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Soil features contribution as biogeochemical functioning factor of alkalinity in lakes of Nhecolândia, Pantanal, Brazil.

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As part of one of the largest fluviolacustrine system, lakes at Nhecolândia south region of the Brazilian Pantanal can be distinguished by fresh or different types of saline-alkaline water (green, black or crystalline), subject to a very seasonal climate cycle. Water color differentiation accompany different types of environment developed under the same sedimentary substrate. On a single representative site of the system, we evaluate the role of their soils regarding their genesis and dynamics that contributes to each type of lake dynamics found. The selection of representative lakes took into account the isolation of different alkaline environments by a 45-month temporal monitoring of satellite data used to assess the connection of the lakes to the seasonal flood network. This initial analysis showed that the isolation of the environment due the presence of a ridge around a lake is not sufficient to explain the maintaining alkalinities observed. With detailed toposequence soil studies characterizing the granulometry, chemistry and mineralogy of soil horizons we have shown that the presence of deep impermeable horizons at the lower half of the toposequences suffice the conditions needed for each type of lake (Fig.1). The main mineralogy involves quartz, alkali feldspars, micas, kaolinite and iron (hydro)oxides. In less extent, calcite, 2:1 expandable clays and amorphous silica are present. The studied soils also show hyperacidic horizons (pH < 4) neighboring alkaline horizons (pH > 10) with a sharp contact. Through these different mineral phases, their distribution along the soil toposequences, soil texture, soil pH and others characteristics, it was possible to infer the contribution of the downslope soils acting as buffers to store labile species during the dry season, allowing alkalinity to be maintained from one year to the next. Geochemical modelling using PHREEQC stablished the necessity of at least 125 years to obtain the alkalinity observed in the lakes and that the water alkaline nature can quickly disappear after changing drainage conditions [1].

[1] Merdy, P., et al. 2022. Catena, 210, 105876.

Figure 1 - Soil toposequences around saline-alkaline lakes and water data: Distribution of brownish sandy horizons and greenish loamy horizons between ridge and near lake soil. Numbers followed by letters indicates lake name and their respective drilling sites. Water data was collected during the dry season of each year.