MINERALIZED LEAVES IN LATERITIC CRUST OF THE QUATERNARY OF TIJUCAS DO SUL, PARANÁ STATE, BRAZIL

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INTRODUCTION

During the earthworks of an area in the municipality of Tijucas do Sul, about 30 km south from Curitiba, Paraná State, Brazil (coordinates -25,823546 S, 49,130016 W) (Fig. 1), a lateritic crust about 5cm thick and 5m in lenght, containing hundreds of fóssil leaves was exposed (Fig. 2). This layer occurs at the Colombo Member (Tabatinga Formation, Tijucas do Sul Sedimentary Basin, proposed by Moreira *et al* (2019)), formed by conglomeratic lens and immature Sandy matrix, overlaid by a colluvium layer up to 5m thick (Fig. 3), and its inferred age is Upper Pleistocene to Holocene.

Figure 1 – Brazil/South America map, highlightning the Paraná State, and the city of Curitiba.

Figure 2 - Outcrop of the Tabatinga Formation, where the latritc crust (dark brown) was found.

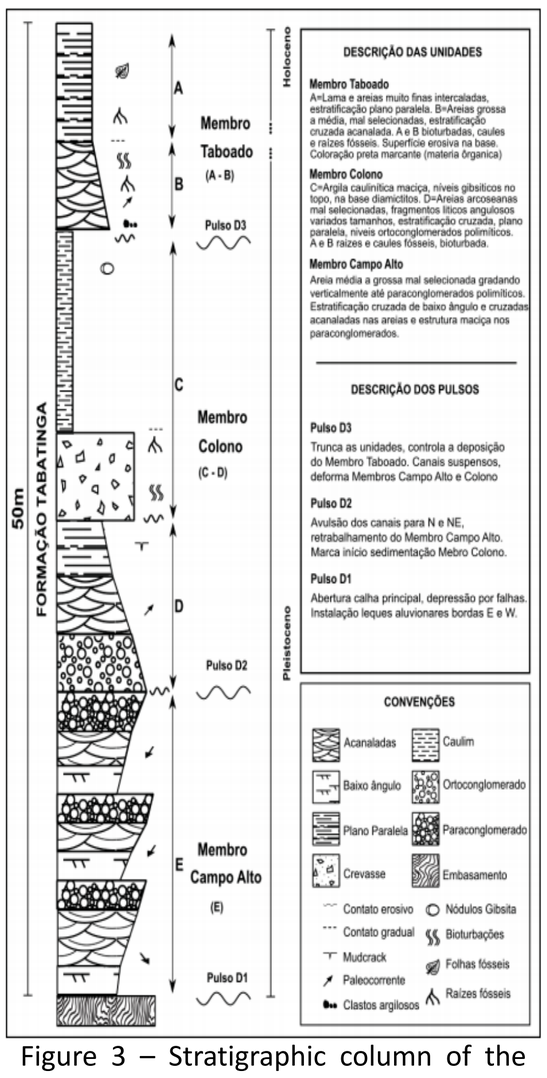

Figure 3 – Stratigraphic column of the Tijucas do Sul Sedimentary Basin (MOREIRA *et al*, 2019).

METHODS AND MATERIALS

Due to the high resistance and irregularity of the layer, the samples were removed from the site in irregular blocks. In the laboratory, the samples were washed and opened with hammers and chisels to expose the leaves, with the finalization made with needles and brushes. After the preparation, 37 samples, containing more than 520 leaves, were obtained and studied. The initial taphonomic and morphologic analysis was made using a stereoscopic microscope. A subsequent analysis of the material was made using a Scanning Electron Microscope (SEM) in association with the Energy Dispersive Spectroscopy (EDS) technique.

RESULTS AND DISCUSSIONS

The initial analysis of the samples revealed that most leaves were fragmented, with only 4 entire leaves, and varying from low to densely packed (Fig. 4), which indicates high energy of the environment. Most leaves were concentrated in thin layers, with little sediment between them. The material presented some subtle but still noticeable variation in the granulometry of the matrix.

Figure 4 – Sample detail, showin multiple leaf fragments.

Subsequent analysis made using SEM revealed a good preservation of microstructures from the leaves, such as stomata (Fig. 6), veins and epidermis and mesophyll cells, indicating a rapid fossilization process. The EDS technique used in association with SEM revealed that the leaves were indeed mineralized by iron and manganese oxides. It also revealed the presence of cerium, an element commonly associated with the lowering of the groundwater level in fluvial environments (COELHO, VIDAL-TORRADO, 2000).

The morphological analysis of the material indicated that the leaves are from Angiosperms, based on the venation types (Fig. 5) with sizes varying between nanophyll and microphyll, predominantly elliptical, with acute base and apex (when preserved) and erose margin type (WING, 1999; TAYLOR *et al*, 2009).

Figure 5 – Leaf detail under stereoscopic microscope, with venation patterns.

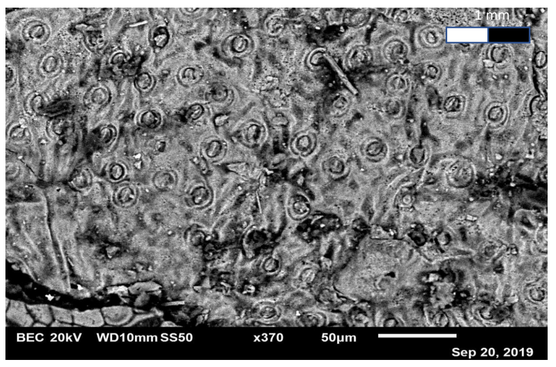

Figure 6 – Multiple stomata, as seem in SEM analysis

CONCLUSIONS

- The material was deposited in a high energy environment.
- Morphology indicates the leaves are from angiosperms.
- The fossilization process was fast, which allowed good preservation of microstructures.
- The presence of cerium indicates a lowering in the groundwater level in the fluvial environment.

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