Well Log and Production Based Analysis of Fractures in Karachaganak Field, Northwestern Kazakhstan

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Karachaganak field, a super-giant retrograde gas condensate field located in northwestern Kazakhstan, contains significant reservoir volume where fractures are an important part of the permeability system. Both resistive (generally sealed), conductive (generally open), and effective (flowing fractures) fractures are found to occur in all investigated intervals (PV2 to P1). Field-wide amalgamations of data reveal weak strike preference toward NNE and E-W for resistive fractures, while conductive fractures show no preferred trend. However, trends in conductive fractures are apparent when the data are examined with respect unit and to the mapped stratal horizons. In Devonian through Early-Visean units, fracture trends appear to align with respect to lineaments visible in structural surfaces. These structural lineaments are interpreted to be due to normal faulting of the platform top. Thus, Devonian and Early-Visean fractures formed in a tectonically-controlled stress environment, likely related to extension roughly perpendicular to the northern Pricaspian Basin margin. In contrast, fracture trends in Carboniferous through Permian units tend to align parallel and perpendicular to local platform margin orientations. Thus, fractures in these units are interpreted to be non-tectonic in origin and to have formed in a stress environment controlled by interaction of stratal geometry, sediment composition, and gravity forces.

Based on current understanding of existing data (primarily image and wireline logs, production logs, well tests, lost circulation zones), the majority of Karachaganak field is classified as a Type 3 NFR (after Nelson, 2001), where fractures provide excess permeability above that of the background matrix system. A few wells are interpreted to exhibit Type 2 NFR behavior, where fractures provide essential permeability in a dominantly matrix storage system. It should be noted that, due to limitations in data availability, uncertainties remain regarding the exact magnitude of fracture-related flow effects. However, the fact that a significant number of wells show some fracture influence at this early-stage in the field development suggests that the fracture influence might grow with time. Thus, the effects of fractures on future development scenarios should be considered.