INTEGRATION OF 3D AND SITE SURVEY SEISMIC DATA IN ANALYSIS OF NEAR-SURFACE HAZARDS TO PLATFORM LOCATION AT DULANG FIELD

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The Dulang oilfield, operated by Carigali in partnership with EPMI, began development drilling from two platforms, A and B, in late 1990 after installation of the platforms earlier in the year. Installing these platforms involved driving piles up to 120m into the seabed, to provide support for the structures in about 75m of water. To do this it is essential to have a good understanding of the near subsurface to ensure the structural integrity of the platforms as well as identify potential hazards.

At Dulang Field we found that integrating the 3D seismic survey, shot for exploration and field development purposes, with the site survey data, acquired specifically to address the seabed and near subsurface, provided a quicker and more comprehensive interpretation than the more conventional approach of interpreting the site survey alone. The 3D seismic survey comprises about 1100km of digitally recorded and processed multichannel data with a 75m line spacing and a bandwidth of approximately 10 to 110 Hz in the shallow section.

The site survey comprises four data sets with a 100 m line spacing:

(a) High resolution digital seismic data. These are similar to the data shot for exploration/development but the shooting parameters are somewhat different, aiming for high resolution in the uppermost 500-1000 m. The source is high resolution air/ watergun arrays or sleeve exploders giving frequencies of about 10 to 250 Hz.

(b) Boomer Data. These employ an implosive source and have peak frequencies of 2-7 kHz which provides very high resolution but limited penetration, only about 60m into the seabed at Dulang.

(c) Sidescan sonar data. These are very high frequency data, again analogue, generated by transducers which emit 105 kHz pulses. Sidescan sonar has no penetration, imaging the seafloor obliquely, in detail, about 100 m either side of the ship's track.

(d) Echo Sounder data. Whilst water depth information is visible on both Boomer and sidescan sonar data, echo sounder data provide detailed information using a high frequency transducer source.

At Dulang we used all these data sets in analysing the platform locations but when moving the planned position of the A platform in 1990, we integrated the 1984 3D seismic data set.

The main hazard to platform location at Dulang is a Pleistocene channel about 500m wide which cuts from near the seabed to about 80m below the seabed. Soil borings show the channel-fill to comprise dominantly stiff clays but with significant organic material and some coarse clastics at its base. Generation of timeslices on the 3D workstation enabled mapping of this channel and its associated point bar. Mapping by hand from the high resolution digital data would have been much more time consuming and despite somewhat limited resolution, the 3D data give the best overall visualisation of the laterally-accreted point bar and abandoned channel. With the site survey Boomer data, additional resolution becomes an important factor. Rising gas plumes sourced from biogenic degradation of organic matter are evident in the sediments at the channel margins. In concert with the sidescan sonar data these can be seen to cause up to 5m seafloor depressions, and, where they have reached the seabed evacuation of water and gas has cause proliferation and coalescence of seafloor pockmarks above the channel margins.

Two potential platform locations were identified on the basis of this interpretation, an optimum location (for drilling considerations) at the channel centre and an alternative outside the channel. Subsequent soil borings and engineering tests showed both locations to be acceptable and the A platform was successfully installed at the optimum location without encountering any hazards.

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