

## **Constraining Fold Geometry with Airborne Laser Swath Mapping Data and Numerical Interpolation from Sheep Mountain Anticline, Wyoming**

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Sheep Mountain anticline (SMA), Wyoming, is an asymmetric fold resulting from Laramide compression accommodated by an underlying basement-cored thrust fault. Excellent outcrop exposures, as well as a wealth of data including detailed mapping and interpretation of fractures, make SMA an ideal site for studies relating the mechanics of fold evolution to present day fold geometry and fracture patterns. Because most fractures are below the resolution of seismic imaging, and imaging quality deteriorates rapidly in regions of high topography typical of reservoir-scale folds with quality outcrop exposures, alternative methods must be found to constrain fold geometry at sites where outcrop fracture data is available. For this purpose we have obtained an airborne laser swath mapping (ALSM, aka LiDAR) digital elevation model (DEM) of SMA from the National Center for Airborne Laser Mapping. We present the DEM, on which we have mapped bedding-plane exposures of several prominent, weathering-resistant stratigraphic horizons. We use differential geometry to characterize the curvature of these outcrop exposures, considering both principle curvatures, and classifying the surfaces into 8 different fundamental shapes. The resulting outcrop-scale curvature maps are compared with similar maps at select outcrops derived from high precision GPS measurements. We then explore several interpolation techniques for the construction of a structural surface model representing the resistant horizons, including a minimum-curvature spline with inequality constraints governing layer thickness and a finite element technique which deforms horizontal layers of uniform thickness to present day geometric constraints provided by the LiDAR data. The resulting models are compared with a previously published structural model derived from kinematically balanced cross-sections constrained by outcrop mapping.