Processes and controlling factors of lacustrine sedimentary dynamics over the last ~6000 years in Lake Ighiel, Apuseni Mts, Romania

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Lake sediments act as high-resolution archives of past climate and environments, able to record natural and anthropogenic driven changes, and their effects on the ecosystem. Here we discuss a new lacustrine record from Lake Ighiel (924 m a.s.l.), located in Apuseni Mountains, in an attempt to reconstruct the lacustrine dynamics over the last 6000 years and identify the main processes, which controlled the depositional system during specific phases of lake evolution. Based on ^{210}Pb and ^{14}C dating, X-ray fluorescence scanning (μ-XRF) measurements, long-core sedimentary logging and environmental magnetic proxies (susceptibility, natural and induced remanences) we discuss the following points: *i)* the characteristics of main lacustrine sedimentation phases; *ii)* the amplitude and interplay of processes controlling the depositional environment through time; *iii)* contribution of hydroclimatic forcing in explaining changes in the nature of lacustrine deposition.

The 553 cm long composite profile of lake Ighiel was divided in four main sedimentation phases based on macro- and microscopic description (composition, structure, color), layer thickness and frequency and geochemical behavior of selected elements. The age-depth model revealed that sediments started accumulating in the basin ~6000 years ago. The first phase of lacustrine depositional environment covers the interval ~6000-4000 cal yr B.P., the Middle to Late Holocene transition, and is characterized by the highest clastic input and lowest lacustrine productivity of the entire profile. The presence of sand-sized clastic layers coupled with information derived from environmental magnetic proxies suggests that at the inception of lacustrine sedimentation, intense erosional processes affected the catchment area. Our finding is supported by other regional (Feurdean et al., 2013, Magyari et al., 2009) and extra-regional (Magny et al., 2006) studies which document the interval between 6000-5,500 cal yr B.P. as a period dominated by cold and wet conditions, that likely favored water retention in the basin and intense slope activity.

During the second phase of lake sedimentation covering the interval ~4000-2500 cal yr B.P., the sediment changed from massive to partly laminated, and the detrital fluxes decreased while productivity increased; these sediment characteristics point to a decline of erosional activity. The third sedimentation phase, 2500-1000 cal yr BP, is dominated by alternating stable and unstable conditions where the clastic input is decreasing, productivity is increasing and there was a tendency towards high oxygen conditions in the water column. The increased frequency of thin organic layers, composed mainly of aquatic plants, could be interpreted as reflecting seasonal and rapid variations in lake levels, most likely due to enhanced evaporation during warm seasons. This interpretation is supported by the

synchronicity with the Roman Warm Period, when climatic conditions in the region were warmer and drier than previously.

The last sedimentation phase, lasting from 1000 to -60 cal yr B.P. shows increasing detrital fluxes, oscillating lake productivity, reducing oxygenation conditions, and high carbonate contents; the last 300 years are marked by a strikingly oscillating trend in almost all proxies. This centennial instability is probably showing the intensification of human activities over the more recent past through landscape exploitation.

The statistical analysis (PCA) applied on the entire dataset helped better disentangle the processes responsible for the different sedimentation phases identified. Moreover, the changes observed in our proxies appear synchronous with regional hydro-climatic indexes, such as precipitation and total solar iradiation, pointing to a causal link between lake dynamics and natural climate variability. Superimposed on the natural climate forcing, changes observed in lake evolution also reflect the contribution of anthropogenic factors, starting with the Bronze Age and extending towards present times.

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References

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