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270 - Establishing a baseline of environmental isotope and trace element concentrations in an area of critical minerals potential: Murray Basin, Victoria, Australia

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As Australia transitions towards net zero, the responsible development of the nation's critical mineral resources requires a baseline of pre-development environmental conditions and processes. The Murray Basin in northwest Victoria hosts world-class deposits of titanium, zirconium and rare earth elements within mineral sand deposits of the Miocene-Pliocene Parilla Sand. To support delivery of the Victorian Critical Minerals Roadmap, the Geological Survey of Victoria and the CSIRO are collaborating to sample and analyse the geochemistry of groundwater, soil, vegetation, lake sediment and salt precipitate to establish an environmental baseline over a study area of 50,000km².

An extended trace element suite is being analysed in all sample types. Additionally, in groundwater major and minor elements, isotopes 2H, 3H, 13C and 14C help map recharge, discharge, mixing processes and critical mineral occurrences across the region. Vegetation, soil and lake sediments were collected from >100 sites, while groundwater was collected from 163 bores screening 8 stratigraphic units. Major, minor and trace element geochemistry in all sample media display regional variability, with local elevated concentrations of relevant elements hypothesised to occur adjacent to known mineral sand deposits. Significant overlap in groundwater hydrogeochemistry, isotopic compositions and ages may be observed between aquifers, consistent with inter-aquifer mixing between the Parilla Sand and deeper units.

Parent geology, inter-aquifer mixing and reflux brines from the region's saline lakes likely have a significant influence on groundwater hydrogeochemistry, as supported by stable and radioisotope compositions. 3H activities below detection limit suggest recharge to the Parilla Sand is limited away from basin margins.

The freely available data helps understand hydrogeological and geochemical processes and linkages, creates a strong regional geochemical baseline, and refines the probabilistic distribution of critical mineral occurrences in the Murray Basin. This information can benefit a wide range of stakeholders.