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Shale Gas characteristics of Permian black shales (Ecca group, Eastern Cape, South Africa)

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This study involves a comprehensive and detailed lithological, sedimentalogical, structural and geochemical description of the lower Ecca Group in the Eastern Cape, South Africa. The Ecca group hosts a $\sim$ 245 million year old organic-rich black shale, which has recently been the focus of interest of petroleum companies worldwide. The shale was deposited under anoxic conditions in a setting which formed as a consequence of retro-arc foreland basin development related to the Cape Fold Belt. This sedimentary/tectonic environment provided the conditions for deeply buried black shales to reach maturity levels for development in the gas window.

The investigation site is called the Greystone Area and is situated north of Wolwefontein en route to Jansenville. The area has outcrops of the Dwyka, the Ecca and the lower Beaufort Groups. The outcrops were mapped extensively and the data was used in conjunction with GIS software to produce a detailed geological map. North-south cross sections were drawn to give indication of bed thicknesses and formation depths. Using the field work, data two boreholes were accurately sited on the northern limb of a shallow easterly plunging syncline. The first borehole reached 100m and the second was drilled to 292m depth (100m percussion and 192m core). The second borehole was drilled 200m south of the first, to penetrate the formations at a greater depth and to avoid surface weathering.

Fresh core from the upper Dwyka Group, the Prince Albert Formation, the Whitehill Formation, Collingham Formation and part of the Ripon Formation were successfully extracted and a detailed stratigraphic log has been drawn up. The core was sampled during extraction and the samples were immediately sent to the GFZ in Potsdam, Germany, for geochemical analyses.

As suspected the black shales of the the Whitehill Formation are high in organic carbon and have an average TOC value of 4.5%, whereas the Prince Albert and Collingham Formation are below 1%. Tmax values and the evolution of organic material to bitumen characterise these sediments as overmature. The HI and OI results reveal that the Collingham and Whitehill sediments are type II kerogen and the Prince Albert is type III kerogen sediment. XRD data shows major rock forming minerals of the black shales to be quartz, illite, muscovite and chlorite with some plagioclase and large amounts of accessory pyrite. Average meso-and macro-porosity of these black shales is 1.5% and SEM images confirm that these sediments are tightly packed. The samples are highly affected by the Cape Fold Belt due to its location so far south and is unlikely to hold gas at this position, however this ongoing investigation will give greater insight to the gas potential of these black shales which are found more north of the region.

At the GFZ open system pyrolyses and thermovaporization analyses are still underway.