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[PS]Unraveling Fluvial Complexity Using Unmanned Aerial Vehicles and Structure-From-Motion Photogrammetry: An Example From the Salt Wash Member of the Morrison Formation, East-Central Utah*

John T. Chesley[1], Cody Heinze[1], and Andrew Leier[1]

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[1]Earth and Ocean Sciences, University of South Carolina, Columbia, South Carolina, United States (jchesley@geol.sc.edu)

Abstract

The complexity of fluvial systems presents many challenges to non-marine reservoir evaluation and development. The variability of these units over three-dimensional space represents a particularly difficult aspect of fluvial reservoirs, and one that is difficult to assess using most outcrop exposures. South of Green River, Utah the Salt Wash Member of the Morrison Formation is exposed vertically and in plan-view, allowing for measurements and interpretations to be carried out in three-dimensions. The entire Salt Wash Member has been recently re-interpreted as an ancient prograding distributive fluvial system (DFS) that extended across parts of Utah, Colorado, Arizona, and New Mexico. This study incorporates an unmanned aerial vehicle (UAV) and structure-from-motion (SfM) photogrammetry to build high-resolution virtual outcrop models of exposed fluvial sandbodies. SfM provides researchers with an inexpensive, effective, and flexible approach to capturing complex outcrop exposures at high-resolution. Plan-view widths indicate three general groups of fluvial channel bodies are present: very narrow (1m-3m), narrow (15m-80m), and wide (85m-115m). The very narrow sandstone bodies are typically less than 1m thick, straight to possibly dendritic in plan-view, bioturbated, and interpreted as crevasse splay channel deposits. The narrow sandstone bodies are typically 2m thick or less, straight-to-sinuous in plan-view, and are generally oriented to the north and northeast with similarly directed paleocurrents. The wide sandstone bodies are typically 4m thick or more, straight in plan-view, and are oriented to the east and southeast with similarly directed paleocurrent indicators. Sandstone orientations are highly variable and cross-cutting relationships are common. The combination of fluvial channel body dimensions and outcrop data such as facies, paleocurrents, porosity, and permeability, can provide quantitative geostatistical constraints for stochastic reservoir models. Additionally, the techniques and workflows used in this study can be applied to almost any outcrop exposures and therefore hold the potential to assist in other sedimentary studies.

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