Post-stack Seismic Processing Refinement Facilitating Khuff and Pre-Khuff Exploration: Case Study From Shallow Marine Offshore Abu Dhabi

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Three 3-D ocean-bottom cable (OBC) seismic surveys acquired in offshore Abu Dhabi have been subjected to ADNOC's in-house post-stack seismic refinement routine. The objectives were to resolve the tuning effects caused by various stratigraphic features and enhance fault imaging at the deep Khuff and pre-Khuff targets. There were some remaining persistent issues, such as: (1) noise; (2) strong short wavelength jitters of the acquisition footprint, which degraded the stack continuity even at depth; (3) multiples; and (4) the relatively low-frequency bandwidth of the final data. These issues hampered the interpretation of the data after the imaging stage.

A post-stack seismic data reprocessing flow was used, which includes 3-D FKK dip filter, notch filter, deconvolution-after-stack, time-variant spectral whitening and 3-D spatial filtering. Post-stack P-Z summation of the dual-sensor components was investigated and assessed on one of those surveys. The in-house reprocessing resulted not only in the significant reduction of the residual, random and linear noise, but also in the significant attenuation of the severe acquisition footprints. Time-variant spectral whitening resulted in wide usable frequency bandwidth without either magnifying the noise level or distorting the phase and/or amplitude of the input dataset. Deconvolution-after-stack significantly minimized the residual shallow-water reverberation multiples that were detrimentally interfering with the primaries in the dataset.

ADNOC's in-house post-stack processing flow reduced the uncertainties in the interpretation stage. The horizon tracking at the Khuff and pre-Khuff levels turned out to be much easier compared to the interpretation of the previous processing vintages of those surveys. Seismic attributes such as curvature and coherency cubes have been extracted from the data after the completion of the in-house reprocessing. Some geological features, such as subtle structure undulations with faults lineaments, became easily delineated on the reprocessed dataset with this tailor-made post-stack reprocessing route, which were hardly easy to be achieved on the original dataset because of the various noise problems.