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The Kashagan Discovery: An Example of the Successful Use of a Multi-disciplined Approach in Reducing Geologic Risk

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The Kashagan field is one the largest discoveries made in the last several decades. The oil is hosted within a late Paleozoic isolated carbonate platform that is approximately 75 km in length and 35 km in width. The field is located under the present-day North Caspian sea, offshore Kazakhstan, and has been penetrated by two exploration wells. The success of these wells is due in part to the management of geologic risk during both the pre-drill and drilling phases of the project.

Drilling for sub-salt Paleozoic carbonate reservoirs in the North Caspian sea presents numerous subsurface and surface challenges. The goal of such drilling is to safely penetrate carbonate reservoirs that range in depth from 4 to 5 km, are sealed by thin and variable shale and carbonate lithologies, and which are likely to contain karstified reservoir intervals and over-pressured and H₂S-rich hydrocarbons. The surface challenges include operating in shallow, ecologically-sensitive waters which are subjected to harsh winter and ice conditions. OKIOC has met these challenges by thorough pre-drill geologic and geophysical study, careful planning, and operational execution which reduced geologic risk and allowed for the controlled penetration of the Kashagan reservoir.

The Kashagan reservoir is situated beneath thick and variable salt and is located some 50 to 100 km from neighboring onshore wells and fields which could provide geologic control. Thus the pre-drill delineation of both reservoir quality and seal facies was problematic. Study of offset analog fields, sequence stratigraphic concepts and regional correlation of well log, biostratigraphic and seismic data were used to project known reservoir and seal horizons into the prospect area. This allowed for the mapping of probable Kashagan reservoir and seal facies, delineation of reservoir intervals, and the development of a detailed well prognosis and drilling plan. During drilling, progress was monitored through cuttings examination, logging-while-drilling analysis and changes in ROP, and confirmation and refinement of the well prognosis was made through the use of well-bore geophysical surveys and synthetic models. Well results document that penetration of the predicted seal and reservoir stratigraphy was achieved with meter-scale accuracy.

The Kashagan East 1 and Kashagan West 1 exploration wells successfully penetrated a significant oil column that is hosted in late Devonian to Carboniferous platform carbonates and is sealed by Permian shale and evaporite. As predicted, the majority of the oil is reservoired in 3rd-Order highstand sequences of Upper Visean to Bashkirian age. Preliminary data suggest that the Kashagan oil is light (~45 degrees API), has a high GOR (~2800-3000 scf/bbl), is over-pressured, and contains significant quantities of H₂S (~19%). These results verify that geologic risks were properly identified and successfully managed.