

GEOCHEMICAL PROCESSES AFFECTING METAL CONTAMINANTS IN AN ESTUARINE ACIDIC AQUIFER, AYRSHIRE, SCOTLAND.

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ABSTRACT.

Geochemical data obtained from an estuarine sandy aquifer situated below an old industrial landfill (Ayrshire, Scotland) indicated that acidic groundwater ($\text{pH} < 2$) exists 100 meters from the estuary banks. Associated with this acidic plume, elevated concentrations of dissolved heavy metals (Al, Zn, Cu, Cr, Cd) were observed. Water table monitoring and chemical data showed that the groundwater is intruded by estuarine water and is tidally influenced (up to 40-cm fluctuations over a tidal cycle).

Whereas the geochemical processes associated with acidic plumes and related metal contaminations have been widely studied in inland aquifer systems, they have received much less attention in near shore aquifers. And rarely have processes taking place in tidally influenced acidic aquifers been investigated in the field.

The aim of the study was to identify the key processes controlling the migration of the acidic plume and reactive transport of contaminants, on the path from the aquifer to the estuary. More specifically, the research work has focused on the role played by estuarine water intrusion on the geochemical processes occurring in the acidic aquifer.

Through integration of intense geophysical, hydrogeological and hydrogeochemical investigations, a comprehensive field-monitoring program and laboratory experiments have been carried out. Results were analysed using the geochemical modelling program, PHREEQC [Parkust and Appelo, 1999].

Keywords: geochemical processes, freshwater-estuarine water mixing, acidic groundwater, metals, pH buffering processes, tidal oscillations.

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