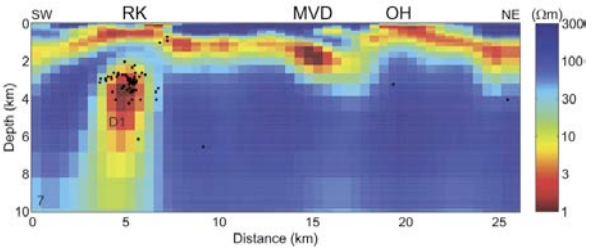
Drilling into magmatic environments: A view forward

CHAMBEFORT, I.[1], BIGNALL, G.[1], BERTRAND, E.[2]

[1]GNS Science, Wairakei Research Centre, Taupo, NZ, i.chambefort@gns.cri.nz,
[2]GNS Science, Avalon Lower Hutt, NZ.

Over the years the drive for sustainable energy has become relevant to every developed country. A global effort to understand deep ressources has resulted in state of the art geophysical studies in order to characterise the deep seated source of active geothermal systems (Fig)[1,2]. By studying active and fossil magmatic-hydrothermal systems, we are able to anticipate the chemical reactions that will occur by drilling closer and closer to magma in different tectonic settings.



MT resistivity profile through the Rotokawa (RK) and Ohaaki (OH) geothermal fields with earthquake hypocenters (black dots) occurring within 1 km of the profile overlaid.

Recent investigations on a buried Taupo Volcanic Zone fossil magmatic-hydrothermal system, using trace element content of rocks, show a clear enrichment toward the surface in Te, Bi, Au, Sb, As and ± Pb, Se, Sn above the intrusion. Unsurprisingly similar zoning is observed above porphyry-Cu systems[3]. This zoning is associated with deep hypogene acid and potassic alteration assemblages that grade toward the surface into phyllic and advanced argillic alteration. This is different from the hornfels carapace intercepted by IDDP1[4]. The occurrences of high acid assemblages above magmas at depth are common in arc environments suggesting that supercritical water-rock interactions are variable in between tectonic settings.

This contribution will present what has been learned to date from deep investigations in New Zealand and what the scientific community still needs to resolve.

[1] Bertrand et al. (2015), JVGR, 305, 63–75. [2] Heise et al. (2015), JVGR, doi:10.1016/j.jvolgeores.2015.10.017. [3] Halley et al. (2015), SEG Newsletters, 100. [4] Schiffman et al. (2014) Geothermics, 49, 42–48.