Identification of mud flood layers within stalagmites

Denniston et al. (1) provide an important contribution to the prehistoric record of rainfall and tropical cyclones (TCs) in northwest Australia. The authors identify mud layers within limestone stalagmites as evidence of cave flood events and associate these with the passage of TCs. There is little doubt that the prominent thicker layers of mud, some of which occur on the flanks of the stalagmites, were deposited during cave flood events. The methodology used to identify the other reported thinner (<0.5 mm) mud layers, however, is not clearly articulated. Nor is it clear if an objective methodology was used to identify flood layers that may be only several tens of microns thick.

Other studies of flood-deposited mud layers within stalagmites use fluorescence microscopy to identify these features (2, 3), as many of these layers can be very thin (<100 μ). One of these studies (2) used a series of epi-fluorescence photomicrographs of the stalagmite surface, which registered a distinct reduction in fluorescence at the site of a mud layer because of the lack of humic acids within these clays. Humic acids are often incorporated into a layer deposited by drip waters as these waters have percolated through soil above the cave. Floodwaters have reduced amounts of humic acids and fluorescence microscopy can be used to objectively differentiate clays deposited by floodwaters as opposed to those incorporated within cave drip water.

Denniston et al. (1) report numerous mud layers between <0.5 mm and >1 mm thick. Whereas the relatively thick mud layers (>0.5 mm) will be obvious, there could be many other mud layers that are much thinner. In their study, stains (Type 0) that did not appear to contain appreciable mud were recognized and not included in the flood record. However, it is possible that there were also many mud layers that would not have been visible without detailed fluorescence microscopy. Many mud layers identified in other studies (2, 3), for example, were between 10 and 200 μ thick and were layered within annual calcite couplets. Such mud layers, which were included in these flood records, would be difficult to identify without the fluorescence microscopy techniques. Even though Denniston et al. (1) did compare their Type 0 stains with the mud layer record and found no appreciable change in flood behavior over time, it would have been interesting to examine the flood record in their stalagmites using the epi-fluorescence photomicrograph technique, as many more flood layers may have been identified.

Denniston et al. (1) suggest their flood and TC record supports the view that the medieval period (9th to 15th centuries) was dominated by enhanced La Niña-like conditions across the equatorial South Pacific. Other studies (4, 5) have suggested the opposite, with this period dominated by enhanced El Niño-like conditions. Flood and TC records, such as that presented by Denniston et al. (1), are crucial to help resolve this issue. Using fluorescence microscopy to identify thinner, less obvious flood layers may have revealed a different pattern of floods and TCs.

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