Geophysical Research Abstracts
Vol. 17, EGU2015-11392, 2015
EGU General Assembly 2015


# What can we tell from particle morphology in Mesozoic charcoal assemblages?

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Sedimentary charcoal particles provide a valuable record of palaeofire activity on both human and geological timescales. Charcoal is both an unambiguous indicator of wildfire, and a means of preservation of plant material in an inert form; thus it records not only the occurrence and extent of wildfire, but also the species affected.

While scanning electron microscopy can be usefully employed for precise taxonomic identification of charcoals, the time and cost associated with this limit the extent to which the technique is employed. Morphometric analysis of mesocharcoal particles (c. 125-1000 $\mu$m) potentially provides a simple method for obtaining useful information from optical microscopy images. Grass fires have been shown to produce mesocharcoal particles with a higher length-to-width ratio than woodland fuel sources. In Holocene archives, aspect ratio measurements are thus used to infer the broad taxonomic affinity of the burned vegetation. Since Mesozoic charcoals display similarly heterogeneous morphologies, we investigate whether there is a similar potential to infer the broad botanical affinities of Mesozoic charcoal assemblages from simple morphological metrics.

We have used image analysis to analyse a range of Jurassic and Cretaceous sedimentary rocks representing different vegetation communities and depositional environments, and also to determine the range of charcoal particle morphologies which can be produced from different modern taxa under laboratory conditions. We find that modern charcoals break down into mesocharcoal particles of very variable aspect ratio, and this appears to be dependent on taxonomic position. Our analysis of fragmented laboratory-produced charcoals indicates that pteridophytes produce much more elongate particles than either conifers or non-grass angiosperms. We suggest that for charcoal assemblages that predate the evolution of grasses, high average aspect ratios may be a useful indicator of the burning of a pteridophyte-dominated flora.