ISOTOPIC MEASUREMENTS AT BROADLANDS

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Measurements were made on samples from Broadlands geothermal area in 1976 for as many environmental isotopes as practicable[1-4]. The purpose was to assess their usefulness for understanding the system, to allow intercomparison between the measurements and to compare with results for Wairakei.

Three radioisotopes with a wide range of half-lives were determined (carbon-14 (5735 years), tritium (12.5 years), radon-222 (4.8 days)). These are related to surprisingly different aspects of the system. Carbon-14 levels were very low (<0.7 PMC, where PMC is percent of the modern carbon-14 standard) because of extensive dilution by old CO_2 from country rock or magma sources. Even quite high proportions of modern CO_2 (high ^{14}C) bearing groundwater would not be detected at Broadlands because of the dilution with old CO_2. At Wairakei, some wells are low in CO_2 and ^{14}C may be a sensitive measure of dilution by young groundwater. Tritium contents are low and probably only one well at Broadlands (BR23) contained significant tritium. Tritium is a good indicator of inflow of young water into the geothermal aquifer.

Radon contents at Broadlands are low and relatively constant (Rn/CO_2 ~ 0.3 nCi/litre), with a tendency for low gas wells to have higher Rn/CO_2 ratios. This level is similar to one group of the Rn/CO_2 ratios observed at Wairakei (0-10 nCi/litre) if allowance is made for the ten times higher CO_2 contents of discharges at Broadlands. The second group of Wairakei Rn/CO_2 ratios (40-60 nCi/litre) is tentatively ascribed to

draining of fluid from small cracks in country rock in response to exploitation.

Stable isotope ratios in water and gases ($^{18}O/^{16}O$, D/H, $^{13}C/^{12}C$, $^{34}S/^{32}S$ and $^{40}Ar/^{36}Ar$) were also measured and these relate to the sources and equilibration temperatures of the containing species.

References

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