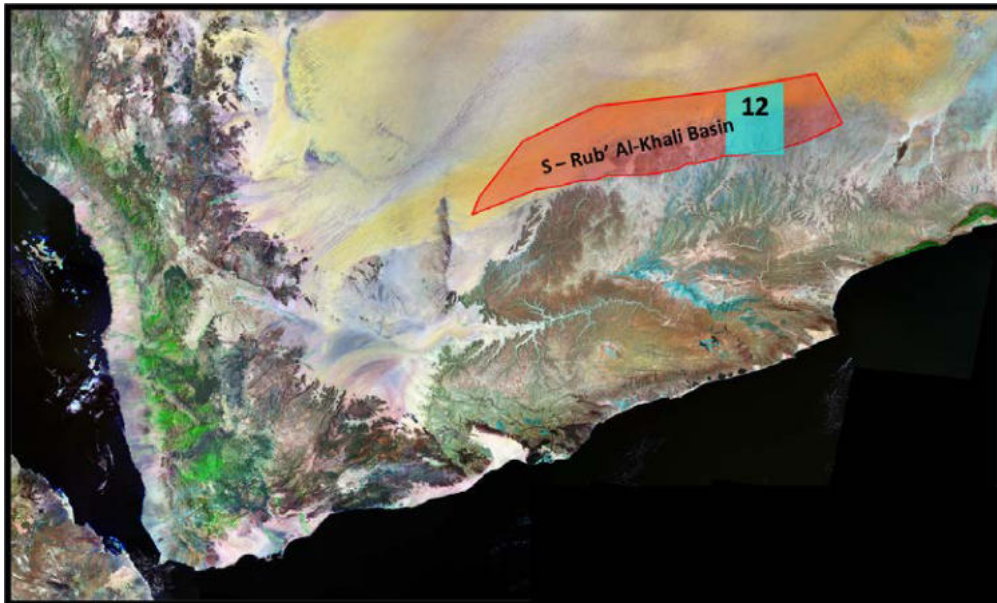
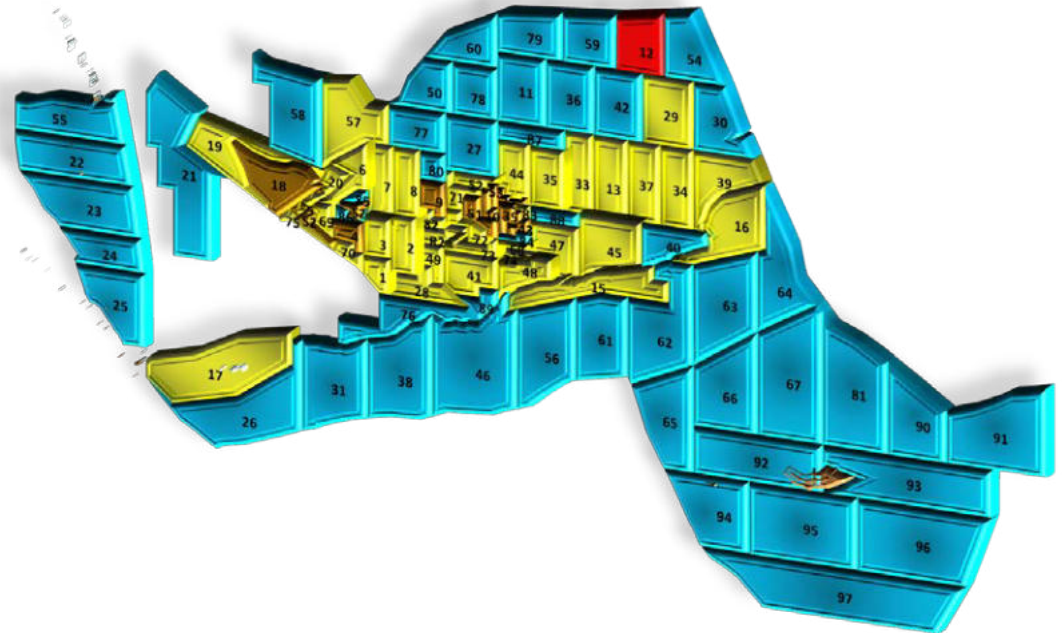




BLOCK 12 (NORTH SANAU)



- ☞ The North Sanau Block (12) occupies an area of 7867 km² in the South Rub Al Khali Basin in the northern part of Yemen.
- ☞ The petroleum system of the Rub Al Khali Basin has been confirmed by the discoveries of the major oil and gas fields in the Central Saudi Arabia, in western Oman and recently in southern Saudi Arabia.
- ☞ The Block (12) bordered on the north by Saudi sector of the Rub Al Khali Basin.



Rub Al Khali Blocks are located along the southern margin of the Rub Al Khali Foreland Basin. The prospective section is composed mainly of Mesozoic and Paleozoic clastics and shales thinning to the south onto the east-west trending North Hadramawt Arch.

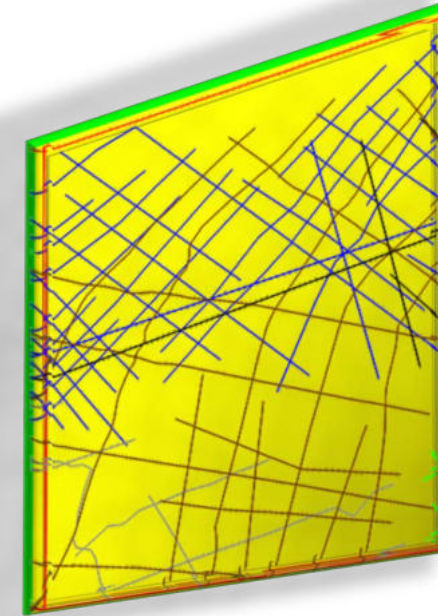
GENERALS

Block Name	NORTH SANAU
Block N^o	(12)
Province	Hadramawt
Basin	South Rub Al Khali Basin
Area (Km²)	7,867

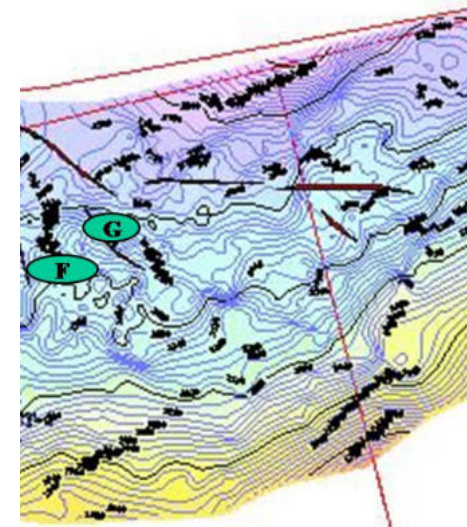
PREVIOUS EXPLORATION ACTIVITIES

Company	Period	Activities
Sonatrach	70-73	2D seismic
PED	76-81	2D seismic
Russian	76-82	Gravity & aeromagnetic 2D seismic
ARCO	91-97	Gravity & aeromagnetic 2D seismic
Canadian Petroleum + Nexen	99-04	Gravity & 2D seismic

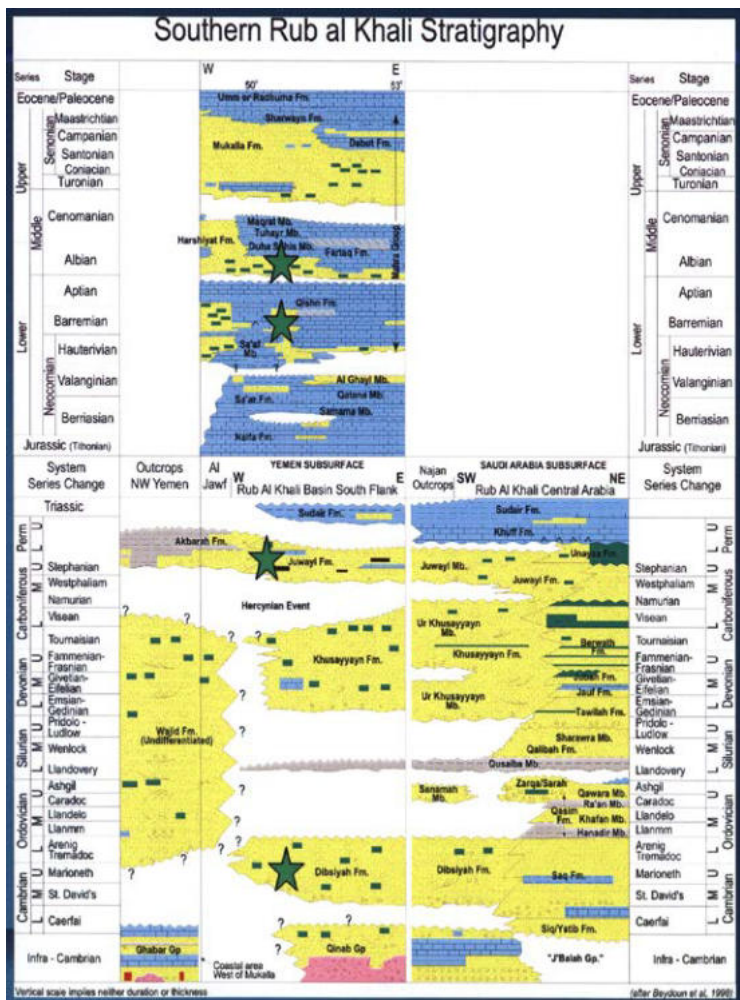
NO WELLS WERE DRILLED



Previous Work



Leads _ INFRA CAMBRIAN TWT STRUCTURE



Eleven oil fields produce 200,000 BOPD (API>40) from Paleozoic clastic reservoirs 420 miles to the north of the study area, south of Riyadh, Saudi Arabia. The proven source rocks for the Saudi fields are oil prone (type II) Silurian age shales of the Qusaiba Member within the Qalibah Formation. The Qusaiba source rocks are regionally widespread and extend southward into Yemen. Age equivalent Silurian argillaceous rocks have been identified in Shihr-1, Hathout-2 and possibly Qinaab-1. The Silurian source rock quality and maturity levels are expected to improve basinward (north) and have effective source rock characteristics at, or just north, of the Saudi Arabian border.

Older Infracambrian source rocks appear to extend into northern Yemen from Saudi Arabia along the NW-SE trending Najd fault system. Seismic evidence suggests the presence of salt. In Oman, the Infracambrian Huqf Group Ara salt Formation is contemporaneous with organic rich source rock. Basin modelling using the Hathout-2 well suggests that any Infracambrian source rocks present would be in the main oil window (Ro=0.7) on the northern half of the area. The Infracambrian enters the main gas window just north of the present day Saudi Arabia-Yemen border. Oil analysed from the Tarfyat-1 well located along the North Hadramaut Arch is geochemically similar to oil derived from the Infracambrian Huqf source rocks of the South Oman Salt Basin.

Regional topseals are postulated to be the Silurian Qusaiba Member shales and Permian Akbarah Formation shales (equivalent to Khuff Formation limestones). The lower Permian Akbarah Shale is present in all blocks and could act as an effective seal. Based on existing well penetrations, other shales exist within the Paleozoic section that could act as potential top seals; namely, distal facies equivalents in the Dibsiyah (Cambro-Ordovician section). The northern portions of all blocks is thought to have the best developed petroleum system.

Reservoir targets include the Cambro-Ordovician, Devonian and lower Permian clastics. Core analysis from Hathout-2 indicates Cambro-Ordovician sandstone porosity of up to 20% and permeability ranging from several hundred millidarcies to over one Darcy. Log analysis from Shihr-1 suggests corrected sonic porosity of 15-20 % for other clastic zones.

Many Infracambrian mobilised salt drape leads have been identified in the Infracambrian graben area and at least three antithetic fault dependant leads have been defined. Seismic suggests reefal buildups may occur within the Qishn (Shuaiba) carbonates and oil shows have been reported from the underlying Jurassic interval from several Saudi Arabian stratigraphic test wells north of the border. More seismic is required to properly evaluate the petroleum potential of this vast region.

PETROLEUM SYSTEM TRAPS AND PLAY FAIRWAYS

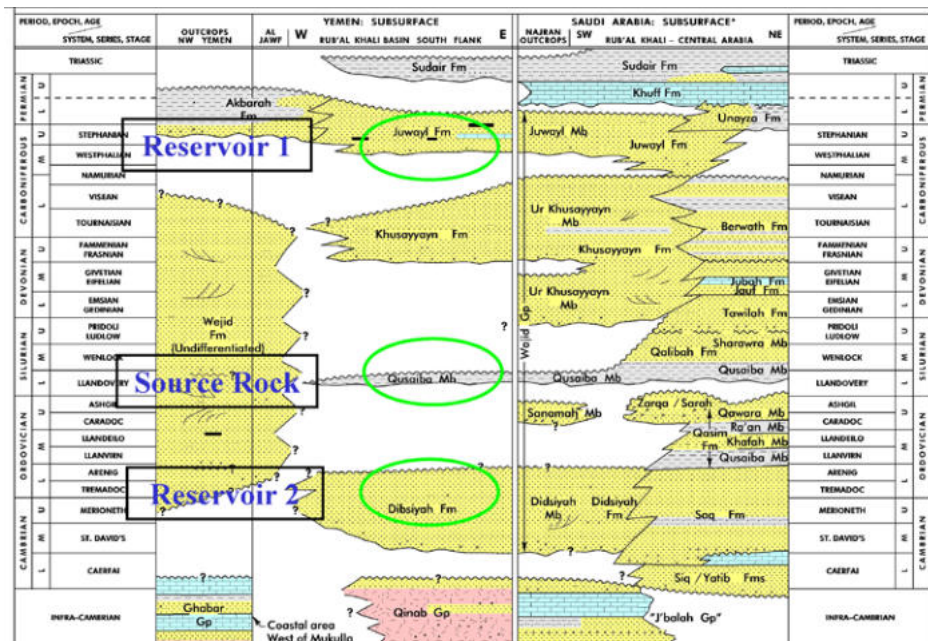
- Structural and stratigraphic.

SOURCE ROCKS

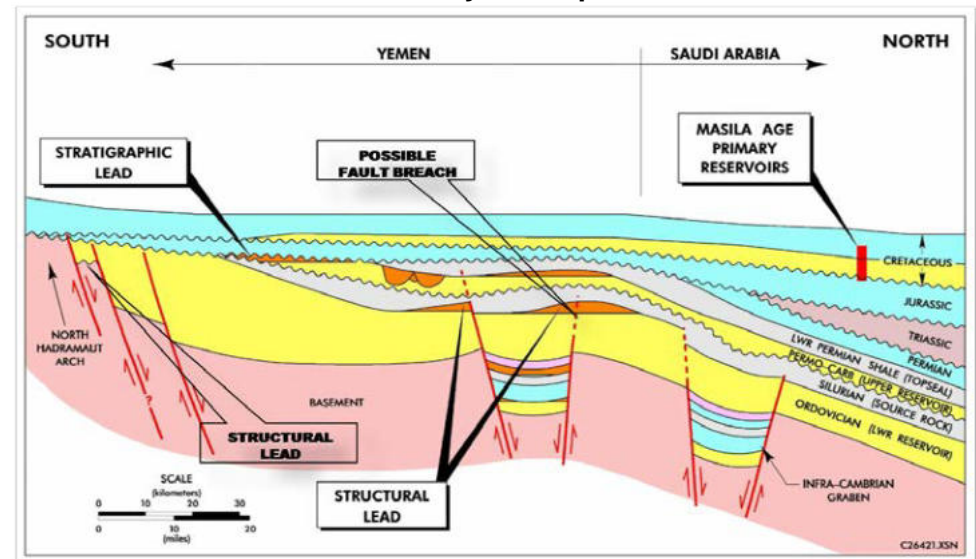
- The Silurian Qusaiba Shale of the Qalibah Formation source rock was confirmed by four exploration wells such as Shahr-1, Rakhawt-1, Hathout-2 and Qinab-1 in Yemen-Rub Al Khali Basin. The thickness of Qalibah Formation (21-118 metres). The maximum content of TOC is 1.25% in Hathout-2 well.
- The Infra-Cambrian source rock.

RESERVOIR - SEAL

- The fractured Precambrian Basement can be good reservoir (in the Southern part of the block).
- The Infra-Cambrian to Early Carboniferous clastics are a potential reservoir sealed by basinal Cambro-Ordovician shales of the Lower Silurian Qusaiba shale.
- Lower Permian (Juwayl Formation) clastics have potential reservoir facies. The Akbarah shales act as seal.
- The Jurassic Naifa-Shuqra Formation (limestone-dolomite).
- The Lower Cretaceous Qishn Formation (limestone-dolomite).
- The Upper Cretaceous Harshiyat Formation (sandstone).



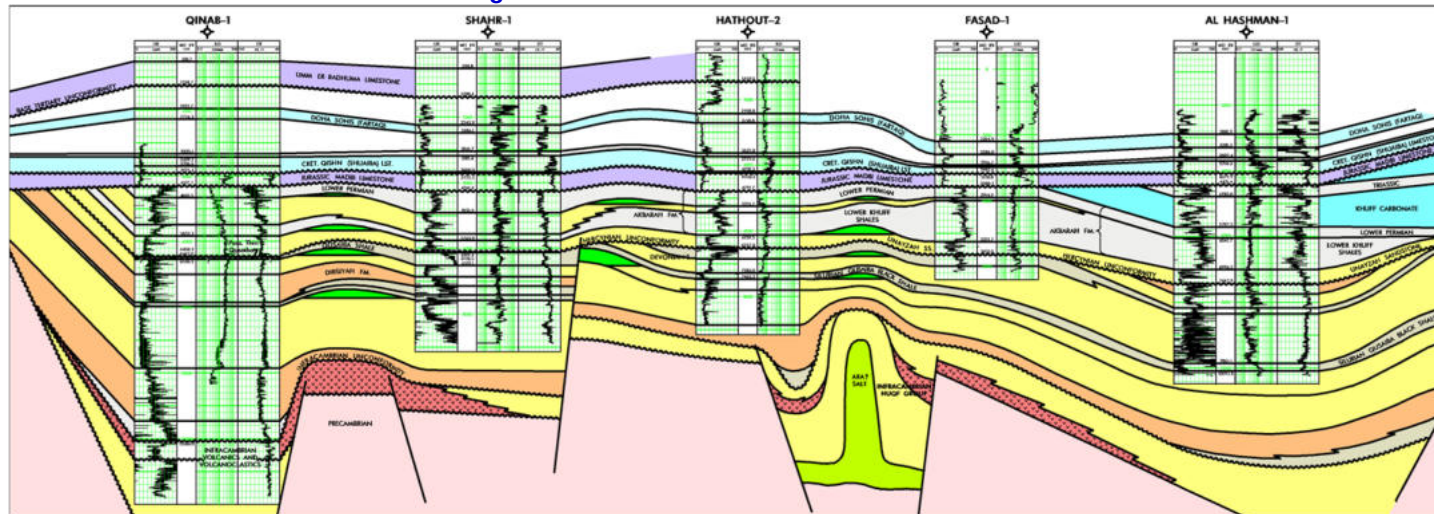
Play Concept



Conclusions

- Block 12 is located on the structural margin of a hydrocarbon-rich basin with proven production to the North and East.
- Hydrocarbon shows are present in downdip wells in Mesozoic and Paleozoic reservoirs.
- Four major potential source intervals exist in the region within the Infracambrian, Silurian, Jurassic and Cretaceous.
- Paleozoic exploration targets include transpressional structures formed by re-activation of older Najd Fault trends.
- Ordovician sand reservoirs are sourced and sealed by the overlying Sahmah shales.
- The Lower Permian is a red bed sequence that could contain high porosity sands sandwiched between Red-brown shales of the Akbarah Formation by analogy to Lower-Middle Permian eolian Unayzah sands in Saudi Arabian Fields near Riyadh.
- The northward dipping Permian section is truncated to the south by the overlying base Jurassic unconformity. This results in a favorable geophysically-defined trapping geometry and reservoir-bottom seal pairs which potentially extend across all northern blocks.
- Long-range migration is well established for Infracambrian and Silurian sourced reservoirs in Saudi Arabia and Oman.
- The mudstone from the Paleozoic interval showed a potential of 2.3 kg/ton in the Shahr-1 and 2.0 kg/ton in the Hathout-2, the source potential is fair.
- Infracambrian reservoir rocks have been encountered in outcrop both in Saudi Arabia and Western Yemen.
- Potential reservoir horizons include Huqf equivalent carbonates, Cambro-Ordovician and Permian sandstones.
- Infracambrian aged outcrop in West Arabia and SW Yemen include syn-rift transgressive carbonate and clastic packages that may be analogous to the Huqf source-rich strata in Oman.

Geological Cross Section in South Rub' al Khali Basin



Hazmi