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3D Outcrop Reservoir Characterization

Newly developed digital mapping, 3D photorealistic technologies, 3D geospatial visualization, and geostatistical analysis greatly enhance 3D outcrop description and modeling. The methods quantify the preserved sizes and shapes of specific facies elements in three dimensions for a variety of clastic and carbonate depositional systems. By integrating data from outcrop, core, shallow subsurface Ground Penetrating Radar (GPR), Global Positioning System (GPS), and Laser Range Finders, specific beds and bounding surfaces interpreted on photomosaics are tied to the same beds and surfaces imaged in subsurface GPR and borehole data. Geospatial modeling packages accurately render the data in 3D. Faults are also interpreted and rendered. The geometric models comprise an ordered set of stratal and fault surfaces that define a strata-conforming reservoir simulation grid appropriately formatted for 3D flow simulation studies. Accurate positioning of borehole and measured section data integrates conditioning data into geostatistical rock property models. Suites of flow simulations are designed to examine the effects of geological variability over a wide range of factors and to develop predictive models. Imaging, rendering, and simulating near-surface and outcrop reservoir analogs in 3D presents new opportunities for examining and understanding rocks, and potentially opens new perspectives for research questions which were previously intractable using older 2D or pseudo-3D technologies.