The Use of CSEM and the Exploration Challenges in the Voring Basin (Norwegian Sea)

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ABSTRACT

Within a period of six months, from end 2014 and into June 2015, four consecutive discoveries were made in the deep water Voring basin in the Norwegian Sea. These wells add to a total of eight wells drilled on structural highs along an axis extending from the Vema dome to the south up to the Nyk High to the North. Seven out of the eight wells have been gas discoveries, while one of them has in addition proven a 4-meter-thick oil leg under the gas (Senfrid North, 6706/12-2). Several 2D CSEM survey lines were acquired in the area in 2003, 2007 and 2010, testing nine different structural highs, of which four have been tested with drilling. A review of the CSEM data shows a 100% correlation between our interpretations and the drilling results, with two out of the four interpretations made prior to drilling the Ivory (6707/10-3s, 2014) and the Gymir (6706/11-2, 2015) gas discoveries. The other two true interpretations are the Vema (6706/11-1, 2001) dry well and the Luva (6707/10-1, 1997) gas discovery. Following the recent successful drilling results, two 3D CSEM surveys were designed and acquired for the first time in the area, to overcome the CSEM imaging challenges over some of the yet undrilled but still appearing resistive structural highs. Constraining the depth of deeper resolved anomalies, separating between tentatively stacked resistors, steeply dipping geology, and shallow resistivity variations, are the key reasons why 3D data are needed. South of the Vema dry well and the Gymir gas discovery, there is a CSEM anomaly corresponding to the seismically mapped prospect at Upper Cretaceous (Nise Formation) level within the recently awarded exploration license PL897 that stands out. This is as a structural trap associated with a very poor seismic response and a localized resistivity anomaly. The overlying, remobilized ooze layers distort the seismic imaging and this makes the CSEM data the key information for the derisking the prospect. The CSEM imaging challenges in the area will be discussed further together with the nicely fitting resistivity anomaly that is attributed to the presence of hydrocarbons.