

# ***VOLCANICALLY INFLUENCED SPELEOGENESIS: FORMING EL SISTEMA ZACATÓN, MEXICO AND POZZO MERRO, ITALY, THE DEEPEST PHREATIC SINKHOLES IN THE WORLD***

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The two deepest phreatic karst sinkholes in the world, *Él Zacatón* in México (> 329 meters) and *Pozzo Merro* in Italy (392 meters), formed in similar geologic environments - thick Mesozoic carbonate platforms proximal to Pleistocene igneous rocks. Independent studies at these locations generated similar initial hypotheses linking recent volcanism to the karst development of these mega-sinkholes. The hydrothermal, sulfuric nature of both systems provides the initial impetus for a volcanically influenced speleogenesis theory, based on sulfuric acid dissolution. The karst area around *Pozzo Merro* has analogous characteristics to that of *El Sistema Zacatón*, including extensive travertine deposits, sulfur bacterial colonies, and water chemistry. *Él Sistema Zacatón* has over 20 major karst features, of which the most notable are large diameter (50-300 meters) circular sinkholes. The extreme depth of some of these features and their low elevation (the bottom of *Zacatón* is over 100 meters below sea level), when compared to similar Cretaceous carbonate rocks rimming the Gulf of Mexico, make it unlikely that karstification near the water table by meteoric waters could form such features. Initial strontium isotope data from the ground waters of *Sistema Zacatón* indicate lower  $^{86}\text{Sr} / ^{87}\text{Sr}$  ratios (0.70714 – 0.70724) than would be expected in Turonian (~90Ma) carbonates (0.70735). The lower values are attributed to mixing with volcanic groundwater. The shallower sinkholes appear to be covered with travertine “lids,” which possibly cover deep phreatic void spaces. Multi-electrode earth resistivity data collected on large travertine areas show that these lid morphologies are likely.