Paper 11

The Upper Miocene deepwater fans of NW Borneo: new insights on stratigraphy and palaeogeography from basin-wide 3D seismic data and well control

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Upper Miocene submarine fan deposition across NW Sabah has been influenced strongly by tectonic (as well as eustatic) events. Uplift and erosion across the inboard shelf and mountainous hinterland regions of Sabah have shed large volumes of sand into the NW Borneo basin. Because of limited accommodation space along a narrow shelf, sand cascaded over the shelf edge through a system of upper slope feeder channels or canyons and was deposited in a system of fan lobes on the deepening floor of the NW Borneo trough. Today these fans are folded and thrust within the NW Borneo active margin fold belt. Deformation within this fold belt commenced around 9.5 Ma. Prior to this, gravitational delta tectonics was the dominant deformation mechanism within the basin.

Shell Malaysia-EP has been exploring its deepwater acreages of Blocks J and G, offshore NW Sabah, since 1995. In this 8-year period, the company has amassed a significant deepwater database comprising basin-wide 3D seismic data and 6 exploration wells that have been drilled to test a number of plays and fan intervals. These data have enabled SM-EP to de-risk the NW Borneo deepwater play, to understand the complexity of the deepwater fan stratigraphy, to reconstruct the basin-wide palaeogeography through time, and to establish the spatial and temporal controls on deepwater fan deposition in this active margin setting, namely, basin inversion, delta progradation, and fold belt development.

"Carpet" 3D seismic data provide a broad and detailed canvas on which to evaluate and illustrate the morphology of sand-rich deepwater fan systems. 3D framework mapping of key sequence boundaries on each individual 3D survey allows individual fan units to be isolated seismically. Traditional methods for unravelling fan morphology use combinations of horizon slicing and amplitude extraction to identify depositional characteristics. New interpretation workflows are being developed to rapidly screen 3D seismic data to highlight the main sand fairways in a more automated, less user intense fashion. For example, neural net seismic facies analysis and voxel body extractions are used to recognize and assess depositional elements. AVO data are also incorporated into reservoir facies analysis and can be used to screen for sand sweet spots particularly in the younger, shallower fans.

For the future, SM-EP is reprocessing post-stack its entire 3D dataset and will migrate the data into one large "mega" 3D survey of more than 8,000 sq. km. Once complete this amalgamated 3D seismic dataset will further enhance our ability to evaluate consistently the deepwater play without concern for edge effects, processing artefacts or data gaps.

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