

The Phanerozoic records of paleo-wildfire and their impact on paleoclimate

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Wildfires are common events in modern ecosystems, and are also frequent and interact with paleoclimate in geological history. This study collects literature on paleo-wildfire events from 1990 to 2025, and approximately 630 records are sorted out and analyzed (before Quaternary). Statistical analysis shows a significant increase since 2010, revealing that frequency and distribution of paleo-wildfires are critical for global climate change (Fig. 1). Using GPlates and ArcGIS software, the paleogeographic locations of paleo-wildfire are relocated, and a series of paleogeographic molds showing distribution of wildfires during the Phanerozoic are reconstructed (Fig. 2). Combined with paleo-atmospheric oxygen and distribution of charcoal, the relationship between the occurrence of wildfires and fluctuation of paleoclimate is revealed.

The earliest wildfire occurred in the Silurian (Wenlock, ~430 Ma), with rarely distributed near 30°S latitude, accounting for only 1% of the Phanerozoic record (before the Quaternary). For the first time, the global atmospheric oxygen content has reached the minimum level of supporting combustion. In the Devonian, the range of wildfires expanded, but the frequency remains relatively low (6%). Wildfire records increased significantly from the Carboniferous (11%) to the Permian (23%), reaching a first peak during the Late Permian with widespread global distribution, with the arrival of the global coal-forming period. Wildfire activity declined during the Triassic (11%)–Jurassic (10%), followed by a second peak in the Cretaceous (22%), with another global-scale spread. In the Paleogene (7%) and Neogene (9%), wildfire activity began to decrease. Although the geological records of paleo-wildfires are incomplete and the identification of features also needs to be further improved, they still provide a new perspective for paleoenvironmental evolution.

