

## Deepwater exploration, offshore NW Sabah: Kamunsu East upthrown drilling success

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A window of opportunity came to SSB/SSPC to utilise the semi-sub rig suitable for deepwater drilling that had successfully drilled Kamunsu East-1 when the rig was available again at very short notice in November 1999. At that time a potential large oil prospect named Kamunsu East Upthrown (KMEU) in a water depth of 3,500 ft was just ready to be tested.

In order to realise this opportunity SSB/SSPC had to face the main challenges of planning, preparing and executing a deepwater well within four weeks and limited budget.

The solutions to these challenges was handled by SSB/SSPC in the following forms: (1) Strike alliances with the key providers based in Singapore so that deepwater project materials were kept within reach for quick mob but without any commitment from both parties (2) Discounted rate to contract the rig into Malaysia in Q4 99 from Shell Philippines Exploration (3) Best practices from other wells were built upon and adapted for KMEU-1 well. Drilling the limit initiatives were adopted such that they could match and improve on the achievements from the previous Kamunsu East-1 well.

A fit for purpose data acquisition programme was proposed with the objective to acquire only the essential data to minimise up-front expenditure.

No high-resolution digital and side scan survey was acquired as the available 3D seismic data is of high quality and did not indicate any obvious shallow gas risk at the proposed well location.

Kamunsu East Upthrown prospect had several potential hydrocarbons bearing fan levels within the Miocene turbidite sandstones. This drilling opportunity was maximised by combining exploration and appraisal multi-objectives in the vertical and geological sidetrack holes.

The vertical exploratory well was designed test the hydrocarbon potential and fluid type of the Pink, Kinarut and Keabangan fan levels each exhibited clear flat spot at each levels that were interpreted as fluid contacts. The sidetrack was planned to appraise the up-dip Pink and Kinarut fan levels seen in the vertical hole and also to drill a deeper Keabangan exploration target.

Geophysical modelling predicted the primary Kinarut fan level to have a high probability of being oil-bearing whilst the Pink level as likely gas-bearing. No clear prediction could be made on the likely hydrocarbon type at Keabangan level.

The results of the vertical and sidetrack wells verified the presence of gas and oil in the Pink and Kinarut fan respectively. At the Keabangan level it was gas and oil-bearing in the vertical hole and sidetrack respectively. The wells proved some 200 ft oil column, the longest oil column so far found in SSPC deepwater acreage but also discovered gas at a previously unpenetrated Pink turbidite fan.

The vertical well confirmed that the flat spots penetrated in the Pink and Keabangan levels were indeed associated with the fluid contacts. However, the flat spot at the Kinarut level proved to be a paleo-contact. At the Kinarut level the oil saturation is low at 45% probably due to poor reservoir quality. Interbedded thin oil and water columns were detected in the sidetracked Keabangan exploration objective.

Strong changes in net-to-gross at the Pink fan level were observed between the vertical and geological sidetrack over some 50 ft distance. Oil was found in the poorer net-to-gross upper Kinarut level but the good quality blocky sand at lower Kinarut was water-bearing.

The main learning points that will be incorporated into future deep water well planning are: (1) MDT samples proved crucial in evaluating reservoir fluid types as hydrocarbon differentiation was sometimes difficult on wireline logs. (2) The shearlog data acquired with the Baker Hughes MAC tool was adversely

affected by the tool mode problem especially in slow formations. It is recommended to use XMAC tool. (3) SSB/SSPC had demonstrated the ability to drill cheaply (US\$9.3 M for vertical and sidetrack) by taking rig opportunity at discounted rate, fastest (12 days from spud to TD at 10,300' in vertical hole) and deepest water depth location drilled in Malaysia with a planning lead time of just four weeks.

The continuous and successful exploration efforts have increased the probability of success for both oil and gas plays in Sabah deepwater outboard acreage. SSB/SSPC have proven the ability to deliver low cost deepwater wells that will allow smaller reserves cut-off and a promise of lower development expenditure. These combined factors provide the stimulus for SSB/SSPC to launch an aggressive campaign for the search of oil and gas whilst commercialise the proven gas in the deepwater acreage.