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What drives vegetation changes in South Sulawesi during the MIS 5e transition?

Alena Kimbrough[1,2], Michael Gagan[1,2,3], Gavin Dunbar[4], Pauline Treble[5,6], Wahyoe Hantoro[7,1,3], Jian-xin Zhao[3], R. Lawrence Edwards[8], Chuan-Chou Shen[9,10], Bambang Suwargadi[7], Henri Wong[5], and Hamdi Rifai[11]

[1]University of Wollongong, School of Earth, Atmospheric and Life Sciences (SEALS), Faculty of Science, Medicine and Health, (akimbrough@uow.edu.au)

[2]Research School of Earth Sciences, The Australian National University, Acton, ACT 2601, Australia

[3]School of the Environment, The University of Queensland, Brisbane, QLD 4072, Australia

[4]Antarctic Research Centre, Victoria University of Wellington, Wellington 6140, New Zealand

[5]Australian Nuclear Science and Technology Organisation, Lucas Heights, NSW 2234, Australia

[6]School of Biological, Earth and Environmental Sciences, UNSW Sydney, Kensington, Australia

[7]Research Center for Geotechnology, Indonesian Institute of Sciences, Bandung 40135, Indonesia

[8]School of Earth and Environmental Sciences, University of Minnesota, Minneapolis, MN 55455, USA

[9]High-Precision Mass Spectrometry and Environment Change Laboratory (HISPEC), Department of Geosciences, National Taiwan University, Taipei 10617, Taiwan ROC

[10]Research Center for Future Earth, National Taiwan University, Taipei 10617, Taiwan, ROC

[11]Department of Physics, Universitas Negeri Padang, Padang 25131, Indonesia

Sulawesi speleothem carbon isotopes ($\delta^{13}C$) are found to co-vary with deglacial warming and atmospheric CO_2 measured from Antarctic ice cores. This co-variation has thus far been attributed to speleothem $\delta^{13}C$ recording changes in vegetation productivity and microbial activity in the soils overlaying caves as vegetation and microbes respond to glacial-interglacial changes in temperature and atmospheric CO_2 (Kimbrough et al., 2023; Krause & Kimbrough et al., in press). However, the relationship between speleothem $\delta^{13}C$ and regional environmental change is complex and deconvolving the effect of different environmental drivers is difficult. To further investigate the ecosystem response in the Indo-Pacific Warm Pool to substantial warming and CO_2 rise during the penultimate deglaciation/marine isotope stage 5e (~127 kyrs ago) we use complimentary geochemical proxies extracted from stalagmite $CaCO_3$. These proxies include phosphorus and sulphur which respond to nutrient uptake by forest biomass above the cave (Treble et al., 2016). The relative abundance of metals such as copper, iron, zinc, and lead are assessed as another means to track biomass/soil regeneration via selective element delivery to the stalagmites by organic colloids flushed from the soil zone (Borsato et al., 2007). These vegetation proxies are compared with the speleothem $\delta^{13}C$ and $\delta^{18}O$ records and corresponding high-resolution fluorescence mapping of organics via confocal laser scanning (fluorescence) microscopy (Sliwinski & Stoll, 2021). The comparison of transition metals to stable isotopes ($\delta^{18}O$, $\delta^{13}C$) in the Sulawesi speleothem records makes it possible to distinguish between periods in the record

where vegetation productivity increased in response to a rise in temperature and CO_2 verses periods where changing hydroclimate played a more dominant role. Characterising the appropriate drivers and proxy response is critical to accurately interpret tropical paleoclimate records where interpretations rely on assumptions that rainfall is the primary driver of vegetation change.

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