Tracing the groundwater inputs and water-mass mixing in the Coorong lagoons (South Australia) using strontium isotopes

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TRACING THE GROUNDWATER INPUTS AND WATER-MASS MIXING IN THE COORONG LAGOONS (SOUTH AUSTRALIA) USING STRONTIUM ISOTOPES

TRACING GROUNDWATER INPUTS INTO THE COORONG WITH SR ISOTOPES

ABSTRACT

Analysis of elemental concentrations of strontium [Sr] and isotope ($^{87}Sr/^{86}Sr$ ratios) compositions measured in lagoonal waters sampled across the northern and southern parts of the Coorong Lagoon, South Australia are presented. These data are complemented by the analysis of major water inputs into the lagoon, including (i) Southern Ocean seawater, (ii) Murray River water, and (iii) a local groundwater source. Results of this study confirm that these different source endmembers have very distinctive $^{87}Sr/^{86}Sr$ signatures, which in turn allow quantification of their relative contributions to the water balance of the Coorong. Importantly, data confirms that at certain parts of the Coorong Lagoon (e.g., near Noonameena through Parnka Point) the magnitude of submarine groundwater discharge can be significant in localized areas, and by using $^{87}Sr/^{86}Sr$ a tracer along with bimodal isotope mixing equations, local contributions of these endmembers were able to be quantified. Specifically, results indicate that at these sites up to 38% of strontium in the North lagoon waters and up to 64% of strontium in the South lagoon waters originates from groundwater discharge, with the remaining part primarily derived from seawater. With the use of a further mass balance equation which also takes into account the Sr concentrations of the seawater and groundwater it was determined that the isotope signatures within the North Lagoon reflect groundwater inputs by volume of up to 80% in localized areas. In this contribution, we will discuss these new isotope and geochemical data within the context of the bimodal mixing processes, along with an observed initial decrease in the salinity of lagoonal waters observed in the northern parts of the Coorong before rapidly increasing to hypersaline waters further south through Parnka Channel and within the South Lagoon.

KEYWORDS

Coorong
Salinity
Submarine Groundwater Discharge (SGD)
Strontium Isotopes
Hyperbolic Mixing
Bimodal Mixing

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