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GEOLOGICAL CONTROLS AND TIDAL FORCING OF SUBMARINE GROUNDWATER DISCHARGE FROM A CONFINED AQUIFER, ELIM BEACH, NORTHEAST AUSTRALIA

Discharge of fresh groundwater from large, discrete springs in the intertidal zone is documented at a remote beach in North East Australia. The geologic and hydraulic controls of this spring discharge were investigated, using a combination of geological, geophysical and hydrological tools. A sharp subsurface gradient of electrical ground conductivity as well as strata recovered from sediment cores indicate the presence of a sandy clay layer providing aquifer confinement ca. 1 m below the seafloor. Spring discharge occurs where this layer is breached. Net hydraulic head and groundwater discharge flux were inversely correlated with tidal water level, but remained positive throughout the tidal cycle. An increase in hydraulic head with increasing tidal water level was observed, which can be explained by a change in hydraulic pressure of the confined aquifer in response to a differential pressure forcing at the seaward limit of the confining sedimentary unit. Long-term time series of discharge volume recorded with purpose-built seepage meters indicate no direct response to rainfall, and rather suggest a substantial lag between recharge and discharge, which is also confirmed by CFC groundwater ages of tens of years. The continuous presence of fresh groundwater in the intertidal zone affects the nearshore vegetation - Melaleuca trees which are usually associated with freshwater swamps are here growing in the intertidal zone, with root inundation occurring at every high tide.

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