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Understanding the origin of groundwater in the Evander basin goldfields to assist mine water management during closure, South Africa

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Non-operational gold mines in the Witwatersrand basin of South Africa are flooded to some extent, particularly the West Rand sub-basin which started decanting acid mine water in 2002 [1,2] . In the Central rand sub-basin, surface water bodies are the main sources of ingress to old underground workings. The Evander sub-basin which is situated on the eastern side of the Witwatersrand basin began operating in the early 1950's, with operational depths ranging from 300m to over 2000m. The understanding of the groundwater flow system in the Evander sub-basin is of prime importance for effective mine water management, both during and after mining ceases. However, this is complicated by the numerous geological structures such as faults, dikes and mine shafts in the area. Environmental isotopes in groundwater can provide information about climatic and environmental conditions at the time of recharge. Ground, surface and rain water samples were collected and analysed for chemical and isotopic ($\delta^{18}O$, $\delta^{2}H$ and tritium) compositions and were used to determine the origin, interrelationships and to distinguish between the various water bodies encountered in the study area. The results show that there are two main groundwater components in the study area. The first component consists of a shallower groundwater system in Karoo Supergroup with samples of groundwater collected in the upper part of the underground mine workings and a second component comprising of groundwater samples collected below 2 000 bmsl. Based on the isotopic signatures of both components, it is clear that the water is of meteoric origin. Furthermore, the integration of deuterium excess also suggests that groundwater component one was recharged under prevailing climatic conditions, whereas the second component was recharged under different climatic conditions. These observations are important factors to account for, particularly when setting up mine dewatering strategies during mine closure and will add value to future mine water source determinations in other gold mining basins.

References:

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