



Smart Solutions for Today's Geoscientist



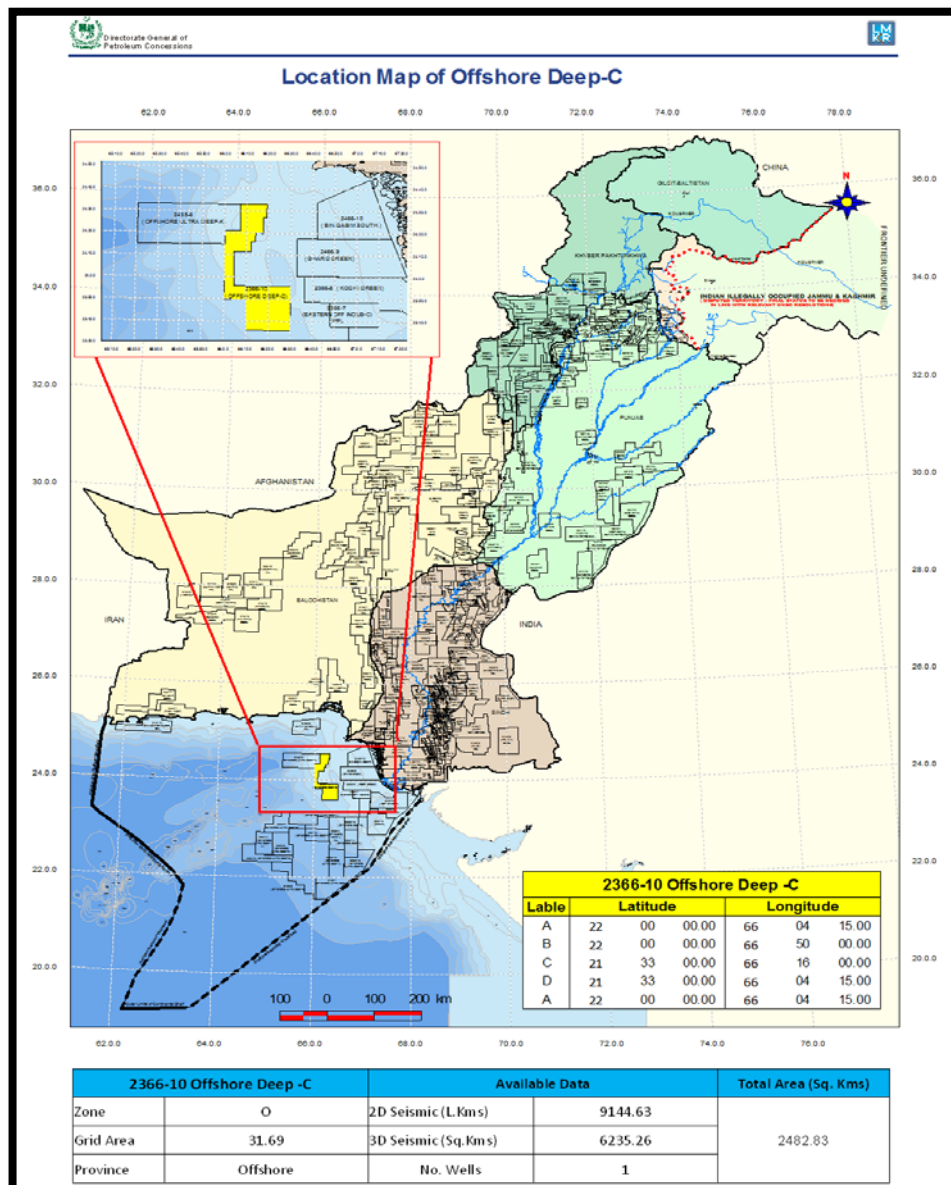
BLOCK: OFFSHORE DEEP C

OFFSHORE BIDDING BLOCK ROUND 2023

MINISTRY OF ENERGY PETROLEUM DIVISION (DGPC)

INTRODUCTION

- Offshore Deep C Block covers an area of 2482.83 Sq. Kms.
- Geological Basin: Offshore Indus, Basin Pakistan.
- The block falls in Prospectivity O.
- ELF, WGC, Lasmo, Shell, OXY, Phillips, Wintershall, Shell, ENI and OGDCL acquired 2D and 3D seismic data approximately 9144.63 L. Kms and 6235.26 Sq. Kms in the block within the years 1969-1972, 1977, 1988, 1998, 1999, 2007 and 2009 respectively.
- The Block is surrounded by Offshore Ultra Deep K (West) block.
- The wells drilled in the near vicinity is Indus Marine-1C and Shark-01.



GEOLOGICAL HISTORY



Late Cretaceous – Early Paleocene:

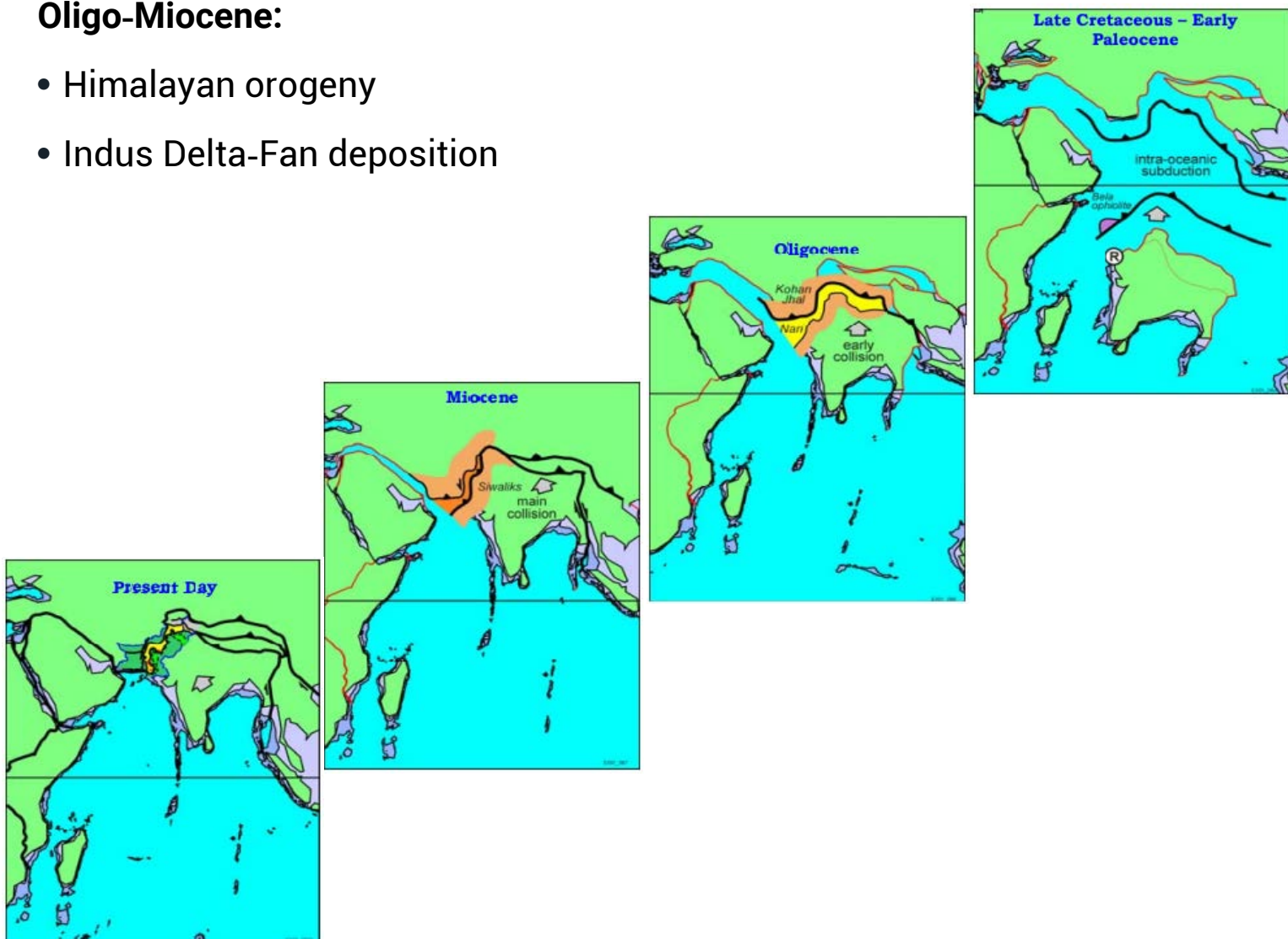
- Rapid northward movement of Indian Plate after separation from Madagascar
- Bela ophiolites obduction
- Extrusion of Deccan Volcanics

Paleocene - Eocene:

- Deposition of limestone on seamounts and shales in lows / depressions

Oligo-Miocene:

- Himalayan orogeny
- Indus Delta-Fan deposition



PETROLEUM SYSTEM

Source Rock:

- Paleocene carbonate section can be the source rock.
- Oligocene and Miocene section can also act as source rock in Offshore Indus Basin.

Reservoir Rock:

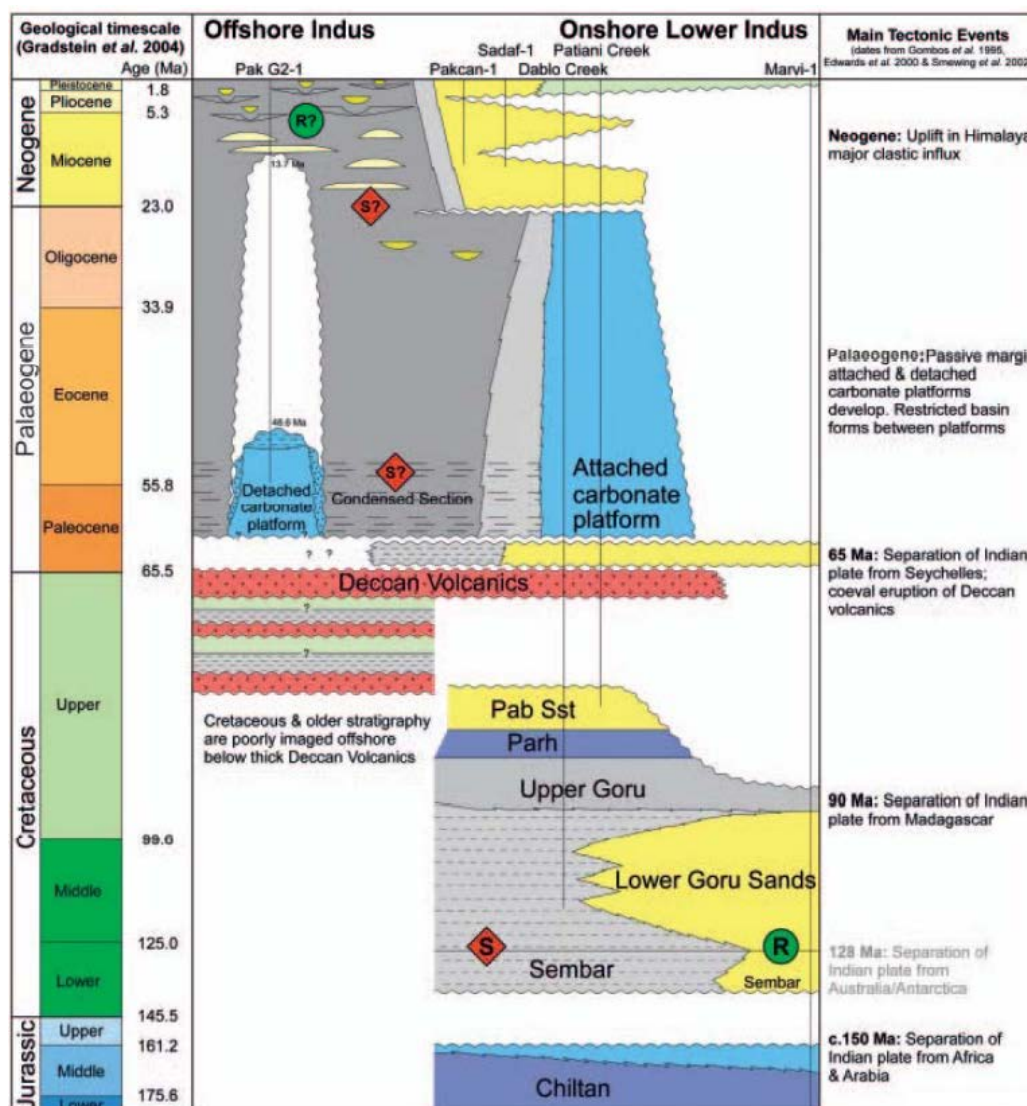
- Miocene sandstones are proven reservoir, Individual sandstone units vary in thickness from 2-50m with porosity ranging between 15-20%.

Seal:

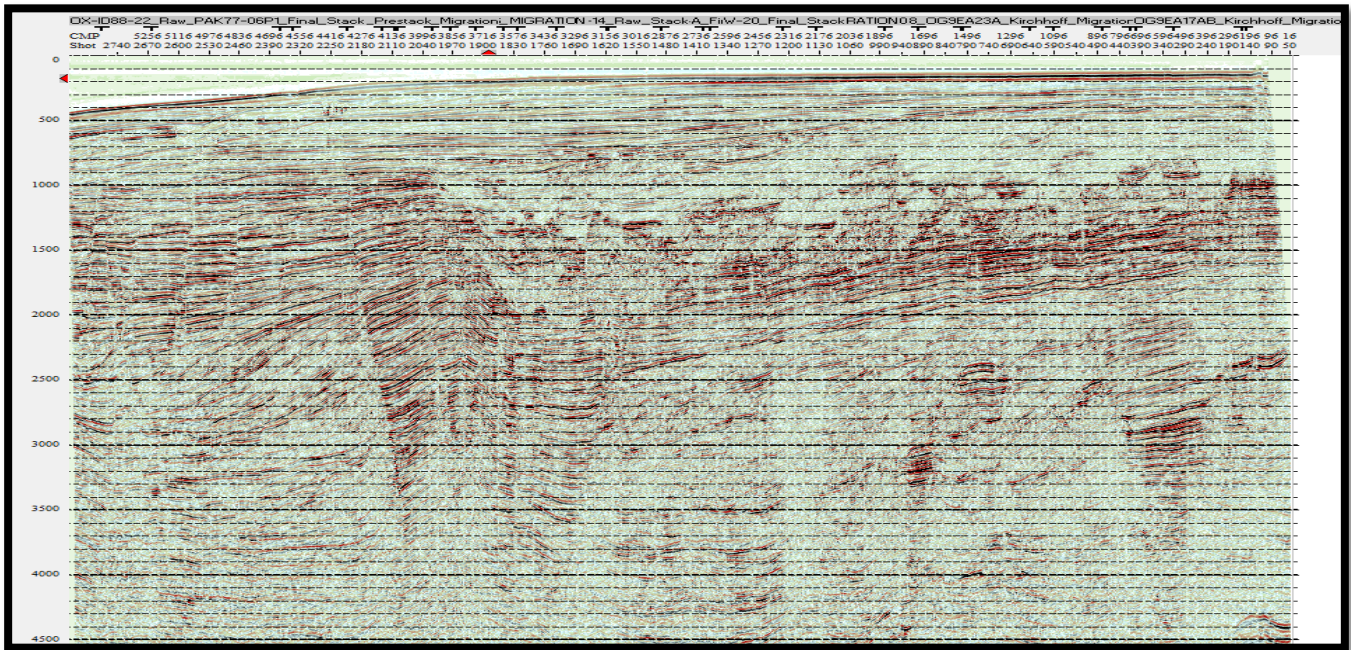
- Intra-formational shales of Miocene would provide seal for the Miocene sands.

Trap:

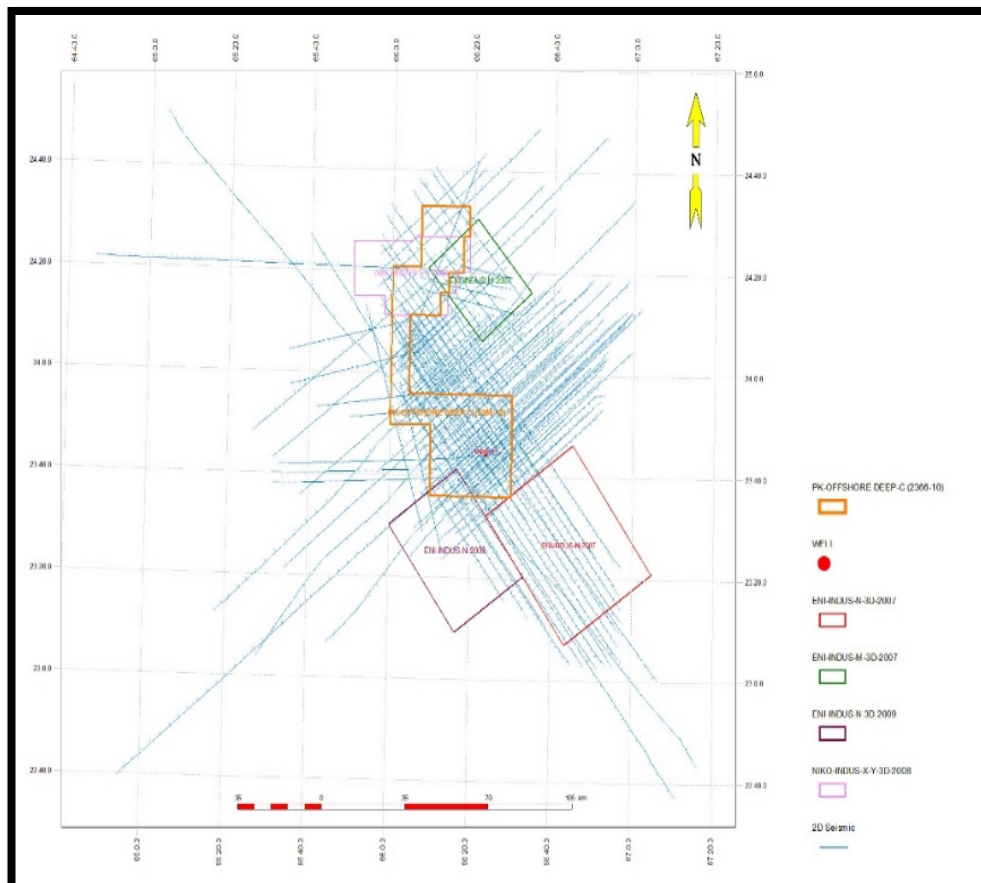
- Carbonates build ups over seamounts, growth faults, roll-over anticlines and stratigraphic traps within deltaic fan system (e.g., bars, barrier islands and pinch-out / facies change etc.) are likely trapping mechanisms



PROSPECTIVITY



- High resolution seismic data can allow to delineate true potential of the block
- Both structural and stratigraphic traps.



EXPLORATION RISKS



- Source & Charge: Medium to High risk
- Reservoir: Low to Medium risk
- Seal: Low to Medium risk
- Trap: Low to Medium risk
- Key challenges for future exploration in Tertiary Petroleum System are to establish:
 - Distribution and timing of effective source intervals' development within the drainage area of prospect.
 - Timing of over-pressuring (up to 7000 psi at 2800m in Indus Marine-1A well) within Miocene section (for Miocene and younger targets) with respect to source rock maturation and expulsion.

Comparison suggests that discoveries in offshore deltas have been made in:

- Extension of proven onshore petroleum system to offshore at drillable depth (e.g. Niger, Nile, Irrawady & Mahakam deltas)
- Reservoir –Seal pairs associated with good quality but less mature source rock drilled onshore (at shallow depths) progressively mature in offshore (e.g. Krishna-Godavri and Nile deltas)
- Biogenic gas found in shallow younger Tertiary section (e.g. Krishna-Godavri and Nile deltas)

International offshore exploration efforts in delta areas have generally been successful due to:

- Extension of established onshore petroleum system to offshore at drillable depths
- Good quality less mature source rock drilled onshore progressively mature in offshore
- Gas discoveries of biogenic origin.



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