C-41 DEEP WATER SLOPE CHANNEL RESERVOIRS FROM THE NILE DELTA, EGYPT

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Abstract

Slope channels are increasingly being recognised as highly prospective deep water exploration targets. An extensive slope channel system is exceptionally well developed in the West Delta Deep Marine Concession, offshore Nile Delta, operated since 1995 by BG with partner Edison. Within the concession the Scarab, Saffron, Simian, and Channel 12 & 13 systems have all recently been successfully tested by a number of exploration wells (Figure 1). When gas-charged these Upper Pliocene El Wastani Formation channels are spectacularly imaged by 3D seismic, both in time sections and through a variety of amplitude extractions. Remarkable variations are revealed in their stratigraphic architecture, with changes apparent both within individual channels and between the different channel systems.

A variety of trap types are evident. The majority of the channels exhibit well developed flat-spots to the north where dip-closure is evident. Up-dip closure varies between dip, fault and perched contacts. Typically, the shale-dominated channel margins provide the lateral seals. Gas trapped within the structures is derived from a mixture of biogenic and thermogenic activity.

An extensive program of core and wireline log acquisition and analysis has enabled high resolution definition of the channel-fill sediments and their depositional geometries. The channels were initiated by the introduction of coarse sediments to the shelf edge possibly at times of relative sea-level fall. Gravity transport of this material down-slope either initially caused slumping or followed the low topography of pre-existing slump scars. In some channels there was significant erosion in areas up depositional dip prior to infill/backfill from low and high-density turbidites, debris flows, slumps and slides. Subsequent channel evolution varies from backfilling, plugging by slumping to re-incision.

There is an excellent match between the seismic expression of the channels and their fill and a channel model has been developed based on integration of the well and seismic data. The model reveals significant variations in the architecture and likely production characteristics of the channels. Internal connectivity is promoted by the thin-bedded turbidite, laminated and levee facies. Detailed examination of the seismic data also reveals insights into the smaller scale channel depositional architectures and a wide variety of channel types have been identified. Some elements of the channels are characterised by near-vertical aggradational stacking of nested channels. In other channels the sands are laterally extensive and display well developed accretion surfaces.

Figure 1: Amplitude map from 3D seismic of the major WDDM Channels