EAGE

25545

Broadband Seismic Processing enhances illumination of deeper targets on shallow-waters off India

R. Fainstein* (Cairn India Ltd), L. Bubeqi (Cairn India Ltd.), S. Mathur (Cairn India Ltd.), S. Dutta (Cairn India Ltd.), M. Lennane (Cairn India Ltd.), D. Bakshi (Cairn India Ltd.), N.J. Whiteley (Cairn India Ltd.), S. Chacko (Cairn India Ltd.), Y. Xiao (CGG), Y. Guo (CGG), P. Lim (CGG), S. Chauhan (CGG), P. Lam (CGG) & J. Sun (CGG)

SUMMARY

In a shallow water block in the vicinity of the Krishna River, east coast off India, new geophysics data from a 2013/2014 3D survey long offset data was broadband processed pre-stack time and depth. Broadband increased the lower and higher frequency amplitude spectra providing for high precision seismic resolution to several of the deep seated features of pre-rift and syn-rift that were essentially invisible (or not properly imaged) with vintage seismic.

The Ghost Wavefield Elimination (GWE) with Frequency-P (Slowness) domain bootstrap pre-mig deghosting method was employed for this data. The extra low frequency from de-ghosting successfully imaged the deeper targets, such as steep flanks around 2s to 4s.

With the clearer images, the velocity analysis and modeling were much reliable. Comprehensive demultiples flow was applied for this data too: SWD + SRME + Tau-P decon, to address the severe multiples issue due to shallow water bottom. The enhanced low frequency spectra are also paramount for the improved depth migration derived from velocity models.

Broadband Seismic Processing enhances illumination of deeper targets on shallow-waters off India

Roberto Fainstein, Lavdosh Bubeqi, Sudhir Mathur, Sushobhan Dutta, Michael Lennane, Debjani Bakshi Nicholas J. Whiteley, Soman Chacko (Cairn India Ltd) and Yongdeng Xiao, Yonghe Guo, Pinfu Lim, Sonika Chauhan, Pham Lam, Jason Sun (CGG-Compagnie Générale de Géophysique)

Progress in structural seismic interpretation and on seismic stratigraphy is fundamentally linked to advances in seismic acquisition and processing technology. Broadband seismic, one of the very latest improvements to seismic imaging, takes geologic interpretation to the limits of seismic resolution**.** Seismic data often lose resolution with depth. The signal, especially the high frequency, is heavily attenuated due to absorption as it travels through thick overburden. Low frequency has better penetration. However, low frequency suffers the ghost effect for conventional flat streamer acquisition. Overall the illumination for the deep targets is generally poor. Broadband processing partly remove the ghost effect to recover the lower frequencies that are very critical for interpretation of the deeper targets.

In a shallow water block in the vicinity of the Krishna River, east coast off India, new geophysics data from a 2013/2014 3D survey consist of long offset data that is broadband processed pre-stack time and depth. This conventional 3D seismic data is intrinsically higher resolution respective to legacy data with channel spacing at 12.5 meters intervals yielding a conventional 81 CMP fold. A test broadband cube was designed for the purpose of comparing results of broadband with conventional processing that was key to broadband process the full-offset volume (fig. 1). Broadband increased the lower and higher frequency amplitude spectra providing for high precision seismic resolution to several of the deep seated features of pre-rift and syn-rift that were essentially invisible (or not properly imaged) with vintage seismic.

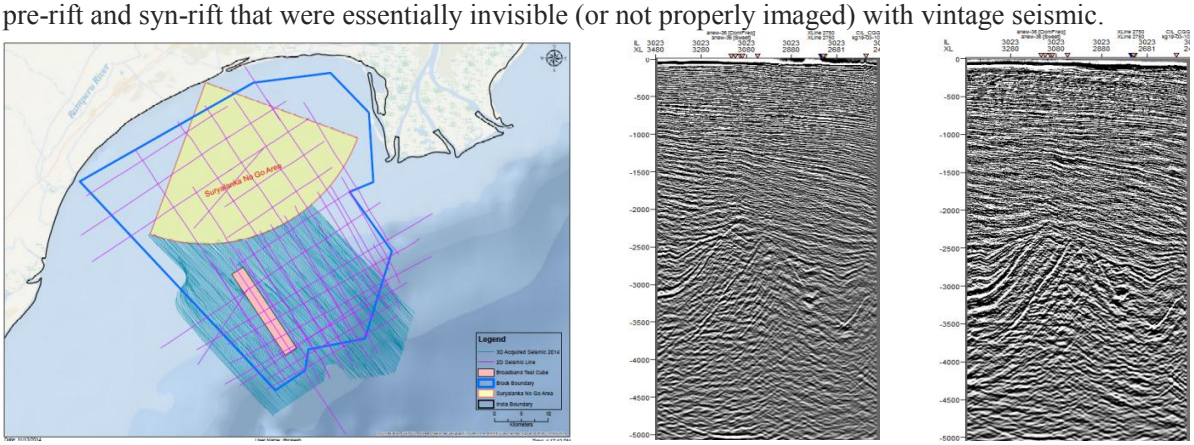

Fig.1: a) Outline of Krishna Offshore Block displaying the 2D and 3D seismic acquisition and test cube area. b) Comparison of conventional and broadband processed seismic lines.

The employed processing flow of broadband processing was very much similar to the conventional processing flow except for one extra deghosting step added after the major demultiple steps. In this paper, the case study is a shallow water block (see fig. 1). Although the water bottom varies mostly from ten to one hundred meters over most of the area, the main syn-rift and pre-rift layers need illumination deeper in the section, around 2s to 4s, for proper interpretation. The Ghost Wavefield Elimination (GWE) with Frequency-P (Slowness) domain bootstrap pre-mig deghosting method was employed for this data. The extra low frequency from de-ghosting successfully imaged the deeper targets, such as steep flanks around 2s to 4s (fig.1). With the clearer images, the velocity analysis and modeling were much reliable. Better velocity further improved the image again. Comprehensive demultiples flow was applied for this data too: SWD + SRME + Tau-P decon, to address the severe multiples issue due to shallow water bottom. The enhanced low frequency spectra are also paramount for the improved depth migration derived from velocity models.