



ABSTRACT

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EVALUATION OF 4D SEISMIC OVER THE YACHENG GAS FIELD, SOUTH CHINA SEA.

The use of 4D (time-lapse) seismic has grown considerably over the recent years, and is now an important reservoir management tool. Many examples exist where changes in reservoir conditions have been detected on 4D seismic data, although most examples are from oil fields. The application of 4D seismic data over the Yacheng field is an example of the technique being evaluated for use in reservoir management of a gas field.

The Yacheng Y13-1 gas field is situated in the Qiong Dong Nan Basin, 100km south of Hainan Island. The water depth is about 300ft. The structure lies on the northern flank of a basement high called the Yacheng Spur, close to the boundary with the Ying Ge Hai Basin to the west. The main gas-bearing interval in the Y13-1 gas field is the late Oligocene age Lingshui III (LS3), which overlies the Yacheng Formation coal measure strata and is covered by the Middle Miocene age Meishan Formation calcareous sandstone and shale. The LS3 reservoir is approximately 200 metres thick, and at a depth of approximately 3800 metres.

The Yacheng field has been on production since the mid-90's, from initially 6 production wells located in the north of the field. A second phase of development drilling was conducted in 2000/2001, when a further 4 wells were drilled and completed in the south of the field, and 1 further well was drilled into a shallower reservoir interval. 3D seismic data was acquired over the field in 1992 (the baseline survey), and again in 2001 (the repeat survey). The quality of the two surveys is very good, and whilst 4D was not the objective of the repeat survey, the acquisition was planned with 4D evaluation in mind.

The Yacheng field is produced under depletion drive. The initial reservoir conditions were approximately 5600psi, and 350° F. In the northern part of the field the pressure has declined by approximately 2500 psi due to production. The field is clearly compartmentalized, as the southern wells show depletion that varies between 0 (virgin conditions), and approximately 2000 psi. Vertical pressure barriers exist in addition to lateral barriers.



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An evaluation of the potential for 4D seismic to provide an improved subsurface understanding of the Yacheng field was conducted in 2002. A technical analysis of the rock physics and modeling of the expected seismic response to changes in pressure was carried out. Calibration of the modeling was achieved using acoustic measurements made on core data. This work supported further analysis, and 4D processing of the 2 seismic vintages commenced. Specialized and detailed seismic processing of the data has been applied to both seismic vintages in parallel, leading to datasets with a high level of repeatability. Examples will be shown of the rock physics evaluation, the key steps in the seismic processing sequence, and examples of the fully processed results.