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Temporal variability in charcoal distribution in Permian coal: Implications for interpreting palaeowildfire history

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The presence of fossil charcoal [inertinite (Scott and Glasspool, 2007)] in coal provides evidence for palaeowildfire event/s. Charcoal distribution has been shown to vary both spatially and temporally in modern wildfires, therefore this needs to be taken into consideration when studying inertinite from palaeowildfires in order to better understand palaeowildfire history. To determine whether this variation occurs in the geological past, charcoal produced by palaeowildfires from four randomly sampled Late Permian in situ coal (fossil peat) pillars from the Kuznetsk Basin, Russia [seam 78 (a and b) and seam 88 (a and b)] have been studied using petrographic techniques. The use of in situ coal pillars are judged to be essential for this type of work as they retain the orientation of the original inertinite distribution, unlike the crushed coals that are typically used for commercial petrographic analysis.
These coal pillars contain charcoal in all lithotype units, but show temporal variation both in the amount and type of inertinite between successive lithotype units. Furthermore, the pillars also contain varying amounts of charcoal both within and between seams [mean inertinite: 78(a) 29.8%, 78(b) 42.6%, 88(a) 48% and 88(b) 35%]. The distribution of this charcoal in these pillars can be used to interpret palaeowildfire type. All pillars show: (1) microscopic, scattered charcoal which is interpreted to represent background fire events and (2) macroscopic charcoal which is either scattered or contained in charcoal horizons, which is interpreted to represent surface fire events. Previous petrographic work on crushed coals by Pakh and Artser (2003) has shown that seam 78 has a higher inertinite content (33%) than seam 88 (22%), in contrast this study has shown that the pillars from seam 88 contain more inertinite (with a combined mean of 41.5%) than those from seam 78 (combined mean = 36.2%). This may suggest that during the formation of pillars 88(a,b) fires were either more frequent or that more charcoal was produced in individual fire events compared to the rest of seam 88. The variation in the amount of inertinite both within and between pillars provides evidence for temporal variation in wildfire history for the duration of both pillar and seam formation in this Late Permian peat-forming environment.

References

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