Structural and depositional controls on Plio–Pleistocene submarine channels: the Taranaki Basin as an analogue for North American continental margins

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High-quality 3D seismic data are used to investigate the geometry of submarine channels in the Northern Graben of the Taranaki Basin, New Zealand. The distribution of lithologies, the large-scale geometry of submarine channels, and the structural controls in the Taranaki Basin may resemble depositional elements observed in sedimentary basins in eastern Canada.

The Parihaka Fault, as one of the most distinctive structures of the Cape Egmont Fault Zone, comprises four segments with variable vertical displacements in the study area. Thus, this talk will focus on the geometry of four representative channel systems incising the Giant Foresets Formation as a function of Plio–Pleistocene faulting. The successive formation of new fault segments to the north controlled the development of channels on both the footwall and hanging-wall blocks. Channel deflections also reflect structural controls on the channel configuration, combined with significant sediment inputs.

To assess channel distribution throughout the study area, seismic attributes including variance, instantaneous frequency, generalised spectral decomposition and reflection intensity were applied to reveal the amplitude anomalies that (1) highlight variations in lithology; and (2) outline the channel geometry. As a result, we identify three drainage types in the study area: oblique, transverse and parallel to the Parihaka Fault trace. A channel density plot was created based on the identification of Channel Points (CP) on the channel edges and compared to an isochron thickness map of channel-fill deposits. We found a discrepancy between channel density and the thickness map, as the areas of maximum sediment supply are positioned on the footwall of the Parihaka Fault, while two depocentres are located in the northeast part of the study area.

This work shows that relay zones developed between the Parihaka Fault segments had limited influence on channel location. Channels developed close to the transfer zone were diverted from their original courses close to the Parihaka Fault segments and flowed transversally to the fault trace instead of running through the relay ramps. Hence, we invoke that the sediment fed setting recorded along the Parihaka Fault was important enough to limit the influence of this structure on sedimentation, thus imposing a very moderate control of faulting on channel incision. Similarities between this case study in New Zealand and basins in Eastern Canada will provide insights into the distribution of faults and sediment deposits and implications for petroleum systems in both areas.

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