

Using Paleosurface Geology to Help Predict Reservoir Quality; An Example from the Southern Natal Valley Basin, South Africa

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Abstract

A new generation of palaeosurface maps, which show deposition, bedrock types and associated drainage networks, have been compiled for Africa for each stage of the Cretaceous. We present the use of these maps in source to sink reconstructions, as they indicate the type of bedrock being eroded in the hinterlands and bulk transport pathways and allow us to understand potential reservoir quality. Initial data comes from published geological maps. These are digitised, comprehensively attributed, standardised and correlated against the literature. Units younger than the Cretaceous were removed, leaving only relevant geology to be rotated back to its paleoposition. This produced an initial understanding of Cretaceous and older surface geology. There were, however, large gaps in the data. Paleogeographic reconstructions were used to extrapolate the extent of sediments actively being deposited in the timeslice of interest. Remaining gaps suggested that there was no active deposition in these areas; subsurface geology and literature were then used to fill in these gaps. During this whole process, the effects of uplift and erosion were considered. These maps provide visual representations of the interactions between surface geology, transport pathways and influencing structures. They enable users to understand basin sediment source regions and associated lithologies. This is demonstrated using the Southern Natal Valley Basin, offshore the east coast of South Africa. Currently, there are proven source rocks, but little information on potential reservoirs. Analysis of the palaeogeographic,

palaeosurface geology and palaeodrainage networks of the Tugela River and the subordinate Umengi and Umfolozi Rivers indicates that potential reservoirs do exist. These are likely to be of good quality, analogous to the proven Cretaceous reservoirs in the Outeniqua Basin, which are sourced from the Silurian - Ordovician sandstones of the Cape Fold Belt. Indeed, these may even be of higher quality, due to less regional metamorphism of the equivalent Natal Group in comparison to the Outeniqua source rocks. Furthermore, this analysis has provided complimentary information on the potential of the reservoirs in the undrilled Durban Deep Water Sub-basin located eastwards from the Durban Sub-basin and Tugela Delta well control.