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High resolution reconstruction of late Holocene climate variability of the Guiana Highlands of northeastern South America

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The Intertropical Convergence Zone (ITCZ) consists of an organized band of precipitation located several degrees north of the equator. Model projections of future climate under anthropogenic forcing predict large alterations in the processes that control ITCZ organization, highlighting the importance of understanding the paleoclimate of regions that are sensitive to ITCZ variability. One such region is the Guianas of northeastern Amazonia, which experience major episodes of drought and extreme precipitation due to meridional migration of the ITCZ and ITCZ intensity. Here we report preliminary data on late Holocene climate variability from studies of sediment cores recovered from Lac Toponowini, a landslide-dammed lake near the top of a valley watershed in the undisturbed rainforest of the southern highlands of French Guiana (Guyane). The Toponowini sediments are finely laminated, with pronounced light-dark laminae couplets that appear to be annual varves reflecting alternating wet and dry season conditions. High-resolution X-Ray Fluorescence (XRF) profiling reveal that the laminae couplets consist of alternating bands of a weathered clay fraction and a high organic fraction with co-precipitated Pb/Fe sulfides and platinum group elements (PGEs), sourced from the abundant gold deposits in the lake's watershed. The leaching and differential mobility of PGEs in tropical laterite sequences is highly sensitive to local hydrology and groundwater chemistry. In the Toponowini sediments, second-order variations in PGE concentration and composition appear to have tracked past hydrologic variability. Over the last 800 years, downcore variation in the Pd/Pb ratio, a putative hydrologic proxy, is inversely correlated with the %Ti record of fluvial input into the Cariaco Basin (Peterson and Haug 2006, Palaeogeog. Palaeoclim. Palaeoecol. 234, 97-113) and suggests antiphasing between rainfall in northern South America and French Guiana, consistent with ITCZ migration forced by multidecadal Atlantic variability. The carbon isotopic composition (δ13C) of the n-alcohols of terrestrial leaf waxes increases with depth and is maximal at $\sim$1500 years BP, indicative of drier conditions and consistent with other evidence of drier conditions from a pollen record in a central Guyane bog (Ledru 2001, Rev. Paleobot. Palynol. 115, 161-176).