DISCUSSION: "POST-SPELEOGENETIC EROSION AND ITS EFFECT ON CAVES IN THE GUADALUPE MOUNTAINS, NEW MEXICO AND WEST TEXAS"

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DuChene & Martinez (2000) consider the erosional dissection of the Guadalupe Mountains as it affects the distribution and dimensions of known caves in each of three physiographically defined segments. They conclude that "long [defined as >8 km] cave systems probably once existed throughout the Guadalupe Mountains, but west of Rattlesnake Canyon erosion has mostly destroyed them..." Their paper contributes valuable data, but does not address an important question: is the distribution and size of known caves primarily controlled by erosional dissection (which could lead to the inference above), or by prior speleogenetic factors?

They state: "The longest known caves are in the eastern segment of the mountains where erosion has not cut deeply enough to expose cave-bearing strata..." This is true, but much more can be said about cause and effect relationships of Guadalupe cave distribution, which probably was not originally uniform through the mountains.

If one considers DuChene and Martinez's three segments in terms of verified cave distribution as well as physiography, their western and eastern segments can each be further subdivided. The new far western segment, from about McKittrick Canyon west (mostly coinciding with Guadalupe Mountains National Park) has about an order of magnitude fewer and smaller known caves than the eastern (Lincoln National Forest) half of their original western segment. The original eastern segment can be split east of Carlsbad Cavern. The short western sub-part contains Lechuguilla Cave and Carlsbad Cavern, each of which has at least an order of magnitude more passage length and volume than any other known Guadalupe cave. (In the area studied, these two are the only caves presently known that are "long" as defined by the authors.) The easternmost sub-segment has relatively few and short known caves.

For the original western segment, DuChene & Martinez say "If surface erosion and mass wasting followed the joint systems that controlled speleogenesis, then the largest parts of many of these caves have been destroyed." However, I have seen little demonstrable correlation between passage locations and surface geography in the Guadalupes. Surface canyons do not routinely align with cave passages. Over Lechuguilla and Carlsbad, the two least-dissected major Guadalupe caves, surface drainage patterns do not mirror the underlying cave voids (except for Bat Cave Draw).

DuChene & Martinez do not quantify the differences in erosional volume removal between the Guadalupe Mountains National Park and Lincoln National Forest halves of their western segment (~32% for the entire segment), but greater erosion alone does not appear to be sufficient to account for the roughly order-of-magnitude difference in cave length and size between these two sub-areas. Some of the discrepancy may reflect less exploration in the Park, but my personal observation does suggest sparser distribution of entrances and solution features there.

For the far eastern Guadalupes from Carlsbad Cavern northeast, long caves may remain undissected, but we have no direct evidence of that.

Speleogenesis in the Guadalupes has been episodic (Palmer & Palmer 2000); even within Carlsbad and Lechuguilla, voids and levels have limited interconnection and erratic distribution, and at least one interval of raft deposition intervened between episodes of dissolution. The watershed has also enlarged with uplift. It follows that the intensity of speleogenesis has varied from west to east as uplift proceeded. It is, thus, unlikely that cave abundance and size range were originally similar throughout the mountains. The numbers and sizes of caves we see now may owe at least as much to the configuration of hidden sulfuric acid sources, and to changes in hydrologic recharge, as they do to variations in exposure and destruction by erosion.

As I have mentioned (Davis 2000), the occurrence of subterranean rillenkarren in Carlsbad, Lechuguilla, and nearby Mudgetts Caves (and not in others to the west or northeast) suggests a higher paleotemperature gradient in the caves of that block, which in turn implies more intense speleogenesis (since the reactions involved in sulfuric-acid speleogenesis are exothermic). These caves may well be exceptional, and systems on that scale may not have been widespread in the overall range of Guadalupe speleogenesis. The caves destroyed by erosion in the western Guadalupes were not necessarily much larger than those surviving there at present.