Separating Allogenic and Autogenic Controls in a Super-Greenhouse Fluvial System

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The Early Eocene fluvial succession in the Uinta basin displays distinct stratigraphic changes in channel-fill and lateral/vertical channel amalgamation character. The channel fills alternate between “normal”, with dominantly trough-cross-stratified sandstones organized into thalweg deposits and barforms with lateral, downcurrent and upcurrent accretion directions. Such “normal” channels alternate at different scales with channel fills that are dominantly plane-parallel and climbing-ripple laminated, organized into erosionally based, thick, downstream accreting packages, in many places bioturbated at their tops. Such channel fills indicate rapid local infilling and consequent high avulsion rates. Avulsions are commonly linked to autogenic controls like local gradient or topographic variations. We link the avulsion rate variations to episodic changes into highly seasonal, ephemeral discharge and deposition with an initial erosional stage, followed by high rates of deposition, and then by non-deposition, bioturbation and paleosol formation. The great thickness of individual accretion packages suggests that such channels were locally filled and forced to avulse during a single season. In some startigraphic intervals the degree of lateral and vertical channel amalgamation suggests development of megafans. Based on stable carbon isotope and paleosol analyses, we link these high-frequency stratigraphic changes in fluvial deposition style to the PETM and the successive Early Eocene hyperthermals. We interpret the changing fluvial style to be controlled by intensification of the hydrological cycle during the hyperthermals. Nevertheless, the specific distribution of channel fill styles and avulsion rates is controlled by local erosion and deposition rates, and laterally the channel style changes due to these autogenic controls.