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A 35,000 YEAR RECORD OF CLIMATIC CHANGE RECORDED BY BACTERIAL MEMBRANE LIPIDS IN AMAZON FAN SEDIMENTS

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Reconstructing Amazon basin paleoclimatic change is important for a number of reasons. Firstly, the basin's forests are a major component of the global carbon cycle and are characterised by remarkable biodiversity and endemism. Secondly, it is a principle component in the global hydrological cycle. Huge volumes of water are discharged into the ocean by the Amazon river. Even more water is recycled in the basin through the precipitation/evaporation cycle; this vents latent heat energy into the atmosphere and is a key driver of atmospheric circulation. Thirdly the regional excess of moisture results in >10^5 km^2 of tropical wetlands (which at least doubles in area during the rainy season); such wetlands represent a major source of atmospheric methane.

In order to provide a multiproxy 35 kyr record of terrestrial paleoclimatic change from the Amazon basin, analysis of glycerol dialkyl glycerol tetraethers (GDGTs) was carried out on sediment recovered from Ocean Drilling Program (ODP) Site 942 (Amazon fan, 5°45'N, 49°6'W). The GDGTs include those with methyl-branched alkyl components, derived from unknown terrestrial bacteria (present worldwide in peat bogs and soils) which have been fluvially transported from the Amazon basin and sequestered in the Amazon fan. The catchment area supplying sediment to the Amazon fan covers a large portion of South America, including vast areas of tropical forests and wetlands; hence proxy records from ODP 942 potentially provide a spatially averaged terrestrial signal of major significance. The preliminary down-core GDGT-proxy data are illustrated in Figure 1; we use recently developed indices that predict changes in: the relative fluvial input of terrestrial organic material (BIT index); annual mean air temperature (MAT) and soil pH. We also use the ratio of branched GDGTs/ *n*-alkanols and taraxerol/ *n*-alkanols as qualitative proxies for the relative inputs of wetland and mangrove material, respectively. Relative terrestrial inputs decrease (BIT index) as the continental shelf floods and the mouth of river becomes more distal from site 942. MAT varies between ~22 and 25°C up to 11 kyr, but drops to ~13°C at the start of the Holocene. This reflects a change in sediment supply from a warmer central/

eastern Amazonian source to a cooler Andes/ western Amazonian source due to retreating alpine ice in the early Holocene and associated discharge of Andean sediments. Prior to this major change in sediment sources the record indicates a glacial to interglacial temperature increase of ~5°C, consistent with pollen and geochemical reconstructions from the Amazon. In the glacial the soil pH varies between 5.4 – 6 but it increases dramatically from 13 to 11 kyr; this is possibly related to an inferred ~40% decrease in effective moisture in the Amazon basin (Maslin and Burns, 2000). pH again drops in the early Holocene, probably due to the large influx of acidic Andean soils.

The ratio of branched GDGTs to *n*-alkanols exhibits a more complex record. The ratios increase between 18-15 kyr, possibly suggesting a wetland expansion. After 15 kyr BP, sea-level rises rapidly and the large continental shelf becomes submerged; this is associated with a decrease in the relative abundance of GDGTs, perhaps due to a loss of coastal wetland environments. As sea-level continues to rise there is second major increase in the inputs of GDGTs, but this one also coincides with an increase in mangrove material (taraxerol/ *n*-alkanols), suggesting a breaching of fringing mangroves resulting in major erosion of wetland and mangrove material. The post-glacial increase in wetland biomarkers recorded in ODP 942 suggests that the propagation of tropical wetlands, on continental shelves, may have been a key source of the post-glacial increase in global atmospheric methane.

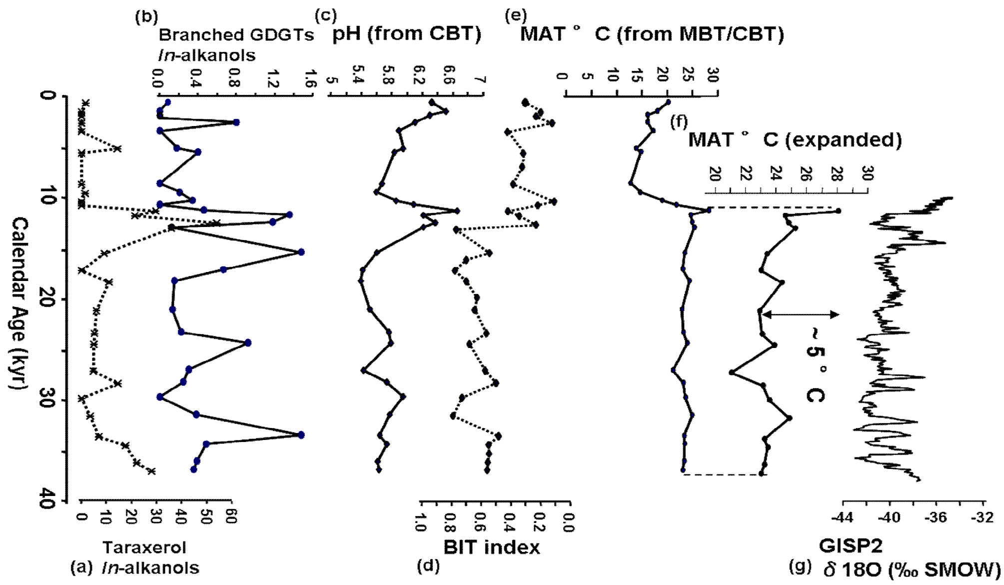

Figure 1. Age profiles measured in ODP core 942 for: (a) Taraxerol/n-alkanols, (b) Branched GDGTs/n-alkanols, (c) pH (derived from the CBT index), (d) BIT index, (e) MAT °C (derived from the MBT & CBT indices), (f) MAT °C (expanded x-axis). GISP2 $\delta^{18}O$ data (g) is included for comparison.

REFERENCES

Maslin, M.A. and Burns, S.J. (2000) Reconstruction of the Amazon basin effective moisture availability over the past 14,000 years. *Science*, **290**, 5500, 2285-2287