The Nature of Clastic Sandstone Intrusions in a Deepwater Environment – Outcrop Examples from the Southwestern Karoo Basin, South Africa

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Two different modes of sand remobilization and injection are associated with the Karoo deep-water deposits: Downward injection and upward injection. Sandstone dykes have widths of up to 6m, are horizontally and vertically orientated, and can be traced over distances of more than 100 meters. The intrusive sandstone bodies are massive, fine-grained and are distinguished from the sedimentary units by their lack of primary sedimentary structures, cross-cutting nature, zigzag compaction deformation, host rock shale inclusions and peculiar but characteristic “scuffle” marks along their contact surfaces. The scuffle marks, believed to be the result of highly mobile sand being squeezed under high pressure into semi-consolidated cohesive mudstone and siltstone, are good indicators for upward or downward injection. Although the scuffle marks show that the surrounding silt and clay was highly susceptible to deformation during injection, the occurrence of shale inclusions or “xenoliths” within some dykes show that the clay was slightly compacted during injection. Dyke emplacement rarely cross-cut into over- or underlying sandstone units.

The abundance of sandstone intrusions in an area where facies distribution strongly suggests topography control on sedimentation patterns, most likely relate to the tectonic instability created by the orogenic growth stages of the large syntaxis anticlinal structures of the Cape Fold Belt during basin filling. Compressional forces created zones of weakness and small movements in the basin floor that caused increased instability on the slope to base of slope area with resultant formation of sandstone dykes.

The formation, distribution and scale of the clastic intrusions could have a significant influence on matters such as reservoir architecture, sand body connectivity and reservoir production performance.