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The Interaction Between Basin-Scale Extensional Folding and Sedimentation in a Supradetachment Basin

Hanging-wall deformation in extensional settings has the potential to create complex syntectonic sedimentary packages. These sediments record interplay between sedimentation and synextensional folding, as recorded in Grasshopper rift basin, SW Montana. As a result of this interaction, Grasshopper basin, has a complex, three-dimensional stratigraphic and structural geometry. Large, basin-scale extensional folds developed in this north-trending Paleogene supradetachment basin during extensional deformation. A major N-trending anticline, 10 km long and 1.8 km in structural relief, occupies the western half of the basin. Approximately perpendicular to the anticline, a major syncline 8 km long and roughly 0.5 km in structural relief plunges 88 toward an antiformal in the underlying listric detachment fault.

Sedimentologically, we interpret the basin as a sediment starved lacustrine system dominated by southward axial infilling and lesser, yet significant, transverse sediment influx. The basin contains about 4 km of Tertiary basin fill. Stratigraphic and sedimentological analyses reveal that several basin-scale lacustrine transgressions, facilitated by slip on the eastern border-fault and increased accommodation space due to folding, laterally shifted depositional environments. Interruptions in the southward progradation of the fluvial-deltaic facies are marked by the north-northeast retreat of conglomerates and sandstones on the north limb of the transverse syncline. In the mid to late stages of basin deformation, current data suggests that the longitudinal anticline evolved. To help visualize the large-scale stratigraphic and structural features of this basin, we integrated seismic data and structural, stratigraphic, and sedimentological field data into three-dimensional structural models (2D/3D Move from Midland Valley Exploration) of the basin.