EXPERIENCES GAINED FROM THE CIMERA-KARIN SCIENTIFIC DRILLING PROJECT ON THE SHALE GAS POTENTIAL OF THE SOUTHERN MAIN KAROO BASIN

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ABSTRACT

CIMERA-KARIN drilled two deep cores through Ecca-Dwyka beds of the Karoo Supergroup during 2015 to investigate the maturity and gas content of carbonaceous shales in the succession with special focus on the Whitehill Formation. The first (KZF-1), targeting an area without dolerite intrusions, was drilled to a depth of 671 m in the Tankwa Karoo east of Ceres in the Western Cape Province in the far southwestern corner of the Main Karoo Basin (De Kock et al., 2015). The second (KWV-1) was drilled to a depth of 2352 m in an area with abundant dolerite intrusions near Willowale in the Eastern Cape Province in the far southeastern part of the basin (De Kock et al., 2016). Samples of Ecca and Dwyka shales, collected from a core (BH-47) drilled by an exploration company near Colesberg, some 200 km south of Bloemfontein in the more central area of the basin, were also investigated (Adeniyi, 2016). The contact of the Dwyka Formation with basement rocks was intersected at 1400 m depth in this hole. In core KZF-1 well-preserved pyritic black shale of the Whitehill Formation, with a thickness of 19 m, was intersected at a depth of ~420 m overlying siltstone and shale of the Prince Albert Formation with sharp gradational contact. However, some 10 m below that contact the beds are sheared and thrust faulting duplicates the Whitehill Formation. Strong (~ 24 000 l/h) very fresh good quality artesian ground water, with a temperature of 43ºC, was intersected at a depth of 650 m along the contact between the Prince Albert and Dwyka formations in the hole. In core KWV-1 the Whitehill Formation is 13 m thick and intruded by a 19m thick dolerite sill along its contact with overlying fine sandstone of the Rippon Formation. No deep ground water was intersected. In core BH-47 the Whitehill Formation could not be positively identified but shale with exceptional high organic carbon contents relative to others in the core is tentatively correlated with it. Typical Collingham Formation with abundant tuff beds is only present in core KZF-1. RockEval, illite crystallinity (Kübler Index) and vitrinite reflectance analyses of the Whitehill Formation and other carbonaceous shale beds all indicated that the succession is over mature and has regionally experienced anthracite grade metamorphism enhanced by thermal metamorphism next to dolerite sills. Only dead carbon is preserved even in Whitehill samples that contain 4,5 - 6,5 wt % organic carbon.

Gas analyses undertaken indicated negligible concentrations of desorbed gas in KZF-1 samples with none present in KWV-1. Sub-economic concentrations of adsorbed gas were found in KZF-samples with negligible concentrations in KWV-1. Conclusions are thus that large volumes of gas must have been expelled and lost from the succession in the past with small pockets locally trapped as conventional gas in parts of the basin as indicated by some of the earlier SOEKOR wells. However, our results indicate that the shale gas potential of the southern Karoo basin may be much less than initially thought. We acknowledge that our gas analyses studies took place outside the areas considered as “hot spots” for shale gas exploitation in the basin, namely in vicinity of Sutherland and the area between Beaufort West and Cradock where the Whitehill Formation occurs at depths of more than 1500 m and is predicted to contain less than 20 percent dolerite sill intrusion. We are thus looking forward to results that would come from the deep core the Council of Geoscience plans to drill at Beaufort West in the near future.