

# Rapid cave formation by sulfuric acid dissolution

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Anti-creationist, Arthur Strahler, takes biblical creationists to task for not having enough time to dissolve limestone caves and deposit speleothems (e.g. stalactites & stalagmites). He writes:

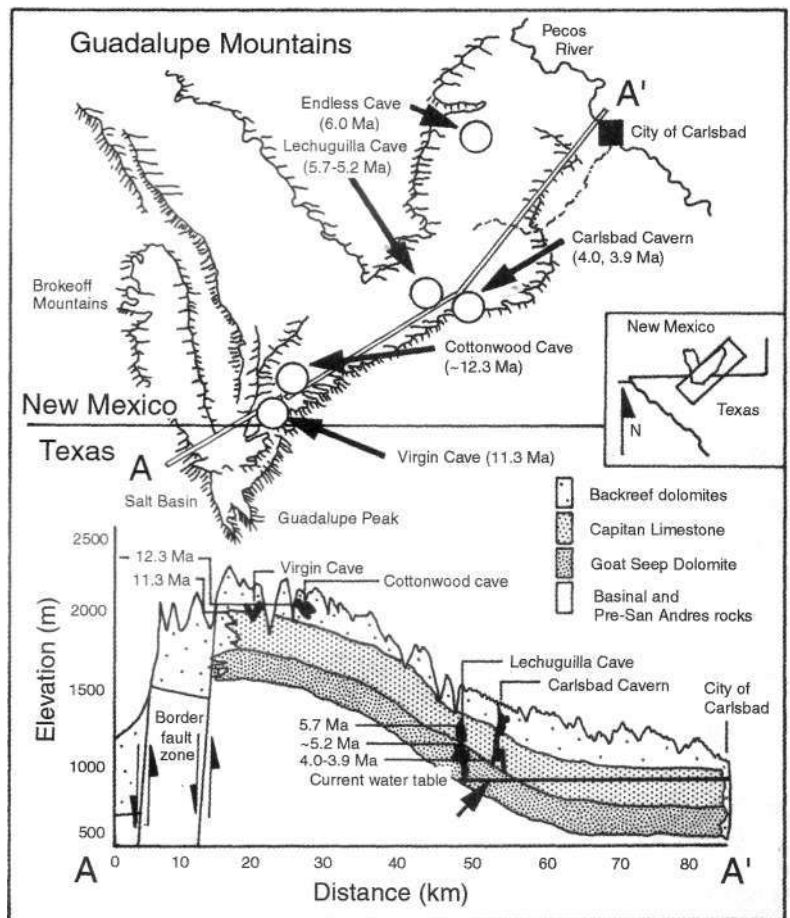
*If it can be shown that either the excavation of caverns or their subsequent filling must require a vastly longer time to accomplish than the post-Flood limit, literal acceptance of the Genesis chronology is untenable. We turn first to rates of removal of limestone by the process of carbonic-acid reaction.<sup>1</sup>*

The theory that caverns are dissolved by the percolation of CO<sub>2</sub>-rich ground water through joints or along bedding planes in the limestone, forming a weak carbonic acid that reacts with the limestone, is quite old. It is likely based on strict uniformitarianism, since carbonic acid is the only acid that forms in significant quantities in ground water today. Thus, carbonic acid dissolution has simply been assumed, although some scientists have admitted that the mechanism for cave excavation is unknown: *'Ground water forms caves, but exactly how is not known.'*<sup>2</sup> Modern textbooks continue to teach the above explanation for cave formation.<sup>3</sup>

A recent article<sup>4</sup> and accompanying commentary<sup>5</sup> add another variable to the origin of limestone caves that will be of interest to creationists. It appears that sulfuric acid has been primarily responsible for the excavation of at least 10 % of the caves in the Guadalupe Mountains of southeastern New Mexico and west Texas. This is especially the case for the larger caves, such as Carlsbad Cavern and Lechuguilla Cave (see Figure 1). This result is based on the discovery of the reaction products of sulfuric acid dissolution trapped in the cave. The sulfuric acid is formed by the oxidation of hydrogen sulfide in hydrothermal water. The reaction products include elemental sulfur, gypsum, hydrated halloysite, alunite, and other minerals. Alunite apparently can be dated by the <sup>40</sup>Ar/<sup>39</sup>Ar dating technique, which provided the incentive for geologists to investigate the above reaction products. The

<sup>34</sup>S/<sup>32</sup>S ratio indicates the hydrogen sulfide is biogenic.

What this means for creationists is that cave formation, in at least some cases, was much more rapid, since sulfuric acid is much stronger than carbonic acid. Sulfuric acid dissolution is not only postulated for the caves in the Guadalupe Mountains, but it is thought that 10 per cent of known major caves worldwide were carved out by sulfuric acid.<sup>67</sup> In the Guadalupe Mountains, the reaction occurred below the water table (phreatic zone), which is currently much lower. Thus, cave formation is not necessarily a post-Flood phenomenon as Strahler thought. It could have formed anytime after the limestone was first deposited in the Flood, since hydrothermal water would be expected to begin moving through the limestone soon after deposition. Furthermore, once the cavern is formed, deposition of speleothems, mainly flowstone, can also occur below the water table, which contradicts the



**Figure 1.** Map and profile of the Guadalupe Mountains of New Mexico and Texas. Numerous faults that have uplifted the block of carbonate rocks that make up the Guadalupe Mountains are north-northwest trending normal faults and define the western edge of the mountains (border fault zone in vicinity of Brokeoff Mountains) The Capitan Reef is exposed along the southeastern escarpment. Guadalupe Peak is the highest point in the mountains. Profile A-A' shows the general stratigraphy of the Permian rocks, location of four caves, and position of the present water table from Lechuguilla Cave to the city of Carlsbad (after Polyak et al.<sup>4</sup>)

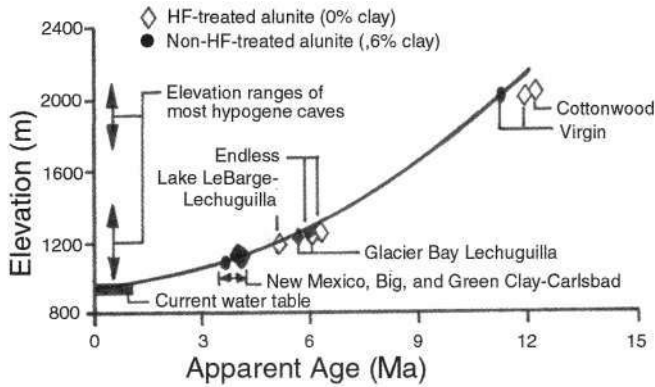


Figure 2. A plot of apparent ages versus elevation illustrates the strong correlation of elevation with alunitic age (after Polyak et al.<sup>4</sup>)

conventional wisdom.<sup>8</sup> The biological signature of the sulfur isotopes would also fit into the Flood scenario of rapid deposition and decay of plants and animals upon burial.

It is possible that many more than the postulated 10 % of caves worldwide were formed by sulfuric acid dissolution, because these types of caves are recognised in dry areas where some of the dissolution products remain in the cave.<sup>9</sup> However, in humid climates, the reactants may have been washed out of the cave. So, it is difficult to know whether a cave in a humid climate was excavated by sulfuric acid.<sup>10</sup>

It is of further interest that the dating of alunitite resulted in significantly older dates for Carlsbad Cavern and the other caves in the Guadalupe Mountains (see Figure 2). The new dates range from 4 to 12 million years (Ma) in the uniformitarian timescale.

Furthermore, alunitite ages increase and correlate strongly with the elevation of caves in the Guadalupe Mountains from 1090 m to 2040 m. Previously, the cavern was dated at 1.2-0.75 Ma,<sup>4</sup> or as much as 3 Ma based on the timing of mountain uplift.<sup>11</sup> The younger dates were not only based on field evidence, but also on paleomagnetic, uranium-series, and electron-spin-resonance dating.<sup>12</sup>

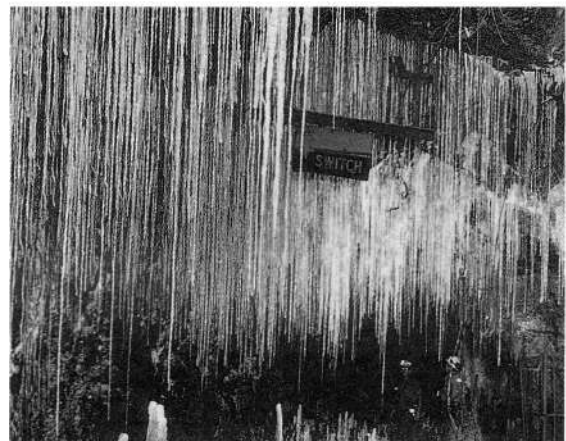
This does not give one much confidence in dating methods.

Sulfuric acid dissolution may have further creationist application in the rapid formation of karst topography, which forms approximately 10-20 % of the Earth's land surface.<sup>13</sup> Karst topography is caused by dissolution of subsurface bedrock, mainly carbonate, followed by subsidence and local collapse of the surface. Karst formation by sulfuric acid has been suggested by Carol Hill.<sup>14</sup> Sulfuric acid reactions may also be related to the rapid formation of some hydrothermal alteration products and ore mineralisation.<sup>14</sup>

References

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Rapid stalactite formation



Courtesy of Mount Isa Mines Ltd.

A 1977 picture at level 5 in the lead-zinc mine at Mt. Isa, north-western Queensland, Australia. Stalactites formed in less than 55 years (the age of the mine), by the continuous seepage of lime-saturated water through the porous dolomite rock. Miners with hard hats, bottom right, to give some idea of scale.