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Acquisition and Integrated Interpretation of Controlled Source Electromagnetic (CSEM) Survey Data with Other Geophysical

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SUMMARY

Controlled source electromagnetic sounding (CSEM) is now becoming a mainstream exploration tool in a wide range of geological environments; and to date the technique has been primarily used on a standalone basis. It is recognised that by accurately integrating CSEM data with other geophysical data types, such as rock physics and seismic, that significant improvements in subsurface understanding can be gained throughout the E&P process.

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Up-to-date case studies are presented in this paper, highlighting applications of integrating geophysical data in steep bathymetric and complex geological areas. These demonstrate that by taking into account and assimilating multiple geophysical data types, all stages of the CSEM survey process – from survey planning to data acquisition to interpretation – can be enhanced to provide a more rigorous methodology of the technique for exploration. Ultimately, this combined approach provides the explorationist a much more informed and interpretable view of the challenge facing them.

One case in point gives a demonstration of addressing the challenge of a steep bathymetric scenario, and combining the results with available seismic data; we illustrate this using CSEM data acquired by OHM on the Baobab field, offshore Cote d'Ivoire.

The Baobab reservoir, operated by CNR, consists of Late and Middle Albian turbidite sands, trapped within a 3 way dip closed tilted fault block at 2100m below seafloor. There were a number of complications in this survey.

Firstly the water depth across the survey area varies between 200m and 2500m. There is therefore a dramatic change in the interaction of the transmitted EM signals with the air along the line, which if not accounted for correctly can significantly degrade results. Secondly the area is cut by a number of deep, North-South trending canyons. Rapid variations in topography can cause local distortions in the measured EM field. Finally seafloor infrastructure must be avoided, resulting in rapid changes in source height and hence signal coupling to the seafloor.

Fig 1: Co-rendered seismic & CSEM data over the Baobab field

When these complexities are taken into account, using advanced data processing techniques and available seismic data, we obtain a well resolved image of the resistivity structure of the Baobab field.

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