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Magnetic detection of Holocene climatic events in sediments from the Galician continental shelf. Interplay between detrital input and progressive early diagenesis.

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The evolution of the continental shelf off SW Galicia since the Upper Pleistocene has been studied integrating sedimentological and high-resolution magnetic and geochemical data from 6 cores arranged in two transects oriented NW-SE, at depths around -100m, and NE-SW, from -70 to -130 m water depth.

Four sedimentary units have been identified. Unit A is a muddy layer, mainly deposited during the Middle to Late Holocene. Unit B is composed of coarse sands and gravels, rich in bioclastic fragments and glauconite. These sediments have been interpreted as of transgressive nature, based on previous work in the area. An erosive surface separates this coarse unit from the fine to medium sands of unit C, developed during and/or before the LGM. The depths of the cores around -100 m suggests that these are coastal sediments, probably beaches or coastal sand barriers, that were subaerially exposed during the lowstand of the sea level. This interpretation is supported by the absence of carbonatic bioclasts, which were dissolved under subaerial conditions, and the good sorting and parallel lamination of these sediments, characteristics developed under a high energy regime. Unit D is only detected to the south, and is interpreted as of fluvial origin considering its gravelly, non carbonatic nature, and its location close to the paleovalley of the Ría de Vigo during the LGM.

The magnetic properties of these sediments exhibit up to 3 peaks of decreasing amplitude with depth in the uppermost unit A. The good correlation obtained between the concentration-dependent magnetic properties and Ti suggests a detrital origin of the observed signal. The age model of these sediments has allowed the correlation of these peaks to three well known climatic events occurred during the Holocene, the Medieval Climatic Optimum, the Roman Warm Period and probably the Subboreal/Subatlantic transition. The two uppermost peaks are probably the result of the interplay between the greater erosion due to the deforestation driven by human activities and an enhanced continental runoff. The lowermost peak is probably related to the greater climatic instability associated with the cited transition. Low concentration levels, however, show an increase in coercivity related parameters as well as a coarsening of the magnetic mineral assemblage, specially evident below the lowermost peak. This is usually interpreted as the result of reductive dissolution of magnetic minerals during suboxic/anoxic diagenesis. SEM analyses have provided a positive identification of early diagenetic processes throughout these cores, as evidenced by the observation of iron sulfides, usually confined to microenvironments. The decreasing amplitude of the observed peaks and the exponentially decreasing shape of the concentration-dependent magnetic parameters suggest that early diagenesis has been progressing through time, eventually destroying any detrital magnetic signal below a certain depth threshold.

Magnetic properties have proven useful for detect low amplitude climatic signatures during the last four millennia. However, progressive early diagenetic dissolution of this detrital signal has completely erased the climatic record below a certain depth threshold, not allowing further paleoclimatic reconstructions based of the magnetic content of the sediments.