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Cyclic sediment deposition in the Miocene wetland of Western Amazonia is controlled by orbital forcing, uplift of the Andes and sea level change

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In the Miocene, a large wetland extended from the Andean foothills into western Amazonia. This system plays an important part in current biogeographic models and is thought to have acted as an evolutionary 'cradle' for aquatic species and an 'inhibitor' for terrestrial taxa. The generating mechanisms of this system are not fully understood, but dynamic topography, Andean uplift and eustasy are all thought to have controlled deposition. Orbital forcing is likely an additional driver that could explain the succession of shallowing upwards cycles that characterize the sedimentary record. In this study we investigated the presumed cyclicity at the Los Chorros (Colombia), a site that constitutes a representative example for the sedimentary record in the Miocene wetland system. We integrated lithological, palynological and malacological data from a sequence biostratigraphic perspective. In this approach, the Los Chorros succession is visualised to be composed of a series of flood-fill packages, with a rapid initial flood, with marine-influenced conditions at the time of maximum flood, and followed by a longer regressive infill phase. Based on the palynology we could differentiate local vegetation, such as swamps, from sources of regional origin such as *terra firme* vegetation (non-flooded Amazonian Forest) and montane forest (Andean), while also separating local and regional sediment sources. Marine influences are intermittently evident in this section, based on the occurrence of short-lived maxima of mangrove pollen, foraminiferal test linings, dinoflagellate cysts, some mollusc species, and an episodic decline in terrestrial biomarkers. At the times of flooding, the lacustrine conditions in the wetland system were characterized by the presence of algae, floating ferns, and mollusc assemblages that indicate alternating oligotrophic and eutrophic conditions, while intervening subaquatic debris points to proximal submerged lowlands. The palynology also shows that the shallow lakes were fringed by a succession of Mauritiinae palm swamps, ferns, and grasses, with a diverse rainforest

in the wider periphery. The sequence biostratigraphic evaluation suggests that the deposition of this sediment sequence took place prior to the 13.8 Ma global sea level fall, and most likely the period just after 14.5 Ma, towards the end of the Middle Miocene Climatic Optimum. We propose that the studied succession comprises eight 41 ka obliquity-driven depositional cycles, with rapid phases of transgression, and that mangrove elements would have colonised within the timeframe of each sea level rise.