Platform-Margin Trajectory as a Control on Neptunian Dike Distributions, Devonian Reef Complexes, Canning Basin, Western Australia

Frost, Ned[1], Dan Carpenter[2], Charles Kerans[1] (1) The University of Texas at Austin, Austin, TX (2) ExxonMobil Upstream Research Company, Houston, TX

Syndepositional opening-mode fractures known as neptunian dikes are a ubiquitous feature of early-cemented platform-margins and are recognized in many carbonate systems throughout the geologic record. The Canning Basin's Devonian reef complexes preserve perhaps some the world's best examples of these features. Neptunian dikes exert a strong influence on diagenetic patterns and permeability distributions; understanding the controls on their distribution is critical to accurate reservoir prediction and characterization.

Mechanisms proposed for the generation of neptunian dikes include: differential compaction of underlying sediments, compaction over basement structure, slope bedding-plane slippage, coeval faulting, gravitational instability, and seismicity. Which mechanisms control syndepositional fracturing depends largely on platform-margin trajectory, with fundamental differences in dike distribution, orientation, and extension observed between retrograding and prograding platform-margins.

In the retrograding platform-margins of the Frasnian southwest Oscar Range syndepositional fracturing is most intense in the reef/reef-flat, and decreases only subtly into the platform interior. Dike orientations run parallel and orthogonal to regional structural features, often intersecting the platform-margin at high angles, suggesting that compaction over basement topography and Devonian fault movement (e.g. Djowi Fault) were the dominant controls on syndepositional fracturing.

Fracture patterns observed in the prograding Famennian Barnett Spring platform are fundamentally different than those of the southwest Oscar Range. In Barnett Spring neptunian dikes primarily run parallel and orthogonal to the platform-margin (not regional structure) and are best developed in the reef/reef-flat, with fracture intensity decreasing dramatically towards the platform interior. These prograding margins consistently show double the amount of extension observed in the retrograding Frasnian margins.