

## Forum

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**Figure 1:** The Tres Pueblos tiankeng, with the Rio Camuy flowing across its floor between large cave entrances.



**Figure 2:** The Tres Pueblos site when flooded following the rainfall deluge associated with Hurricane Maria. (Photo: Juan Toledo.)



**Figure 3:** The scale of flooding at Tres Pueblos, visualized by superimposing the Figure 2 photograph on Figure 1.

## Short communication

### Tiankeng flooding in Puerto Rico

Extreme weather conditions associated with Hurricane Maria had a massive impact on islands in the northeastern Caribbean in September 2017. On Puerto Rico the hurricane winds devastated most of the island's agriculture and wrecked the power infrastructure. When torrential rains associated with Hurricane Maria struck the island, hundreds of landslides were triggered, and around 3000 people died. Some 18 months after the event, the widespread damage is still visible. Recovery and restoration are far from complete at many sites, including at the Camuy Caves Park.

Las Cavernas del Rio Camuy is a major cave system in the heart of the spectacular fengcong cone karst that extends over a large part of northwestern Puerto Rico. The cave includes a series of large, abandoned, high-level galleries and also large, active, low-level streamways linking river sinks to the main rising; known passages total around 15km in length (though local tourist information makes bizarre claims of it being the third largest cave in the world!). Midway along the Camuy caves, the Tres Pueblos doline is some 180 metres in diameter with vertical perimeter walls that reach to 120 metres in depth. It qualifies as being a tiankeng, and has the Rio Camuy flowing across its floor (Fig.1).

During Hurricane Maria, more than 250mm of rain was dumped on the entire Camuy catchment within less than 48 hours. The result was flooding on a scale that may be unprecedented since the caves were explored by Russ Gurnee and friends in the 1960s. Details of the Maria flooding are not readily available, but a photograph records the Tres Pueblos tiankeng when it was more than half full of water (Fig.2). It appears that the water was around 60 metres deep, backed up behind narrows in the active streamway and overflowing through some of the normally dry high-level caves. Superimposition of the two photographs better depicts the scale of the flooding in the tiankeng (Fig.3).

Since the 1980s a short section of the downstream Camuy caves has been developed as a show cave. Its tourist trail passes along high-level passages between two large sinkholes, both of which are smaller than the Tres Pueblos tiankeng. Even though it was one of the island's major tourist sites, the Camuy Caves Park has been closed ever since the onslaught of Hurricane Maria. Little, if any, restoration work has yet been carried out at the cave, perhaps because a tourist site must necessarily be low on the priority list for hurricane damage repair work. Local opinion is that it will be many years, if ever, before the cave park can re-open.

There is a conspicuous lack of official information about the cave closure, but it appears that the show-cave paths and tourist facilities in the high-level caves were wrecked by the flood – and these are more than 50 metres above the level of the cave river. Clearly, neither those cave passages nor the Tres Pueblos tiankeng can yet be described as inactive features within the karst of Puerto Rico.

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