Application of AI Based Seismic Data Quality Enhancement to Update Lower Pliocene Stratigraphic Framework in the South Caspian Basin

Rashad Bakhtiyev[1], Elnur Aghataghiyev[1], Orkhan Mammadov[2]

[1]SOCAR
[2]WAVERITY

Abstract

Historically, sparse well data and suboptimal imaging due to the seismic acquisition parameters were the main limiting factors of the detailed Lower Pliocene stratigraphic framework delineation in the deep part of the South Caspian Basin. As processing and new acquisition techniques evolved, imaging quality of the deep stratigraphic units improved. However, due to gaps in the data between different fields and prospects and variability in the data quality, the basin wide stratigraphic framework of the lower part of the Productive Series remained inconsistent. The working group realized the necessity of data quality enhancement of the case study area. Since full re-processing would take a lot of time, AI based denoise and resolution enhancement techniques were applied to improve the imaging quality. The proposed technology is based on data-driven approach that takes advantage of recent innovations in the field of Artificial Intelligence and is attributed to advanced deep learning architecture combined with different signal processing techniques.

Major oil & gas fields in the South Caspian Basin mainly produce from upper part of Lower Pliocene intervals and to the south of the basin reservoir properties were degraded due the very distal depositional environment of these stratigraphical intervals. Thus, it led to a weak interest in the exploration of deep-water prospects in the South as a limited number of exploration wells were drilled and proved HC potential within tight sands.

Understanding of depositional environment, available well logs and seismic data also supported the idea upper Lower Pliocene reservoirs to the south are thin and of low quality.

AI based post stack processing helped to improve the seismic well tie quality and better match the well and seismic stratigraphy. Thereafter, the case study seismic was tied to the adjacent field and prospects to build a consistent regional stratigraphic framework of the lower part of the Lower Pliocene. Additionally, resolution enhancement enabled the characterization of internal features within the key stratigraphic units, which provided improved understanding about the seismic facies variation and potential depositional model in the area.

There is only one producing field and 2 exploration wells drilled to this new Lower Pliocene play. Based on 2D and AI based processed 3D seismic data it was possible to correlate and prove the existence of these reservoirs in nearby structures which adds value to further exploration activities in the South Caspian basin. Gross depositional environment model of the area covering ~30000 km2 was updated and reservoir depositional setting elements were described based on seismic facies analysis and well data. Upper NKP and Lower NKP subzones were

identified as 2 major stratigraphic units separated from the rest of Lower Pliocene sediments by two major transgressive events – Kirmaki and NKG shales.

Unlocking a new play of lower part of Lower Pliocene may open a new page of exploration to estimate a large hydrocarbon resource from thick moderate quality sandstones reservoirs of primarily Paleo Volga River system in the South Caspian Basin.