

Sub-Basalt Imaging in the Gulf of Kutch

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We present a case study which describes a sub-basalt imaging project in the Gulf of Kutch. The objective of the project was to improve the seismic imaging of Mesozoic sediments lying beneath the Deccan Trap basalts. As the earlier processing attempts were unable to bring out sufficient resolution of the structure so to improve confidence in the interpretation ahead of a further phase of exploration drilling a detailed study was commissioned which included seismic modelling, re-processing of the two available surveys from field tapes, velocity modelling and pre-stack depth migration using the very latest algorithms including Beam and Reverse Time Migration.

The area of the study falls in the shallow waters of Kutch basin and is characterized by 800m to 1000m thick Deccan trap basaltic lava flows sandwiched between Tertiary and Mesozoic sediments. The Cretaceous Bhuj reservoirs lying below the basalt layer are considered potential hydrocarbon targets but imaging these sub basalt events is challenging due to attenuation of energy, strong presence of multiples and mode conversions, and guided waves within the heterogeneous layers of basalt. The objectives of the project have been

- Accurate focusing and positioning of sub basalt structural play.
- Imaging the geometry of Deccan trap basalts.
- Determination of major litho-facies boundaries (clastic Icarbonate).

To address these issues the project comprised the following steps:-

- Analysis and modelling of shot records close to existing exploration wells to try and understand the nature of the arrivals and tailor the noise suppression techniques to suit.
- Derive a robust scheme for attenuation of surface, water layer and interbed multiples.
- Build a velocity model which honours the overburden and accurately delineates the high velocity basalt unit.
- Selection of the most appropriate depth migration algorithm.

The existing datasets in the area had very poor sub-basalt imaging and the experienced eye of the interpreter was critical in taking decisions during the interpretive processing sequence. There was close cooperation between ONGC and GXT staff thorough, the project particularly during the velocity model building phase and in choosing the appropriate migration algorithm.