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Is Mineralogy Controlling the Pore Pressure Distribution in Cretaceous Mudstones, Offshore Tanzania?

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SUMMARY

Statoil has drilled 14 wildcat and appraisal wells over the past three years in Block 2, offshore Tanzania. The wells have penetrated numerous gas bearing sandstone reservoirs and aquifers spanning from Early Cretaceous to Neogene age. While the Lower Cretaceous and Tertiary sandstone penetrations are at or near hydrostatic pressure, several Upper Cretaceous sandstones are overpressured. These overpressured units are typified by laterally discontinuous deep marine sandstones encapsulated within thick mudstone. The hypothesis is that overpressure in the Upper Cretaceous sections is related to compaction disequilibrium, which is controlled by the composition of the mudstones. This hypothesis is tested by quantifying and comparing the mudstone mineralogy in the Lower Cretaceous, Upper Cretaceous and Neogene deposits.

X-ray Diffraction (XRD) analyses have been run on samples from 4 exploration wells: Zafarani-1, Lavani-2, Mronge-1 and Giligiliani-1. The first 3 wells are located along the SeaGap fault zone, whereas Giligiliani-1 is in the western part of the block. With the exception of Zafarani-1, the Upper Cretaceous shales have been interpreted to be overpressured, and Upper Cretaceous sandstones in Lavani-2 and Giligiliani-1 had higher than expected pore pressure. XRD analysis will give the composition and proportion of quartz, feldspars, carbonates and total clay, and the distribution of common clay minerals: kaolin, chlorite, illite, smectite, mixed layer clays.

Identifying the controls on the development of overpressured zones will allow for better prediction of their occurrence, improve well planning and further the understanding of hydrocarbon distributions in the basin.