Vadose Zone Salinity Accumulation and Flushing in Aridland Regolith Aquifer, South Australia

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Shallow, regolith-hosted groundwater of relatively low salinity (700-2000mg/l TDS) is widespread in the arid eastern Musgrave Province of northern South Australia. Twenty six bores were sampled and analyzed across an area of 3600km² for environmental tracers including stable isotopes of water, strontium and ¹⁴C. The unconfined water table occurs between 9 and 12 m depth and flows to the east following topograhy. Environmental tracer analysis of water, rock, and regolith indicate: 1) hydrochemistry of the groundwater is relatively homogenous despite the TDS variation from 700 to 20,000 mg/l; 2) strontium isotopes indicate no significant interaction with Precambrian granitic and doleritic basement rocks; 3) strontium isotopes mass balance indicates 50/50 mix betweeen rainfall and regolith as the source of solutes, except chloride, and; 4) water isotopes do not show evaporation trends with differing salinity. Therefore, the large salinity differences are probably due to solutes accumulating in the vadose zone which are then flushed to the groundwater system during recharge events. Recharge, determined from chloride mass balance and ¹⁴C analysis ranges from 0.02mm/a to 0.6mm/a. The large range in recharge rates and thus salinity is due to texture of the soil-regolith; areas with sandy soils and regolith produce higher recharge and lower salinity groundwater whereas silty and clayey soils-regolith produce lower recharge and higher salinity groundwater.

