Fire history and the relationship with late Holocene mining activities in the NW Romanian Carpathians reconstructed from two peat core sequences

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Little is known about how areas of high ecological value and biodiversity hotspots will be impacted in the long-term by increasing anthropogenic pressure, added to future climate warming. One such example is the Romanian Carpathians, among the richest biogeographical regions in Europe in terms of biodiversity indicators and home to the largest unmanaged old-growth forests in Europe. This area is currently threatened by forest clearance and other anthropogenic land-use change, poor management practices and increased risk to wildfire. Peat bogs are among the most important palaeo-archives for the reconstruction of past environmental changes and disturbance regimes, with the potential to provide the longer-term perspective at a local to regional scale necessary for a sustainable management and restoration of these areas. Here we reconstruct late Holocene fire history and the relationship with anthropogenic disturbance, particularly mining, in a former mining area located in Lapus Mts, NW Romanian Carpathians, based on two peat sequences.

To reconstruct past fire activity, we used sedimentary macroscopic charcoal and also employed macro-charcoal morphologies to determine the type of material burnt (wood, grass, forbs). Past local soil/bedrock erosion and regional atmospheric pollution from historical mining were reconstructed on the basis of abiotic sediment properties such as elemental geochemistry, magnetic mineral characteristics, organic matter content and particle size. Our results show clear variations in macro-charcoal concentration, which coincide with changes in the geochemical, magnetic and grain-size indicators. Specifically, increases in macro-charcoal concentration, particularly the wood charcoal morphotype, were shortly followed in both cores by marked increases in heavy metal concentration and by enhanced soil and bedrock erosion, as inferred from geochemical, magnetic and grain-size proxies. This suggests increased local disturbance during intervals with mining activities and indicates the likelihood that humans used fire to clear the forests and open the access to the mining sites. Such actions likely resulted in topsoil removal
and bedrock left exposed to environmental and climatic factors. Over the last centuries, the recovery of the local environment is evident in the proxies, with low fire activity and low soil/bedrock erosion, which coincides with the cessation of local mining activities.

By showing both impact and recovery of the landscape, our study offers insight into the past evolution of this area and can be used to predict future possible responses of the local environment to anthropogenic stressors.