OBN (Ocean Bottom Nodes) Seismic Acquisition and Application on Reservoir Imaging and Characterization

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The success of hydrocarbon exploration, field development and reservoir surveillance depends significantly on effective reservoir imaging, characterization and detection of seismic signal related to fluid content in reservoir intervals. Therefore, it is very important to acquire a high quality seismic data beyond conventional towed streamer recording such that the new dataset allows application of new processing technology to eliminate noise, and attenuate unwanted water-bottom (or other type) multiples in order to increase signal-to-noise ratio. With the advance and development of seafloor sensor (4-components Ocean Bottom Node), the chance to achieve this goal becomes significantly higher. The OBN acquisition technology is particularly useful for reservoir surveillance in a very congested oil field to monitor oil production, identify by-passed reserves, minimize unnecessary wells, and help mitigate risk of early premature field decline, water encroachment and gas breakthrough. The cable-less node allows full-azimuth seismic surveys with continuous coverage and recording for P-wave and converted PS-wave even in highly obstructed areas. The high resolution USBL + inertial positioning system enable node deployment to well within +/- 5 meter limit. The combination of new acquisition and processing technologies (e.g. shot record migration, mirror imaging and RTM) provides step-changes in data quality, and advancing seismic imaging technology in complex and challenging deepwater areas. Chevron has recently completed an Ocean Bottom Node (OBN) seismic acquisition over the Agbami Field, offshore Nigeria. The survey utilized both source vessel and node vessel equipped with 3D and 4C (four components – hydrophone and 3-components geophone) capabilities. The operation involved in deploying 4C receivers (nodes) onto the ocean floor via ROV (Remotely Operated Vehicle) at water depth ranging from 1300m to 1800m. The key objective was to acquire new seismic data with improved data quality (over the towed streamer surveys) for better reservoir imaging, reliable reservoir property extraction, and detail reservoir characterization in key producing intervals. Initial review and evaluation on fast-track processed data indicated higher signal-to-noise ratio and broader bandwidth in both high-frequency and low-frequency ends. The recorded multi-components data also enables effective multiple attenuation and application of other processing/imaging technology application (e.g. 3D Up/Down deconvolution and mirror imaging).

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