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THE RECORD OF A HIGH-ENERGY EVENT IN A MUD ENTRAPMENT ON THE INNER SHELF OFF THE GUADIANA RIVER

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ABSTRACT

Recent environmental changes associated with high-energy events and human impacts were investigated in a mud entrapment confined in the paleo-Guadiana incised valley. Those changes were recorded in a gravity core during the last 2500 years. An erosional event seems to have occurred at ca. 500 cal yr BP but it is not clear how much sediment was removed. This event was followed by an increase in river discharges until ca. 465 cal yr BP while the benthic foraminiferal faunas were dominated by species associated with shallow-water sandy sediments. Upward, sedimentological and benthic foraminiferal variations indicated environmental changes, promoted by variable sediment supplies to the shelf.

RESUMO

As mudanças ambientais recentes associadas a eventos de alta energia e impactes antrópicos foram investigadas numa área de deposição sedimentar recente, confinada pelo preenchimento do paleovale do Guadiana. Estas mudanças foram registadas durante os últimos 2500 anos. Um evento erosivo terá ocorrido ca. 500 cal anos BP, mas não é clara a quantidade de sedimento removida. Este evento foi seguido por um aumento das descargas do rio até ca. 465 cal anos BP e por um domínio de espécies que ocorrem associadas a sedimentos arenosos a pouca profundidade. Nas últimas quatro décadas, as variações sedimentológicas e das faunas de foraminíferos bentónicos indicam a ocorrência de alterações ambientais, promovidas por períodos de fornecimento sedimentar variável para a plataforma.

INTRODUCTION

Mud depocenters can be used as high-resolution archives, since they sensitively record environmental changes occurred during their formation. On the inner shelf off the Guadiana River, northern Gulf of Cádiz, the recent deposition is mainly driven by river discharges, with high sedimentation accumulation rates and consequently detailed temporal resolution. The purpose of this study is to unravel environmental changes recorded in a mud entrapment whose development is apparently linked by the previous local physiography dictated by the paleo-Guadiana incised valley. The distinct evolutionary phases observed within the depocenter are discussed in the context of high-energy events, including river discharges variability, and human impacts in the Guadiana River basin during the last 2500 years.

METHODS

A gravity core GeoB19522 was recovered in March 2015, during the RV Poseidon cruise POS482 CADISED, in a mud entrapment constituting the most recent Guadiana paleovalley infilling, at 14 m water depth. In this core, twenty seven samples were analyzed for grain size and benthic foraminiferal assemblages; the chronology was based on six radiocarbon datings.

RESULTS

The radiocarbon date obtained at the base of the analyzed core (228.5 cm) indicates a median probability calibrated age of 2516 cal yr BP (566 BC) (Figure 1). Low sedimentation rates were observed from the core base to ca. 508 cal yr BP (185.5 cm) with values ranging from 25 to 20 cm/ka. The highest sedimentation rates, with values ranging from 227 to 918 cm/ka, were observed above 185.5 cm, during the last ca. 508 cal yr BP (1442 AD) (Figure 1). The silt and clay fractions are generally most abundant along the core (together 38-99.8%) with two exceptions, near the core base and from 186 to 177 cm where the gravel and sand fractions exhibit higher proportions (0.2-62%)

(Figure 1). The benthic foraminiferal abundances varied between 9 and 1095 specimens per gram of sediment. The maximum value was obtained at 161 cm core depth, where the species richness was also higher (96 species). According to their relative abundances, benthic foraminiferal species were grouped in three clusters (Figure 1).

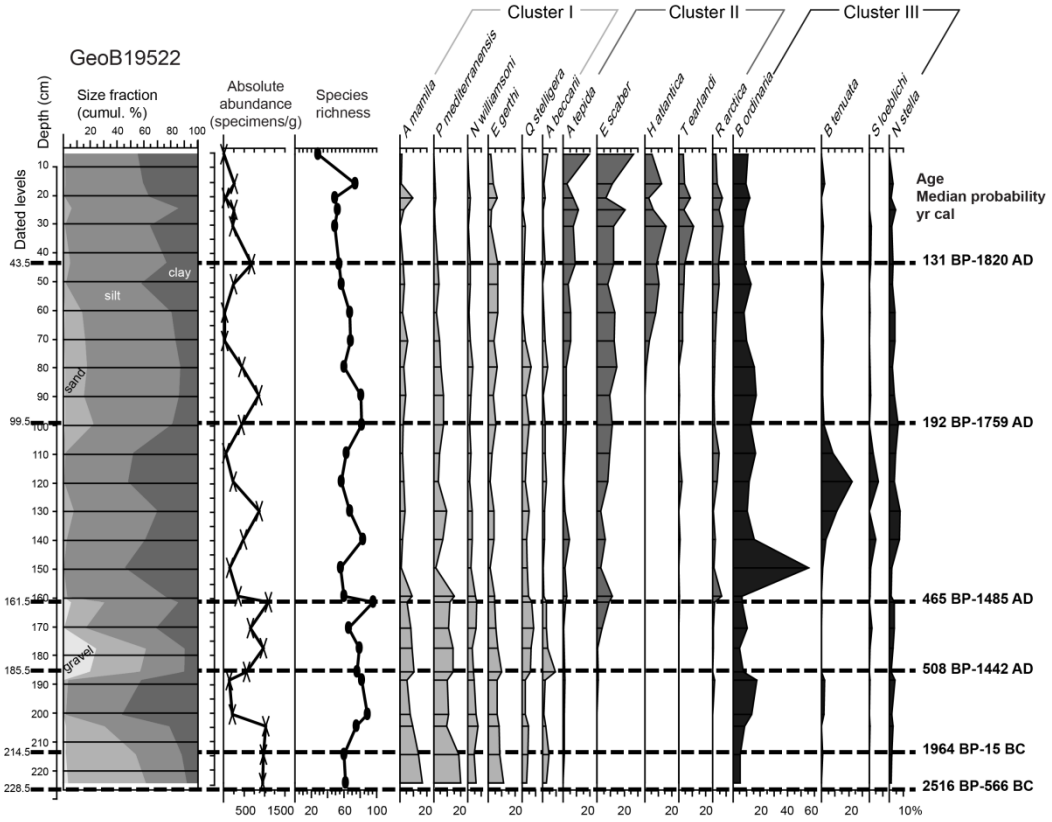

Figure 1. Variation of cumulative grain size fraction, benthic foraminiferal absolute abundance, species richness and relative abundance of most abundant benthic foraminiferal species with depth, for core GeoB19522. Results obtained by R-mode cluster analyses (Cluster I to III) are represented. Dashed lines indicate radiocarbon dated levels.

DISCUSSION AND CONCLUSION

Several environmental changes were recorded during the last 2500 years in a mud entrapment constituting the most recent infilling phase of the Guadiana paleovalley. Low sedimentation rates recorded in the lower part of the core could be interpreted as the result of low sediment inputs to the shelf and/or the prevalence of erosional processes in this area. This period seems to culminate with the deposition of a coarse-grained layer possibly related with a high energy event recorded from ca. 508 to 465 cal yr BP (Figure 1). The transient increase of the gravel and sand fractions, normally associated with higher river discharges (e.g. Mendes et al., 2012a), the increase of benthic foraminiferal abundance and the number of species, suggest that a new environment with different substrate properties, which enabled the coexistence of more specimens and species in the same habitat was established. This environment was dominated by species from cluster I (Figure 1), normally associated with sandy sediments at shallow depths (Mendes et al., 2012b). In the last ca. 465 cal yr BP, sedimentological and benthic foraminiferal variations indicated subsequent environmental changes, promoted by alternating periods of increased/decreased sediment supply to the shelf.

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