



New insights of the Heinrich events inferred by speleothems from Northeast Brazil

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Heinrich events (HEs), characterized by massive and rapid ice-rafted debris from Laurentide Ice Sheet into the Labrador Sea as far south as the Iberian Margin, are observed in some stadial periods during the last glacial, however, it is still unclear regarding to the trigger and response mechanism of the HEs. A landmark work by Wang et al. (2004) was one of the first studies to associate tropical rainfall in southern Hemisphere with HEs, showing wet periods in tropical northeastern Brazil, a region that is currently semi-arid but very sensitive to the hydroclimate changes related to the cold events occurred in the northern Hemisphere, are synchronous with HEs in the North Atlantic. After two decades, we have a new chance to study the relationship between hydroclimate in NE Brazil and cold events in the North Atlantic in the light of much more new speleothem records obtained from TBV and TBR caves, NE Brazil. Here we show evidence of stalagmite growth periods and $\delta^{18}\text{O}$ records during the last 90 kyrs from NE Brazil, in addition to the HEs observed by Wang et al. (2004), we have newly found wet periods during the HE2 and HE3 and GS 5-8 that were not discovered before. It indicates that previous conclusions that the orbital insolation also modulated these events on millennial timescales need to be reinterpreted, and also provides new insights to understand the mechanisms of the HEs and why the HEs only occurred in some Heinrich Stadials. Additionally, we also compare detailed structures of each HE inferred from cave $\delta^{18}\text{O}$ records in NE Brazil with sea surface temperature and other records in the Atlantic realm, which deepens our understanding of the trigger-response mechanisms of the HEs and its effect on the hydroclimate in the NE Brazil.