AN INTEGRATED STUDY OF FLUVIAL MEGAFAN SYSTEMS: SEDIMENTARY PROCESS, MORPHODYNAMICS RESPONSES, AND ITS AUTOGENIC BEHAVIORS

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ABSTRACT

Various large fluvial fan systems have been recognized in the geological record. Yet their sedimentologic and stratigraphic differences are unclear. This study recognizes the Early Eocene Green River Formation in the Uinta Basin and the Cretaceous Williams Fork Formation in the Piceance Basin as fluvial megafans, as seen by their lateral extent, internal architecture, and lateral and vertical facies transitions. Outcrop measured sections, photomosaics, and georeferenced aerial photographs taken by drone were integrated to study sedimentary facies variability, channel to floodplain ratio, and areal mapping of channel dimensions. By comparing outcrop data with results from experiments and mathematical models, as well as modern fluvial fans on satellite images, some common characteristics stand out. Fluvial megafans are a radial set of channels created by successive nodal avulsions, where generally only one channel is active at one time. This is seen in both basins that the sandying upward successions exist and an increase in channel to floodplain ratio, channel size, and degree of amalgamation in various scales ranging from avulsion to lobe switching. The lateral extent and vertical thickness of each sandying upward successions are documented for the target geologic units across the basin. Dominance of Froude supercritical flow is critically responsible for the unique barform geometry and the upstream migrating channel fills, as seen in Green River Formation, which is testified by physical experiments and mathematical models. These systems were proved to be sediment supply driven rather than accommodation driven in both basins, regardless of sea level or lake level control.

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