



The formation process of a paleoindian open-air site in Central Brazil: integrating lithic analysis, radiocarbon and luminescence dating

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ABSTRACT

Lithic analysis, radiocarbon dating and luminescence dating are applied to a stratified open-air Paleoindian site in Central Brazil, lending some balance to a published record dominated by rock shelter sites. Most lithics are found in two discrete occupation layers. Lithics found outside these layers are attributed to post-depositional movement of small flakes mainly upwards. Single-grain luminescence dating on quartz grains also suggest post-depositional movement. Both wind and bioturbation are suspected mechanisms. The luminescence analysis does not provide precise depositional dates in this situation but does support such dates suggested by radiocarbon.

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1. Introduction

Central Brazil has a rich Paleoindian record but most studied sites dating to the Pleistocene/Holocene transition are found in rockshelters (Kipnis, 1998; Prous and Fogaça, 1999; Schmitz, 1987). Only in sheltered sites has the Paleoindian record been well-dated, and also only in these sites has the transition between Paleoindian and subsequent technologies been described. Little is known about open-air occupations, although presumably they are important for understanding Paleoindian settlement and subsistence patterns. Schmitz (1980), for example, has suggested that populations aggregated in rockshelters during summer rainy seasons but dispersed to open-air locations along small rivers and creeks during dry seasons. Lack of detailed studies of open-air sites has prevented testing this hypothesis as well as a better understanding of Paleoindian territoriality. Although hundreds of open-air sites have been recorded, they rarely allow for clear stratigraphic sequences or good conditions for dating (Bueno, 2008; Kipnis, 1998; Prous and Fogaça, 1999; Rodet, 2006).

This paper provides a detailed analysis of the chronology and lithic technology of an extensively excavated Paleoindian open-air site near the city of Miracema do Tocantins, located in a paleo-dune field above the Tocantins River, at the northern outskirts of the Central Brazilian Plateau. Particular attention is paid to site formation processes in dune environments and the extent to which post-depositional sand movements and mixing might have affected the understanding of the occupation sequence and the detected changes in lithic technology.

2. Archaeological background: open-air sites and the early occupation of Central Brazilian Plateau

The Central Brazilian Plateau (CBP) is an uplifted region bordered by lowlands to the north (Amazonia), west/southwest (Chaco lowlands) and east (Atlantic seaboard) (Fig. 1). The main geologic features are flat, dry Mesozoic-aged sandstone plateaus, or *chapadas*, occasionally interrupted by pre-Cambrian mountain ranges (*serras*). Altitudes range from 200 to about 1000 m. A more rugged topography consisting of older limestone and quartzite mountains is found in the southeastern portion. Several large rivers, such as the Tocantins and the São Francisco, provide drainage, mostly to the north. Savannah-like *cerrado* vegetation

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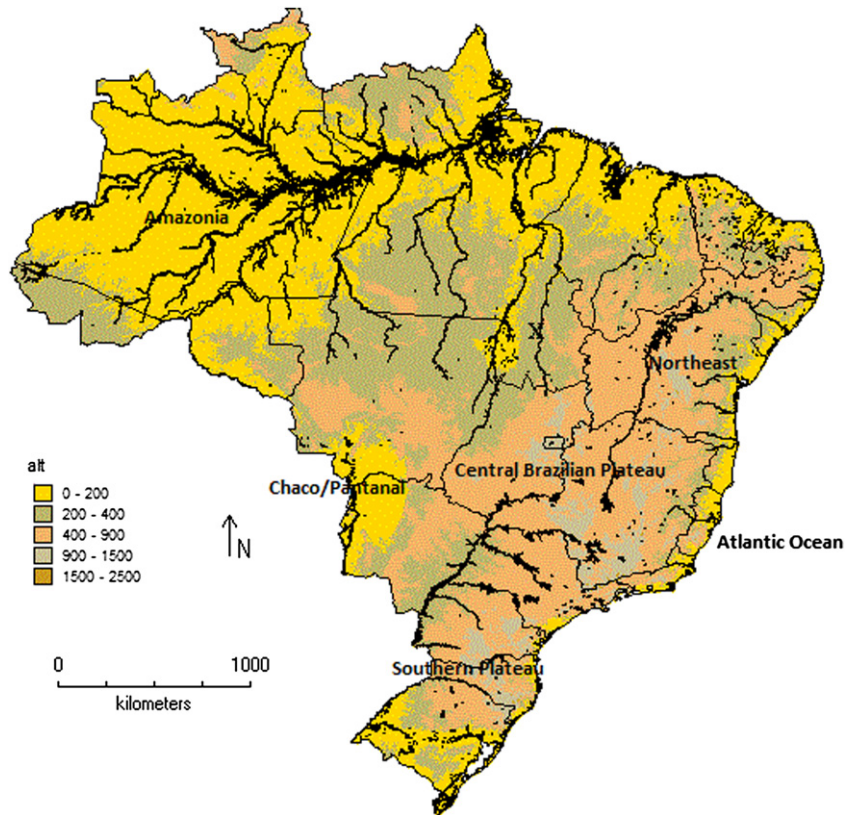


Fig. 1. Relief map of Brazil (contours in meters above mean sea level) showing the Central Brazilian Plateau and major river drainages. The X near the center of the country gives the location of Miracema do Tocantins.

dominates the landscape, though denser forests are found along rivers and canyons and on the moister slopes of the *serras* (Ab'Saber 1982, Ledru 1993, Oliveira and Marquis, 2002).

Hundreds of rockshelters are found along the steep slopes, or *cuestas*, of the *chapadas*, usually along small tributaries to the larger rivers. They are also found in limestone formations in the south-eastern portion of the plateau (Araujo and Neves, 2010; Prous et al., 1998; Prous and Rodet, 2009). Paleoindian archaeological remains in the shelters date as early as 14–13.5 ka cal BP, but most sites date between 12.8 and 9.5 ka cal BP (Bueno, 2011; Dias, 2004; Prous and Fogaça, 1999; Kipnis, 1998; Oliveira and Viana, 1999/2000). Lithics are commonly characterized by formal, well-finished unifacial artifacts. The most distinctive are *limaces*, which are large, elongated flakes retouched into cutting/scraping tools with flat-convex transversal sections (Fig. 2). Expedient unifacial tools are also common. These assemblages are commonly referred to as Itaparica Tradition and, although they are defined mainly by these intensely retouched and curated unifacial tools, a few finely retouched stemmed bifacial points, and bifacially retouched flakes, are also found in most of these assemblages (Bueno, 2007a; Schmitz, 1987; Fogaça, 2001; Lourdeau, 2010).

Itaparica sites in the CBP sometimes form site aggregates such as in the Serranópolis, Peruaçu, Serra da Capivara and Lajeado/Miracema (middle Tocantins) areas (Schmitz et al., 2004; Fogaça, 2001; Rodet, 2006; Guidon, 1986; Bueno, 2007a). Whether these aggregates reflect settlement patterns of cyclic and recurrent occupations or are a matter of sample bias, is still an open question. What is indisputable is that late Pleistocene/early Holocene sites with similar formal and quantitative lithic characteristics are found over distances of more than 2000 km (Schmitz, 1981; Lourdeau, 2010; Bueno, 2011). These similarities are based on assemblage composition, raw material procurement



Fig. 2. Silicified sand stone limaces of the Itaparica Tradition from Lajeado region. Increments are in cm.

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