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Textural Mapping with Lidar and Real-Time Kinematic GPS on the Flow-Unit Scale: An Example from the Pipe Creek Early Albian Rudist Buildup, Central Texas

A superb 3-D exposure of a rudist buildup and related facies fore-mound, back-mound, and beach facies occurs along Pipe Creek as part of a Lower Albian Glen Rose carbonate shelf. In situ and debris apron deposits that steadily grade northward into patch reef tucasid communities and finally beach grainstones present distinctly different rock fabrics and pore systems that resemble those of producing rudist-dominated reservoirs in Mexico and the Middle East. Due to the extremely rugose creek-bed exposure, with 5-meter mini-slot canyons in places, discerning fine-scale caprinid build-ups from debris aprons was extremely difficult. Without a 3-D template or virtual base map the three-dimensionality of the caprinid build-up would have been difficult to impractical to capture. Existing maps and air photos of the area were insufficient to convey quantitatively the localized complexity of the Pipe Creek area and the nature of the creek-bed outcrop made conventional photography unsuitable.

Ground-based lidar (light detection and ranging) provided the 3-D base template upon which facies contacts between the in situ caprinid mounds and debris aprons were mapped using a difference in weathering patterns between whole caprinid-test casts with mud-rich matrix versus coarse inter-mound rubble with a high percentage of touching-vug pore systems. These facies and their containing high-order sequences were then mapped in the field "live" with RTK GPS (real-time kinematic global positioning system). Textural mapping was used to examine relatively smooth versus relatively jagged surface micro-topography and correlated with the RTK GPS survey. Samples were taken from each facies to be analysis and porosity and permeability modeling in the ongoing effort to better constrain fluid flow in mixed-contact vuggy limestone.