AAPG International Conference
Barcelona, Spain
September 21-24, 2003

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Application of Laser-scanned Outcrop Data to Build Models of Deepwater Reservoirs: Examples from the Tabernas and Ainsa Basins, Northern and Southern Spain

Lidar (light detection and ranging) technology has proven itself to be a valuable tool for rapid, quantitative characterization of outcrop geology. Recent advances in acquisition technology, data handling, data merging, and visualization provide a superior method of outcrop capture and analysis when compared with traditional photograph-based methods. Outcrop faces are now readily placed into navigable 3-D volumes that can be examined immediately in the field and later interpreted on a workstation or PC. The high-resolution digital terrain models are draped with conventional photographs and corendered with attributes such as weathering profile (shape), laser intensity (reflectivity), and multispectral data, producing greatly enhanced outcrop data.

Recent work in the Ainsa and Tabernas Basins combined conventional field study methods and tools with laser-generated imagery to create 3-D representations of several well-studied outcrops. The digital scans from the Ainsa 1 and Ainsa 2 channel systems were manipulated to provide an elevated vantage point that sites down bed dip. This approach revealed an abundance of strongly layered bed and bed-set architecture that was not readily apparent from the ground. Small-scale accretionary or off-lapping beds are also evident. Scans of the Solitary Channel from the Tabernas Basin provided a 3-D digital framework from which lithofacies and time-significant surfaces (high-frequency sequence boundaries and abandonment surfaces) are better correlated along the 2-km outcrop belt. In addition, a series of faults disrupt stratigraphic continuity of the channel fill, and digital removal of the faults simplified oft-debated stratigraphic relationships. In addition, laser intensity data were integrated with outcrop weathering patterns and RGB values from digital photographs to produce a classification scheme that distinguished mudstones from sandstones and even differentiated sandstones having varying lithic-grain content. All of these data have been used to generate a cellular-based geological model of a slope-channel reservoir analog in GOCAD.