

Mid-Late Holocene climate variability and fire events in a High Atlantic mountain area in NW Iberia (Picos de Europa)

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In this contribution we present data from a 182 cm-long sedimentary sequence collected in the mid-altitude area of Belbín, a depression dammed by a moraine during the Last Glaciation in the Western Massif of the Picos de Europa (Cantabrian Mountains, NW Spain), in order to reconstruct the environmental changes and the conditioning factors of these changes occurred during the Mid-Late Holocene in this mountain area. The uppermost 60 cm of the sediments have been studied using a multi-proxy analysis including the texture, the organic matter content, the micromorphology of the quartz grains, and the concentration of charcoal particles. The geochronological framework of the environmental and climatic events for the Mid-late Holocene was established with three AMS 14C dates.

During the last 6.7 ky cal BP a sequence of environmental changes took place in Belbin area driven by both warmer (between 6.7-5, 3.7-3, 2.6-1.1, 0.87-0.51 and since 0.01 ky cal BP) and colder stages (between 5-3.7, 3-2.6, 1.1-0.87 and 0.51 to 0.01 ky cal BP). The warmer stages were defined by the prevalence of chemical weathering of the quartz grains and relative increases of the C/N ratio. Conversely, during colder stages physical weathering of the quartz grains particles prevailed and the C/N values were lower. During the Late Holocene the sequence shows a progressive increase in the organic matter content, which may be associated with higher temperatures. Higher or lower concentration of charcoal particles according to warmer or colder climatic conditions is not detected, so the fires that have occurred in the area were likely to be related to human-induced fire management for grazing purposes. The period with the most frequent fire events occurred between 3.5 and 3 ky cal BP during the Bronze Age. Other significant peaks of charcoal particles occurred at ca. 2.6, 0.71 and 0.36 ky cal BP.

This study shows evidence that the environmental changes occurred during the Mid-Late Holocene in this area of the Cantabrian Mountains are both conditioned by climate variability and human activity. Also, it has been demonstrated the relationship between the type of quartz grains, the weathering intensity (chemical and physical) and the concentrations of charcoal particles. There is a clear relation between the samples that evidence high intensity of chemical and physical weathering with higher average of charcoal particles concentration. Climatic conditions have an important role in weathering intensity, through the combination of silt abundance and cryogenic weathering, but in our study this is not the case, therefore fire most possibly modified local environmental conditions making quartz grains more vulnerable to post-fire situations. This emphasizes the important role of the fires in the micromorphology of quartz grains.