Environmental influences on coccolithophore distribution and abundance in the water column of the western Iberian margin (August 2022)

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This study investigates the abundance, composition, and biogeographical distribution of coccolithophores in the water column of the northwestern Iberian coastal upwelling system during late summer 2022. The coccolithophore data were compared with physical, chemical, and biological parameters measured *in situ* to evaluate the influence of the environment on coccolithophore distribution. Additionally, coccolithophore data were compared with satellite data (NASA Ocean Biogeochemical Model [NOBM] and NASA Moderate-Resolution Imaging Spectroradiometer [MODIS]) and the upwelling index (UI) in the study area. The results reveal a latitudinal and longitudinal gradient in coccolithophore abundance with peaks towards the north and east. This indicates that the stations closest to the coast (CA-7, CA-8, and CA-4) are most affected by coastal upwelling, with cooler surface temperatures and higher fluorescence and turbidity values. Moreover, our data suggest that the source of the upwelled water in the north (Eastern North Atlantic Central Waters of subpolar origin, ENACWsp) is different from that in the south (ENACW of subtropical origin [st]). The significant correlation between the upwelling index and the total abundance of coccoliths and coccospheres underlines the important role of upwelling mechanisms in controlling the abundance and spatial distribution of coccolithophores along the western Iberian margin. Furthermore, the significant correlation between coccolithophore abundance and fluorescence (Chl-*a*) and turbidity suggests that coccolithophores account for a substantial fraction of the primary production in the region.

The affinity of certain species to specific environmental conditions supports their use as paleoenvironmental indicators in the study area. In particular, the small Noelaerhabdaceae group (sum of the small *Gephyrocapsa* group and *Emiliania huxleyi*) is proposed as a proxy for primary productivity (PP) and enhanced upwelling intensity (UI > 0), whereas *Florisphaera profunda* appears to be associated with conditions of upwelling relaxation, stratified water column (deep thermocline), and low productivity in the upper photic zone. Discrepancies between our *in situ* observations and satellite data are attributed to the limited capacity of satellites to detect subsurface biological processes. In addition, this study supports the viability of using the N ratio in water column samples, as opposed to only in sediments as suggested by previous work. Overall, this research contributes to a deeper understanding of primary productivity on the western Iberian margin during the upwelling season and emphasizes the crucial role of coccolithophores in paleoenvironmental reconstructions.