

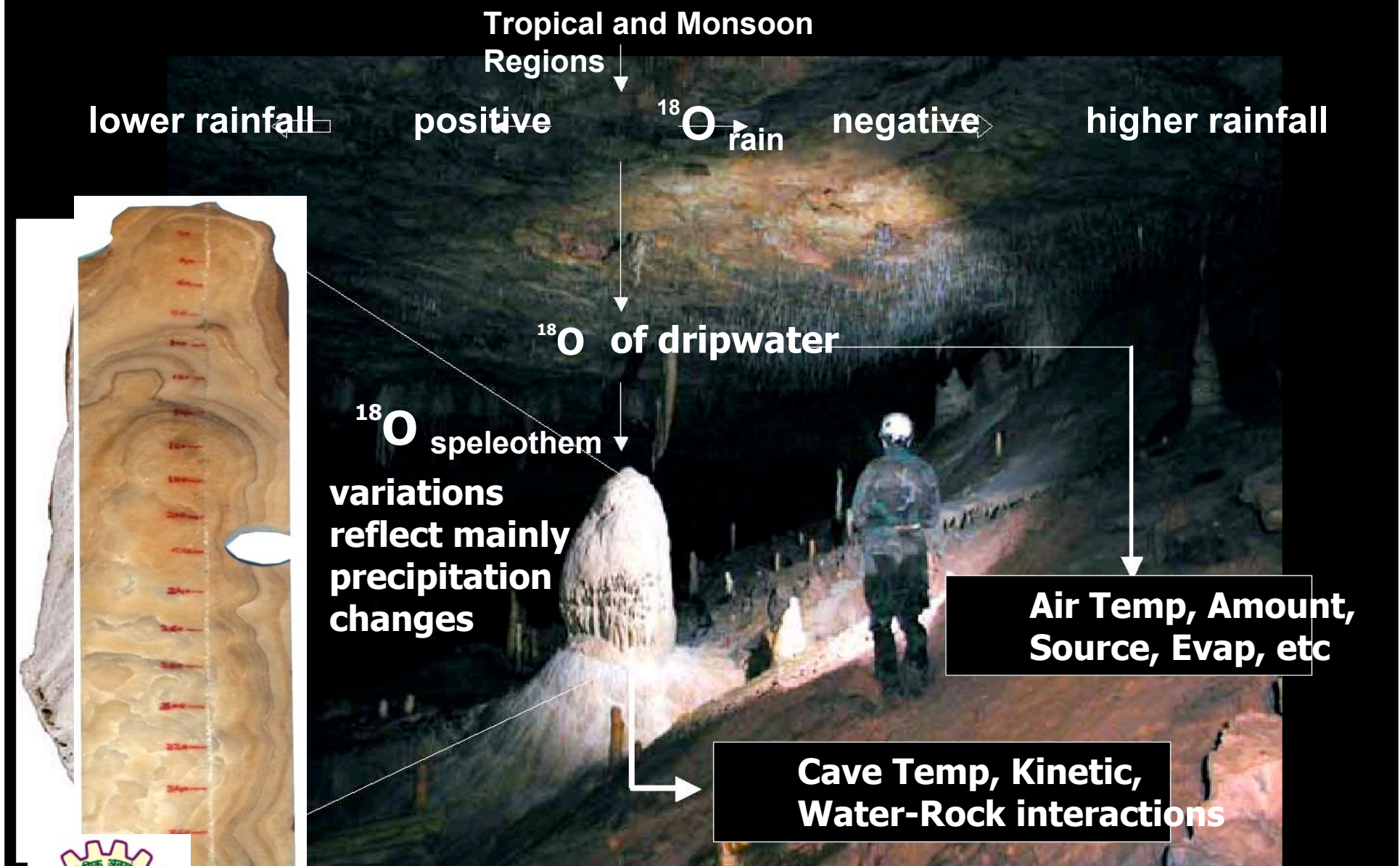
Paleomonsoon variations in Himalaya during ~ 2300 to ~ 800 yrs BP: Inference from oxygen and carbon isotopes of speleothem

V.M. Padmakumari, S. Masood Ahmad, Waseem Raza,
G. Suseela & Netramani Sagar

*National Geophysical Research Institute (C.S.I.R.)
Hyderabad, India*



Speleothems as Climate Proxy



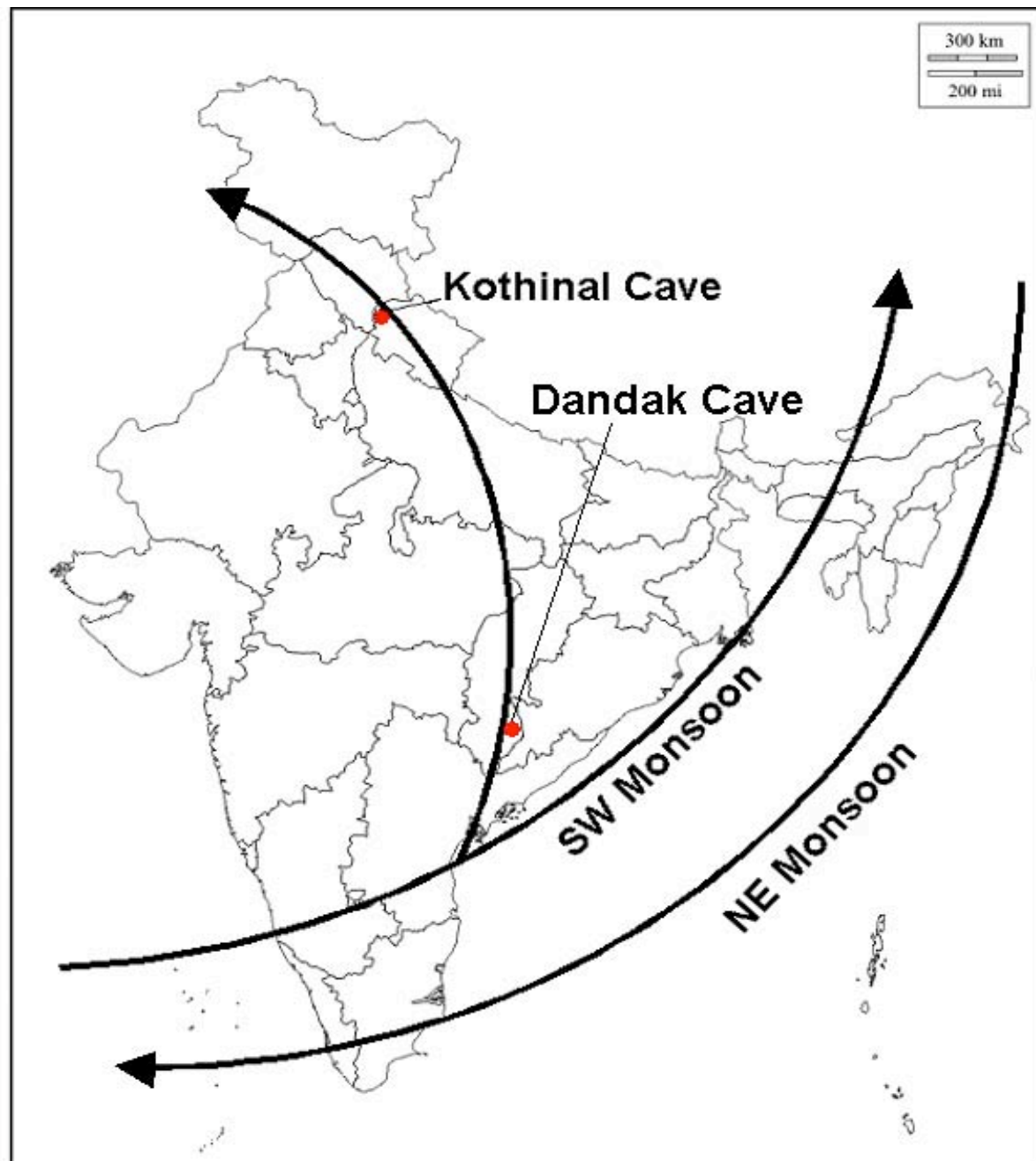
- * **Recent studies have shown that speleothems can be excellent archives of rainfall compared to marine proxies.**
- * **The instrumental records (~ 150 yrs) of ISM reveals strong interannual to multi-decadal climate variability.**
- * **Longer records of ISM variability are important in order to evaluate the longer intervals of monsoon failure of the past and assess future risk. However there is a scarcity of data for the last 2 kyr.**
- * **Oxygen isotopic compositions ($\delta^{18}\text{O}$) of speleothem from tropical regions is primarily controlled by the $\delta^{18}\text{O}$ of the precipitation and/or fraction of the water vapour removed from maritime air masses as they move away from their source region.**



- * **In tropical caves, $\delta^{18}\text{O}$ of calcite layers on a growing speleothem is depleted with increasing precipitation.**
- * **$\delta^{13}\text{C}$ in speleothems depend upon type of vegetation (C3 or C4), dripping rate of water, rate of bedrock dissolution and seasonal variations in the soil pCO_2 in a complex fashion.**
- * **Several continental and marine climate records indicate pronounced shifts in ISM intensity throughout the Holocene.**
- * **Paleomonsoonal reconstruction studies from the North Indian Ocean sediments suggest a considerable decrease in the monsoon intensity over the last 2 kyr followed by an increase in last ~400 years.**







Kothinal cave : **N 30° 48'**
E 78° 01'

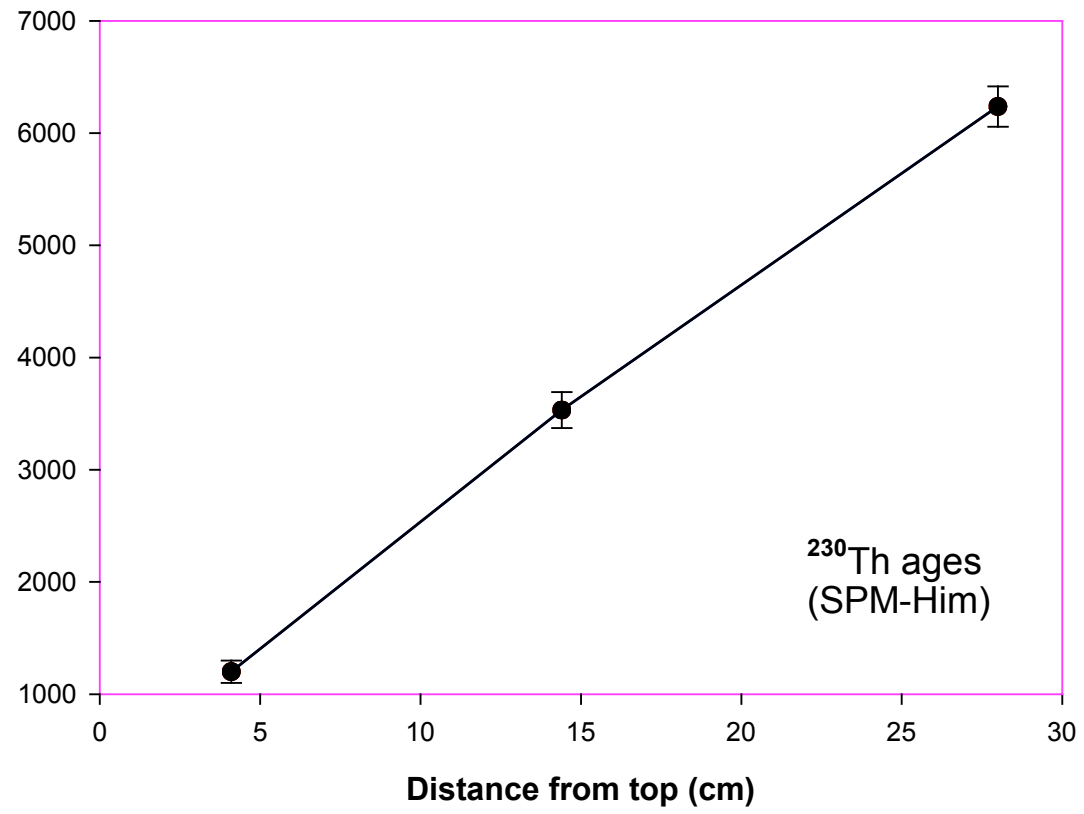
Altitude : **1927 m**

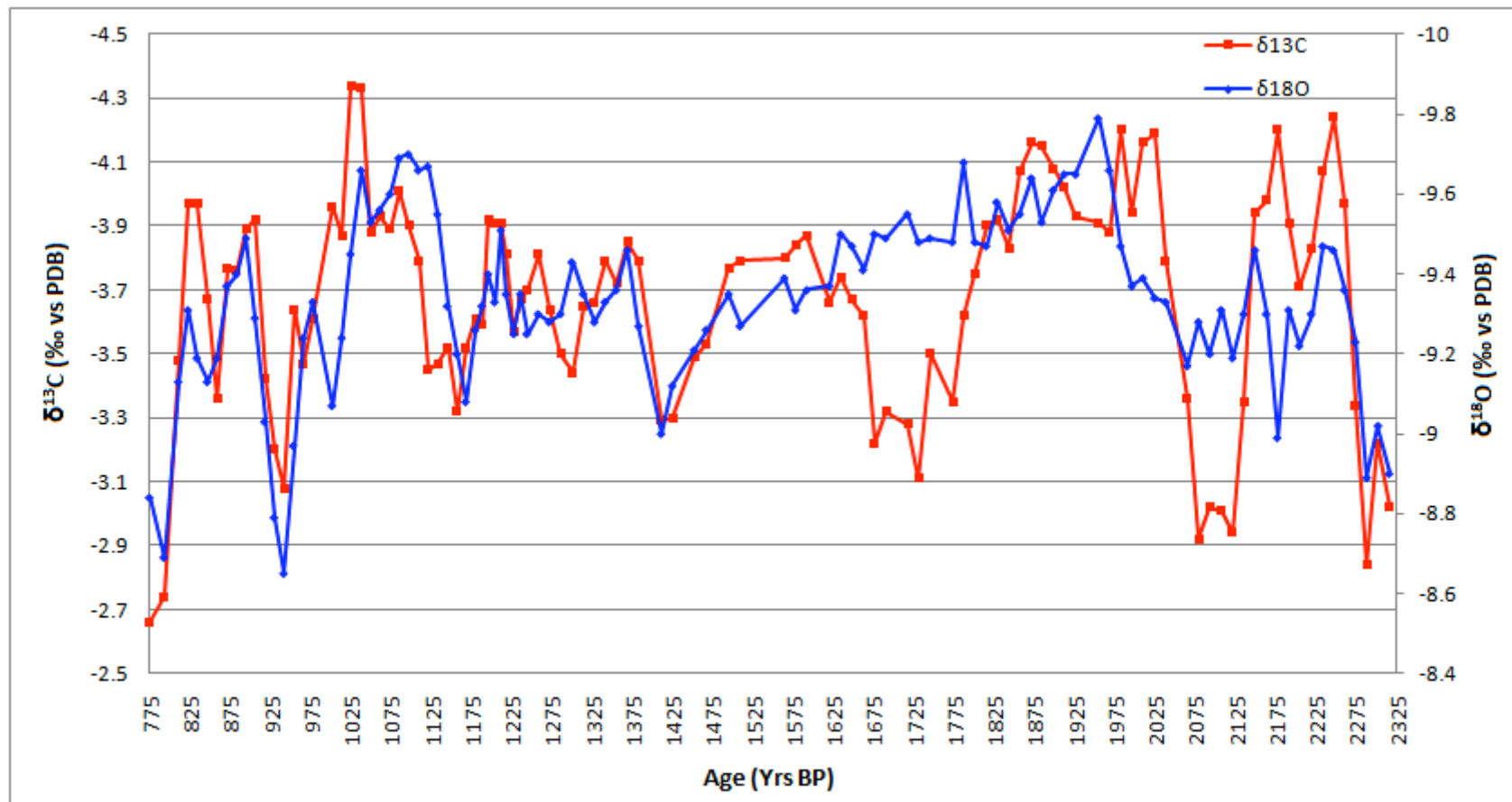
Annual Rainfall : **~ 150 cm / yr**

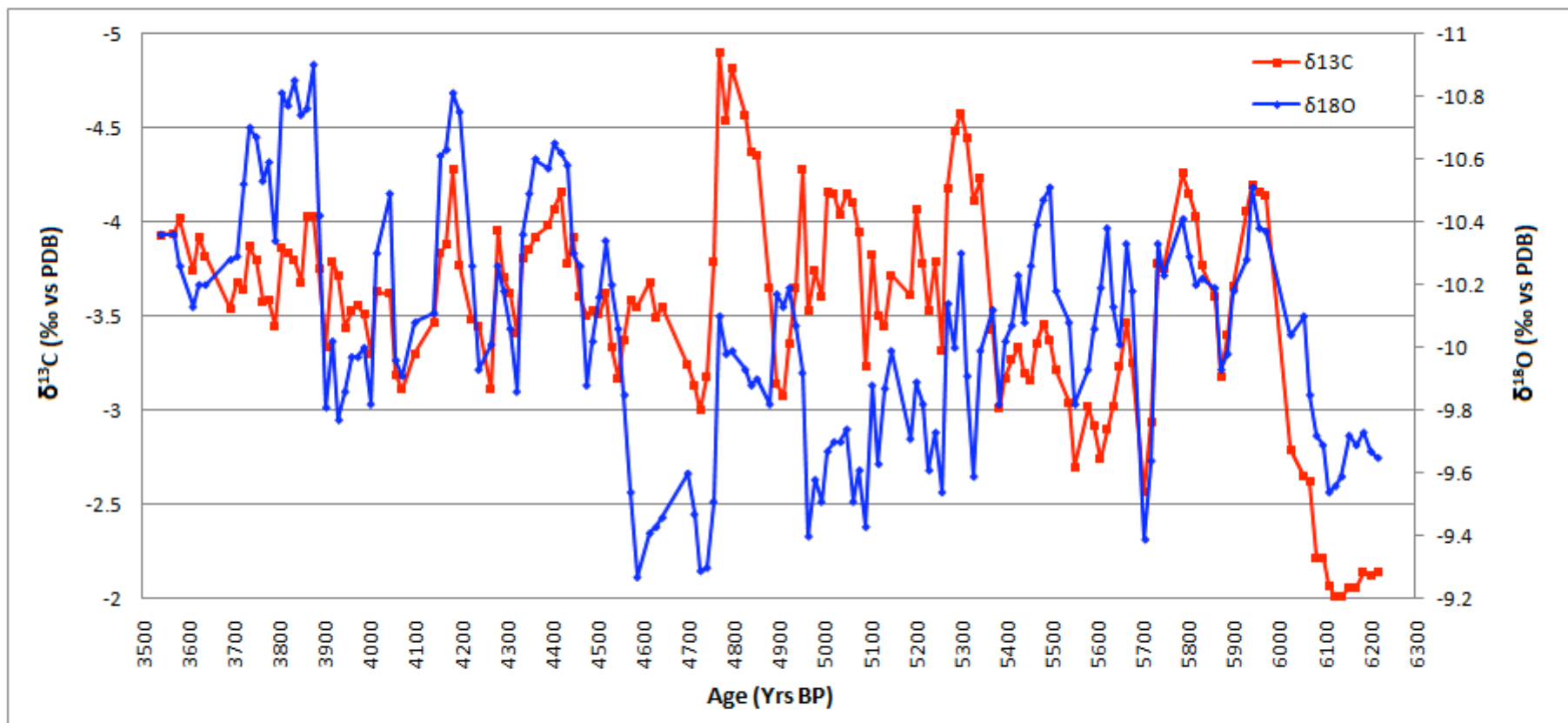
Host Rock : **Limestone (20 m thick cover)**

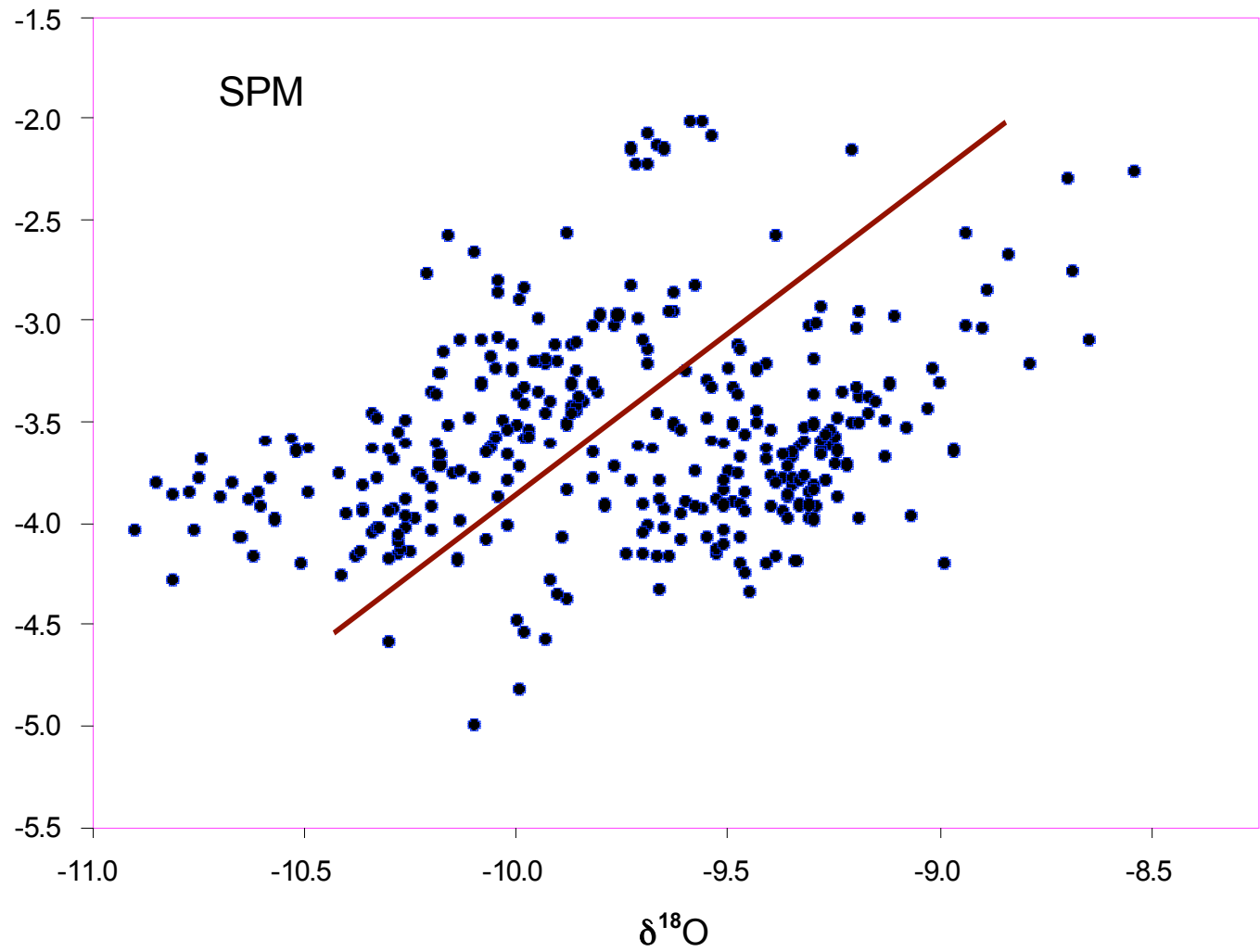
Vegetation cover : **Oak, Xerophytic plants**



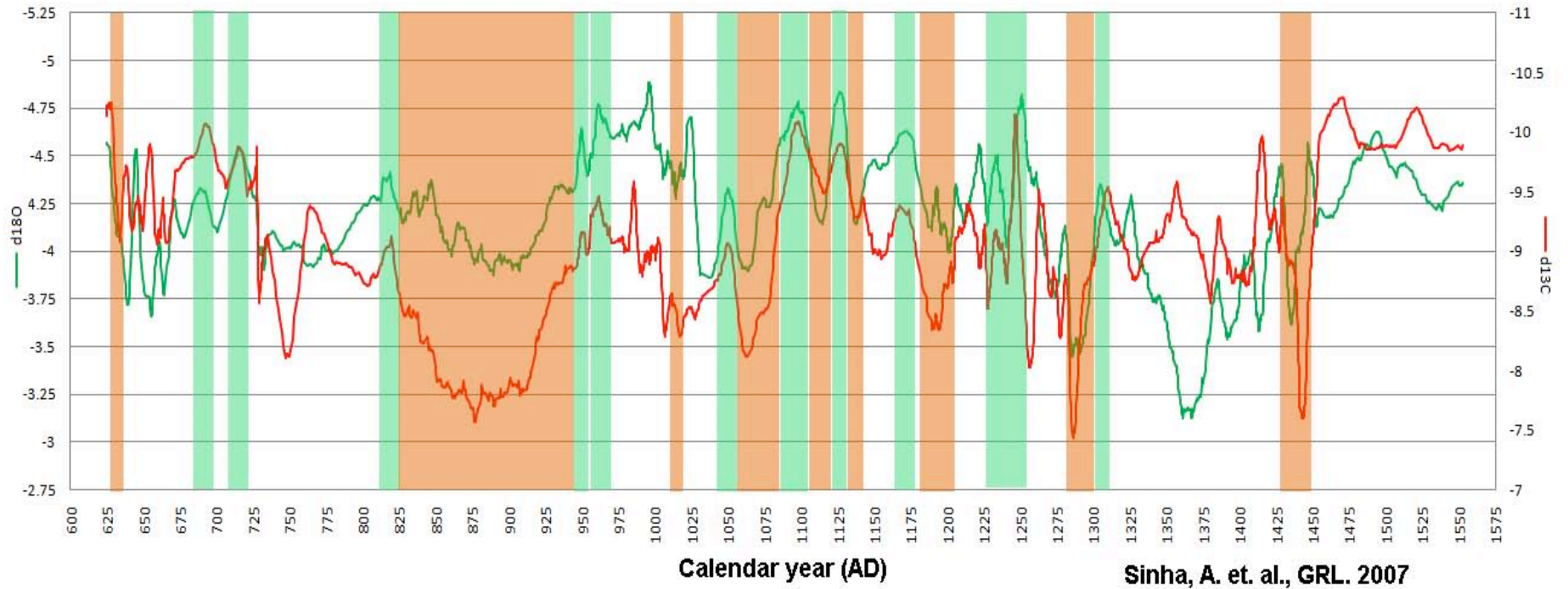




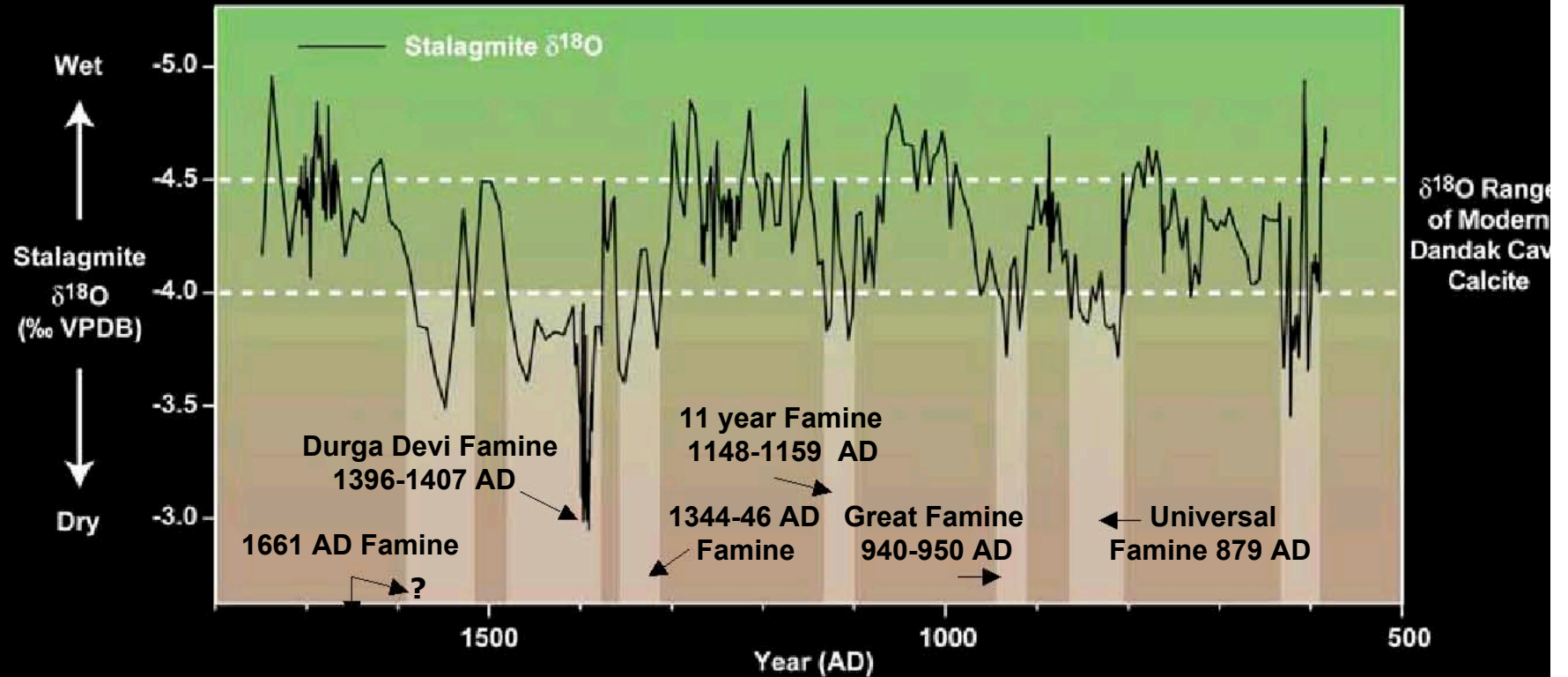




Dandak Cave



Dandak Cave Indian Monsoon Precipitation Record

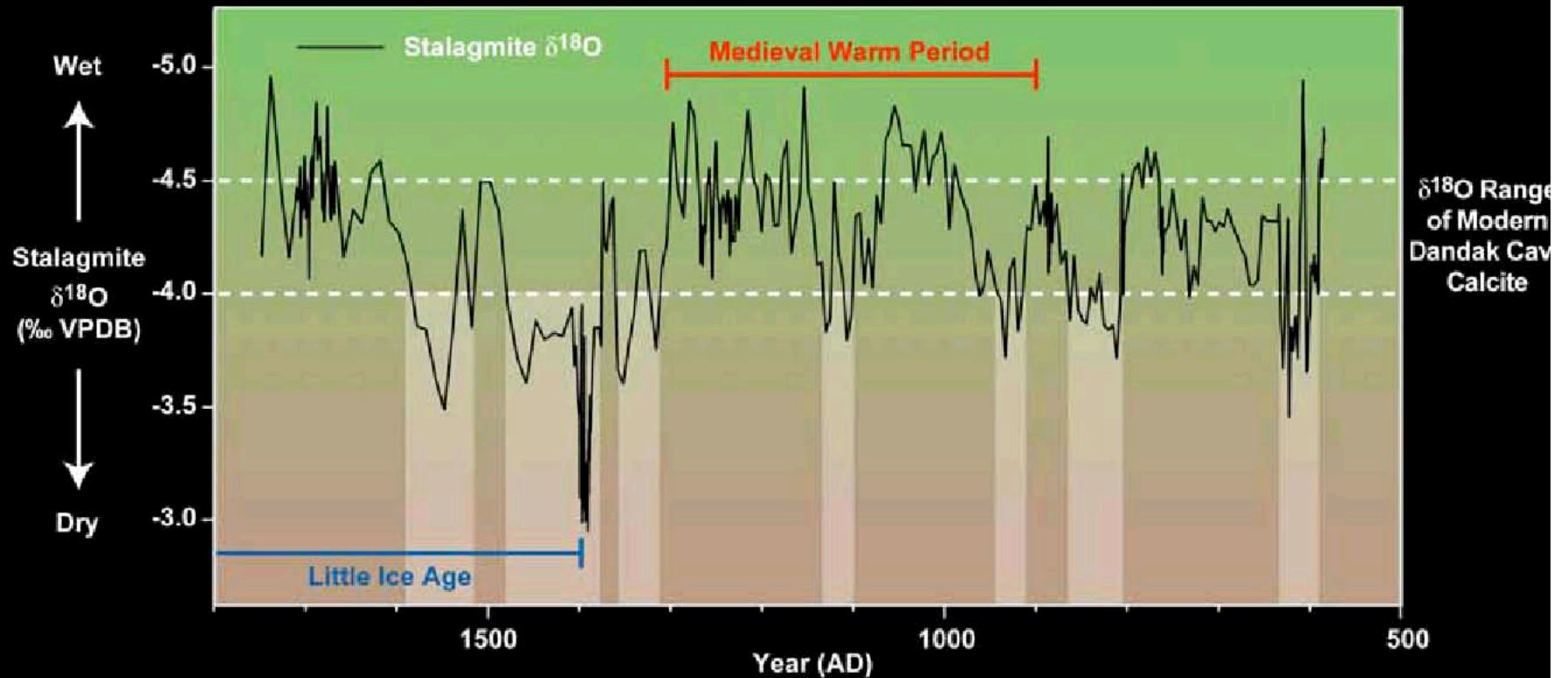


Multi-Decadal to Centennial Length
Episodes of Reduced Monsoon Rainfall

Theoretical and Observational Considerations
Suggest Rainfall Reduction of 15-30% Compared
to the Present - amounting to 'Mega-Droughts'

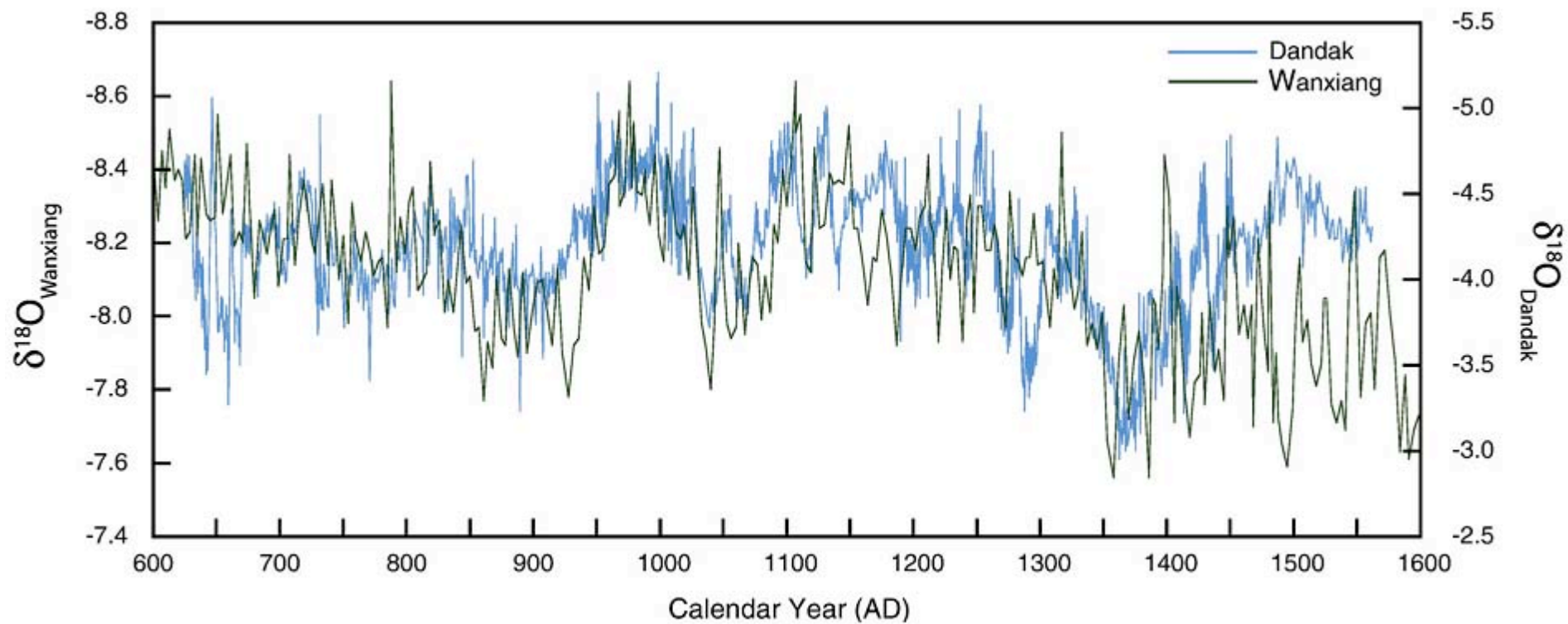


Dandak Cave Indian Monsoon Precipitation Record



Longer intervals of more reduced rainfall during LIA compared to MWP





Berkehamer, M. et. al., EPSL, 290: 2010



Conclusions

- Our record and other speleothem records suggest large changes in the Indian monsoon rainfall for the last 2000 years.
- Oxygen isotopes through time clearly identify dry and wet conditions.
- There is a positive correlation between $\delta^{18}\text{O}$ and $\delta^{13}\text{C}$ suggesting that both tracers are controlled dominantly by the rainfall.
- Positive pulses in oxygen isotopes in Dandak speleothem coincides with the past famine events.

Thank You