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The use of thermomagnetic curves for paleotemperature evaluation in sedimentary basins.

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The Karoo succession has economic significance through the exploitation of extensive coal deposits and in recent years has seen significant international interest due to potentially large shale gas resources. The thermal history of sedimentary basins affects the genesis of hydrocarbon deposits. It is therefore essential to model and reconstruct the geothermal variation across the Karoo Basin with respect to the large volumes of magma that were emplaced during the Gondwana breakup, before evaluation of the hydrocarbon resources can take place.

The peak paleotemperatures away from the intrusive can be examined using thermomagnetic curves [1]. With this method the relationship between the heating and cooling curves of magnetic susceptibility measurements made during individual progressive heating and cooling runs in normal atmosphere is quantitatively evaluated [2]. The thermomagnetic curves of powdered samples as well as fragments of rock from eight stratigraphic boreholes taken at varying intervals from mafic intrusions across the Karoo Basin were analyzed.

Results indicate a general elevation of paleotemperatures of the organic-rich sedimentary rocks of the Ecca Group to temperatures where hydrocarbons are normally converted into gas. Importantly, it is clear from this study [3] that the greatest thermal effects of the sill intrusions on the sedimentary strata are limited to the contact aureoles, suggesting that there is an, as yet unquantified, potential for hydrocarbon resources remaining between these intrusions. A general increase in the paleotemperatures from southwest to northeast across the basin was observed [3]. It is suggested to be mainly due to differences in thermal conductivity of the various lithologies across the basin from tight low porosity marine shales in the south and southwest towards more lacustrine mudstone and porous sandstone in the northeast.

References:

[1] Hrouda et al. (2003) *Physics and Chemistry of the Earth*, 28, 653–657.

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