Application of environmental isotopes to understand recharge mechanisms to a sub-basaltic deep lead system in western Victoria, Australia

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Radiocarbon, tritium and stable isotopes ($\delta^{2}H$, $\delta^{13}C$, $\delta^{18}O$, and $\delta^{87}Sr$) were used to determine aquifer interactions within and recharge to a deep lead/palaeodrainage system beneath the basalt plains of western Victoria. The deep lead aquifer (Eastern View Formation) covers an area of more than 2000km^2 and consists of several sequences of Tertiary fluvial sediments with an overall thickness of up to 140m. Groundwater quality is highly variable ranging from drinking water quality to highly saline groundwaters.

The isotope data indicate that the quality of the groundwater is controlled by the location relative to eruption points: in close proximity to volcanoes groundwaters are very fresh (<0.5mS/cm) and the groundwater dating gives comparatively young ages. With increasing distance away from the eruptive centres (down flow), the groundwater becomes progressively older and more saline (>10mS/cm).

The application of radiogenic and stable isotopes in combination with major ion chemistry and hydraulic data shows that the Eastern View Formation and overlying basalt aquifer are hydraulically separated by an aquitard, except where it is penetrated by eruption points. The deep lead palaeodrainage system is therefore predominantly recharged through these eruption points which are associated with rocky outcrops and thin soil cover. There is no or only limited interaquifer leakage (and thus, recharge to the deep lead system) in most areas.