

# **Volcanism Occurrences in the Canterbury Basin, New Zealand and Implication for Petroleum Exploration**

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## **ABSTRACT**

Petroleum exploration in the Canterbury Basin has been reinvigorated in the last 10 years and although wells indicate an active petroleum system, there have been no economic discoveries in the basin to date. The geometries, thicknesses and lithologies of basin strata are strongly influenced by the Cretaceous and younger tectonic history which can be divided into three phases. (1) mid-Cretaceous rifting, (2) Late Cretaceous to Oligocene passive margin formation and, (3) Oligocene-Recent contractional deformation. These tectonic phases were related to Gondwana breakup (1), post breakup drift (2) and the inception of the obliquely convergent plate boundary (3) respectively and were contemporaneous with magmatic events still not well understood. This work shows the temporal and spatial distribution of igneous systems within Canterbury Basin and how they can impact petroleum systems.

Outcropping rocks, wells, seismic reflection and magnetic data in Canterbury Basin show evidences of several igneous events occurring from the mid-Cretaceous to the Pleistocene. Onshore intrusive and extrusive rocks outcrops are numerous and vary in age and composition from mafic to felsic. Seismic reflection data shows volcanic edifices of apparent diameter up to 2 to 20km. Preliminary interpretation suggests that some volcanoes are related with rift faults but their distribution within the basin doesn't follow any regional trend. Some large volcanic systems show presence of reflectors continuing underneath the volcano. The geometry of these reflectors is hard to define due to the decrease in seismic resolution beneath volcanic structures. Previous works in Canterbury Basin have shown impact of magmatic intrusions on the thermal gradient (Newman, 2000; Sahoo, 2015) but same might happen with magmatic extrusion.

Understanding the late Mesozoic-Cenozoic igneous activity in the Canterbury Basin is crucial to the evaluation of petroleum systems. Interpretations show that areas affected by volcanism are structurally controlled by mechanisms of magma emplacement and eruptions, which have potential to form traps, reservoirs or influence the thermal gradient of the basin.