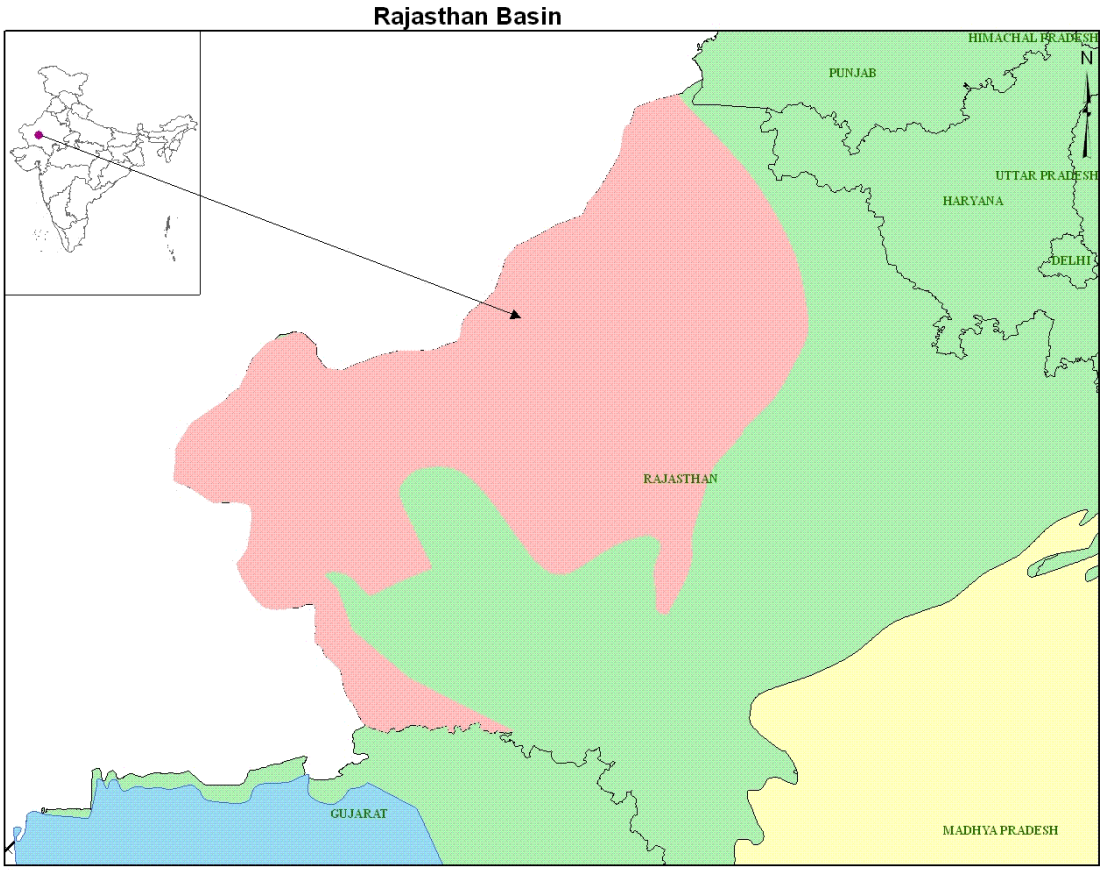
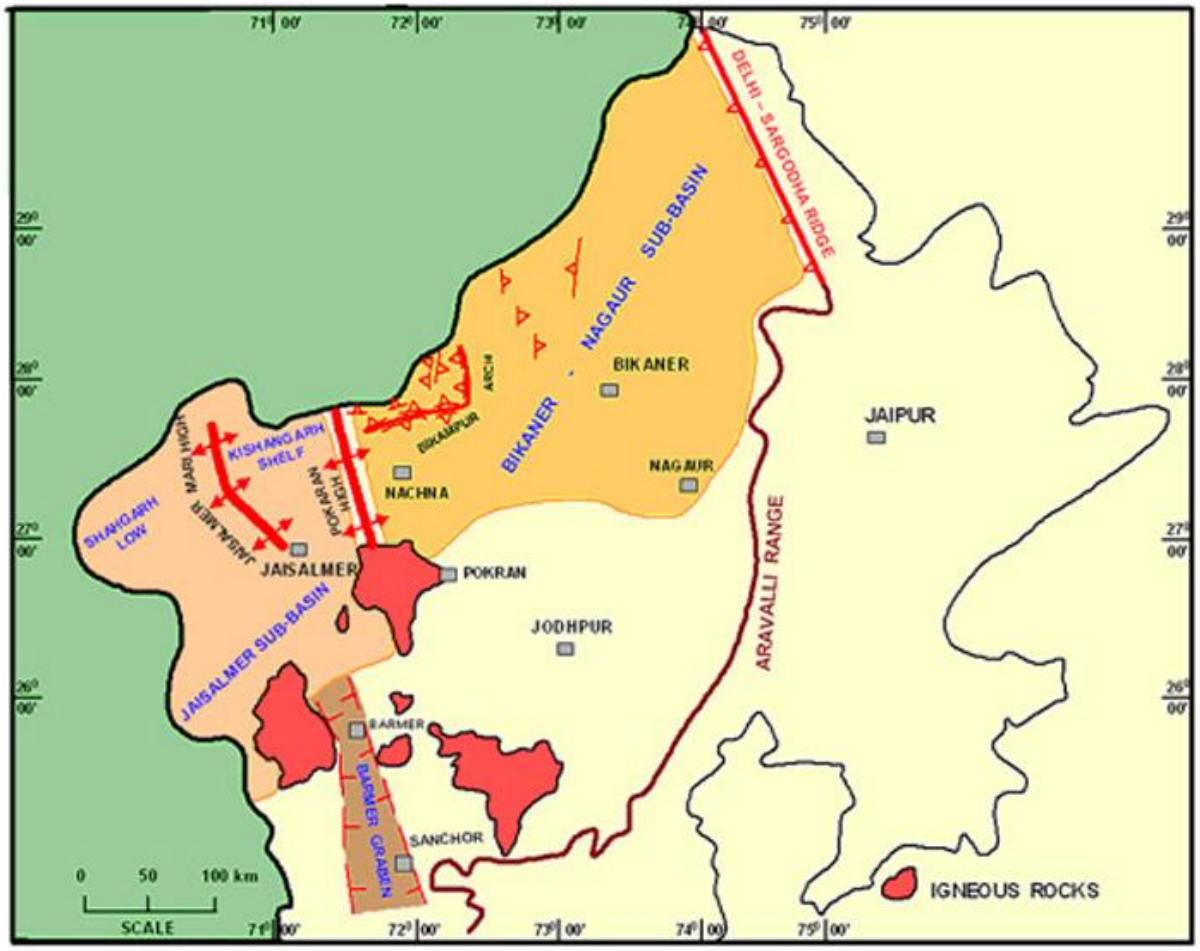
Basin Introduction :



Geographic Location of the basin

Rajasthan Basin forms the eastern flank of Indus geosyncline and comprises the sedimentary tract to the west and northwest of Aravallis upto Indo-Pakistan border.



This pericratonic basin also forms a part of the great Thar Desert.

Category of the basin

The Rajasthan Basin comes under the Category – I basin (onland) with established commercial production.

Area of the Basin

Total Basinal area: 1,26,000 Sq. km (Onland)
Sub-basin wise distribution:
Barmer-sanchor: 11,000 sq. km
Bikaner-Nagaur : 70,000 sq. km
Jaisalmer : 45,000 sq. km

Age of the Basin

Age ranges from Cambrian To Recent
Barmer-sanchor: Tertiary basin
Bikaner-Nagaur : Paleozoic basin
Jaisalmer : Mesozoic & Cenozoic basin

Sedimentary thickness

Average thickness of sediments in Rajasthan basin is ~ 5000 m.

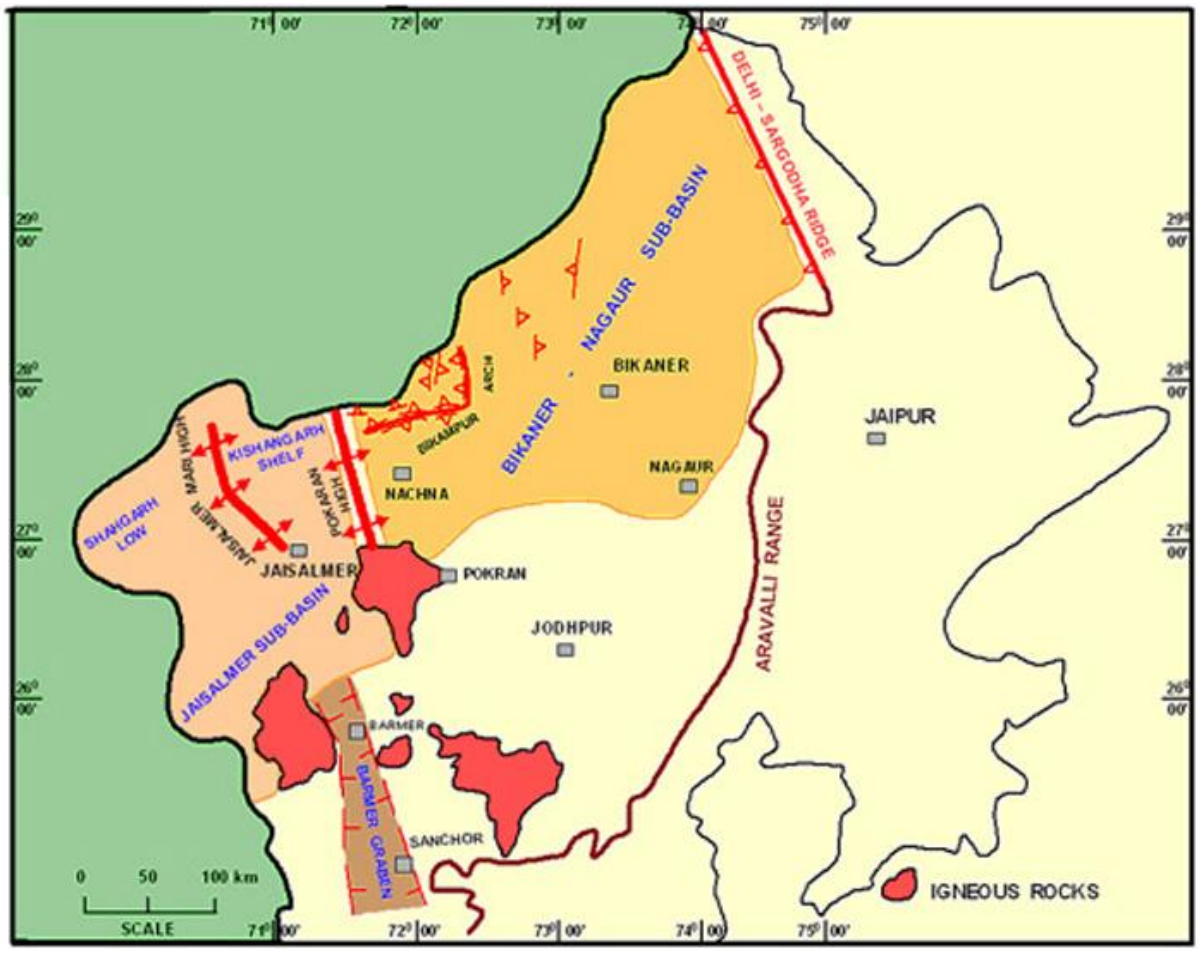
Top

Tectonic History :.

Type of Basin

Jaisalmer sub-basin - Pericratonic Basin

Bikaner- Nagaur & Barmer-sanchor – Intracratonic Basins



Rajasthan Basin has been divided into three Sub-basins separated from each other by basement ridges/faults. These Sub-basins are:

-Jaisalmer Sub-basin which is further divided into 3 depressions

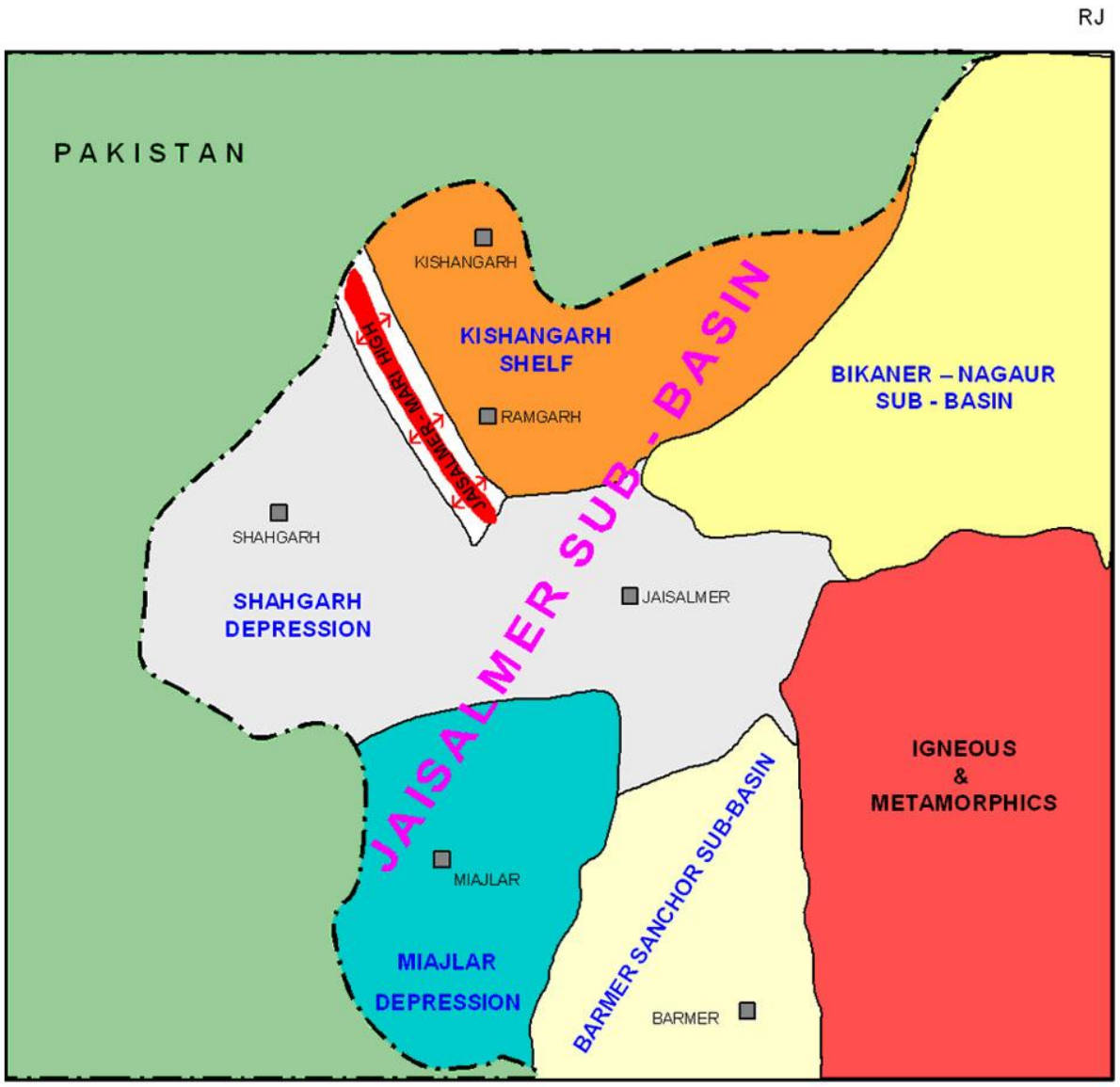


FIG. 23 THE THREE DEPRESSIONS OF JAISALMER SUB - BASIN

~ Shahgarh Depression
~ Kishangarh Shelf
~ Miajlar Depression

-Bikaner- Nagaur Sub-basin

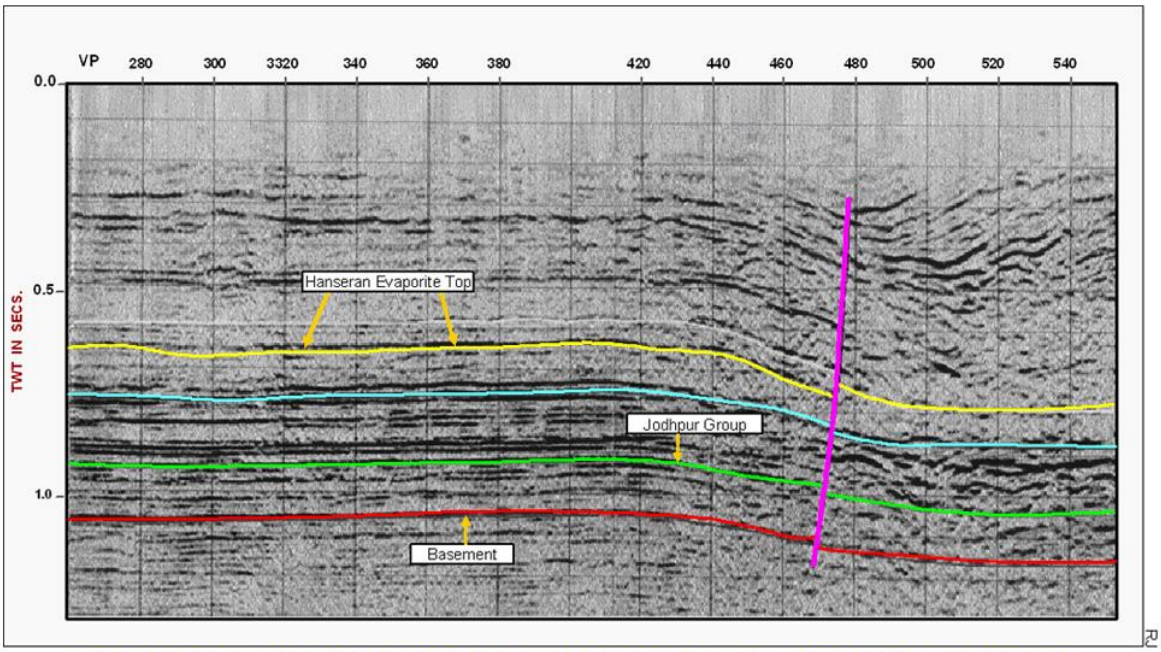


FIG. 15 SEISMIC SECTION ACROSS NANUWALA PROSPECT : BIKANER-NAGAUR SUB-BASIN

The major tectonic element in Bikaner- Nagaur Sub-basin is an almost east-west trending basement ridge, 'the Bikampur Arch'.

-Barmer-sanchor Sub-basin

Prominent tectonic elements in this subbasin are : Devikot-Nachna Uplift with Fatehgarh Fault which marks the northern limit and an east-west trending Tharad Ridge marks the southern limit while separating it from Cambay Basin. Another cross trend along Sarnu Hill Fault divides Barmer-Sanchor Sub-basin into Barmer Depression in the north and Sanchor Depression in the south.

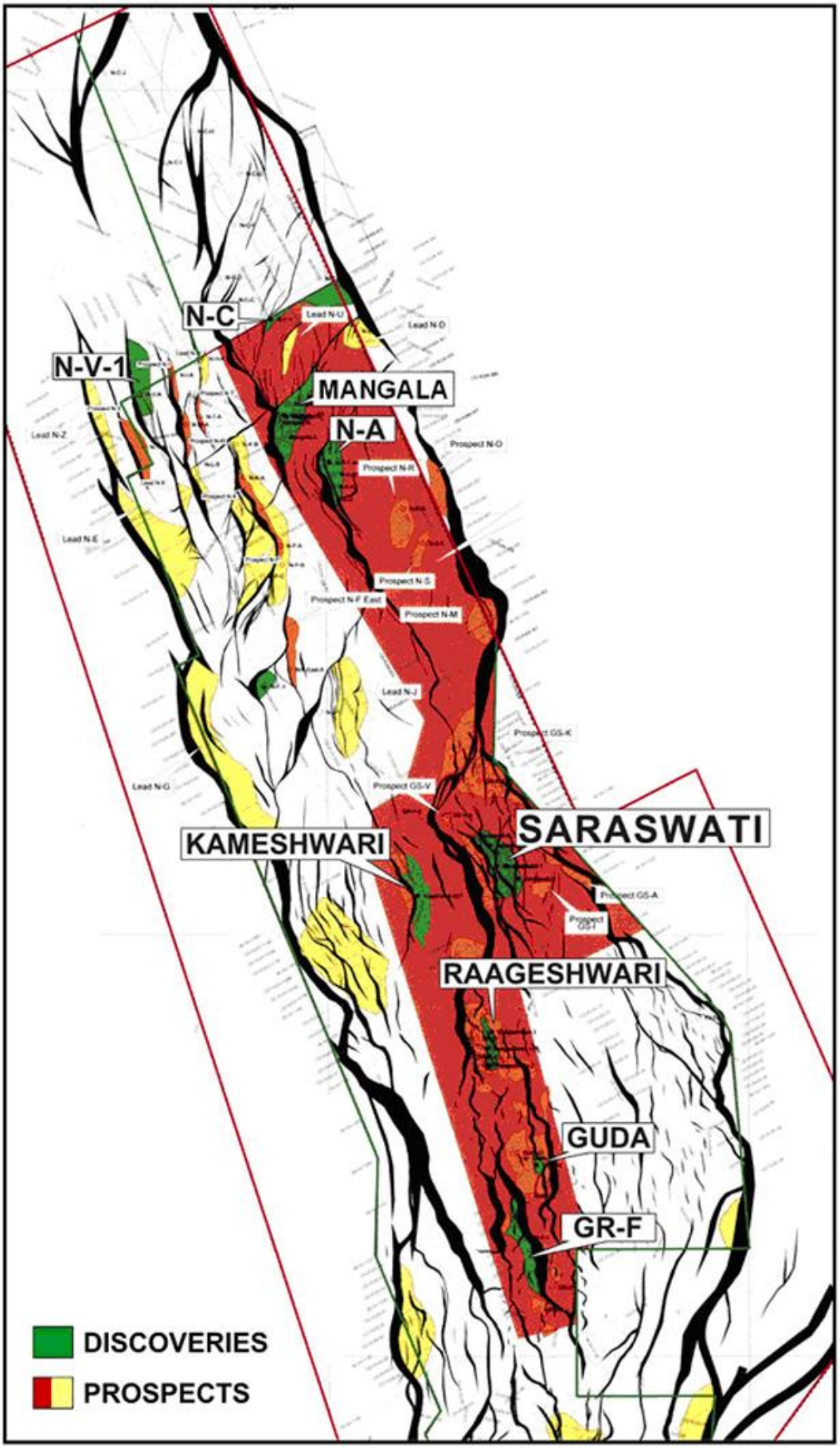


FIG. 13 NEW DISCOVERIES IN BARMER-SANCHOR SUB-BASIN

The Pokhran High separates the Bikaner-Nagaur Sub-basin from Jaisalmer Sub-basin. Devikot-Nachna uplift separates Jaisalmer Sub-basin from Barmer-Sanchor Sub-basin.

The tectonic evolution of Rajasthan Basin took place in four distinct phases corresponding to

- Precambrian - Triassic plate movement
- Breaking of Indian plate from southern continent during Jurassic
- Collision of Indian plate with the Asian plate from Eocene onwards
- Uplift of Sind-Baluchistan fold belt resulting in filling up of the Indus shelf

Major Lineaments

Three major trends along

~ NE-SW (Aravallis) direction

~ ENE-WSW or EW direction

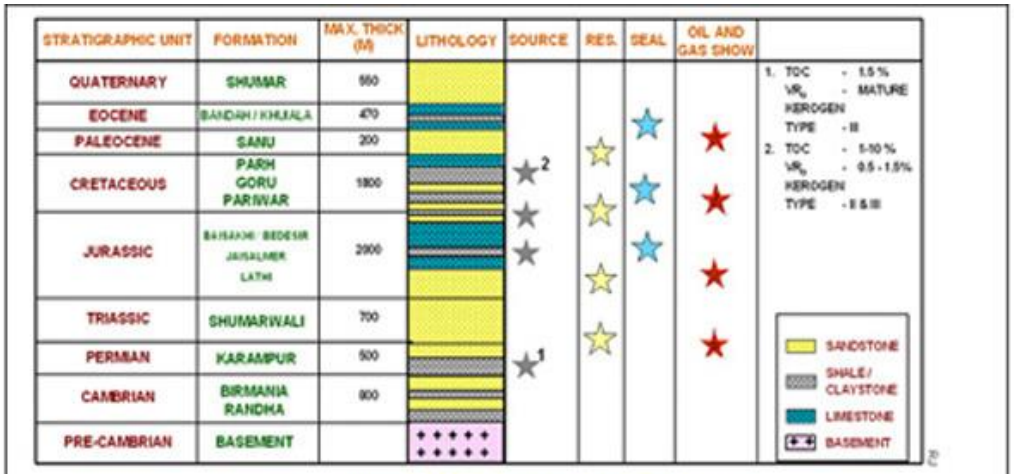
~ NW-SE (Dharwarian) direction

The NE-SW trending lineament (Aravallis) being the oldest is offset by late sublatitudinal lineaments. Both NE-SW and ENE-WSW or E-W trends are affected by younger NW-SE Dharwarian lineament, which resulted in the formation of Barmer-Sanchor Sub-basin.

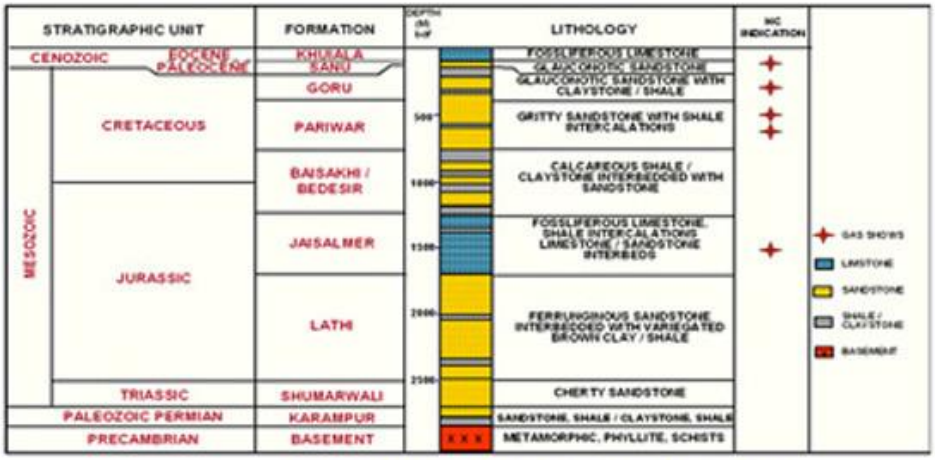
Top

Stratigraphy :.

Generalized & subsurface stratigraphy of Jaisalmer sub-basin

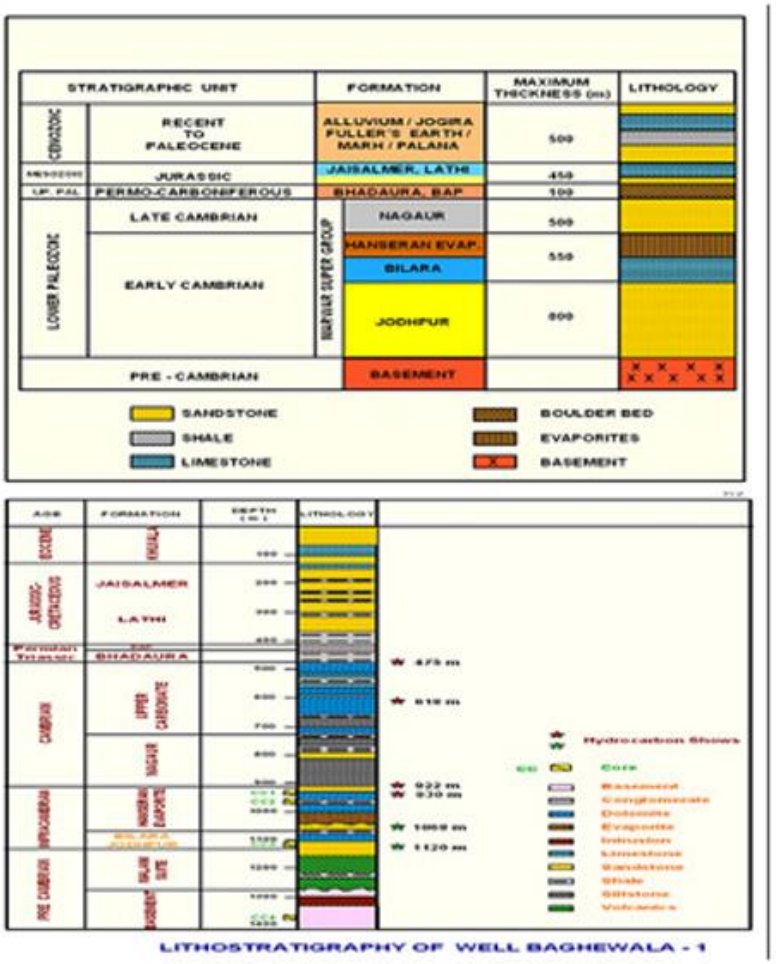


GENERALISED STRATIGRAPHY OF JAISALMER SUB-BASIN

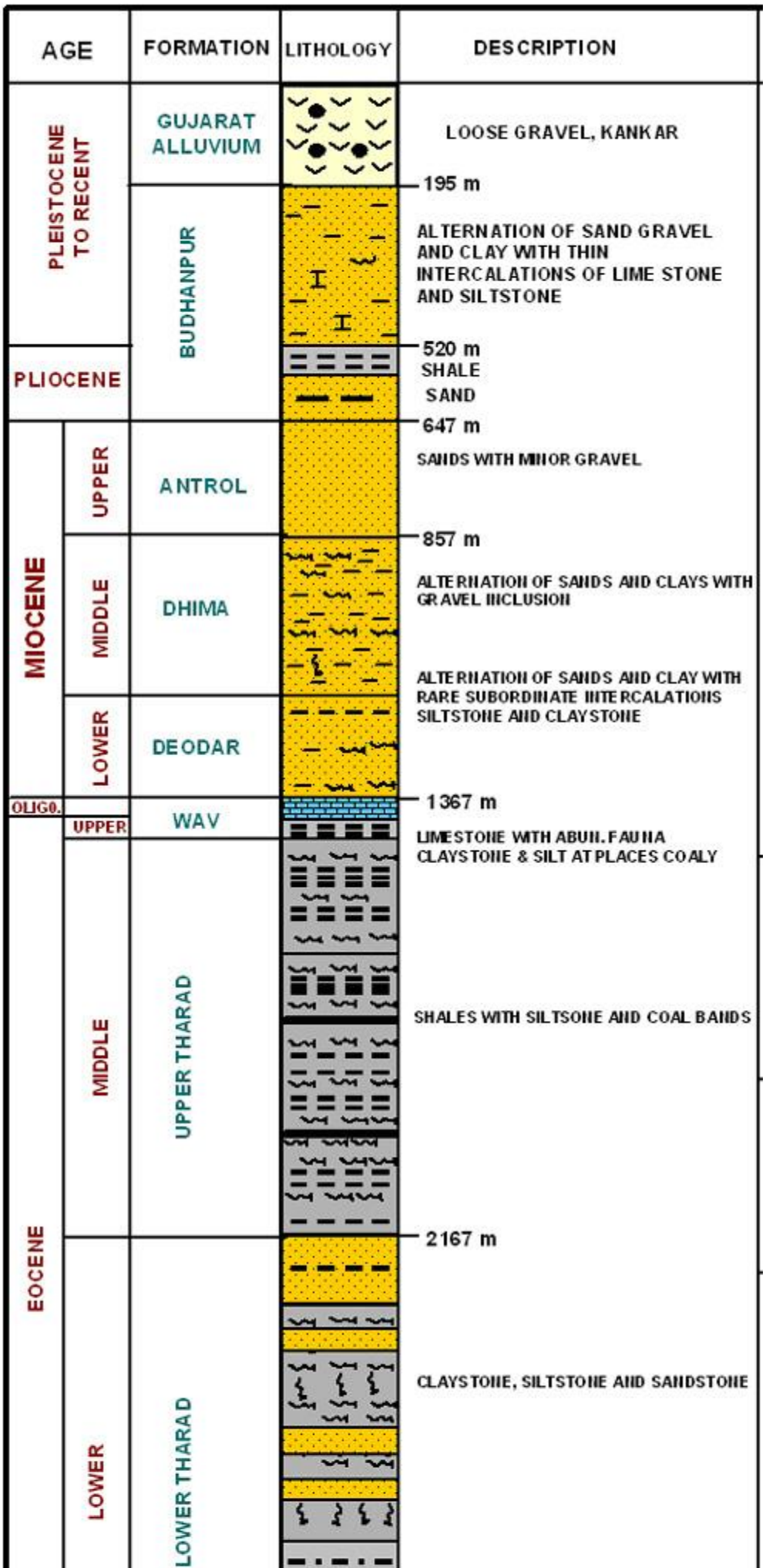


LITHOSTRATIGRAPHY OF WELL RAMGARH – 1

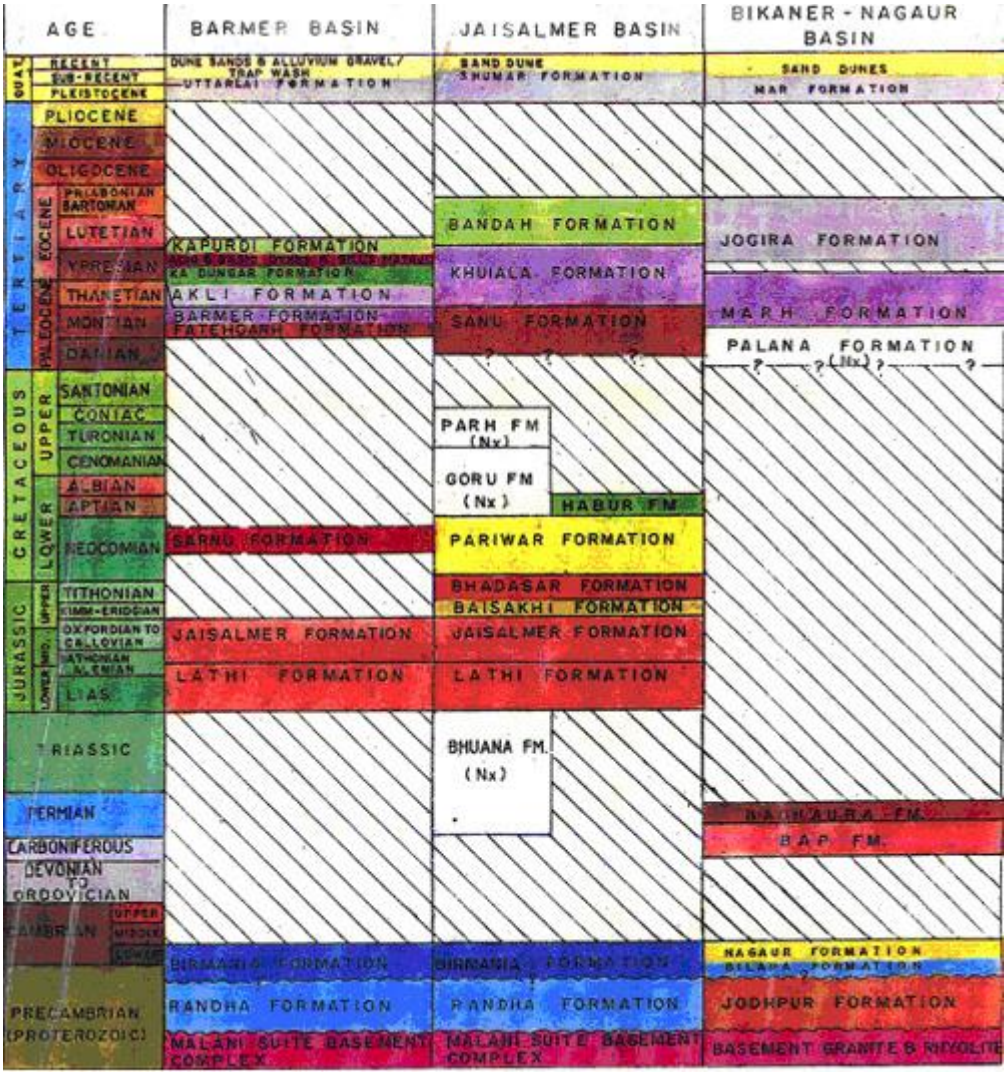
Generalized & subsurface stratigraphy of Bikaner – Nagaur sub-basin



Generalized & subsurface stratigraphy of Barmer – Sanchor sub-basin


AGE
FORMATION
LITHOLOGY
DESCRIPTION
PLEISTOCENE TO RECENT
GUJARAT ALLUVIUM
LOOSE GRAVEL, KANKAR
195 m
BUDHANPUR
ALTERNATION OF SAND GRAVEL AND CLAY WITH THIN INTERCALATIONS OF LIME STONE AND SILTSTONE
520 m
PLIOCENE
SHALE
SAND
647 m
MIOCENE
UPPER
ANTROL
SANDS WITH MINOR GRAVEL
857 m
MIDDLE
DHIMA
ALTERNATION OF SANDS AND CLAYS WITH GRAVEL INCLUSION
ALTERNATION OF SANDS AND CLAY WITH RARE SUBORDINATE INTERCALATIONS SILTSTONE AND CLAYSTONE
LOWER
DEODAR
1367 m
OLIGO.
UPPER
WAV
LIMESTONE WITH ABUN. FAUNA CLAYSTONE & SILT AT PLACES COALY
EOCENE
MIDDLE
UPPER THARAD
SHALES WITH SILTSONE AND COAL BANDS
2167 m
LOWER
LOWER THARAD
CLAYSTONE, SILTSTONE AND SANDSTONE

Interbasinal Stratigraphic Relationship



Sedimentation History

The Western Rajasthan Shelf which forms an integral part of Indus Basin, originated during Pre-Cambrian period. The sediments range in age from Late Proterozoic to Recent with intermittent transgressions and regressions.

~ The first cycle of sedimentation corresponding to Proterozoic-Early Palaeozoic is designated as Birmania/Randha Formation representing deeper water sediments.

~ A prominent orogeny, probably resulting from the collision of older plates led to a major uplift and hiatus in this region. On the peneplained Birmania-Randha topography, the Karampur Formation of Permain age was deposited over the unconformable surface.

~ A major regression took place during the Triassic and Early Jurassic, which resulted in deposition of Shumarwali Formation and Lathi Formation The Jaisalmer sediments have been deposited in very shallow water depths. During this period the Bikaner-Nagaur Sub-basin became positive due to differential block movement.

~ During the Upper Jurassic, a narrow elongated Cambay rift graben was connected to Jaisalmer Sub-basin through Sanchor-Barmer Sub-basin. The resulting clastic sequence representing Baisakhi and Bedesir formations in Jaisalmer Basin continued to be deposited in an oscillating shallow marine environment whereas in Sanchor Depression conglomerates and pebbly sandstone facies was deposited under fluvial regime designated as Serau Formation.

~ The Lower Cretaceous (Neocomian) Pariwar Formation represents further regression with shallow marine and brackish condition towards the lower part and complete regression with setting in of continental conditions towards the top.

~ The next phase of sedimentation started with the deposition of shallow marine Habur Formation in Jaisalmer Sub-basin which continued during Turonian and ended in Coniacian times with the development of predominantly marine marls and carbonates with clastic interbeds.

~ A major uplift of the axial belt gave rise to a prominent hiatus ranging in age from Maestrichitian to Danian and brought an end to this marine cycle. During this interval there was a major volcanic eruption in Sanchor Depression, which obliterated the pre-existing topography. The volcanic activity was more intense south of Sanchor.

~ The next cycle of sedimentation began with the deposition of clastic sequence of Sanu/Akli/Balutri Formation representing brackish to shallow marine environment probably during early Paleocene and Early Eocene.

~ The Khuiala and Bandah formations of Jaisalmer Sub-basin, and Mandai and Kapurdi formations of Barmer Depression indicate a somewhat stable condition during Lower Eocene. However, Sanchor Depression witnessed a minor pulse of regression, resulting in deposition of Lower Tharad Formation.

~ In the central part of Indus Basin, clastic deposition continued under slightly oscillating shallow marine condition represented by Mari and Gaj formations of Oligocene and Lower Miocene. The eastern flank of the Indus Shelf including, Bikaner-Nagaur, Jaisalmer and Barmer-Sanchor remained uplifted from Middle Eocene to Pliocene and supplied clastics to the fluvial Basin to the west and southwest. However, during Quaternary a thin veneer of fluvial sediments covered Middle Eocene sediments.

~ The Sanchor Depression had a continuous sedimentation from Early Miocene to Recent, deposited under minor pulses of transgressions and regressions.

Depositional Environment

Jaisalmer Sub basin :

Formation	Age	Sedimentary Thickness(Max.)	Depositional Environment
Shumar	Quaternary	730	Fluvial/lacustrine/eolian
Bandah	Mid to upper Eocene	Outcrop:50 Subsurface:200m	Marine shelf environment ranging from inner to middle shelf regime.
Khuiala	Paleocene to lower eocene	Outcrop:25 to 50 Subsurface:90 to 400	Shelf/shallow Neretic sea
Sanu	Paleocene	Outcrop:8 to 75 Subsurface:670	Continental to marine/inner to middle shelf
Parh	Turonian to conlacian	350	Open marine environment ranging from middle to outer shelf regime
Goru	? Aptian to Cenomanian	565	Overall transgressive shallow marine with short regressive cycle
Habur	Aptian	200	Nearshore environment with occasional effect of storm surges
Pariwar	Neocomian	670	Overall regressive phase with intermittent marine incursion
Baisakhi-Bhadasar	Upper Jurassic to Cretaceous	730	Near shore to shallow marine
Jaisalmer	Mid Jurassic	1138	Low energy environment over a stable shelf with occasional intertidal effects
Lathi	Lower Jurassic	600	Continental – Fluvial/fluvio-deltaic
Bhuana	Permo-Triassic	707	Fluvial to shallow marine
Birmania	Proterozoic to Lower cambrian	2000	Marine reducing environment with restricted circulation
Randha	Proterozoic to Lower cambrian	200	Continental to nearshore

Bikaner-Nagaur sub-basin :

Formation	Age	Sedimentary Thickness(Max.)	Depositional Environment
Mar	Quaternary	50 to 70	Fluvial environment showing changes from arid to eolian condition
Jogira	Lower to middle Eocene	60	Shallow marine (inner to middle Neretic)

Marh	Paleocen to Lower Eocene	210	Fluvial to shallow marine
Palana	Paleocene	120 (+)	Reducing parallic/swampy environment
Badhaura	Lower Permian	350	Shallow marine/intertidal
Bap	Permo-Carboniferous	50 to 160	Fluvio-glacial condition
Nagaur	Proterozoic to Lower Cambrian	180	Shallow water high energy condition
Bilara	Proterozoic to Lower Cambrian	30 to 1000	Restricted shallow marine condition
Jodhpur	Proterozoic to Lower Cambrian	100 to 200	Shallow water fluvial environment

Top

Petroleum System :.

Source

Source	
Jaisalmer	Lower Goru, Pariwar, Sembar / Bedesir - Baisakhi Shales , Karampur/Badhaura Formation Shales, Bilara Shales and Dolomites
Bikaner-Nagaur	Karampur/Badhaura Shales, Upper Carbonate Dolomites , Bilara Shales and Dolomites
Barmer-Sanchor	Cambay Shale, Tharad shales

Reservoir

Reservoir	
Jaisalmer	Clastic: Baisakhi-Bedesir, Pariwar, Goru, Sanu and Khuiala formation sandstones Carbonate: Fractured limestones of the Jaisalmer Formation, Lower Bandah Limestones / Khuiala Limestones
Bikaner-Nagaur	Upper Carbonate Dolomites, Nagaur Sandstones, Jodhpur Sandstone and Bilara Dolomites
Barmer-Sanchor	Sandstones of Barmer and Tharad formations, Silty sandstones of Lathi Formation feldspathic sandstones of Sarnu Hill Formation, conglomerates of Serau Formation

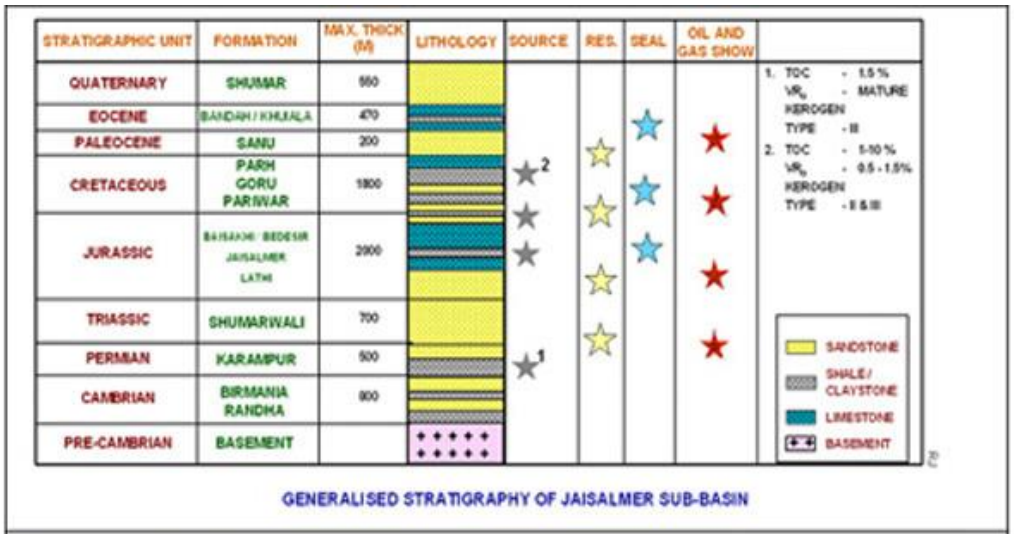
Trap

Trap	
Jaisalmer	Anticlinal closures, Fault related closure/traps, Unconfirmity related traps viz., Wedge outs, Lithostratigraphic traps.
Bikaner-Nagaur	Moderate to high basement-controlled anticlinal structures and fault closures
Barmer-Sanchor	Roll over anticlines developed on the previously planer boundary faults and fault closures against the transverse faults

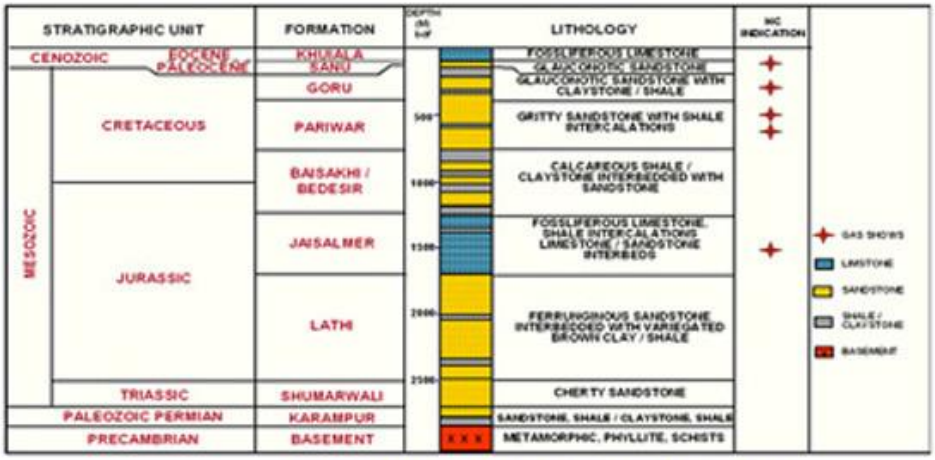
Top

Petrolrum Plays :.

Jaisalmer sub-basin



GENERALISED STRATIGRAPHY OF JAISALMER SUB-BASIN



LITHOSTRATIGRAPHY OF WELL RAMGARH - 1

~ Paleocene extensional fault blocks with Cretaceous age reservoirs
~ Early Tertiary stratigraphic subcrop closure of Sanu clastics beneath the shales of the lower Khuiala Formation
~ Mesozoic subcrop of either Cretaceous age sediments below Base Tertiary or early-mid Jurassic Lathi Formation beneath Jaisalmer Limestone.
~ Lowstand Fan mounds at the base-of-slope (intra Baisakhi Formation)
~ Relative sea-level fall, forced regression sands at shelf break.

- Mesozoic plays

Mesozoic sediments are expected to hold good prospects on Jaisalmer – Mari platform. The rising flank of Jaisalmer Sub-basin is the target for subtle traps. Lunar and Daw are considered to be good prospects for Mesozoics. Bhuana structure has a potential of estimated 2BCM of gas. The Mukleri structure is expected to host about 1 MMt of oil. In Lunar area eight drape structure have been identified which are most favourable targets for hydrocarbon entrapment.

- Cretaceous plays

Probability of striking oil in Kharotar – Sadewala area in Cretaceous sediments appear to be high.

Bikaner-Nagaur subbasin

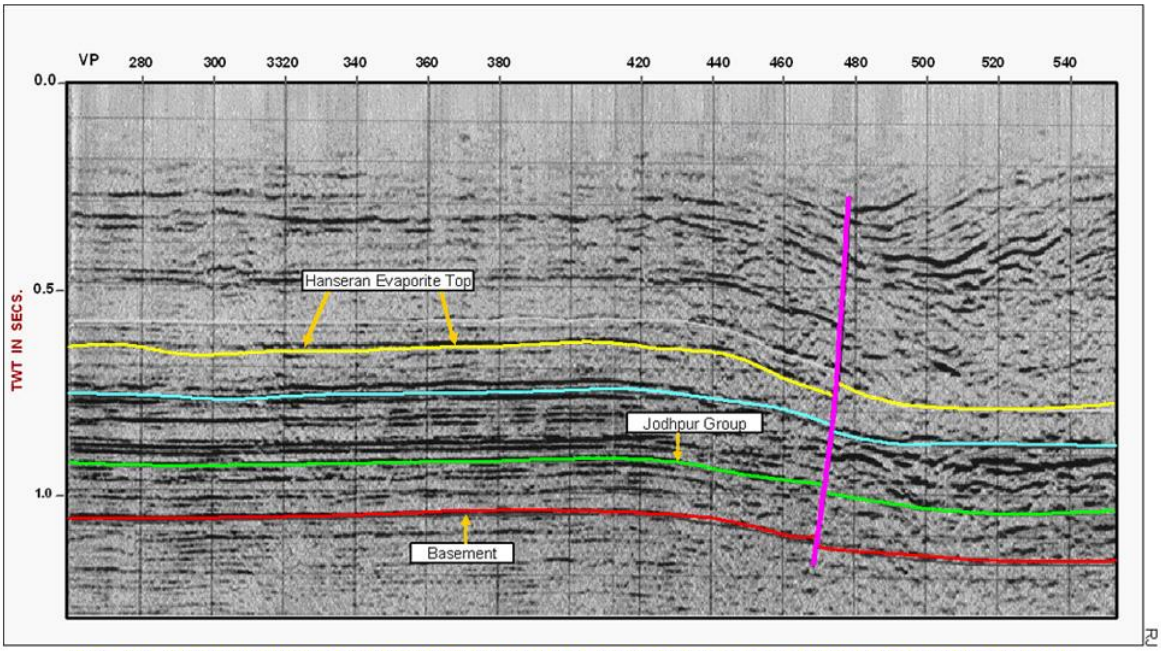


FIG. 15 SEISMIC SECTION ACROSS NANUWALA PROSPECT : BIKANER-NAGAUR SUB-BASIN

~ Early Cambrian Transpressional fault-blocks.
~ Early Cambrian Transpressional reactivation combined with salt swells.
~ Sands developed at the toe-set end of 'clinoform sequence'.

~ Sands developing structure within prograding clinoform.
~ Tertiary reactivated fault-blocks, extensional movement along existing faults.
~ Late Tertiary transpression of pre-existing faults.

- Cambrain plays

Available evidence indicates that the Cambrian sediments have gererated both oil and gas. Oil is discovered in Cambrain dolomites in the well Karampur-1. Heavy oil is present in multiple zones within Cambrian sediments （Bilara Limestone and Jodhpur Sandstone） in Baghewala, Tavriwali and Kalrewara structures. Presence of light oil has been reported in an exploratory well drilled in an exploration block RJ-ON-90/5.

Barmer-Sanchor Sub-basin

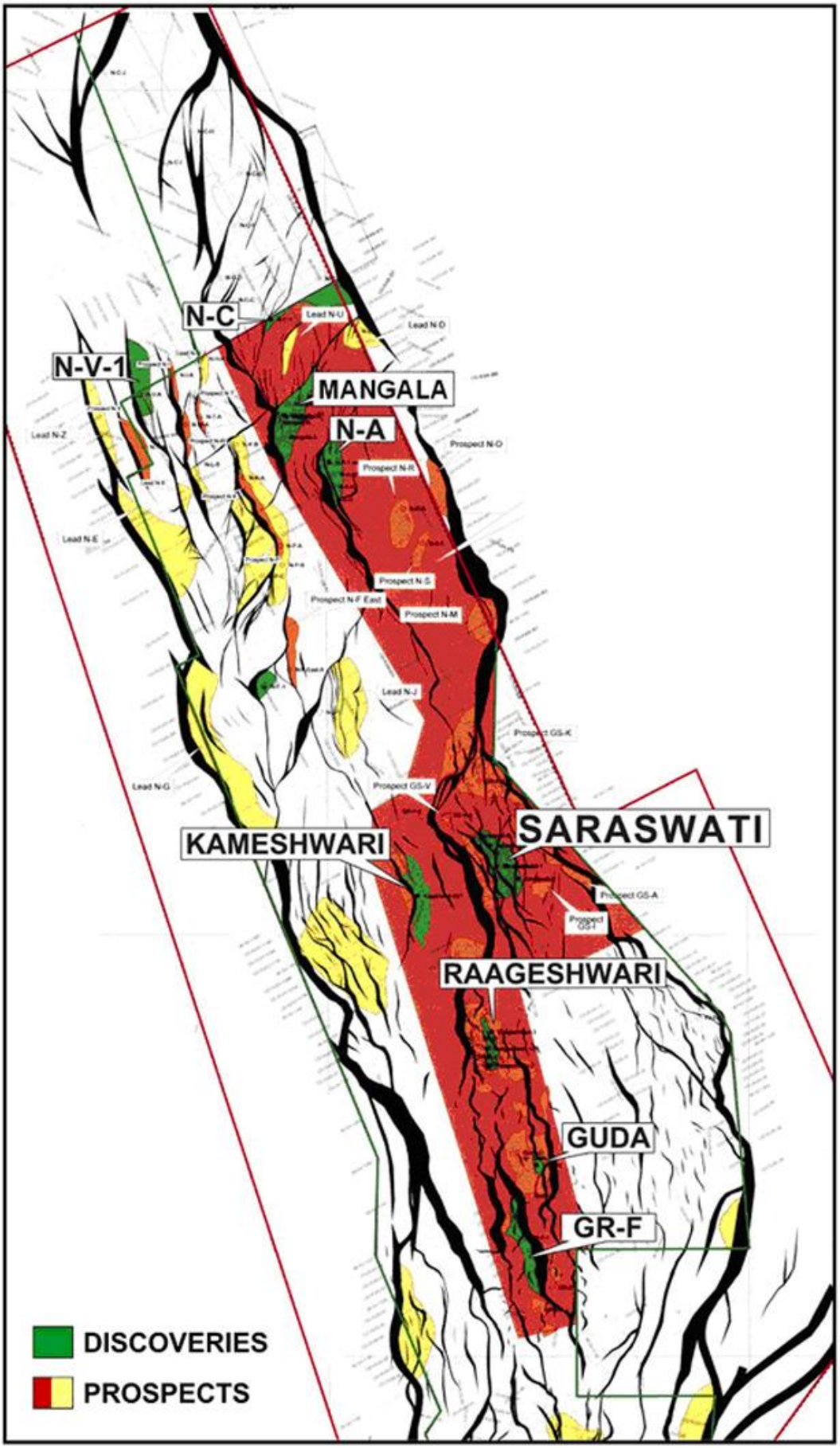


FIG. 13 NEW DISCOVERIES IN BARMER-SANCHOR SUB-BASIN

- Mesozoic plays

Updip migration from Cambay basin northwards is considered to have sourced the hydrocarbons encountered in Barmer-Sanchor sub-basin. However latest data suggests that thick sediments of tharad formation having good source rock characteristics constitute a significant source sequence within kitchen areas of Barmer-Sanchor basin itself. Hydrocarbon entrapment is established in structural as well as strati-structural traps with possibility in updip pinchout prospect towards the basin margin. Potential oil and gas bearing reservoirs range from the upper Cretaceous volcanic basalts to the Eocene - Oligocene arenaceous units. Mesozoic sediments are also possible reservoirs in the northern part of Barmer- Sanchor basin.