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Deposition modes in the paleo-lake Colônia (São Paulo, SE / Brazil): detrital input and bio-geochemical processes

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Colônia, a geomorphological circular structure in southeast Brazil, probably originated from an meteor impact with still unknown age. The structure, situated 40 km south of the center of the mega city São Paulo, has ca. 3.6 km in diameter and a surrounding rim elevated by ca. 120 meters. At present, the inner part of the structure contains a swampy alluvial plain. Sediment columns recovered in September 2014 have shown that below a circa 8 meter thick peat deposit, sediments are lacustrine and characterized by light-gray bands (cm scale). According to a preliminary age-depth model, based on radiocarbon ages, luminescence ages and paleomagnetism, the transition between lake to peat deposition seems to relate to climate boundary conditions from glacial towards interglacial conditions. In the lacustrine fine-grained sediments, the banded gray layers have distinct grain size, as macroscopically observed from mica grains/plates. Correlated to high-resolution geochemical data, lighter colored bands hold increased amounts of K and Si [XRF counts], originating from detrital input from the basin, e.g. flood events during tropical storms. Potassium is mainly contained in the crystalline structure of muscovite, whereas silica is additionally contained in kaolinite and quartz, thereby completing the minerals that make out the major mineral assemblage found in the sediments. Pyrite is found as an accessory mineral with average concentrations between 1 and 2%, peaking at 5% up to 10% in covariance to Fe/Ti [XRF count ratio]. Overall a covariance pattern, with or without phase lag, between pyrite, ∂13C (of TOC) and the concentrations of the biomarker hopane is observed in the lacustrine sediments. These relationships likely originate from stratification conditions in the paleo-lake, such that a more stable stratification eventually led to anoxic lake bottom conditions, favoring authigenic/microbial pyrite precipitation, better preservation of organic matter and affecting gas exchange between the water and the atmosphere.