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Initiation and Death of Normal Faults, Northern Graben, Taranaki

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Abstract

This poster will contain the research objectives, and first order results to date of my MSc project. A brief summary of what I hope to achieve during this year is as follows.

This thesis will investigate the spatio-temporal distribution of the growth and death of faults from a hydrocarbon prospectivity perspective. Extensive research, including 3D seismic analysis of petroleum basins worldwide, has as yet been unable to confidently determine a model to describe the kinematics of fault growth and death. Fault death is the least understood of the two, with the knowledge gap existing because of poor preservation of syn – sedimentary growth strata, which are the key to understanding fault behaviour through time. Knowledge on the topic is in its infancy, but recent advances in 3D seismic technology have allowed discovery and interpretation of these rarely observed strata in 4 dimensions.

The research will add to the understanding of how faults grow and die in 4 dimensions, using the Northern Graben of New Zealand's Taranaki basin as a case study. The work will involve analysing the 1520 square kilometres of existing high quality Parihaka 3D seismic data obtained by Pogo New Zealand in 2005. This data includes well preserved syn -sedimentary growth strata (particularly in the Plio-Pleistocene) which are critical to understanding fault behaviour through time. Analysis of these data will add to earlier results obtained by Pogo New Zealand 3D seismic analysis, which focused on reservoir and fault distribution, rather than fault behaviour through time. Early results by Pogo were limited in scope due to strict analysis deadlines.

Two key sets of measurements will be taken to calculate fault behaviour through time. These will be combined with biostratigraphic ages from well ties for dating of structures. They are:

1. The relative thicknesses of coeval strata on both the hanging wall and footwall of faults (syn – sedimentary growth strata). This will allow fault displacement histories to be calculated.
2. Fault tip-line locations as seen in time both time slices and cross sections of the volume. Fault tip-line locations at specific points in time allow lateral and vertical fault propagation to be studied, as well as fault strain fields, and fault interaction.

Understanding fault behaviour through time will allow better judgments to be made with respect to hydrocarbon migration and the integrity of trap structures. The results of this project will improve understanding of fault growth and death both globally and in the Taranaki Basin, and may add support to the one or more of the various existing hypotheses regarding the topic discussed in this poster. In terms of local benefits,

the results will assist in reducing risk to petroleum exploration by adding additional information regarding fault altered prospectivity in the Taranaki region. A map of the study area can be seen in Figure 1 below.

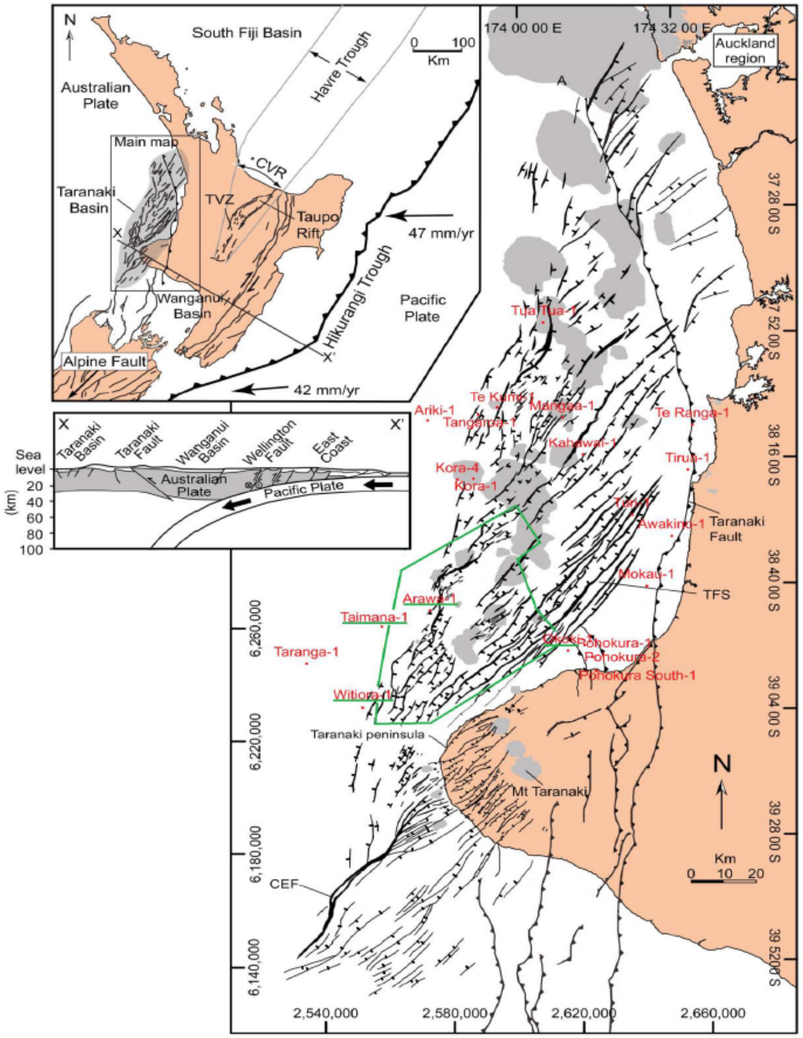

Figure 1. Location map showing spatial extent of the Parihaka 3D survey, which is represented by the green polygon. Wells relevant to this study are underlined in green. The tectonic setting of the area is also shown, with normal faults active in the early Pliocene represented as black polygons. Dip ticks point toward the hanging walls. Black polygons with triangles attached represent Miocene – Pliocene reverse faults. Miocene – recent volcanoes are represented by grey shading in the large-scale map. (Image adapted from Giba et al., 2010).