

Tropical Climate Dynamics and Civilizations

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We are starting to make a serious effort to combine high-quality climate data with archeological information to study the impact of climate on societies. One tropical climate archive with an appropriate memory for the most relevant sub-centennial to sub-decadal scale climate swings is the anoxic Cariaco Basin off northern Venezuela. Millimeter to micrometer-scale geochemical data in the laminated sediments of the Cariaco Basin have been interpreted to reflect variations in the hydrological cycle and the mean annual position of the Intertropical Convergence Zone (ITCZ) over tropical South America during the past millennia. These data with decadal to (sub)annual resolution show that the Terminal Collapse of the Classic Maya civilization occurred during an extended dry period. In detail, the Cariaco record reveals evidence for three separate droughts during the period of Maya downfall, each lasting a decade or less. These data suggest that climate change was potentially one immediate cause of the demise of Mayan civilization, with a century-scale decline in rainfall putting a general strain on resources and several multi-year events of more intense drought pushing Mayan society over the edge.

We also present a new data set of comparable quality and resolution from Southern China. In the sediments of lake Huguang Maar in coastal southeast China, the titanium content and redox-sensitive magnetic properties record the strength of winter monsoon winds at subdecadal resolution over the last 16 thousand years. The record indicates a stronger winter monsoon prior to the Bølling-Allerød warming, during the Younger Dryas, and during the middle and late Holocene, when cave stalagmite oxygen isotope data indicate a weaker summer monsoon. The anti-correlation between winter and summer monsoon strength is best explained by migrations in the ITCZ that occurred simultaneously in central America and Africa. Drought associated with southward ITCZ migration may have played a role in the termination of several Chinese dynasties. A remarkable similarity of ITCZ migration in east Asia and the Americas from 700 to 900 AD raises the possibility that the coincident declines of the important Tang Dynasty in China and the Classic Maya in Central America were catalyzed by the same ITCZ migrations.