A 1500 year aeolian history as recorded in a peat bog from northern Romania: dust fluxes and deposition control in comparison with Western Europe

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Dust consists of small particles that reached the atmosphere from various sources (arid or semi-arid regions) via aeolian processes. Dust plays an important role in climate systems due to the changes it can induce in the radiative properties of the atmosphere; reflecting or absorbing solar radiation, or, indirectly, by affecting cloud formation and precipitation patterns. Dust transport and deposition can vary over time and space, and it is controlled mainly by climatic characteristics (e.g., precipitation, wind speed, the movement of air masses) (Fig. 1). However, in Europe past variability in dust fluxes has been reported mainly from western regions of the continent.

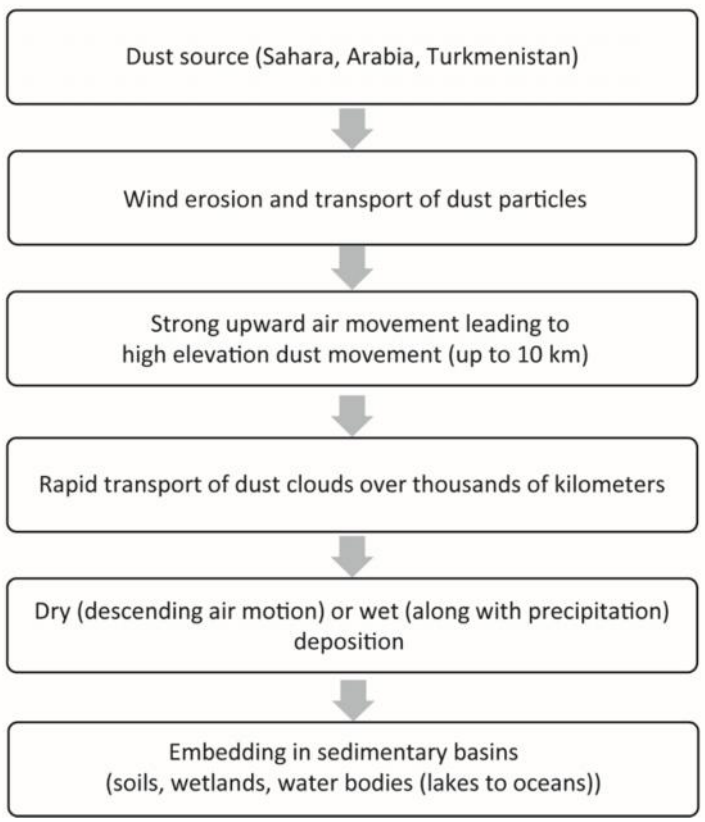

Fig. 1 Simplified scheme of dust transport and sedimentation.

Here, we have used a multi-proxy approach including physical (loss-on-ignition and two methods of particle size analysis), geochemical (XRF elemental data and carbon isotopic composition $\delta^{13}C$), biological (testate amoeba, pollen) and dating measurements (AMS ^{14}C, ^{210}Pb) to investigate an ombrogenous peat bog in the Carpathian Mountains of northern Romania. Our aims were to: i) determine dust fluxes over an extended Period (the last 1500 years); ii) examine the conditions that have influenced dust deposition in this area and whether these factors have changed over time; and iii) compare our data with studies elsewhere in continental Europe placing our Carpathian millennial dust history into a wider regional context.

Our results from show that during the Medieval Climatic Anomaly (MCO) (1050 – 750 years BP) the dust flux was high at time when the bog's testate amoeba and $\delta^{13}C$ indicate a wetter climate in this region. At the same time the minerogenic content, median size of particles and the maximum grain size diameter show high values indicating higher wind speeds. During the Little Ice Age (LIA) (650 - 150 years BP), dust fluxes declined, whereas climate conditions changed to a dry. Minerogenic content of the peat is low during this period, with a diminished median and maximum grain size, suggesting a fall and the fining of inputs during this period. From the end of the LIA to 1950 AD we recorded an increasing trend in dust flux associated with wetter climatic conditions. Subsequently, dust fluxes peaked over the last 60 years when climate conditions were warm and dry. As the same time the arboreal / non-arboreal pollen ratio indicates substantial deforestation in the wider region although not locally.

In Central-Western Europe (Poland and Switzerland) in the MCO dust fluxes were low in contrast to the LIA when they increased (De Vleeschouwer et al., 2009; Le Roux et al., 2012). Our record of dust fluxes from the MCO and LIA in the Carpathian Mountains are therefore contrary to those recorded elsewhere (and further west) in central Europe.

References

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