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## **Geological Characterisation of Upper Devonian to Lower Permian Intervals in the Karachaganak Reservoir, Kazakhstan: Technical Challenges and Initial Conclusions**

Karachaganak Field hosts world-class gas (1.37 TCM) and liquid (9.75 Bbl) reserves in an Upper Devonian to Lower Permian isolated carbonate platform. Geological and petrophysical studies were undertaken in conjunction with a reservoir characterisation program to establish new reservoir models for reserves determination and production forecasting. Initial geological work focused on the Frasnian through Artinskian and aimed to

- Establish facies to facilitate reconstruction of depositional environments
- Assess relative timing, distribution and controls of major diagenetic processes
- Define hierarchical controls on poroperm and interpretation of mm-to-km scale reservoir heterogeneity

These aims were achieved through detailed investigation of a representative suite of core samples, thin sections, reprocessed wireline logs and petrophysical data. Results of concurrent biostratigraphic analyses were closely integrated into the work program. Poor depth calibration, lack of continuous core, and severe diagenetic heterogeneity posed considerable challenges for reconciliation of petrographic information with log data.

From the Frasnian through the Artinskian, Karachaganak evolved from a low-angle ramp to a steep-sided isolated bank with an aggradational 'wedding-cake' architecture. Contemporaneous analogues are difficult to find, but potential analogues have been identified from the Canadian Arctic, Barents Sea, south-western USA, Russia and Kazakhstan.

Complex, polyphase diagenesis extended from syndepositional to deep burial settings. Effective porosity in most parts of the reservoir is secondary in nature. Understanding the role of diagenetic modification within the facies, and ultimately within a sequence stratigraphic framework, will be critical to maximising recovery efficiency.