



High-resolution paleo-precipitation records of late MIS3 inferred by isotopic analyses of stalagmites from Northwestern Vietnam

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Karst area located in northwestern Vietnam is geologically well-known as a tectonically extruded block apart from its counterpart: Permian limestone distributed in Yunnan, southern China. It has long been geographically stabilized since its early sinistral movement ceased in middle Miocene. Its distribution covers latitudes roughly from 21 to 23 degree north where is currently located within the summer ITCZ. Enormous karst caves are formed due to the sufficient groundwater replenishment and speleothems are consequently developed including stalactite or stalagmite. With the purpose of understanding the paleo-precipitation changes in respond to the evolution of the global climate change, we collected stalagmites and used geochemical analyses to conduct sequential isotopic values and corresponding ages. Two of them within the age range from 22ka to 33ka display continuous records of precipitation in this period. Global climate events: the Heinrich events II, III and Dansgaard-Oeschger events 3 and 4 can be recognized in our records, similar to other speleothems collected in low latitudes. However, the changing patterns including starting time, rate, and duration are different from place to place when comparing with other geographical records. Also, our high-resolution results obviously exhibit centennial-scale events. According to the previous studies the Oxygen isotope record of speleothem is mainly controlled by the precipitation changes in this latitude. We believe those explicit features found in northwestern Vietnam are related to the strength variation of Asia Summer Monsoon, which is governed by the global climate forcing in both scales of millennium and centennial.