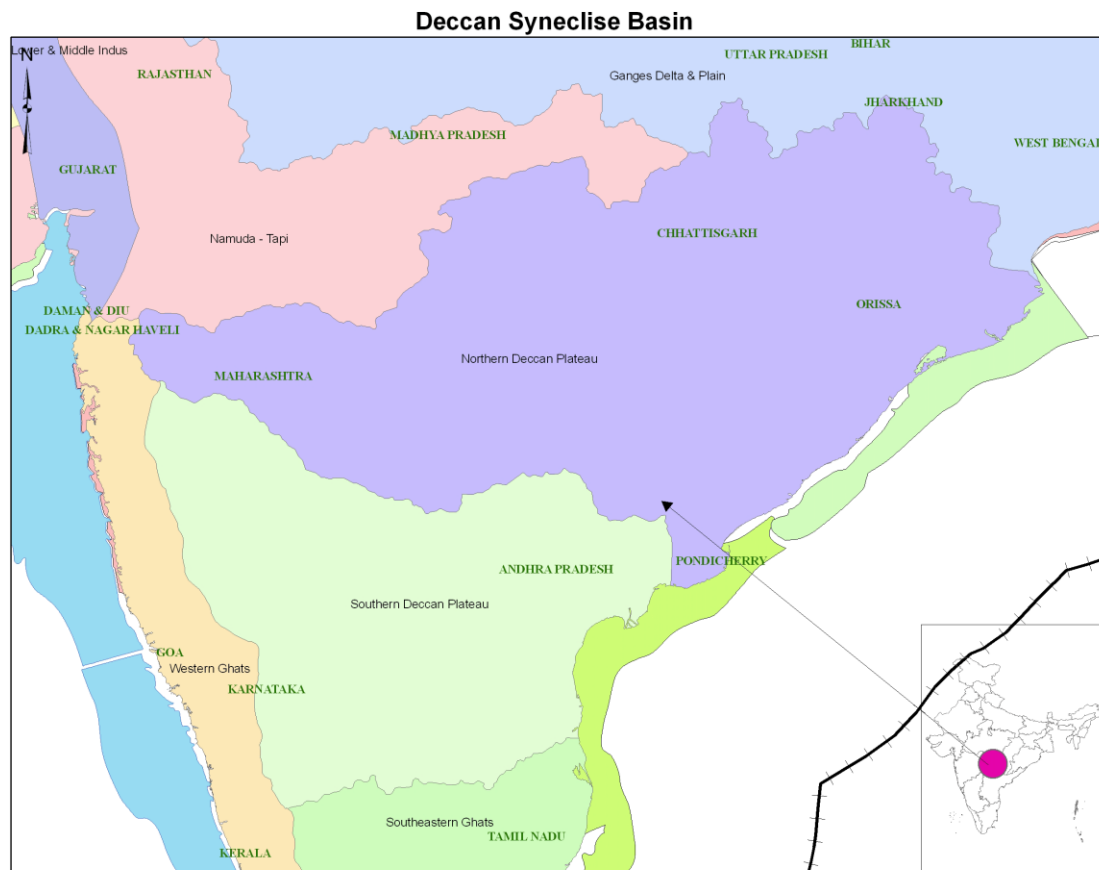


Basin Introduction:



The Deccan Syncline, located in the western and south-central part of India covers an area of about 273,000 km². The Syncline is considered to have good potential for hydrocarbons. The main rock exposures in the basin consist of a number of basaltic lava flows which have been poured on to earth's surface during Cretaceous-Paleocene period, blanketing all pre-existing rocks ranging in age from Precambrian to Cretaceous. It is bounded to the north by the Narmada-Son rift (even though the lava spread extends much north of Narmada river) and to the south and east by the Precambrian sediment and Archaean metamorphic exposures. The western limit may be defined as the longitudinal fissures from which the basaltic lava erupted and is marked by a highly increased thickness of Deccan volcanics, even though the Trap is known to extend upto the shelf margin of Bombay Offshore basin. At the margins, lava flows extend over Precambrian to Early Cambrian rocks, Gondwana and Cretaceous sediments found in the (1) Kaladgi and Bhima depressions along the southern margin. (2) Pranhita-Godavari graben on the east and (3) Narmada graben on the north. Lava flows have spread beyond the Syncline limits.

The Deccan Syncline is a super order negative platform with substantial thickness of sediments below the Trap. It has a regional gravity anomaly of the order of 90 mgal. Recent surveys, carried out by National Geophysical Research Institute (NGRI) for Directorate General of Hydrocarbons (DGH) have revealed the presence of a few sedimentary basins buried under the lava flows. These sedimentary basins and those on its periphery are believed to hold good hydrocarbon prospects. Similar geological settings are known in Tungus Syncline of Siberia and Parana basin of South America, both being platform depressions with considerable sedimentary thickness. One block, considered prospective for hydrocarbon exploration in the thick sediments lying under a thin cover of lava flows, is being offered for exploration in the present round of bidding.

Tectonic Framework:.

Gravity data and DSS profiles reveal several rift basins buried below the Deccan Trap. Two rifts, namely, the Koyna rift (northwest continuation of the Kaladgi basin) and the Kurduvadi rift (northward continuation of the Bhima basin) filled up by low density material, were identified from gravity data under the Trap separated by the Sangola uplift.

The Koyna rift and the Kurduvadi rift, about 540 km and 390 km in length respectively, appear to merge in the region north of Pune. The western sides of the Koyna and Kurduvadi rifts appear to be steeper than their eastern flanks. These rifts possibly originated during the Precambrian period when Cuddapahs were deposited in trough faulted basins. These troughs were subsequently deepened and extended in length by a second phase of crustal disturbances, prior to the deposition of Gondwana sediments. During the last phase of deposition, the sediments were laid down in the narrow areas of Cretaceous sea.

DSS data also suggest the continuity of the Pranhita-Godavari graben towards north-west. Nearly 2 km thick sedimentary section is expected within the graben. These sediments indicate a seismic velocity of 32 km/sec. In Multai-Pulgaon region, another graben of 100x100 km² dimension has been interpreted with a possible sedimentary fill of about 500m below the Trap.

These rifts are associated with thermal springs towards north and north-west and fan out towards south and south-east.

Tectonics of the Narmada-Tapti Region of the Deccan Syncline has been investigated in detail by NGRI under a sponsored study by OIIB of Government of India. The area was studied through a number of geophysical investigations like detailed gravity observations and data interpretation, recording of Magneto-Telluric observations, deep resistivity soundings and refraction seismic survey along selected profiles. The integrated interpretation brought out existence of two small sedimentary basins concealed under trap rocks. With the help of modeling, trap thickness, sediment thickness, basement configuration for these basins have been determined.

Stratigraphy:.

The generalized stratigraphy of Deccan Syncline is given in Table-2. Brief description is as under :

Dharwar :

To the south of the Trap country is the Dharwar suite of rocks comprising mainly gneisses and schists with occurrences of dolerite, quartzites etc.

Cuddapah :

The Kaladgi Formation of Cuddapah age is seen in the Kaladgi basin, located between the banks of the Krishna and Malaprabha rivers, the principal exposures occurring as inliers in the Deccan Trap plateau on the banks of the Krishna river. The Kaladgis are separated from the crystallines by an unconformity and have been divided into lower and upper stages with average estimated thicknesses of the order of 600 and 3000 meters, respectively. The rocks of the upper stages comprise shales, limestone, schists and quartzites with occasional conglomerates and breccias, whereas the lower stage consists of limestones, clays, shales, sandstones, siliceous limestones breccias, quartzites and conglomerates.

Vindhyan :

The Bhima series comprising sub-metamorphic rocks of Vindhyan age are seen in the Bhima basin in the valleys of the Bhima and Krishna rivers. The Deccan Trap forms scarps over them. and also, occasionally, over the granites on the northern side. Towards south, they rest directly over the peninsular granite, coloured limestones, laminated limestones, red lithomorphous shales and sandstones. The rocks of this series are expected to have a maximum thickness of the order of 350 meters.

Gondwana :

Gondwana rocks of Permo-Carboniferous to Early Cretaceous age, fluvial to lacustrine in nature, occur in the Pranhita - Godavari Valley and continue underneath the Trap. Rocks of Precambrian age form the floor on which Gondwana sediments were deposited.

Gondwana sediments of Lower Permian age consist of diamictite, conglomerates, shales, turbidites, rhythmites and coal seams. Middle Permian sediments are essentially coal free and consist of coarse sandstones and red clays. Gondwanas of upper Permian age are again coal bearing.

In the Pranhita-Godavari graben, more than 5 km thick Gondwana sediments are estimated to occur. Depth computation from DSS data indicates the maximum Gondwana thickness of 1.8 km under the Trap.

Lower Triassic to Lower Jurassic formations essentially consist of alternation of red clays, sandstones and conglomerates. Sediments of Liassic age consist of thick sandstones, siltstones, silty clays, minor red clays with a prominent terrestrial limestone bed towards the base. Lower Cretaceous sediments comprise massive sandstones, conglomerates, white clays, thin coal seams and carbonaceous shales. The overlying Lameta beds consist of marine/brackish water limestones, sandstones, marls and clays.

Deccan Trap :

It consists of a series of basaltic lava flows presumed to have been poured on to the surface during late Cretaceous period, blanketing all pre-existing rocks. The thickness of individual flows ranges from 2 to 100 meters. These are massive to vesicular with an average specific gravity of 2.9. The flows are generally horizontal with a gentle westerly dip and attain a maximum thickness along the Arabian Sea coast. The geologically estimated thickness of the Trap ranges from 60m at Belgaum to 1600m at Mahabaleswar and 1900m along the Bombay coast. The rocks generally consist of basalts, the prevailing type being a dark green or nearly black basalt of varying chemical composition, amygdaloidal to vesicular and with intertrappean sedimentary beds and numerous highly ferruginous clayey beds.

Hydrocarbon Potential:

Gondwana sediments are expected to form the main source and reservoir facies in the Deccan Syncline as in the adjoining Pranhita-Godavari graben and Satpura rift basin. Gas has been struck in the western part of the Krishna-Godavari basin at Mandapeta well in Chintalpudi Sandstone of Upper Gondwana, which is an encouraging factor for exploration in Gondwana sediments. A number of gas shows have been observed and investigated in the Satpura basin, on the northern boundary of the Deccan Syncline. These gases contain high percentage of Methane (94%+) and are considered to be of thermogenic origin.

Lower Gondwana sediments (Barakar Formation in particular), containing abundant organic matter, are thought to constitute good source rocks. Vitrinite reflectance studies indicate that the shale sequences are within the zone of hydrocarbon generation (Satpura: TOC 10.1%, VRo 0.6 to 1.3; Pranhita Godavari: TOC 3.58 to 6.41%, VRo 0.47 to 0.67; Son - Mahanadi: TOC 1.06 to 18.725%, VRo 0.4 to 0.6).

About 2 km thick sedimentary section is sandwiched between the Deccan Trap and the Precambrian basement in a number of depositional basins as revealed by DSS and other geophysical studies. Reservoir facies are well developed in the adjoining Pranhita-Godavari basin in both the Upper and Lower Gondwana sequences, and are expected to be present in the Deccan Syncline as well. As discussed earlier, gravity-magnetic and DSS data indicate the extension of the Pranhita Godavari and Koyna rift basins towards northwest and north, respectively and are merging with the east-west

trending Narmada-Son lineament. This junction of three lineaments enhances the prospectivity of the area.