

## Palynological Controls On Biostratigraphy Of Barmer Basin, India

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### ABSTRACT

Barmer Basin is located in north-western part of Indian subcontinent and considered as the extended northern part of the intracratonic Cambay Basin. Discovered by Cairn, this proven petroliferous basin has diverse tectono-depositional history originated from multiple rift systems of Mesozoic- Tertiary ages. Primary hydrocarbon reservoirs are pre-rift Ghaggar Hakra Formation, Late Paleocene Fatehgarh and Barmer Hill Formations, Early Eocene Dharvi Dungar Formation and Middle Eocene Thumbli Formation. Lithology wise Fatehgarh Formation is a dominantly fluvial deposit, syn-rift Barmer Hill Formation is mainly lacustrine authigenic silica rich porcellanite reservoir, overlying Dharvi Dungar Formation consists lacustro-marine deltaic sediments and shallower Thumbli Formation is a combination of fluvio-lacustrine and coastal-deltaic sediments. To establish and constrain the basin deposition history, inferences from the palynological studies have been used as a major tool along with different controls from geo-chronological dating and sedimentological inputs. The study is confined to the reservoir sections though palynological data are present from Fatehgarh to Late Eocene Nagarka Formation. Rich assemblages of Dinocysts, Algae, Fungal elements, Spores and Pollens samples in 20 studied wells distributed over 6800 km<sup>2</sup> area summarize the paleoenvironmental changes in this basin.

In Barmer Basin common dinocysts are *Apectodinium* spp., *Cleistosphaeridium* spp. and *Spiniferites* spp. Dinocysts are mainly reproductive stage of Dinoflagellate and indicative of marine or coastal influences. Two main fresh water algae species preserved are *Pediastrum* spp. and *Botryococcus* spp. Characteristic fungal elements are fresh/brackish water born *Pleuricellaesporites* spp. and wetland origin *Phragmothyrites* spp. Terrestrially derived spore and pollen species are highly abundant throughout all the formations. Within spore elements, rainforest origin indicator *Deltoidospora* spp. and *Cyathidites* minor are dominant. Abundant pollen species are mainly from palm and mangrove plants of tropical rainforest i.e. *Proxapertites* spp., *Spinizonocolpites* spp., *Tricolpites* spp., Bisaccate pollen (pinus), *Monocolpites/ Monosulcites* spp. etc.

Palynological zonation marked by the extinction, inception and abundance events of the palynomorphs and the associated changes in the overall palynofacies composition with paleoenvironments have been identified thoroughly using the cores and cuttings. Fatehgarh Formation has diversified assemblage of all palynomorphs along with marine dinocysts indicating lateral palynofacies changes from terrestrial fluvial setup to marine influenced lacustrine (?) environment. The Fatehgarh sediments deposited throughout the basin does not typically indicate any marine dominated lithology. Sharp changes in the assemblage indicated by absence of dinocysts and highly reduced amount of spore-pollen marks the initiation of Barmer Hill Formation where freshwater algae are dominant. Though the cause of the reduction of these palynomorphs is unclear, low preservation potential in rifting stage and reduction of the terrestrial flora could be probable causes. The Dharvi Dungar Formation is marked by flourishing of both freshwater and marine dinocysts and abundance of spore-pollen coming from hinterlands. Highly

abundant *Pediastrum* indicates occasional lateral emergence of freshwater fluvio-deltaic setup amidst marine dominated lacustrine environment. Thumbli Formation initiation marked with the reduction of the dinocysts (especially marine *Apectodinium* group) and spore-pollen assemblages while more freshwater ponding effect is indicated by the relative abundance of *Botryococcus* species in a coastal deltaic setup.

Entire sequence is a product of tropical/subtropical climate with periodic changes between fluvial, coastal, deltaic and lacustrine setups with occasional marine influences. Separately conducted microfossil and nannofossil studies also corroborate to similar observations. This palynological study has been helpful at both basinal and field level contexts of lithological and chronological high resolution stratigraphic correlations. Also geochemical studies of hydrocarbon and source rock maturity analysis are highly affected by the biostratigraphic observations. Analogous study from Suriname-Guyana Basin of northern South-American continent suggests identical paleoenvironments with similar palynological assemblages.