Pliocene Deep Water Channel System of Celebes Molasse as New Exploration Play In Banggai Sula Foreland Basin, Eastern Sulawesi-Indonesia

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ABSTRACT

Study area located in the onshore area of Matindok Block, Eastern Sulawesi, Indonesia. Pertamina EP started exploration activities in this area since 1996 and discovered several gas and condensate fields such as Matindok, Maleo Raja and Donggi Fields. Tectonically, Banggai-Sula foreland basin in Matindok block is the product of Late Miocene to Early Pliocene collision between Banggai-Sula microcontinent and East Sulawesi Ophiolite (ESO)-magmatic arc of Sundaland. Proven petroleum system plays for Donggi, Senoro, and Matindok gas fields are Miocene build-up carbonate and platform carbonates related to wrench structures, sealed by Plio-Pleistocene Celebes Molasse consists of conglomerate, conglomeratic sandstone, shale and charged during early Pliocene related to collisional tectonic from Miocene marine clastic source rocks.

In 2014, Pertamina EP drilled 2 (two) onshore wells, Matindok-7 and Penyu-1, and discovered Gas and Condensate in M-52 carbonate layer of Plio-Pleistocene Celebes Mollase. Based on gas geochemistry analysis, gas and condensate sample in Matindok-7 are possible thermogenic origin while gas sample in Penyu-1 is possible biogenic origin. These discoveries were significantly important because it breakdown all the previous study that only assumed Celebes Mollase act as overburden sediment and regional seal. There is no detailed study about petroleum system of Pliocene Celebes Mollase.

In this study, using mostly 2D and 3D seismic datasets, biostratigraphy and petrography report, regional wells data, and analog model references from published paper, we delivered the geological model of NE to SW trending Pliocene channel systems in Celebes Molasse as new potential reservoir.

Based on NW-SE 2D regional seismic key line, we interpret 6 (six) NE to SW trending channel system. Isochron map of each channel were used to construct channel system model. 3D seismic attributes such as RMS amplitude and spectral decomposition also used to determine the geometry of the channel regardless 3D Seismic data set only covered small portion of southern study area. Using channel fill pattern on seismic data characterization by Mitchum et al (1977), mostly all channels have onlap, divergent and mounded onlap pattern fill that related to low energy sediment in medial to distal area. We interpreted several point of erosion on the NNE area as sediment provenance that filled the deep water channel in the SW area

Regional well correlation using 4 (four) well data pass through NW-SE 2D Regional seismic line in figure 3 were made, there are several result as follows:

- Biostratigraphy analysis shown that post-collision interval was deposited in marine environment from outer sub littoral to bathyal
- Fining upward sequences is detected based on gamma ray log.
- Gas reading of channel interval shows C1 to C3 up to 980 ppm. Gas Analysis ratio using gas dryness, wetness, balance, character and pixler plot indicate possible light dry gas.
- Possible Low Resistivity – Low Contrast (LRLC) pay due to thin laminated sandstone-shale sequences in channel interval.

Despite of there is no well testing data on these channels interval yet; we believed that this Pliocene deep water channel can become the new exploration play. Further study about biogenic generation and migration, lateral seal effectives of each channel and possibility to acquire new 3D seismic data set in northern area study is needed to give better understanding of deep water channel petroleum system play.