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Surface to Subsurface: 3-D Structural Interpretation and Visualization of Complex Fold-Thrust Structures

The Idaho-Wyoming overthrust belt contains structures with complex 3-D fold-thrust geometries. 3-D interpretation and visualization of surface structures in the Idaho belt and subsurface structures within the Fossil basin of the Wyoming belt are used to develop an understanding of the geometry and evolution of these structures. Surface structures from the Palisades Reservoir area in the Idaho belt are interpreted by draping geological maps and orthophotos over digital elevation models. Visualization of the topography and structural geometry combined with field reconnaissance studies is used to refine the structural maps. Structural cross sections constructed from the digitally enhanced maps are integrated to develop 3-D surfaces of the Jurassic Nugget and other selected units using GO-CAD software.

Subsurface structures from the Fossil basin area, such as the Painter and East Painter Reservoir structures are interpreted using formation tops and dipmeter data from over 60 deviated wells. Area-balanced cross sections constructed through the structures are integrated with well data to develop 3-D surfaces of selected reservoir units and faults. Comparison of mapped surface and subsurface horizons in the Idaho-Wyoming belt suggests that the structures consist of asymmetric faulted detachment folds developed above detachments in the Triassic and older incompetent units. The structures exhibit branching, relay, and en echelon folding patterns, and also show abrupt changes in vergence both across along structural trend. The improved structural models resulting from these studies can be used to explore for new structures in the area as well as to improve production from existing fields.