

Analysis of an Unanticipated AVO Pitfall, Onshore Taranaki Basin, New Zealand

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The objective of this analysis is to present an AVO pitfall whereby the special conditions of the local geology and rock properties define an AVO response that is opposite to the regional trend and nearby analogues. Failure to recognize this pitfall resulted in a dry hole. The play in question is the Miocene Mt. Messenger formation, onshore Taranaki Basin, New Zealand. The Mt. Messenger is a deep-water turbidite deposit frequently characterised by thick sand accumulations on a sequence boundary at the base of the formation. The classic analogue is Kaimiro Field, where seismic amplitude response has been successfully used to locate the best drilling targets.

In this exploration example adjacent to Kaimiro Field, the Mt. Messenger target has an amplitude response consistent with the field analogue. Another attribute of the prospect is that it sits above a gas chimney from a deeper reservoir. While gas chimneys are evidence of a leaky hydrocarbon system, they also are evidence of an active system and therefore this chimney was viewed positively as indication of migration into the Mt. Messenger formation.

Upon drilling the target, excellent reservoir sands were found, but were wet. Logging demonstrated an anomalous response, whereby the shales exhibited a lower $V_p:V_s$ ratio than the sands. This is opposite to the field analogue and causes the wet sand response to look like the Kaimiro hydrocarbon response. Fluid-substitution modelling indicates that a hydrocarbon response in this target would look like a wet response at Kaimiro. It is postulated that the gas chimney is the cause of the anomalous $V_p:V_s$ trend in the shales.