Petroleum Geoscience Collaboration Conference 2007

Controls on the 3D seismic geomorphology of submarine channel systems: Nile Delta slope, Egypt

Vicky Catterall[1], Jonathan Redfern[1], Dorthe Moeller Hansen[1], Rob Gawthorpe[1], Gianluca Badalini[2]

1 Basin Studies and Petroleum Geoscience, University of Manchester, School of Earth, Atmospheric and Environmental Sciences. Williamson Building, Oxford Road, Manchester, M13 9PL.
2 BG-Group, Rio de Janeiro, Brazil.

The Nile Delta is an active area of hydrocarbon exploration and in recent year's submarine channel systems have become successful plays. Submarine channels are abundant in the study area and played a key role in the transport of sediment downslope from the Nile shelf to the deep-sea. Despite the importance of the channel systems for hydrocarbon exploration and the wealth of information they contain about climatic and tectonic processes, little is known about their evolution.

High resolution, 3D seismic data (provided by BG-Group) from the western Nile Delta, provide excellent coverage of the Plio-Pleistocene channel systems. The channel systems are imaged using volume-based maximum amplitude extractions and spectral decomposition techniques. At an individual channel scale, the architectural development of channels is qualitatively assessed and at basin scale, the spatial and temporal distributions of the channel systems are documented. In addition, the basal erosion surfaces bounding many of the channels are quantified.

The Pliocene channels are smaller, less incisional and levees are minor features compared with the Pleistocene channels. Pleistocene channels are up to 4 km wide, 500 m deep and are associated with levees up to ~ 250 m thick. In planform, the channels are tens of kilometres long and have variable orientations. Throughout the succession the location of channel head regions change. The head region of several of the channels is located between the Rosetta Fault System and the Nile Delta Offshore Anticline. In addition to changes of geomorphology between Pliocene and Pleistocene channels, the spatial and temporal locations of the channel systems change. In the Pleistocene there is an initial eastward migration of the channel-belt followed by a prominent westward shift.

The increase of channel size from the Pliocene to Pleistocene is controlled by decreasing distance of the study area from the shelf break related to Pliocene progradation of the delta. Channel location and orientation is influenced by slope topography which is controlled by structural deformation related to the Rosetta Fault System and Nile Delta Offshore Anticline. The temporal evolution of individual channel systems is influenced by changes in flow parameters associated with sea-level/climate change whereas the downslope evolution of individual channels is controlled by local structure.

The temporal and spatial migration of submarine channel systems described in this study shows the evolution of the Pleistocene depositional system. Understanding relationships between channel evolution, local structure, sea-level change and delta-top processes are essential to develop predictive models for channel inception and development.