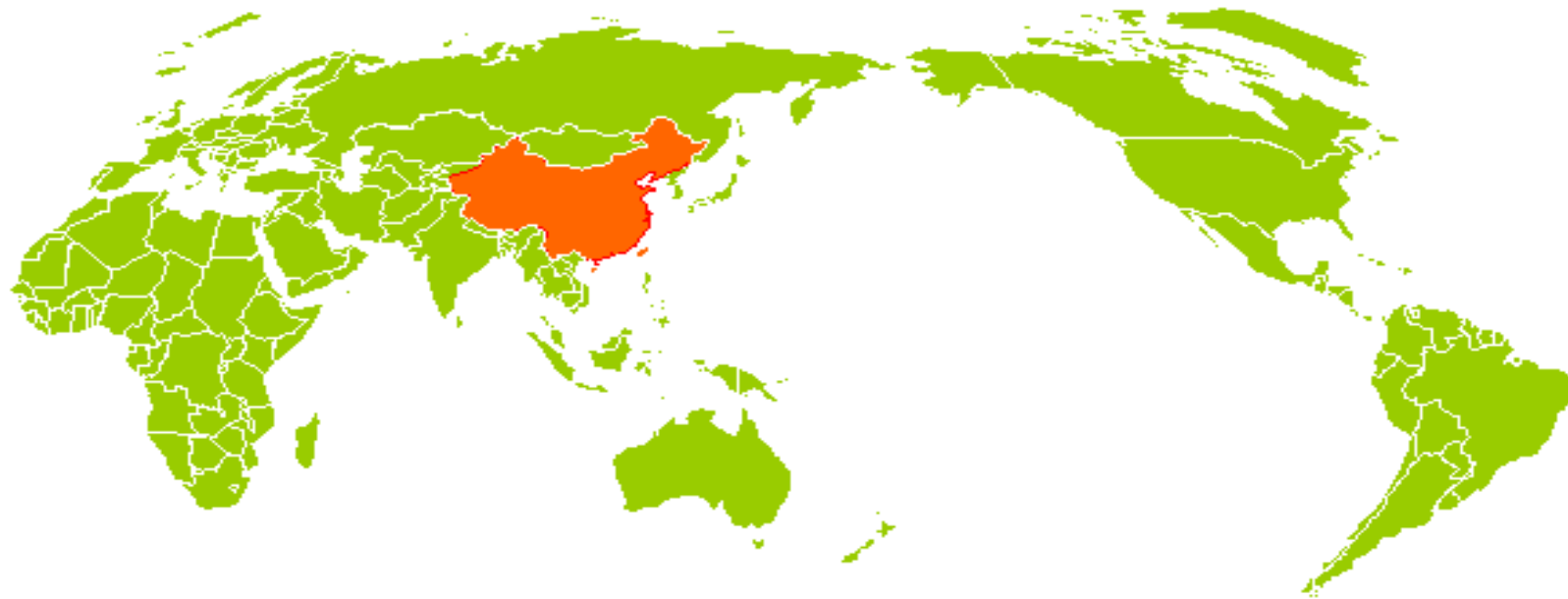


Global Oil & Gas Exploration Situation and Implication



CNPC RIPED
December, 2019

Background

Why did:	for CNPC overseas business (91 Projects in 35 countries)
What deliver:	Petroleum resources distribution Exploration situation Long-term tendency
Information Covered:	Global 2018 exploration events
Value added:	for CNPC for IOC/NOC/Independents for Stakeholders for Services

Outline

I. Global Oil and Gas Exploration Situation

II. Global 2018 Key Exploration Discoveries Overview

III. Implication for Future Global Oil and Gas Exploration

Global 2018 Oil and Gas Exploration Situation

Exploration Investment

Lower in general, **but** slightly increase share in upstream

Exploration Activities

Less Exploration workload, **but** drilled wells increased

Exploration Discoveries

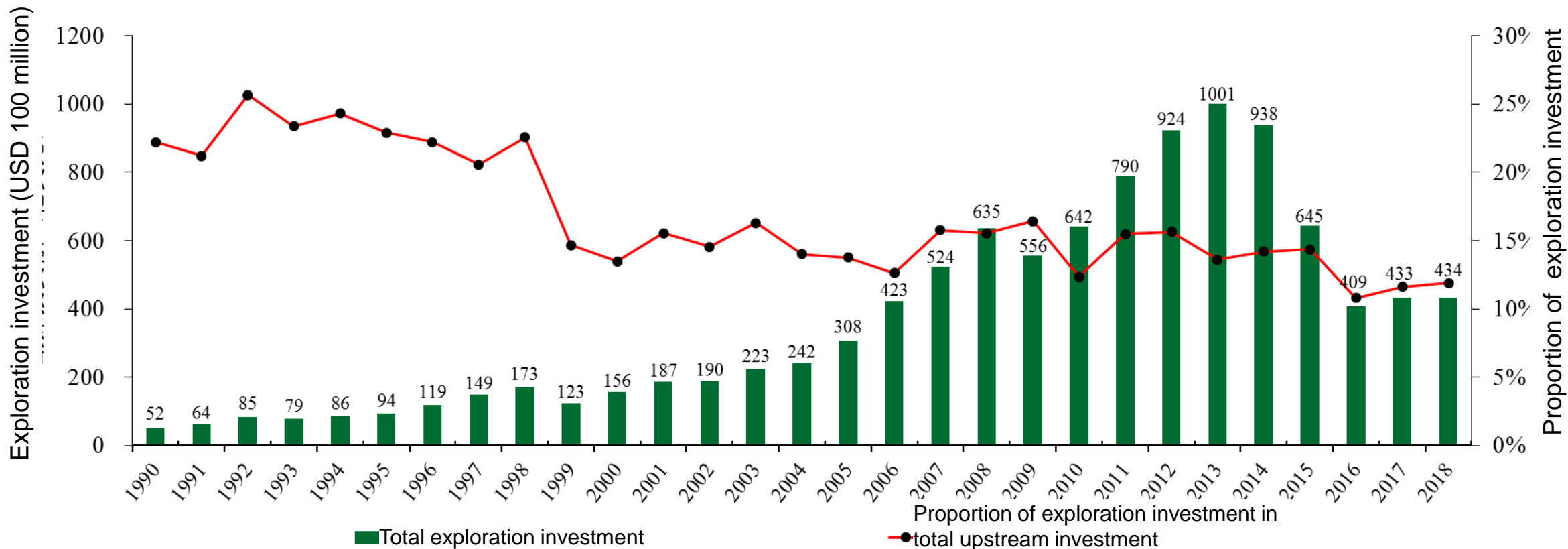
Depressed newly conventional O&G discoveries, **but** 6 features identified

□ Exploration Investment

2018: **USD 43.4 billion**

Percentage of total : 12%, YoY **↑2.3%**

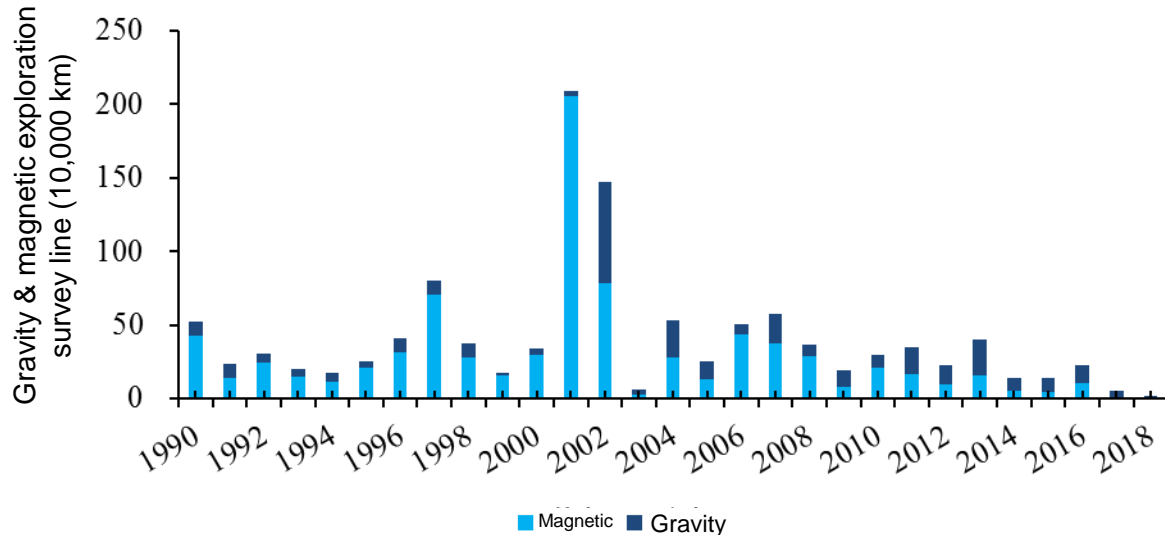
2016-2018: Low level



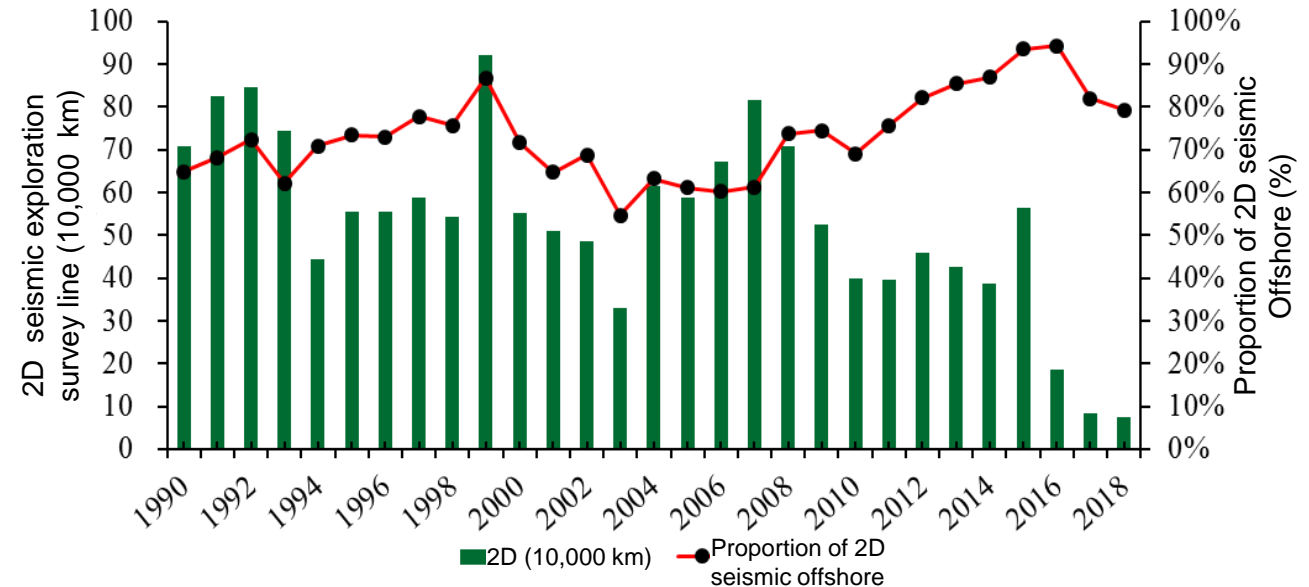
Global annual oil and gas exploration investment by year

Less workload on gravity, magnetic survey & 2D seismic maintained for two consecutive years

- Gravity & magnetic survey: **20,000 km**, **↓78.5% YoY**
- **2D seismic: 76,000 km**, **↓9% YoY**
- Target basins: Bas-Congo & Benin (West Africa), Natal Trough (South Africa), Kofoli (Sri Lanka), North Atlantic (Canada), Paneba (Brazil)
- Survey lines: **5,000 km+**
- Offshore 2D seismic / Total 2D seismic : **≥ 80%, 7th consecutive years**



Global gravity & magnetic exploration workload by year



Global 2D seismic exploration workload by year

3D seismic acquisition slightly dropped in 2018

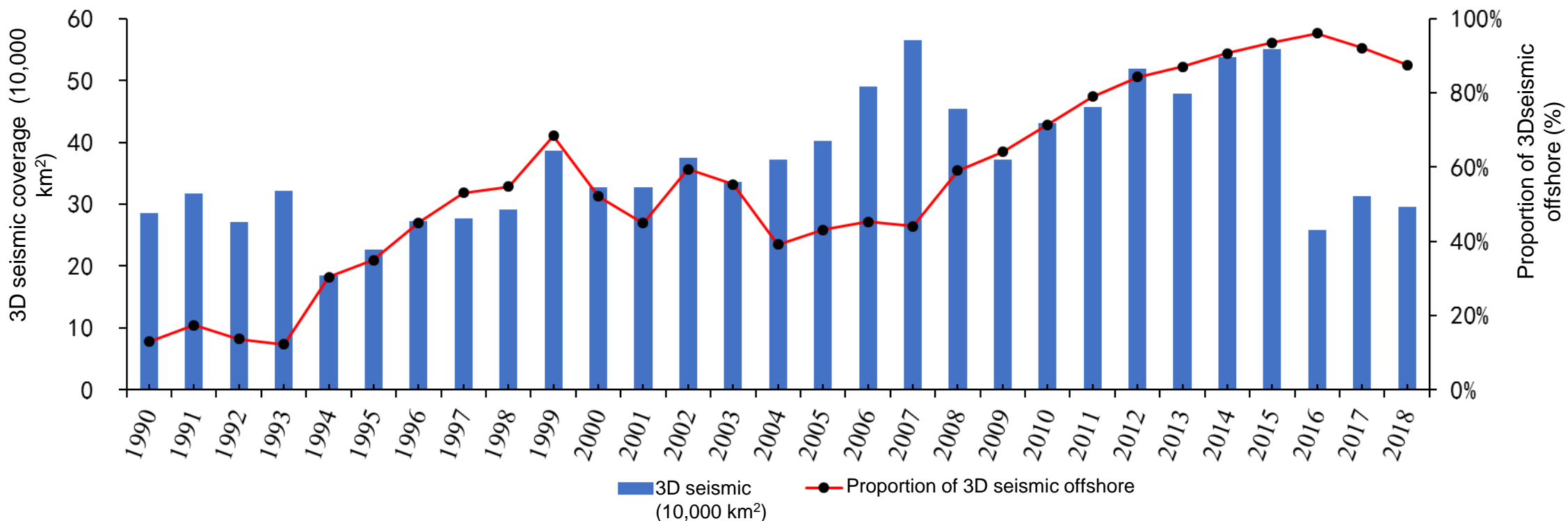
Global 3D Seismic

Regions: Andaman Sea (Malaysia), Côte d'Ivoire, (North Sea), Moore (Norway), North Atlantic (Canada), Australia-Bonapat (Indonesia), Senegal, Tarfaya (Morocco)

Acreage: **>10,000 km²**

Total length: **296,000 km²**, **↓ by 5.4% (YoY)**

Offshore 3D seismic / total: **88%**



Global 3D seismic exploration by year

Exploration well drilling dramatically increased in 2018

2018 Drilling Wells Review

Total exploration & appraisal : **1,657**, **↑14.7% YoY**

Offshore drilling: **406**

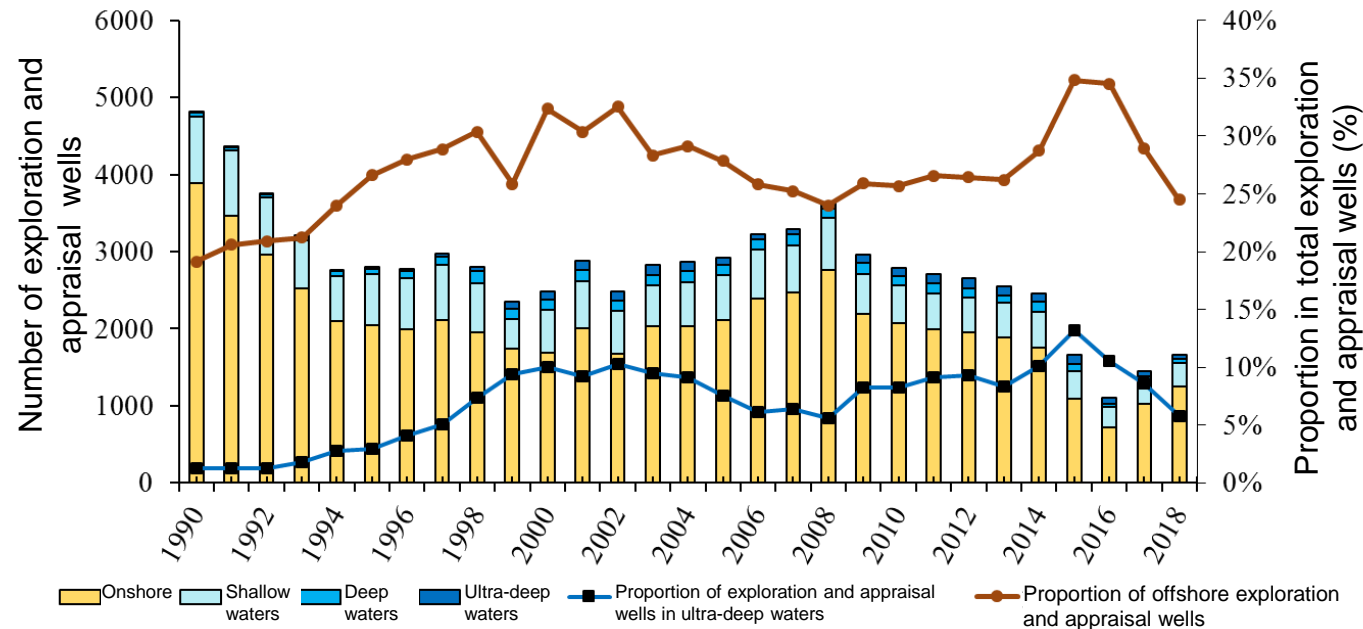
Offshore drilling/Annual total : **25% YoY ↔**

Offshore Drilling Regions:

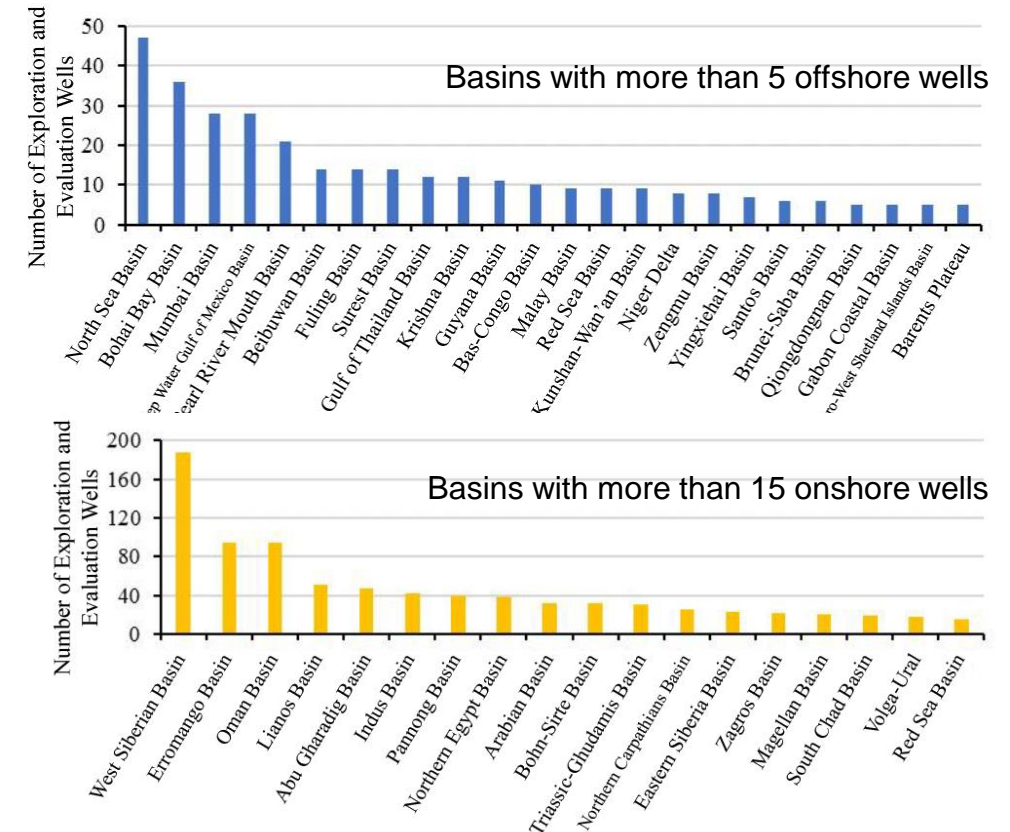
North Sea Basin, Bohai Bay Basin, Mumbai Basin, Deep-water Gulf of Mexico Basin

Onshore Drilling Regions:

Siberia Basin, Oman Basin, Australia's Erromanga Basin



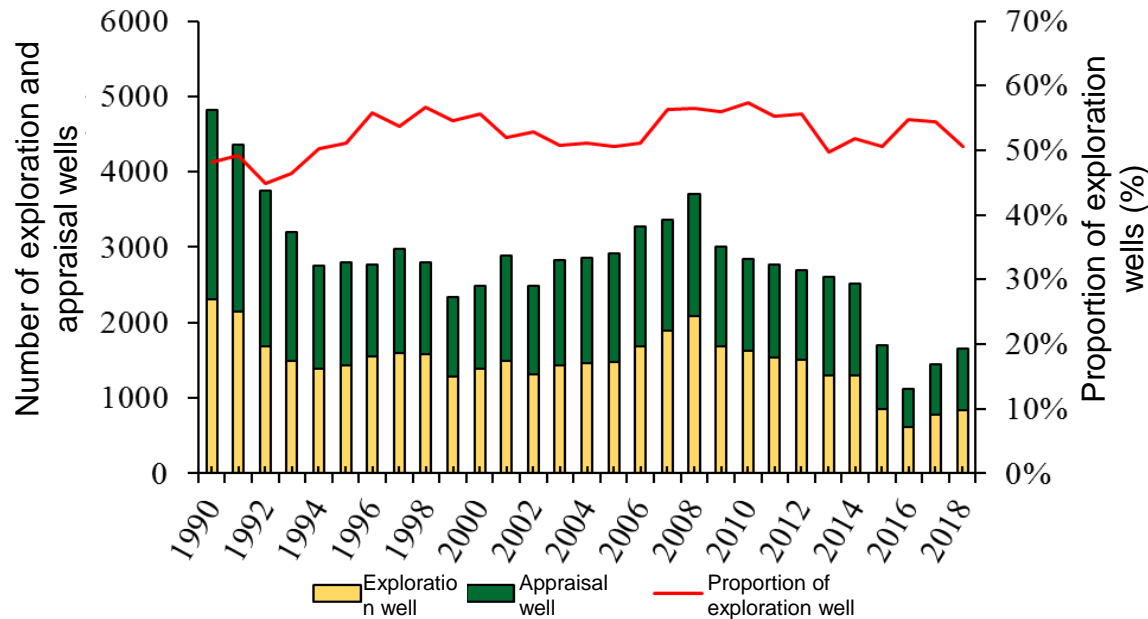
Exploration and appraisal wells by sector / by year



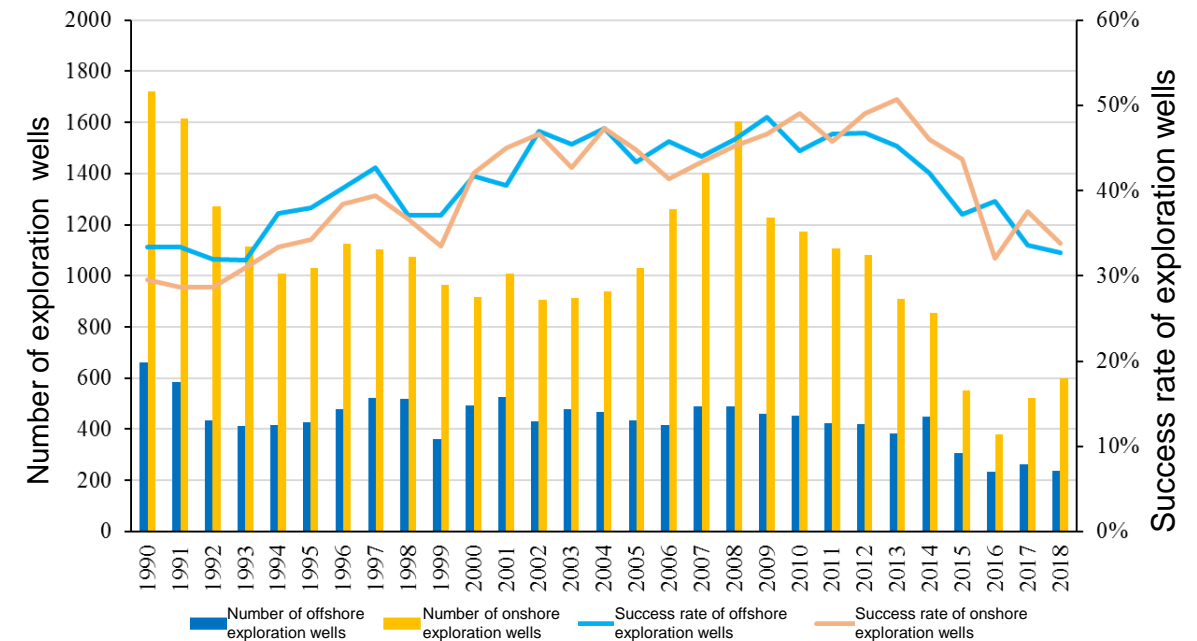
Stable exploration drilling, similar success rate between offshore and onshore

Global 2018 Exploration Drilling Review

- Total wells drilling
 - Exploration: **838**
 - Percentage of total: **51%**
 - Drilling Region: Eromanga Basin, Indus Basin, Abu Gharadig Basin (Egypt), North Sea Basin, Oman Basin, etc.
- Total offshore drilling
 - Exploration: **237**
 - Percentage of total: **58.4%**
- **Success Rate: Onshore ≈ Offshore**



Global exploration wells by year



Success rate of global risk exploration wells by year

Global 2018 Oil and Gas Exploration Situation

Exploration Discoveries

Continuously depressed newly conventional O&G discoveries, but 5 features identified

Global 2018 Conventional O&G Discovery Review

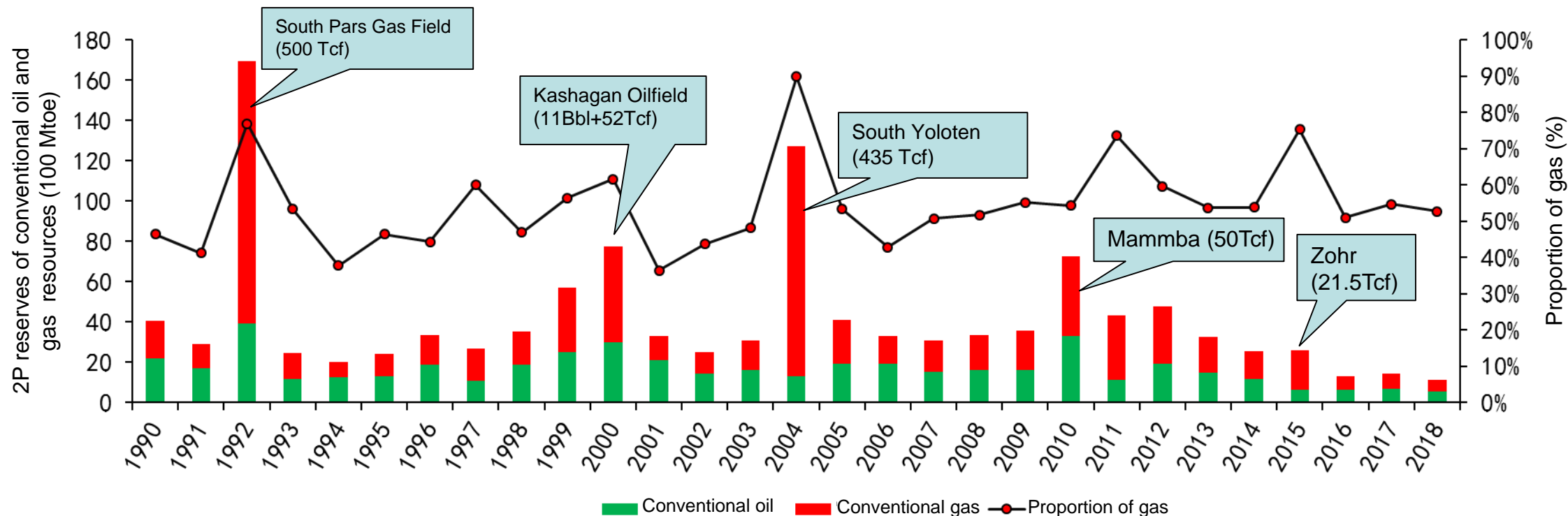
Discovery

Conventional O&G fields: **263**, **3%↑ YoY**

The newly added recoverable reserves

Total O&G: **1.1 BToE**, **27% ↓ YoY**

Oil: **510 MMT**, Gas: **699.7 BCM**



Global recoverable reserves from newly conventional oil and gas discoveries by year

20 large- and medium-scale oil and gas fields were major contributors to global newly added reserves

- ❑ Reserves of newly discovered O&G fields
 - > 500 MMbbl : 3**
 - 100- 500 MMbbl : 17**
- ❑ Recoverable reserves
 - 710 MToE, 65% of the total**
 - Oil: 300MMt**
 - Gas: 492 BCM**
- ❑ **18** Offshore fields
 - Recoverable reserves: **647 MToE**
 - Offshore: **91%** of the total

Global newly discovered oil and gas fields with reserves greater than 100 Mboe in 2018

Oil and Gas Field	Country	Basin	Basin Type	Operator	Type	Realm	Oil (10,000 t)	Gas (100 MCM)
Calypso	Cyprus	Eratosthenes Basin	Passive continental margin basin	Eni	Gas field	Ultra-deep waters	27	998
Pluma	Guyana	Guyana Basin	Passive continental margin basin	EEPGL	Oil field	Deep waters	5479	285
Obskoye Severnoye	Russia	West Siberian Basin	Rift basin	ARCTC SPG3	Gas field	Shallow waters	411	855
Ranger	Guyana	Guyana Basin	Passive continental margin basin	EEPGL	Oil field	Ultra-deep waters	4110	114
Zhongqiu (Tr)	China	Tarim Basin	Craton basin	PETCHIN TR	Gas field	Onshore	0	600
Longtail	Guyana	Guyana Basin	Passive continental margin basin	EEPGL	Oil field	Ultra-deep waters	3767	114
Dorado	Australia	Roebuck Basin	Passive continental margin basin	SANTOS WA	Oil field	Shallow waters	2562	238
Hammerhead	Guyana	Guyana Basin	Passive continental margin basin	EEPGL	Oil field	Deep waters	3151	86
Triton	Russia	North Sakhalin Basin	Backarc basin	GAZPROM SH	Oil field	Shallow waters	1767	146
Hades/Iris	Norway	Voring Basin	Passive continental margin basin	OMV	Gas field	Shallow waters	726	268
Guanxuma A	Brazil	Santos Basin	Passive continental margin basin	EQUINOR EN	Oil field	Ultra-deep waters	1712	114
Glendronach	UK	Faroe-West Shetland Basin	Passive continental margin basin	TOTAL	Gas field	Shallow waters	97	285
Dover	US	Deep Water Gulf of Mexico Basin	Passive continental margin basin	SHELL OFF	Oil field	Ultra-deep waters	2055	17
Tepat	Malaysia	Beikang-Nansha Trough Basin	Passive continental margin basin	TOTAL	Gas field	Ultra-deep waters	342	200
Timi	Malaysia	Zengmu Basin	Passive continental margin basin	SSB	Gas field	Shallow waters	103	200
Merakes East	Indonesia	Kutai Basin	Rift basin	Eni	Gas field	Ultra-deep waters	55	180
Aung Siddhi	Myanmar	Bengal Basin	Foreland basin	CNPCI WOOD	Gas field	Deep waters	0	182
Oyo Northwest	Nigeria	Niger Delta	Passive continental margin basin	ERIN EN	Oil field	Shallow waters	1370	14
Willow West	US	North Slope Basin, Alaska	Foreland basin	COP ALASKA	Oil field	Onshore	1301	11
Mulach	Mexico	Sureste Basin	Foreland basin	PEMEX	Oil field	Shallow waters	1233	17

Natural Gas, Offshore and Middle-Shallow reservoirs dominated the new discoveries

□ Natural Gas

Newly added reserves:

699.7 BCM

53.2% of the total

□ Offshore

Newly discovered O&G fields: **85**

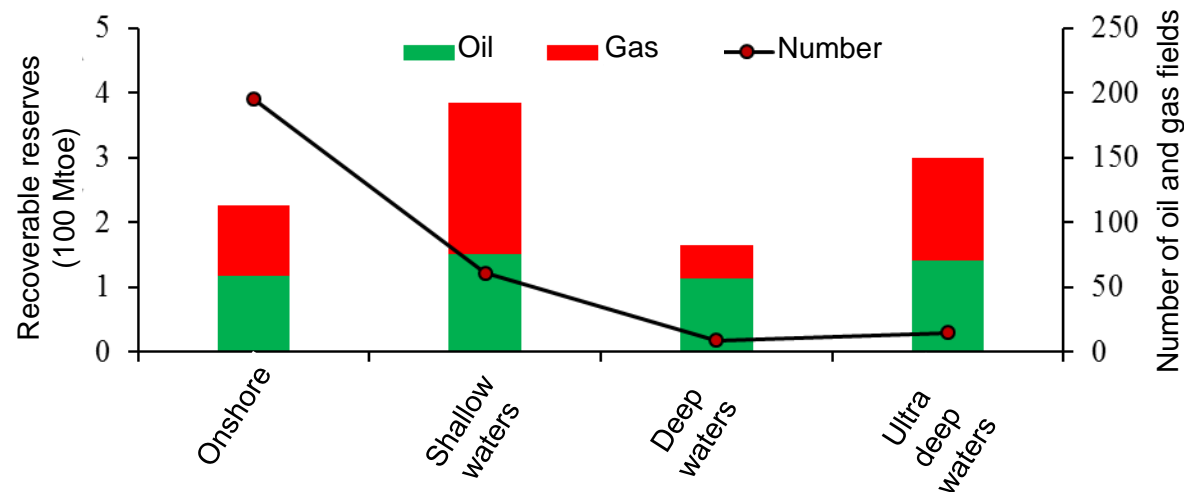
Newly added reserves: **860 MToE**, **79%** of the total

□ Middle-shallow reservoirs

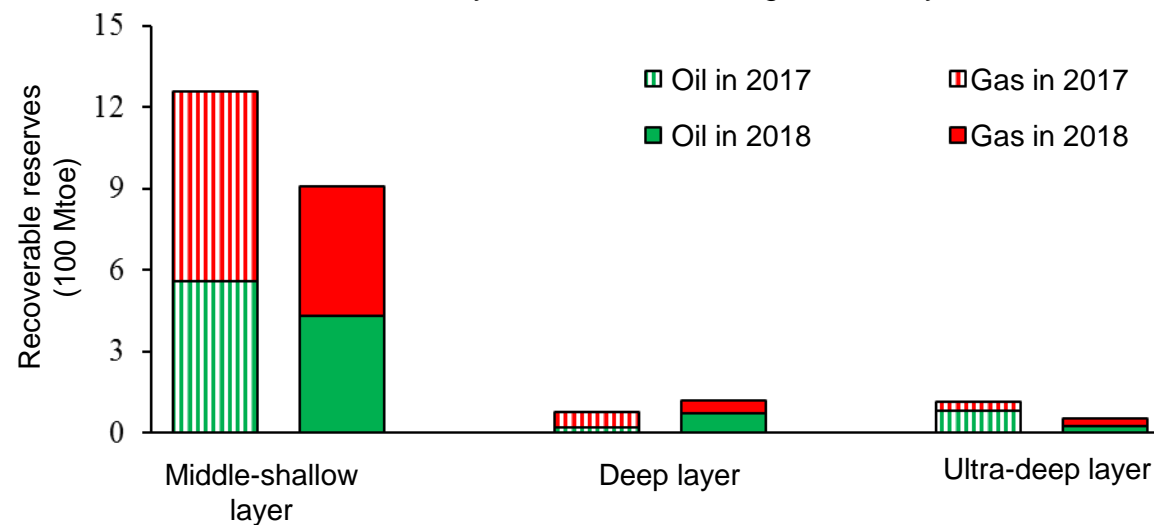
84.4% of the total new discoveries

Deep reservoirs: slightly increased

Ultra-deep reservoirs: slighted declined



Global 2018 newly discovered oil and gas fields by sector



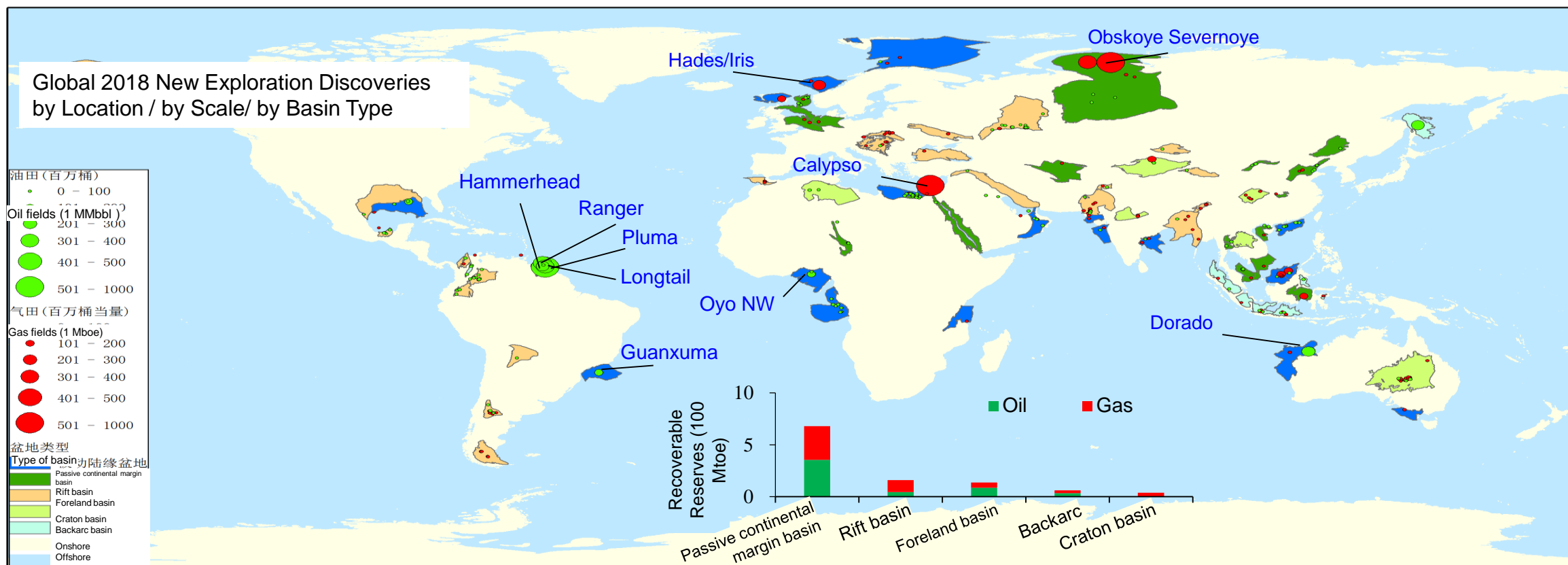
Global 2017 & 2018 newly discovered oil and gas fields discovered by depth

Passive continental margin basins still dominated in new oil and gas exploration discoveries

Passive continental margin basins: 67%

Mid-Atlantic Guyana Basin, Eastern Mediterranean Basin, Bas-Congo Basin(West Africa),
Roebuck Basin (Australia), Voring Basin (Norway) and deep-water Gulf of Mexico Basin

Rift basins: 16% Foreland basins: 13%



Major contributions from mature basins, New territories were attractive for discoveries

Recoverable reserves

Mature basins: **72**

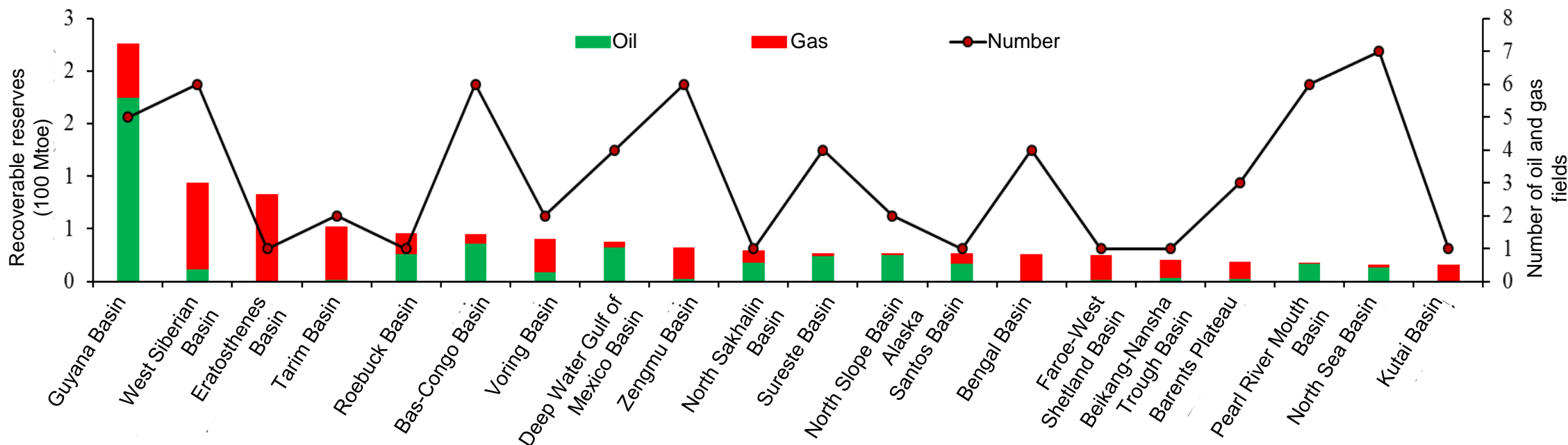
Contribution: **680 MToE, 62.6% of the total**

Basins: West Siberian Basin (Russia), Bas-Congo Basin (West Africa), Voring Basin (Norway)

New territories were attractive

11 basins, e.g. Guyana Basin, Eratosthenes Basin (Eastern Mediterranean), Roebuck Basin (Australia)

Recoverable reserves : **410 MToE, 37.4% of the total**



Global 2018 top 20 newly discovered basins by reserves

Outline

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Global 2018 Key Exploration Discoveries Overview

Eratosthenes Basin, Eastern Mediterranean

Guyana, South America

Arctic South Kara Sea, Russia

Donner Halten Sub-basin in Voring Basin, Norway

Roebuck Sub-basin, North West Shelf, Australia

Organic reefs

Deep water

North-Obskoye large gas field

Largest discovery (20 Years)

Largest oil field discovery (40 Years)

Organic reefs continuously to be the significant exploration target in Eratosthenes Basin, Eastern Mediterranean — Calypso Gas Field

Eastern Mediterranean Waters

3 basins, **282,000 km²**

Passive continental margin basins

Formed at northern margin of Gondwana

Exploration History

At early stage: Oligocene-Miocene delta sand body in onshore-shallow waters of the Nile Delta

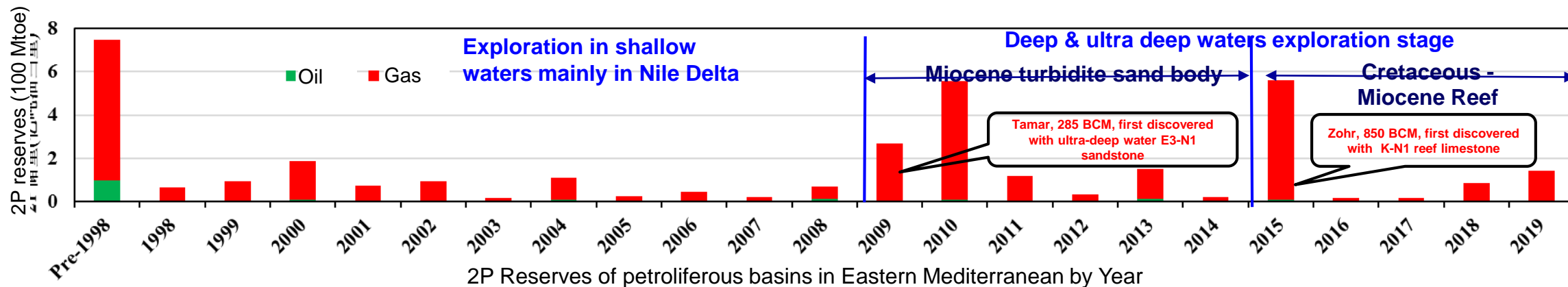
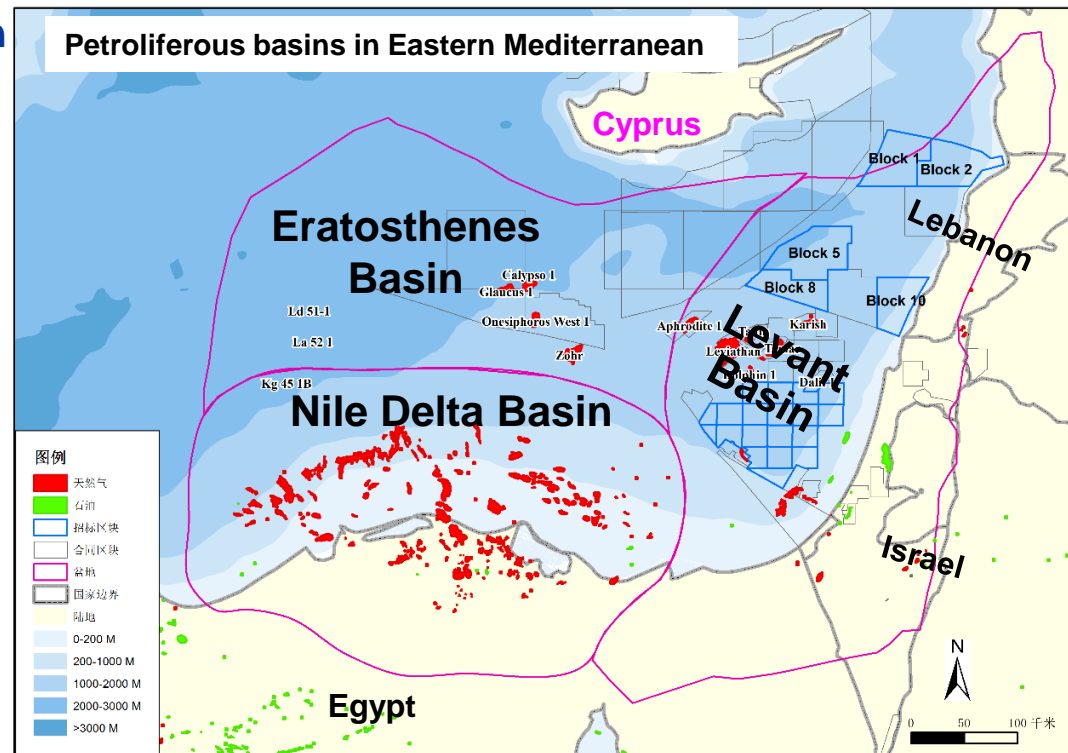
Since 1999: Deep-water delta front (Shell ,Noble Energy)

2009: Breakthroughs were made in Levant Basin

Since 2015, Deep organic reefs in Eratosthenes Basin (Eni)

Current Status

NG accumulated recoverable reserves: **3.8 TCM**



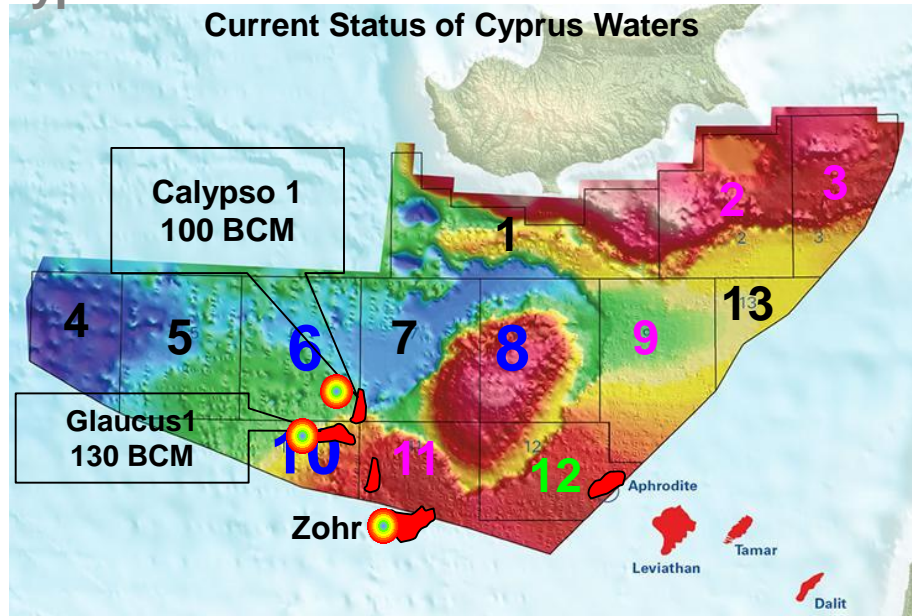


RIPED

Global 2018 Key Exploration Discoveries Overview

Case 1-Calypso Gas Field

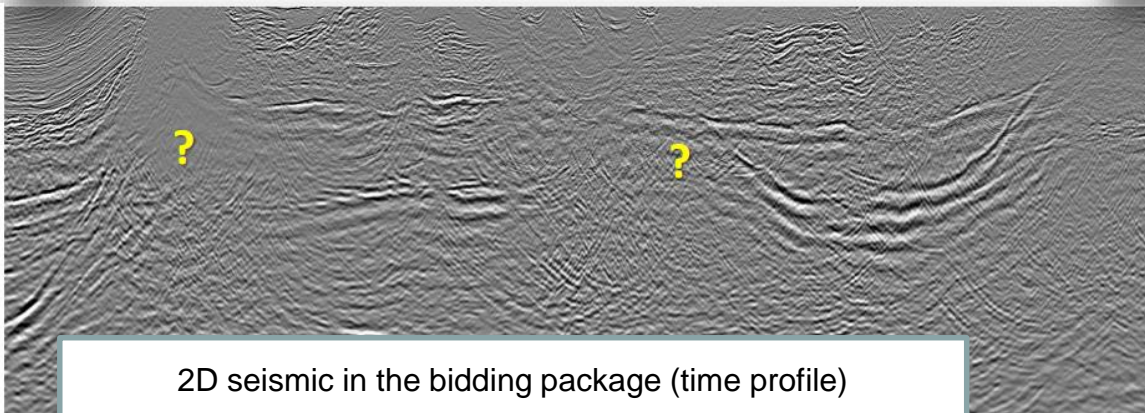
Organic reefs continuously to be the significant exploration target in Eratosthenes Basin, Eastern Mediterranean — Calypso Gas Field



New data & understanding on hydrocarbon accumulation

- ❑ 2012: 2D seismic reprocessed (Eni)
likely organic reefs in Cretaceous-Miocene system
- ❑ 2014 , Shorouk Block (Egypt), Eni: 100% participant
- ❑ 2015, Refined characterization of organic reefs with new 3D seismic data
- ❑ **Aug. 2015, Well Zohr-1: Discovery of giant organic reefs gas field**
Area: 100 km², Gas column: 654m, Reserves: 850 BCM
- ❑ 2017, Offshore Concession (blocks 6/8/10)Bidding (Cyprus) --Eni, Exxon Mobil
- ❑ **2018, Calypso Gas Field (Blk 6) -- Eni**
Area: 72 km² , Reserves: 100 BCM
- ❑ 2019, Glaucus Gas Field (Blk 10) --Exxon Mobile
Area: 100 km², Reserves: 130 BCM

SW

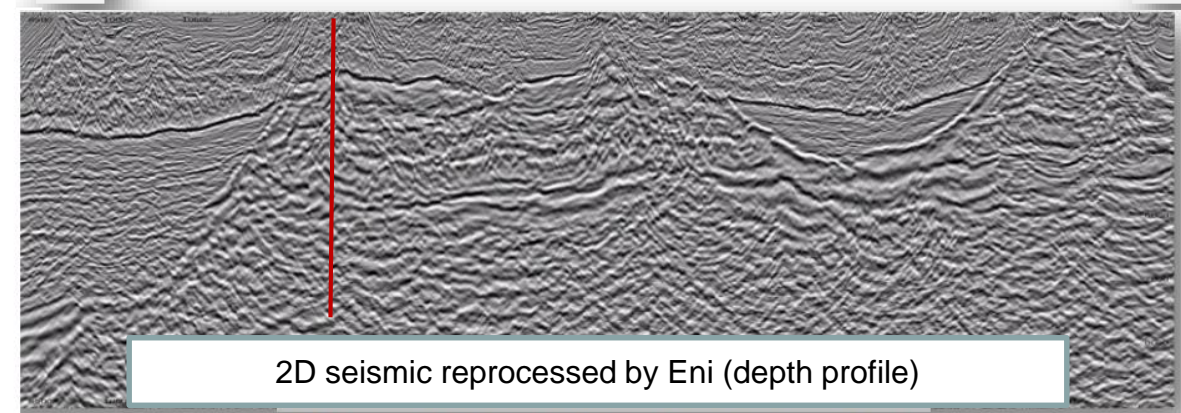


NE

SW

Zohr-1

NE



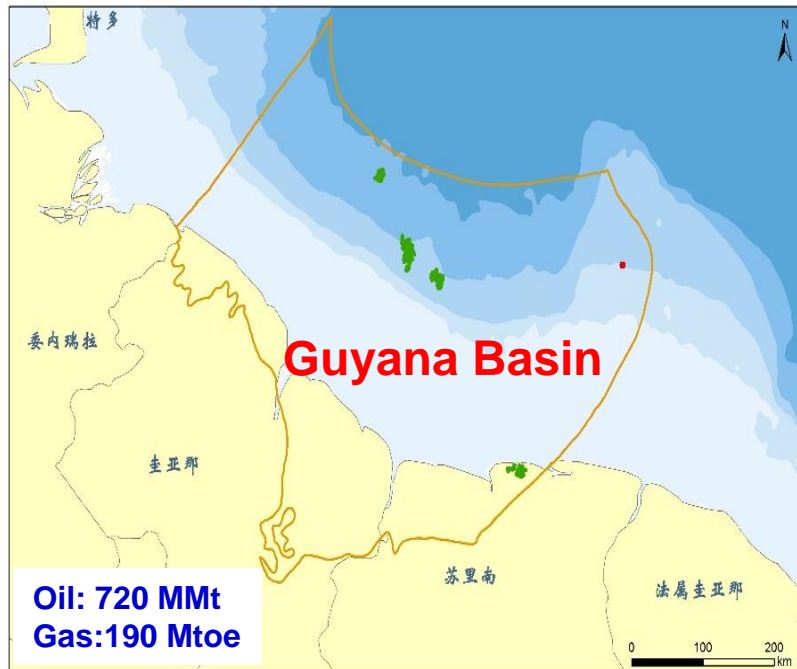
Deep water exploration continuously to be the significant exploration target in Guyana, South America

□ Guyana Basin

Early Cretaceous passive continental margin
Area: 230,000 km²

□ Before 2007

Onshore exploration
No significant discovery



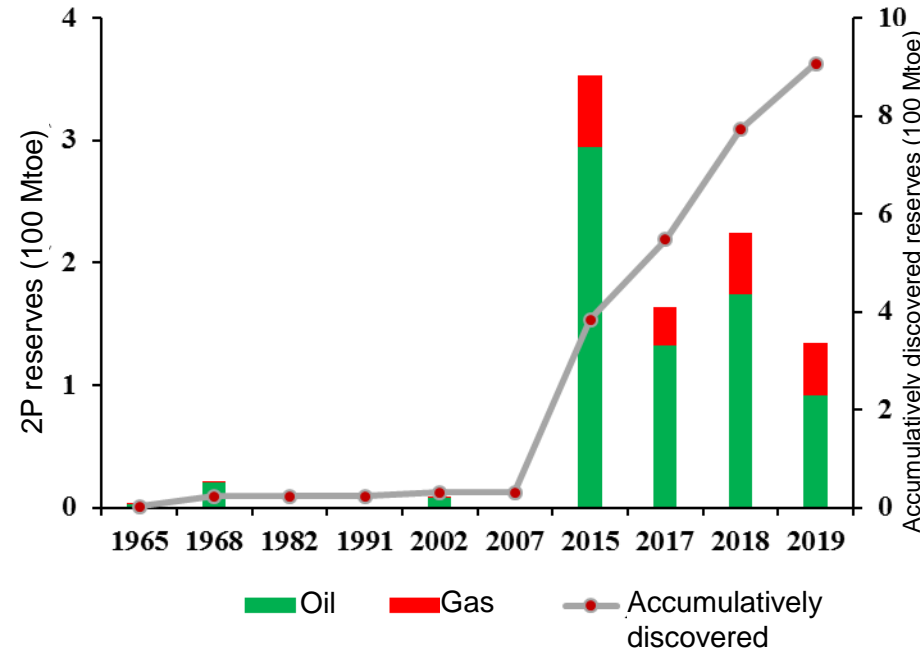
Oil and gas fields in Guyana Basin

□ 2013

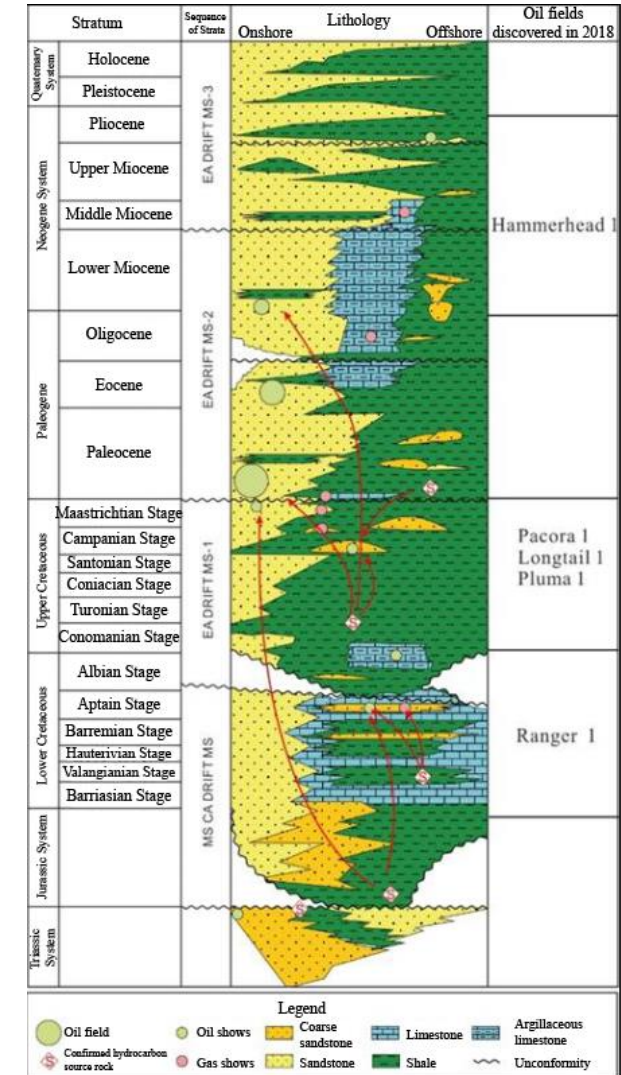
Offshore seismic exploration

□ 2015-2017

5 large-scale O&G fields, e.g. Liza
Upper Cretaceous Turbidite Sandstone
By Exxon Mobil



Oil and gas reserves discovered in Guyana Basin by year



Deep water exploration continuously to be the significant exploration target in Guyana, South America

5 Newly Discovered Oil Fields, 2 Types of Hydrocarbon Accumulation

Blk Stabroek

13 O&G fields

Accumulated recoverable reserves: **910 MToE**

2018

Location: SE of Blk Stabroek

Drilling: 3 wells (Pacora 1, Longtail 1, Pluma 1)

Discovery: Cretaceous

3 oil fields, Total reserves: **137 MMt**

Newly added reserves: **226MToE**

J3-K1 Carbonate (Well Ranger-1)

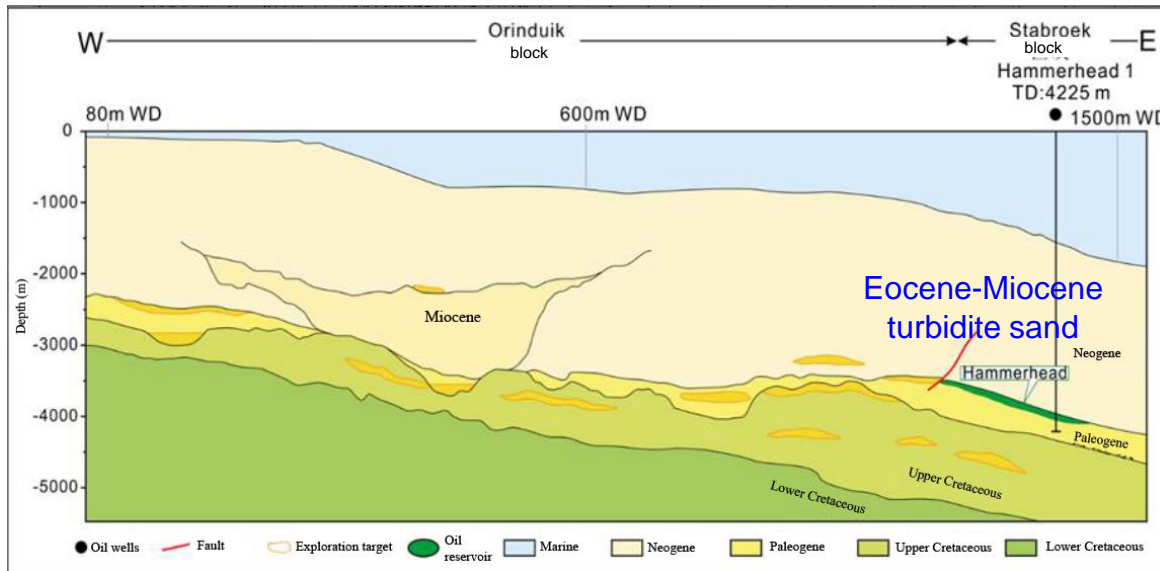
Location: Northern part of Blk Stabroek

Area: **36 km²**, Reservoir thickness: **70m**

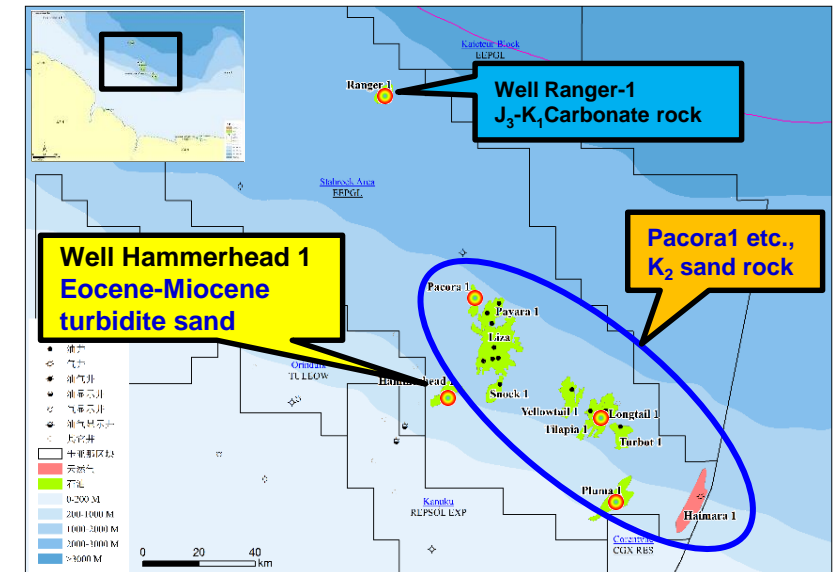
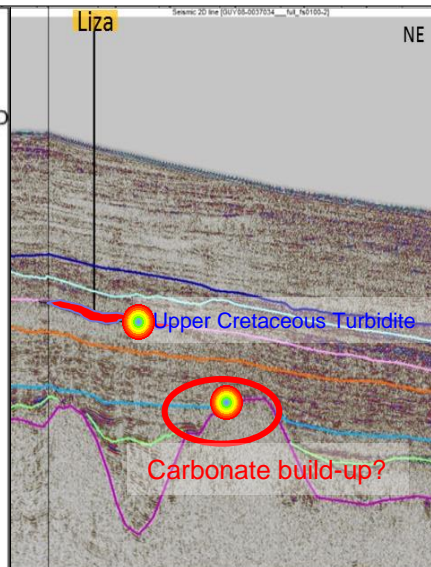
Reserves: 50.54 MMt

Eocene-Miocene turbidite sand (Well Hammerhead 1)

Area: **51 km²**, Reserves: **38.59 MMt**



N-S section of Guyana passive continental margin basin

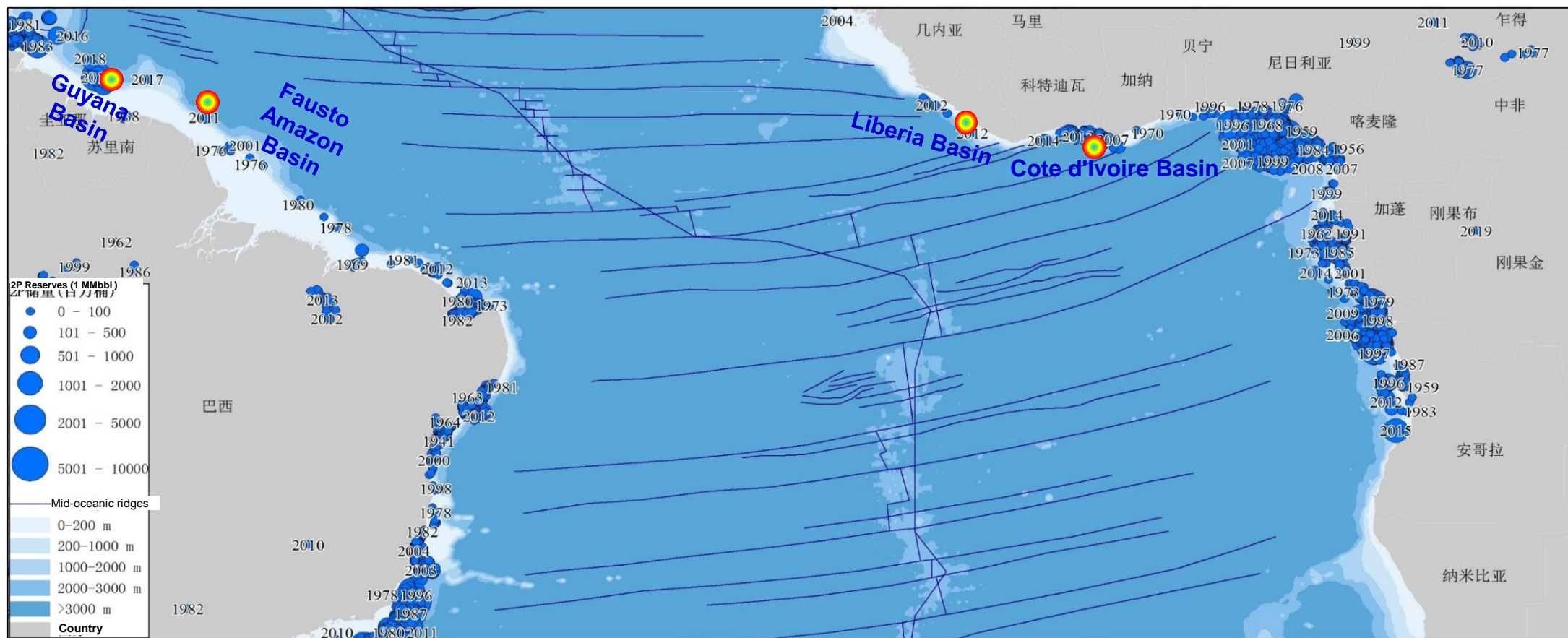


Distribution of blocks and oil and gas fields

Deep water exploration continuously to be the significant exploration target in Guyana, South America

Jubilee : Cote d'Ivoire Basin (West Africa) → Upper Cretaceous turbidite sandstone accumulation (Guyana Basin)

Guyana Basin → Fausto Amazon Basin, Liberia Basin, Cote d'Ivoire Basin



Oil and gas fields in middle and south coast of the Atlantic Ocean

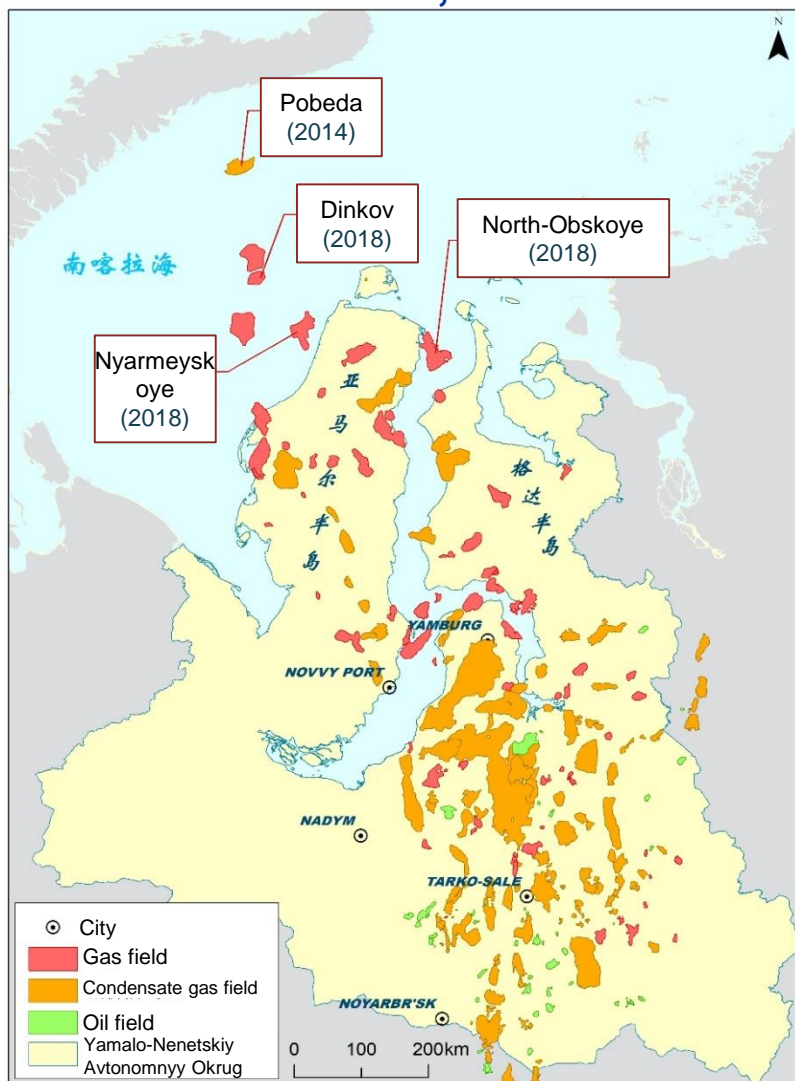
North-Obskoye large gas field was discovered in Arctic South Kara Sea, Russia

The South Kara Sea: Extension of West Siberian Basin to the Arctic waters
Exploration area: 769,000 km²

- ❑ 1960-1980's Onshore giant gas condensate fields
- ❑ After: Stagnant exploration
- ❑ 2014: Pobeda (Victory) giant oil field (Rosneft & Exxon)
- ❑ 2018: North-Obskoye giant gas field (Novatek)
2 Gas fields -- Dinkov & Nyarmeyskoye (Gazprom)
- ❑ **By the end of 2018, total NG reserves -- 6.3 TCM**

Gas Fields Discovered in South Kara Sea Area

Gas field	Year of discovery	Oil (10,000 t)	Gas (100 MCM)
Obskoye Severnoye	2018	411	855
Im.V.A.Dinkova	2018	41	283
Nyarmeyskoye	2018	0	142
Nyakhartinskoye	2018	41	64
Pobeda	2014	130	209
Obskoye	2003	0	42
Chugoryakhinskoye	2002	178	371
Kamennomysskoye-More	2000	0	4855
Kamennomysskoye Severnoye	2000	273	3534
Leningradskoye	1990	192	5834
Rusanovskoye	1989	264	2098
Salekaptskoye	1985	420	30
Tota-Yakhinskoye	1984	1	1259
Salmanovskoye	1979	3613	7727
Antipayutinskoye	1978	0	1874
Geofizicheskoye	1975	410	1361
Kharasaveyskoye	1974	4971	12464
Tambeyskoye Yuzhnoye	1974	3578	9065
Semakovskoye	1971	0	3204
Yurkharovskoye	1970	3390	5588



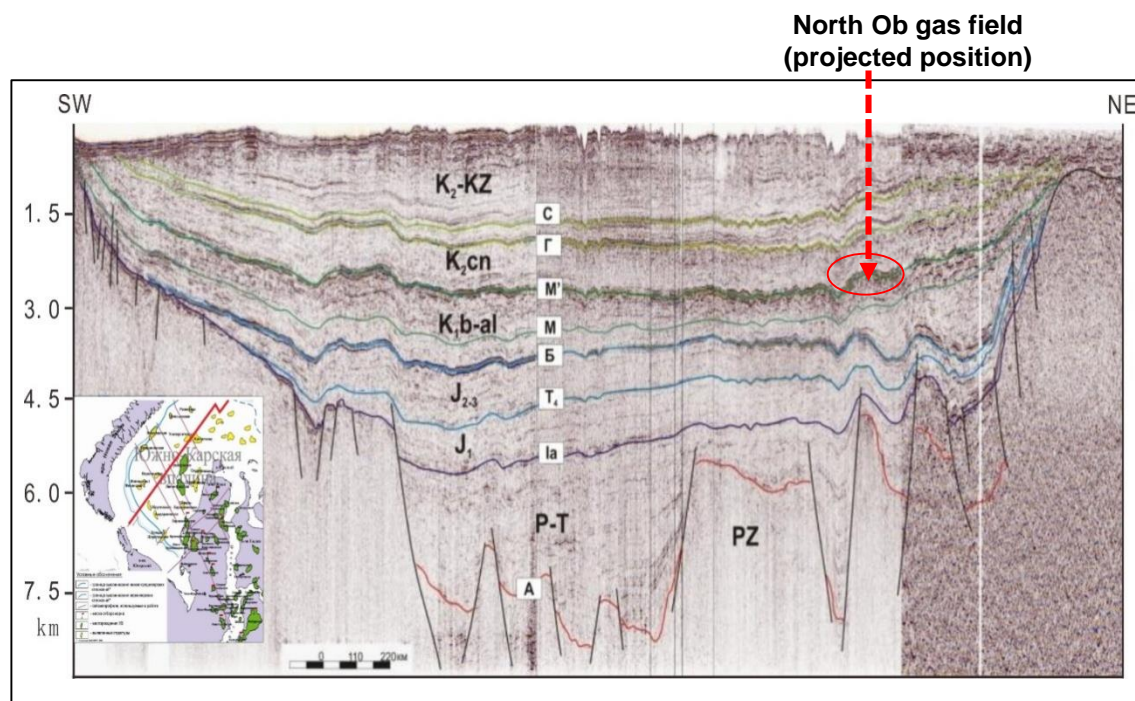
Oil and gas fields in Yamalo-Nenetskiy area

Global 2018 Key Exploration Discoveries Overview

Case 3- Obskoye Severnoye Gas Field

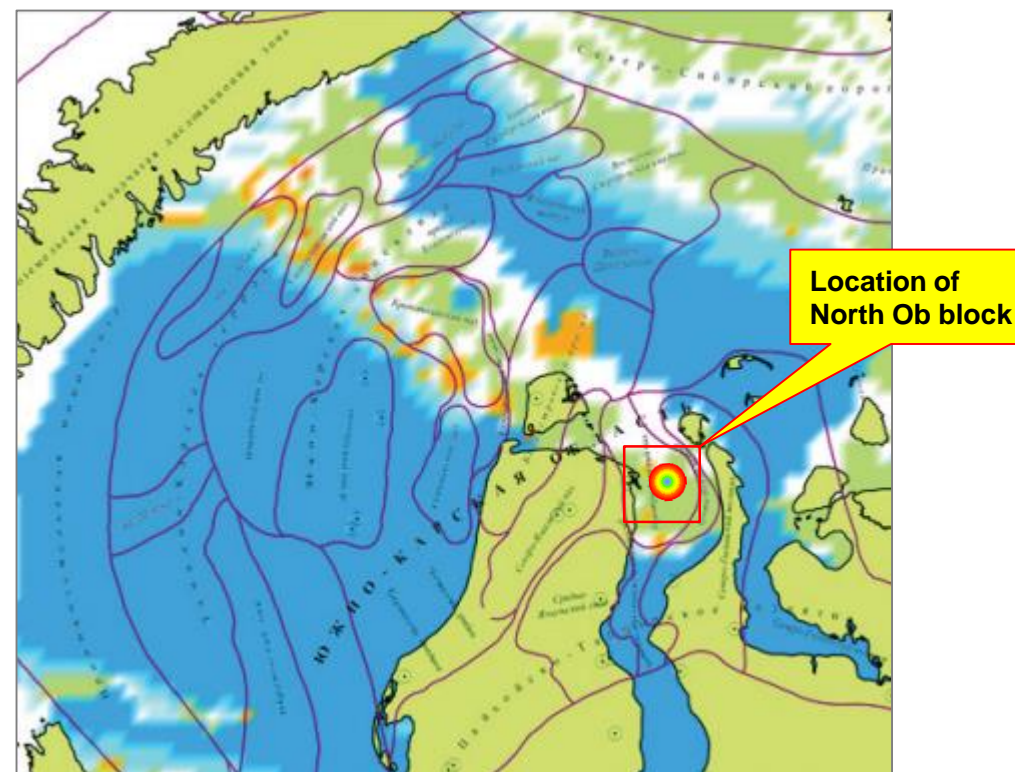
North-Obskoye large gas field was discovered in Arctic South Kara Sea, Russia

- ❑ 2011 North-Obskoye block (Novatek Concession)
 - ❑ Oct, 2018 Well Drilling -- Obskaya North-1
- Discovery: lower Cretaceous Aptian
 Area: 1116.5 km², Thickness: 15m
 Recoverable reserves: 84.96 BCM



SW-NE Regional Seismic Profile, South Kara Sea

There are still a lot of untapped traps in the South Kara Sea waters. With the proceeding of the exploitation and production of Yamal project and Arctic project, the E&P potential in this area will be further unleashed.



Regional Geological Section of Upper Jurassic, South Kara Sea

Discovery breakthrough over past 2 decades in Donner Halten Subbasin in Voring Basin, Norway

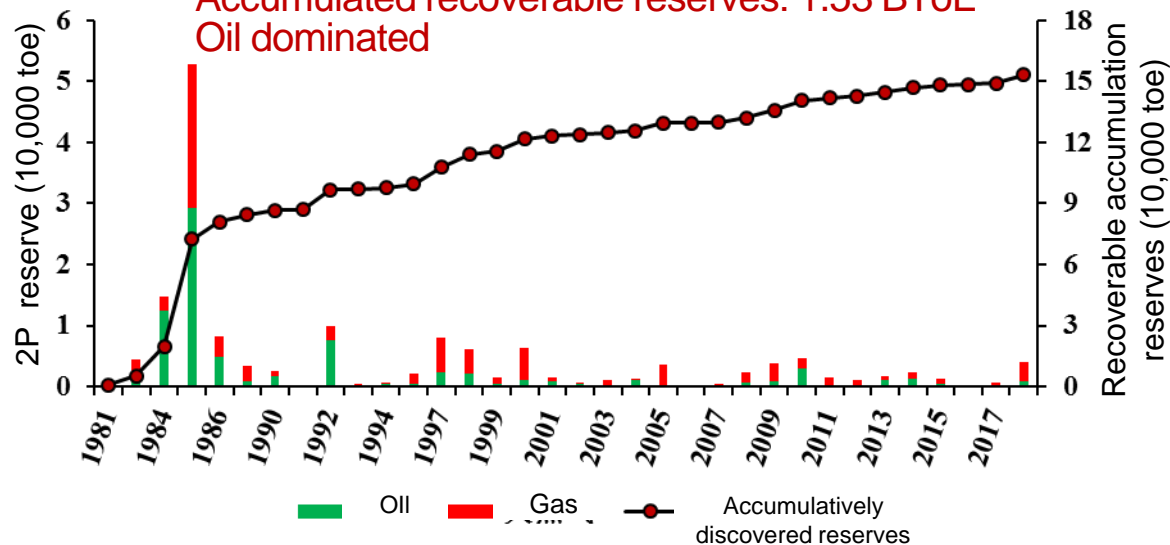
- ❑ The Voring Basin
 - Passive continental margin basin
 - Area: 148,000 km²
- ❑ 1980's: Exploration initial stage
 - Major target: Donna & Halten sub-basin
 - Continuous discoveries
- ❑ Since 2000, Expanding Stage
 - Deep & ultra deep waters to the west of the sub-basin

❑ Current

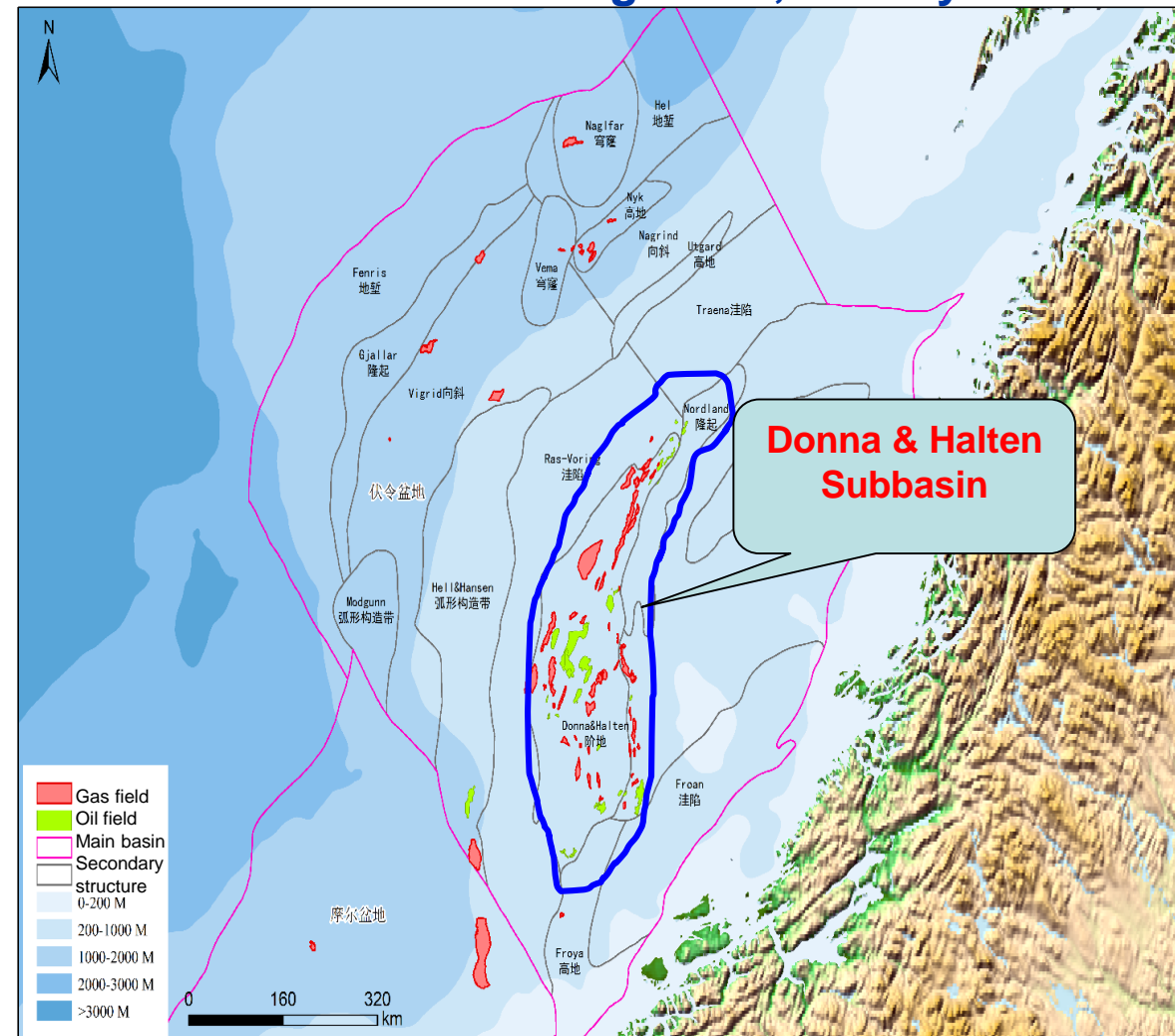
Discovered O&G fields: 96

Accumulated recoverable reserves: 1.53 BToE

Oil dominated



Oil and gas reserves in Voring Basin by year

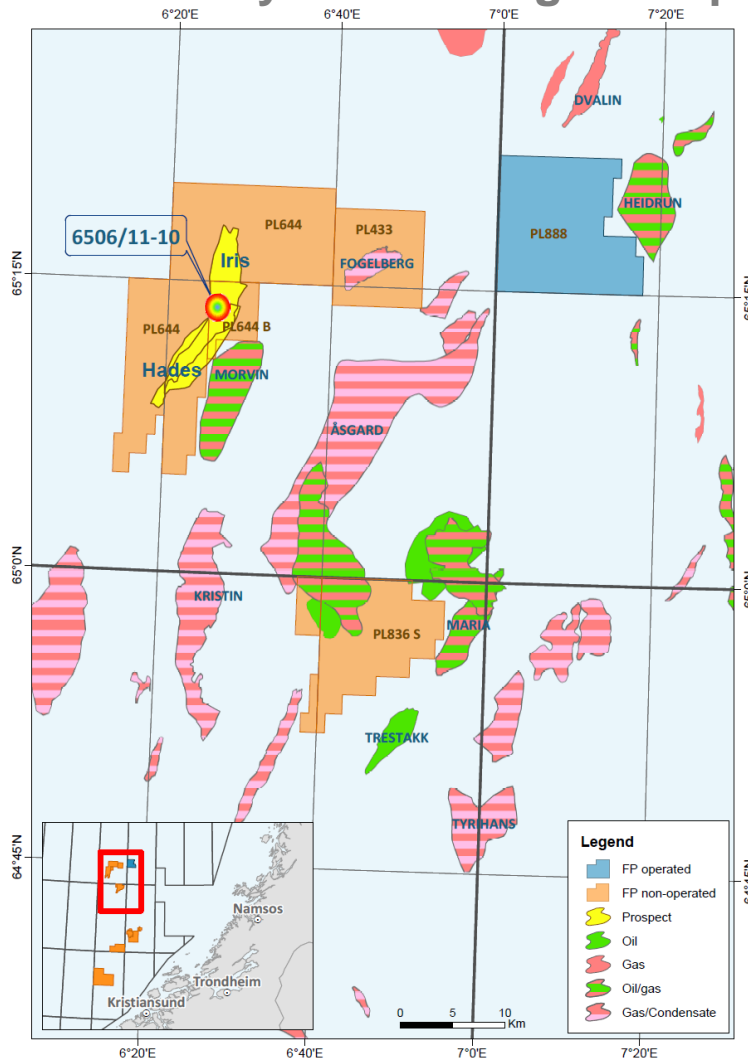


Oil and gas fields in Voring Basin

Global 2018 Key Exploration Discoveries Overview

Case 4- Hades/Iris Gas Field

Discovery breakthrough over past 2 decades in Donner Halten Subbasin in Voring Basin, Norway



□ 2001

Morvin oil field,
Onstream
1st discovered by Equinor (Statoil)

□ 2012

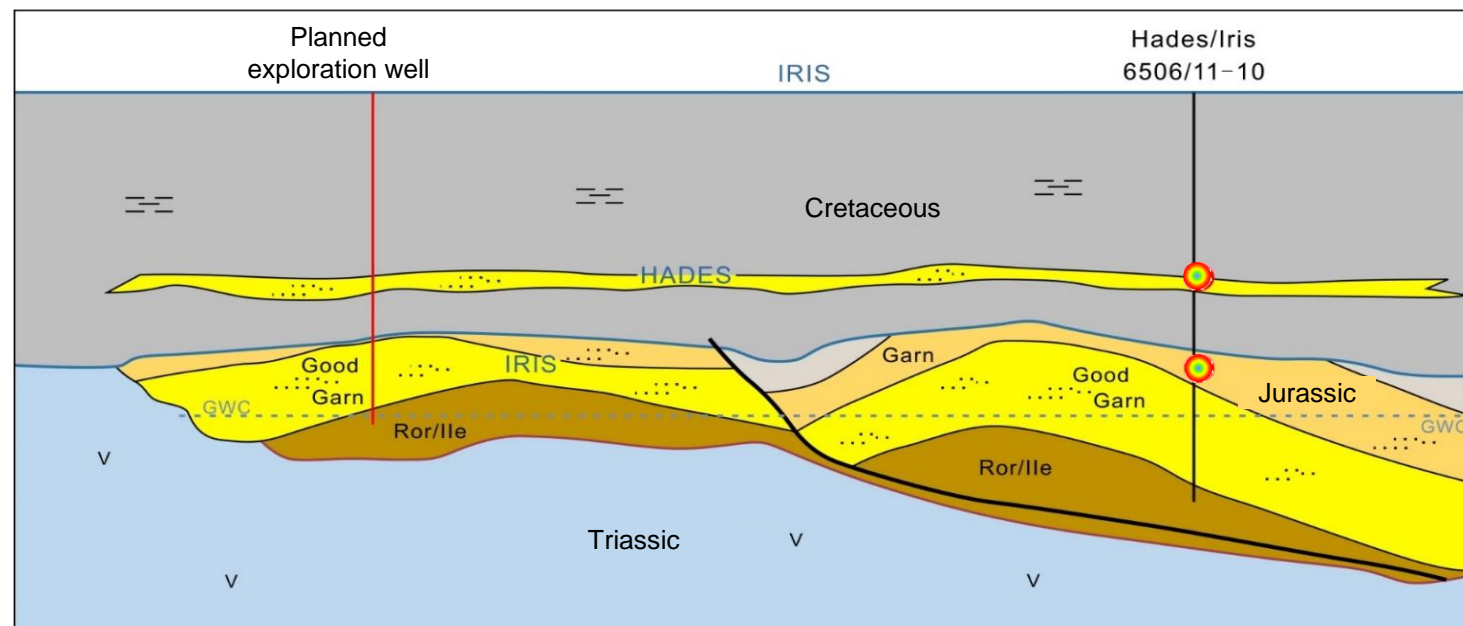
Block 6506/11-10
1st CA in Voring Basin of Norway
OMV ,Austria (Operator)

□ April, 2018

Discovery of Hades/Iris Gas Field
Location: 5 km NW to Morvin oil field
2P reserves of 28.72 MTtoE.

□ **Biggest Discovery (20 years)**

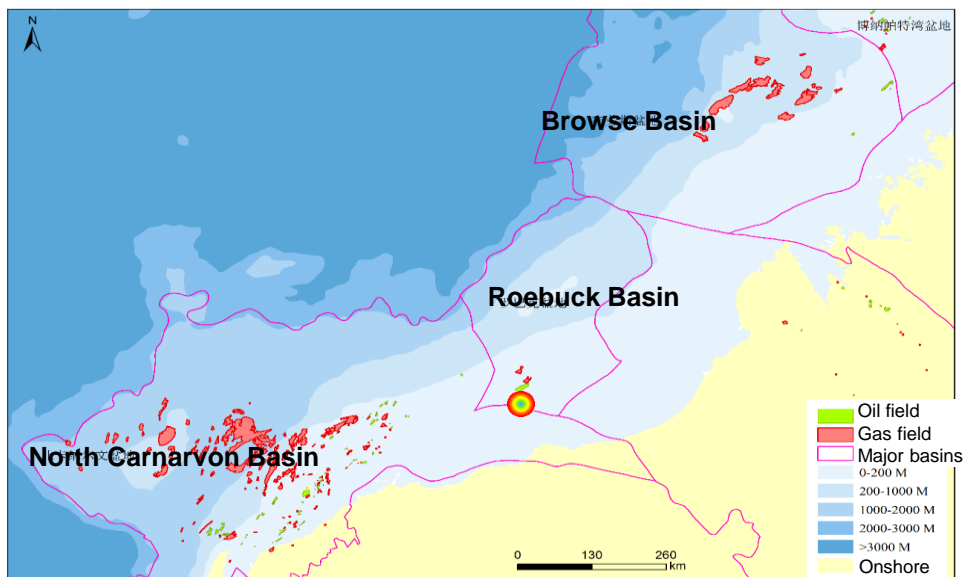
Condensate gas accumulation
Cretaceous & Jurassic



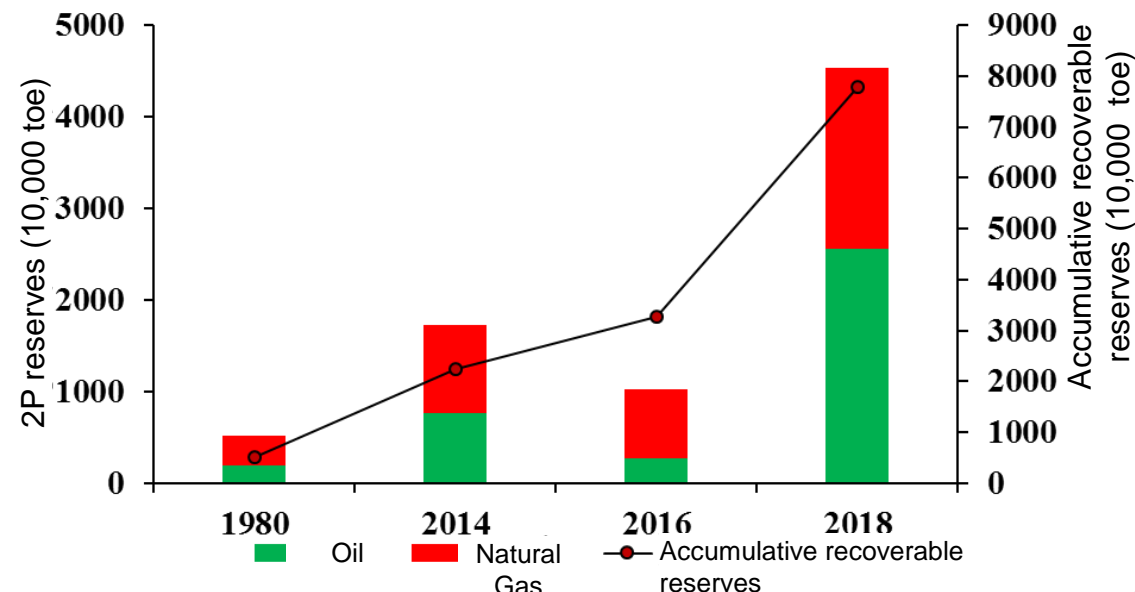
Largest oil field discovery over 4 decades in Roebuck Sub-basin, North West Shelf, Australia

- ❑ Roebuck Sub-basin
 - Passive continental margin basin
 - Northwestern Australian continental shelf
 - Area: 84,000 Km²
 - Prolific gas basins surrounding
- ❑ North Carnarvon Basin
 - Rich oil in shallow waters (J-K)
 - Rich gas in deep waters (T)
- ❑ Browse Basin
 - Rich oil in shallow waters (K)
 - Rich gas in deep waters (J)

- ❑ Before 1980
 - Drilling : 8 wells
 - Discovery: Phoenix Gas Field
- ❑ 1980s'—2014
 - No exploration discoveries
- ❑ **After 2014**
 - Discoveries: 3 O&G fields
- ❑ Total O&G recoverable reserves
 - 77.96 MToE**
 - Gas dominated



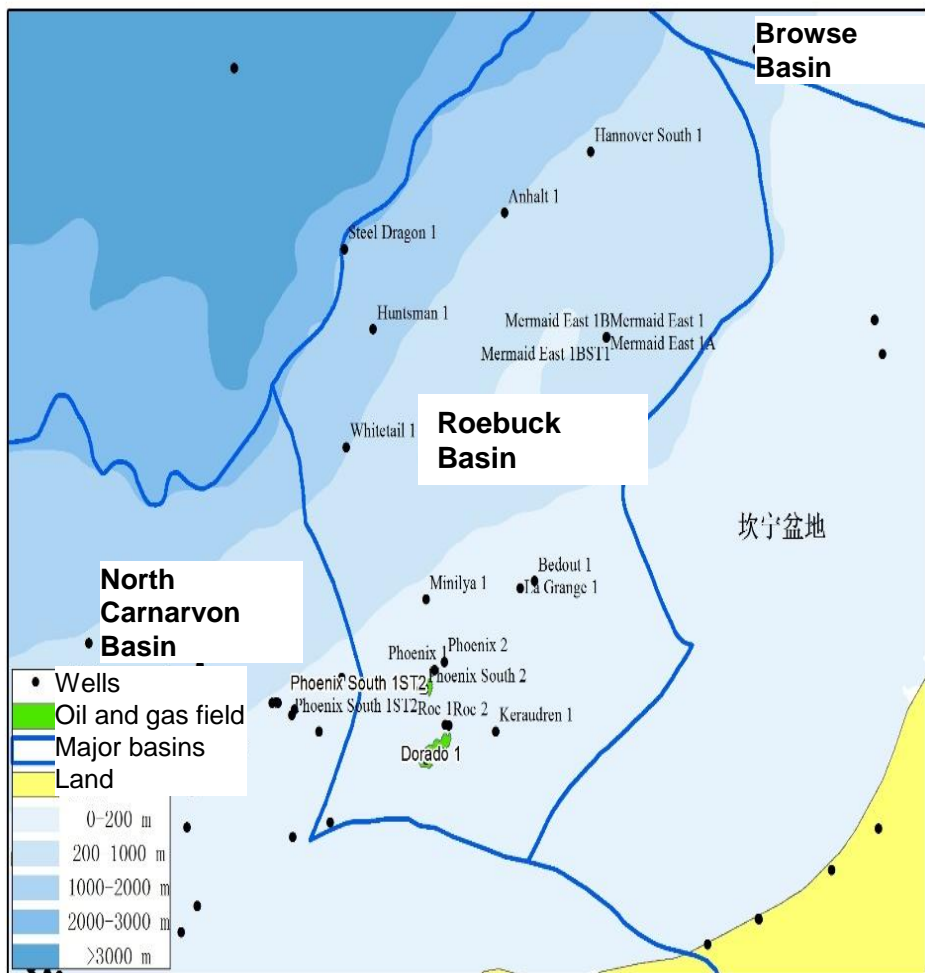
Major petroliferous basins in the northwestern Australian continental shelf



Reserves of discovered oil and gas fields in Roebuck Sub-basin by year

Largest oil field discovery over 4 decades in Roebuck Sub-basin, North West Shelf, Australia

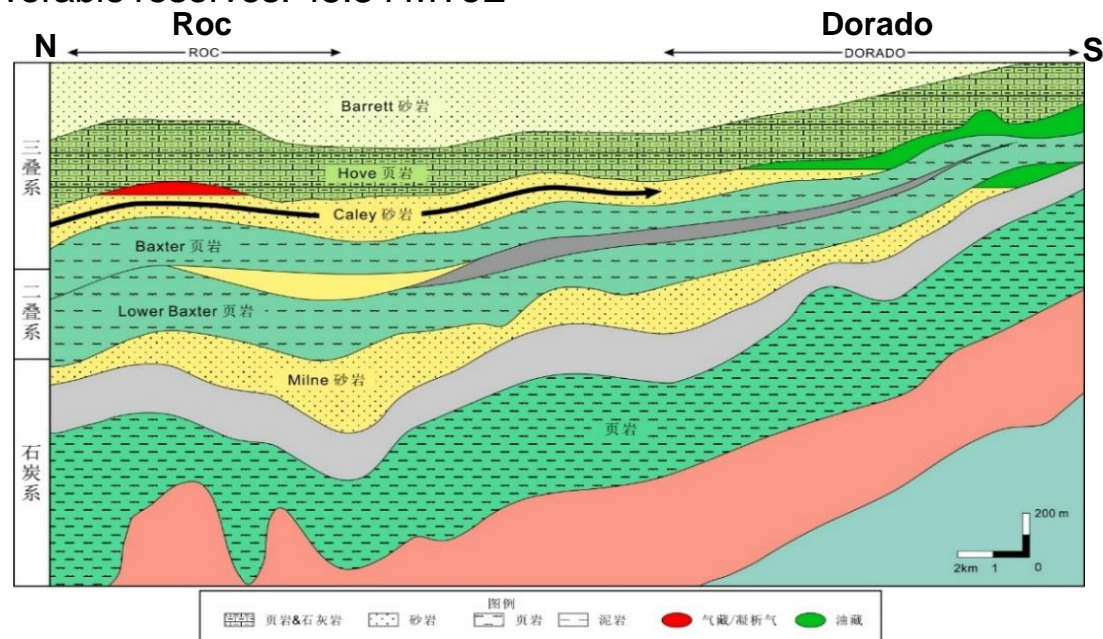
Roebuck Sub-basin Exploration Review



Exploitation overview of the Roebuck Subbasin

- ❑ 2014 -- by Apache
R&D: Phoenix south trap
Drilling: O&G discovery
Formation: Middle Triassic sandstone
- ❑ 2016 -- by Quadrant Energy
Further exploration: Southwards
Discovery: Roc condensate reservoir
2P recoverable reserves: 45.34 MToE

- ❑ 2018 -- by Quadrant Energy
Discovery: **Dorado light oil reservoir**
lithologic turbidite sandstone trap
the 3rd largest oil discovery in Western Australia
Significance to the exploration of NW Australian continental shelf



Accumulation model of Dorado Oilfield

Outline

I. Global Oil and Gas Exploration Situation

II. Global 2018 Key Exploration Discoveries Overview

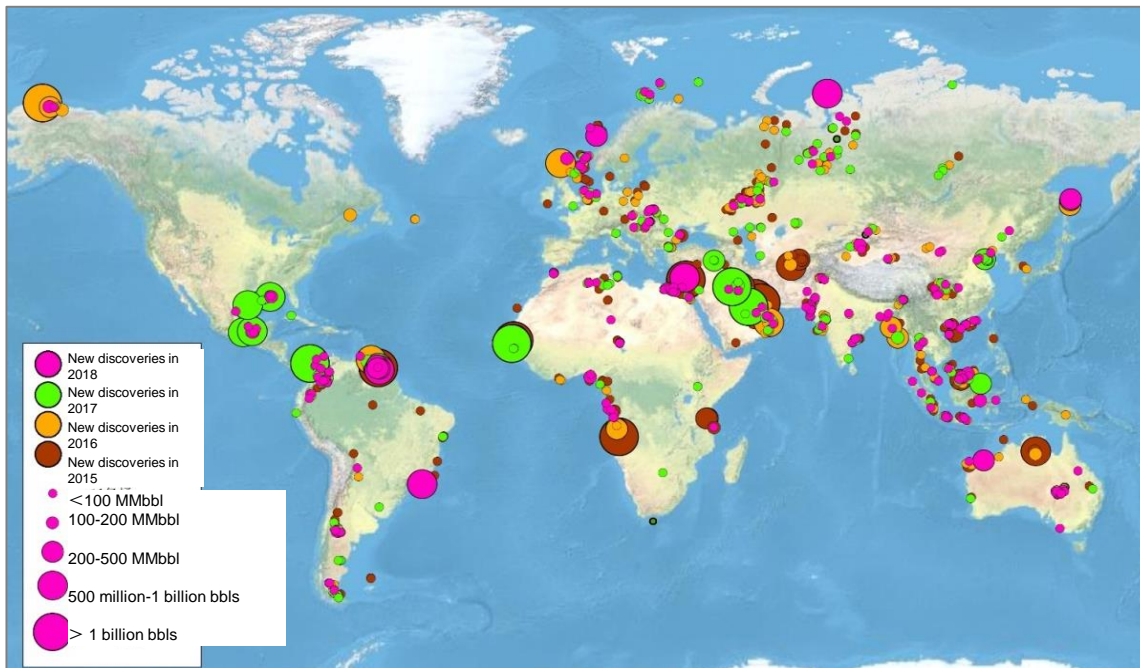
III. Implication for Future Global Oil and Gas Exploration

Implication for Future Global Oil and Gas Exploration

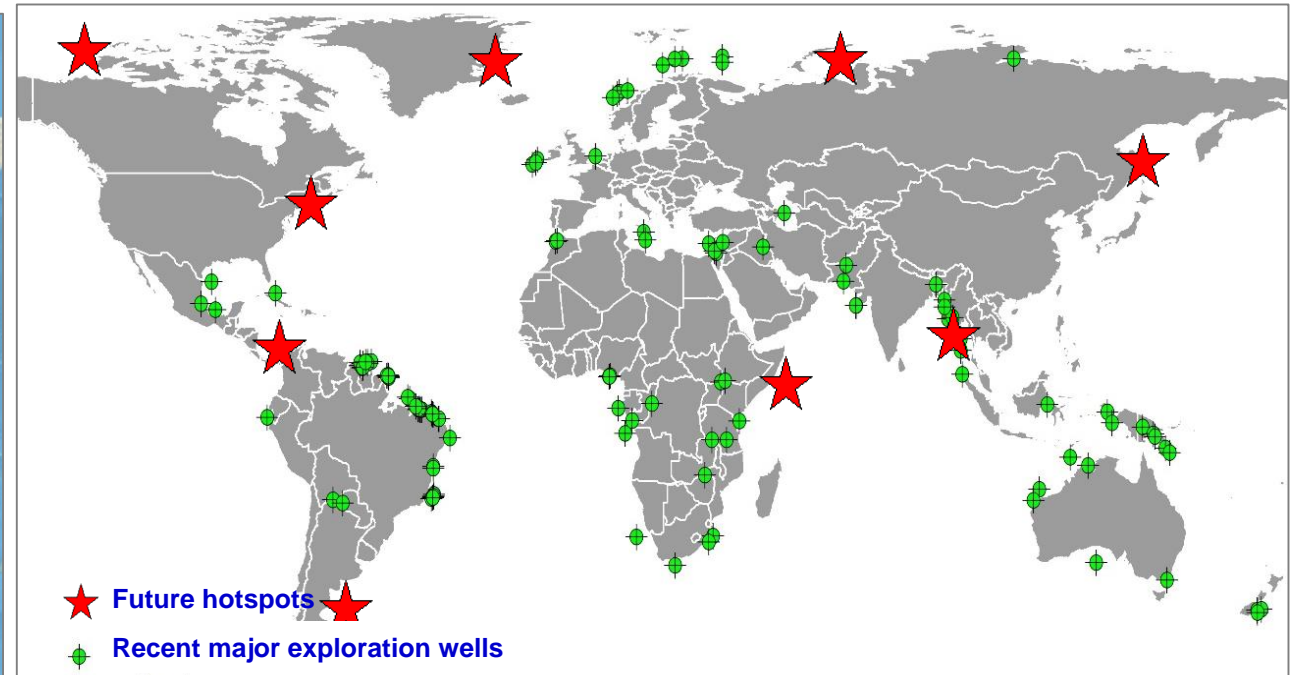
Implication 1- Offshore Dominates Exploration Hotspots

18 Exploration Targets will be the future hotspots, Offshore dominates

- ❑ **Current hotspots:** E turbidite sand (Gulf of Mexico), K-E turbidite sand & carbonate rocks (Guyana), Subsalt carbonate rocks (South Atlantic), K basin floor fan (Senegal), E turbidite sands (East African waters), J-K rift (North Sea & Barents Sea), K-E reefs (Eastern Mediterranean), Zagros-Middle Arab J-E, foreland K-E (PNG)
- ❑ **Future hotspots:** J-K rift in Argentine waters, E turbidite sands (Columbia), K-turbidite sands (east coast of the United States), K-delta sands (north slope of Alaska), J-K sandstone (Greenland), J-K (Kara Sea of the Russian Arctic), Miocene sands (far northeast Sahalin), N sands (the Bay of Bengal-Andaman Sea), K-E sands (Somalia, East Africa)



Global future exploration hotspots prediction
by new discoveries from 2015 to 2018



Global recent important exploration well drilling activities and
future hotspots prediction

Implication for Future Global Oil and Gas Exploration

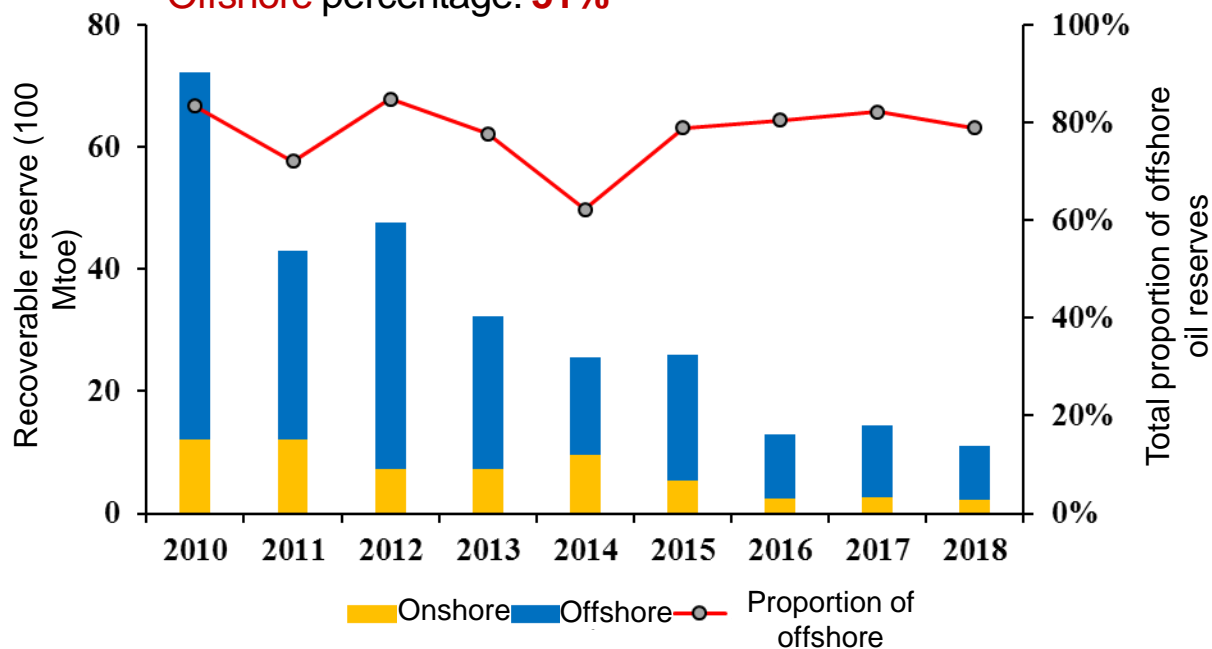
Implication 1- Offshore Dominates Exploration Hotspots

Offshore has already been the global major conventional O&G exploration target area

- In the past 10 years
 - Offshore conventional newly added reserves / Newly discoveries reserves : **70%+**
 - Offshore large-Medium O&G fields / Total: **80%+**

- In the past 5 years

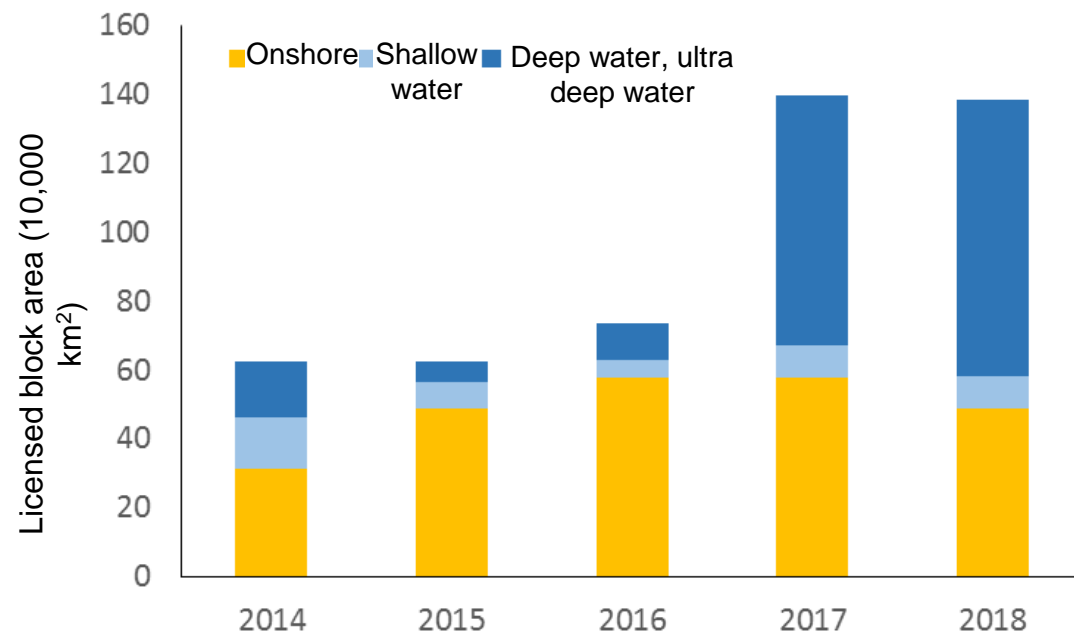
Licensed Blocks acreage: **4.76 Mln Km²**
 Offshore percentage: **51%**



Newly discovered reserves by sector (2010-2018)

- Features summary for newly licensed onshore assets

Basin Margin
 Re-tapping on highly explored target
 Complex geological settings
 Severe operating environment



Blocks licensed by sector (2014-2018)

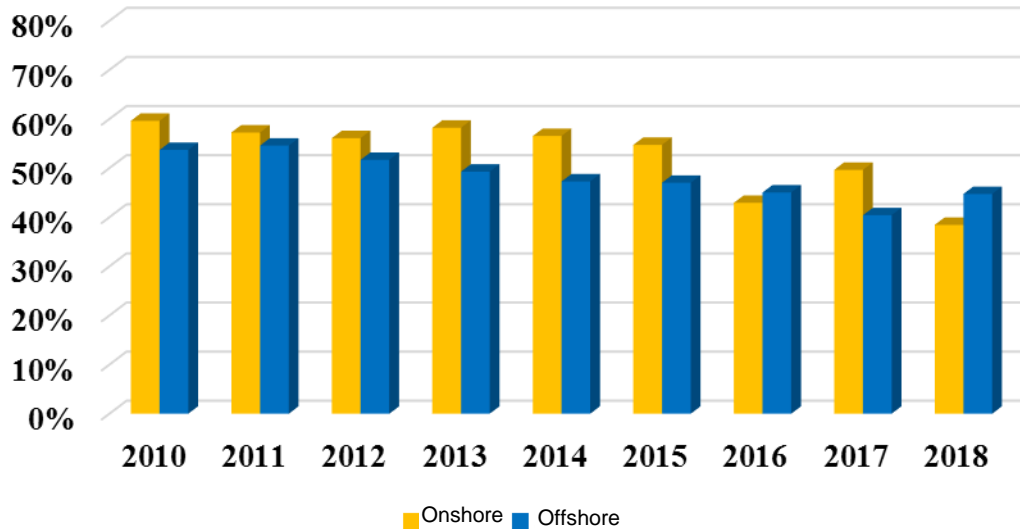
Implication for Future Global Oil and Gas Exploration

Implication 1- Offshore Dominates Exploration Hotspots

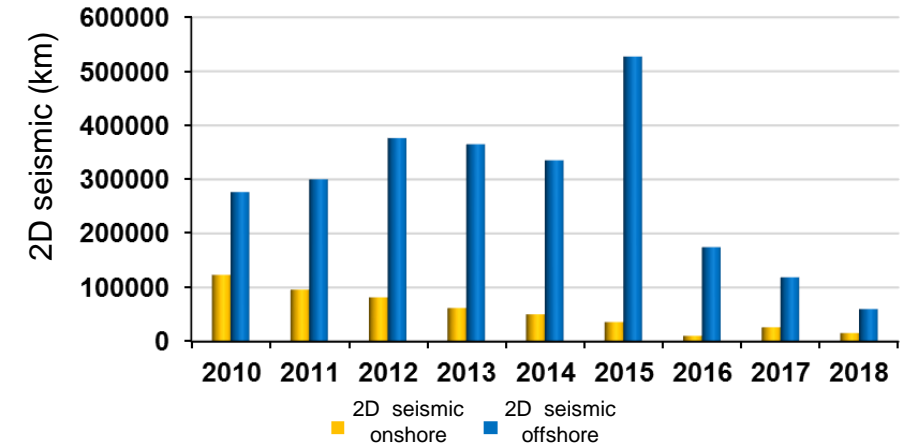
Offshore has already been the global major conventional O&G exploration target area

- 2D & 3D Seismic
 - Offshore of the total: **70-95%**
 - Far greater than Onshore**
- Exploration success rate
 - Onshore: **38-60%**
 - Offshore: **40-55%**

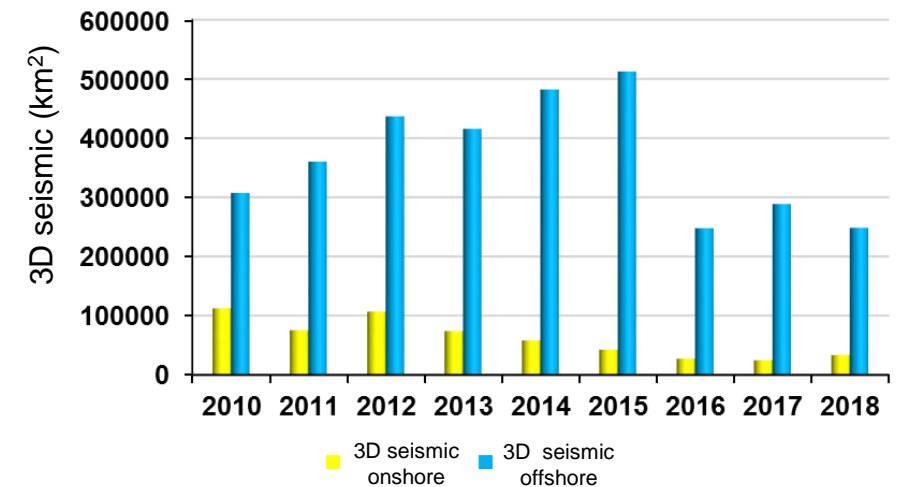
Success rate of deep well and appraisal well



Onshore and offshore exploration success rates by year



Onshore and offshore 2D seismic by year



Onshore and offshore 3D seismic by year

Implication for Future Global Oil and Gas Exploration

Implication 2- Strengthening Independent Exploration

Strengthening independent exploration will be the fundamental for IOC sustainable development

Seven Majors are willing to increase reserves through sustained exploration investment

Independent Exploration Investment

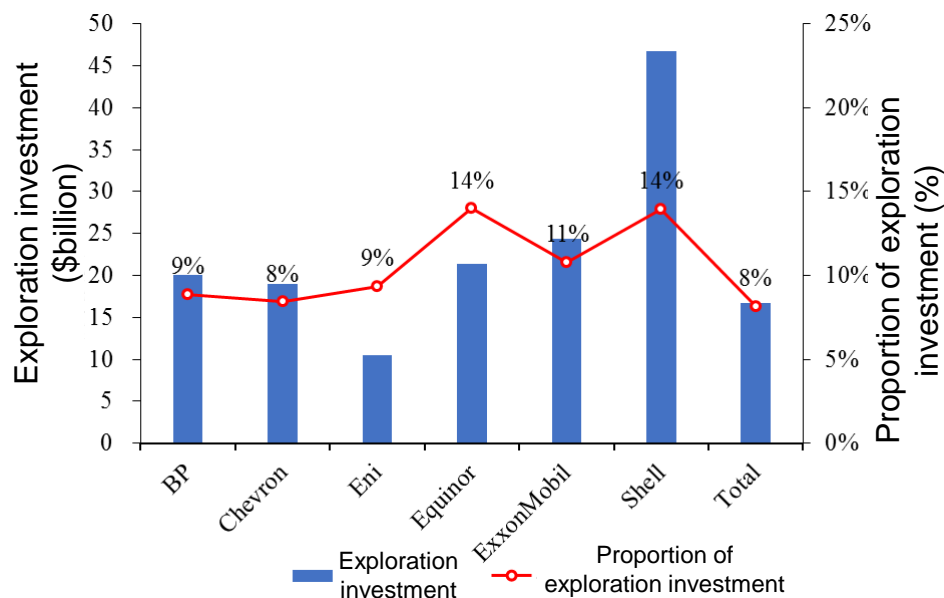
Annual average: USD 2.3 bln

Percentage of the upstream total: 11%

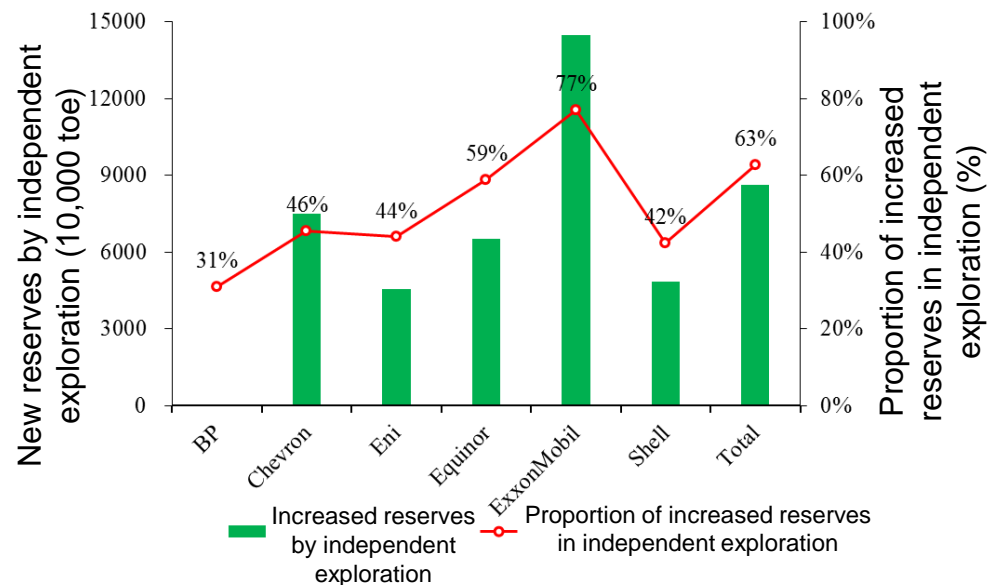
Independent Reserves Increasement after 2014

Annual average newly added equity recoverable reserves: **77 MToE**

Accounting for **43%** of the newly added SEC reserves



Annual average exploration investment and percentage of upstream total from 2014-2018 by Majors



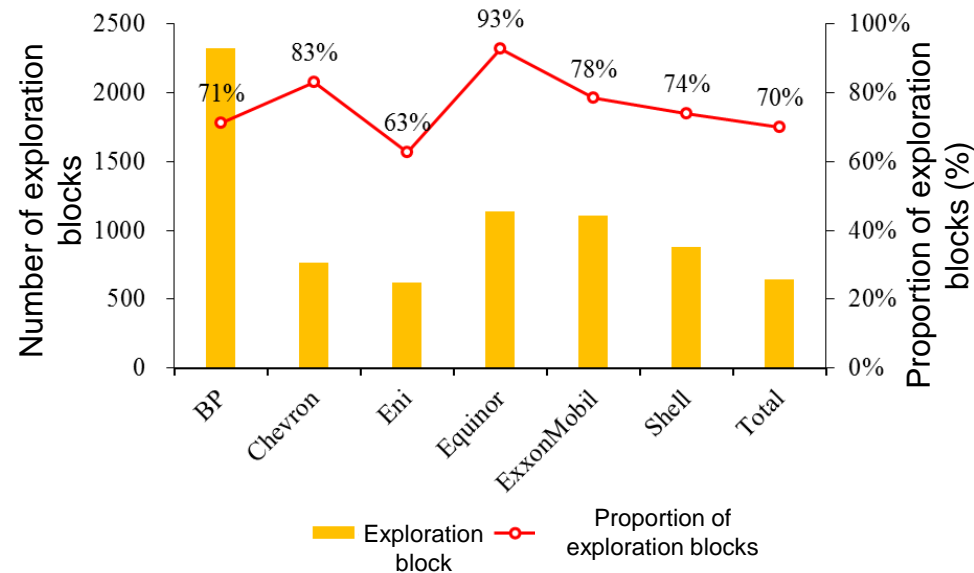
Annual average increase & percentage of independent exploration reserves from 2014-2018 by Majors

Implication for Future Global Oil and Gas Exploration

Implication 2- Strengthening Independent Exploration

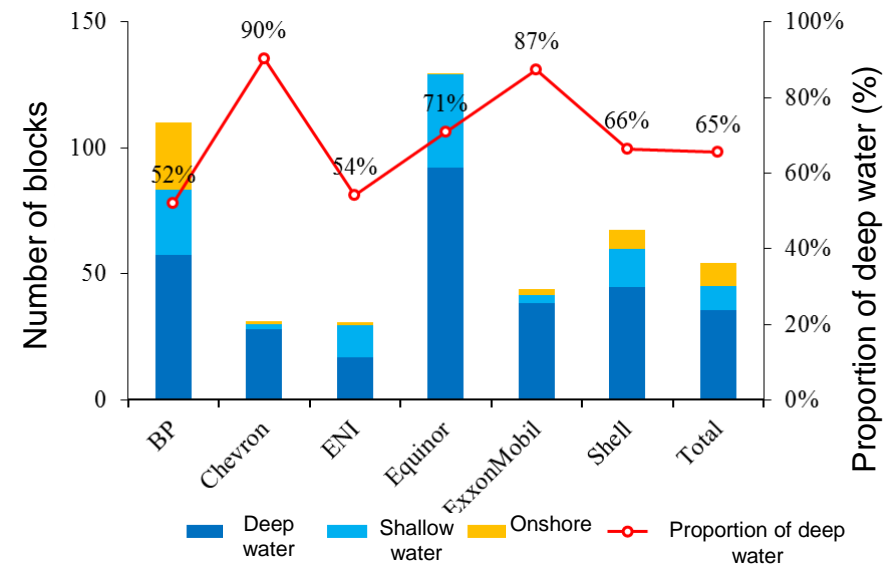
Seven Majors actively participated in the exploration asset bids to ensure sustainable development

- By the end of 2018, average concession license / Major
Exploration blocks: **1068**
Percentage of total blocks: **75%**



Total Exploration Blocks License hold within Majors by the end of 2018

- In past 5 years, annual average concession access /Major
Total exploration blocks: **67**
Deep water blocks: **45, 67%** of the total



Exploration Blocks License hold within Majors in recent 5 years by sector

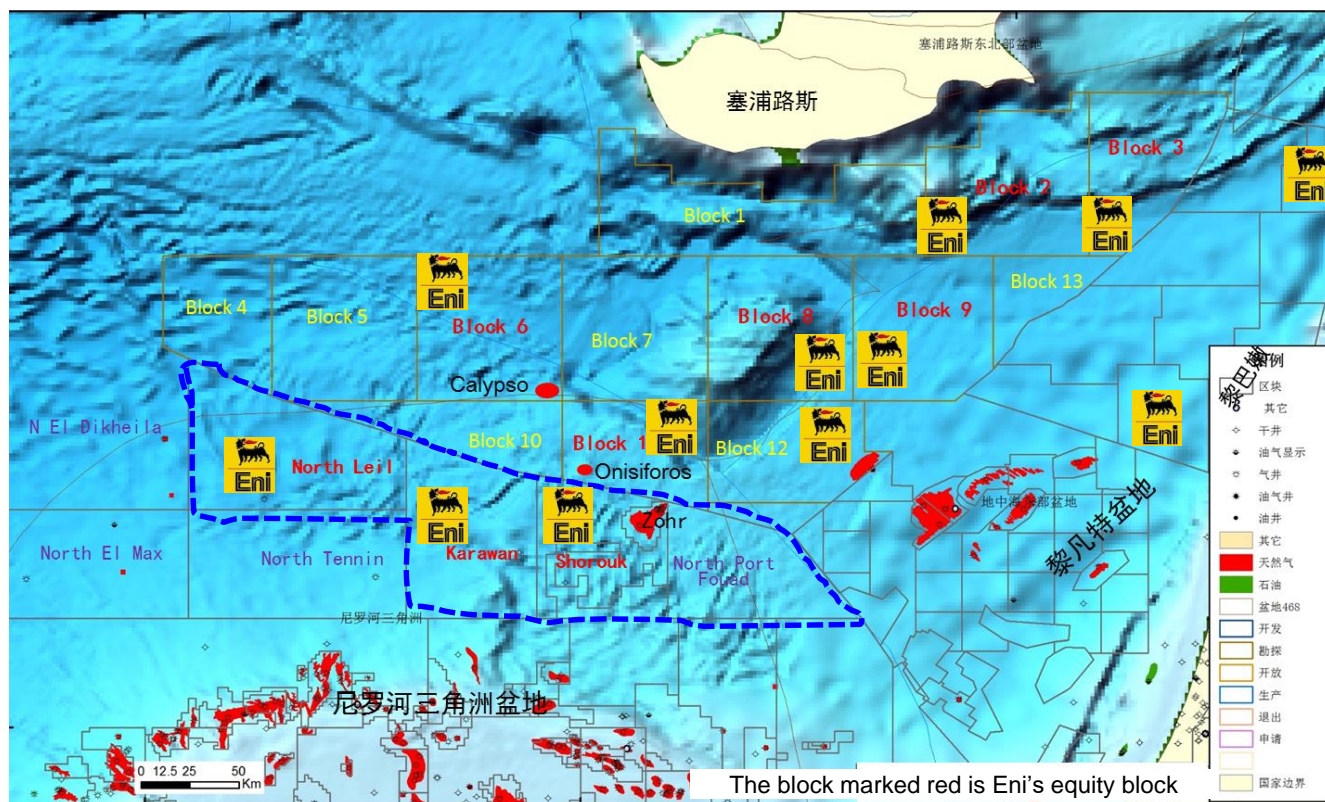
Implication for Future Global Oil and Gas Exploration

Implication 3- Scientific Farsightedness for Exploration Leading Position

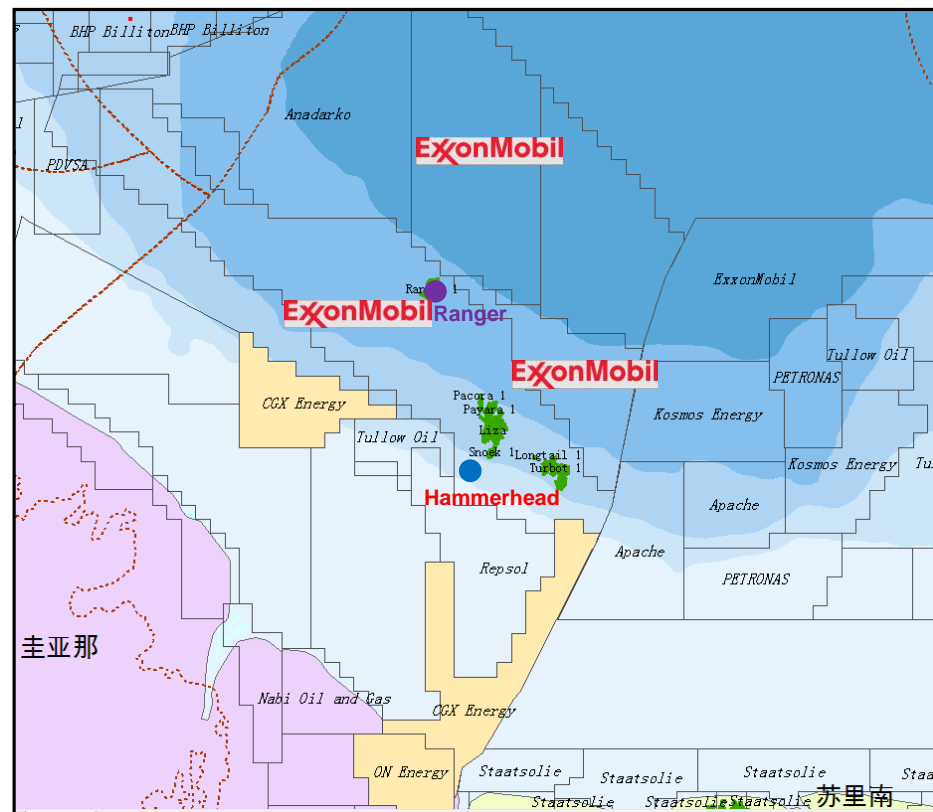
Only by deploying exploration in frontier areas in advance, can a company take the lead in global O&G exploration

□ IOCs' Exploration Strategy

Active in the potential regions: Eastern Mediterranean, Guyana, Brazil's pre-salt, East Africa



Blocks operated by Eni in the Eastern Mediterranean



Blocks operated by Exxon in the Guyana Basin

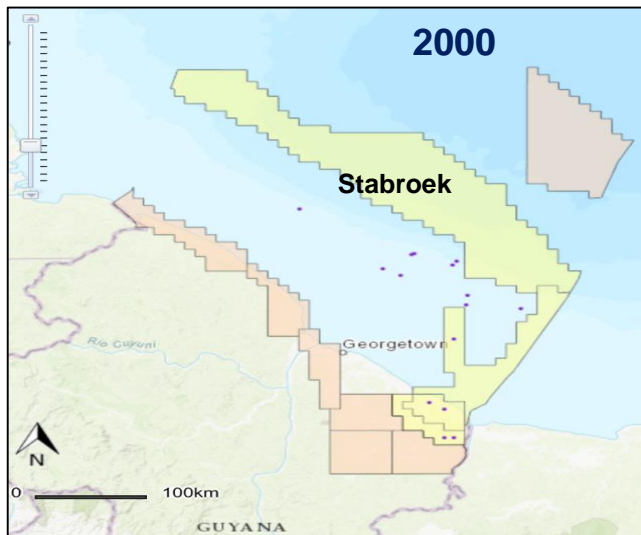
Implication for Future Global Oil and Gas Exploration

Implication 3- Scientific Farsightedness for Exploration Leading Position

Story on Stabroek Block of Guyana

1999-2007

- 1999
Exxon: 100% Participant
Exxon & Mobil merged
No reported exploration activities



2008-2014

- Exxon
15 Years
13 Giant O&G discoveries
- 2008
Exxon: start exploration
- Feb.,2009
Shell: 25% Participant
Exxon: 75% Participant
- Jul.,2012
Shell: 50% Participant
Exxon: 50% Participant
- 2013 –Exploration activities
3D seismic: 2,350 km²
Impacted by territorial sea disputes
- 2014 –Exploration activities
Shell: withdraw (unknown reasons)
Hess: 30% Participant
Nexen: 25% Participant
Exxon: 45% Participant

2015-2019

- Shell
Farm in, Farm out
Lose the chance
- May,2015 Exxon
1st O&G discovery
Well Liza-1, offshore Stabroek Block
- 2017-2018
Discoveries:
Payara, Snoek, Liza Deep, Turbot, Longtail
Ranger, Pacora, Hammerhead, Pluma
- 2019
Shell: seeking for the opportunities

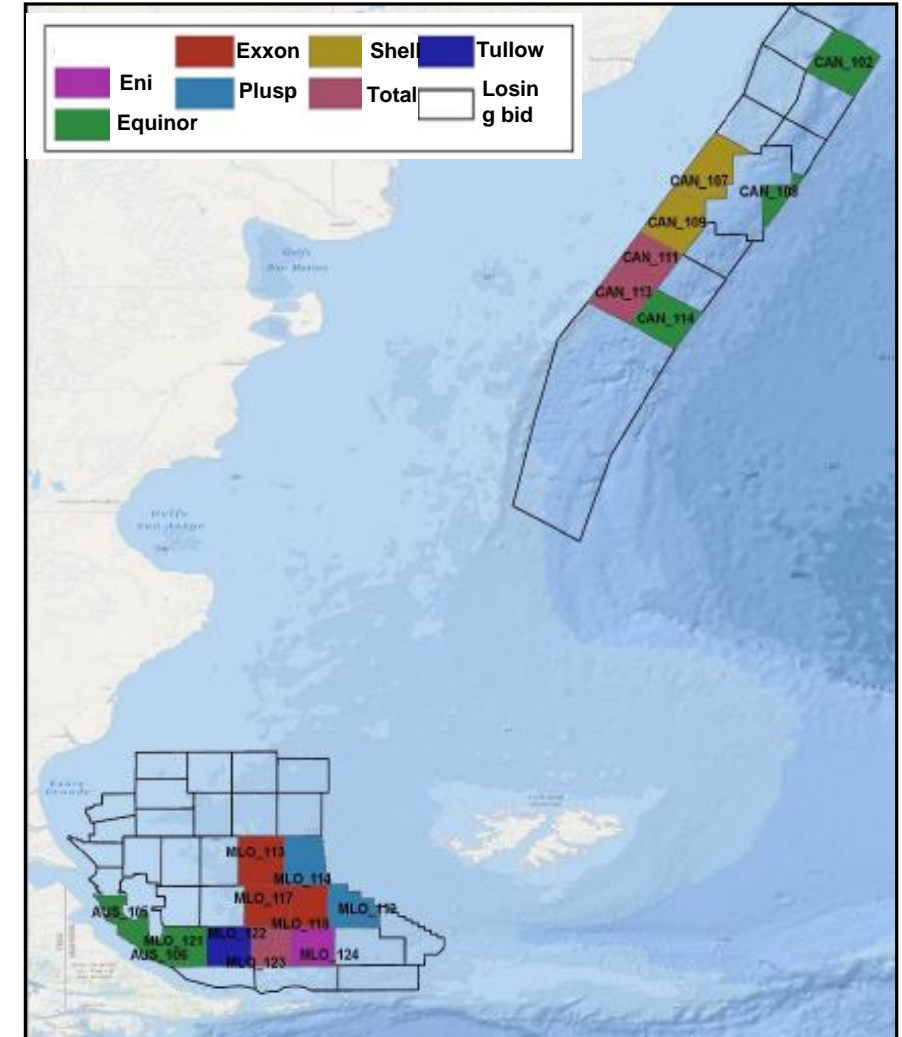
Project	Year	Oil (t)	Gas (100 MCM)	Total reserves (10,000 toe)	Series	Reservoir	Lithology
Liza	2015	25753	647	30936	Upper Cretaceous	New Amsterdam	Sandstone
Liza	2016	3699	88	4406	Upper Cretaceous	New Amsterdam	Sandstone
Payara 1	2017	6849	171	8219	Upper Cretaceous	New Amsterdam	Sandstone
Turbot 1	2017	3082	91	3813	Upper Cretaceous	New Amsterdam	Sandstone
Snoek 1	2017	3288	86	3973	Upper Cretaceous	New Amsterdam	Sandstone
Ranger 1	2018	4110	114	5023	Upper Cretaceous	6250-K1	Carbonate rock
Pluma 1	2018	5479	285	7763	Upper Cretaceous	New Amsterdam	Sandstone
Hammerhead 1	2018	3151	86	3836	Miocene	Pomeroon	Sandstone
Pacora 1	2018	918	26	1123	Upper Cretaceous	New Amsterdam	Sandstone
Longtail 1	2018	3767	114	4680	Upper Cretaceous	New Amsterdam	Sandstone
Tilapia 1	2019	3699	103	4521	Upper Cretaceous	New Amsterdam	Sandstone
Yellowtail 1	2019	4795	100	5594	Upper Cretaceous	New Amsterdam	Sandstone
Haimara 1	2019	652	339	3369	Upper Cretaceous	New Amsterdam	Sandstone

Implication for Future Global Oil and Gas Exploration

Implication 3- Scientific Farsightedness for Exploration Leading Position

- ❑ Short term exploration potential
Argentine waters, Cuba, Somalia, the Russian Arctic, Greenland
- ❑ 2019 Brand new exploration region
Argentine waters
18 Blocks were awarded to 13 oil companies
Equinor: 7 Blocks
- ❑ No Chinese oil companies involved

Block	Operator	Partner	Signature fee (\$10,000)
MLO-124	Eni	Mitsui, Tecpetrol	6260.5
MLO-121	Equinor	/	6619.5
CAN-108	Equinor	/	1617
CAN-114	Equinor	/	4717
AUS-105	Equinor	/	1520
AUS-106	Equinor	/	2287
MLO-113	ExxonMobil	Qatar	3010
MLO-117	ExxonMobil	Qatar	3448
MLO-118	ExxonMobil	Qatar	2945
CAN0197	Shell	Qatar	849
CAN-109	Shell	Qatar	5912.5
CAN-111	Total	BP	1738
CAN-113	Total	BP	868
MLO-123	Total	Equinor, YPF	4446.5
MLO-114	Tullow	Pluspetrol, Wintershall	10597
MLO-119	Tullow	Pluspetrol, Wintershall	8244.5
MLO-122	Tullow	/	4366
CAN-102	YPF	Equinor	2382.5

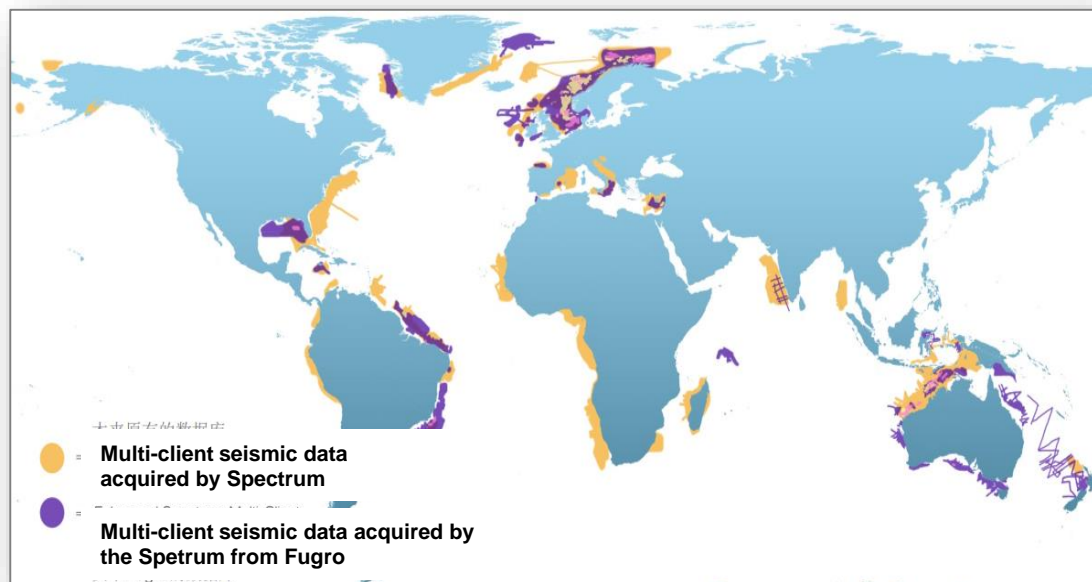


Bidding results in Argentine waters, 2019

Implication for Future Global Oil and Gas Exploration

Implication 4- Data Sharing and R&D

- ❑ Multi-client seismic data base
 - Acquisition: Spectrum, CGG, ION, BGP
- ❑ IOCs' Actions
 - Annual budget & planning
 - R&D for bidding
- ❑ Resource host countries regulation
 - Data base purchase before tendering
 - 2-3 times of the data base prices after awards



Multi-client seismic data of Spectrum Geo utilization by region

Utilization of multi-client seismic data base and enhancing the research for long term successful exploration

Company type	Min. (\$10,000)	Max. (\$10,000)	Avg. (\$10,000)
IOC	650	5500	2650
NOC	560	3000	1500
Independents	300	3800	1020

Annual expenses for purchase of multi-client seismic data by company type
(Data collected from 2017 & 2018)

(Source: tendering information, seismic data inquiry, etc.)

