

Pre-Salt Super Play: Leading Brazil into the World's Top 5 Oil Suppliers*

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Search and Discovery Article #30625 (2019)**

Posted August 26, 2019

*Adapted from oral presentation given at AAPG Latin America and Caribbean Region Geoscience Technology Workshop, Rio de Janeiro, Brazil, June 13-14, 2019

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Abstract

The Brazilian Pre-Salt is the largest worldwide oil discovery in the last decades and it is the most important exploration play in the world, highly coveted by all supermajor oil companies. It is characterized by giant and supergiant fields with excellent quality carbonate reservoirs deposited between the Barremian and the Aptian. These thick and large production zones generally have high porosity and permeability, which is why pre-salt wells have very high productivity, reaching around 60 thousand boe/d. On average, these wells produce 17 thousand bbl/d which is 10 times more than the average production of the post-salt play. Due to these characteristics, in only 7 years, the pre-salt became the main producer play in Brazil, currently producing more than 1.5 million bbl/d, which represents more than 50% of the national oil production. Lula, Sapinhoa and Baleias Cluster are responsible for the vast majority of this production. Over the next five years, Buzios, Mero, Sururu, Berbigao, Itapu and Atapu fields will contribute to dramatically increase Brazilian oil production to 5.0 million bbl/d, leading the country to be among the top 5 oil producers in the world. In addition to the resources already discovered, there are also areas that have been acquired in Brazilian Petroleum Agency (ANP) bidding rounds over the last two years. These areas have geological potential for huge oil discoveries in the Pre-Salt play of both Campos and Santos basins. This potential is corroborated by the strong competition observed in the latest bidding rounds when the largest signature bonuses and profit oil were offered for concession and PSA contracts, respectively. ANP has estimated unrisks in place oil volumes of over 60 billion barrels for these blocks and new discoveries are expected soon. By 2035, considering the potential of these blocks, Brazil could be producing 8.0 to 9.0 million bbl/d, positioning the country in an extremely strategic position as one of the world's largest oil suppliers.



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Latin America & Caribbean Region

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Pre-salt Super Play: Leading Brazil into the World's Top 5 Oil Suppliers

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June, 13th, 2019

Outline

Brazil Oil Industry Scenario

Pre-Salt Super Play & Oil Production Forecast

Upcoming Licensing Rounds in Brazil

Conclusions

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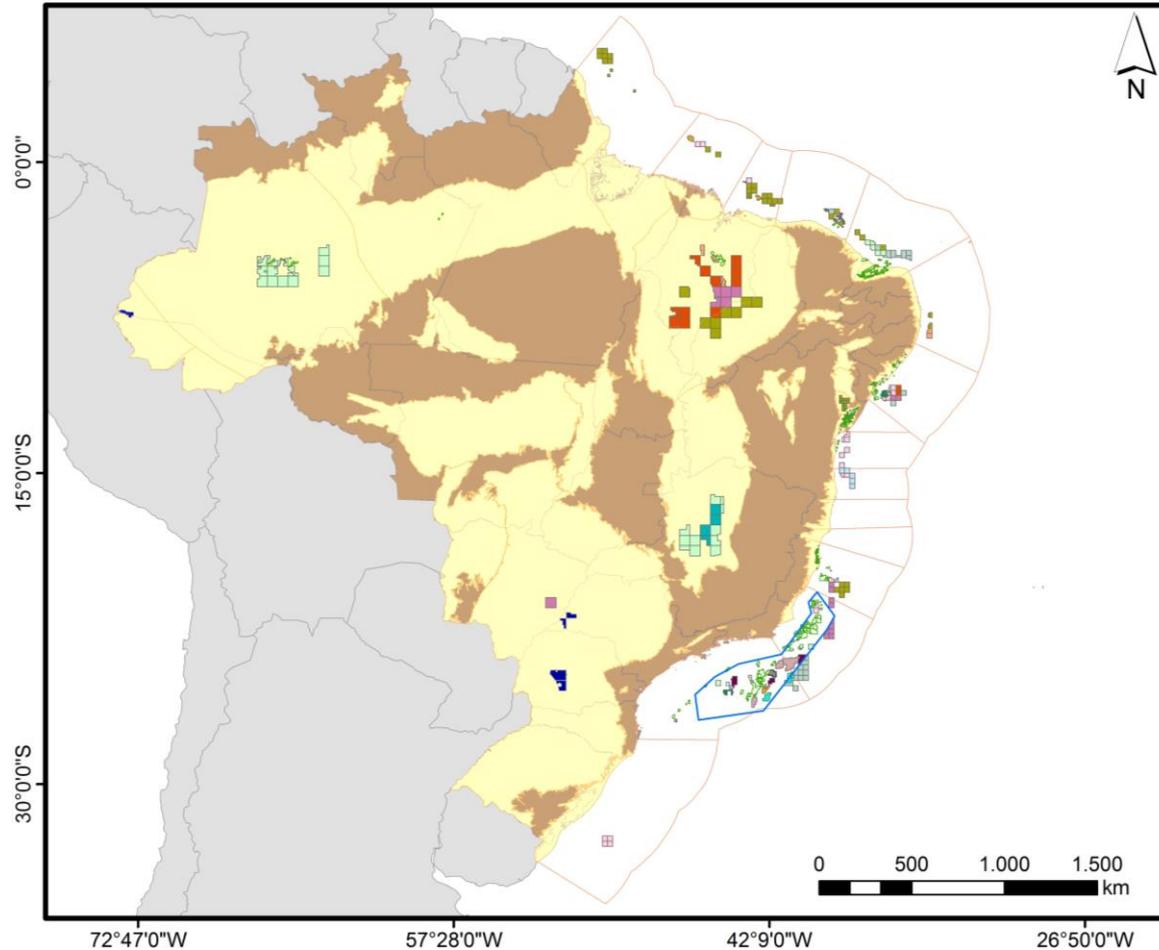
Upstream



Downstream



Brazil Oil Industry Scenario



Area under concession
~ 264,000 km²

310 Blocks

439 fields

Production
(April, 2019)

Oil 2.604 million barrels/d
Natural Gas 113 million m³/d

Proven Reserves
(Dec, 2018)

Oil 13.2 billion barrels
Natural Gas 368 billion m³

10th largest oil producer in the world and the largest in Latin America

Oil Production

1998

Production (Dez, 1998)

970 thousand bbl/d
30 million m³/d

2018

Production (Dec, 2018)

2.56 million bbl/d
111 million m³/d

Oil Export
(2000)

18.68 bbl/d

Crude Oil Export
(Dec, 2018)

1 million bbl/d



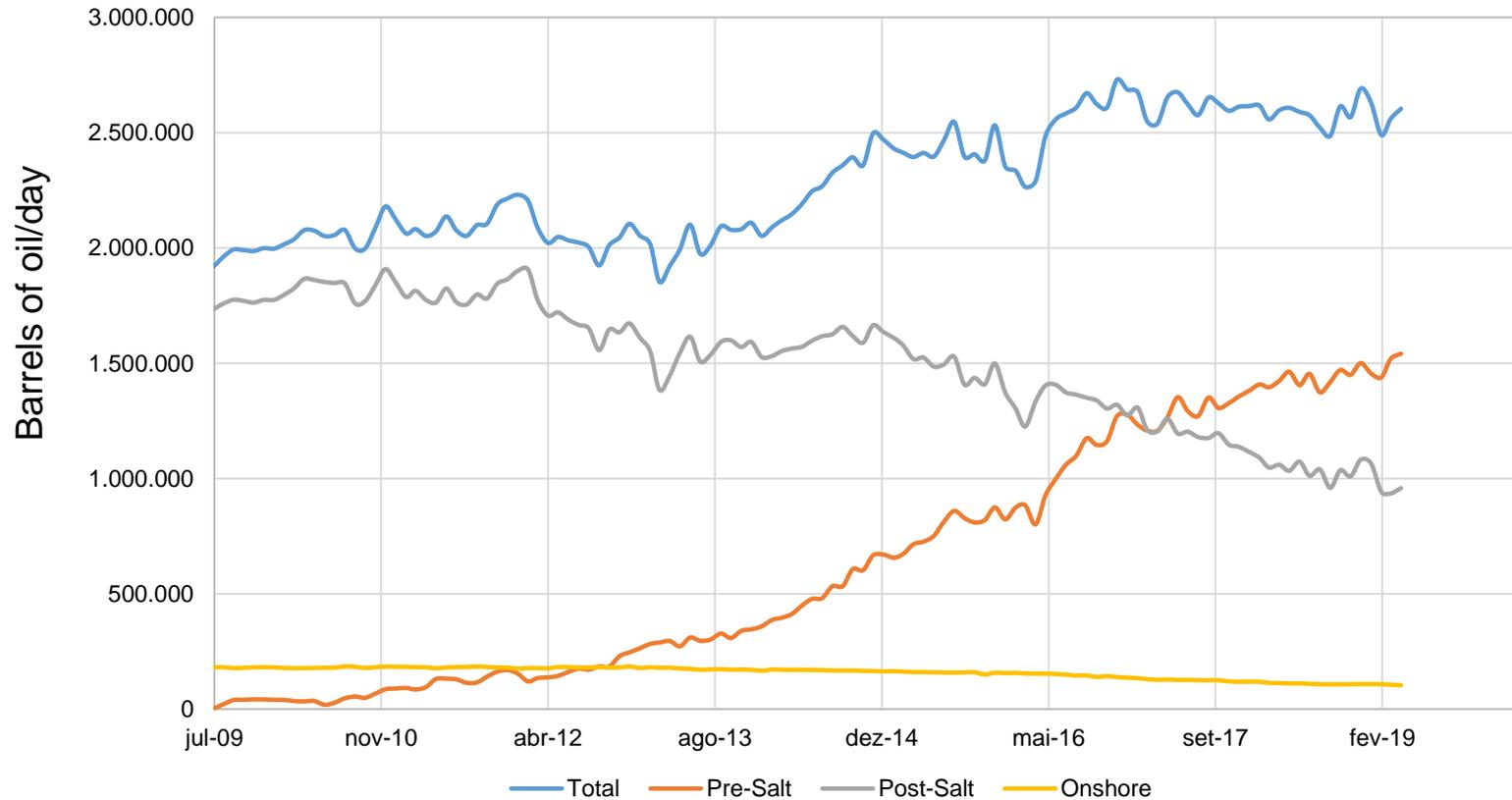
E&P Environments



Average oil production per well

Pre-salt Super Play	High quality Carbonate Reservoirs underneath the salt layer High well productivity Potential for giant or supergiant oil discoveries	 17,655 bpd 85 wells
Conventional Offshore	Eastern and Equatorial Margin Potential for oil discoveries from the Upper Cretaceous to Paleogene turbidite reservoirs	 1,650 bpd 628 wells
Onshore	Mature Basins (Remaining Potential) New Frontier Basins Solimoes Basin: Potential for light oil accumulations Paleozoic and Proterozoic basins: gas prone	 16 bpd 6,683 wells

Oil Production



Proven Reserves



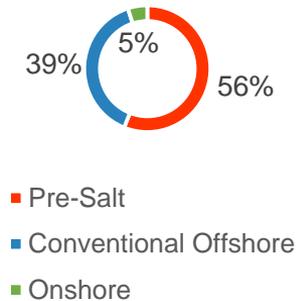
December, 2018

15 Billion boe

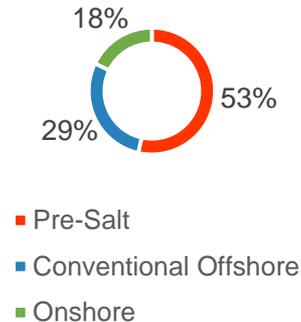
Oil
13.2
Billion bbl

Gas
368
Billion m³

Oil Proven Reserves



Gas Proven Reserves



Pre-Salt



Conventional Offshore



Onshore



Outline

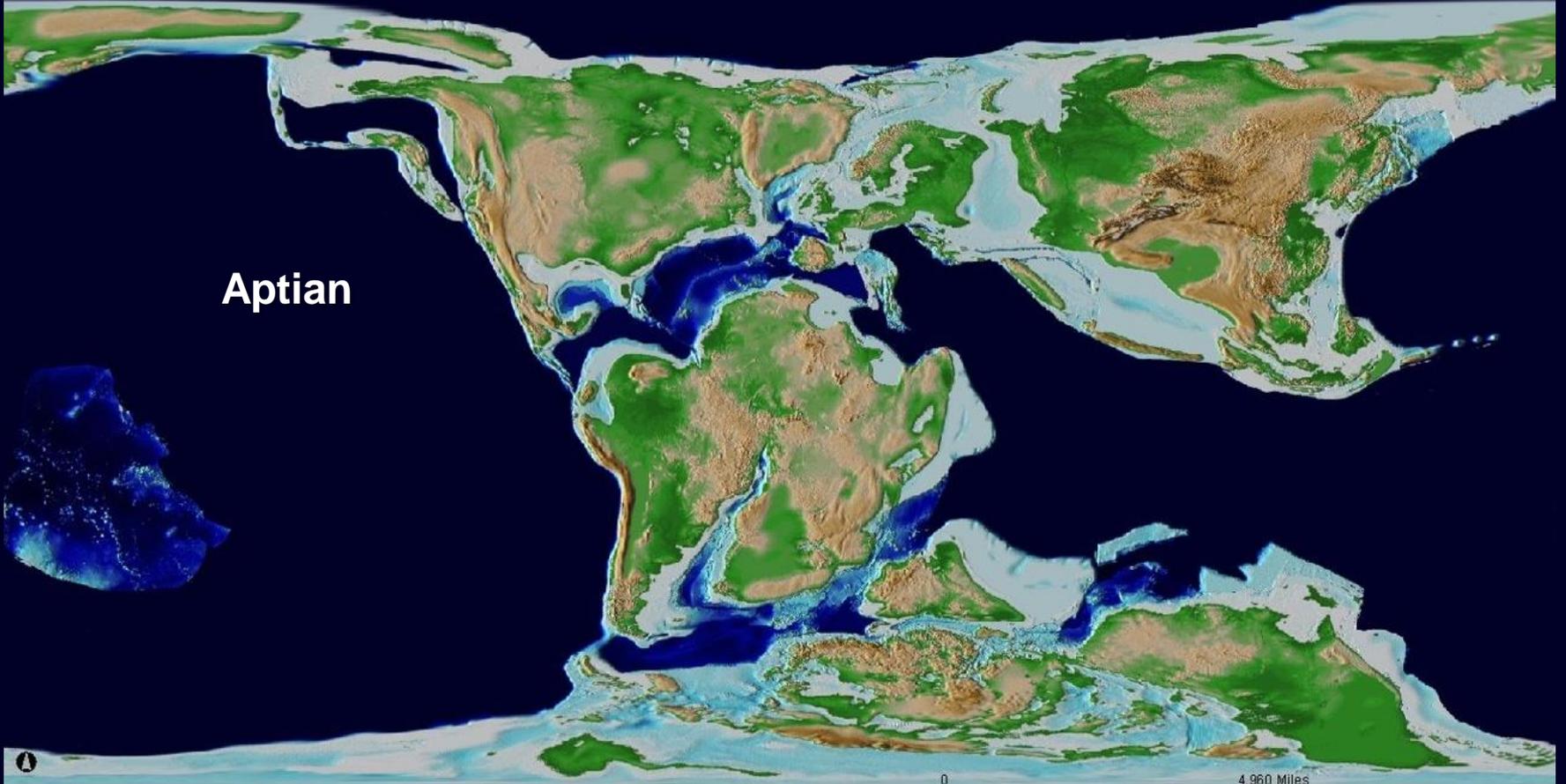
Brazil Oil Industry Scenario

Pre-Salt Super Play & Oil Production Forecast

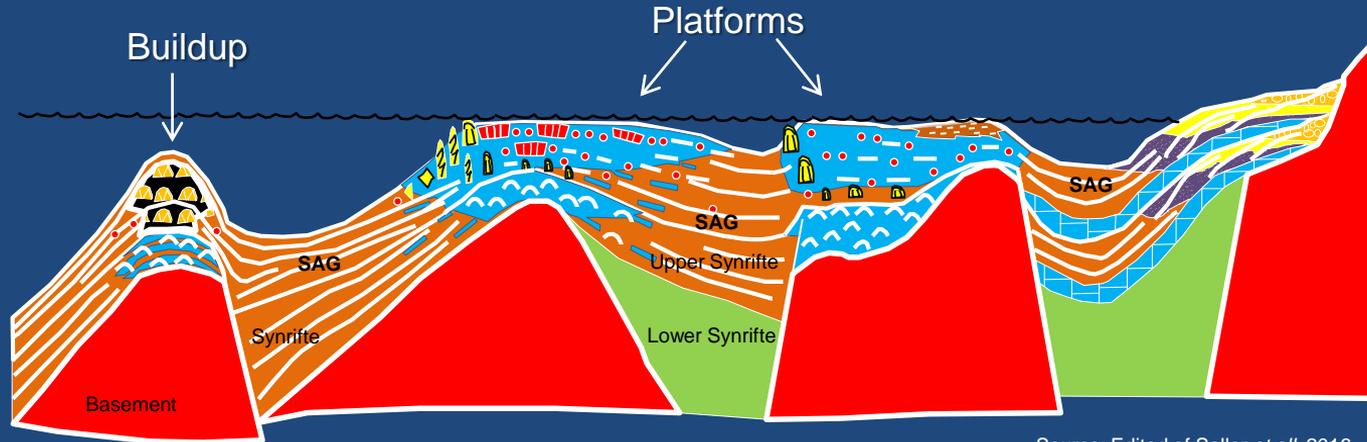
Upcoming Licensing Rounds in Brazil

Conclusions

Pre-Salt Super Play



Depositional Model



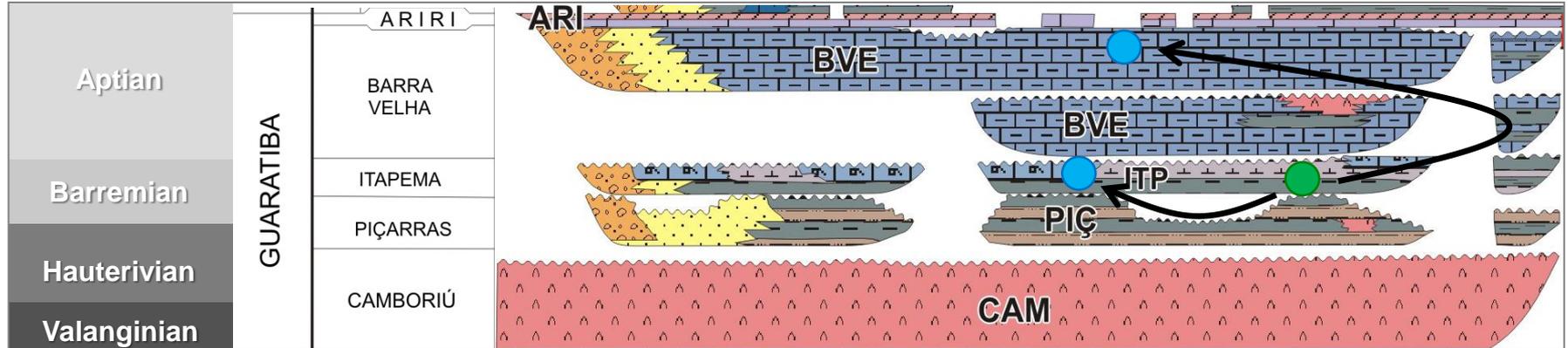
Source: Edited of Saller *et al.*, 2016.



Pre-salt Super Play

Petroleum systems

Itapema – Itapema/Barra Velha



Pre-salt Reservoirs

Facies examples – Buzios Field

Spherulite



Schrubs



Mero Field
Well 2-ANP-2A-RJS

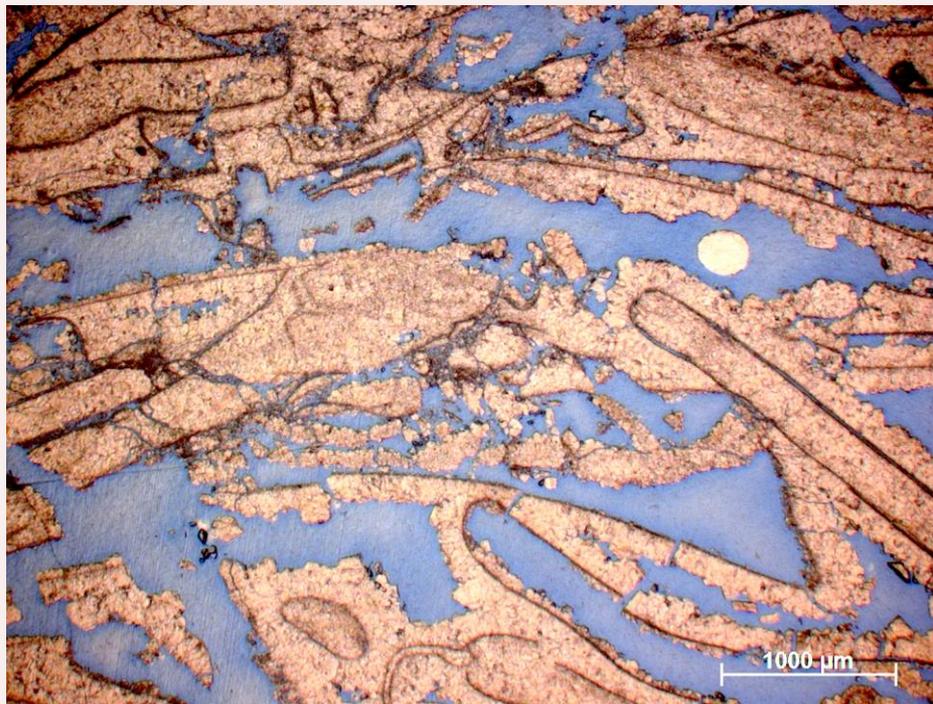
Calcirudite



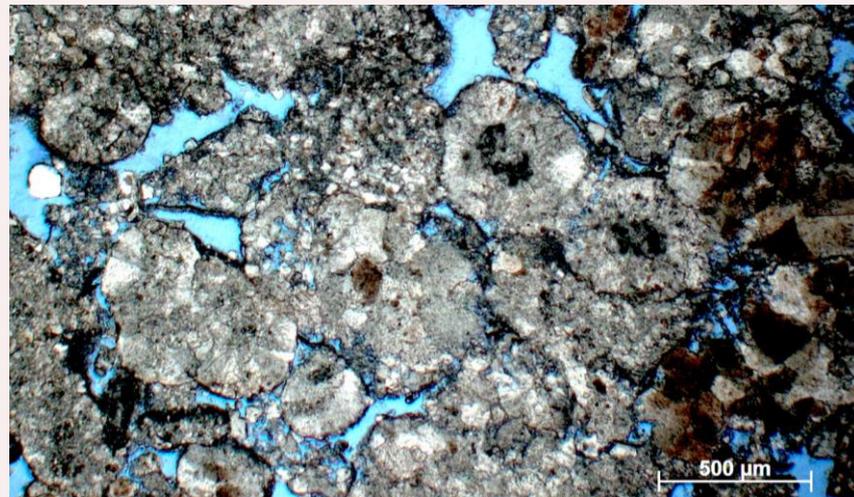
Pre-salt Reservoirs

Thin section petrography

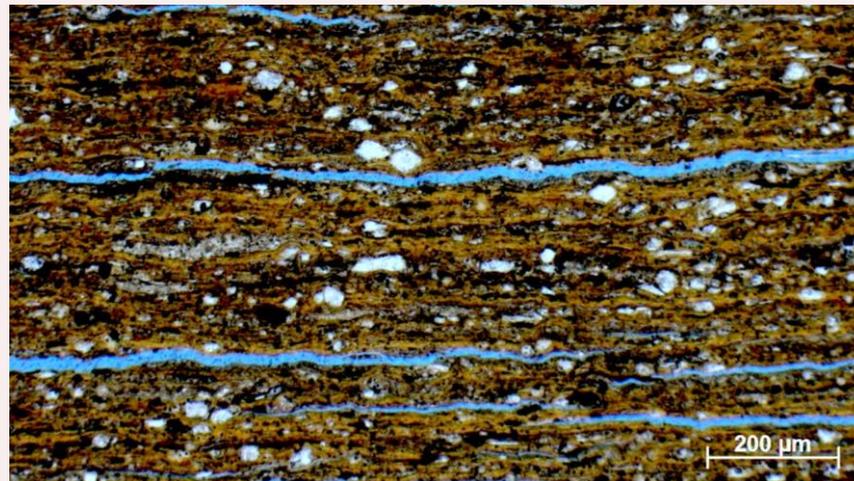
Calcirudite

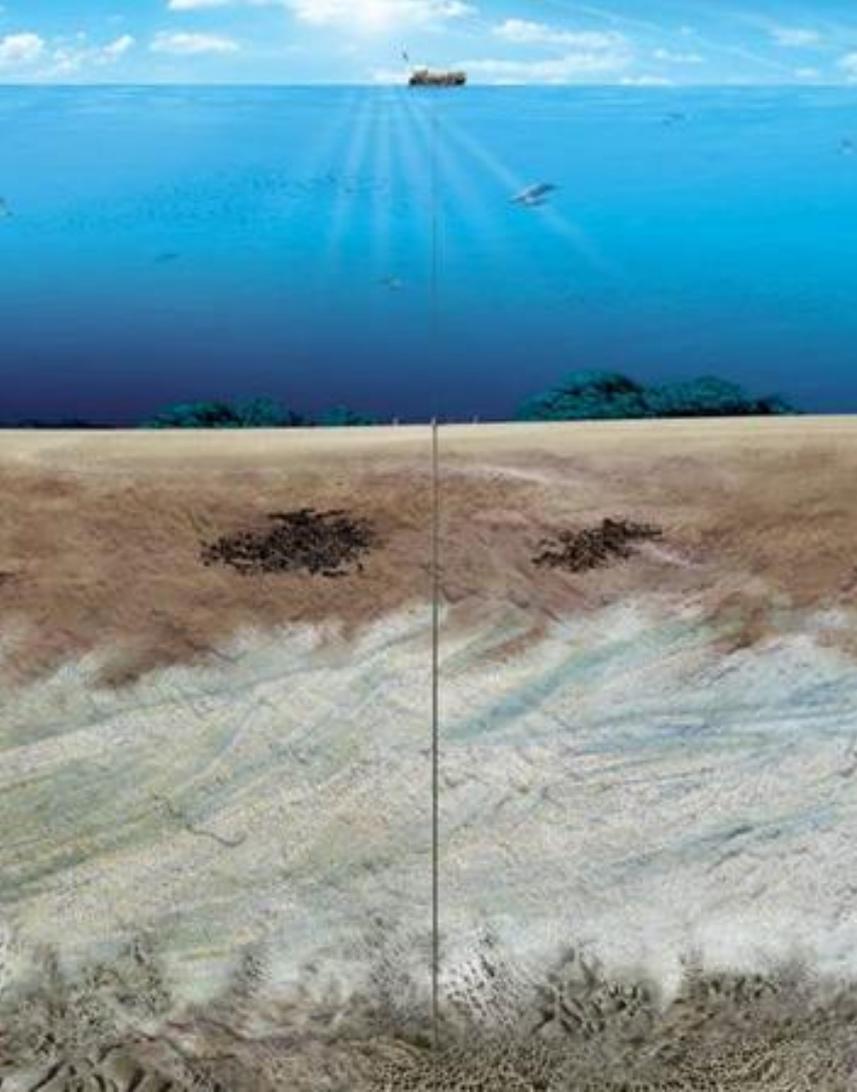


Spherulitic Calcarenite



Laminated Calcilutite





Pre-Salt Super Play comprises huge accumulations underneath the salt layers

Light Oil with excellent quality accumulations and high commercial values:

Great prospectivity, potential for giant and supergiant oil fields

High wells productivity related to high quality carbonate reservoirs and extensive and thick production zones.

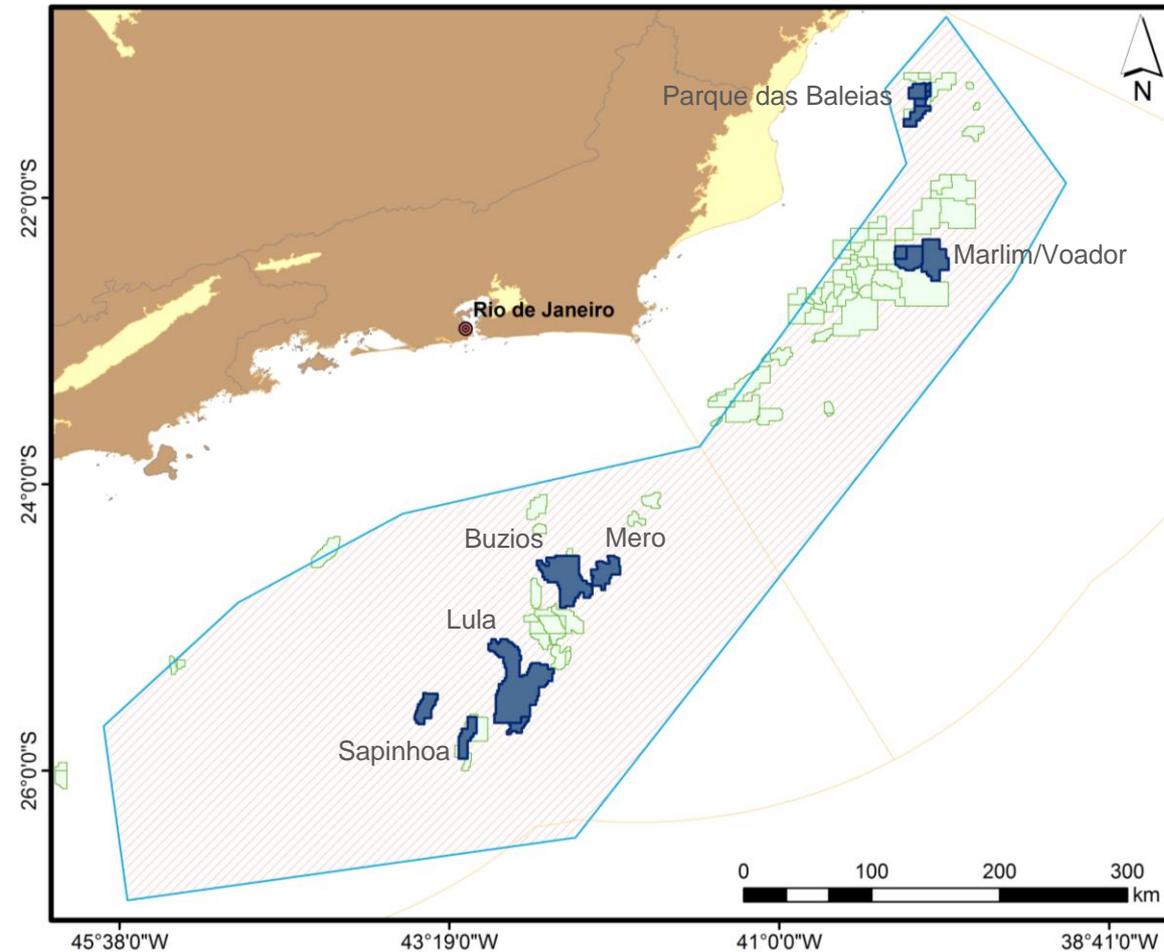
Pre-Salt Super Play accounts for 1.5 million barrels of oil/day

Lula (45 wells)
Oil: 909,240 bbl/d
Gas: 38 MM m³/d

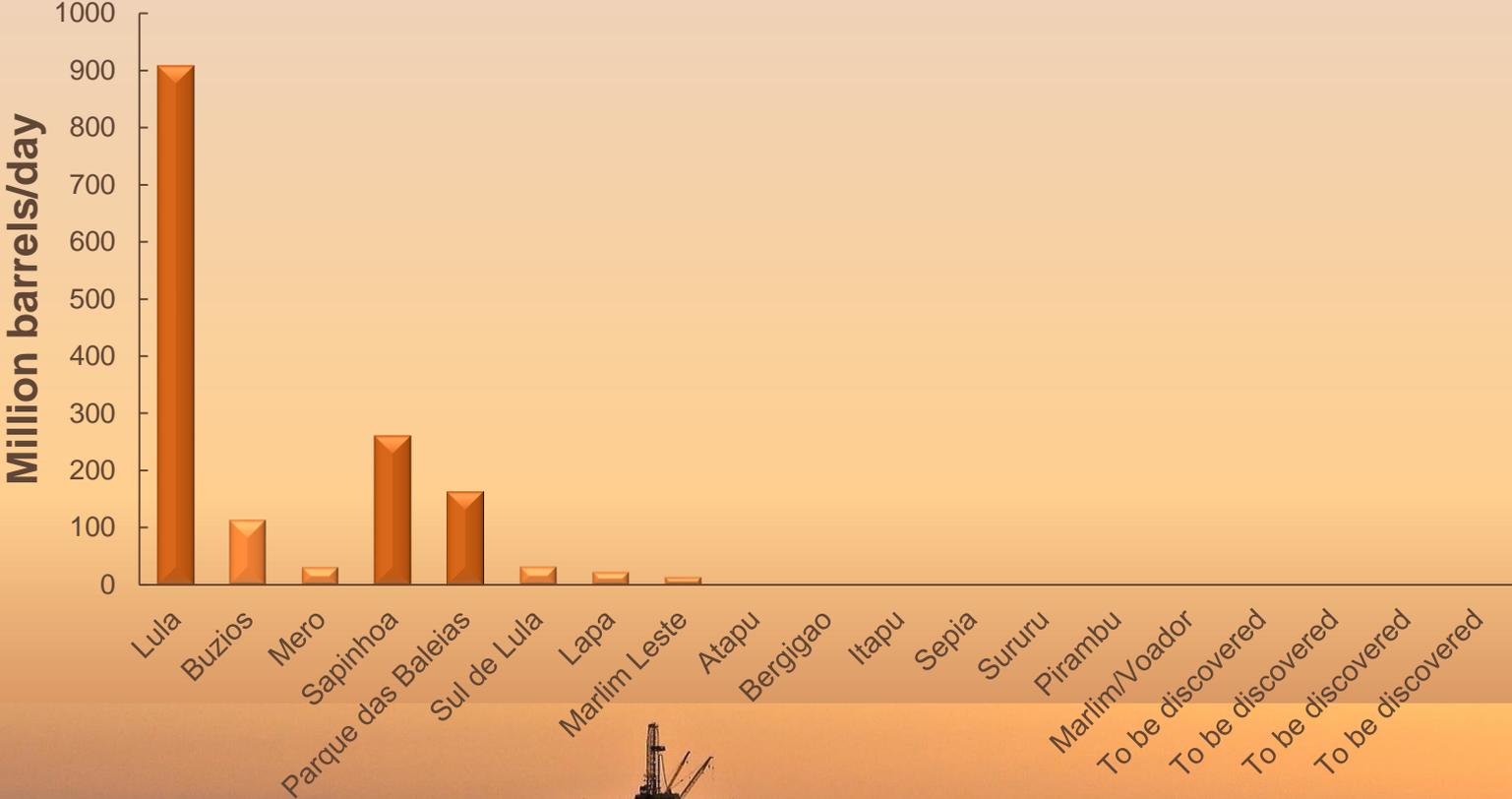
Buzios (6 wells)
Oil: 112,870 bbl/d
Gas: 4.21 MM m³/d

Sapinhoa (14 wells)
Oil: 260,590 bbl/d
Gas: 10.96 MM m³/d

Parque das Baleias (14 wells)
Oil: 163,140 bbl/d
Gas: 5.71 MM m³/d



Pre-Salt Super Play Production

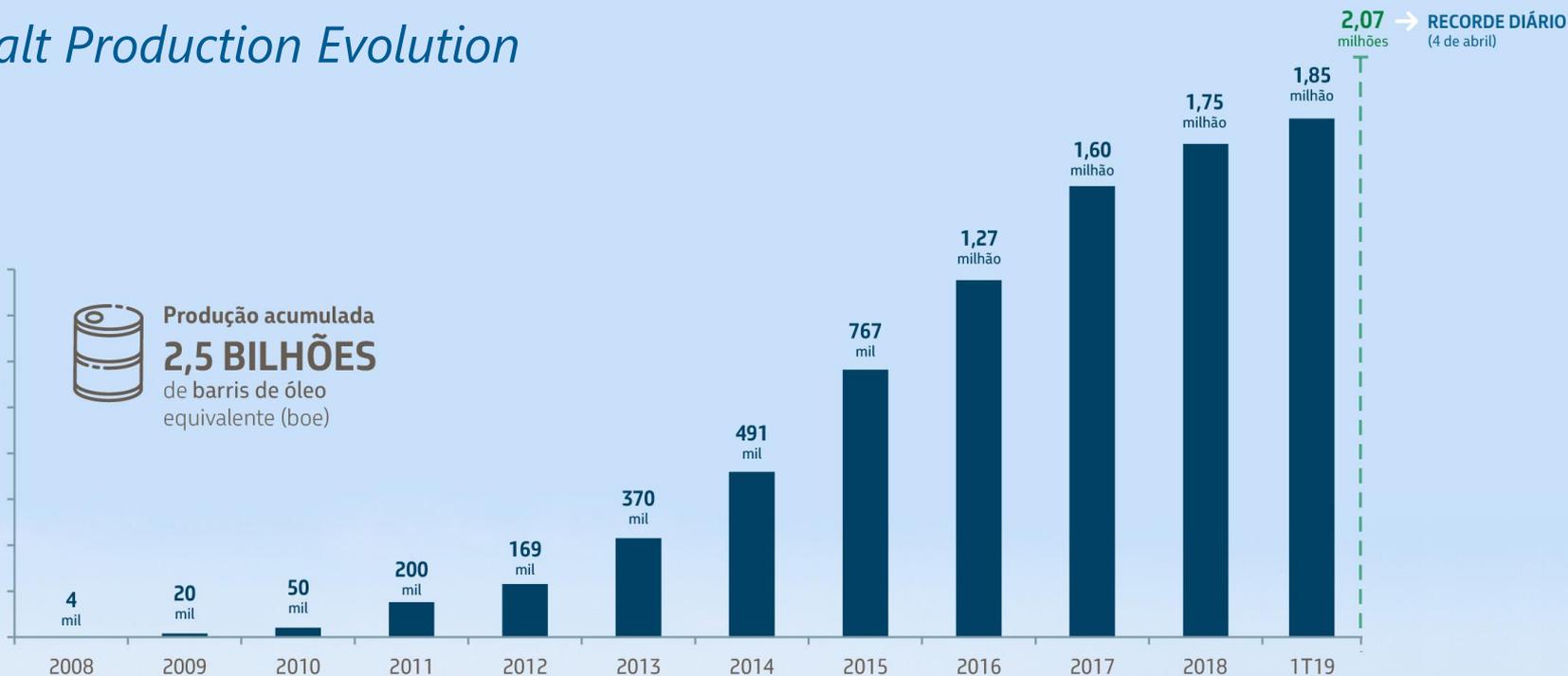


Pre-Salt Production Evolution

Média anual
em barris
de óleo
equivalente
(boe)



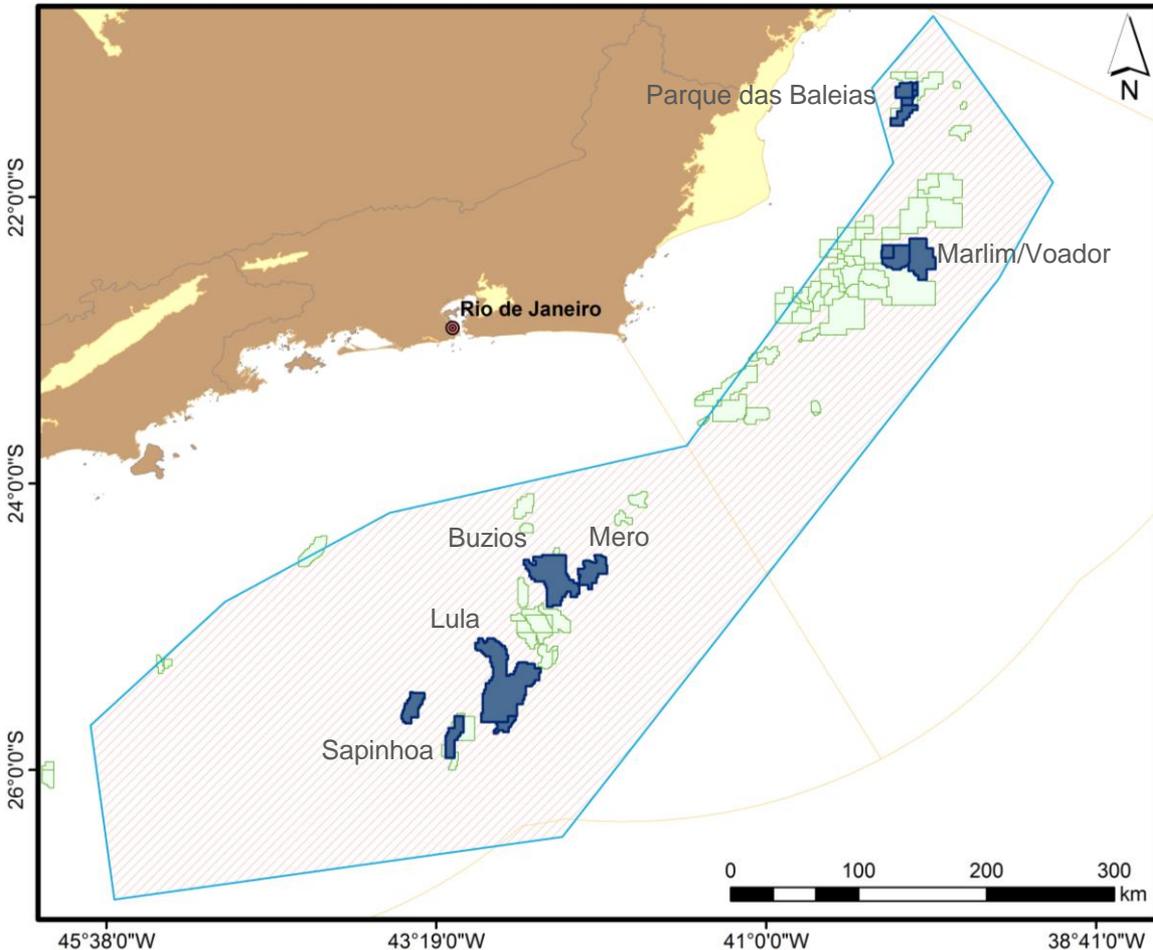
Produção acumulada
2,5 BILHÕES
de barris de óleo
equivalente (boe)



The Pre-Salt production is derived from
91 wells:

69 in Santos Basin
22 in Campos Basin





Huge prospectivity for oil discoveries:

The majority of the recoverable resources are yet to be produced

Pre-salt fields under development phase or in early stages of production:

Buzios
Mero
Sepia
Berbigão
Sururu

Libra Discovery is still under evaluation

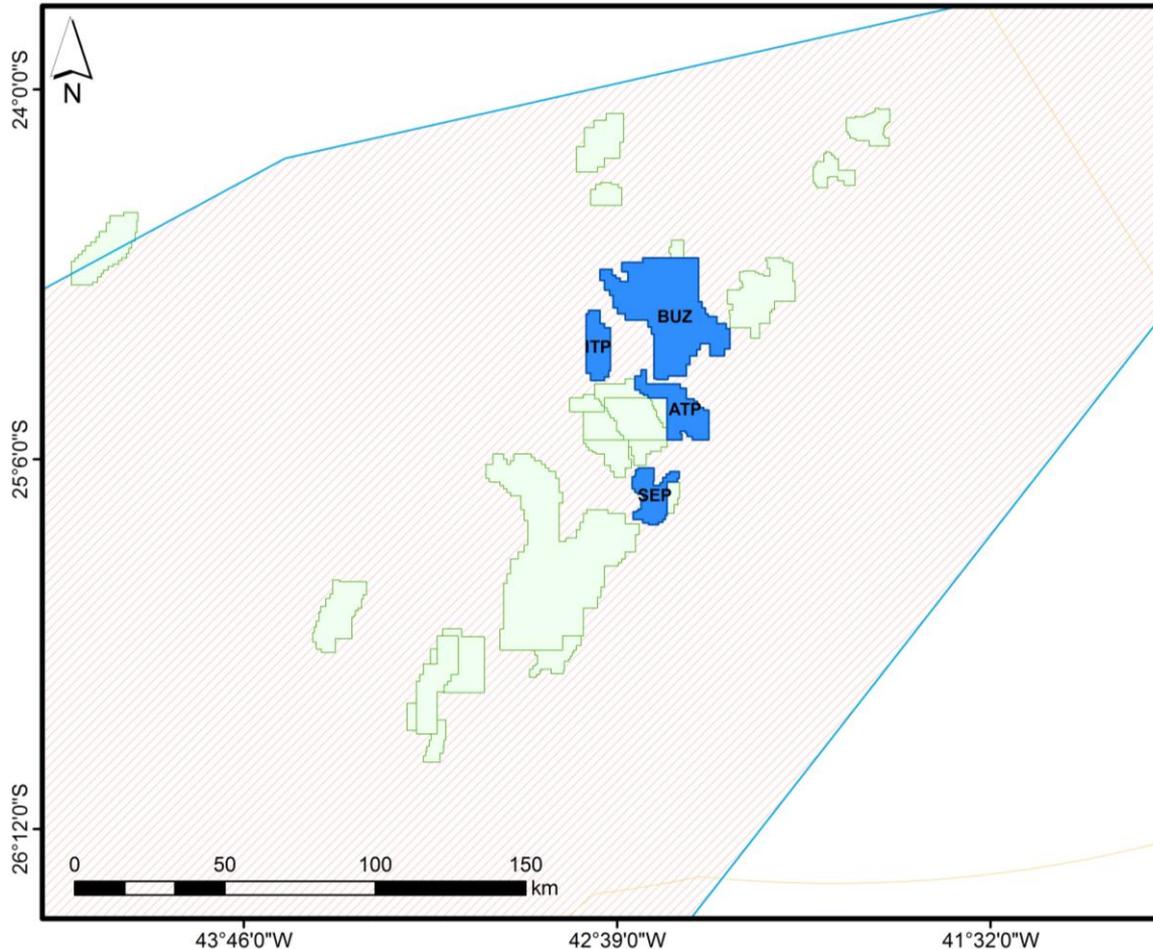
Transfer of Rights Surplus

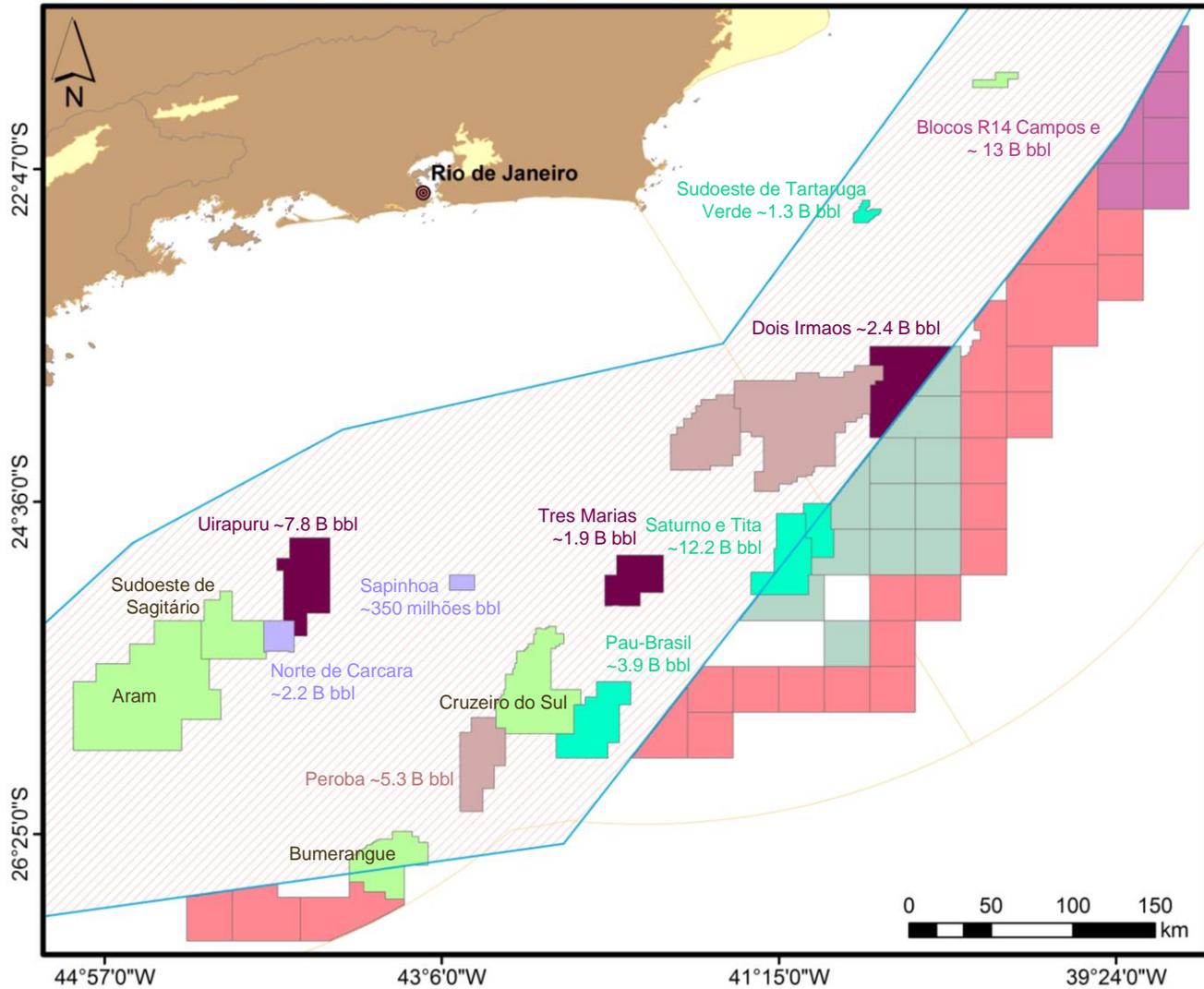
Atapu
Buzios
Itapu
Sepia

Potential Recoverable
resources:

6.0 – 15.0 billion boe

These alone could increase
Brazil's Oil Production in
2.0 million bbl/d





Blocks R14
~13 billion bbl

Blocks LP2
~2.5 billion bbl

Peroba LP3
~5.3 billion bbl

Blocks R15
~9 billion bbl

Blocks LP4
~12.1 billion bbl

Blocks LP5
~17 billion bbl

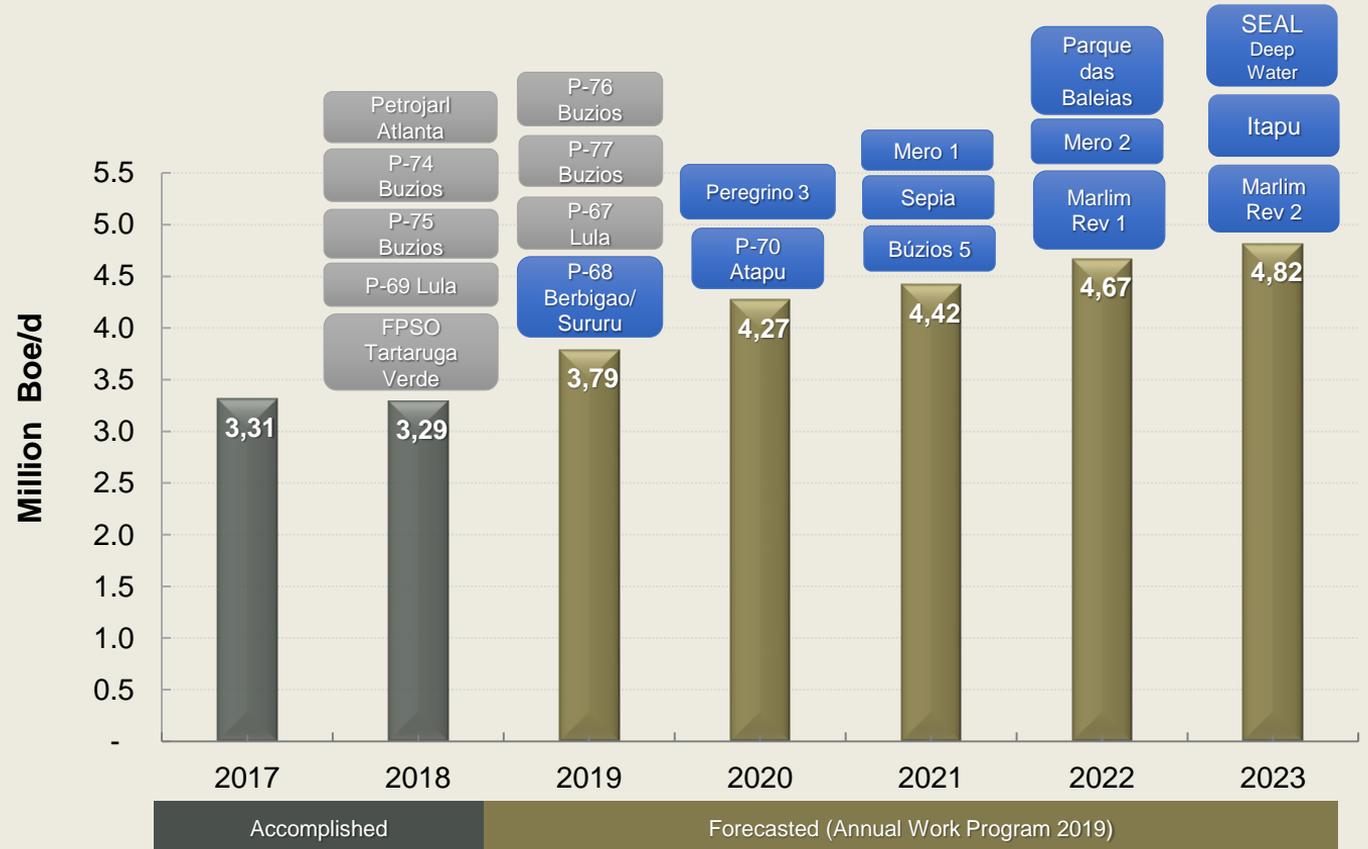
Blocks LP6
~42 billion bbl

Unrisked in place volume
greater than

100 B bbl*

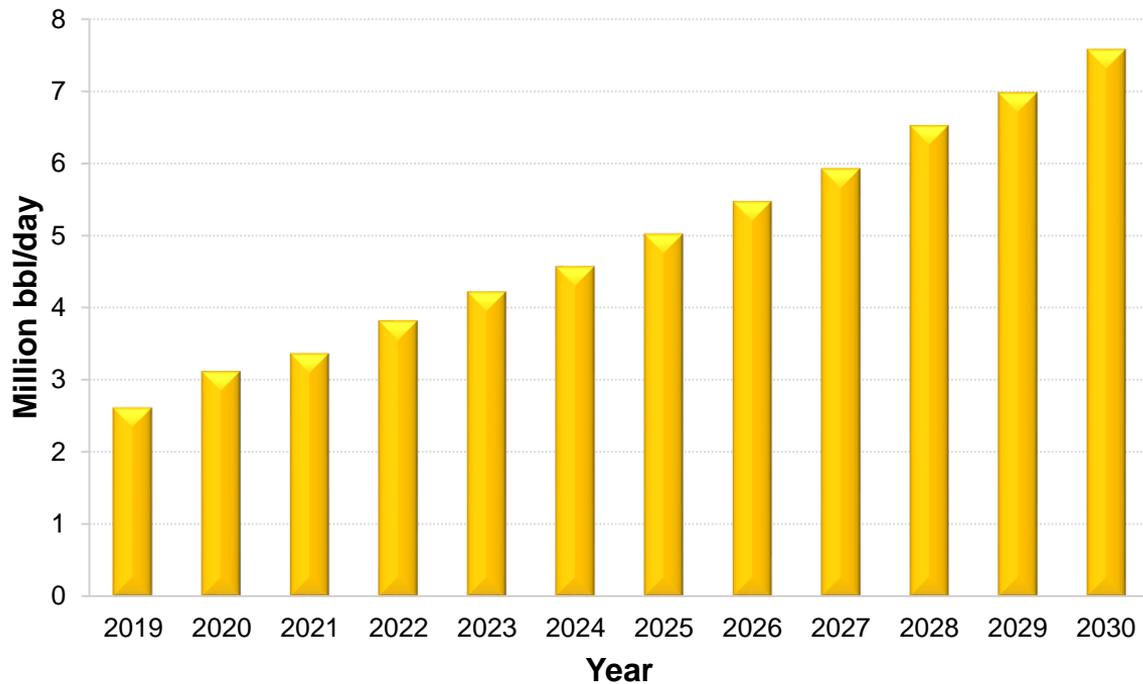
** It includes estimate for the areas on offer in the 6th Pre-Salt Auction and it do not take in consideration volumes still being forecasted for 16th bidding round*

Oil Production Forecast



Future Perspectives

Simplified Production Forecasting Exercise



Assumptions

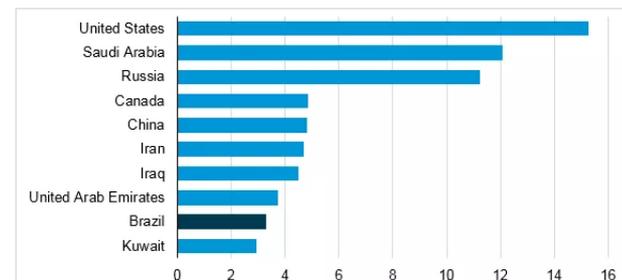
Petrobras Business Plan

Transfer Of Rights Surplus

Very promising potential in the areas awarded in the last ANP Auctions

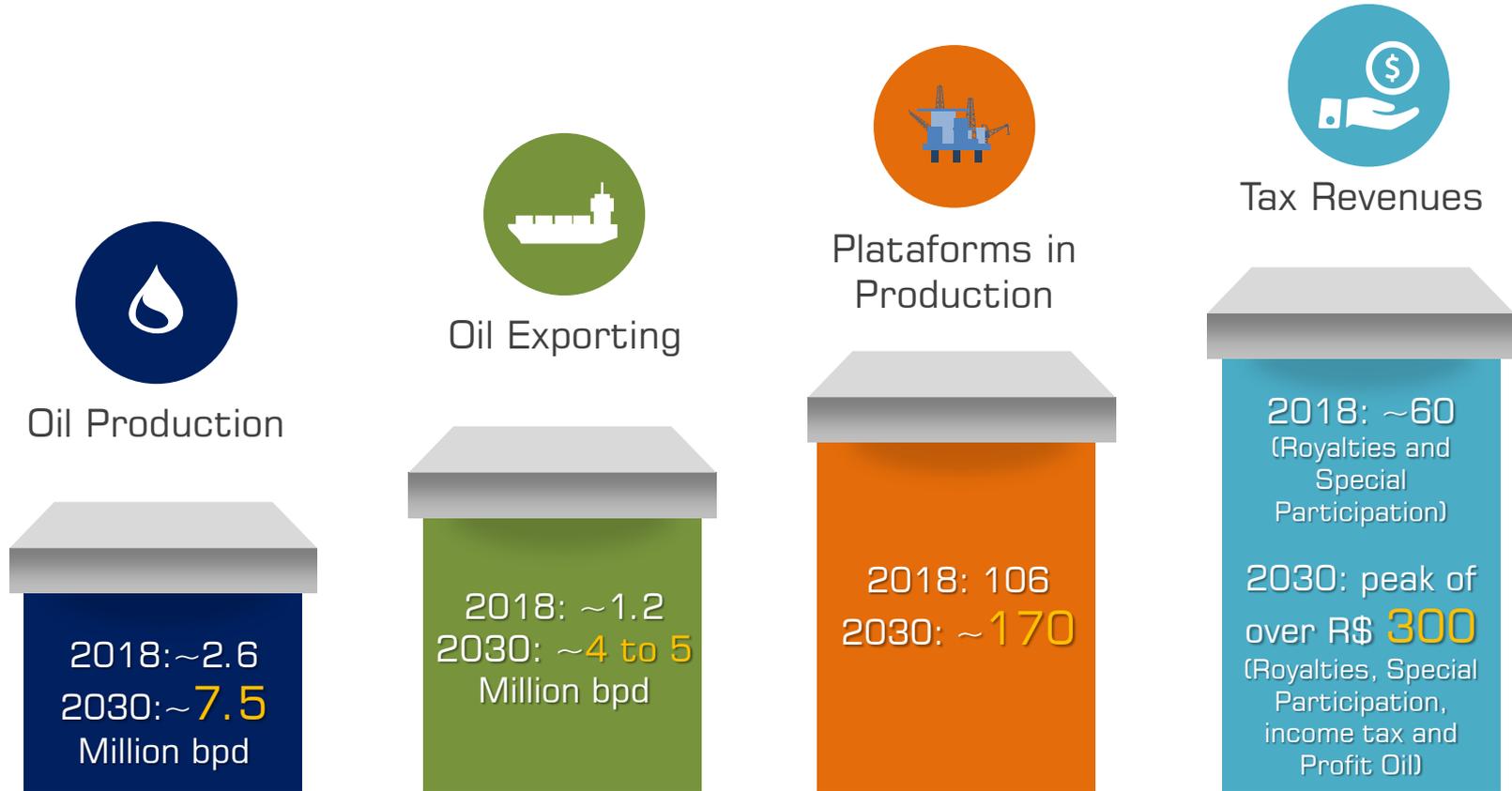
Diverse of Operators

Top ten global producers of petroleum and other liquids (million barrels per day)



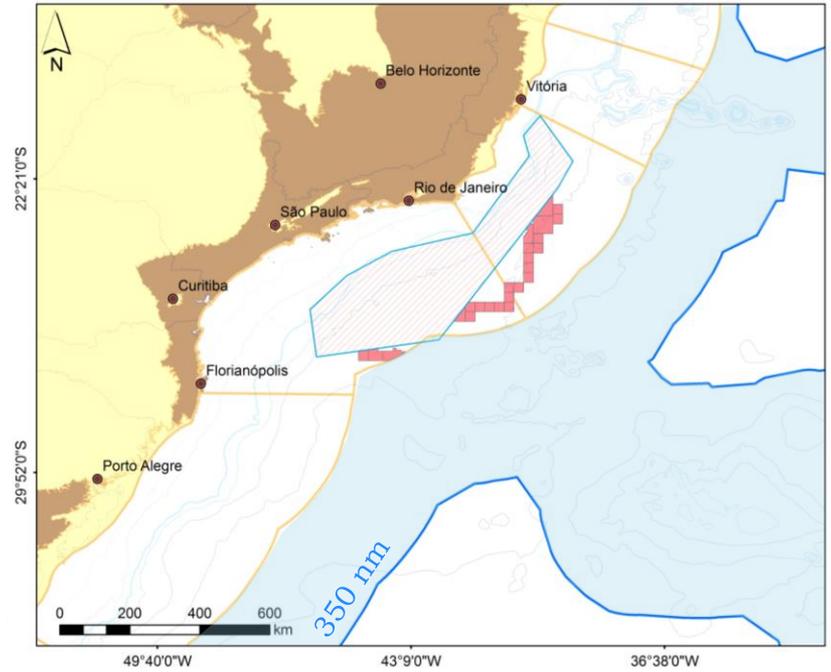
A game breaking change in the Oil Industry

2030: progress can be achieved





Pre-Salt Potential beyond the 200 nm



Outline

Brazil's Current State

Pre-Salt Super Play & Oil Production Forecast

Upcoming Licensing Rounds in Brazil

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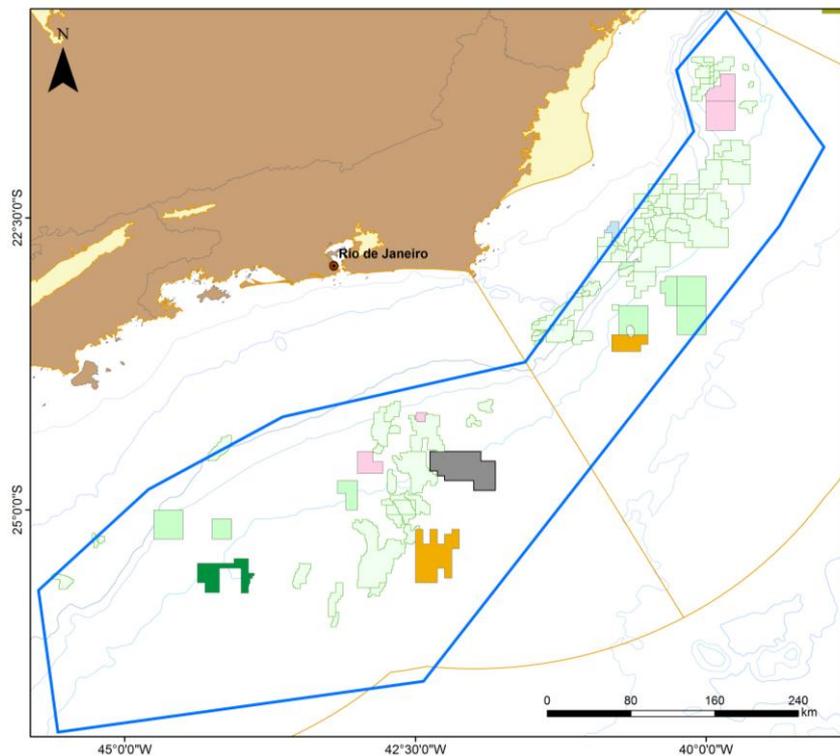
bidding rounds results

2017-2018

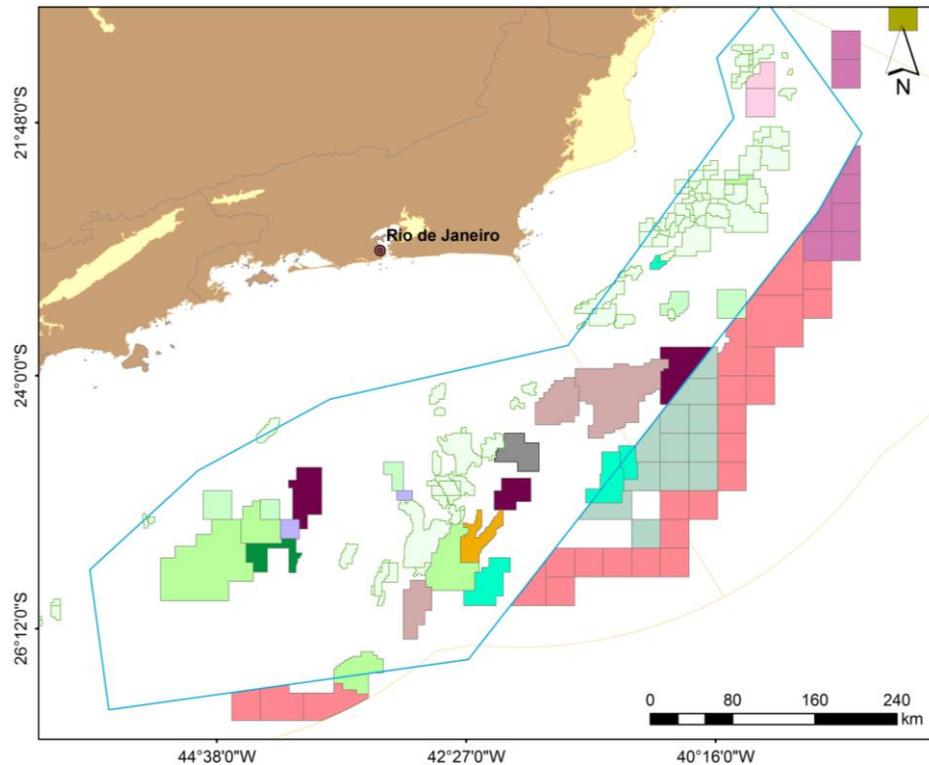
Bidding Round	Blocks Awarded	Signature Bonuses (billion R\$)
14 th Bidding Round	37	3.84
15 th Bidding Round	22	8.01
2 nd Pre-Salt Auction	3	3.30
3 rd Pre-Salt Auction	3	2.85
4 th Pre-Salt Auction	3	3.15
5 th Pre-Salt Auction	4	6.82
Total	72	27.97

Pre-Salt Exploration Scenario Evolution

2015



2019



TRANSFER OF RIGHTS SURPLUS
Brazil
PRODUCTION SHARE

PRE-SALT
Brazil
PRODUCTION SHARE

ROUND
Brazil
OIL AND GAS CONCESSIONS

6
16

TRANSFER OF RIGHTS SURPLUS
16TH BIDDING ROUND
6TH PRE-SALT AUCTION

2018



2019



2020



2021



OPEN ACREAGE

OPEN
ACREAGE
Brazil
OIL AND GAS CONCESSIONS

PRE-SALT
Brazil
PRODUCTION SHARE

ROUND
Brazil
OIL AND GAS CONCESSIONS

8
18

8TH PRE-SALT AUCTION
18TH BIDDING ROUND

7TH PRE-SALT AUCTION
17TH BIDDING ROUND

PRE-SALT
Brazil
PRODUCTION SHARE

ROUND
Brazil
OIL AND GAS CONCESSIONS

7
17



Open Acreage

Continuous offer of blocks and mature fields.

Companies can bid on blocks not sold in previous auctions.

Applications can be submitted anytime and not just at designated points.

It will promote exploration activity in onshore areas where there are more small and medium size companies.

Open Acreage

600 blocks

New Frontier & Gas Prone Basins:

Parana, Parnaiba and Tucano Sul

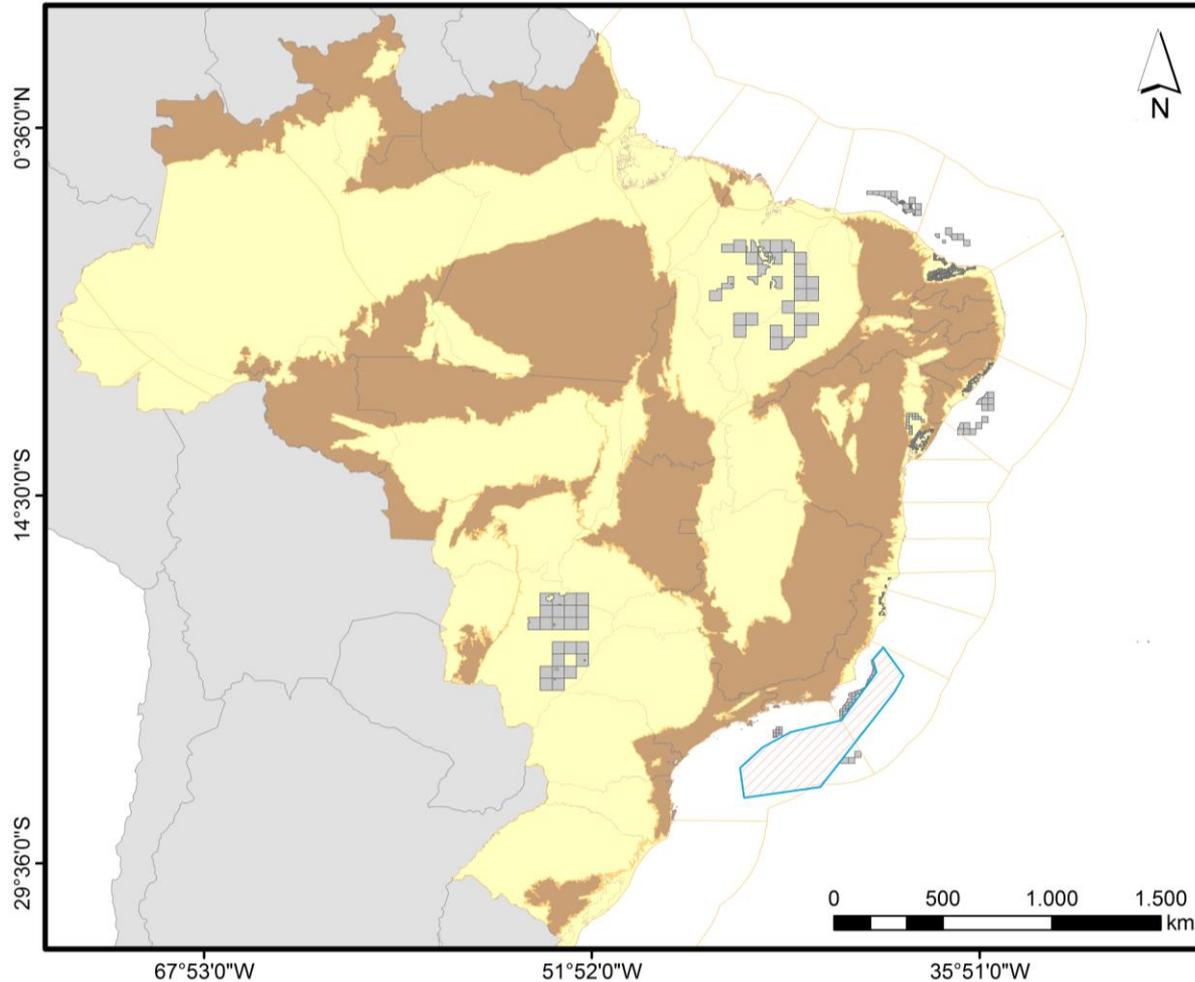
Mature Basins:

Reconcavo, Sergipe-Alagoas, Potiguar & Espirito Santo

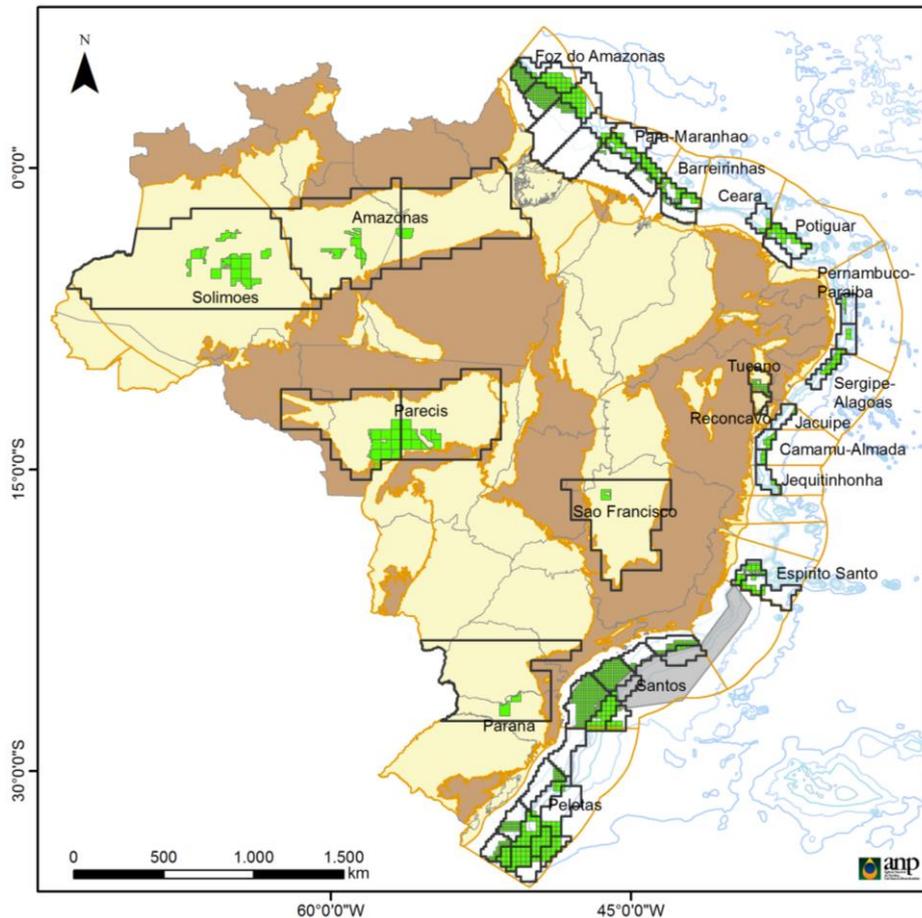
Offshore Basins:

Sergipe-Alagoas, Campos & Santos

14 marginal fields



2nd Wave



Technical and economic parameters are under evaluation

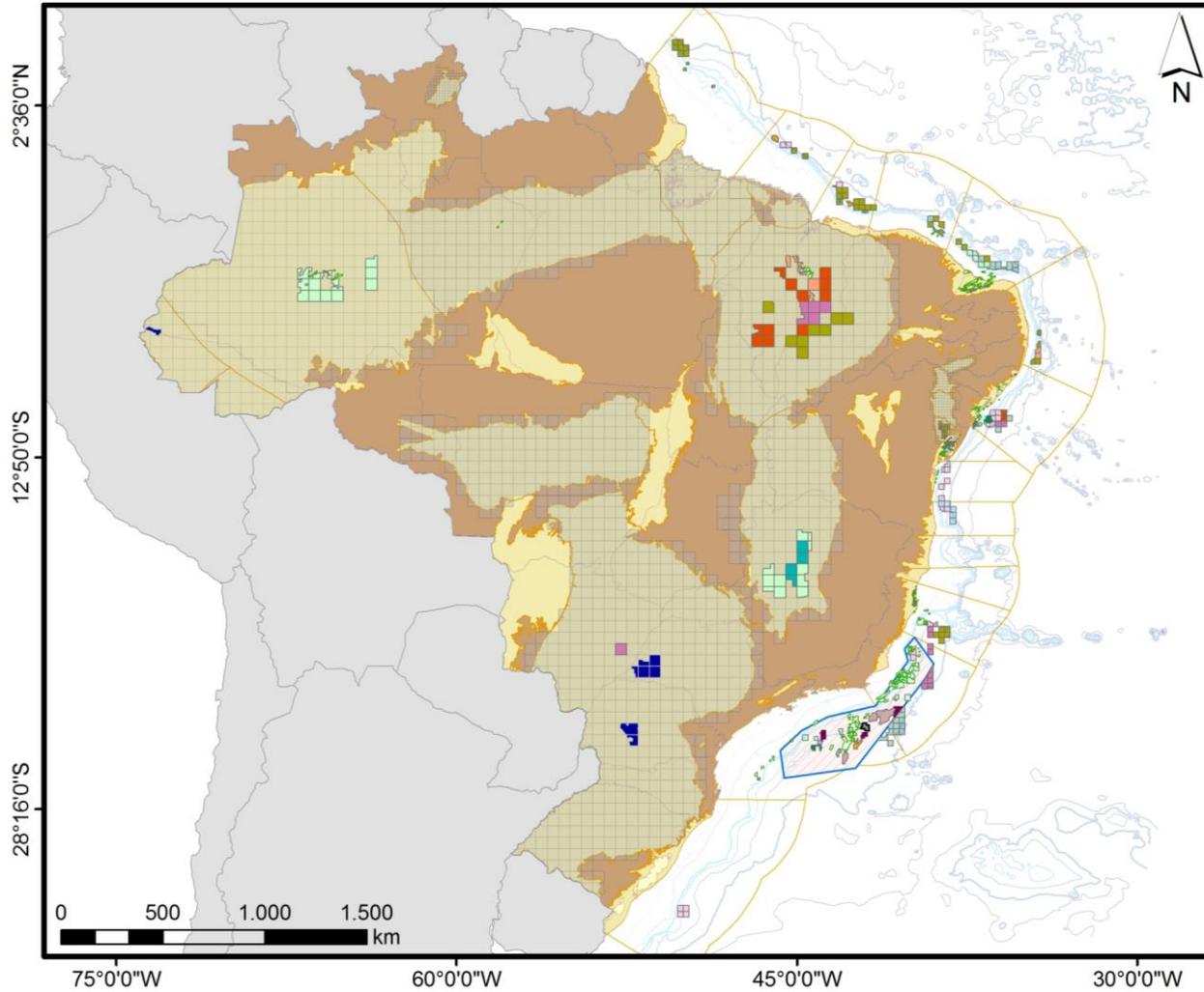
1,054
Blocks

Area
441,400 km²

20
Sedimentary
Basins

85 blocks in 7 onshore basins

969 blocks in 3 offshore basins



Open Acreage

All blocks from all onshore basins will be included in the Open Acreage Process

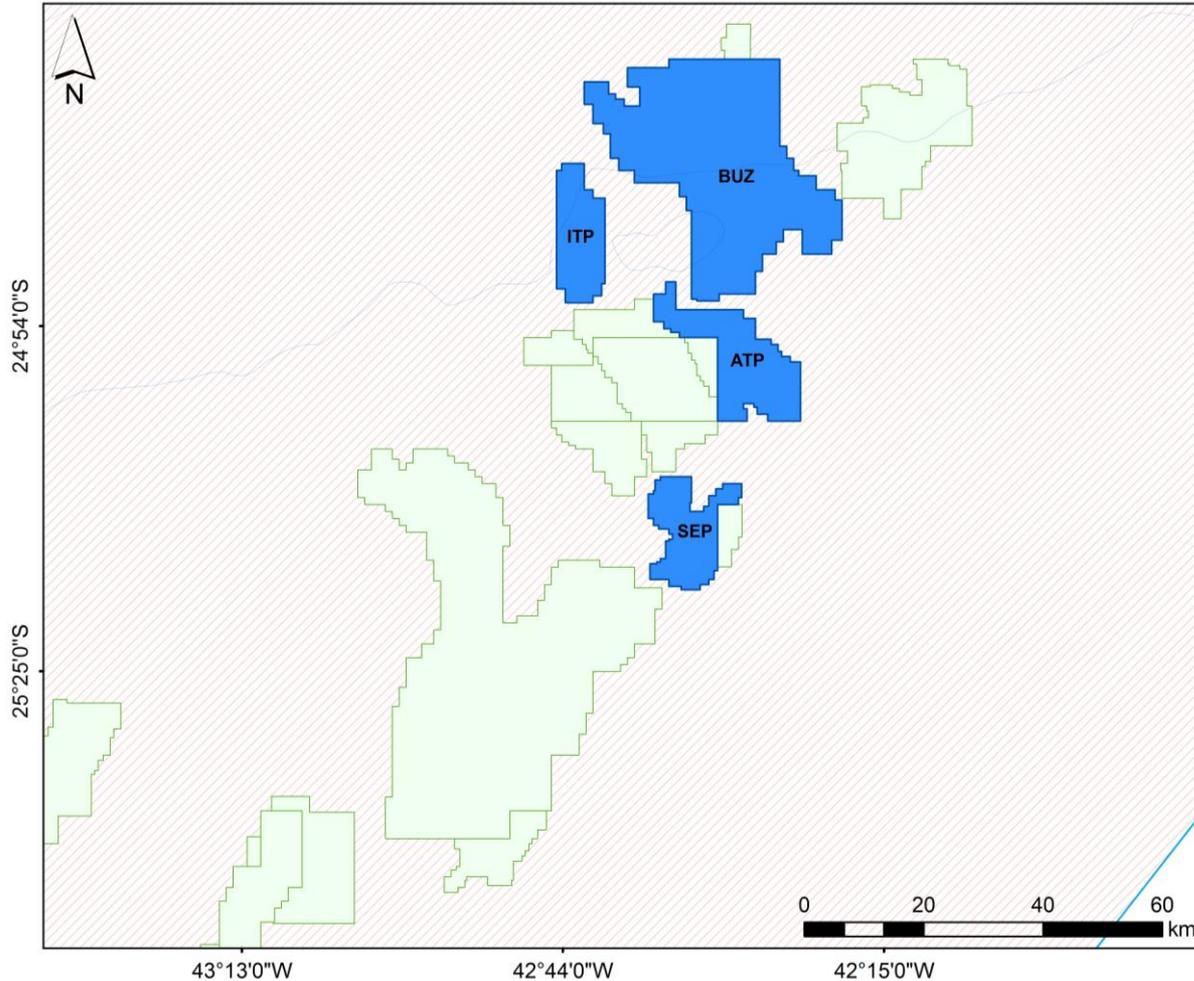
Transfer of Rights Surplus

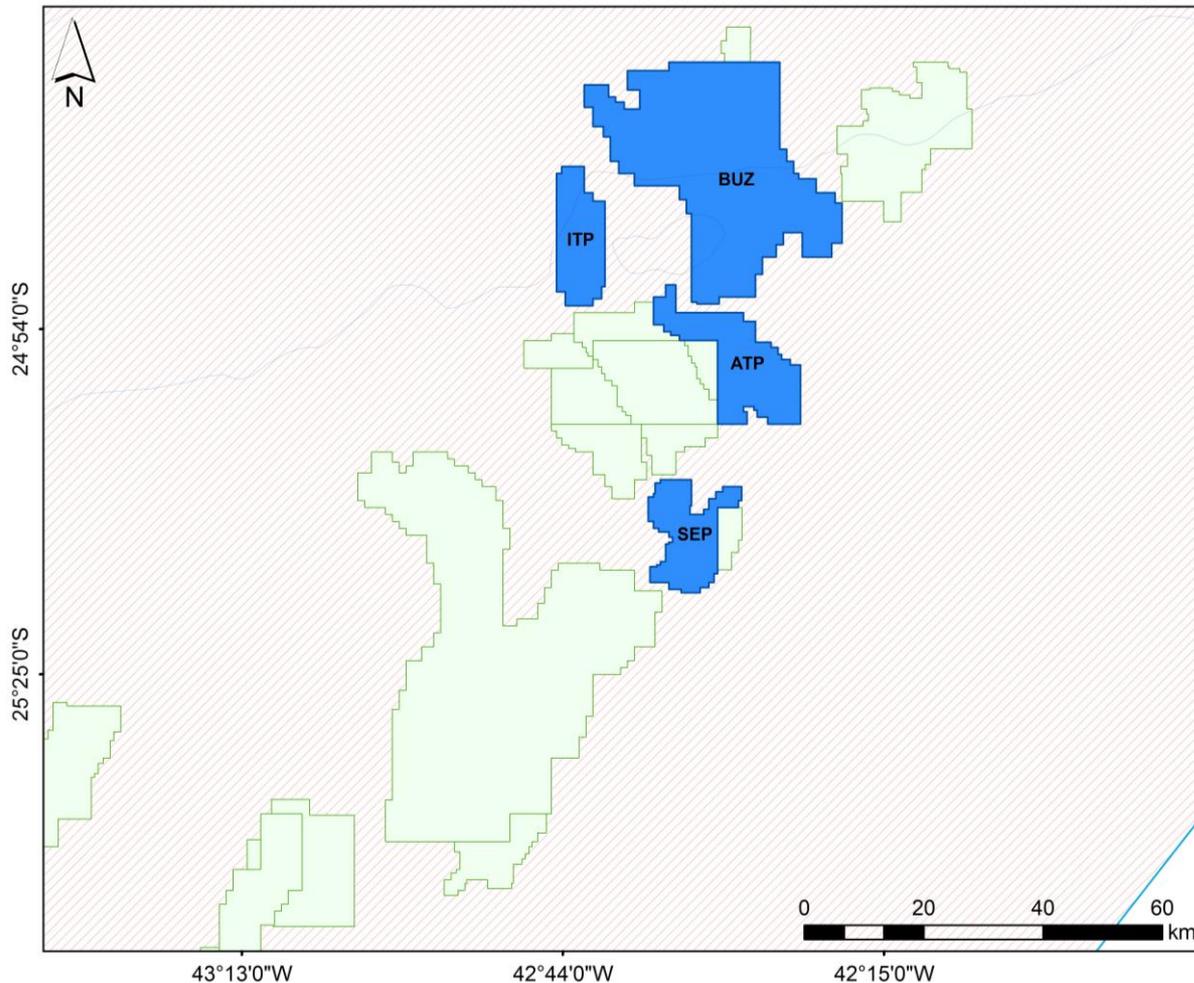
Atapu
Buzios
Itapu
Sepia

Potential Recoverable
Resources:

6.0 - 15.0 billion boe

Nov, 6th

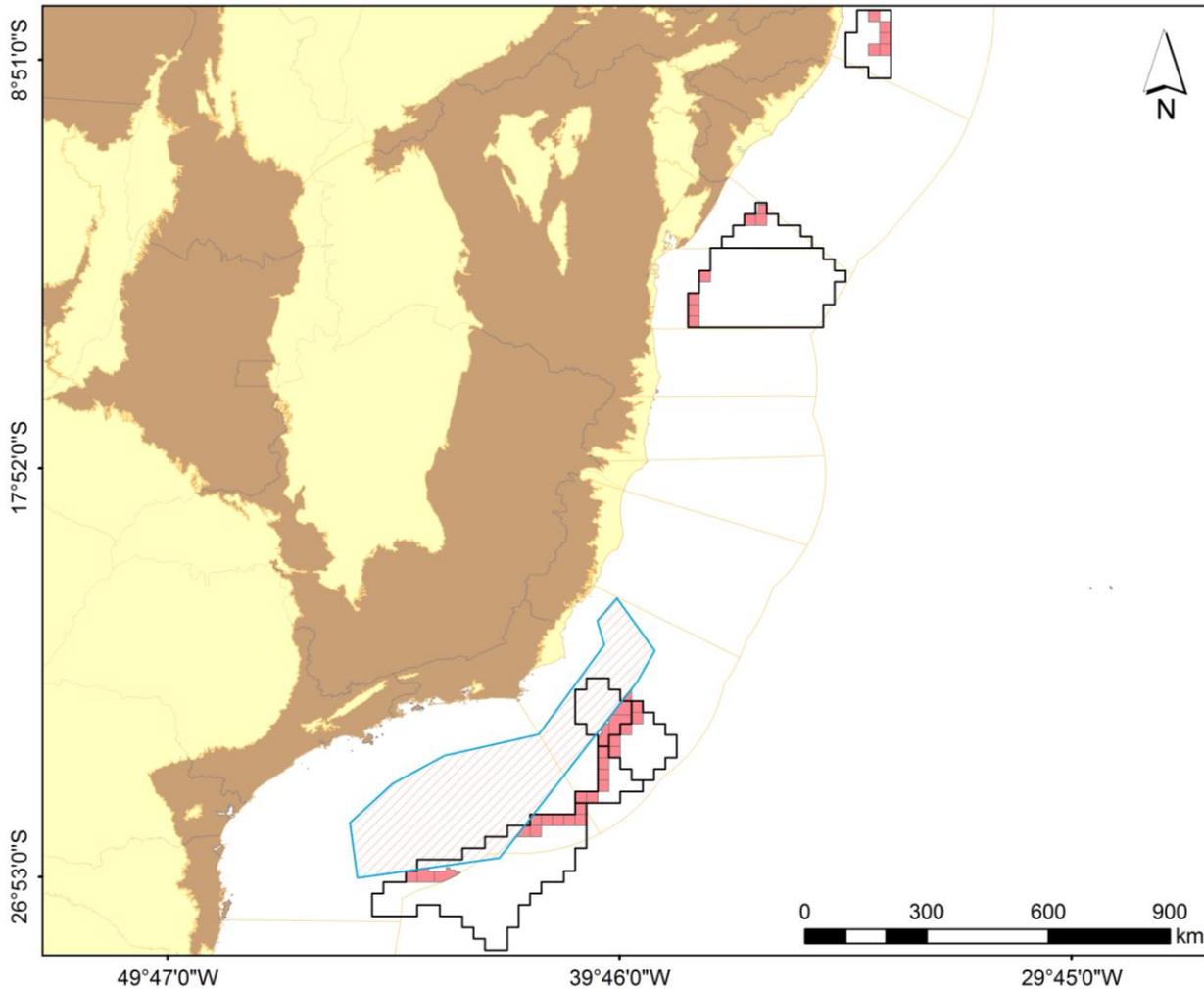




Transfer of Rights Surplus

Economic parameters

AREA	BONUS (BILLION REAS)	PROFIT OIL (% MIN)
Atapu	13,742	25.11
Itapu	1,766	19.82
Buzios	68,194	23.25
Sepia	22,859	27.65
TOTAL	106,561	



16th Bidding Round

36 blocks

~29,000 km²

Pernambuco-Paraíba

Jacuipe

Camamu-Almada

Campos & Santos Basins

Auction: Oct,
2019

6th Pre-Salt Licensing Round

5 blocks:

Aram

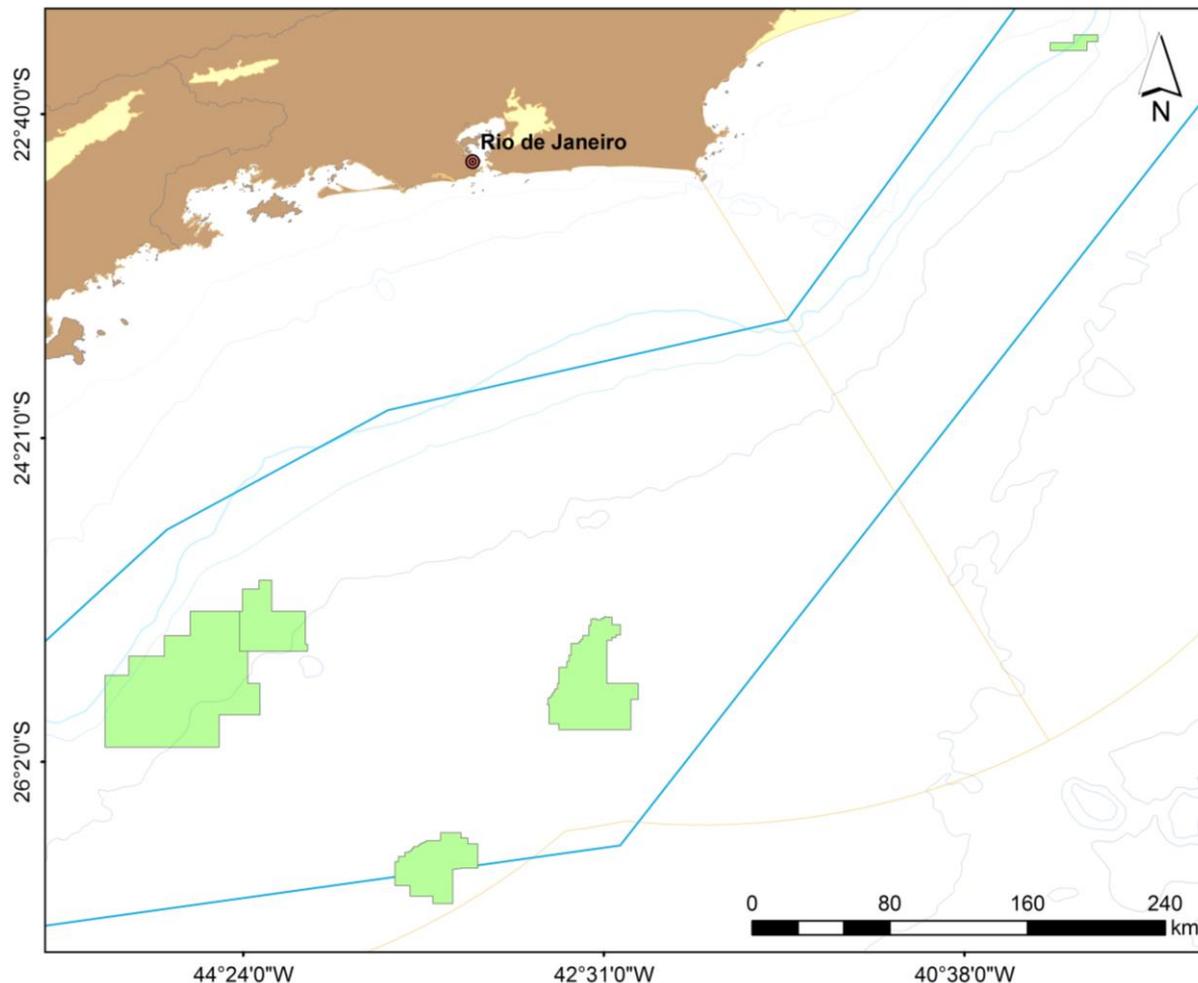
Bumerangue

Cruzeiro do Sul

Sudoeste de Sagitario

Norte de Brava

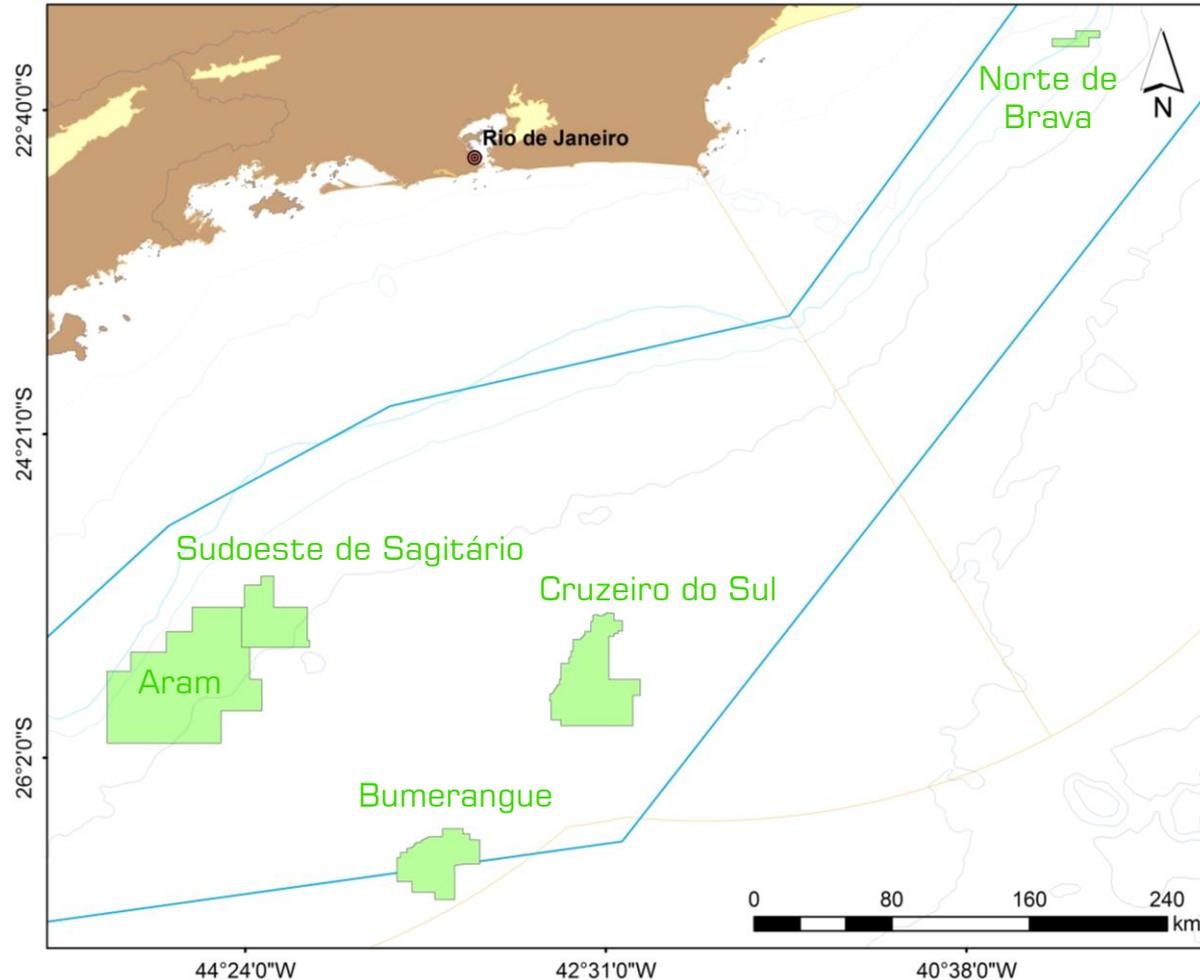
Unrisked oil in place
volume ~ 42 billion bbl



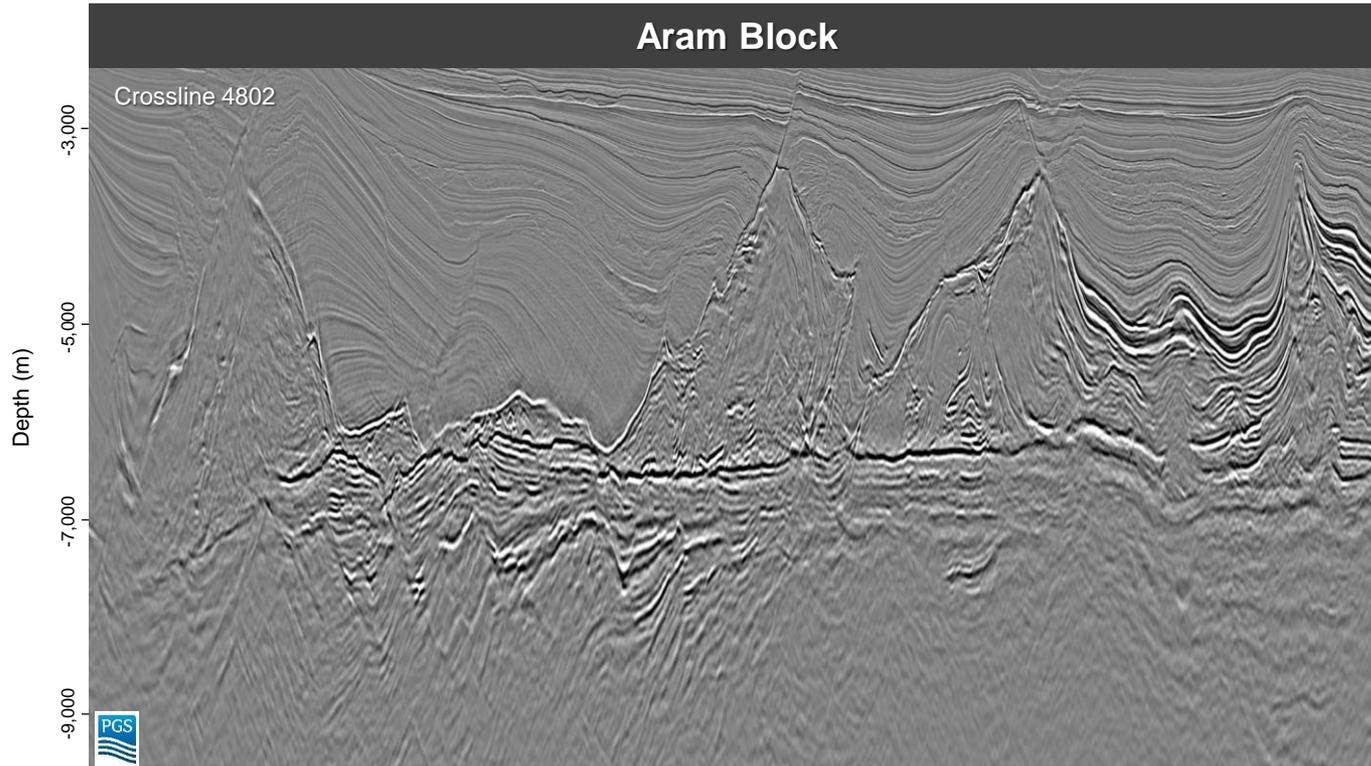
6th Pre-Salt Licensing Round

Economic parameters

AREA	BONUS (BILLION REAIS)	PROFIT OIL (% MIN)
Aram	5.05	24.53
Bumerangue	0.55	26.68
Cruzeiro do Sul	1.15	22.87
Sudoeste de Sagitario	0.50	26.09
Norte de Brava	0.60	36.98
TOTAL	7.85	

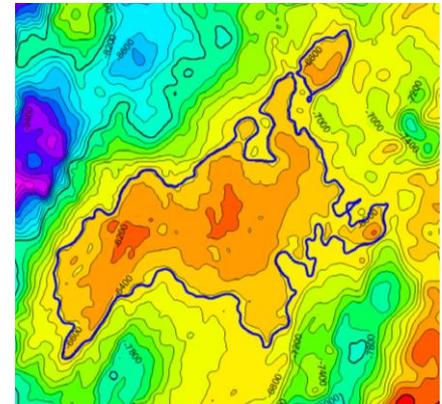


Aram Block

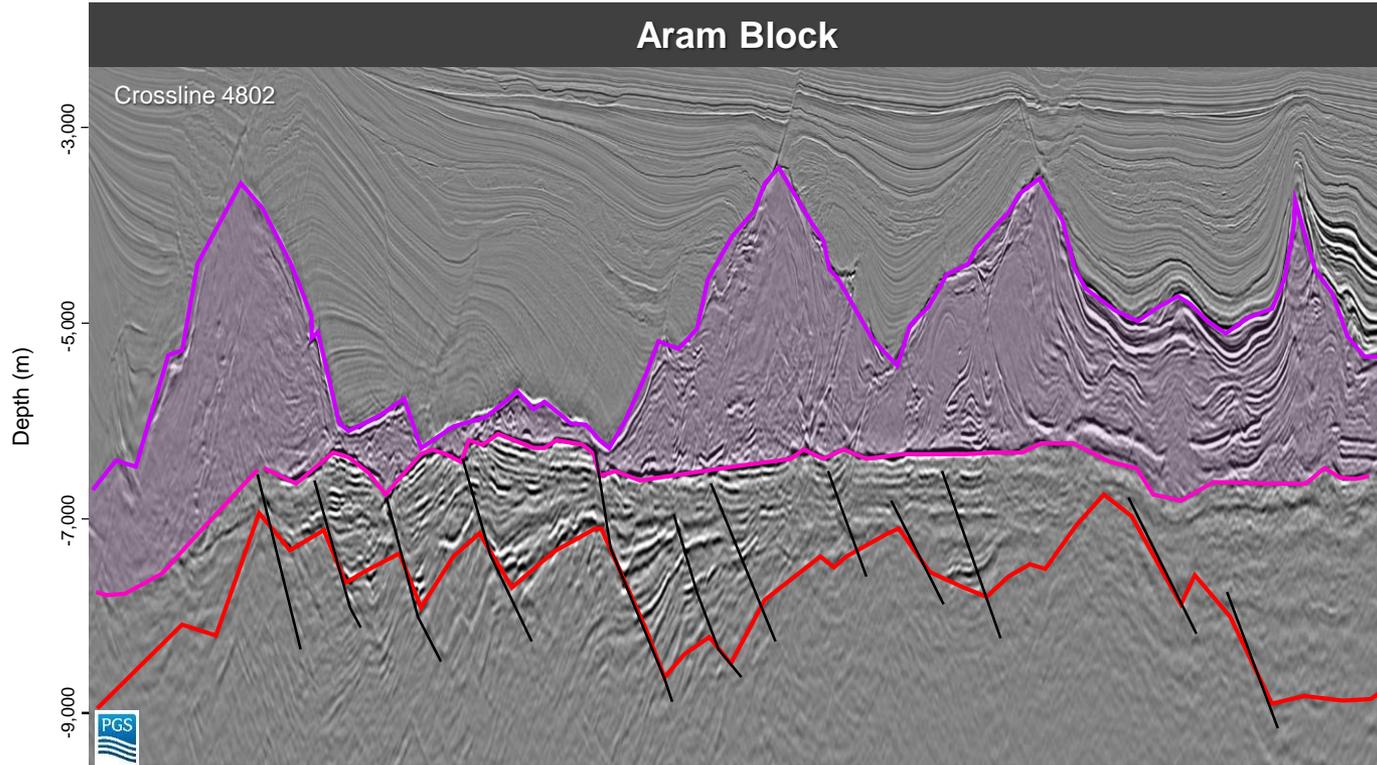


Prominent Basement High
Four-way Closure
Amplitude Anomalies

Area: 1,500 km²



Aram Block

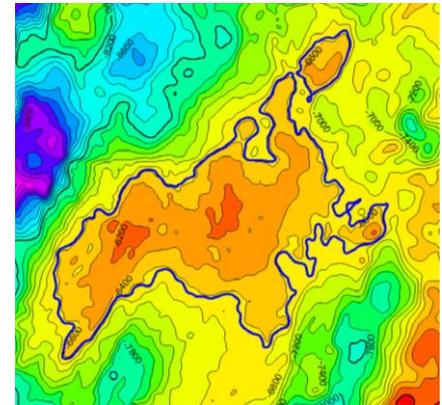


- Top of Salt (Aptian/Albian)
- Basement
- Base of Salt (Aptian)
- Fault

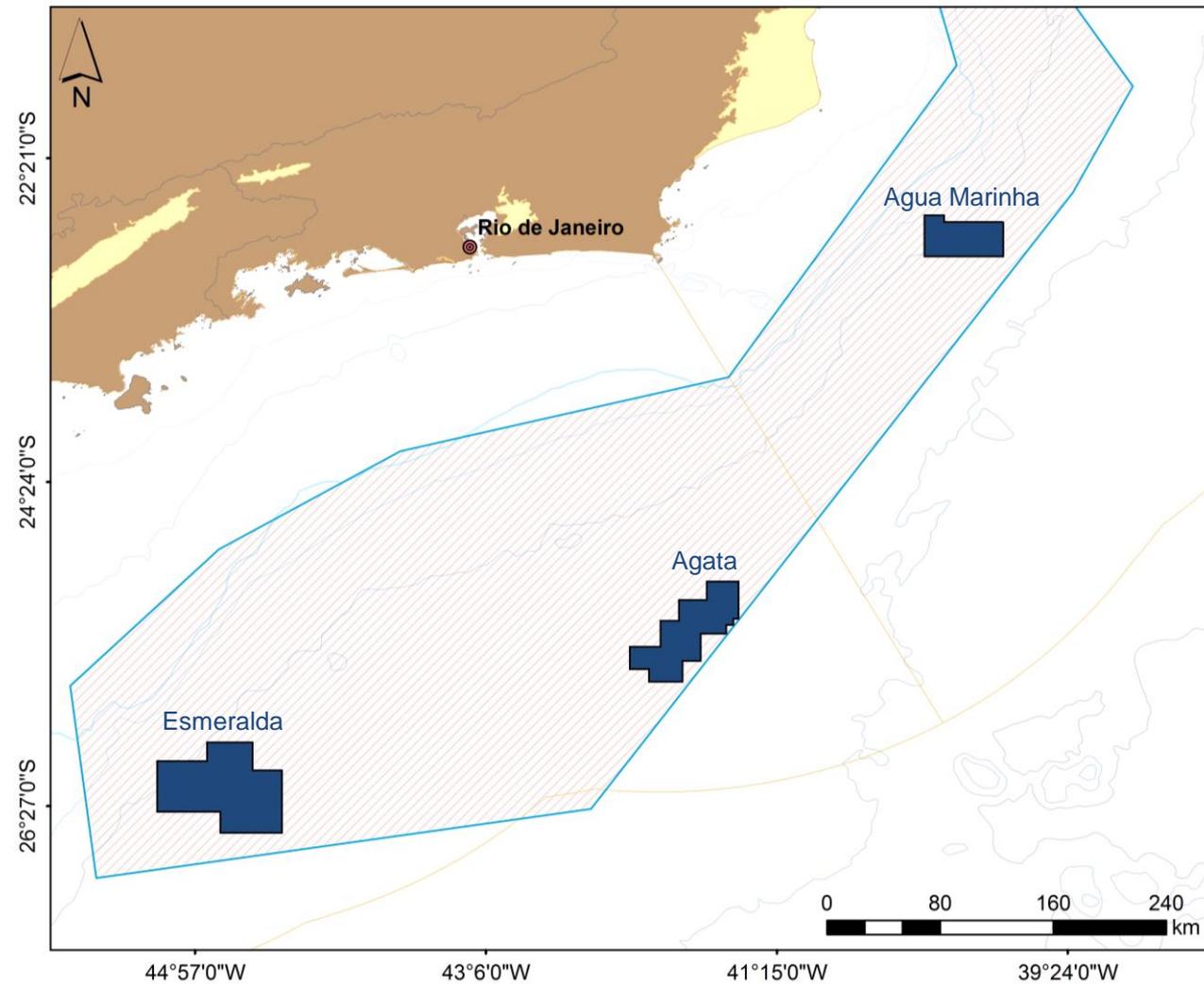
Survey: R0014_BS_1_SOUTH_PSDM – Courtesy of PGS

Prominent Basement High
Four-way Closure
Amplitude Anomalies

Area: 1,500 km²



25 km



2020

Esmeralda

Agata

Agua Marinha

Total Area: ~7,200 km²

2021

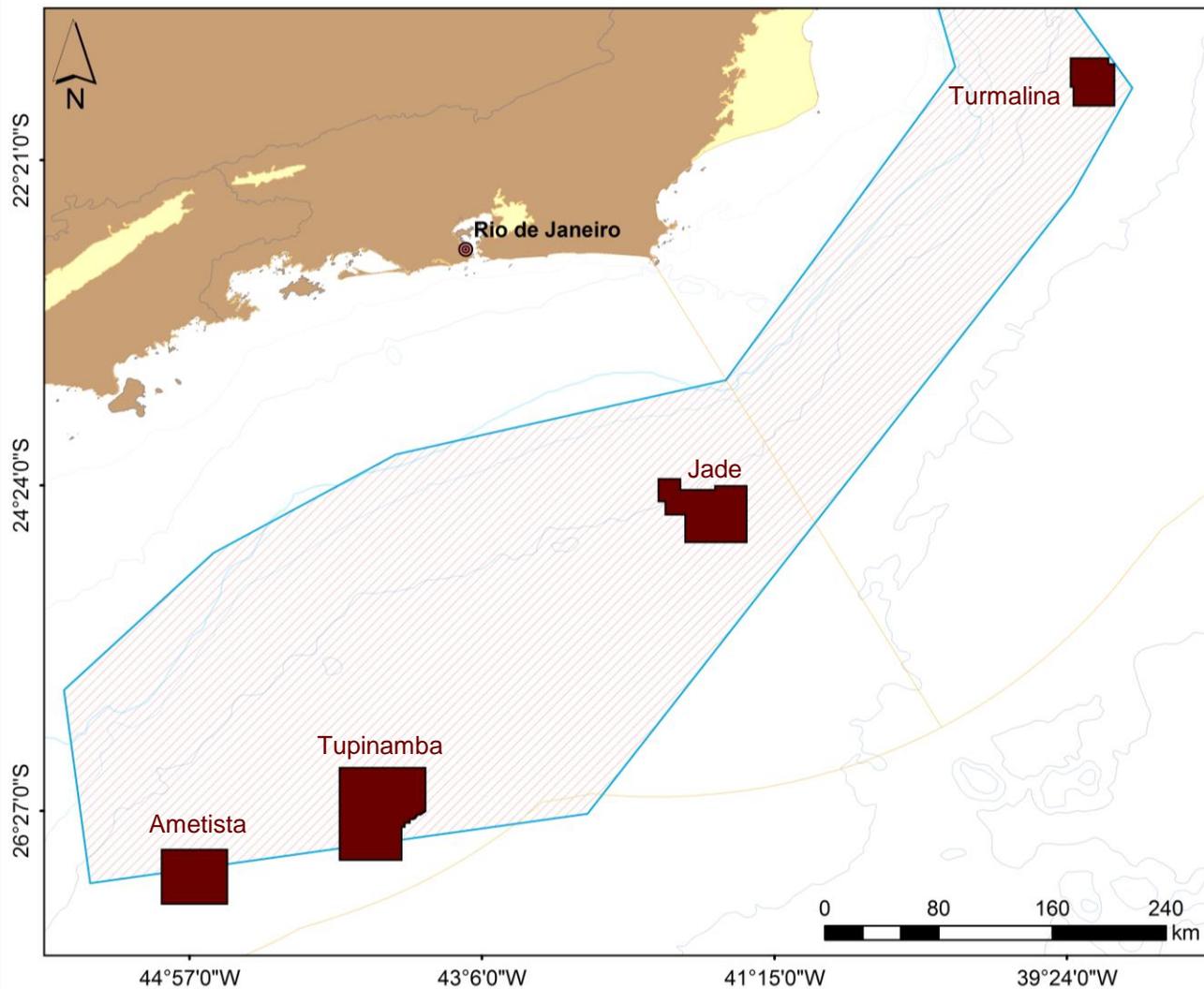
Ametista

Tupinamba

Jade

Turmalina

Total Area: ~7,400 km²



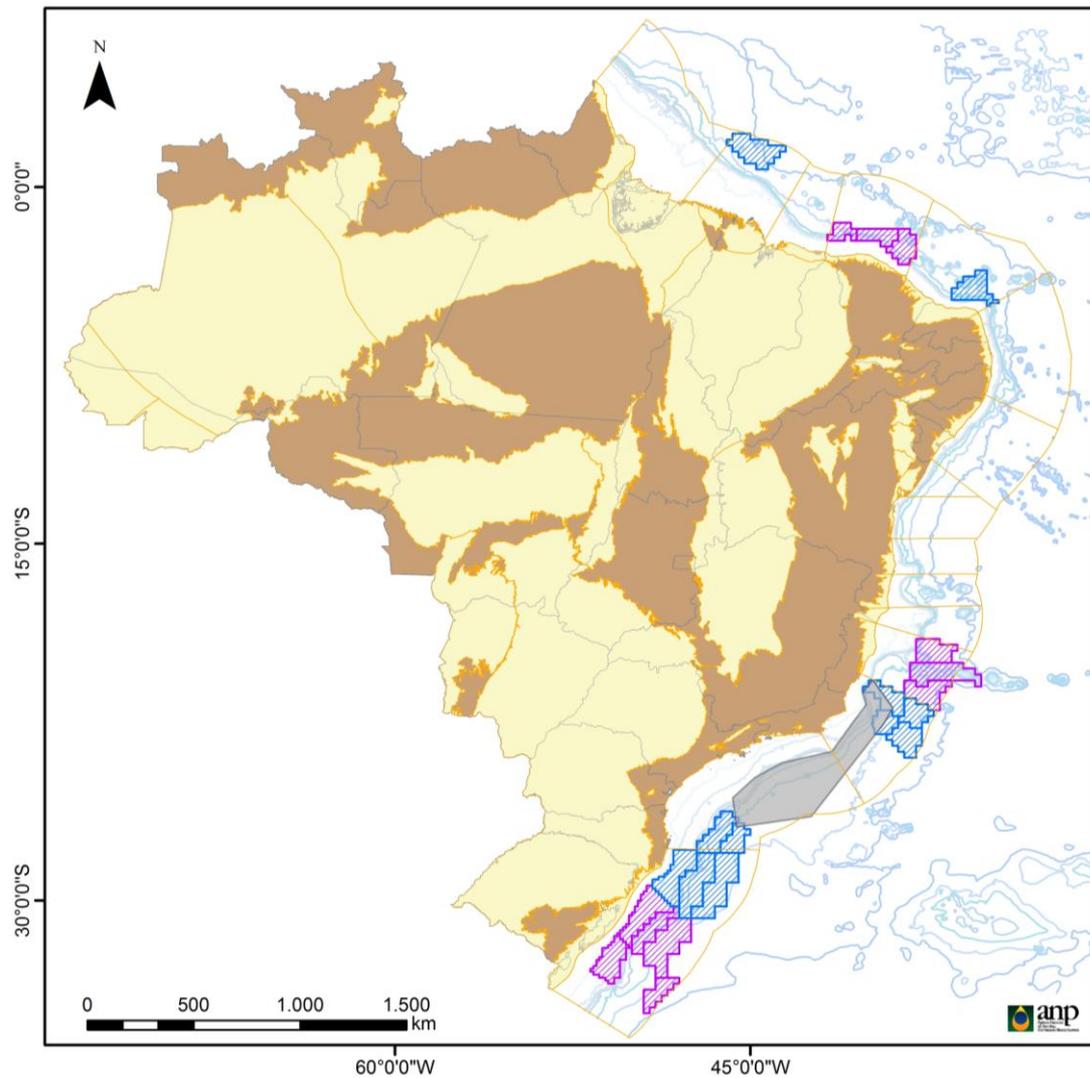
Bidding Rounds schedule concession contracts

2020

Para-Maranhao, Potiguar,
Campos, Santos & Pelotas
basins

2021

Ceara, Espirito Santo &
Pelotas Basins



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Conclusions

The Pre-salt Super Play is the largest oil discovery in the last decade, characterized by giant and supergiant fields with high well productivity.

Currently, Pre-salt super play accounts for 2.0 million barrels of equivalent oil and the majority of the recoverable resources are yet to be produced. Beyond this, several world class leads has been mapped in the blocks awarded in the past bidding rounds. Not to mention areas up for offer in the upcoming ANP Auctions.

The Pre-salt Super Play can lead Brazil to produce 7.5 million barrels of oil per day by 2030, placing it as an extremely strategic position as one of the World's largest oil suppliers.

Brazilian National Agency of Petroleum, Natural Gas and Biofuels ANP

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Additional Information

<http://rodadas.anp.gov.br/en/>

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