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# The partitioning of trace elements in the no. 4 seam of the Witbank coalfield.

**Bergh, Jacobus Petrus**

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# ABSTRACT

South Africa remains the 5th largest producer and 4th largest exporter of coal in the world. It is also the largest supplier of coal to the European Union. This fact is significant as the European Union has recently supported the environmental lobby that threatens the combined full scale use of coal in Europe and other first world countries. This promotes the development of clean coal technologies in order to counter the ever increasing number of environmental constraints threatening the export market. One critical development in clean coal technologies is coal beneficiation, which allows the reduction of ash and inert content. Permian coals from South Africa have characteristically high ash and inertinite contents and therefore require further beneficiation. The Witbank coalfield No. 4 seam is no exception. It can be described as being more inert and having a higher mineral content compared to the No. 2 seam in the same coalfield also mined for export purposes.

With the increase in environmental legislation and the push towards “clean coal” this raises a concern in terms of the performance and marketability of export coal produced from the No. 4 seam. This seam will in the future be economically significant and is still a great source for export steam coal. Due to the nature and composition of the No. 4 seam, coal beneficiation is essential to reduce the mineral and inert content to be in line with export quality specification levels. Washability characteristics of the No. 4 seam coal indicate that the No. 4 seam is difficult to beneficiate. Until recently the main clean-ability parameters evaluated in South African export coals as per customer specification included mainly heating value, moisture and ash reduction with little to no work being done on trace element concentration reduction. This paper focuses on the partitioning of the trace elements within the seam in relation to the organic and inorganic affinity of the trace elements and possible methods of trace element reduction by removal using coal beneficiation techniques. The techniques investigated include reduction by washing using dense medium beneficiation and flotation. In each evaluation the focus was on trace-element-to-mineral and trace-element-to-organic matter relationship and hence setting the basis for liberation analysis to evaluate reducibility.

By the evaluation of the coal mineralogy, petrography and trace element relationships, methods of optimum trace element reduction can be established. With the focus on marketing it was shown that carbon loss need not be sacrificed in the reduction of specific trace elements in the No. 4 seam and that the trace element distribution itself allows for beneficiation whilst maintaining acceptable yields. Processes and possible beneficiation techniques for optimum trace element reduction and marketability in the case of the No.4 seam are proposed.



**Keywords:** Permian coals, Witbank Coalfield, Marketing, Partitioning, Trace Elements, Preparation, Beneficiation, Flotation, Mineralogy, Petrography