

Laser-Mapping and 3-D Reconstruction of the Lower Ordovician El Paso Group Collapse Breccias, Franklin Mountains, Texas

Bellian, Jerome A.¹; Kerans, Charlie² (1) Energy Technology Company, Chevron, San Ramon, CA. (2) Geological Sciences, The University of Texas at Austin, Austin, TX.

The Lower Ordovician El Paso Group is a >400-m-thick carbonate succession exposed in the Franklin Mountains, El Paso, Texas. The El Paso Group contains multiple breccias related to collapsed-paleocave systems. These breccias have been documented as having formed during the top-Lower Ordovician Sauk depositional supersequence lowstand. Evidence presented in this study suggests that cave formation may have been as much as 350 million years younger and related to Laramide oblique right lateral compression. Regardless of the timing of formation, the breccias mapped in this study are of collapsed paleocave origin based on breccia clast organization and matrix content.

Speleogenetic models are compared against observations of breccia distribution by direct field observations and mapping on sub-meter airborne light detection and ranging or lidar data. Point vectors were defined for every point within study area to highlight subtle changes in outcrop erosional profile for mapping geological features directly on the lidar point cloud. In addition, spectral data from airborne photography and hyperspectral image analysis were used assist in geological contact definition.

A digital outcrop model was constructed from 3D geologic mapping results from which spatial statistics were extracted and used to reconstruct collapsed paleocave breccia bodies. The resultant breccia geometries were compared against laser-scanned modern cave dimensions, from Devil's Sinkhole, Rocksprings, Texas, and used in analysis of conceptual models for cave formation.

The breccias of the southern Franklin Mountains follow linear trends that closely match Riedel shear fracture patterns predicted from right-lateral oblique compression. Stress orientations that match right-lateral oblique compression in the Phanerozoic of the El Paso region are related to the Laramide orogeny. The relationship of observed structures and the orientation of collapse breccias may indicate that southern Franklin Mountain breccia bodies are the result of a solution-enhanced tectonic karst system.