

impacted metal character of the Minho estuary sediments, regional geochemical baselines (RGB) are defined for differentiating between natural and anthropogenic contributions. Based on RGB defined for each heavy metal, the degree of enrichment is estimated through the determination of enrichment factors. Despite relatively low total heavy metal concentrations, defined RGB identifies a set of samples characterized by presenting As, Cu, Cr, Hg and Zn enrichments relatively to Al. Mercury is the element showing the highest level of enrichment relative to the baseline values.

Palavras chave: Estuário do Minho, sedimentos superficiais, metais pesados, valores de *baseline* geoquímica, factores de enriquecimento.

Keywords: *Minho estuary, surface sediments, heavy metals, regional geochemical baselines, enrichment factors.*

Effects of ultraviolet radiation, CO₂ and temperature increase on winter phytoplankton assemblages in a temperate coastal lagoon (Ria Formosa, Portugal)

Efeitos do aumento da radiação ultravioleta, CO₂ e temperatura na comunidade fitoplanctónica de inverno numa laguna costeira (Ria Formosa, Portugal)

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Increases in ultraviolet radiation, carbon dioxide and water temperature affect phytoplankton growth and mortality in an array of different ways. In situ responses of natural phytoplankton communities to climate change, as well as its effects on phytoplankton biomass seasonal cycles, are still largely unknown. Although temperature and UVR have been increasing in temperate latitudes during winter months, this season is still particularly neglected in climate change studies, since it is considered a non-active season in respect to phytoplankton growth and production. In addition, coastal lagoons are highly productive ecosystems and they rank as very vulnerable to climate change. The goal of this study is, therefore, to evaluate the effects of increased UVR, CO₂ and temperature on the metabolism of winter phytoplankton assemblages in a temperate coastal lagoon, the Ria Formosa (southern Portugal).

During Winter 2012, two sets of microcosm experiments were used to evaluate the combined effects of: (A) UVR and CO₂, using low (ambient) and high (values expected for 2100) CO₂ treatments, exposed to ambient UV levels and without UV

radiation, and (B) CO₂ and temperature, with low and high CO₂ treatments exposed to in situ and increased temperature (+3°C). Phytoplankton composition, abundance and biomass, as well as primary production, photosynthetic response and nutrient consumption, were evaluated during the experiments.

Overall, phytoplankton growth, photosynthetic capacity and primary production exhibited significant declines under increased temperature, reflecting how well adapted winter phytoplankton communities are to winter conditions. On the contrary, phytoplankton growth, particularly diatoms, was stimulated by CO₂ additions. Ultraviolet radiation had a deleterious effect only on cyanobacteria growth, but not on the other phytoplankton groups.

Palavras chave: fitoplâncton, alterações climáticas, Ria Formosa, metabolismo, fotossíntese.

Keywords: *phytoplankton, climate change, Ria Formosa, metabolism, photosynthesis.*

Mid-late Holocene climatic changes in the Southwestern Iberian shelf

Alterações climáticas no Holocénico na plataforma do SW da Ibéria

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Vegetation (pollen analysis) and Sea Surface Temperature (SST) reconstructions from a south western Iberian shelf core (POPEI VC2B) show orbital and suborbital climate variability for the last 6000 years. The short-term vegetation changes, reflecting millennial scale climatic variability, are clearly identified over the last 6000 years. The first zone, 3310 - 738 cal. yr BC, is marked by the presence of semi-desert plants reflecting dry conditions. The next zone, 738 cal yr BC - 421 cal. yr AD, shows a decline of semi-desert plants and an increase of heathland and *Pine* associated with the establishment of an incipient *deciduous Quercus* forest reflecting temperate and humid conditions that can be associated with the Roman Warm Period (RWP). The Dark Ages Cold Period (DACP) (c. 421 - 1200 cal. yr AD) is marked by a decrease of trees and increase of *cistus* and *chenopodiaceae* suggesting a relative cooling and dryness. In contrast, the Medieval Climate Anomaly (MCA) (c. 1200 - 1449 cal. yr AD) is characterized by the recovery of the temperate forest suggesting warm conditions. During the Little Ice Age (LIA), 1449 – 1795 cal. yr AD, the temperate trees were replaced by semi-

desert plants and there is an increase of anthropic species, suggesting a cooling and dry episode. However these dry conditions have been gradually replaced by wet conditions at the end of this period. Finally, the last 150 years shows the increase of anthropic activities as revealed by the expansion of *pine* and anthropic associations.

Palavras chave: paleoclimatologia, Holocénico médio e recente, SW margem Ibérica, palinologia marinha, vegetação.

Keywords: *paleoclimatology, mid-late Holocene, southwestern Iberian shelf, marine palynology, vegetation, Holocene.*

New insights into the last deglaciation in the south-western iberia: vegetation cover and climate variability

Novos indícios sobre a última glaciação no SW da Ibéria: vegetação e variabilidade climática

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Direct correlation between terrestrial (pollen) and marine climatic indicators (sea surface temperatures-SST) from a core DI3882 (south-western Iberian margin) allows the detection of millennial scale climate variability for the last deglaciation in the mid-latitudes of the eastern North Atlantic realm.

The Bölling-Alleröd (B-A) is marked by the expansion of deciduous trees reflecting warm and wet conditions. In contrast, the Younger Dryas (YD) event is characterized by the contraction of temperate trees and the expansion of semi-desert plants (*Chenopodiaceae*, *Artemisia* and *Ephedra*), suggesting a cooling and dry episode. The beginning of the Holocene is marked by the return to warm and wet conditions as revealed by the recovery of the temperate trees. All these continental climatic changes are synchronous with the sea surface temperature variability in the same region and with the atmospheric temperature oscillations recorded in the Greenland Ice cores.

The maximum expansion of the temperate trees and SST at 11700 cal yrs BP marks the beginning of the Holocene thermal maximum (HTM) in the south-western Iberia.

Palavras chave: paleoclimatologia, deglaciação, SW margem Ibérica, palinologia marinha, vegetação.

Keywords: *paleoclimatology, deglaciation, south-western Iberian margin, marine palynology, vegetation.*

Pulses of aeolian activity in Portugal driven by enhanced westerlies during the deglaciation

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The climate of the Earth Planet is regulated by the transference of energy from the Equator to the poles by the coupled ocean-atmosphere circulation system. Events of rapid climate change during the last deglaciation were characterized by a weakening of the Atlantic Meridional Overturning Circulation (AMOC). Conversely, atmospheric circulation was dramatically enhanced during rapid climate shifts suggesting a complex ocean-atmosphere coupling. Here, we investigated the aeolian record from central Portugal to reconstruct windfield regimes during the deglaciation assuming that dunes are sensitive to changes in atmospheric circulation. The analysis of the internal architecture obtained with Ground Penetrating Radar (GPR) and the ages of the identified units obtained by Optically Stimulating Luminescence (OSL) support enhanced atmospheric circulation during the Heinrich event I and the Younger Dryas inferred from the occurrence of sand drift pulses driven by intense westerly winds. On the other hand, the results suggest enhanced storminess during these cooling events, which in turn conflicts with the widely accepted idea that arid conditions dominated SW Europe during HI and YD cooling events.

Keywords: *aeolian activity, windfield, westerlies, OSL, GPR.*

Latitudinal and Longitudinal SST gradient in the Western Iberian Margin during the LGIT

Gradiente de temperatura Latitudinal e Longitudinal ao longo da Margem Ibérica durante a última transição do glacial para o Interglacial

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Sea Surface temperature records based in alkenone Uk'37 Index and planktic foraminifera along the Iberian margin reveal millennial-scale climate variability over the last deglaciation, in particular during the Last Glacial Interglacial Transition (LGIT). In the Iberian margin, Heinrich event I (HI) and the Younger Dryas (YD)