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Hydrological changes over Papua New Guinea during the last deglaciation

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Today the Fly River in Papua New Guinea is a major sediment contributor to the global ocean (the first in PNG and the 13st globally according to Milliman & Fansworth 2011 CUP). In order to reconstruct hydrological changes during the glacial period, we studied a deep-sea core located in the Gulf of Papua, just in front of the Fly River mouth. The history of detrital input in core MD97-2134 was reconstructed at high resolution by measuring various inorganic and organic proxies. In particular, we present Fe, Ti, Ca profiles measured with an ITRAX XRF scanner. We also measured molecular proxies such as n-alkanes by GC and tetraethers by LC-MS to derive BIT index values.

These independent proxies provide a coherent picture for the period covering the last 30 thousands of years. The riverine input was much stronger during the glacial period with n-alkanes, BIT and Ti/Ca values several times higher than during the Holocene (factor 2 for n-alkanes, 2-3 for the BIT and 6-7 for Ti/Ca). This systematic increase is the likely signature of stronger precipitations superimposed on physiographical changes. The latter are linked to lower sea levels during the glacial period, which led to a shorter distance from the coast and probably to a widening of the drainage basin.

In addition to these expected changes, we also observe prominent maxima of the riverine input during specific millennium-scale periods corresponding chronologically to Heinrich events # 1, 2, 3 and the Younger Dryas event. These precipitation maxima are in phase with those observed in Indonesia (Muller et al. 2012 Geology, Ayliffe et al. Nat. Geo. 2013), but in antiphase with the drought periods reconstructed farther north, notably in China (Wang et al. 2001 Science). The spatial distribution of precipitation changes constitutes the clear signature of wide latitudinal shifts of the ITCZ during H events.

The resolution of our Papua record allows studying further important details, providing evidence for two phases within the H1 period between 18 and 14.5 kyr BP. These H1a and H1b events were identified and defined in North Atlantic sediments (Bard et al. 2000 Science) located at a large distance from the Laurentide ice sheet, which was the main source of iceberg armadas that typified H events. The influence of H1a and H1b at a location of maximum southward extent of the ITCZ migration is a further illustration of their importance and their link with the ice sheet behavior around the North-Atlantic.