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Mapping 3D thin shale and permeability pathway within a reservoir system: Case study from the Sleipner Field

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Reservoir architecture plays an integral part of seismic reservoir characterization. The characteristics of a reservoir which includes its external and internal geometry are important as they influence the production and development strategy employed in the oil and gas sector. Reservoir architecture is defined by the interpretation of seismic data, thus identifying the basic structural and stratigraphic geometrical framework of a trapping and flow system for hydrocarbon and fluids. One major issue though is the interpretation of thin shales and identification of permeability pathways within the reservoir system. This paper employs a method using attributes to map thin shales and identify permeability pathways or transmissitives that exist within a reservoir taking into consideration the seismic resolution and available data. Case study is the Utsira Formation in the Sleipner field, Norwegian North sea. The Utsira formation presents a classic case of thin beds within a sandstone formation and transmissitives that exist as chimneys within the formation. A total of 10 intra reservoir horizon units of shales where interpreted using complex trace seismic attributes. These interpreted horizons where further analysed through spectral decomposition to reveal possible facies distribution and unit thickness within the horizon. Reservoir transmissitives identified as vertical curvilinear structures were also analysed using unique seismic attributes in other to delineate their extent and characterise their occurrence
These interpreted shales and pathway transmissitives illuminate the geometry of the formation, the reservoir heterogeneities on a finer-scale and, in the long term, constrain the migration prediction of reservoir fluids, hydrocarbons and injected CO_2 when matched across a 4D seismic data survey. As such, useful insights into the key elements operating within the reservoir can be provided, giving a good indication of the long and short term reservoir performance.