

The Geology, Petrology and Geochemistry of The Permian Karoo Coal Deposits of The Songwe-Kiwira Coal Field

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Abstract

The coal resources occurring in the Songwe-Kiwira coalfield have been investigated using sedimentological, petrological and geochemical methods. The data is used to assess the coal resources and the associated sediments for their hydrocarbon geneative potential as well as the depositional environment of the coal bearing successions.

The coal is composed of predominatly of inertinite macerals (20-70 vol. %), although lipitinite macerals (1-20 vol. %) are abundant in some parts of the seams which show relatively low inertinite contents. Vitrinite group is dominated by collodertinte but other vitrinite macerals have also been recorded. The liptinite group consists mainly of sporinite and resinite macerals and appear to be abundant.

Rock Eval maturity parameters such as Tmax of 437 – 447 C are in agreement with coal rank data as determnined by vitrinite reflectance measurement ($R_{o-max} = 0.66 - 0.8\%$) and place the coal and sediments within oil window. Hydrogen indices (HI) range from 75-279 mgHC/g TOC and are related to the various proportions of vitrinite, inertinite and liptinite macerals. The coals and associated organic rich shales show type I/II kerogene (organic matter capable of producing both oil and gas). Petrographic evidence for early generation and expulsion of oil from a relative mature source rocks is provided by the occurrence of bitumen (exsudatinite) filling voids of coal macerals and bituminized vitrinite macerals.

Trace elements analyses show that elemental concentration in the Songwe-Kiwira coals are not related to variations in ash contents. Concentration of elements of

prime environmental concern such as As (0.6 – 36 ppm), Cr (34 – 118 ppm), Mo (0.9 – 12.8 ppm), V (24 – 74 ppm), Zn (>6 – 97 ppm) are mostly in the upper range for known world coal basins and exceed in some cases (e.g. Cr and V) maximum amounts reported previously. This entails environmental considerations during the utilisation of the coal resources. Mercury is reported in most samples as less than values (below the limit of qualitative accuracy but above zero).