EVIDENCE OF RECURRENT PALEOWILDFIRES IN A PERMIAN PEAT-FORMING ENVIRONMENT FROM THE RIO BONITO FORMATION OF THE SOUTHERN PARANA BASIN (BRAZIL)

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ABSTRACT: Wildfire events play important roles in diverse environments and charcoal fragments are present in the fossil record since the Silurian in different settings, from terrestrial to marine. While charcoal corresponds to roughly 4% of the total volume in modern peat, in the late Paleozoic it could reach 70%. The study area comprises the Faxinal Coalfield, a former opencast mine located at the southeastern outcrop belt of the Rio Bonito Formation of the Paraná Basin, southern Brazil (30°15′52.6″S, 51°41′53.8″W), where the peat accumulated under post-glacial conditions during the Late Paleozoic Ice Age. A tonstein bed dated at 291 ± 1.3 Ma, corresponding to the late Sakmarian, is interlayered in the upper coal seam (S) and contains abundant compressed fossil leaves of the *Glossopteris* Flora. The prevalent lithotype composition in this coal seam is of banded and thin-banded coal, with predominance of dull coal. Along the five coal seams of the Faxinal Coalfield, inertinite contents range from 6 to15%. Aiming to investigate wildfire events in the peat-forming environment, analyses were conducted through petrographic, fluorescence and scanning electron microscopy (SEM) in inertinite-rich levels associated with the lower and upper boundaries of the tonstein layer. The coal analysis consisted of reflectance measurements in polished blocks under oil of macerals of the inertinite group to confirm wildfire occurrence in the peatland and to estimate the fire temperature range. In the lower coal horizon a major autochthonous/hypauthochthonous wildfire event was identified through fusain transition fossils consisting of horizontally disposed, highly compressed logs (up to 21.8 x 13.4 cm) burned in growth position during an extensive, surface wildfire. This event is possibly related to a more extended drought episode and consequent lowering of the water table. Reflectance values below 1%Ro indicated low-temperature fires. The observation of the dispersed organic matter in polished blocks under fluorescence showed that the microflora has not been affected by the wildfires, but altered fluorescence evidenced environmental dryness, also verified in palynofacies slides. The increased frequency of gymnospermous vegetation above the tonstein evidenced by pollen dominance indicated that a climate regime with extreme oscillations between humidity and dryness with wildfires was favorable to the seed-bearing plants. Under SEM, the charcoalified plant tissue showed homogenized cell walls, indicating burning temperatures between 325ºC and 400ºC given the low reflectance values and the preservation of fragile tissue like secondary phloem. The occurrence of stems charred in situ, followed by multiple horizons of charcoal suggest that wildfires were common and systemic events in this early Permian peat-forming environment in Gondwanaland. The evidence also indicated virtually non-existent charcoal transport in the charcoalified log horizon and that the wildfires from the upper horizons had little effect in the proximal community, occurring regularly in the surrounding areas of the peatland considering the fragmentary macroscopic charcoal input. With atmospheric oxygen levels at >25%, the widespread occurrence of fires in wet environments can be reconciled by the prevalence of lightning strikes and abundant fuel. These findings corroborate that Gondwanan peatlands were highly susceptible to wildfires during the postglacial warming in the Permian.

Keywords: Macroscopic charcoal, Fusain transition fossils, Coal-forming environment, Paleowildfires, *Glossopteris* Flora.