Quaternary climate variability as the main driver of the fluvial Evolution of the Middle Tocantins River, Eastern Amazonia

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Session GM5.1: Fluvial systems: Dynamics and interactions across scales

Introduction

The Tocantins River is the easternmost fluvial system of the Amazon region, with a watershed draining both the Amazon rainforest and the Cerrado dry forest. This condition makes the Tocantins a natural laboratory to investigate the effects of past climate variability along with the rainforest-savanna ecosystems because its watershed drains both the Amazon rainforest and the Cerrado dry forest, and it is influenced by the Equatorial and central-northeast Brazil hydroclimates.

Materials and Methods

We used an integrated approach including:

- Geomorphological Mapping;
- Sedimentological Descriptions;
- Optically Stimulated Luminescence (OSL) Dating

Fig. 1: Context of the study area between the Cerrado and Amazonian biomes. Source: Esri World Imagery 2019. ANA, 2009. MMA, 2006

Results and Discussion

Three main geomorphological units were mapped: **(i) fluvial plain, (ii) fluvial terraces, and (iii) paleo-alluvial fans**. Our data indicate **three stages of fluvial aggradation and two stages of incision.** The older aggradational stage is represented by sediments from Upper Terrace (T1) and the paleo-alluvial fan deposited between 160 and 32 ka. Subsequently, a major incision event occurred at ~31 ka, which resulted in the abandonment of T1. The second phase of aggradation is recorded in the Lower Terrace (T2) and it also promotes reactivation of the paleo-alluvial fans from 31 to 6 ka. A new incision occurred from about 6 to 5 ka, allowing the abandonment of the T2 and reducing the local base level to its current position.

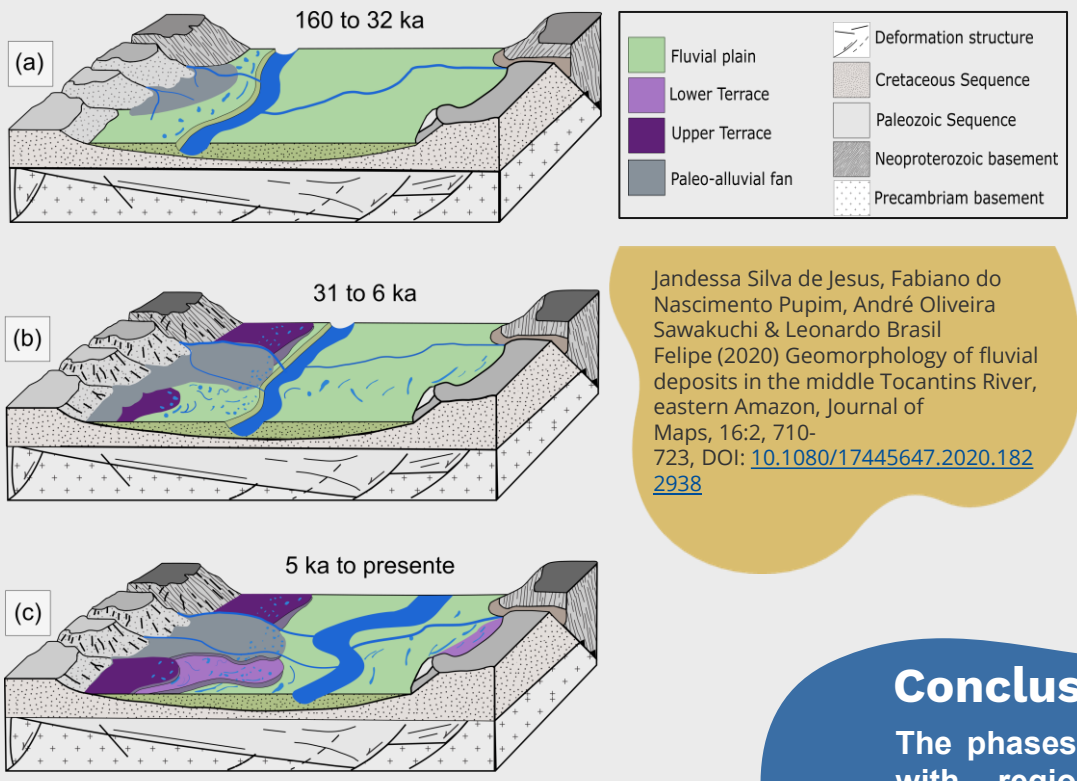

Fig. 2: Schematic diagrams illustrating the geomorphological evolution of the middle Tocantins River during the Late Quaternary. (A) During the Mid-Late Pleistocene (160 – 32 ka), the landscape was dominated by floodplain with contribution of tributaries rivers causing aggradation of the main valley. A regional incision caused the abandonment of the T1 around 31 ka; B) The deposition of the T2 occurred from 31 and 6 ka, followed by another incision around 6-5 ka; (C) The modern landscape have been formed since 5 ka.

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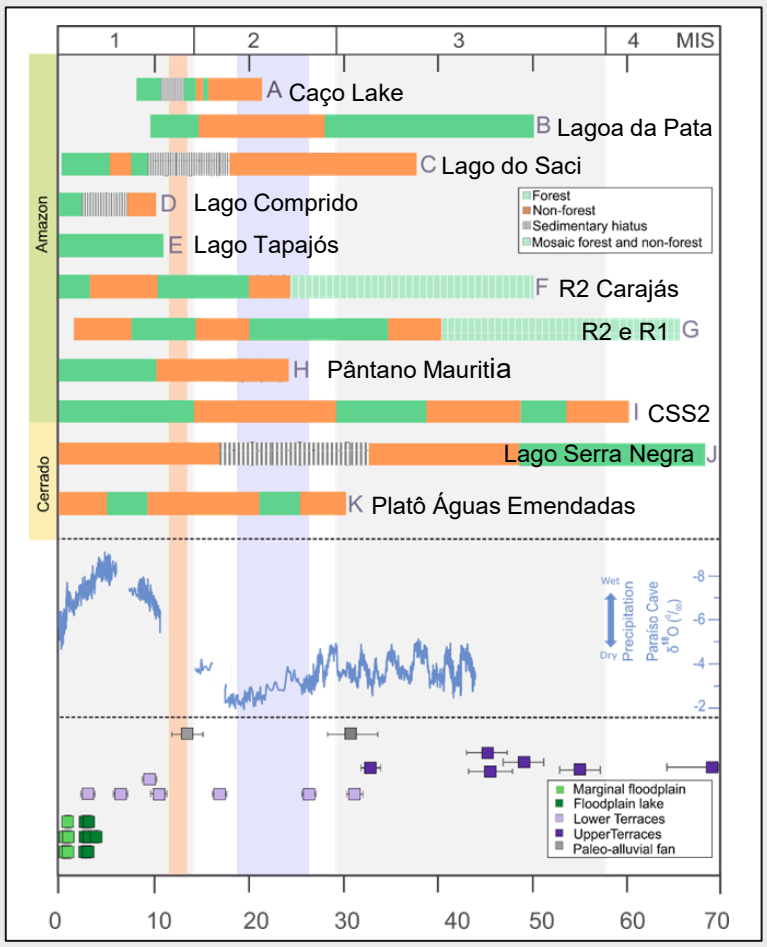

Fig. 3: Synthesis of the chronological evolution of the river terraces in the study area and its comparison with the Quaternary records of palynology and speleothem of the Eastern Amazon.

Conclusion

The phases of aggradation and incision were correlated with regional paleoclimatic data, suggesting that precipitation changes related to the South American Summer Monsoon (SASM) as the main driver of the evolution of the Tocantins river in the last 160 ka. The continuous change in the Tocantins River dynamics has molded a high heterogeneity of habitats in the associated floodplains and terraces, which is a fundamental factor to support the diversity of fauna and flora in this transitional environment between Amazon and Cerrado biomes.