

## Short communication

## Evidence of palaeo-wildfire from the upper Lower Cretaceous (Serra do Tucano Formation, Aptian–Albian) of Roraima (North Brazil)



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## ABSTRACT

Wood fossil charcoal is identified from the upper Lower Cretaceous (Serra do Tucano Formation, Aptian–Albian) of Roraima (North Brazil). The presence of charcoal demonstrates the occurrence of Early Cretaceous palaeo-wildfires for the first time in this region and only the third time for the entirety of South America. A gymnospermous taxonomic affinity can be established for the charred woods and a relationship with conifers is likely, thus providing additional evidence for the taxonomic composition of Early Cretaceous floras in this region.

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### 1. Introduction

Fire, as an intrinsic feature of the biosphere, has been a part of many terrestrial ecosystems ever since the colonisation of the continents by the first embryophytic land plants in the Silurian (Glasspool, Edwards, & Axe, 2004) and there is an almost continuous record of fossil evidence for palaeo-wildfires, e.g. in form of fossil charcoal, as well as certain pyrogenic biomarkers (i.e. polycyclic aromatic hydrocarbons = PAHs) from the Devonian onwards (e.g. Scott, 2000, 2010).

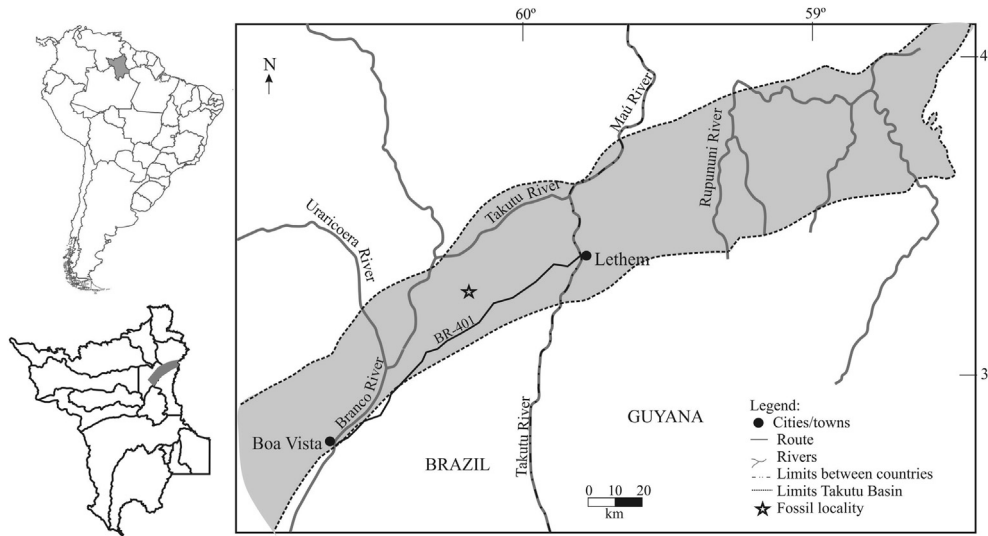
Based on the current knowledge the Cretaceous is considered as a particular ‘high-fire’ period in Earth’s history (Scott, Bowman, Bond, Pyne, & Alexander, 2014), but this interpretation is mostly based on published records from the Northern hemisphere (Bond & Scott, 2010; Brown, Scott, Glasspool, & Collinson, 2012). The number of published records from the Southern hemisphere (i.e.

the former continent Gondwana) is distinctly smaller and so far it is not clear whether this truly reflects differences in the occurrence of fires or just some bias in the fossil record or a lack of studies (Bond & Scott, 2010; Brown et al., 2012; Manfroi, Dutra, Gnaedinger, Uhl, & Jasper, 2015).

The Cretaceous is of great importance for the evolution of modern terrestrial vegetation, dominated in large areas by angiosperms, which appeared and diversified during this period (e.g. Lupia, Lidgard, & Crane, 1999; Barrett & Willis, 2001; Nagalingum, Drinnan, Lupia, & McLoughlin, 2002). In their comprehensive overview about Cretaceous wildfires, Brown et al. (2012) listed only a single record of Cretaceous charcoal from Brazil and only two reports for the entirety of South America. Of these, one comes from the Kachaiké Formation (Lower Cretaceous, Austral Basin) in Patagonia, Argentina (Passalia, 2007) and another one from the Santana Formation Fossil Lagerstätte (Lower Cretaceous, Araripe Basin) of Northeast Brazil (Martill, Loveridge, Mohr, & Simmonds, 2012). Unfortunately, in both cases, the authors did not provide information about the presence of homogenized cell walls or other features diagnostic of charcoal (cf. Scott, 2000, 2010) for this

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**Fig. 1.** Takutu Basin simplified map with its position in the Brazilian Northern Region, crossing the Guyana border.

particular material. Although it seems very likely that this material in fact represents charcoal, the absence of solid evidence makes these reports somewhat doubtful.

In that way, the present paper reports the first detailed/substantiated analysis of macroscopic charcoal from the Cretaceous of South America originating from the Serra do Tucano Formation (Lower Cretaceous, Aptian–Albian) of the Takutu Basin in Roraima State, North Brazil (Fig. 1).

**2. Geological and palaeontological context**

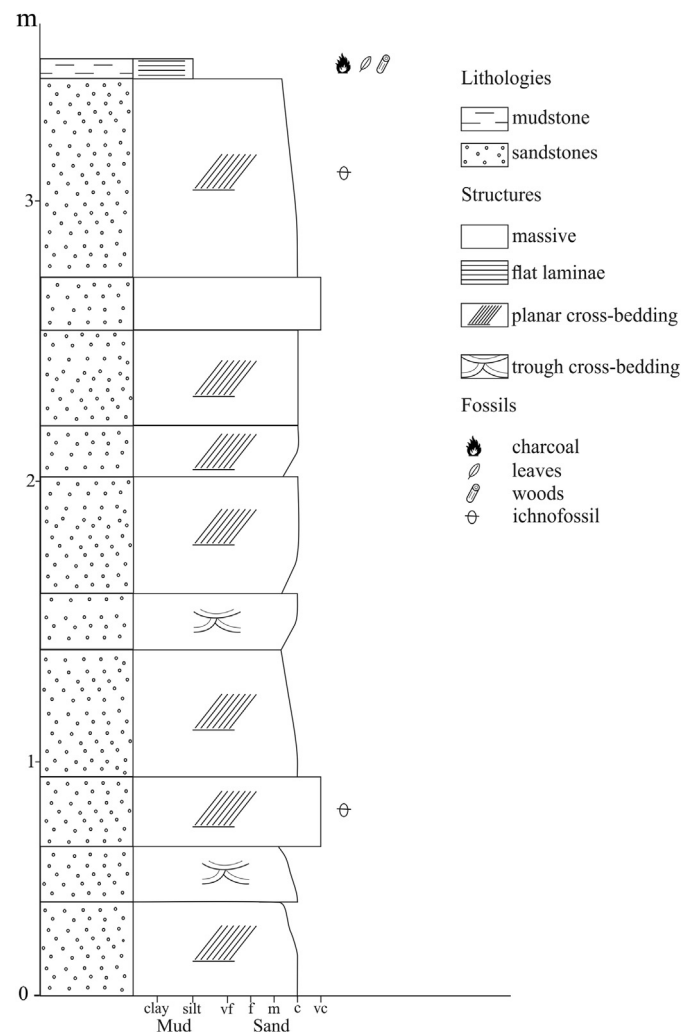
The Takutu Basin is an intracontinental graben, developed in the central part of the Guyana Shield, approximately 300 km long and 30–50 km wide, at the border between northern Brazil and Guyana (Crawford, Szelewski, & Alvey, 1984; Eiras & Kinoshita, 1990). This graben is filled out with more than 7000 m of deposits ranging from the Jurassic (volcanic Apoteri Formation) to the Quaternary (Boa Vista Formation), covering approximately 12,500 km<sup>2</sup> (Eiras & Kinoshita, 1990). It extends around 280 km from the Branco River, near to Boa Vista, capital of the Roraima State, Brazil, to the Essequibo River, in Guyana (Vaz, Wanderley Filho, & Bueno, 2007).

Stratigraphical correlations supported the inference of a late Early Cretaceous (Barremian–Albian) age for the Serra do Tucano Formation (Vaz et al., 2007). The Serra do Tucano Formation is restricted to a homonym syncline, which makes up part of the Serra do Tucano mountain chain (Eiras & Kinoshita, 1990). That formation unconformably overlies the Takutu Formation (Upper Jurassic to Lower Cretaceous) and consists of basal conglomerate and coarse grained sandstones interbedded with siltstones (Hammen (van der) & Burger, 1966; Reis, Nunes, & Pinheiro, 1994). The sandstone facies exhibit bioturbation, as well as planar and cross-stratification. The floodplain facies consists mainly of fine-grained sandstones and reddish siltstones, usually oxidized, with desiccation cracks, planar lamination, asymmetrical current ripples and flasers. The palaeoenvironmental condition under which the deposition occurred was interpreted as a meandering fluvial system in an arid climate (Reis et al., 1994).

**3. Material and methods**

This study was carried out with samples collected at the Morro da Sereia locality (03° 16' 40" N; 60° 10' 52" W; Fig. 1). Sedimentary

rocks from a floodplain facies of the Serra do Tucano Formation (Fig. 2) were sampled and it was possible to detect the presence of



**Fig. 2.** The Serra do Tucano Formation studied area lithological profile indicating the facies from where the macroscopic charcoal samples were collected.

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