



Pollen and spores as biological recorders of past ultraviolet irradiance.

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Ultraviolet (UV) irradiance from the Sun is a key driver of climatic and biotic change. UV irradiance modulates processes in the stratosphere, and influences the biosphere from ecosystem-level through to the largest scale patterns of diversification and extinction. Yet our understanding of UV irradiance is limited to the present; no validated empirical method exists to reconstruct UV flux over long, geologically relevant timescales. Here, we show that a recently developed proxy for UV irradiance based on spore and pollen chemistry can be used over long (100,000 years) timescales. First, we demonstrate spatial variation in spore and pollen chemistry correlate with known latitudinal solar irradiance gradients. Second, using this relationship we provide a reconstruction of past changes in solar irradiance based on the pollen record obtained from Lake Bosumtwi in Ghana. Variations in the chemistry of grass pollen from the Lake Bosumtwi record show a link to multiple orbital precessional cycles (19-21,000 years). By providing a unique, local proxy for broad spectrum solar irradiance, the chemical analysis of spores and pollen offers unprecedented opportunities to decouple solar variability, climate and vegetation change through geologic time and a new proxy with which to probe the Earth system.