Influence of Ancestral and Syndepositional Tectonic Regimes on Sediment Dispersal Pathways in Intermontane Basins: Facies and Paleoflow Evidence from the Renova Formation, Southwest Montana

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Facies assemblages and paleoflow indicators from the late Eocene-early Miocene Renova Formation reveal that intermontane basins in the vicinity of the Boulder batholith may have an ancestral origin as Cretaceous intraforeland basins in the structurally-partitioned Cordilleran foreland. Despite ancestral basin configuration, data indicate that sediment routing responded to evolving Cenozoic tectonic regimes before assuming the modern configuration in the headwaters of the Missouri drainage.

The Renova Formation records initial post-Laramide sediment accumulation in the intermontane basins, marking the transition from fluvial incision to sediment backfilling concurrent with a significant decrease in regional volcanism and local tectonism. Basin margin alluvial facies consist of channel sandstones, mudflow mudstones, sheetflood conglomerates and debris flow breccias containing abundant granitic and sedimentary clasts that record radiating dispersal from basin-bounding uplifts such as the Boulder batholith-Highland Range and Pioneer Mountains. Basin-axial fluvial facies, including channel sandstones, splay deposits and paleosols, interfinger with and are capped by mid and distal fan alluvial facies. In the Divide basin, trunk fluvial channel sandstones contain south oriented paleoflow indicators consistent with the modern Big Hole River. In the upper Jefferson basin, trunk fluvial channel sandstones contain south oriented paleoflow indicators, notably opposite to the north flowing modern Jefferson River, suggesting the paleo-upper Jefferson River underwent post-Renova drainage reversal.

Although Renova deposition coincided with a hiatus in local tectonic activity, paleodrainages and facies distributions indicate that Renova sedimentation was influenced by the structural grain established during Laramide compression. Renova fluvial networks routed around relict Laramide highlands and late Cretaceous plutons, approximately mimicking pre-existing paleodrainage reconstructions for the Cretaceous Kootenai, Blackleaf, and Frontier formations and suggesting the intermontane basins may have an ancestral origin as Cordilleran intraforeland basins. Following Renova deposition, regional tectonic activity increased, marked by the onset of local extension and an increase in volcanism. Post-Renova drainage reversal of the upper Jefferson River to the modern configuration may have been driven by Neogene thermal doming along the Snake River Plain-Yellowstone hotspot track.