



MONGOLIA: FRONTIER EXPLORATION POTENTIAL IN AN EMERGING ECONOMY



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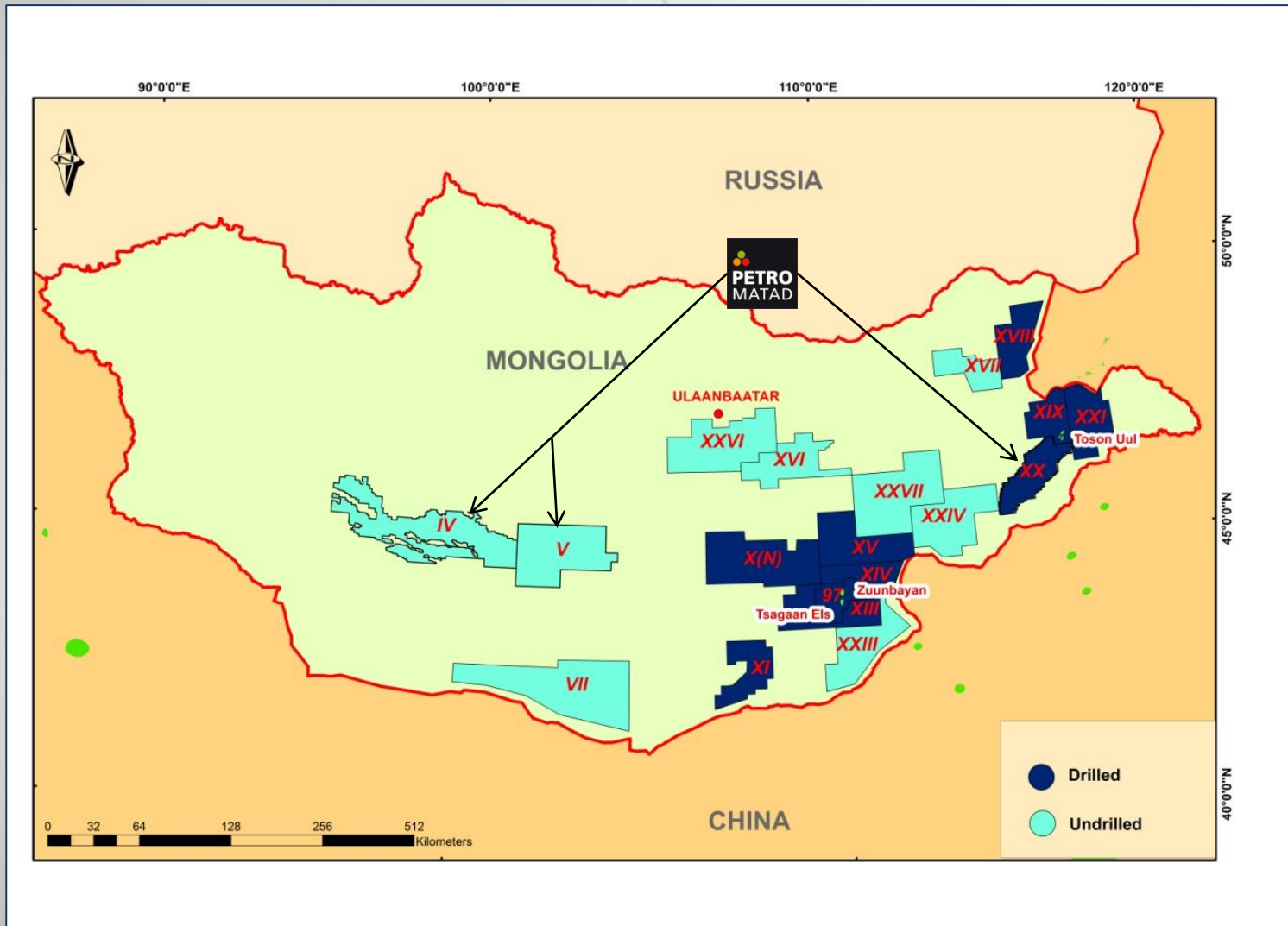


Mongolia - a Developing Market for Oil and Gas

- Became a democracy in 1990, growth now in double digits
- Coal (Tavan Tolgoi), copper & gold (Oyu Tolgoi) are the main economic drivers
- Domestic market uses c.22,000 bbls/d of refined products, all imported from Russia
- Current domestic production is c.9,500 bbls/d, all exported to China
- Mongolia is planning a refining sector, to meet growing domestic demand and use domestic production
- Mongolia needs more domestic production and is very under explored
- Investment climate being helped by new Investment & Petroleum Laws

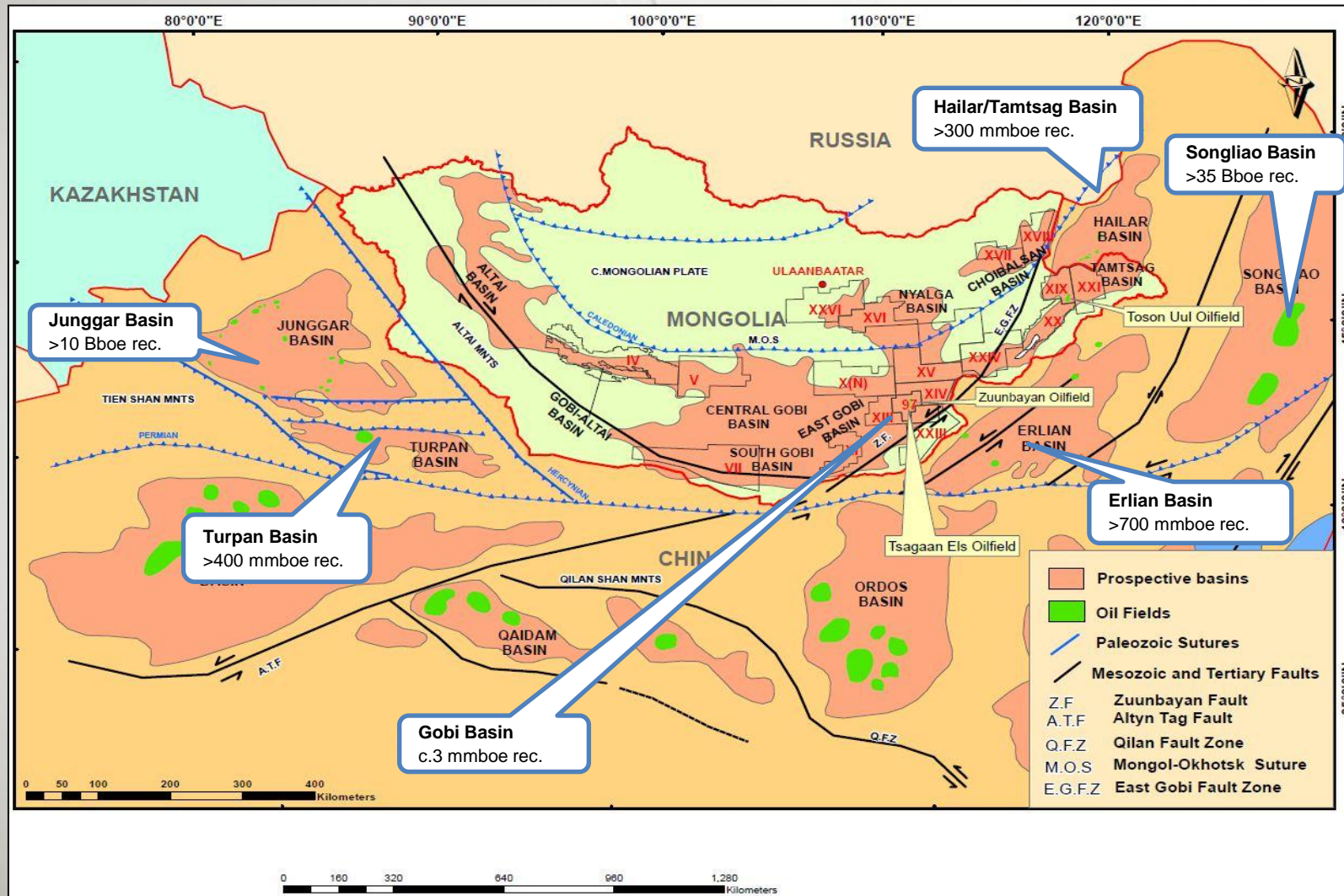


Current PSC's - Mongolia



- All production from Blocks XIX & XXI, eastern Mongolia (Toson Uul)
- Historical production from SE of country, Tsagaan Els & Zuunbayan. Were discovered in the 1940's, now shut-in (Block 97).
- Currently >290,000km² licensed & c.240,000kms² are pending.
- Currently 14 companies have an interest, but most small or inactive.
- Most PSC areas sparsely or undrilled
- Only Petro-China is producing (Block XIX & XXI) with Petro Matad the most active frontier explorer.
- Petro Matad: 100% in Blocks IV, V & XX

Sedimentary Basins of Mongolia Plus Analogue Basins in China



Mongolian basins analogous to Chinese basins, all of which contain commercial hydrocarbons.

Toson Uul area, Block XIX, has >2 Bbbls oil in-place.

All Mongolian fields produce from U. Jurassic – L Cretaceous ‘Syn-Rift’ megasequence.

Reservoirs = fluvio-lacustrine Ssts
Source = Lacustrine oil shales
Seals = lacustrine shales

An unproven Pre-Rift play, analogous to Chinese basins, may exist

Analogue Basins – China vs Mongolia

Junggar
W China

Blocks IV & V
W Mongolia

Block XX
E Mongolia

Erlian
E China

Songliao
E China



•The productive Syn-Rift megasequence of China's Songliao & Erlian basins is repeated across Mongolian Basins

•The Pre-Rift Megasequence so productive in China's foreland basins of Junggar, Turpan & Tarim is present in western Mongolian Basins, although not as well developed

•ALL Chinese analogue basins that have had significant exploration are proven producers

Lithologies:		Qualifiers:	
[Yellow Box]	Medium to coarse clastics	[Dashed Line]	Argillaceous
[Light Green Box]	Fine clastics (lacustrine)	[Dotted Line]	Arenaceous
[Dark Green Box]	Fine clastics (marine)	[Circle with dots]	Conglomeratic
[Blue Box]	Carbonates	[Triangle]	Evaporitic
[Purple Box]	Evaporites	[Inverted Triangle]	Siliceous
[Brown Box]	Ophiolite/Melange	[V-shape]	Volcanic/tuffaceous
[Red Box]	Volcanics	[I-shape]	Calcareous
[Red with + Box]	Basement (Igneous)	[Wavy Line]	Dolomitic
[Green with + Box]	Oceanic crust	[Thick Line]	Coal/Lignite
[Red with / Box]	Basement (Metamorphic)	[Triangle with dots]	Breccia
		[Ph]	Phosphate

Regional Petroleum Geology

Megasequence 1: Permo-Carboniferous - Jurassic 'Pre-Rift'

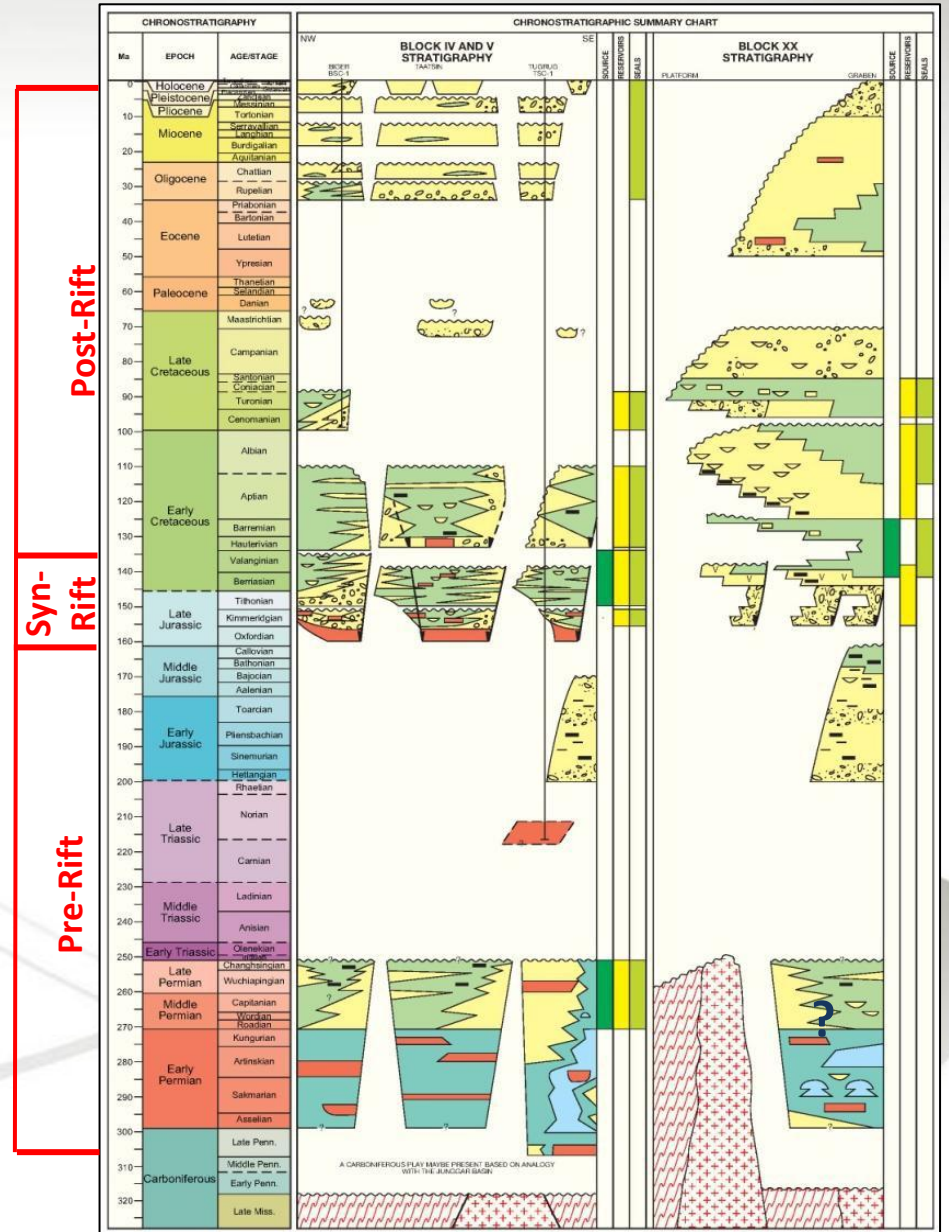
- Transitional marine–continental facies following closure of Palaeo-Tethys Ocean – compressional tectonics
- Lithology = Limestones overlain by coals and clastics
- Major oil & gas play in Chinese basins (eg Junggar, Tarim, Turpan), unproven in Mongolia so far

Megasequence 2: L. Jurassic-E. Cretaceous 'Syn-Rift'

- Major u/c on Pre-Rift, extensional & strike slip tectonics
- Lithology = interbedded fluviolacustrine shales and sandstones
- Major oil & gas play in Chinese Basins (eg Songliao, Erlian), and proven play in Mongolia

Megasequence 3: L. Cretaceous – Recent 'Post-Rift'

- Post-rift sag, overprinted with Himalayan compressional & strike-slip tectonics
- Lithology = fluvial-lacustrine/alluvial shales and sandstones
- Unproven oil & gas potential in Mongolia, limited in China



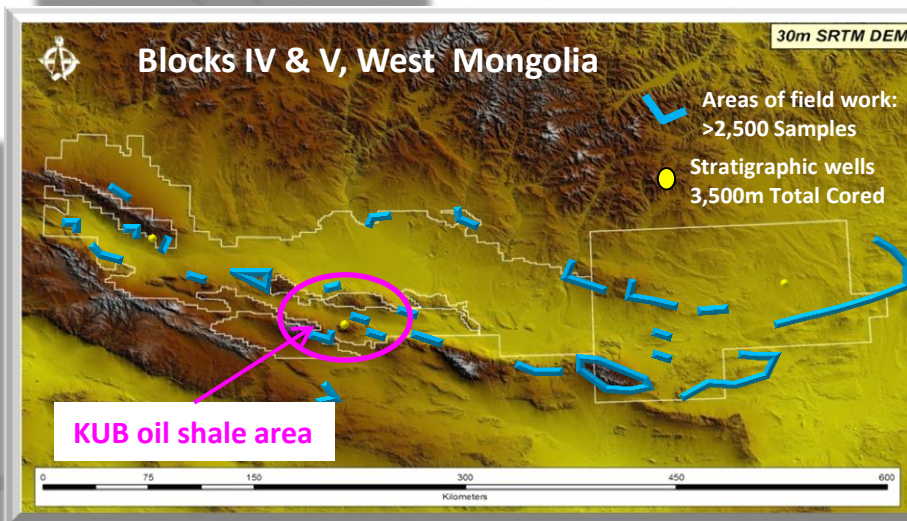
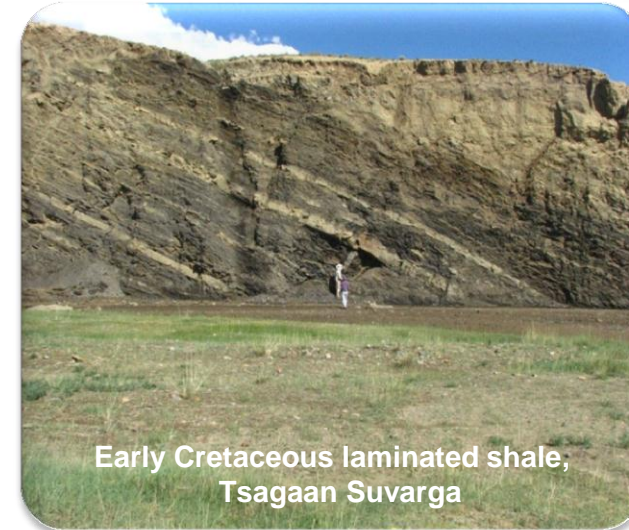
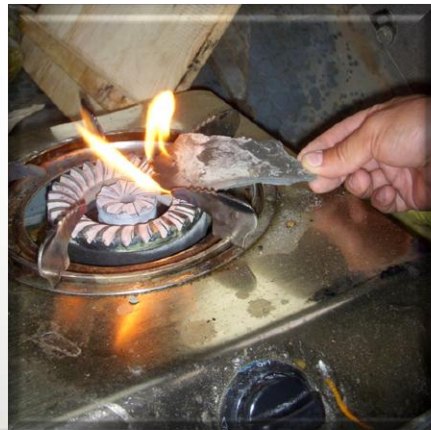
Petroleum System Elements (data from Blocks IV & V)

4 field seasons (2010-2013), 4 stratigraphic boreholes with c.3500m of core & >6000kms of 2D over frontier areas have resulted in a new understanding of the potential petroleum system in frontier areas

SOURCE

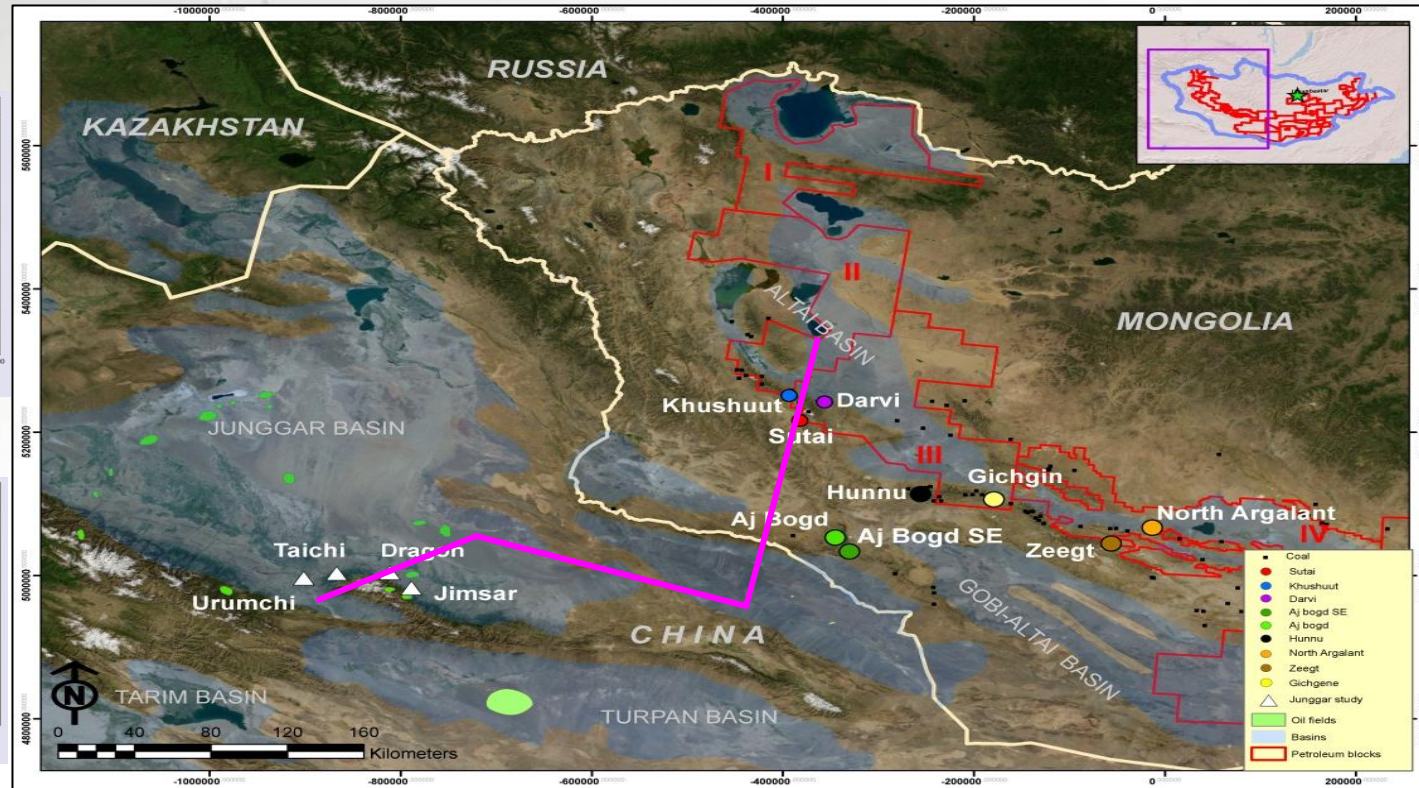
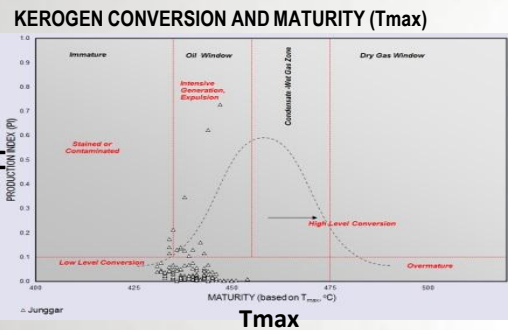
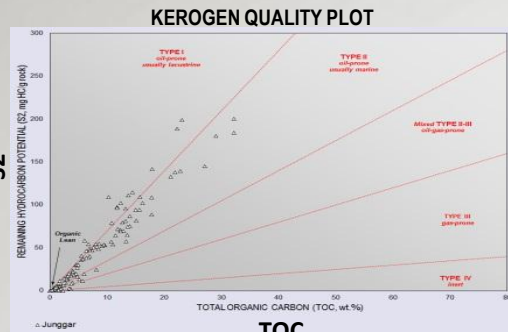
Thick rich world class lacustrine oil shale was sampled from outcrops:

- *Up to 900m net shale (Khoid Ulaan Butag & Tsagaan Suvarga oil shales)*
- *Tithonian-Valanginian age (early Syn-Rift)*
- *3-27% TOC, ave 15.1% TOC (72 samples - KUB)*
- *Type I & II, max HI = 800-900*
- *c.0.6 VRo% at outcrop*
- *Potential for oil shale development*
- *Basin modelling indicates extensive generation potential in subsurface*

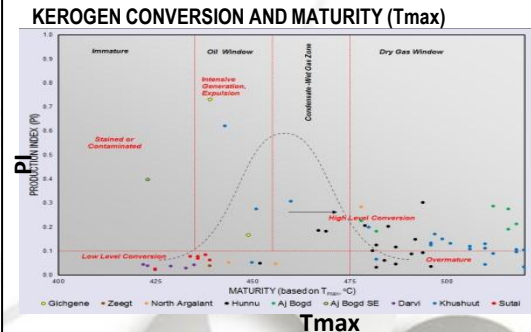
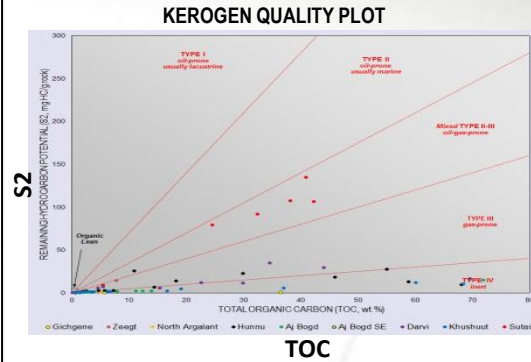


Overview of Source Potential of the Pre-Rift Petroleum System, South Western Mongolia

Geochemical analysis of Junggar Basin
(Carroll et al., 1992 and Tao et al., 2012)

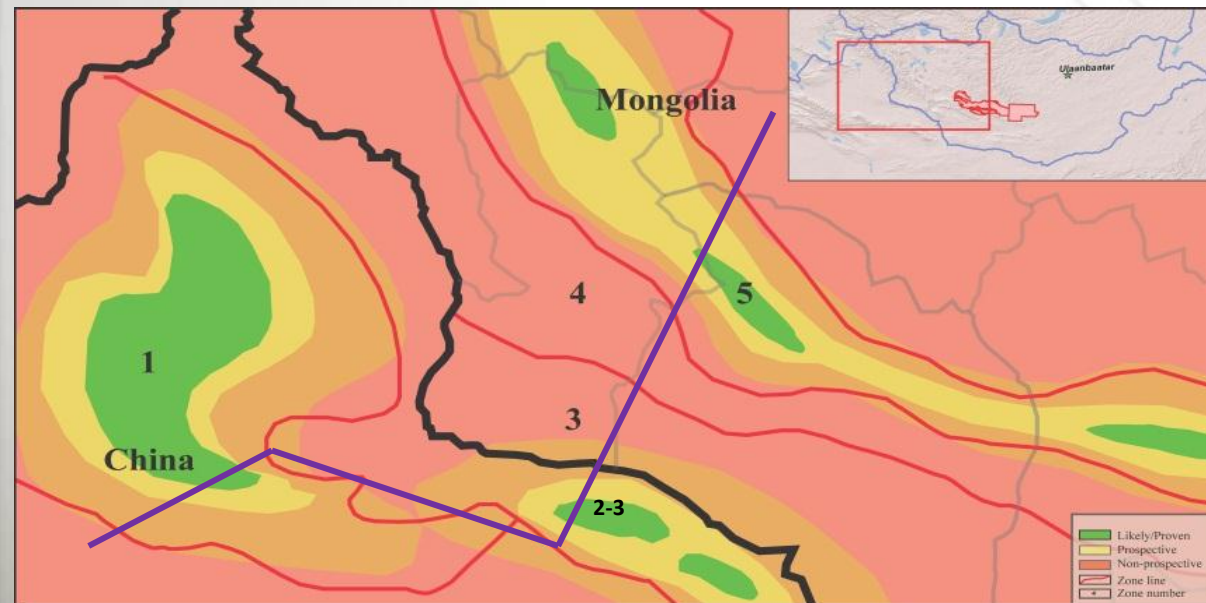
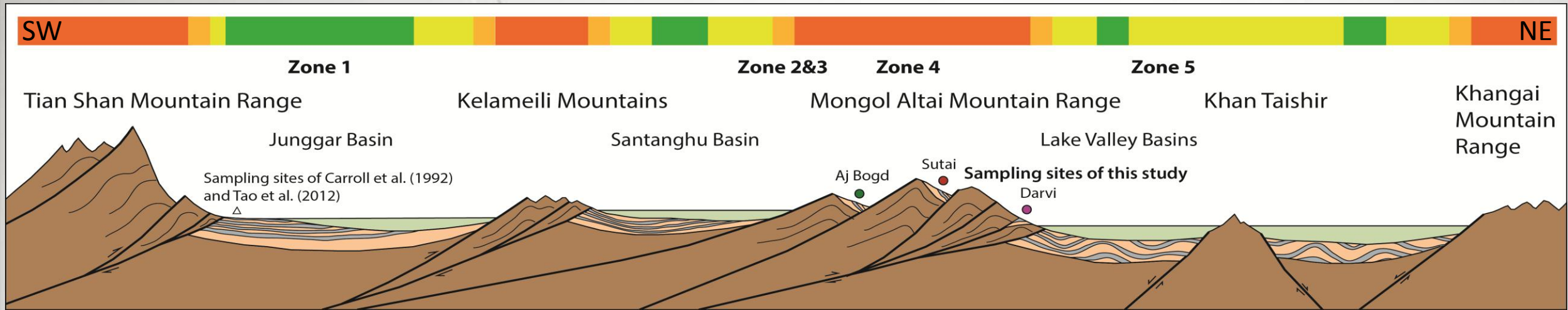


Geochemical analysis of this study



- **Good quality oil-gas prone source rocks were found**, although many samples were lean
- **Mature source rocks were found.** Although many samples were overmature in the fold & thrust belt and some immature
- **High quality source rocks generating oil are very possible below the Mesozoic basins in Southwestern Mongolia.**
- This sample set represents only initial scoping efforts. Positive results justify further examination of many additional exposures across a vast region of southwestern Mongolia.

Overview of Source Potential of the Pre-Rift Petroleum System, South Western Mongolia



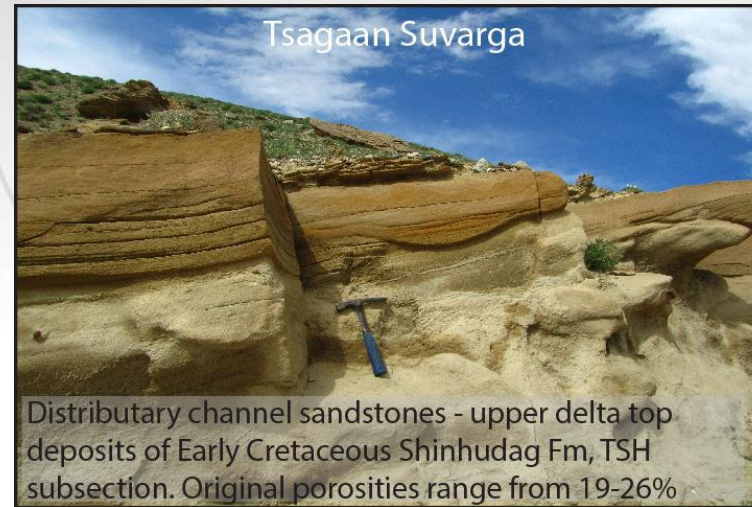
- Petroliferous Paleozoic basin fill thins regionally from the productive Junggar Basin northeastward to the productive Santanghu Basin.
- Across the Mongol Altai Range the Pz section thickens NE into the Mongolian Lake Zone with evidence of quality SR development (from coal studies)
- Upper Permian rocks were sampled from the highly faulted mountainous outcrops. Tectonic preservation of these sections are expected to be more favourable (less disrupted) in the basin centre

Petroleum System Elements (data from Blocks IV & V)

RESERVOIR

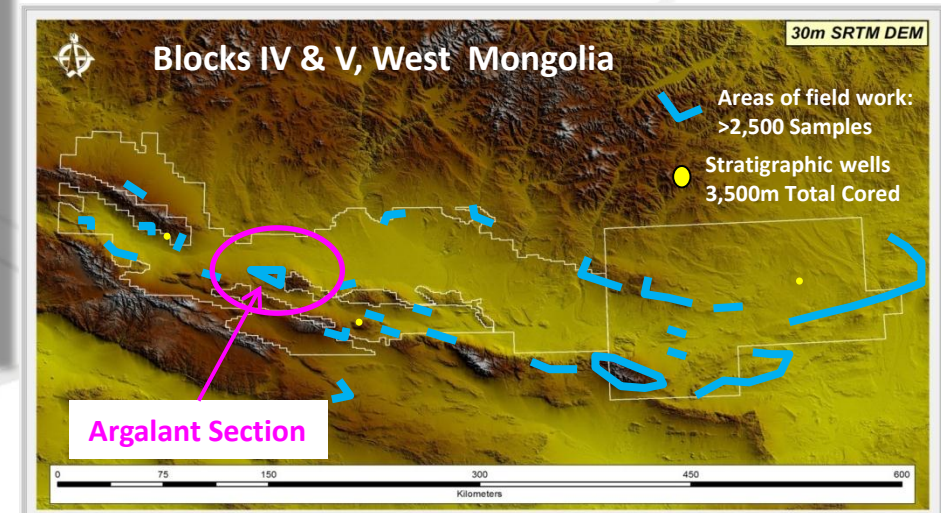
High porosity fluvial-deltaic sands extensive in outcrops.

- 10-30% porosity
- Tithonian-Valanginian age (early Syn-Rift)
- Often interbedded with source rocks
- Clean granitic source
- Laterally continuous



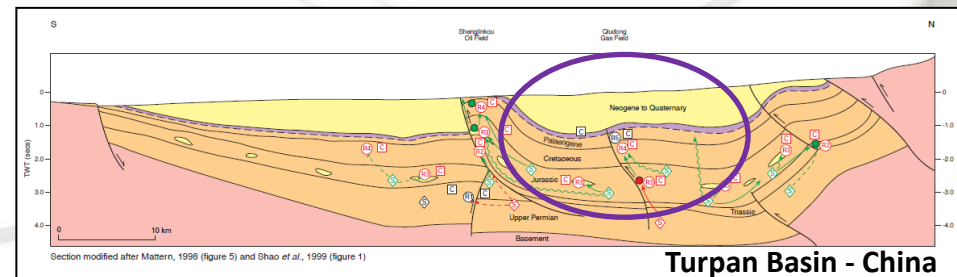
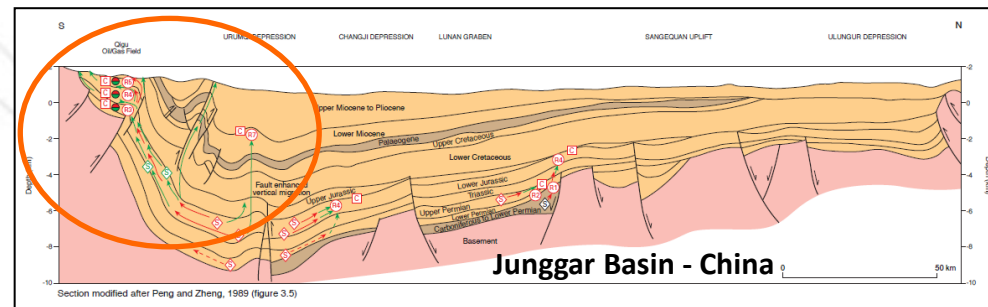
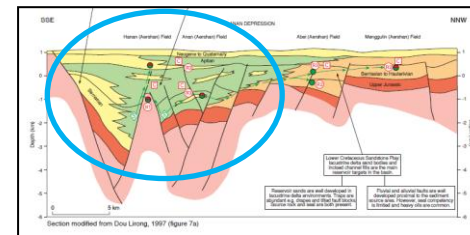
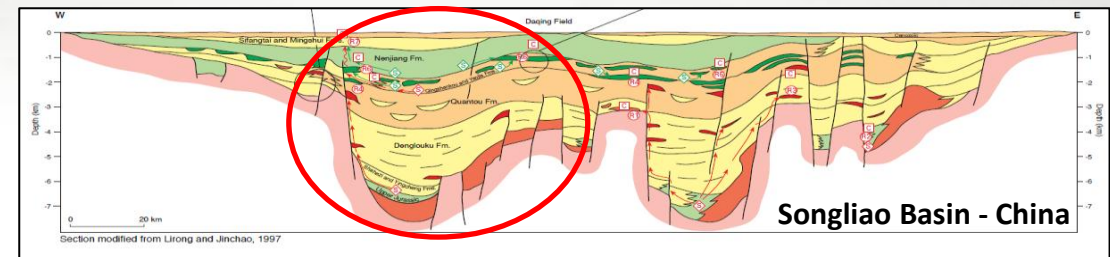
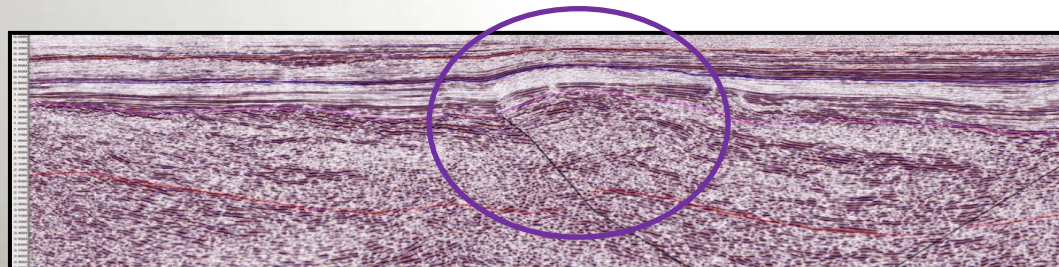
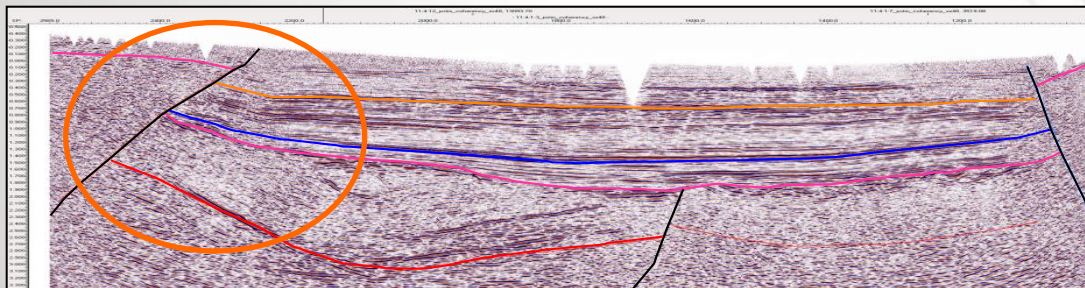
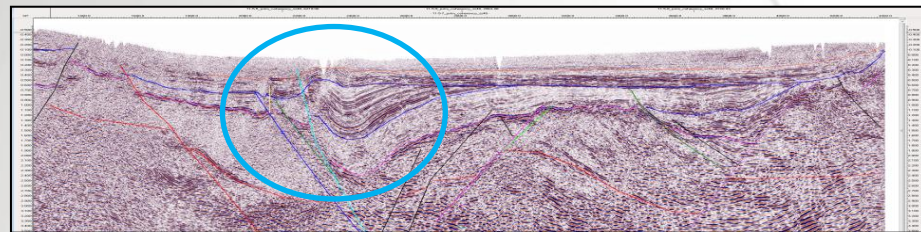
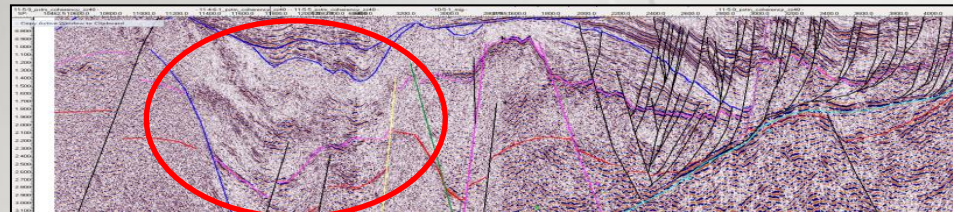
SEALS

- Extensive Cretaceous –Neogene alluvial/fluvial mudrock, siltstone, clastic assemblages. Proven reservoirs sealed by intraformational shales



Trapping Styles – with proven analogues from China

Seismic Examples from – West & Central Mongolia



Erlian Basin - China

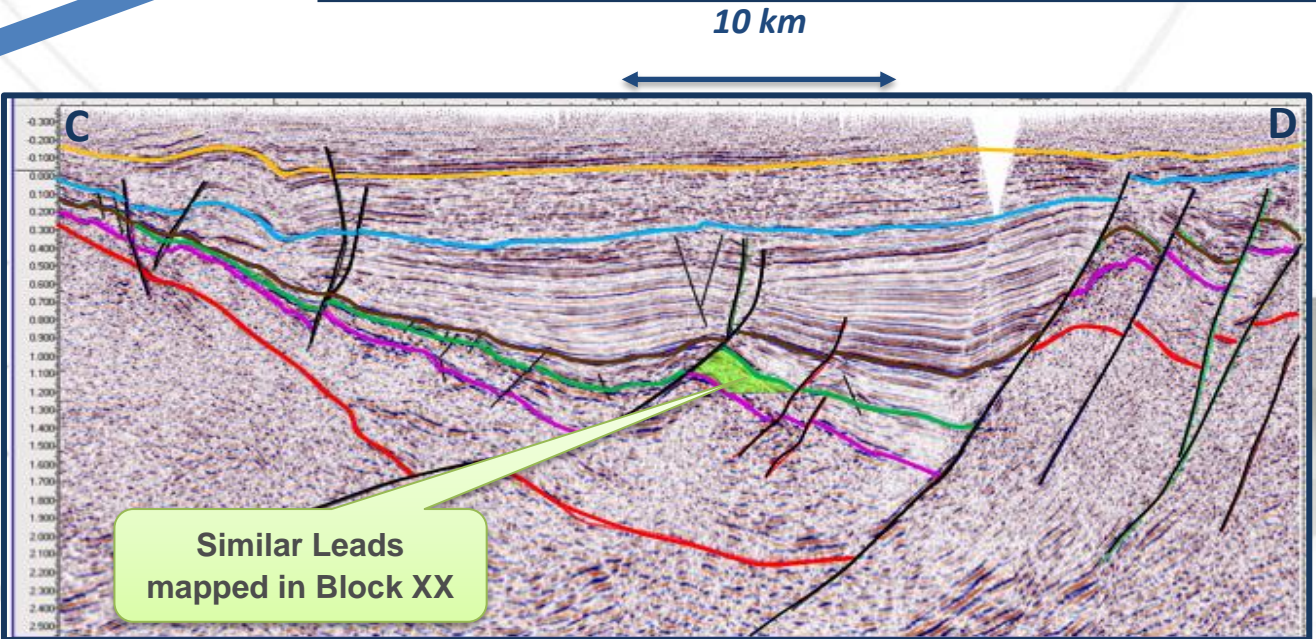
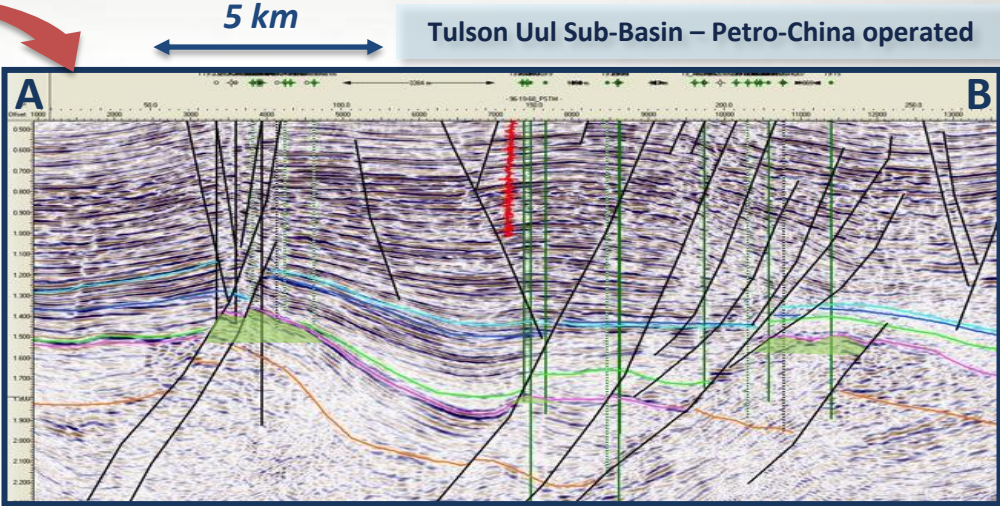
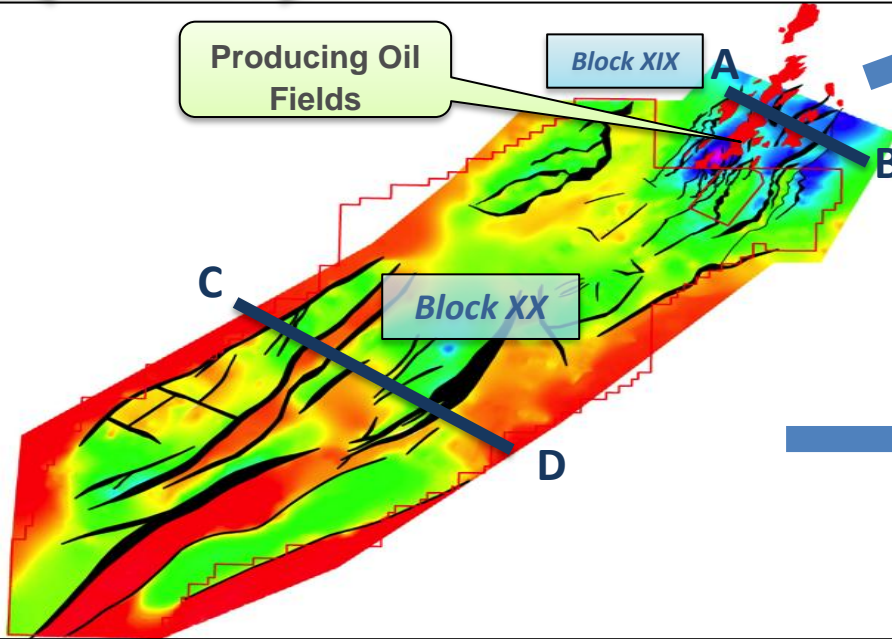
Junggar Basin - China

Turpan Basin - China

Block XIX - Producing Analogue



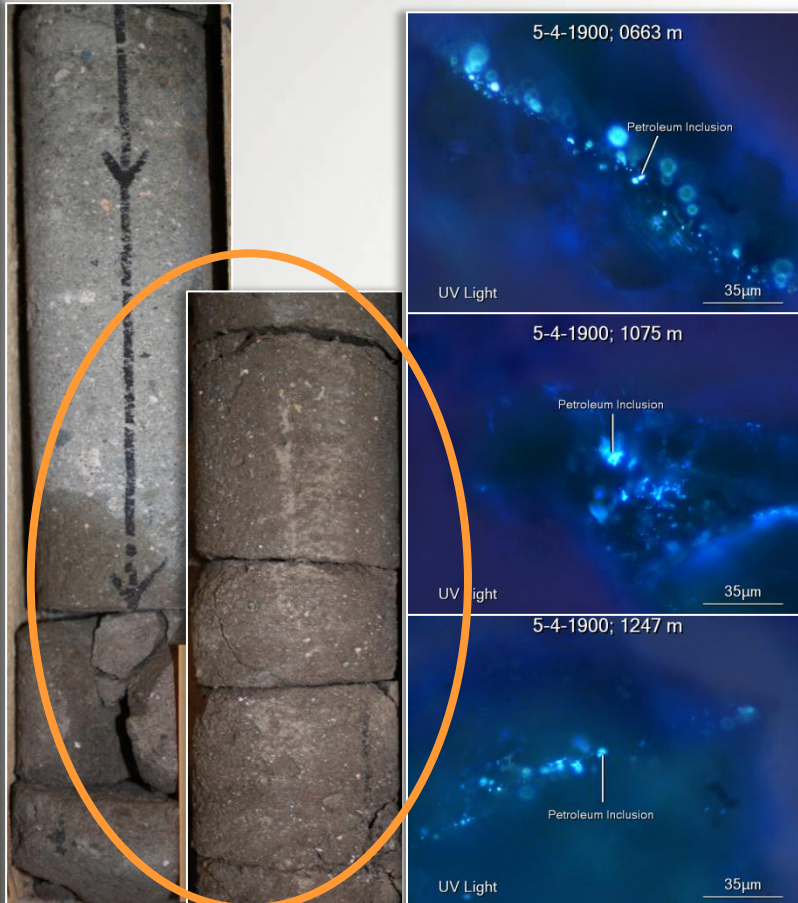
50 km



Direct Hydrocarbon Indicators

Block V

- Dead oil from core of TSC-1 strat test
- Oily fluid Inclusions from strat well



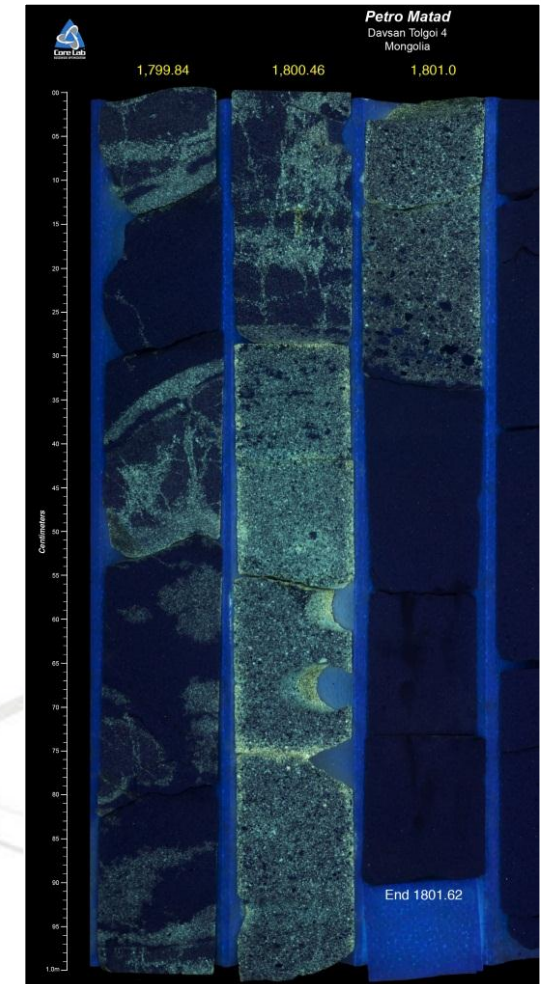
Block IV

- Oily fluid Inclusions from outcrop samples – Tsagaan Suvarga area



Block XX

- Live oil from DT-4 well, fluorescing under UV light



Regional Oil & Gas Infrastructure

Development concepts following discovery

Western Mongolia – Potential Delivery Options

- ✓ Oil trucked c.500 kms to Ulaanbaatar for supply to rail line to China, or trucked/piped to new build refinery
- ✓ Oil pipeline to Yumen in China, which is approx. 500 km south of Blocks IV & V
- ✓ Alternate export route by road to China with a rail line just south of the Mongolian border

Eastern Mongolia – Potential Delivery Options

- ✓ Basic infrastructure already exists in Blocks XIX and XXI
- ✓ Crude from Block XIX is currently trucked c.400 km to a pipeline terminal in the Erlian Basin (China) and then piped and railed to the Hohhot refinery



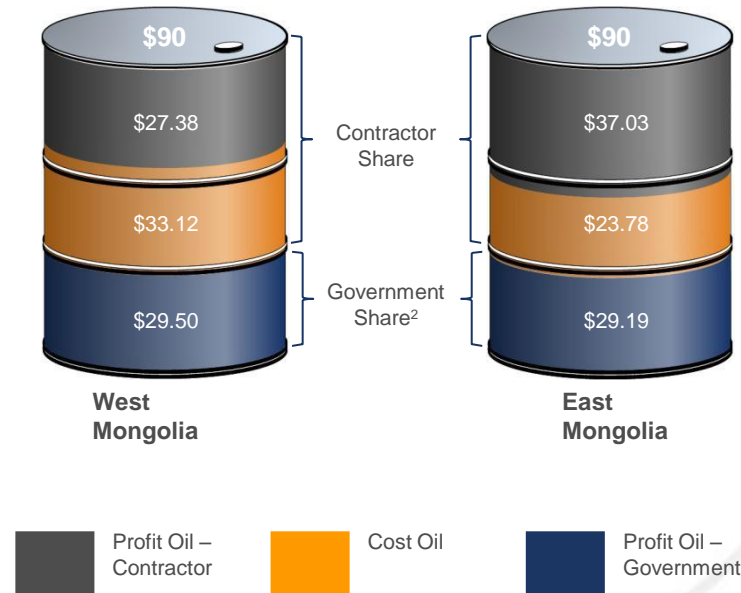
Scoping Economics

Indicative netback per barrel

Key Assumptions

Western Mongolia	Eastern Mongolia
900 km pipeline to planned refinery at Darkhan-uul	Trucking (transport cost US\$5/bbl)
Gross recoverable reserves: 100 mmbo	Gross recoverable reserves: 100 mmbo
Oil price: US\$90/bbl	Oil price: US\$90/bbl
Production rate per well: 200 bopd	Production rate per well: 200 bopd

Split Per Barrel¹



“Depending on the location of the discovery, the development concept and productivity per well, scoping economics for a 100 million barrel discovery at a \$90 oil price, shows NPV’s (10% discounting) ranging from \$0.8 Billion to \$1.2 Billion, net to the Contractor. Robust economic results are not surprising due to the onshore environment, expected good oil quality (based on discoveries made to-date in Mongolia) and very good PSC terms. The scoping economics are most sensitive to oil price and production/ reserves, whereas results are not highly sensitive to variations in costs.”

Source: Company estimates, excluding capital, operating costs and inflation

1. Typical split per barrel of production 2. Government share includes royalty 3. Other costs based on management estimates

Why Mongolia?

- ✓ *Contains several large under-explored sedimentary basins that have all the elements for working petroleum systems and large resource potential.*
- ✓ *These basins are geologically similar to highly productive basins in China, many with multi-billion barrel reserves.*
- ✓ *Basin opener opportunities*
- ✓ *Existing producing petroleum province with infrastructure operated by Petro-China (Blocks XIX, XXI - >2Bbbls in-place)*
- ✓ *Attractive fiscal terms and updated petroleum law*





**PETRO
MATAD**

THANK YOU