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Summary

Reconstruction of Holocene environmental changes using abiotic methods based on peatland sediments from Romania

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Keywords

peat bogs, environmental archives, aeolian fluxes, carbon accumulation, anthropogenic drivers, mining activities, climate variations, environmental changes

Summary

Peat bogs are unique ecosystems that can preserve organic material for thousands of years. As a result of their formation from the accumulation of partially decomposed plant matter in a waterlogged environment, they can serve as natural archives of past environmental conditions. The composition of peat can reveal information about the region's vegetation and climate, as well as the origins and effects of particulate inputs.

This doctoral thesis aims to:

i. Determine changes in atmospheric dust and sand deposition in north and west of Romania and assess their association with climate conditions and land use changes.

ii. Investigate the regional-scale relationship between records across the wider region.

iii. Assess the relative importance of hydrological variability, peat plant composition and disturbances on carbon (C) accumulation rates.

iv. Analyze the regional context of these past trends in physical peat properties and C accumulation.

v. Investigate the relationship between mining activities, atmospheric pollution, and historical events in the western part of Romania, specifically in Apuseni Mountains.

Chapter I introduces an extensive description of the subject, along with the materials and methods employed.

Chapter II describes the patterns in aeolian fluxes from Tăul Muced (northern Romania) and how the minerogenic input was primarily influenced by climate, with anthropogenic drivers, such as disturbance by fire, becoming more important in recent times. It provides a comprehensive reconstruction of Holocene aeolian dust and sand fluxes in the Tăul Muced ombrotrophic peat profile, Romania. Changes in aeolian fluxes over the past 7800 years have been caused by a combination of climatic conditions and human influence. The importance of anthropogenic drivers has grown in recent years. Additionally, the research identifies similarities and differences in dust flux records from other European regions, suggesting both distinct climate conditions and human influences.

Chapter III focuses on the hydrological conditions and carbon accumulation rates reconstructed from a mountain raised bog in the Carpathians. The chapter investigates the relationship between past hydroclimatic variations and carbon accumulation in a Carpathian Mountain peatland. The study reveals that drier and milder conditions increase the capacity of peatlands to sequester carbon, particularly when Sphagnum predominates. However, future anthropogenic pressure may have a negative impact on the potential for carbon accumulation. The research also advocates for additional research to better comprehend the carbon capacity of the region's peatlands.

The objectives of **Chapter IV** are to examine the regionality and localization of minerogenic input and to reconstruct past anthropogenic and natural dust input from ombrogenous peat bog in Apuseni mountains (West Romania). It examines changes in the depositional environment of the peat bog over time, including the influence of human activities such as mining and industry. The study reveals significant variations in environmental conditions that impact the capacity for carbon storage. History of lead (Pb) pollution demonstrates the lasting effects of human activities on the environment. When interpreting geological records, the results highlight the relevance of corroborating spatial variability in sediment sources and depositional environments.

Chapter V is focused on untangling the enigmatic growth and mineral inputs of a peat bog with problematic deposition rates and what were the implications for local erosion and regional dust deposition. Chapter V investigates environmental changes during Early and Middle Holocene. The research identifies intervals of increased dust fluxes and severe erosion, followed by intervals of low sand inflow and decreased erosion rates. Aeolian inputs

and peat accumulation rates were largely determined by climatic conditions, with contributions from local conditions.

Overall, the thesis explores the significance of peat bogs as natural archives of past environmental conditions. The comprehensive examination of various factors such as atmospheric dust deposition, hydrological variability, peat plant composition, and mining activities, shed light on the intricate relationships between climate, land use changes, and regional histories. The findings from this study highlight the role of peat bogs in preserving valuable information about vegetation, climate, and particulate inputs, providing critical insights into the past and contributing to our understanding of environmental dynamics. By unraveling the complexities of peat bog ecosystems and their implications for both local and regional environments, this research contributes to the broader knowledge base on these unique ecosystems and their significance in ecological and historical research.

Based on the results of this doctoral research, it is clear that past environmental changes in the study area were influenced by the complex interaction between natural climatic variations and human activities. In recent years, anthropogenic impacts have intensified, impacting both carbon accumulation in peatlands and atmospheric conditions. The findings emphasize the importance of peat bogs and aeolian sediments for deciphering past environmental changes and their implications for the present and future.

Nonetheless, additional research is required to fully comprehend the exact causes of these environmental and climate changes and their prospective long-term effects on ecosystems. To obtain a comprehensive understanding of past climate and environmental changes, more detailed investigations, including isotopic composition, high-resolution sampling, and enhanced age-depth modeling, are required.

In conclusion, the multiproxy studies presented in these chapters provide valuable insights into the environmental history of the study area and its significance within the larger context of climate and environmental changes in Europe. The results contribute to our understanding of the dynamics of peatland ecosystems, carbon cycling, and the effects of both natural and human-caused factors on the environment.