PARTICLE SIZE FRACTIONATION OF WINDBORNE ORGANIC MATTER: PALAEOCLIMATIC IMPLICATIONS

N. Penalva\(^1\), S. Monteagudo\(^1\), A. Macià\(^1\) and A. Rosell-Melé\(^{1,2}\)

\(^1\)Institut de Ciència i Tecnologia Ambientals, Universitat Autònoma de Barcelona, Catalonia-Spain
\(^2\)Institució Catalana de Recerca i Estudis Avançats (ICREA), Catalonia-Spain

Wind transported biomarkers deposited in marine or lacustrine sediments are valuable sources of information in palaeoclimatic, and environmental studies. Compounds such as \(n\)-alkanes, derived from higher plants, have provided unique insights on past changes in vegetation, atmospheric circulation and hydroclimate. Pyrogenic biomarkers such as levoglucosan are unique markers of biomass combustion and widely used in modern and palaeo reconstruction studies to study the occurrence of wildfires and the fate of their emissions. Polycyclic aromatic hydrocarbons (PAHs) are tracers of petrogenic as well as pyrogenic emissions and routinely investigated in atmospheric pollution research. However, despite their widespread occurrence in the environment, the processes by which these compounds become airborne, are transported and eventually deposited in sedimentary settings are not fully understood. In here, we discuss the role of particle size fractionation processes during transport of frequently studied windborne biomarkers (i.e. \(n\)-alkanes, PAHs and levoglucosan). To this end, we have investigated the composition of the targeted biomarkers in particles with different size ranges, using a cascade impactor placed on a high volume sampler. This sampling set up was deployed during a cruise across the tropical Atlantic, travelling from West to East, to collect airborne particulate matter from Africa blown across the Atlantic towards South America. We also deployed it in the roof of our institute, in a semi-rural area in the outskirts of Barcelona and close to a major motorway. The aim is to investigate the influence of distance from source to deposition site in the composition of particles from different sizes.

One of the main conclusions of our study is that the chemical/biomarker composition of the particles depends on their size range (Fig. 1). The relative proportion of the various compounds studied also changes according to the particles size ranges (Fig. 1). This has some major implications in the interpretation of wind transported biomarkers in sedimentary records. Thus, sediment records receiving inputs from the same sources are likely to deliver different results and lead to contrasting interpretations depending on their distance to the putative sources of the biomarkers, the length of the transport pathways of the air masses, and the wind strength, rather than environmental changes at source. These findings allow the design of more effective sampling strategies that minimize transport and size fractionation biases in the palaeo environmental interpretation of windborne biomarker records.
**Figure 1.** Concentration of major compound classes in filters collecting particulate material of various size fractions in semi-urban air near Barcelona city. PAHs stand for polycyclic aromatic hydrocarbons (grey bars) and are more abundant in particles of mid-size ranges. Levoglucosan (red bars) is derived from biomass combustion and its concentration increases with decreasing particle sizes. n-Alkanes (green bars) comprise chain lengths from C_{24} to C_{37} carbon atoms and their composition, and sources, changes with particle size. CPI (circles) stands for carbon preference index and provides a mean to track the changes in composition and sources of n-alkanes.