GEOLOGICAL CONTROL ON THE LOCATION OF GEOTHERMAL SYSTEMS IN THE TAUPO VOLCANIC ZONE

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SUMMARY - At least 37 separate geothermal systems and hot spring locations are known to occur in the Taupo Volcanic Zone (TVZ) including both active and fossil systems. It appears that the distribution of these systems is well constrained in a NE-SW direction by a set of alignments that are inferred to be fault block boundaries.

Working across the TVZ from east to west and south to north, these alignments can be characterised as follows:

- Waitetoko-Tauhara
- Ketetahi-Waihi/Tokaanu-Motuoapa-Lake Taupo-Taupo-Rotokawa-Ohaaki/Broadlands-Awakeri
- Wairakei-Ngatamariki-Reporoa-Waiotapu-Kawerau
- Orakei Korako-Te Kopia-Waikite-Waimangu-Rotoma
- Western Lake Taupo-Ohakuri-Ngakuru-Okataina-Rotoehu
- Mokai-Atiamuri-Horohoro-Rotorua-Rotokaua-Tikitere
- Ongaroto-Lake Rotorua-Taheke
- Mangakino-Maketu
- Muir's Reef

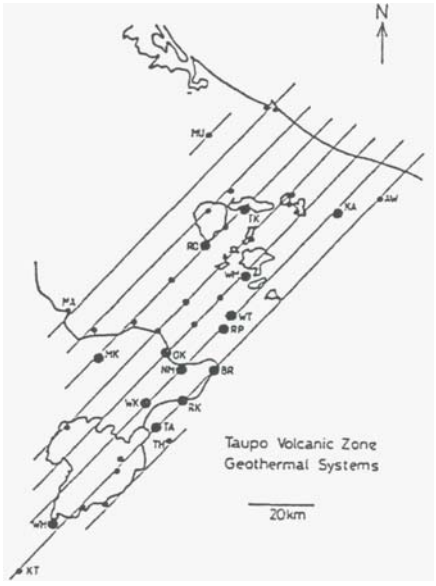
These fault block boundaries are essentially parallel to the strike of the well known Paeroa, Ngakuru, and Guthrie fault blocks and share similar block spacings of approximately 7-8km width. The demonstration of the extension and repetition of these alignments into areas considerably outside that of the Paeroa-Ngakuru-Guthrie area suggests that whatever the tectonic regime that is responsible for these fault blocks, it is consistent across the entire TVZ and occurs more westward and southward than has previously been thought to be the case.

This analysis does not however preclude the possibility that other major fault lineations may occur and that geothermal systems may in some cases arise at intersections between the two sets. It is also important to note that the lineations appear to pass through the calderas of Lake Taupo and Lake Rotorua and indeed geothermal systems occur inside the margins of both calderas.

It is inferred that the fault block boundaries represent extremely localised narrow channels of high vertical permeability up which buoyant hot geothermal fluids can ascend. This upward flux is balance by the very slow percolation of ground water through the large area of low permeable country rock in the fault blocks which surrounds each upflow. It is inferred that the fault block boundary upflows represent prime drilling targets and this is well demonstrated by the results at Wairakei and in the Ohaaki section of the Ohaaki-Broadlands geothermal system.

Using this scheme it is possible to determine some of the finer detail of the geothermal systems of the TVZ. For instance, it would appear that several pairs of systems that have at some time or another been considered to be one system can now be defined as two separate systems, examples are Tikitere-Taheke, Rotoehu-Rotoma, Mokai-Ongaroto, and Wairakei-Taupo. In contrast, other single systems such as OhaakiBroadlands and Kawerau may actually be two separate but adjacent systems, in each case one of the systems is somewhat older than its adjacent neighbour.

A matter worth special consideration is the inclusion of the fossil geothermal system and historic gold mine of Muir's Reef near Te Puke. Previously this system has been considered to be a part of the Hauraki Goldfield although there are no known systems between it and the southernmost Hauraki system at Waihi some 50km to the northwest. Its inclusion here in the TVZ as a fault block boundary system appears to be a more natural setting. Moreover, there is a group of small localised earthquake epicenters in the Te Puke area between Muir's Reef and the coast which appear to be associated with the adjacent block. This suggests that this boundary is active and supports the existence of a fault block on the western extreme of the TVZ.



Sketch Map of the Geothermal Alignments in the TVZ.
Large circles represent major fields, smaller circles represent small fields and single springs. The following prominent fields are identified: (MU) Muir's Reef, (MA) Mangakino, (MK) Mokai. (RO) Rotorua, (TK) Tikitere, (OK) Orakei Korako, (WM) Waimangu, (WK) Wairakei, (NM) Ngatamariki, (RP) Reporoa, (WT) Waiotapu, (KA) Kawerau, (WN) WaihiTokaanu, (TA) Taupo, (RK) Rotokawa, (BR) OhaakiBroadlands, (AW) Awakeri, (KT) Ketetahi, (TH) Tauhara.