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Investigating the hydrogeological conditions of the deep formation in the southern Karoo Basin – Case study of the KARIN-CIMERA KFZ-1 hole

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Groundwater from shallow aquifers (<300 m) is often the only water resource for many municipalities and farmers in the arid Karoo Basin, which covers ~65% of South Africa's landmass. However, the possible existence of shale gas reserves in the Ecca Group has focused attention on the potential impacts on these groundwater resources and the need for legislation to ensure its protection. One of the main concerns is the risk of contamination of poorer quality groundwater from deeper formations during shale gas drilling and exploitation activities. But knowledge on the deep-seated aquifer systems and their possible interconnection to the shallow aquifers is either inferred from thermal springs or sparse data collected by Soekor in the 1960s^[1]. This limits authorities in making sound management decisions to facilitate the protection of these groundwater resources.

This presentation aims to provide results of deep groundwater quality and aquifer properties from geophysical logs collected from drilling of a deep borehole (KFZ-01) in the southern Karoo under the CIMERA-KARIN project. This is the first multi-disciplinary investigation into shale gas in South Africa, which recognised the importance of collecting deeper water quality data in combination with geological information with the drilling of this hole. Where surprisingly the greater parts of the borehole was "dry" due to a number of cavities intersected and lead to water loss. However, at approximately 560 m deep there was weak artisan flow from brecciated shale, which produced notable good quality, warm groundwater compared to the groundwater from the shallow aquifers utilised by the farmers. The lessons learnt from this study are not only applicable to shale gas exploration in the Karoo Basin but also needs to be taken into account for other developments in South Africa. Such as carbon sequestration currently investigated in the Kwa-Zulu Natal^[2] or geothermal energy proposed in the Limpopo Province^[3].

References:

[1] Murray et al (2015) Water Research Commission Report No. 2254/1/15

[2] Cloete, M (2010) Atlas on geological storage of carbon dioxide in South Africa. Council for Geoscience

[3] Dhansay et al (2014) S Afri J Sci 110(3/4): 1-10

