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Chemically isolated microcharcoal can be used for ^{14}C dating when macrocharcoal is absent

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Radiocarbon dating of macroscopically visible charcoal particles (macrocharcoal) in sediments or soils is commonly used to reconstruct past environmental processes and archaeological developments. Dating of chemically isolated microcharcoal, i.e. black carbon, could provide information if macroscopic charcoal is absent. To elucidate if the dating of chemically isolated microcharcoal could substitute the dating of macrocharcoal particles, we compared ^{14}C ages of macrocharcoal particles to the ages of microcharcoal, both charcoal fractions separated from the same soil sample.

Seven pairs of macro- and microcharcoal were taken from the same soil samples in the Lower Rhine Basin (NW-Germany) containing homogeneously distributed macrocharcoals (Gerlach et al., 2006), and we analysed them by AMS ^{14}C. Macrocharcoals ($>$ 1mm) were extracted by hand-picking. Microcharcoal was isolated from the total soil organic matter via UV photo-oxidation and identified by ^{13}C NMR (Skjemstad et al., 1997). About one-third of the total initial soil organic matter was quantified as charred organic matter.

The AMS radiocarbon ages of macro- and microcharcoal varied between 12800 - 12450 calBP to 3240 - 3070 calBP. Most microcharcoal samples (six of seven) were older than the macrocharcoals, although the differences were not significant ($p = 0.128$) and the ages of macro- and microcharcoal did not correlate ($r = 0.46$). While the five younger sample pairs yielded relatively similar ages ($r = 0.90$*), the two oldest sample sets showed larger differences between the macro- and the microcharcoal ages.

We concluded that in soil and sediments (1) microcharcoal is more resistant to degradation than macrocharcoal and thus yields more conservative ^{14}C dates, and (2) chemically separated microcharcoal can be used for dating when macrocharcoal is absent.

.Gerlach, R., Baumewerd-Schmidt, H., van den Borg, K., Eckmeier, E. and Schmidt, M.W.I., 2006. Prehistoric alteration of soil in the Lower Rhine Basin, Northwest Germany-archaeological, ^{14}C and geochemical evidence. Geoderma, 136: 38-50.

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