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Geothermal potential of the buried Drogheda and Kentstown granites, Co. Meath, Ireland

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Granites generally have abundant radioactive heat producing elements such as U, Th and K. Hence, granites buried beneath thermally insulating rocks may serve as targets for geothermal exploitation.

The Drogheda and Kentstown granites are situated in the Iapetus Suture Zone about 35 km north of Dublin in Co. Meath, Ireland. They were drilled in 1997/98 and are overlain unconformably by several hundred metres of Carboniferous sediments. As buried granites, they are potential targets for geothermal exploitation and in this context, their major and trace element geochemistry is being evaluated. The likely thermal insulating role of the overlying sediments and the structural setting of the Drogheda-Kentstown is also being investigated.

Based on available geochemical analyses[1], the Drogheda and Kentstown granites have average heat production rates of 4.5 μW/m^3 and 2.5 μW/m^3, respectively. These differ mainly due to variations in thorium contents. Both granites have uranium concentrations up to 9 ppm, yet the Drogheda granite has a thorium content up to 40 ppm, almost ten times higher than the Kentstown granite and it also has slightly higher potassium concentrations[1].

The two granites also appear to be distinct from each other in their major and trace element geochemistry and in terms of mineralogical features. The Drogheda granite is petrologically relatively 'primitive', exhibiting a high Mg# of $\sim$58, SiO_2 concentrations around 64 $_{wt}\%$ and comparatively high overall trace element contents[1]. The Drogheda body is a quartz monzonite, containing K-feldspar, plagioclase, biotite and amphibole as well as abundant accessory zircon and apatite. All of the major minerals are generally subhedral and show little indication of hydrothermal alteration.

In contrast, the Kentstown body (quartz monzonite to granite) is more leucocratic and exhibits extensive hydrothermal alteration. Plagioclase is generally intensely sericitised; biotite is almost entirely altered to chlorite $\pm$ opaque and oxides $\pm$ muscovite $\pm$ calcite, yet perthitic K-feldspar appears to be less altered[2]. It is hoped that further geochemical studies will reveal the extent to which alteration has affected the composition of the Kentstown granite (Mg# around 48; SiO_2 $\sim$72 $_{wt}\%$ [1]) and possibly reduced its heat production potential.

The sedimentary sequence covering the granites consists predominantly of Carboniferous limestones (grain- and packstones), interlayered with thin shale and quartz-sandstone and is considered likely to serve as a thermal insulator. However, the possibility that the cover rocks (particularly the shales) may also be significant radiogenic heat producers is also being evaluated.

[1] McConnell & Kennan 2002: Irish Journal of Earth Sciences. Vol. 20, 53-60
[2] O'Reilly et al. 1997: Transactions of the Institution of Mining and Metallurgy. Section B. Applied Earth Science. Vol. 106, B31-7