WHAT CAN LAKE MUD FROM BOLIVIAN JUNGLES TELL US ABOUT QUATERNARY ENVIRONMENTAL CHANGE IN TROPICAL SOUTH AMERICA?

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ABSTRACT: Lowland Bolivia occupies a highly significant biogeographic position in South America, that encompasses climatically-sensitive ecotones between evergreen Amazonian rainforests to the north and seasonally-dry forests and savannas to the south. Fossil pollen records from this region can therefore provide important insights, not only into the Quaternary biogeographic history of these globally-important tropical ecosystems, but also the patterns and drivers of glacial-Holocene climate change in tropical South America. In this talk I synthesise the palaeoclimatic records of several lakes analysed by my research group over the years, based, not only on pollen, but also diatoms and charcoal. The three sites I focus on are: Lagunas Bella Vista and Chaplin, in Noel Kempff Mercado National Park of NE Bolivia, and Laguna La Gaiba, in the western Pantanal wetlands on the Bolivian/Brazilian border. I examine three key time periods – the Last Glacial Maximum (LGM), the glacial-Holocene transition, and the early-mid Holocene dry period.

Between ~ 45.0 and 19.5 kyr BP, the climate of lowland Bolivia was both colder and drier than present, supporting open herbaceous vegetation (e.g. savanna/grassland) in place of tropical forest. Immediately following the LGM, at 19.5 kyr BP, tropical forests expanded, marking the onset of deglacial warming (by 4ºC) to near-present temperatures. This evidence for early deglacial warming in lowland Bolivia corroborates central Andean climate archives, strengthening the evidence that warming in Southern Hemisphere Tropical South America (SHTSA) preceded deglacial warming in the Northern Hemisphere by ~ 5.0 kyr. However, the Pleistocene climate in the lowlands remained drier than present until 12.8 – 12.2 kyr BP, when rising lake levels marked the onset of wetter Holocene conditions – a pattern that contrasts with the robust and well-dated speleothem records of NE and SE Brazil and lake-level records of the central Andes (e.g. Titicaca) which instead demonstrate a wetter-than-modern climate during the global LGM (~ 21 kyr BP), in tune with the ~ 20-kyr precessional orbital cycle. Possible reasons for these differing LGM climate signals are explored.

In contrast to this strong geographic variation in LGM precipitation across the continent, there is widespread consistency across tropical South America for early-mid Holocene drought between 10 – 3 kyr BP, although the severity of this drought in lowland Bolivia was not as severe as that of the late Pleistocene. This early-mid Holocene drought caused compositional changes to Bolivia's seasonally-dry tropical forests, but did not disrupt the forest biome. The extent to which these palaeovegetation data serve as a useful analogue for likely tropical forest responses to predicted future climate change is considered.