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A terrestrial temperature peak in the first millennia after the Cretaceous-Paleogene Boundary

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The Cretaceous-Paleogene (K-Pg) boundary marks one of the five major mass extinctions of the Phanerozoic. A bolide impact and flood basalt volcanism compete as triggers for the extinction, but their relative roles remain contentious. This is in part related to a paucity of robust measurements of temperature change at millennial time scales across the K-Pg boundary. Using the distribution of branched tetraether lipids in samples collected from coals (fossil peats), we present the initial findings of an ongoing study attempting to reconstruct temperatures across North America in the latest Cretaceous to earliest Paleogene. The glycerol dialkyl glycerol tetraether (brGDGTs) palaeotemperature proxy – which has been successfully applied to temperature reconstructions in the Pleistocene and Holocene – is being applied to a succession of fossil peats (lignites) that span the K-Pg boundary at ten sites from Colorado in the south to the North West Territories in the north. The Iridium anomaly that is synonymous with bolide impact at the K-Pg boundary can be used as a datum to correlate the coals. Data derived from coals deposited at a latitude of ~55 °N in Saskatchewan (Canada), are interpreted to reveal millennial-scale records of terrestrial mean annual air temperature (MAAT) for an interval spanning the latest Maastrichtian and earliest Paleogene. The MAAT record peaks at 28 °C ~1 ka (+ 4 ka/- 0.3 ka) after the K-Pg boundary, and subsequently recovers to pre-event values in the subsequent ~ 5 ka (+30 ka/-2 ka). Our unique record is consistent with an abrupt increase in atmospheric CO₂ that has been widely documented at this time.