



Genesis of the largest Amazonian wetland in northern Brazil inferred by morphology and gravity anomalies



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ABSTRACT

The *Pantanal Setentrional* (PS) is the second largest wetland in Brazil, occurring in a region of northern Amazonia previously regarded as part of the intracratonic Solimões Basin. However, while Paleozoic to Neogene strata are recorded in this basin, the PS constitutes a broad region with an expressive record of only Late Pleistocene and Holocene deposits. The hypothesis investigated in the present work is if these younger deposits were formed within a sedimentary basin having a geological history separated from the Solimões Basin. Due to the location in a remote region of low accessibility, the sedimentary fill of the PS wetland remains largely unknown in subsurface. In the present work, we combine geomorphological and gravity data acquired on a global basis by several satellite gravity missions to approach the geological context of this region. The results revealed a wetland characterized in surface by a low-lying terrain with wedge shape and concave-up geometry that is in sharp contact with highland areas of Precambrian rocks of the Guiana Shield. Such contact is defined by a series of mainly NE- or NW-trending straight lineaments that eventually extend into both the Guiana Shield and the PS wetland. Also of relevance is that a great part of the PS wetland sedimentary cover consists of dominantly sandy deposits preserved as residual paleo-landforms with triangular shapes previously related to megafan depositional systems. These are distributed radially at the northern margin of the PS, with axis toward basement rocks and fringes toward the wetland's center, the latter containing the largest megafan landform. The analysis of gravity anomaly data revealed a main NNE-trending chain ~500 km in length defined by high gravity values (i.e., up to 60 mGal); these are bounded by negative anomalies as low as –90 mGal. The chain with positive gravity anomaly marks the center of a subsiding area having a geological evolution that differs from the adjacent intracratonic Solimões Basin. Deep rifting associated with the rise of high-density material from the mantle in replacement of low-density continental crust is hypothesized as the most likely load-driving mechanism responsible for the subsidence of the PS sedimentary basin. Alternatively, this might be a shallow basin formed during the Late Quaternary due to mild subsidence of a high-density basement. This process would have been caused by tectonic reactivations of NE-trending strike-slip faults along a zone of low elastic thickness of the lithosphere that characterizes this region of South American platform.

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1. Introduction

Northern Amazonia is dominated by the *Pantanal Setentrional* (PS), one of the largest wetland in Brazil, second only to the *Pantanal Matogrossense* (PM) in central Brazil (Fig. 1A). As the PM, the PS (Fig. 1B,C) corresponds to an area of extensive flooding in

Amazonia, with more than 50% of its surface being inundated during high water stages (Frappart et al., 2005). While previous publications have linked the PM to a tectonically-generated, shallow (i.e., up to 500 m deep) sedimentary basin (e.g., Catto, 1975; Ussami et al., 1999), the geological significance of the PS remains largely unknown, as its subsurface have been not investigated yet.

A common feature to the PS and the PM wetland promptly visualized at the surface is a profusion of conspicuous, fan-shaped residual morphologies of large dimensions (i.e., several tens or

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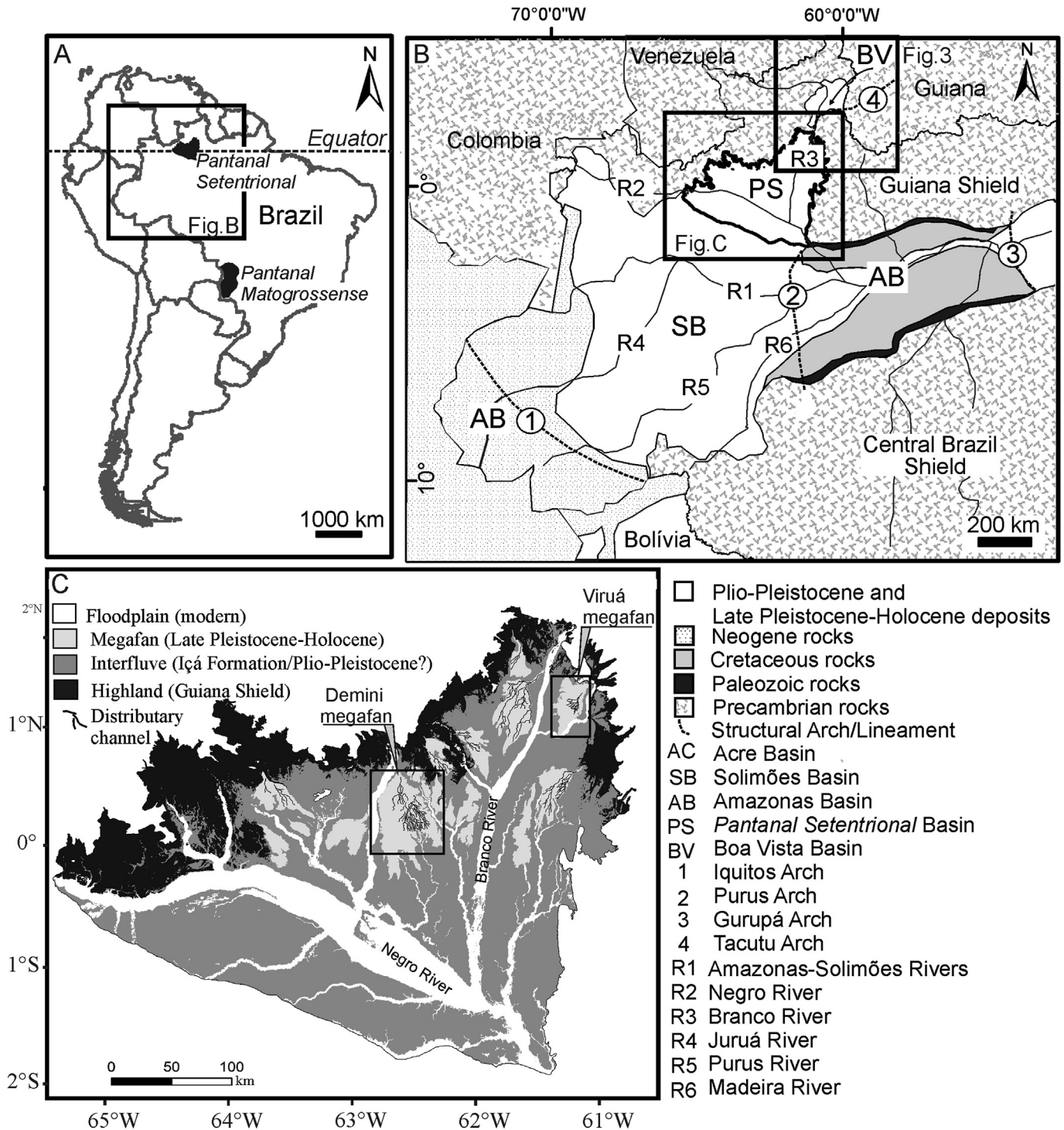


Fig. 1. Location and geological context of the *Pantanal Setentrional* wetland. A) Location of this wetland in northern Amazonia. Also shown is the location of the *Pantanal Matogrossense* in central Brazil. B) Limits and geological context of the *Pantanal Setentrional*. C) Mapping of megafan depositional systems that typify the northern margin of the *Pantanal Setentrional* in the Negro- Branco River basins. Observe that these landforms are triangular-shaped and have their axis pointing toward Precambrian basement rocks of the Guiana Shield, while their fringes spread southward into the basin center.

hundreds of km in length) that are allied to sediment accumulation in megafan depositional systems (Fig. 1C). In the PM, the Taquari megafan is the best studied and became well-known as the classical humid analog of megafans (Assine, 2005), otherwise more often related to arid/semiarid regions (e.g., Gumbrecht et al., 2005; Fielding et al., 2012). The PS megafans have been documented

only recently, with the focus being the Demini and Viruá megafans (Fig. 1C) (Rossetti et al., 2012a,b; Zani and Rossetti, 2012; Cremon et al., 2014).

Despite being located more than 2000 km apart (Fig. 1A), the development of megafans in the PS and PM Brazilian wetlands appears to have been synchronous. Hence, the latter has long been

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