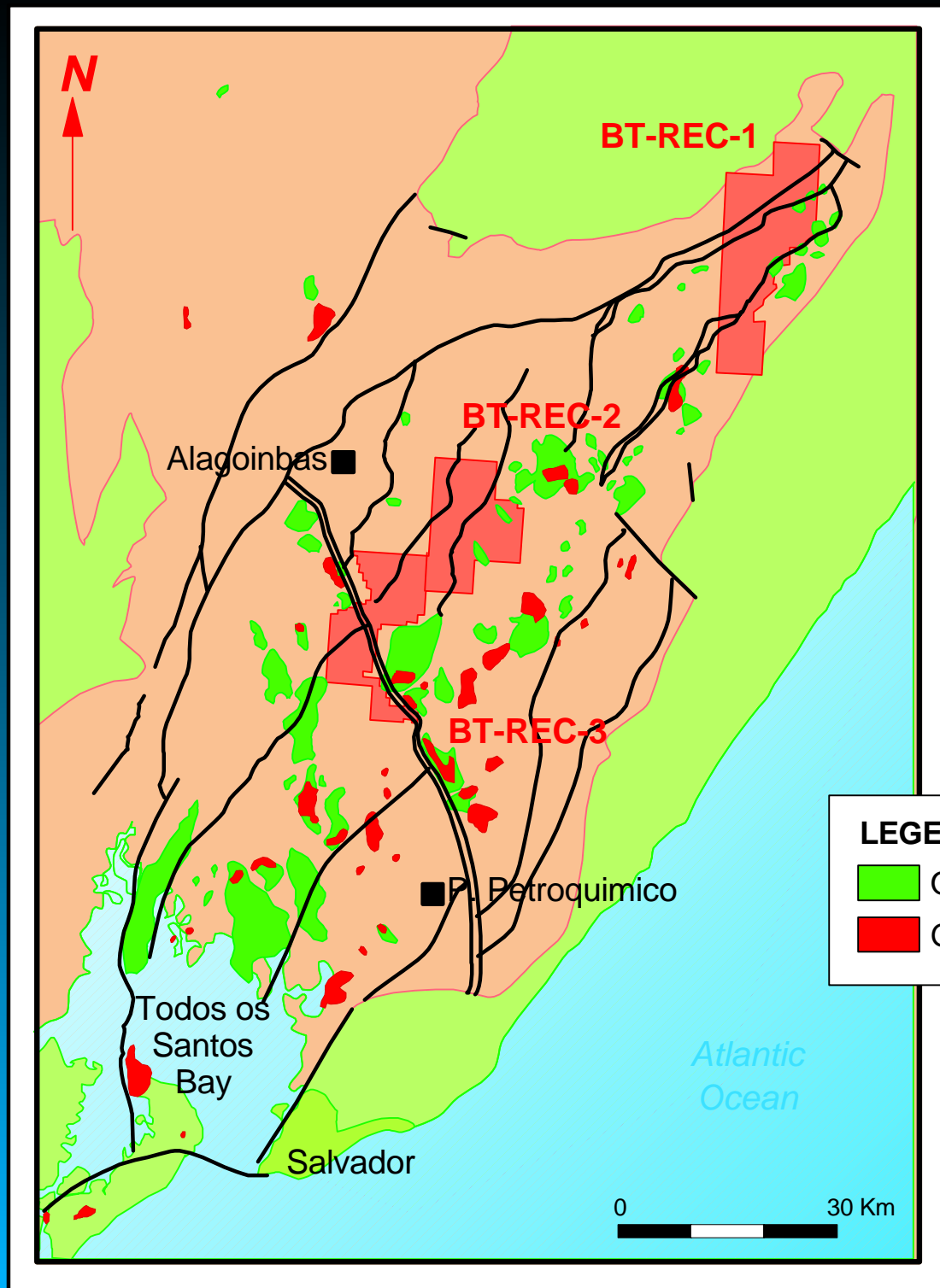
Camamu Basin



Recôncavo Basin



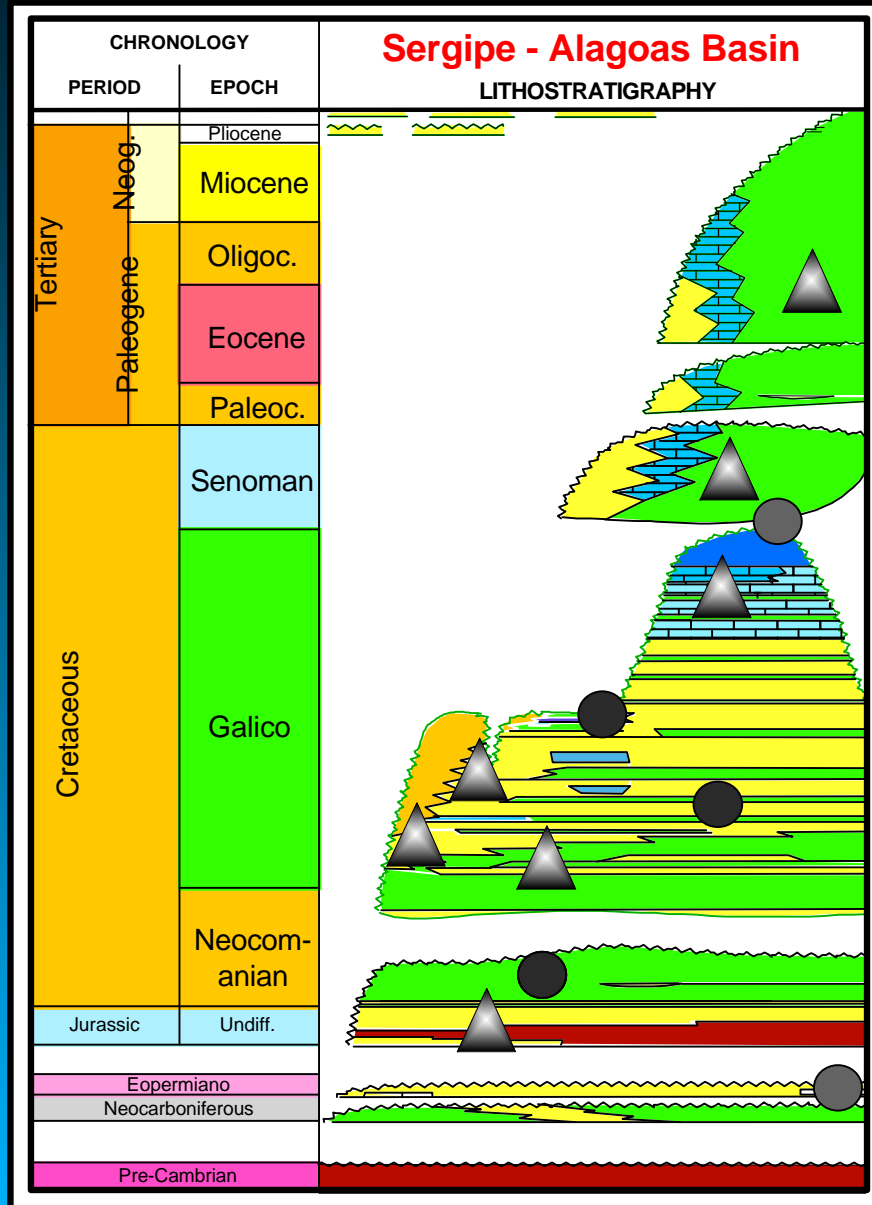
Recôncavo Basin Oil and Gas Fields



Sergipe - Alagoas Basin

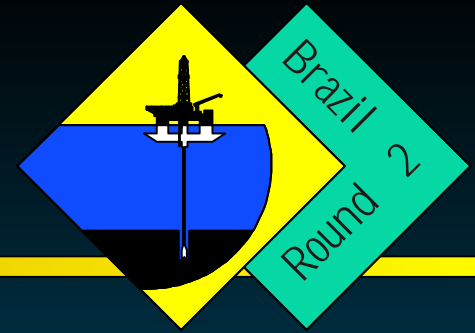


Sergipe - Alagoas Basin



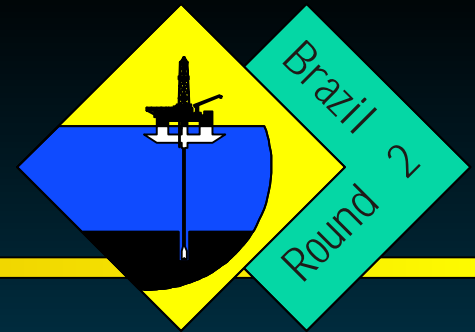
- ▲ Reservoir
- Source rock
- Potential source rock

Equatorial Atlantic Margin Basins



- Related to the gondwana break up
- **11 % of Brazil's production**
- 4 % of Brazil's proved reserves
 - ▶ 300 million bbl

Equatorial Atlantic Margin Basins



3 Stratigraphic sequences

► Rift

- Aptian, Albian
- fluvial, lacustrine, deltaic
- half grabens

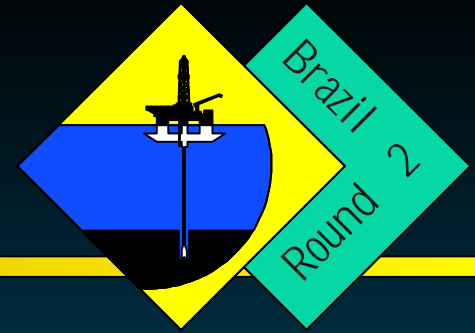
► Transition

- Albian, Cenomanian
- Marine, carbonatic, lagoonal
- Transtension

► Drift

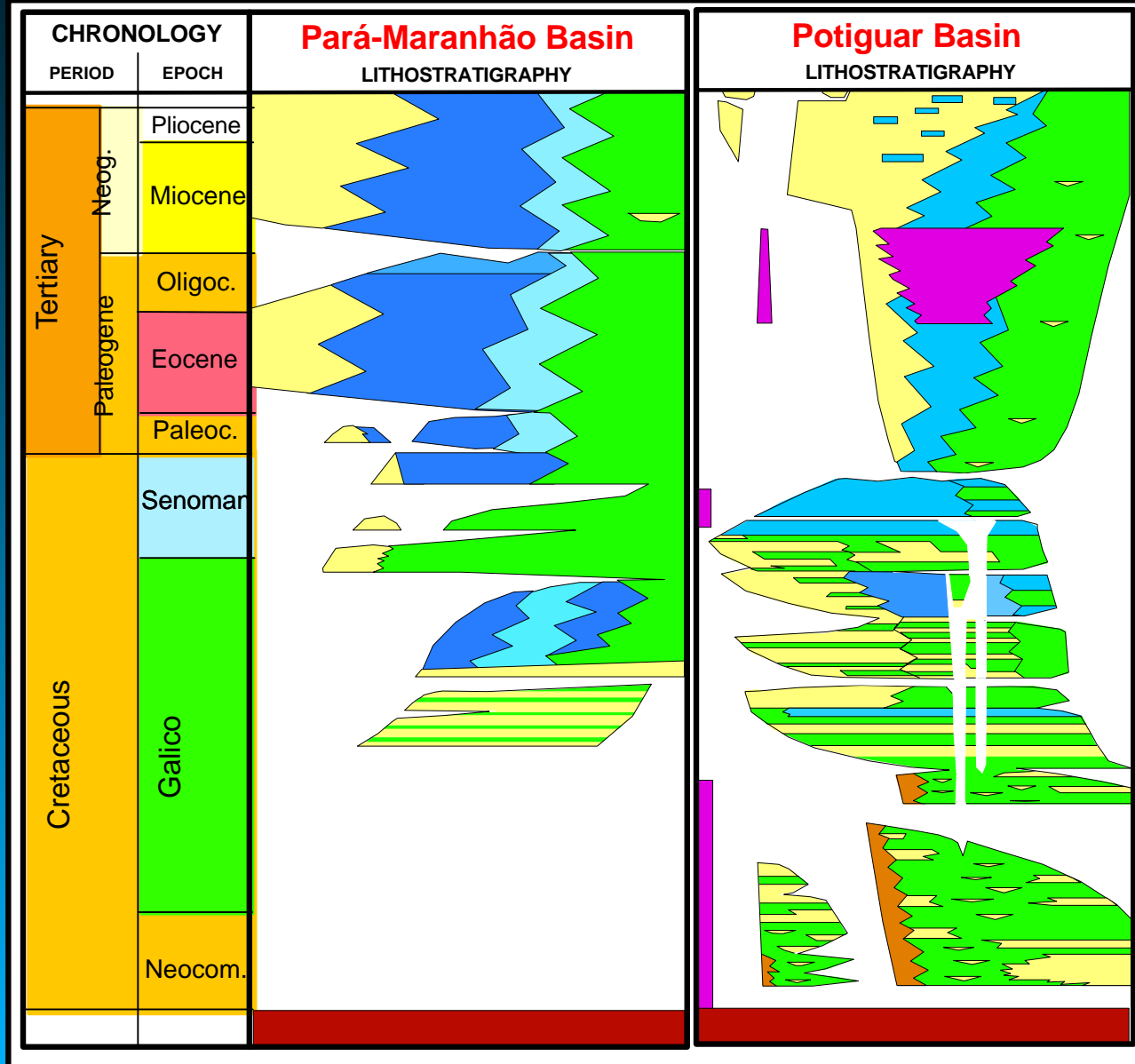
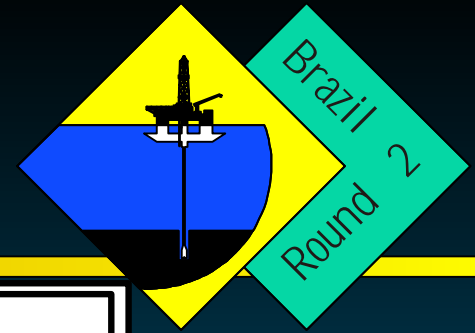
- Cenomanian, recent
- Marine
- (PAMA) gravity slides

Equatorial Atlantic Margin Basins

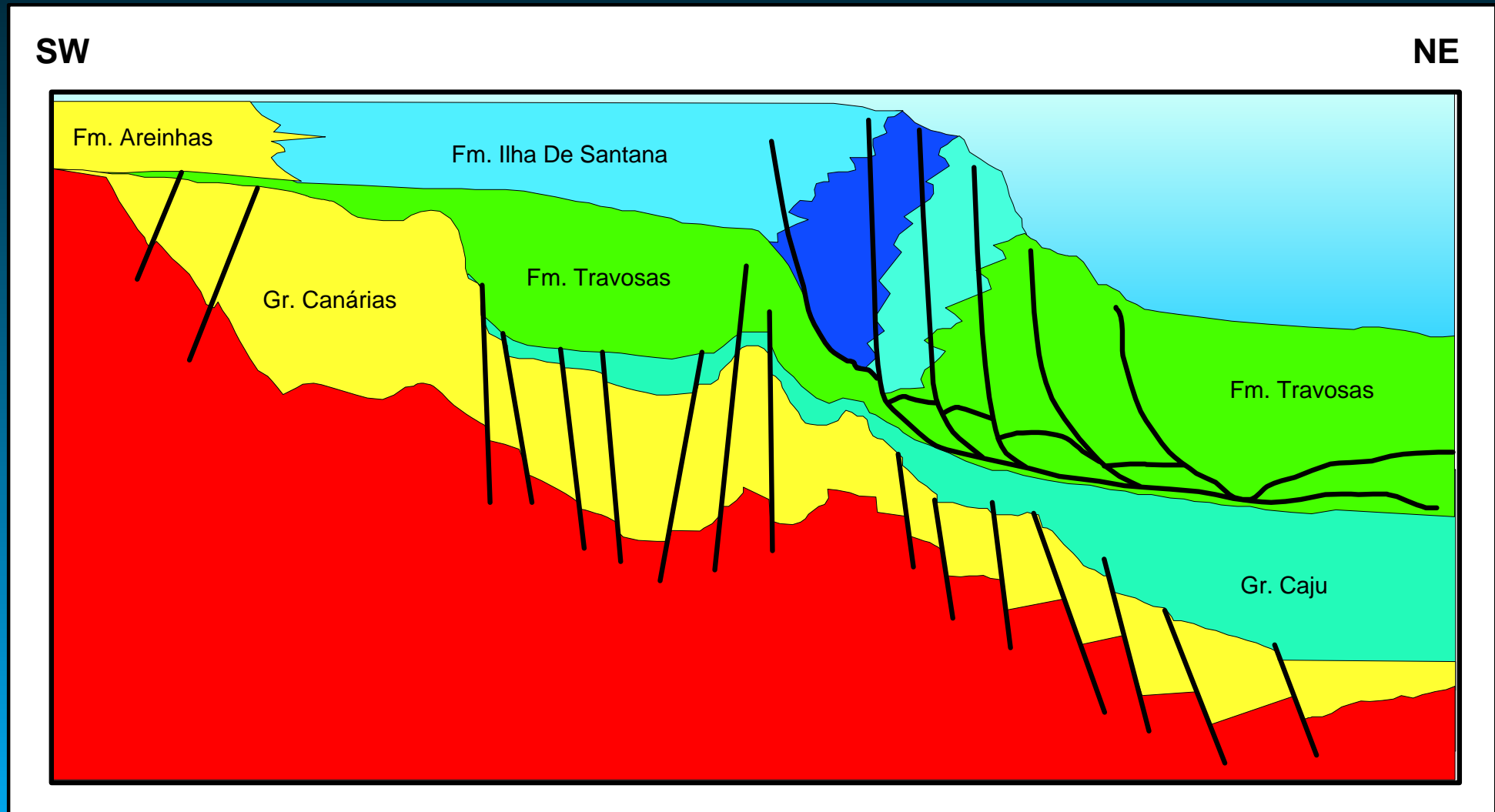
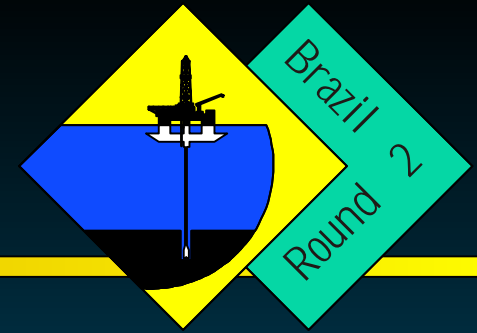


- Source rock
 - ▶ Rift - lacustrine shales
 - ▶ Pama - transitional black shales
- TOC < 5 %
- Plays
 - ▶ Potiguar:
 - clastics / structural traps, mixed
 - very good reservoirs
 - subtle traps
- PAMA - multiple

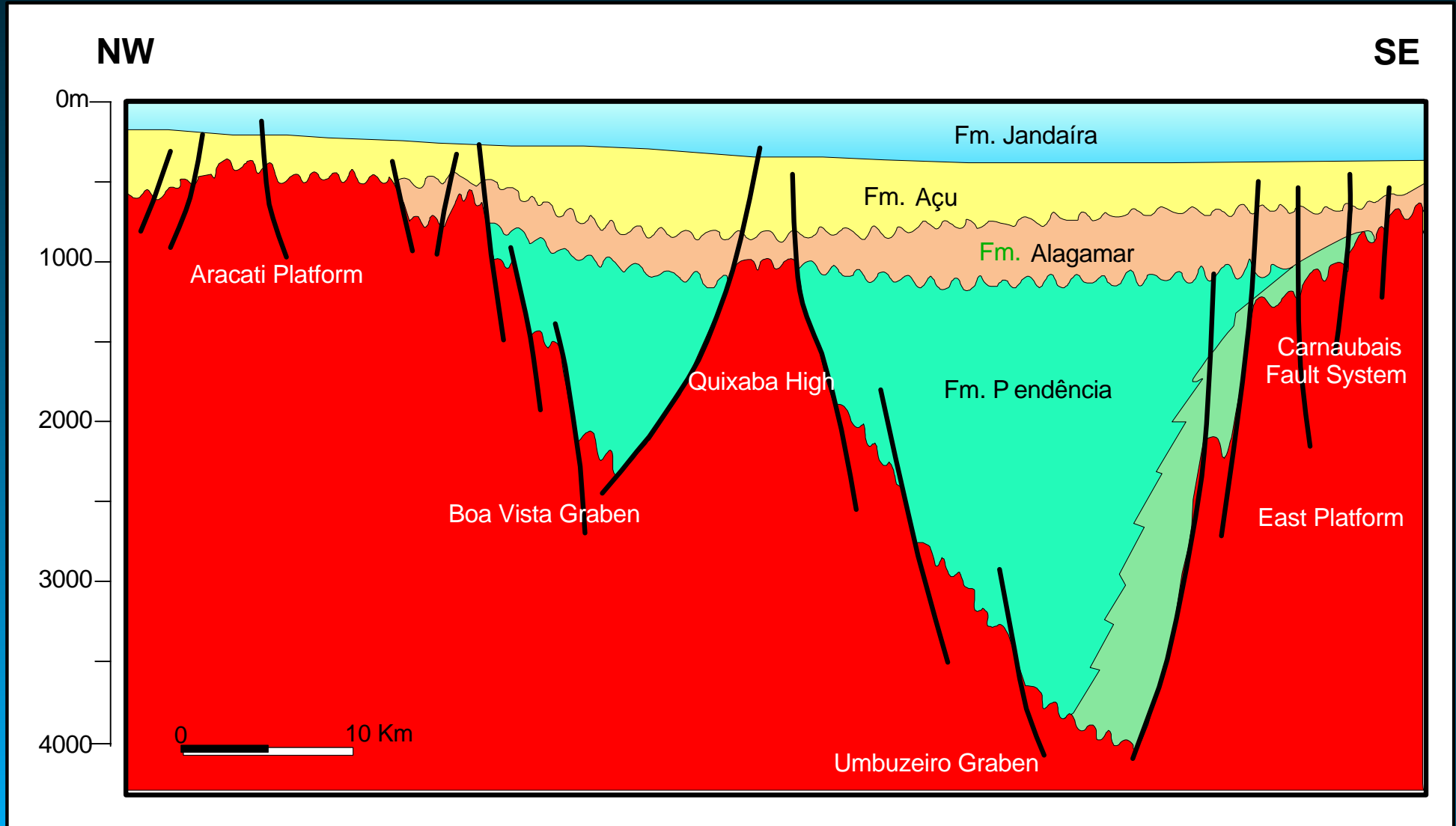
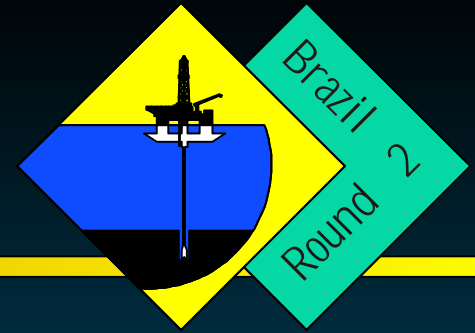
Equatorial Atlantic Margin Basins



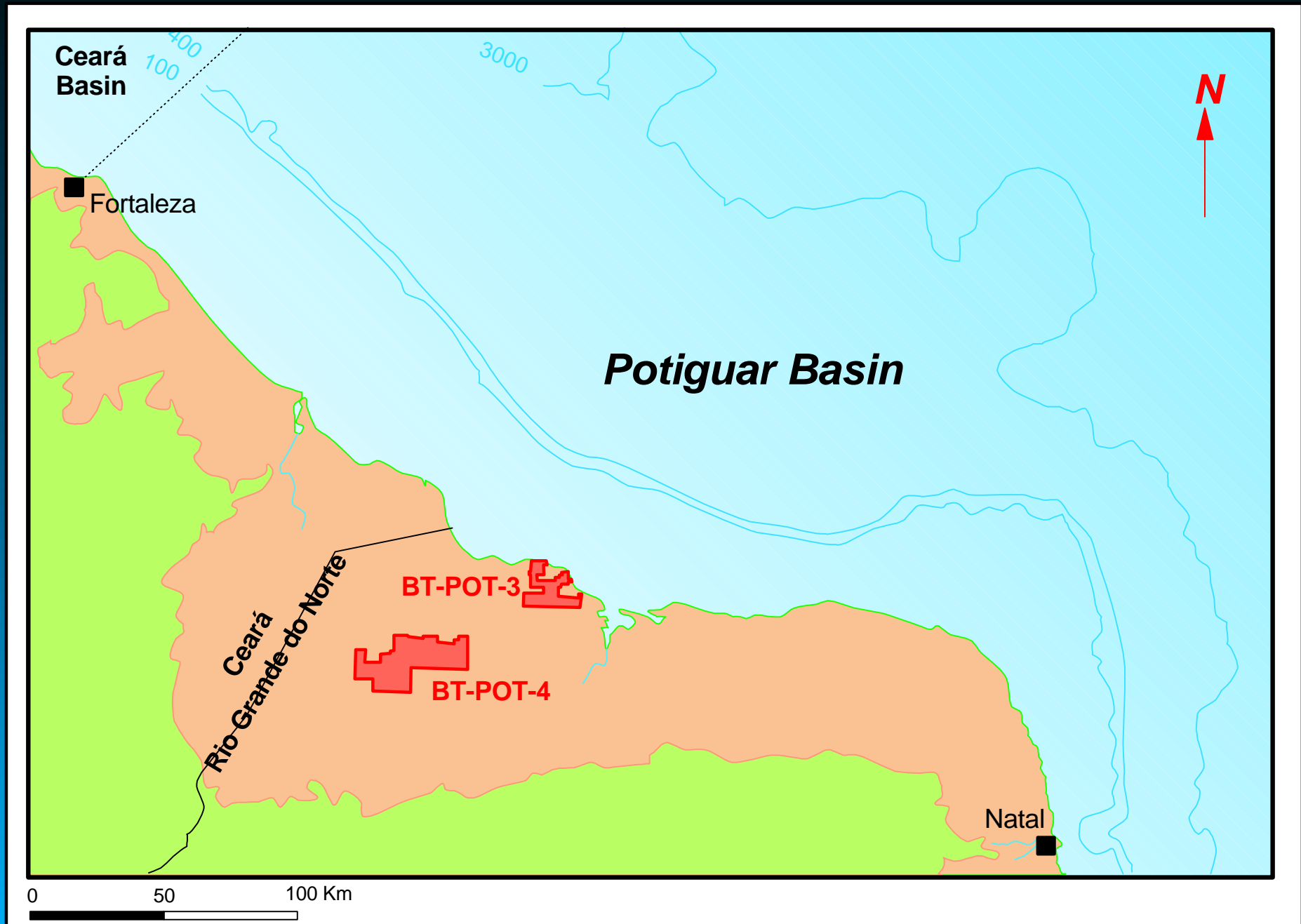
Equatorial Atlantic Margin Basins - Pará-Maranhão Basin



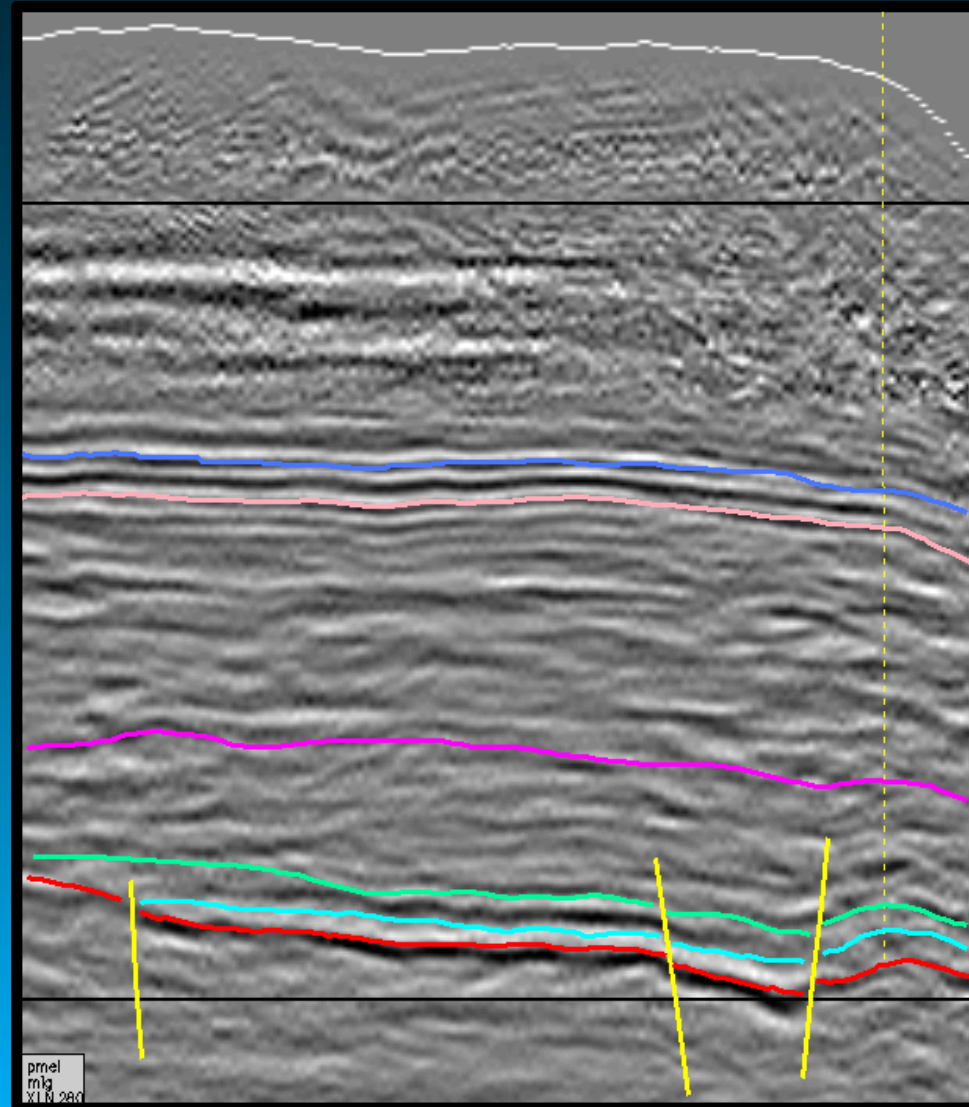
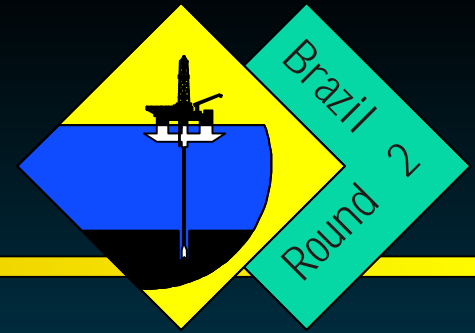
Equatorial Atlantic Margin Basins - Potiguar Basin



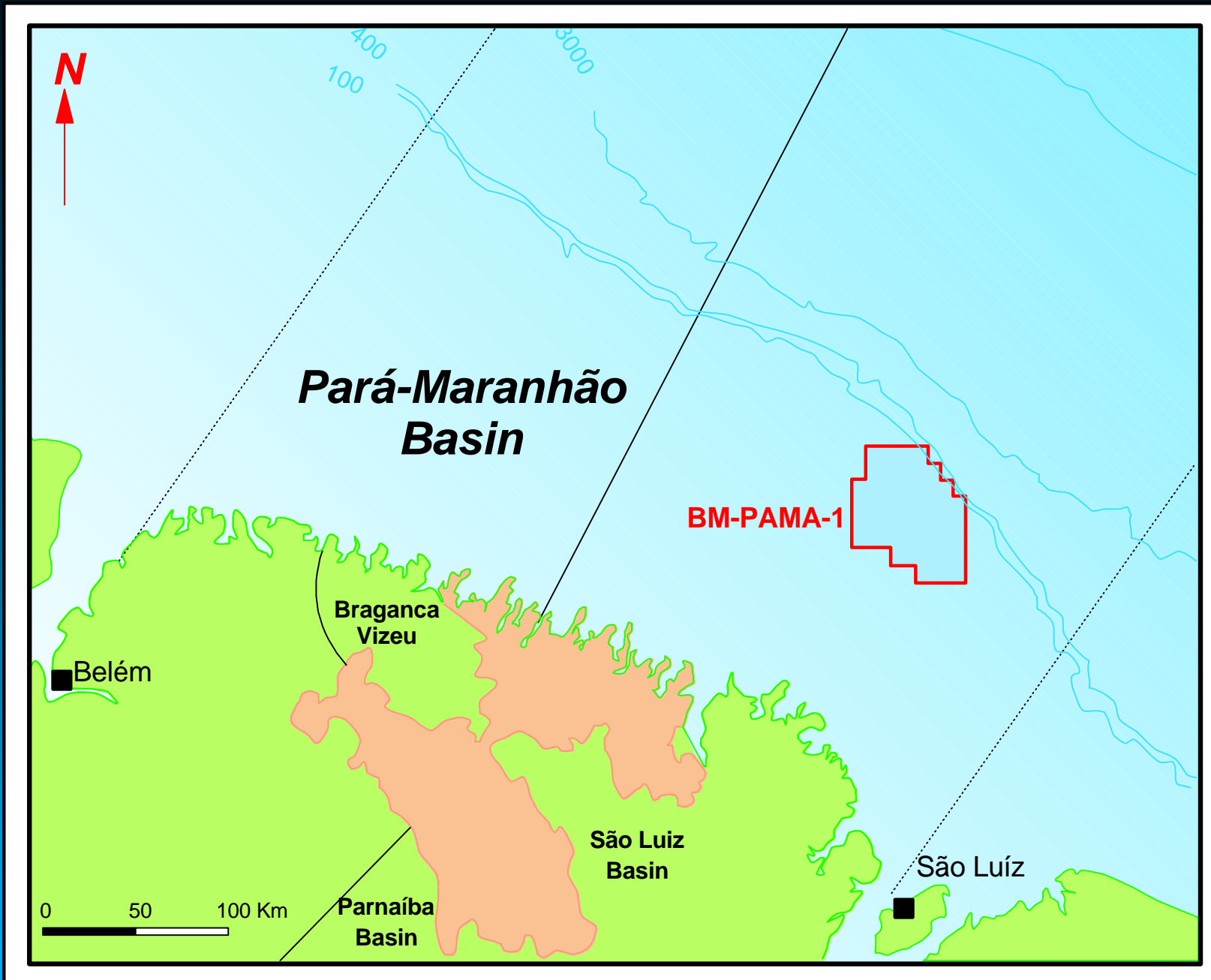
Potiguar Basin



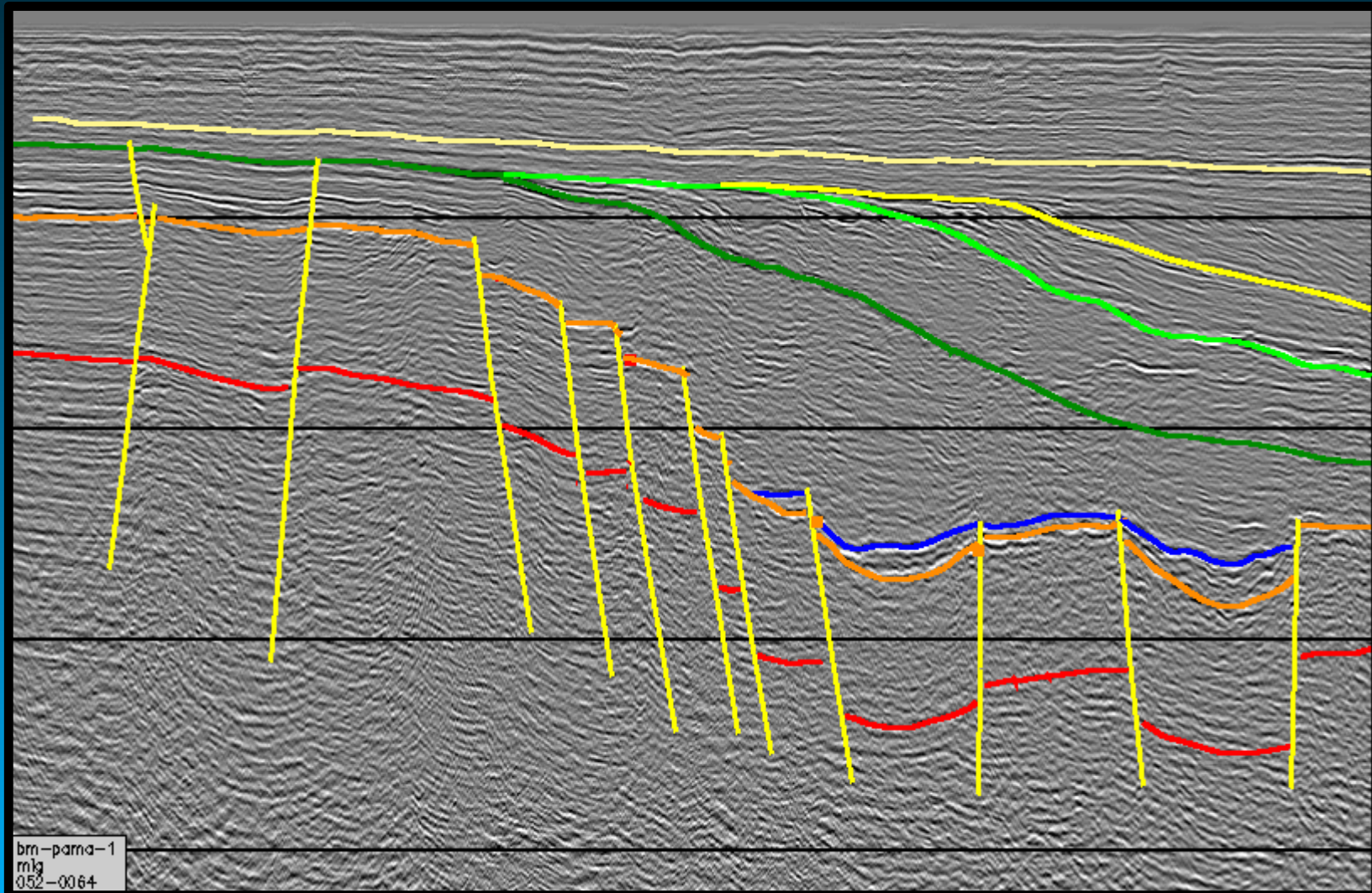
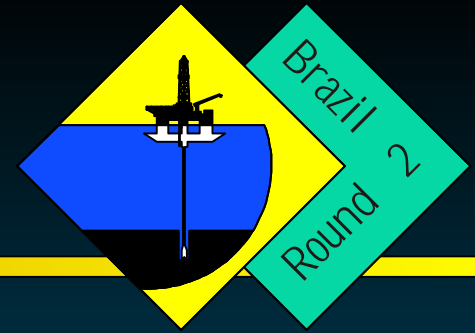
Potiguar Basin



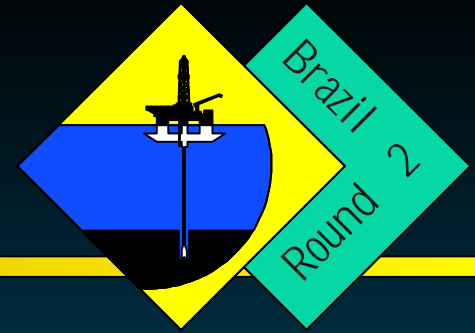
Pará-Maranhão Basin



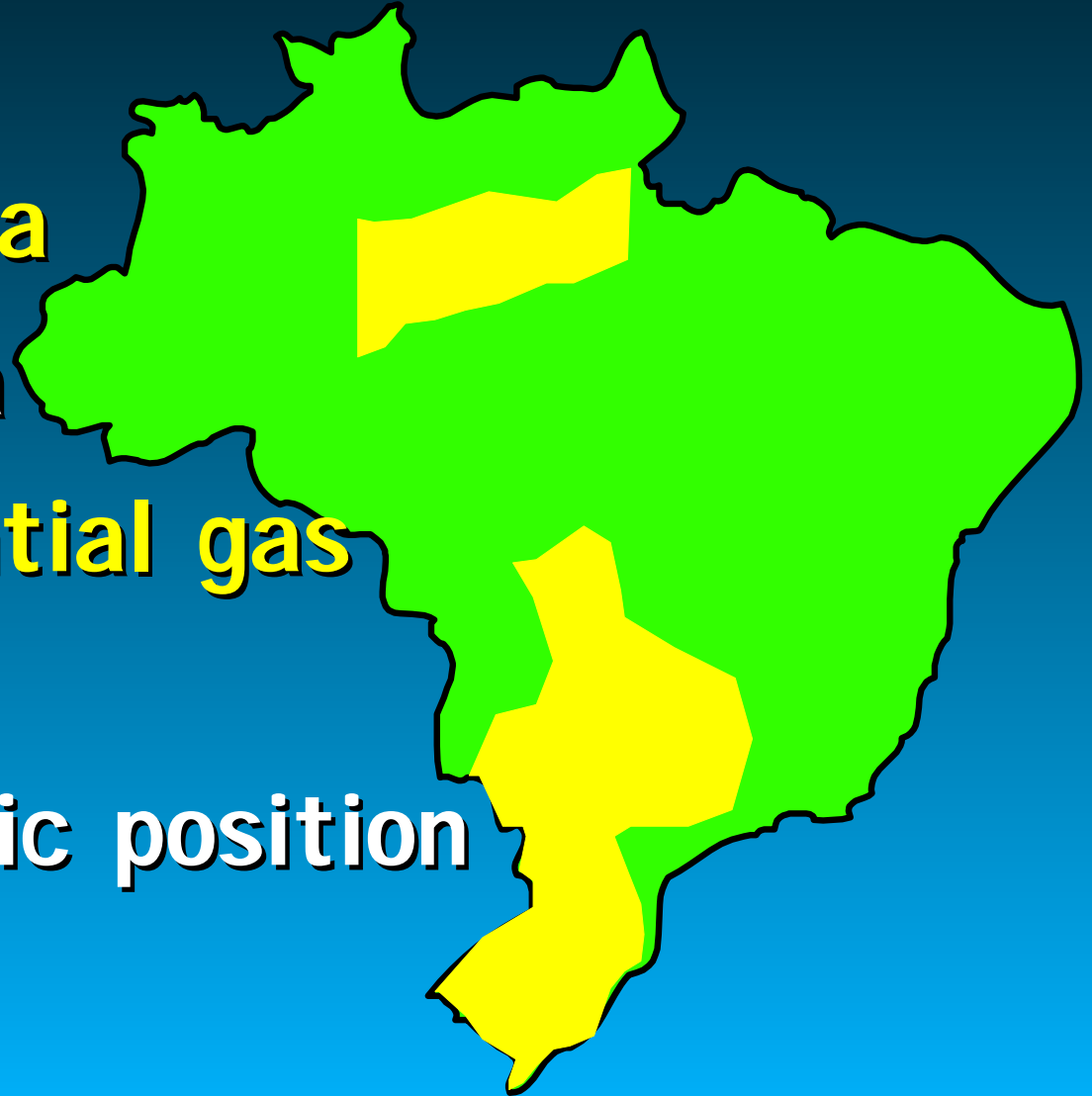
Pará-Maranhão Basin



Paleozoic Basins



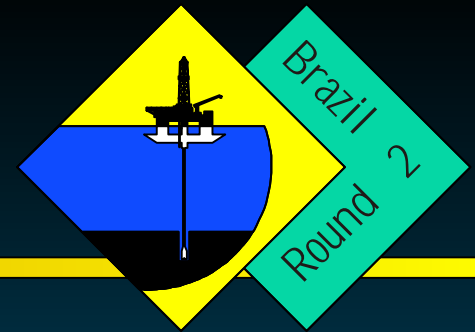
- Frontier
- Very scarce data
- Low quality data
- Confirmed potential gas discoveries
- Paraná: Strategic position





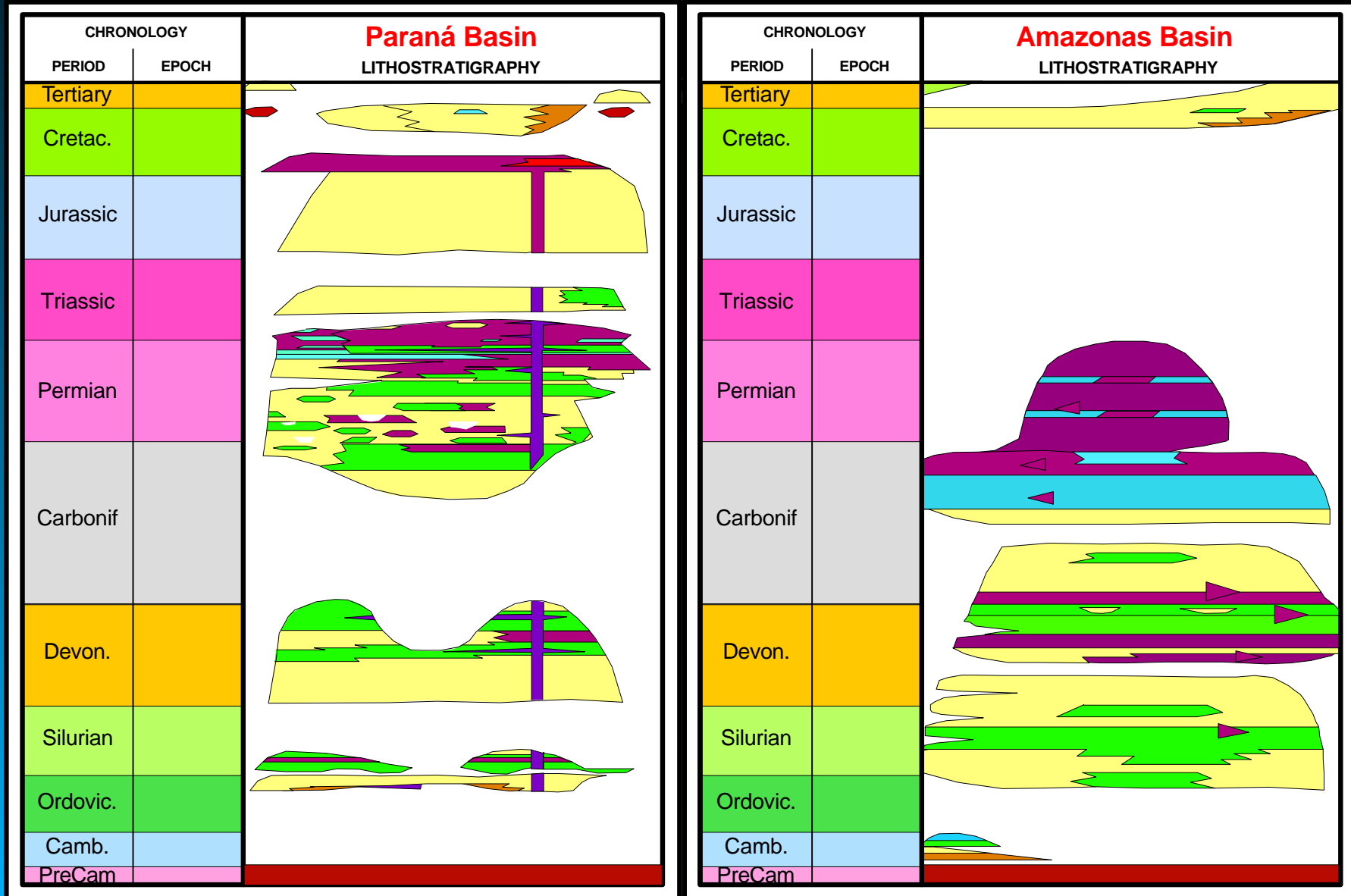
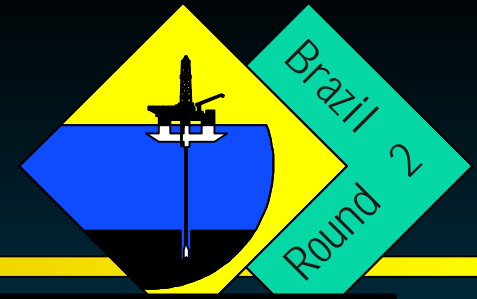
- **3 Paleozoic sequences**
 - ▶ 3 marine episodes
 - ▶ Multiple transgressions / regressions
 - ▶ Continentalization before the Mesozoic

- **Basic magmatism**
 - ▶ Amazonas - Triassic / Jurassic
 - ▶ Paraná - Lower Cretaceous

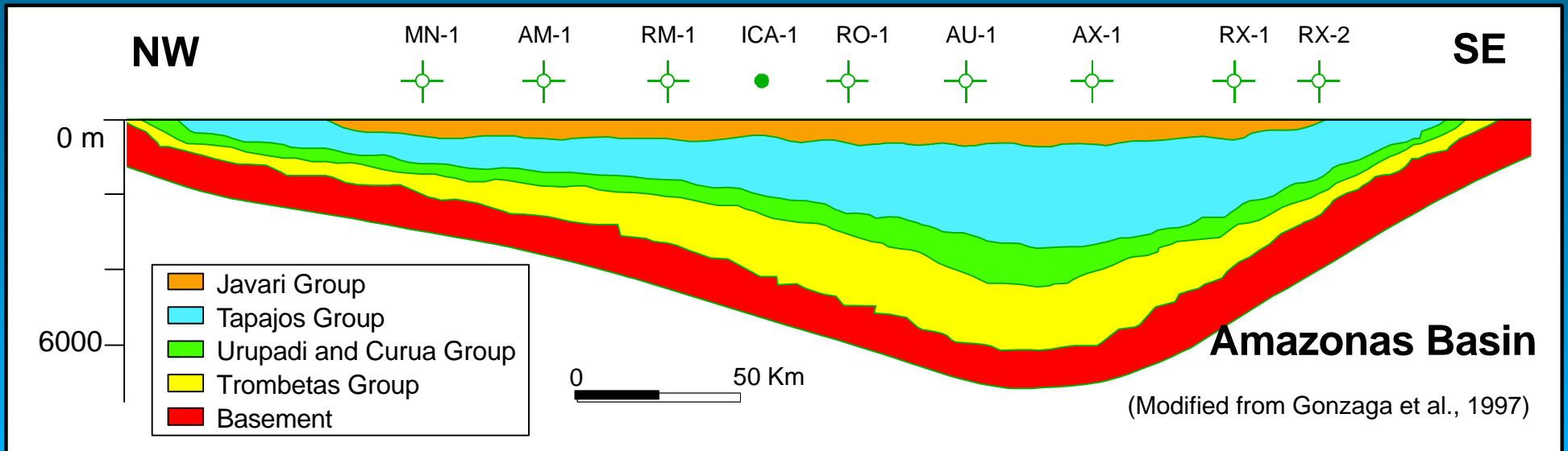
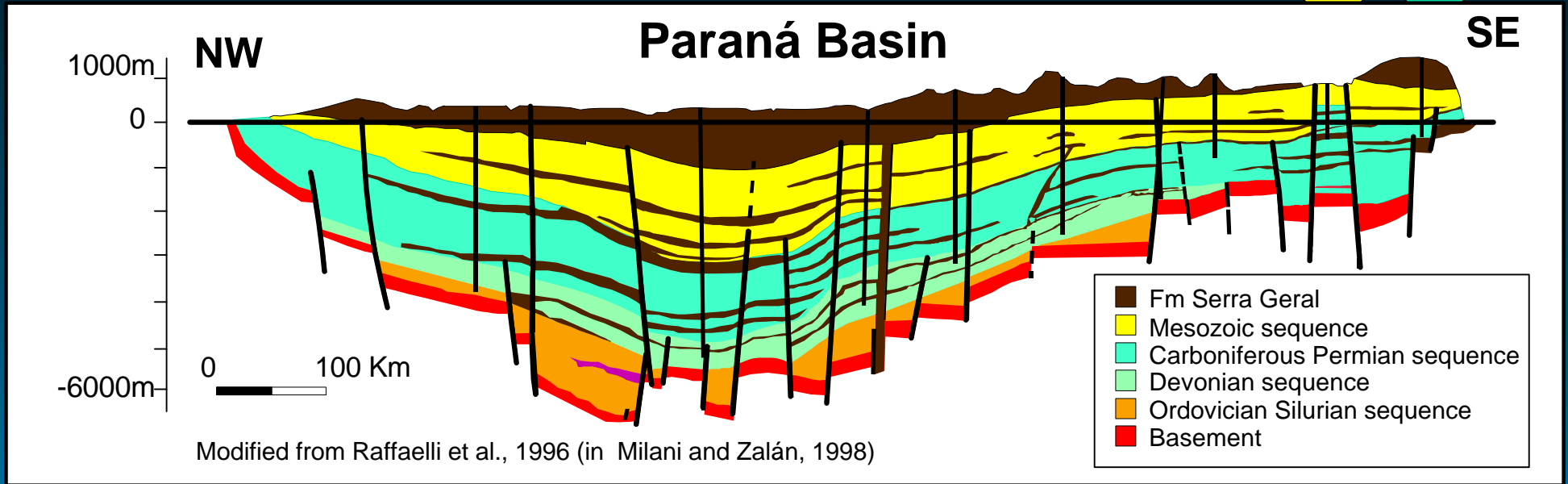
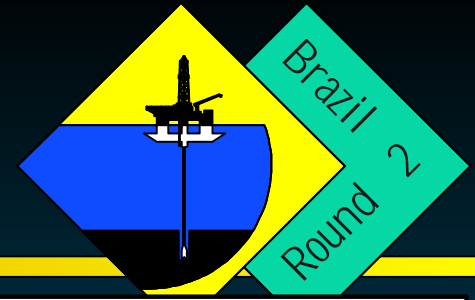


- **Source rock**
 - ▶ Marine - devonian shales
 - ▶ Paraná - supermature TOC: 2%
 - ▶ Amazonas - oil prone TOC: 3 - 8%
- **Secondary source rock**
 - ▶ Paraná - Permian, immature ?
 - ▶ Amazonas - Silurian
- **Plays**
 - ▶ Paraná - Glacial, marine sand bodies, mixed trap
 - ▶ Amazonas - Continental clastics, structural traps

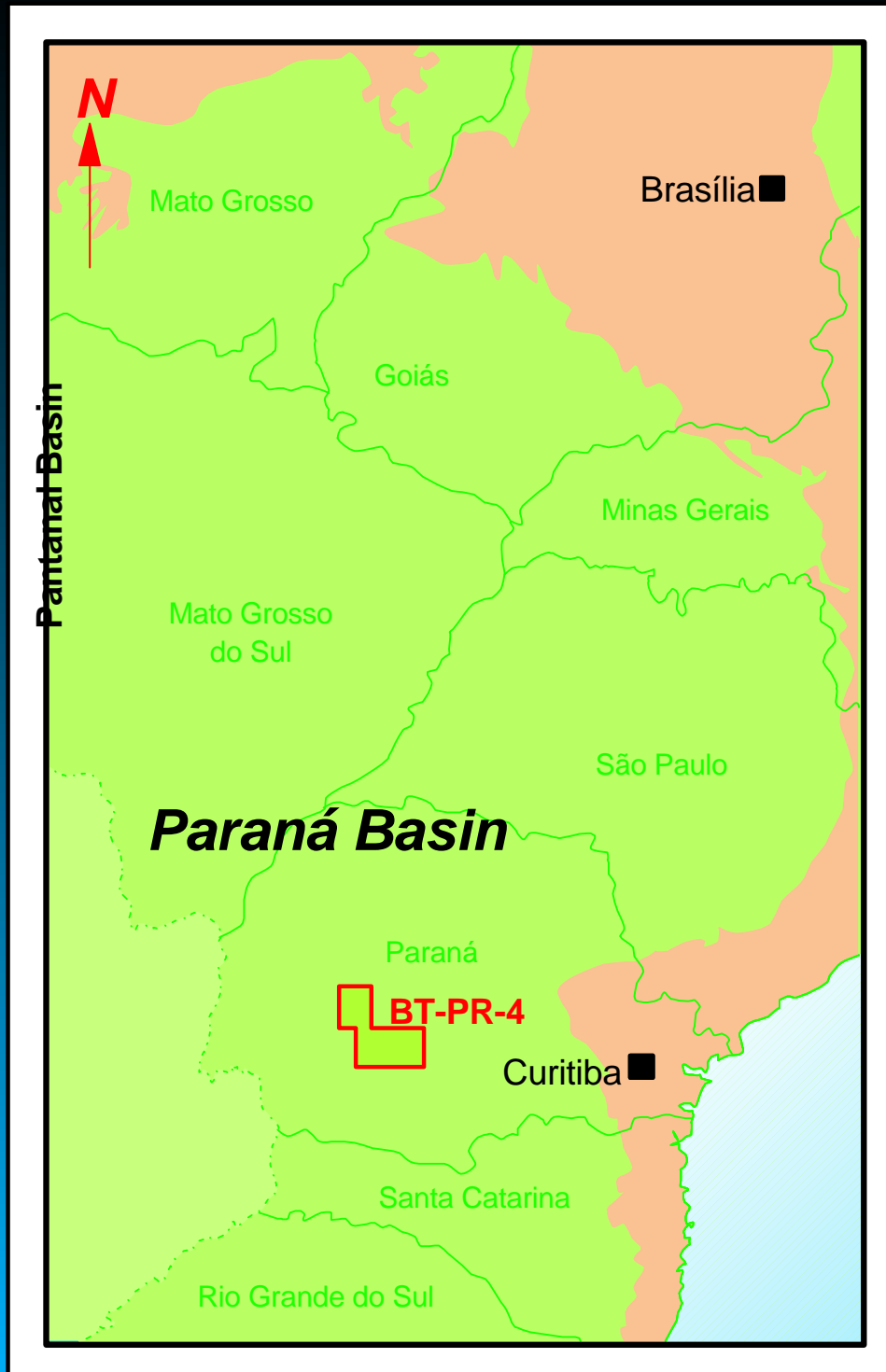
Paleozoic Basins



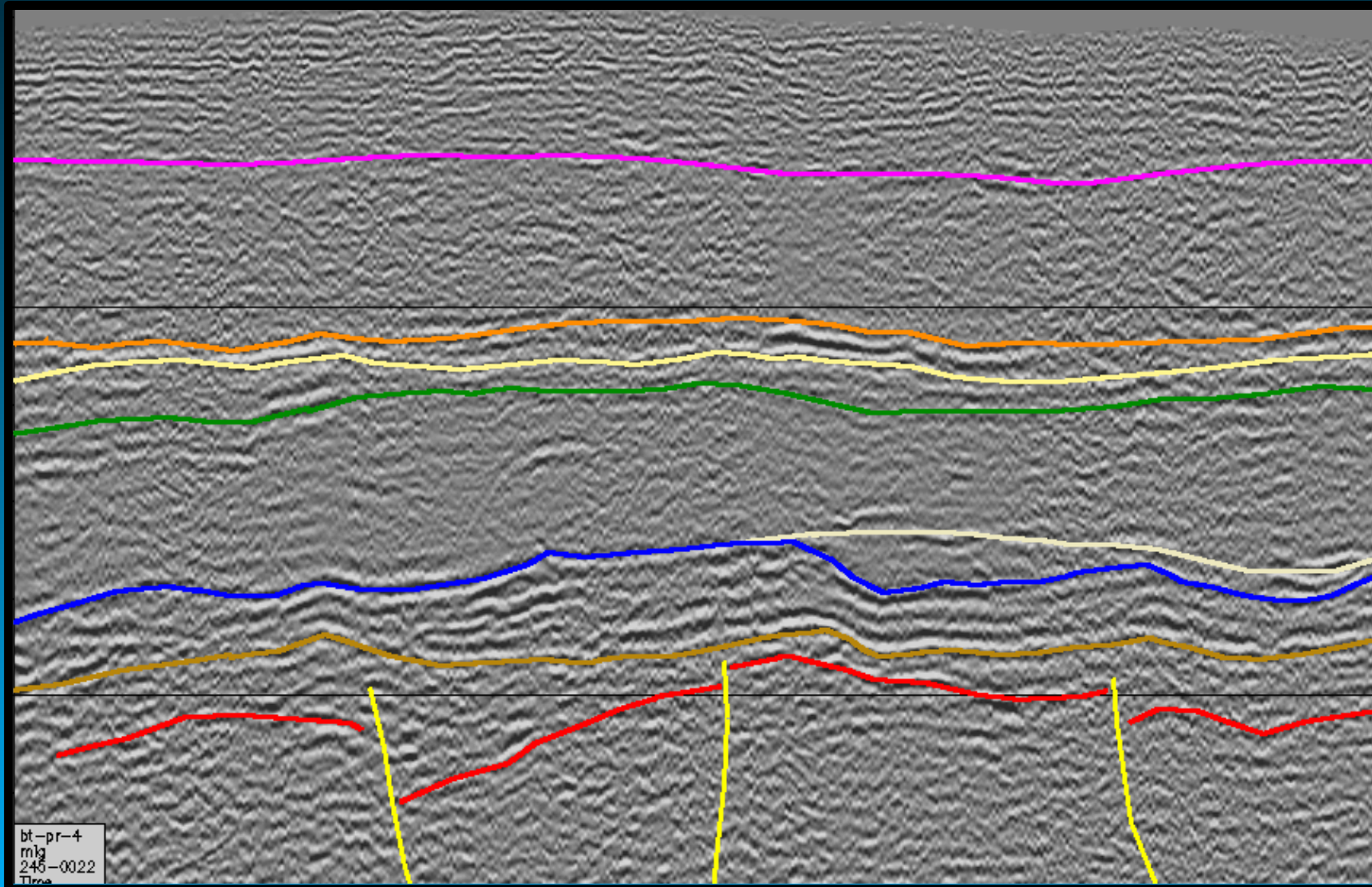
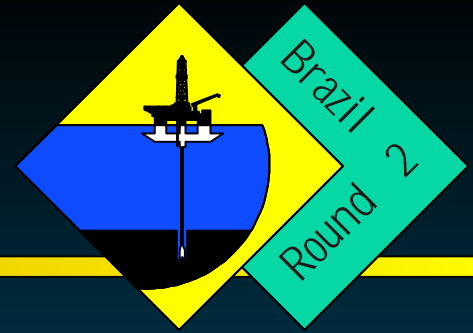
Paleozoic Basins



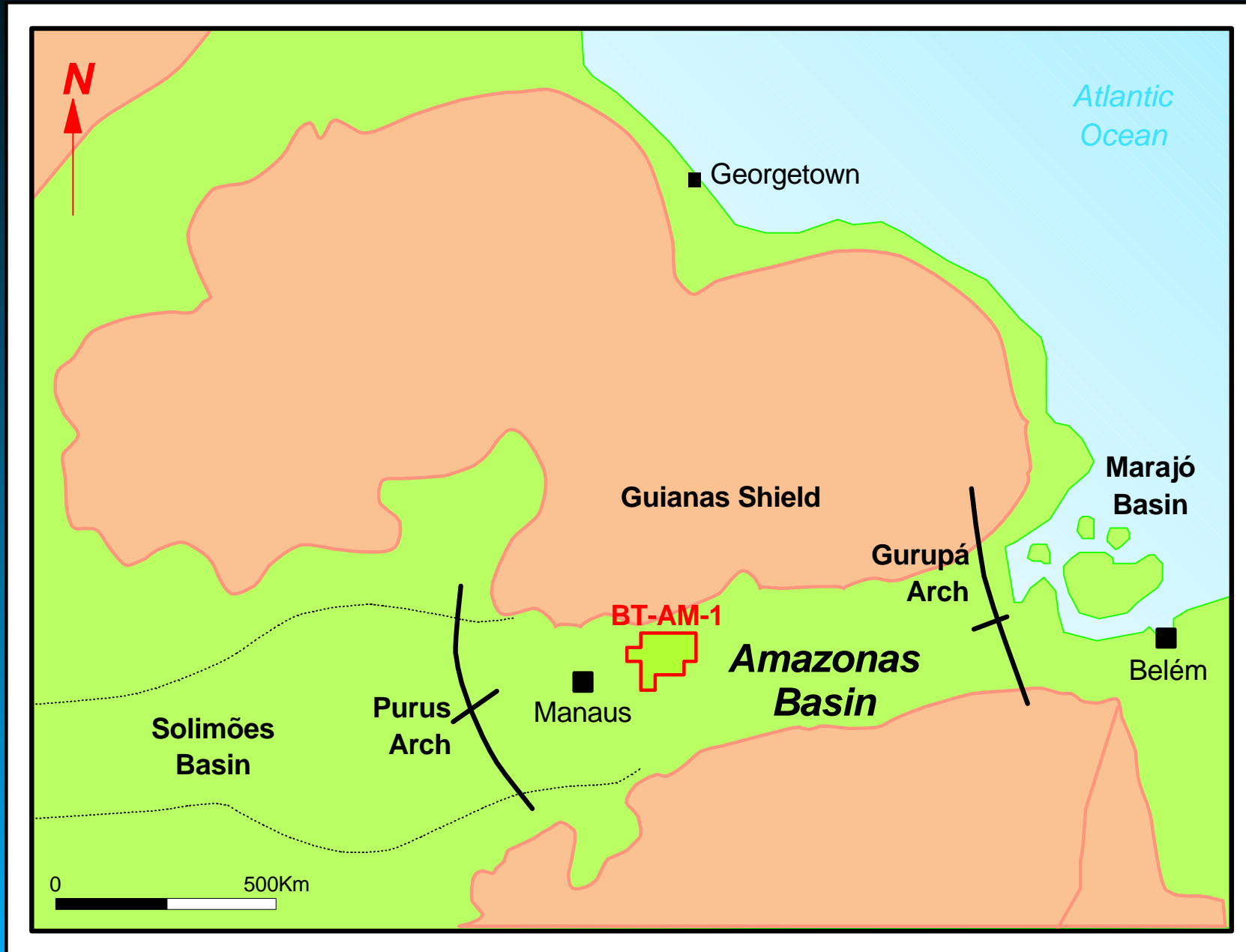
Paraná Basin



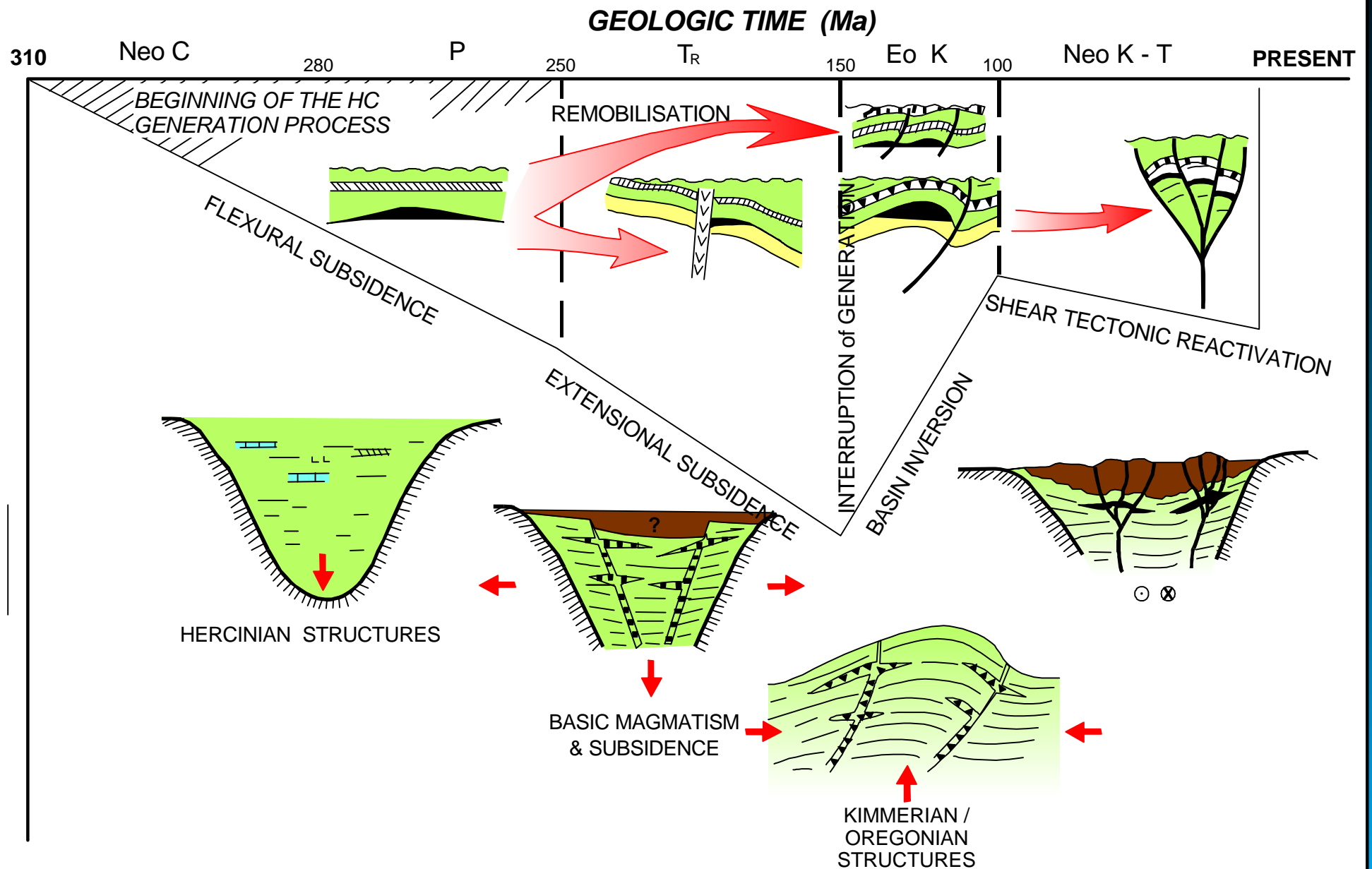
Paraná Basin



Amazonas Basin



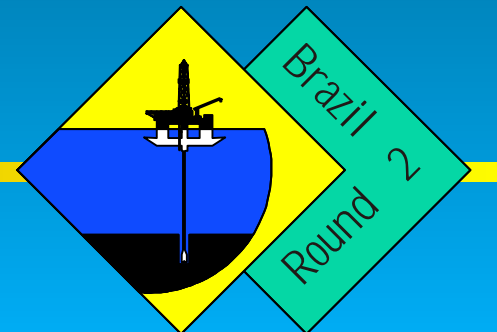
Amazonas Basin

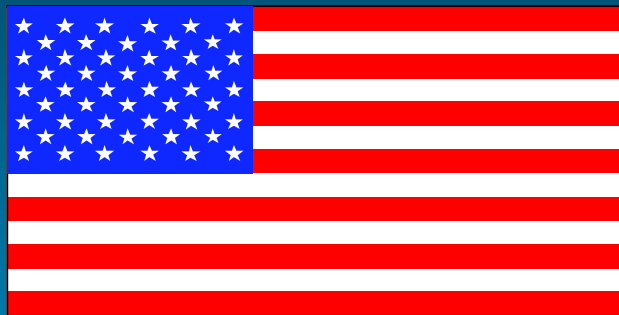
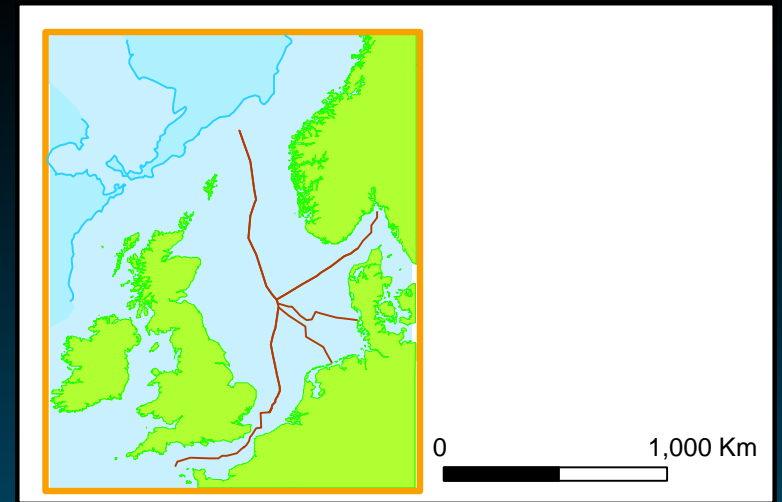


(Neves, C.A de O. , 1989)

Schematic Diagram - HC generation, migration and accumulation with the basin's structural phases

Some More Comparisons



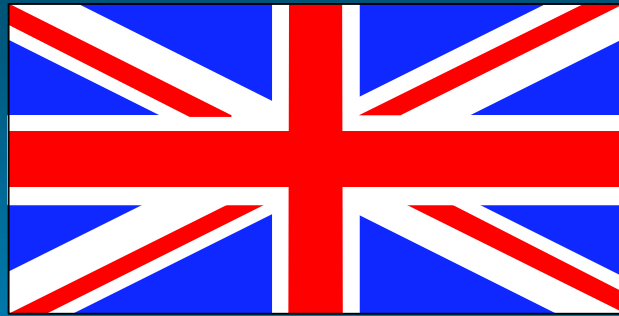
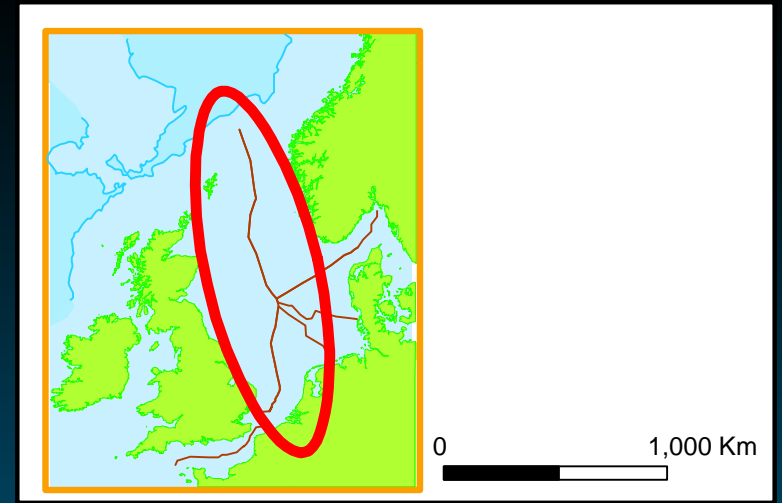


13,300 Expl.wells

24,700 Dev

D R I L L I N G



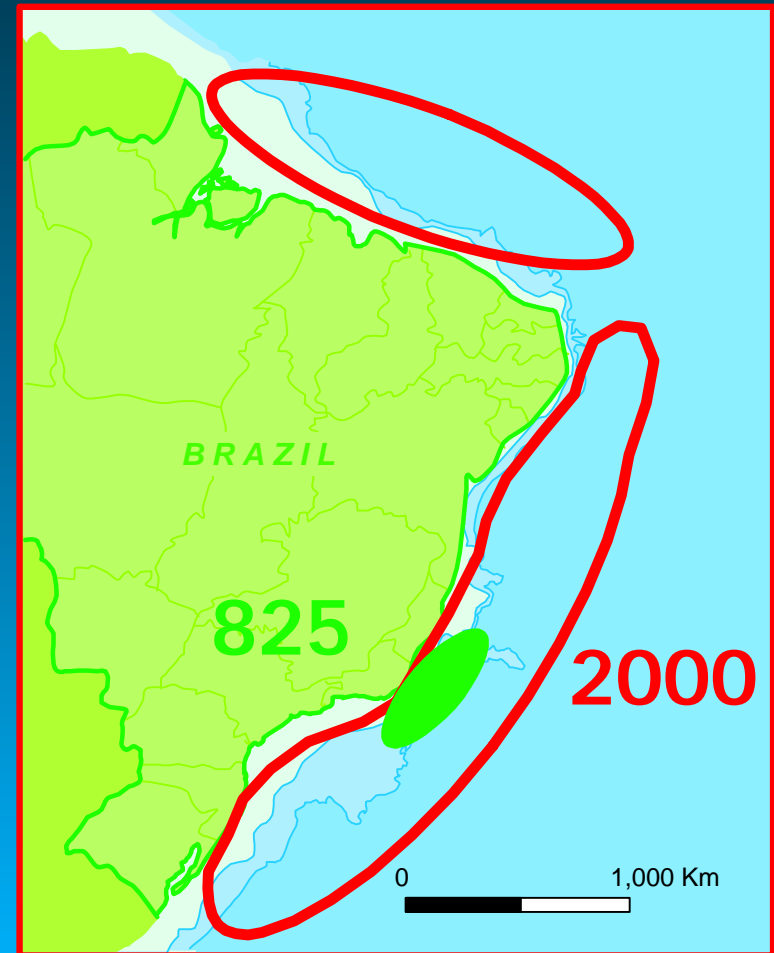
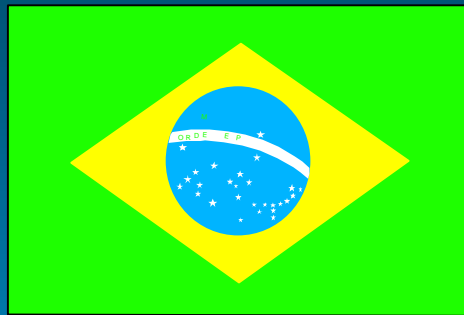
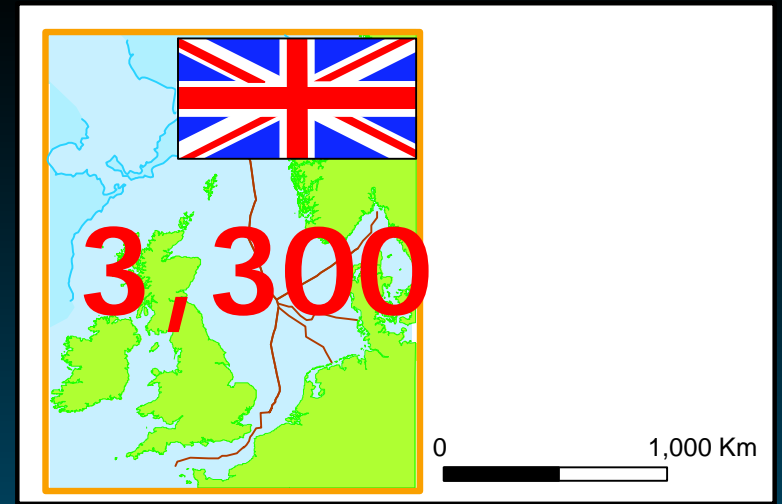


3,300 Expl.wells

3,600 Dev

D R I L L I N G



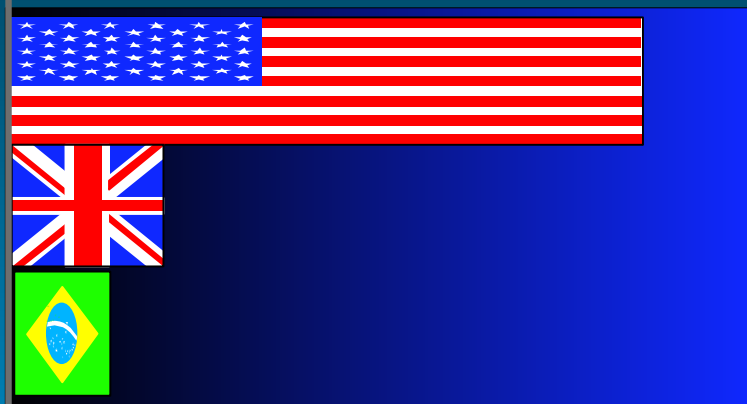
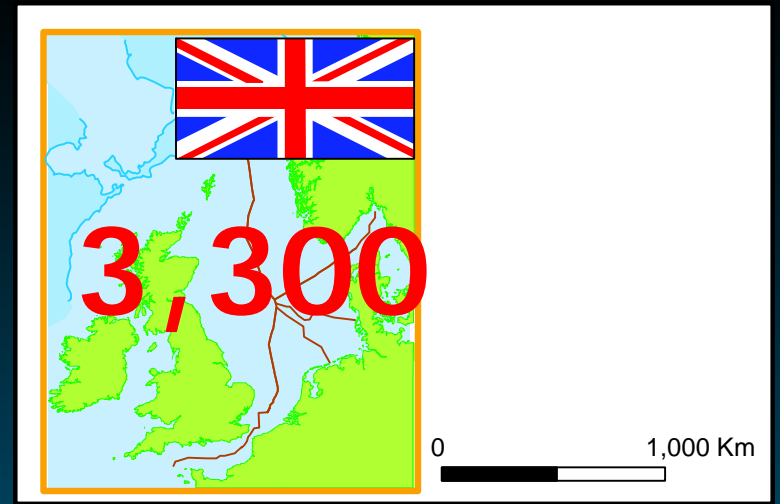


2,000 Expl.wells

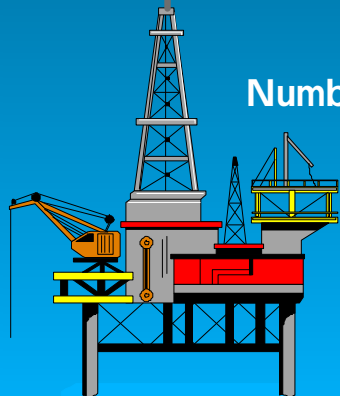
3,600 Onshore Expl

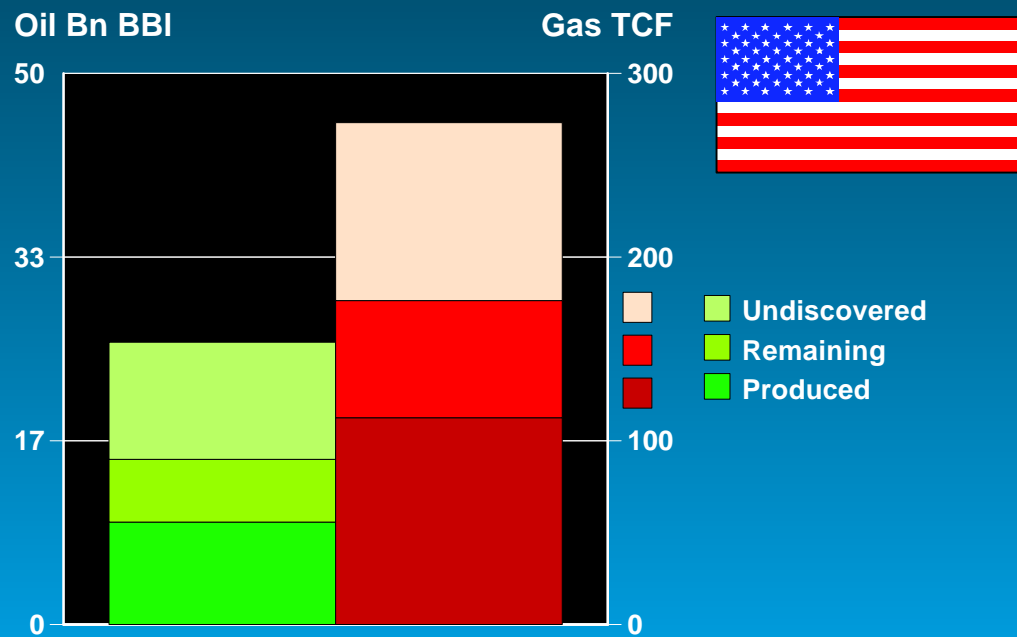
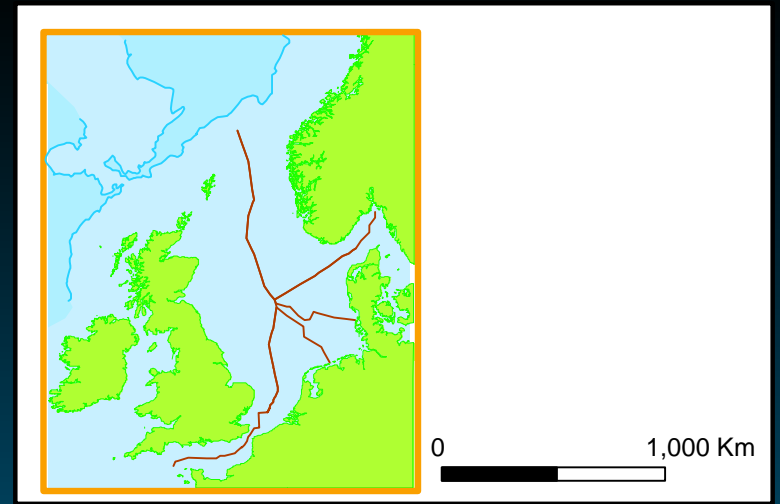
13,900 Dev (< 2,000 offshore)

DRILLING

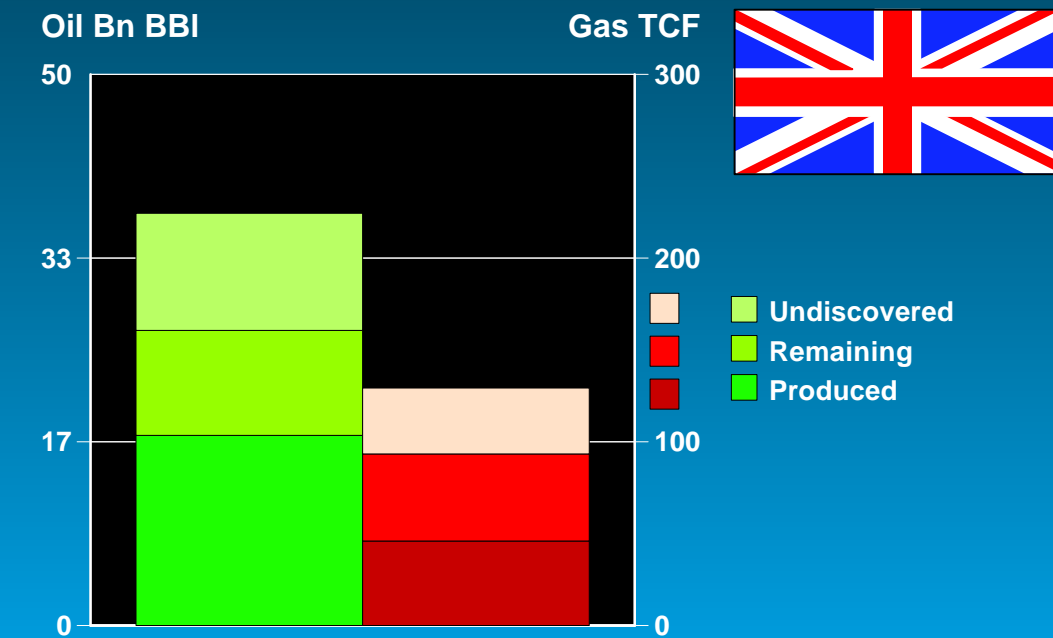
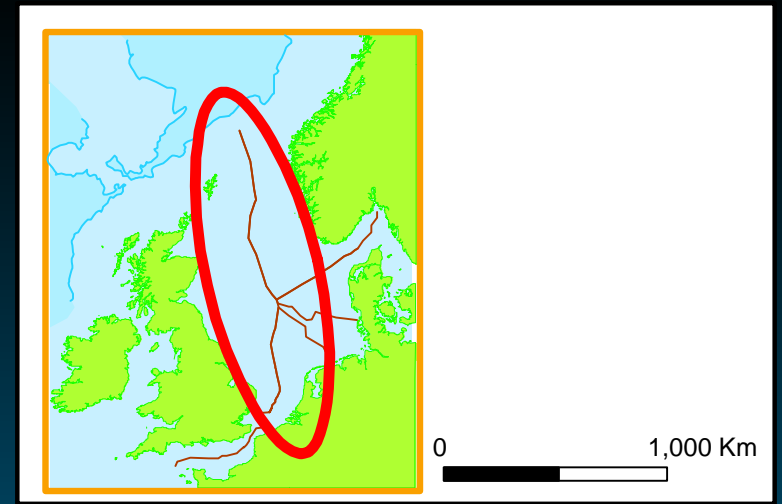
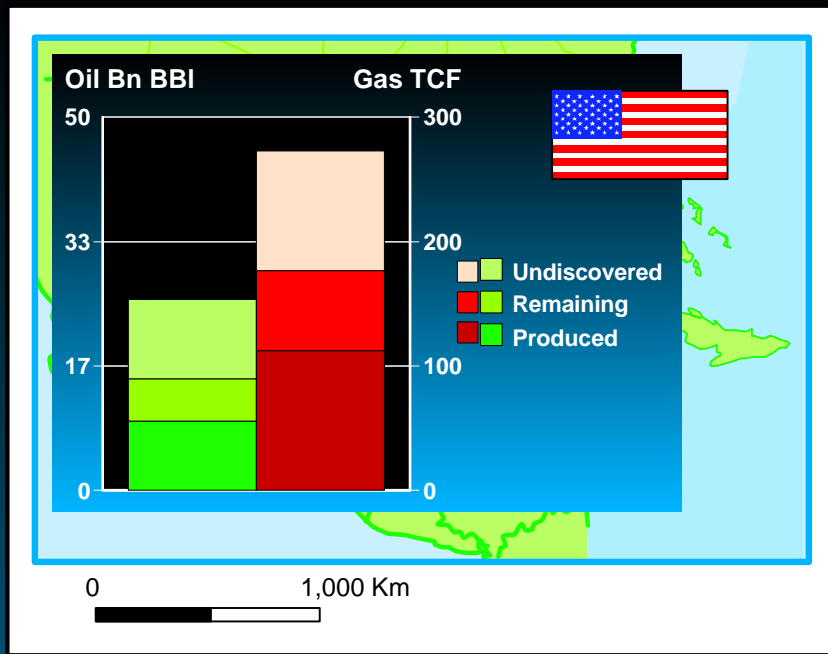


5 10 15
Number of Offshore Expl. Wells '000

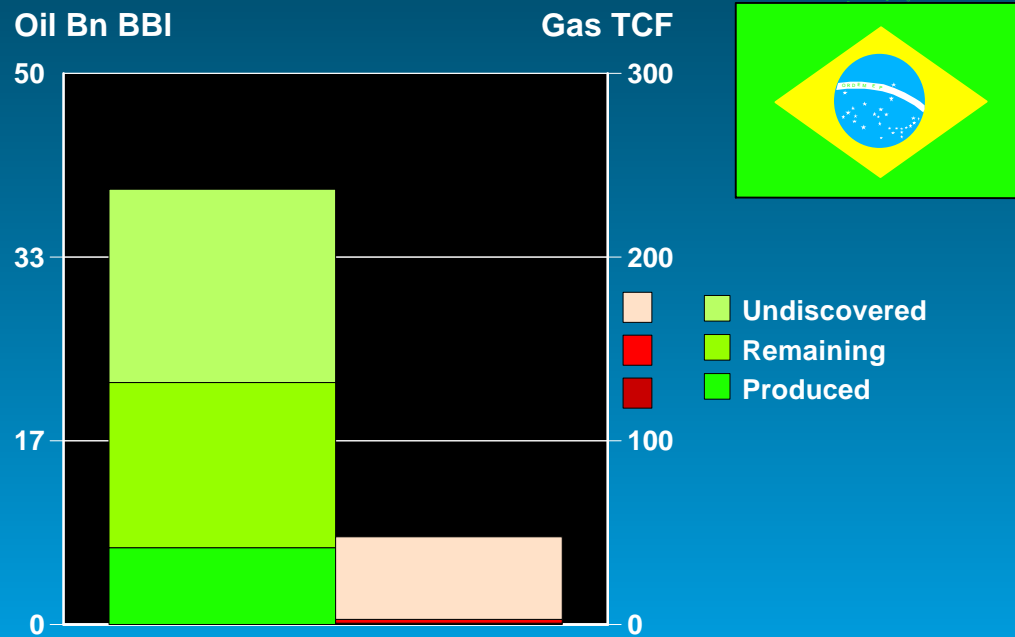
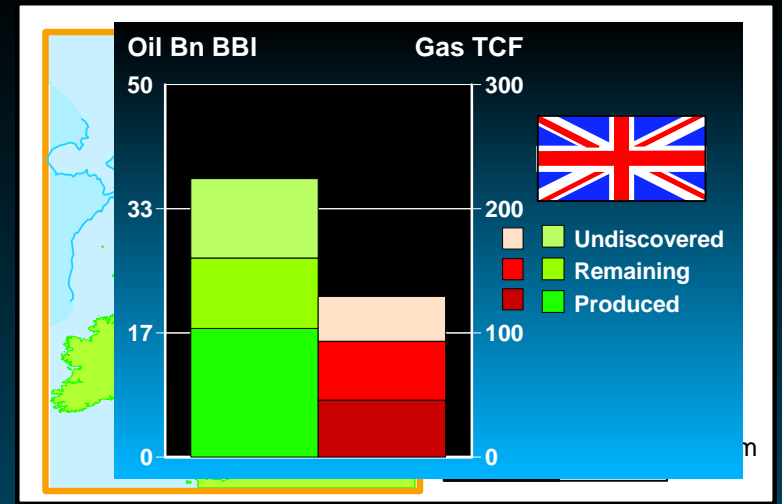
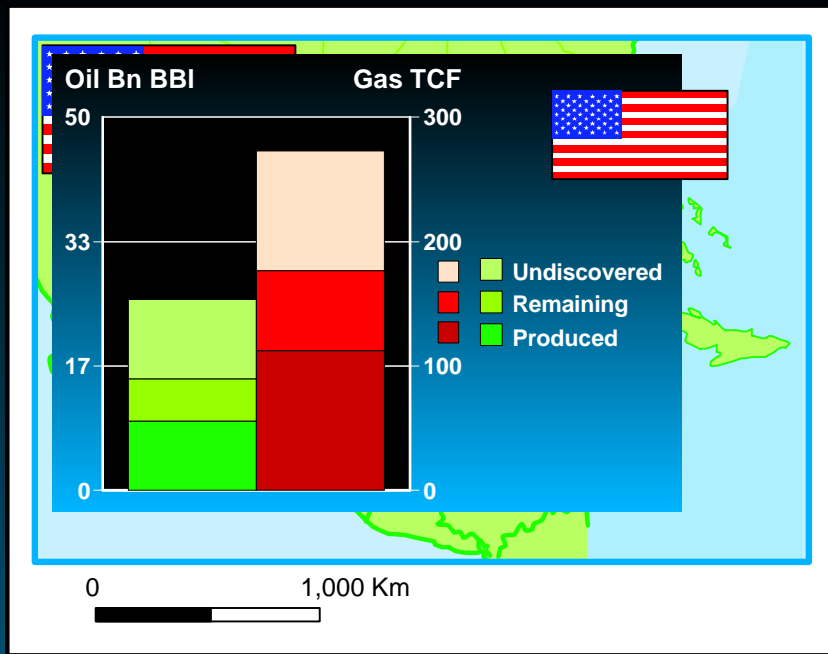




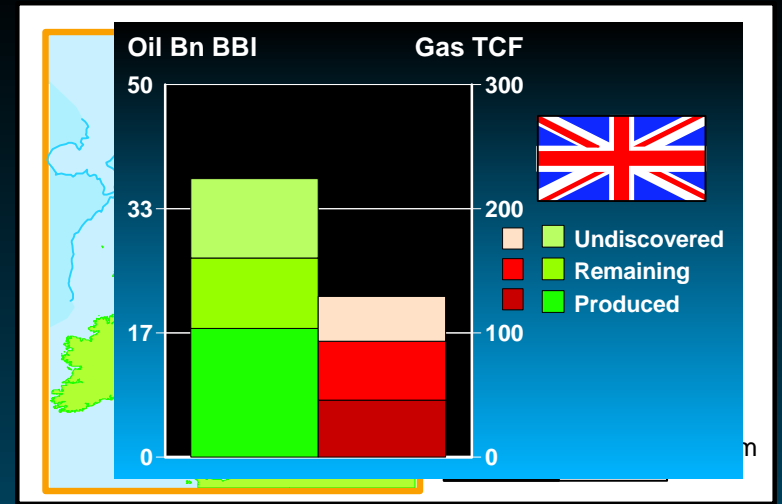
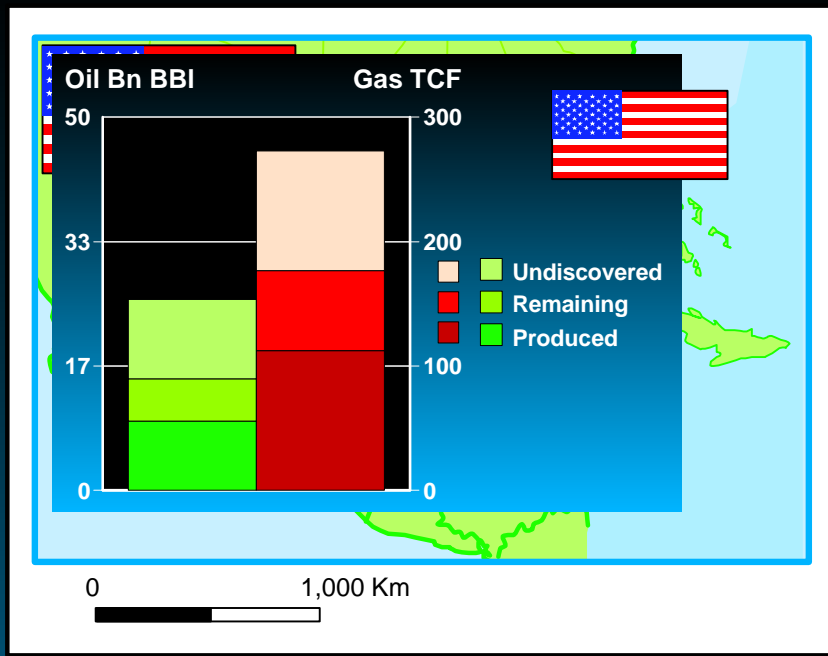
RESOURCES



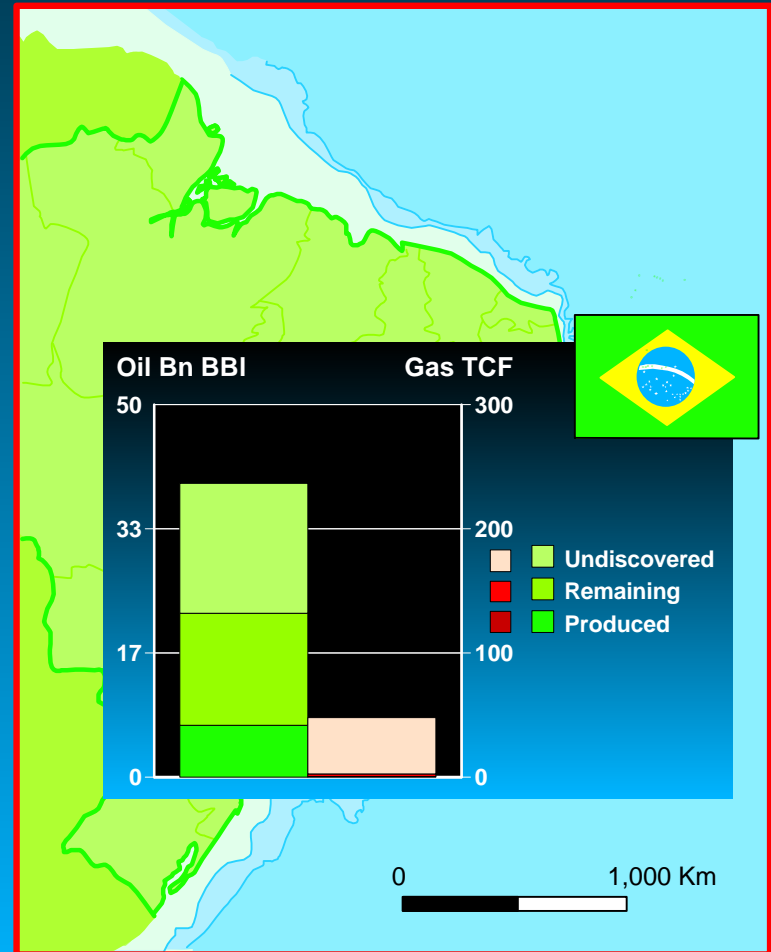
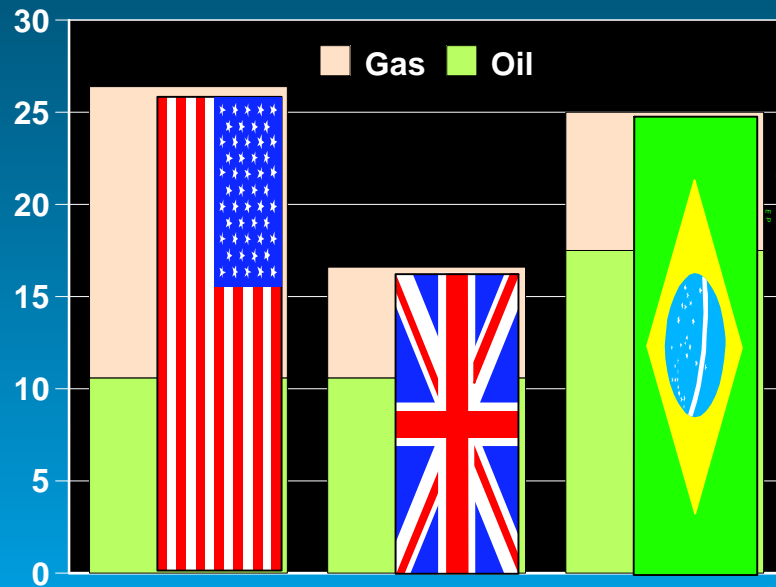
RESOURCES



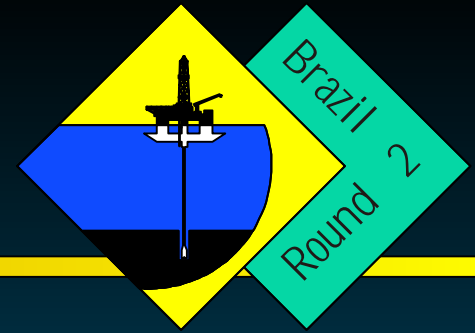
RESOURCES



Bn BOE BBI

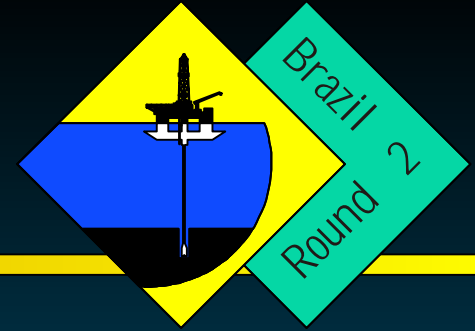


YET TO FIND ...



Now you know the size of the
cake

How can you get a slice?

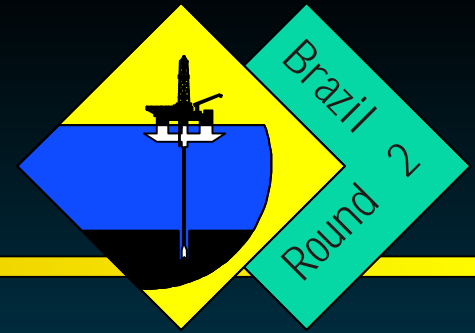


Brazil Round 2 is the
answer:

23 blocks

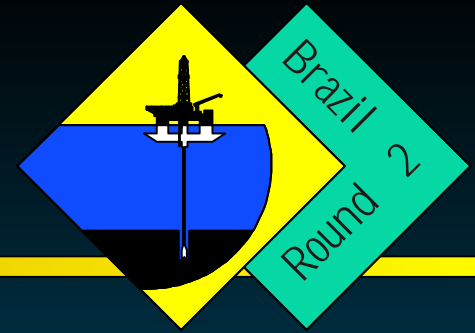
9 basins

Participation

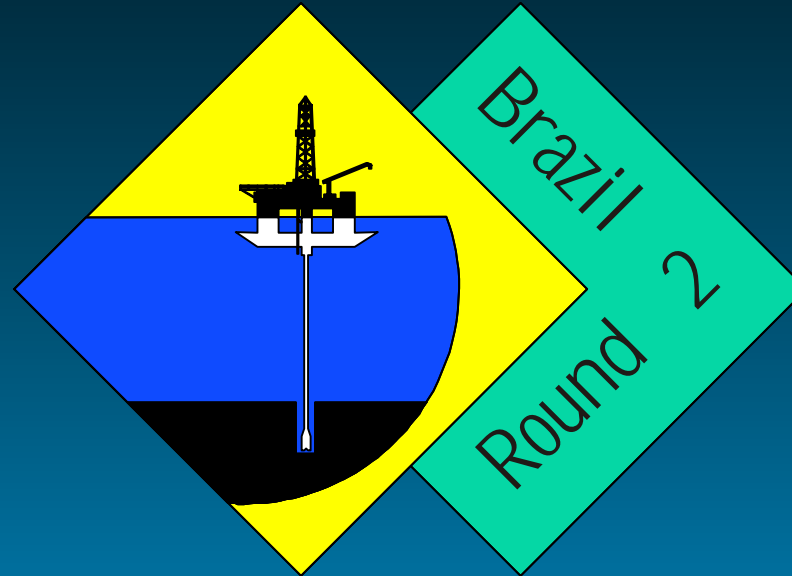
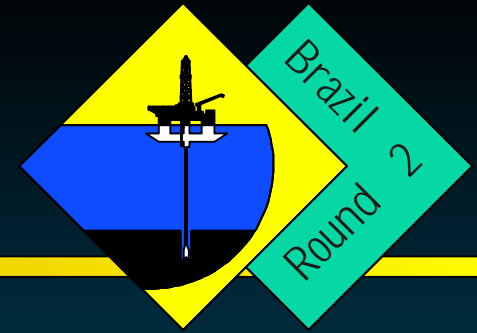


- To participate is a piece of cake !
 - ▶ Sign a Confidentiality Agreement
 - ▶ Pay Participation Fees
 - ▶ Qualify
 - ▶ Bid high !!!

Next Steps

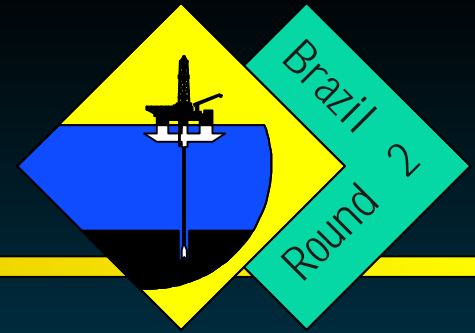


- Legal/fiscal/technical seminar: March 15-16
- Submission of qualification documents: 2nd quarter
- Bidding conference: Late 2nd quarter
- Contract signature: 3rd quarter

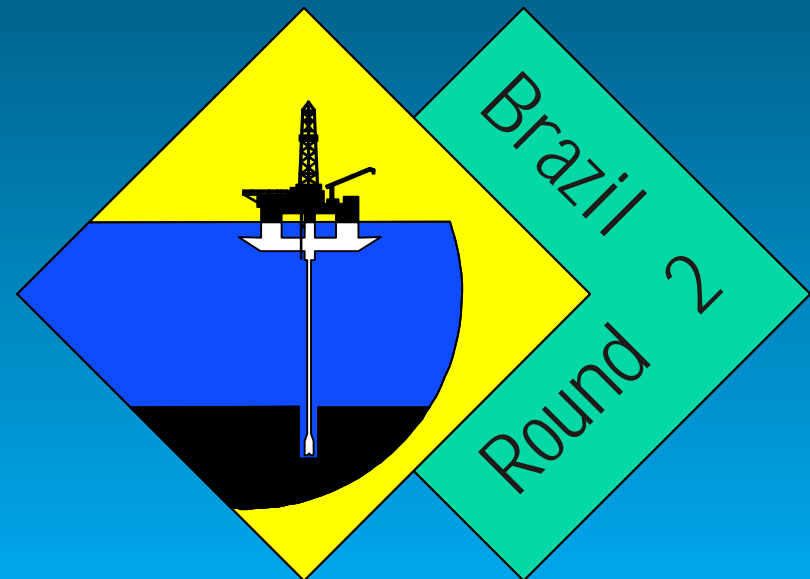


www.Brazil-Round2.com

Brazil-Round2@ibm.net



Brazil Round 2 (and a glass of wine !) is waiting for you



Brazil Exploration Opportunities Size Does Matter

Agência Nacional do Petróleo - ANP

Ivan Simões

Fábio Pinto

Sandro Mercio

