Internal Architecture of a Multi-Sourced, Fine-Grained Fan System in the Tanqua Sub-Basin, Permian Ecca Group, South Africa

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Fan System 5 (FS5) forms the uppermost fan system of the Permian–age Tanqua Fan Complex (Ecca Group) of the southwestern Karoo Basin. It is the most widespread system, covering an area of more than 650 km2 and displaying depositional characteristics markedly different from the underlying fan systems. Stratigraphic architecture and regional facies development and distribution patterns reflect different stages of fan growth coupled with different feeder systems in a base of slope to basin floor setting.

The base and top of FS5 are relatively sharp and well defined by the presence of regionally developed hemipelagic shale units. The spatial/temporal distribution of depositional elements within FS5 such as channel, overbank and frontal splay sheet sand complexes reflect deposition in a proximal fan setting where local depositional and structural control seems to have played a major role in the distribution of sediments. Facies vary from massive amalgamated fine to very fine-grained sandstone beds (channel-fills) to thin-bedded, ripple cross-laminated sand- and siltstone beds (overbank and frontal splay sheet sandstones). Channel-fills are arranged in vertical to offset stacking patterns to form channel complexes and complex sets up to 50 m in thickness. Overbank elements comprise ripple cross-laminated medium to thin-bedded sandstone beds up to a 100m in thickness, whereas massive (Ta) and thin-bedded sandstone units (Tab) constitute frontal sheet sandstones in the down-dip extensions of FS5. The channelization displayed by the more proximal outcrops is interpreted to represent an upper fan setting, with deposition in a base-of-slope to basin floor setting.

The highly erosive, stacked channel complexes, seemingly being controlled by subtle syn-depositional structural features, were able to construct significant thicknesses of regionally well-developed overbank/single channel-fill deposits marginal to them.