

UNDERSTANDING A GLOBALLY UNIQUE NEXUS OF ACID MINE DRAINAGE, KARST AND WORLD HERITAGE SITE

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ABSTRACT

The Cradle of Humankind World Heritage Site (COH WHS), South Africa, is the only UNESCO-protected karst landscape in the world that is under threat from acid mine drainage (AMD). This has generated wide and considerable concern for the preservation of the fossil sites and karst ecosystems of the WHS. A recent assessment of the water resources environment and continued water resources monitoring has better informed this situation, providing support for management efforts to protect the aquatic environment and outstanding universal value of the site. Allogenic recharge of AMD (salinity >300 mS/m, pH <4, Mn ~30 mg/l) at ~18 megalitres/d and of municipal wastewater effluent (salinity ~100 mS/m, pH >7, PO₄-P ~4 mg/l, *E. coli* ~240 000 cfu/100 ml) at ~3 megalitres/d on average from losing surface drainages, combined with a mean autogenic recharge of ~30 megalitres/d from natural precipitation, define the principal inputs to the karst hydrosystem. Their combined impact on the hydrophysical environment is manifested as a rise in groundwater levels of as much as 6 m in the space of a few years. Each input adds a characteristic hydrochemical signature to the associated recharge component that imprints itself variedly on the karst groundwater chemistry. The association of an observed ~3 m rise in Sterkfontein Caves water level with an AMD impact, however, is contradicted by a weak mine water signature in the cave water chemistry (salinity ~60 mS/m, pH ~8). The paper explores the new understanding that informs these circumstances and a hydrovulnerability assessment of each fossil site.

The studies include the exploration and development of groundwater resources for water supply purposes on a local (domestic) and municipal (bulk) scale, the evaluation and assessment of land use activities, such as waste disposal, industry, mining, and residential development, on the groundwater environment, and the mapping of groundwater resources on a regional scale. His principal professional interest is karst hydrogeology and speleogenesis. He served on the Team of Experts advising the Inter-Ministerial Committee on acid mine drainage, and is a member of the Inter-Governmental Task Team on AMD with an individual focus on water resources monitoring.

Biography

In a career that spans more than 30 years across both the public and private sectors, Phil is a registered Professional Natural Scientist currently employed by the Council for Scientific and Industrial Research as a Senior Research Hydrogeologist. His experience covers a wide range of groundwater studies across a broad spectrum of geological and hydrogeological environments.

