

An Integrated Litho-Biostratigraphic Analysis To Evaluate Genetically Related Facies And Parasequences Within Middle Eocene Transgressive System Tract: Hazad Member, Gahdhar Field, Cambay Basin, Gujarat, India

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ABSTRACT

The highly prospective Hazad Sands are thin and hence beyond the resolution for mapping on seismic sections which poses difficulty in modeling and determining dispersal pattern of these sands. Present investigation includes identification of the different litho-biostratigraphic boundaries and detailed examination of the sedimentary features to understand the depositional environment of the Hazad sand units through integrated study of conventional cores, SWC and cuttings. Hazad Member of "Middle to Late Eocene Transgressive System Tract" of Cambay Basin is subdivided into four units based on litho-biostratigraphic analysis and electro logs: Unit-I to Unit-IV from bottom to top, separated by the intervening Transgressive shales viz. Shale-1, 2 and 3. The four units have been classified as four parasequences on account of their continuity in time and space. Correlatable shales identified as "Flooding surfaces" are characterized by abundant and species diverse calcareous nannoplanktons and foraminiferal assemblages, along with fine-grained sediments rich in authigenic minerals glauconite and siderite. A total of six distinct lithofacies have been identified for pay sands. Overall fining upwards trend observed for the entire sequence is indicative of Transgressive System Tract. The reservoirs are deposited as mouth bars, distributary channels, tide influenced channels and fluvial channels in deltaic set up. Features like V-shaped abrasion pits and small etch pits observed on the surface of quartz grains in Scanning electron microscope study also indicate water to be the transporting medium for these sediments. Intergranular porosity development is fair to good towards the bottom of the channels and topmost part of mouth bars. Provenance analysis of the main detrital minerals including quartz, feldspar, mica and heavy minerals indicate acid igneous and metamorphic source for pay sands. Heavy mineral assemblage and textural analysis suggest mature nature of these sediments. Reservoir sands are diagenetically affected and Unit-I exhibits maximum effect of diagenesis. Infiltrated clays are identified as the earliest diagenetic stage. Authigenic pore filling Kaolinite and grain coating Chlorite clays are present which along with precipitated calcareous and siliceous cement have led to reduction of pore spaces. On the basis of biostratigraphic studies, three dinocyst events have been deciphered within Hazad Member. The top of Hazad Member has been dated to 44Ma, Shale-2 as 48Ma and the top of Cambay Shale dated with a 2Ma hiatus at 51/49Ma. Configuration of the identified parasequences on the basis of laboratory analysis, therefore, can enable better understanding of sedimentary dynamics, sand dispersal patterns and their reservoir characteristics which will add to precise estimation of reserves, proper development and enhancement in the recovery of hydrocarbons from this mature field.