

2300 years of tropical cyclone rainfall and cave flooding events in Yucatán, Mexico recorded by a muddy calcite stalagmite

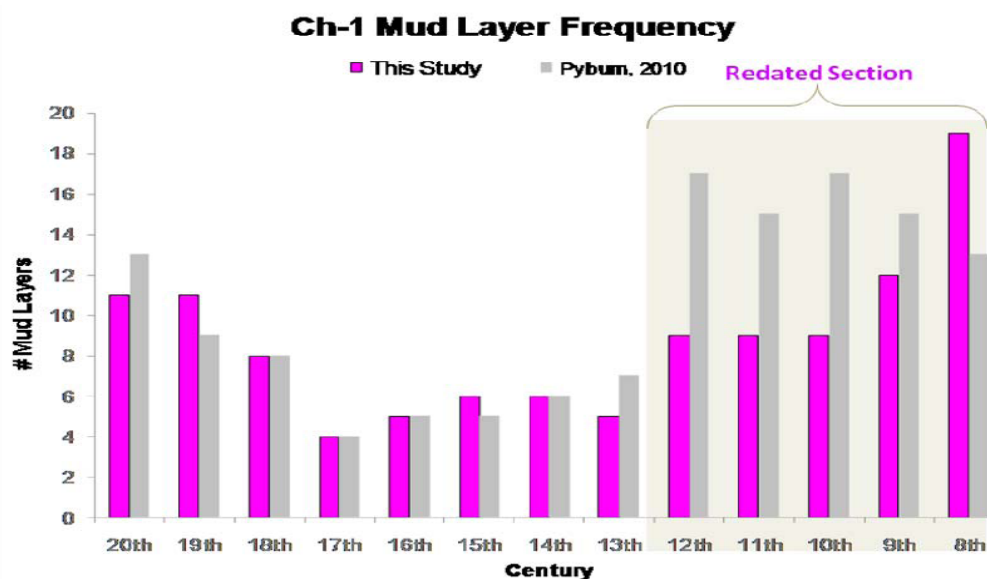
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We have developed an annually-resolved stalagmite paleotempest record of flooding events in Chaltun Ha cave in Yucatán, Mexico from about 300 BC to 2007 CE. We present a conceptual model for emplacement of mud layers in the stalagmite, assess the tropical cyclone proxy's reliability and limitations during the historical-era, and present a ~2300 year record of variability in the frequency of storms generating substantial floods in this cave. This record is then compared to independent records of paleohurricane activity in the Atlantic Basin, including centennial to millennially resolved overwash records from Viequez, the US Gulf and Atlantic coasts, and Bentley and Denommee's new annually-resolved record from the Blue Hole in nearby Belize. We note that the Chaltun Ha record shows that cave flooding events were much more frequent during the first millennium of the record, suggesting that tropical cyclone activity at this site was higher than the 20th century between one and two millennia ago.

Age models are used to translate stratigraphic depth measurements into the time domain. Centennial storm frequency bins were created from the Chaltun Ha mud layers using two different age models: first, our initial radiometrically derived linear age model, and then after performing annual layer counting to assign calendar ages to each mud layer in the stalagmite. Figure 1 shows that centennial to millennial scale patterns are rather different: The initial linear age model indicates a dramatic drop in cave flood frequency during the Little Ice Age, but the calendar-year dating shows greater variability and a gradual decrease in flood frequency. We



discuss these results as a cautionary tale for those interested in the use and interpretation of paleotempestology proxy records to study the temporal evolution of hurricane-climate interactions.