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Process-Based Numerical Modeling of Turbiditic Systems Along a Passive Margin (Pab Formation, Upper Cretaceous, Pakistan)

The aim of this study is to restore the Upper Cretaceous Pakistani passive margin to test the stratigraphic relationships existing between a deltaic shelf and turbiditic fans. This simulation is based on a process-based algorithm and calibrated to outcrops and subsurface data collected in the area.

Three main system tracts had to be restored. The lowstand system tract corresponds to a high efficiency basin floor fan time equivalent to an erosional unconformity on the shelf. This unit is made of amalgamated sand rich turbiditic channels passing distally to lobes. The TST is represented by a mud rich slope fan developing channel-levee complexes while most of the sediment was stored on the platform setting. The HST is represented by a prograding delta feeding a sand-rich slope fan.

Two process-based simulation methods have been combined to restore the geometry of the turbiditic system. The basin floor fan has been simulated with a diffusive approach using water flow as a key control parameter. The decrease of water flow permitted to simulate the basin floor fan backstepping and the slope fan development. Then, the HST delta and slope fan have been modelled respectively with diffusion and gravitary instability.

The distribution, geometry, and sequential evolution of Pab margin depositional systems were successfully reproduced by this approach. The relative contribution of allocyclic factors such as eustasy, subsidence and sediment supply was tested in different stratigraphic scenarii. Finally, the analysis of the 3-D simulated block can help for prediction on reservoir distribution, extension and connectivity.