POLYGENETIC SPELEOGENESIS IN THE CASTILE FORMATION: EDDY COUNTY, NM AND CULBERSON COUNTY, TX

K. W. Stafford¹, P. J. Boston² and R. Nance³

¹Cave and Karst Studies, Department of Earth and Environmental Science, New Mexico Institute of Mining and Technology, Socorro, NM, 87801, kwstafford@juno.com
²National Cave and Karst Research Institute, Carlsbad, NM, 88220
³Carlsbad High School, Carlsbad, NM, 88220

The Permian Castile Formation crops out over an area of ~1800 km² in the western Delaware Basin, where it hosts extensive karst development in laminated, massive, and nodular gypsum fabrics, as well as in selenite, gypsite and biogenic limestone. Karst development ranges widely, including: sinkholes (filled and open), hypergenic and hypogenic caves, brecciation and calcitization. Combined field studies and GIS analyses have identified >3500 surficial karst manifestations and suggest >10,000 are probable; however, less than 10% are open and large enough to be humanly entered for study. Hypergenic karst is characterized by sinkholes and small caves that are laterally limited with rapid passage width decrease away from insurgences.

Hypogenic karst is reflected in larger caves with complex morphologies (e.g. risers, half-tubes and cupolas) indicative of confined dissolution. More than 1000 individual calcitized masses (i.e. biogenic limestone produced as a byproduct of bacterial sulfate reduction in the presence of hydrocarbons) have been documented, which indicate cross-formational fluid migration. Native sulfur and selenite masses are commonly found associated with calcitized evaporites.

Intense karst development, biogenic limestone and selenite commonly occur in clusters, suggesting a speleogenetic correlation between these features. A proposed polygenetic model for speleogenetic evolution is being developed, which includes: 1) Calcitization associated with upward migration of fluids along fractures; 2) Confined evaporite dissolution associated with fluid migration through brine density convection originating from porous biogenic limestone; 3) Selenite precipitation through oxidation of secondary sulfur in the presence of hypergenic fluids; and 4) Epigenic overprinting resulting from surface denudation and cave breaching.

2007 New Mexico Geological Society Annual Spring Meeting
April 13, 2007, Macey Center, New Mexico Institute of Mining and Technology, Socorro, NM
Online ISSN: 2834-5800