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Review article

Distribution of ostracod and benthic foraminiferal assemblages during the last 550 kyr in the East-Corsica basin, western Mediterranean Sea: A paleo-environmental reconstruction

La distribution des assemblages d'ostracodes et de foraminifères benthiques le long des derniers 550 ka dans le bassin Est-Corse, Méditerranée occidentale : une reconstitution paléo-environnementale

Charlie Morelle Angue Minto'o^{a,b,*}, Maria-Angela Bassetti^{a,b}, Samuel Toucanne^c, Gwenaél Jouet^c

^a Université de Perpignan Via Domitia, CEFREM-UMR 5110, 52, avenue Paul-Alduy, 66860 Perpignan, France

^b CNRS, CEFREM-UMR 5110, 52, avenue Paul-Alduy, 66860 Perpignan, France

^c IFREMER-Centre Bretagne, Laboratoire Environnements Sédimentaires, 29280 Plouzané, France

Abstract

The study of Quaternary sediments covering the last 550 kyr from the borehole GDEC-4-2, East-Corsica basin, was performed through the study of benthic meiofaunal assemblages (ostracoda and benthic foraminifera) whose distribution responds to climate changes, and glacial–interglacial variability in particular. The interglacial ostracod group is mainly composed of the *Argilloecia acuminata*, *Cytheropteron alatum*, *Henryhowella* sp., *Polycope* sp. and *Cytherella* sp., which indicate an enhanced surface productivity and possibly high bottom water temperature during these warm intervals. Benthic foraminifera, such as *Hoeglundina elegans*, *Sigmoilopsis schlumbergeri*, *Bigenerina nodosaria* and *Hyalinea balthica* are predominant during interglacial periods and also show an increasing surface productivity associated to warm intervals. Increase in surface productivity would contribute to an enhanced export of organic matter to sea floor at the GDEC-4-2 site during interglacial periods. The bottom temperature drop coupled with the important sedimentary inputs (associated to a significant quantity of refractory organic matter) during glacial periods was highlighted by the predominance of ostracoda, such as *Paradoxostoma* sp., *Cytheropteron testudo*, *Bathycythere vanstraateni*, *Macrocypris* sp., *Echinocythereis echinata* and benthic foraminifera as *Bolivina spathulata*, *Bulimina costata*, and *Bulimina marginata*. The distribution of some benthic foraminifera species describing a turnover system allowed the characterization of the last three climate cycles (MIS 8–9, MIS 6–7, MIS 1–5) probably marked by changes of bottom water paleoceanographic conditions in terms of temperature, salinity, bottom current intensity and surface productivity. The cyclic variations of the allochthonous group recorded over the last 550 kyr suggest a major role played by the eustatic factor, with the latter possibly favouring down slope transport. The distribution of this group allowed thus establishing a link between shelf-basin sediment transfer and climate, with enhanced shelf-basin sediment transfer during glacial low stands.

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Keywords: East-Corsica; Ostracoda; Benthic foraminifera; Allochthonous group

Résumé

L'étude des sédiments du Quaternaire provenant du forage GDEC-4-2 couvrant les derniers 550 ka, dans le bassin Est-Corse, a été faite grâce à la distribution des assemblages de méiofaunes benthiques (les ostracodes et les foraminifères benthiques) dont la distribution répond aux changements climatiques, et particulièrement, à la variabilité glaciaire–interglaciaire. Le groupe interglaciaire des ostracodes est principalement composé de *Argilloecia acuminata*, *Cytheropteron alatum*, *Henryhowella* sp. *Polycope* sp. et *Cytherella* sp. qui indiquent une amélioration de la productivité

* Corresponding author. Université de Perpignan Via Domitia, CEFREM-UMR 5110, 52, avenue Paul-Alduy, 66860 Perpignan, France.

E-mail address: charlie.angue-mintoo@univ-perp.fr (C.M. Angue Minto'o).

de surface et probablement des températures élevées au fond pendant ces intervalles chauds. Les foraminifères benthiques, tels que *Hoeglundina elegans*, *Sigmoilopsis schlumbergeri*, *Bigenerina nodosaria* et *Hyalinea balthica* prédominent pendant les périodes interglaciaires et montrent également une augmentation de la productivité de surface associée à ces intervalles chauds. L'augmentation de la productivité de surface a pu contribuer à une amélioration, pendant les interglaciaires, de l'apport de la matière organique au fond au niveau du site du forage GDEC-4-2. La chute de la température du fond combinée à un apport sédimentaire important (associée à une bonne quantité de matière organique réfractaire) pendant les périodes glaciaires a été mise en évidence par la prédominance des ostracodes, tels que *Paradoxostoma* sp., *Cytheropteron testudo*, *Bathycythere vanstraateni*, *Macrocypris* sp., *Echinocythereis echinata* et des foraminifères benthiques comme *Bolivina spathulata*, *Bulimina costata*, et *Bulimina marginata*. La distribution de certains foraminifères benthiques, décrivant un système de *turnover*, a permis la caractérisation des trois derniers cycles climatiques (MIS 8–9, MIS 6–7, MIS 1–5) probablement marqués par des changements des conditions paléocéanographiques des eaux profondes en termes de : température, salinité, intensité du courant au fond et productivité de surface. Les variations cycliques du groupe allochtone, enregistrées pendant les 550 000 dernières années, suggèrent le rôle major joué par les facteurs eustatiques pouvant favoriser le transport de la pente vers le bassin profond. La distribution de ce group a donc permis d'établir un lien entre le transfert sédimentaire plateau continental-bassin profond et le climat avec un renforcement du transfert durant les bas niveaux marins.

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Mots clés : Est-Corse ; Ostracode ; Foraminifère benthique ; Groupe allochtone

1. Introduction

Ostracoda and benthic foraminifera are found in most marine environments and are among the most important components of modern and ancient benthic communities. They constitute an important tool for paleo-climatic-environmental-oceanographic reconstructions because of their high sensitivity to environmental conditions (e.g. Barut et al., 2015; Casier et al., 2015; Trabelsi et al., 2015). As a result, these benthic microfossils are largely studied over the world (e.g. Zhao and Whatley, 1997; Wollenburg and Mackensen, 1998; Redois and Debenay, 1999; Zhou and Zhao, 1999; Fontanier et al., 2002; Triantaphyllou et al., 2005; Schumacher et al., 2007; Pascual et al., 2008; Hess and Jorissen, 2009; Nachite et al., 2010; Drinia and Anastasakis, 2012; Munef et al., 2012; Martínez-García et al., 2013; among others).

Studies on variation and distribution of benthic foraminifera and ostracod assemblages East-Corsica basin, western Mediterranean, are very rare. A recent study focusing on both the modern and ancient benthic foraminifera and ostracoda in this area, allowed generating data about the general bathymetric distribution of those in this area (Angue Minto'o et al., 2013). These data are used for interpreting the distribution of benthic microfossils in the 125-m long GDEC-4-2 sedimentary record that covered the last 550 kyr and represents the first long and continuous sedimentary record in the East-Corsica basin (Angue Minto'o, 2014; Toucanne et al., 2015). We use these benthic microfossils as a tool to:

- establish the relationship between climatic variations, sea level changes and sedimentary transfer;
- characterize bottom physical and chemical conditions associated to glacial–interglacial periods.

2. Study area

The East-Corsica margin, located in the northern part of the Tyrrhenian Sea (Western Mediterranean), is characterized by a narrow continental shelf with a shelf break situated around

110–120 m (Gervais, 2002; Gervais et al., 2004). This continental shelf is followed by a steep continental slope incised by numerous meandering canyons (Gervais, 2002). The latter open out into a deep basin, which is characterized by a depression named Corsican Trough. The Corsican Trough is narrow (10–30 km) and shallow (400 to ca. 900 m) and is bordered by the Pianosa Ridge on its eastern flank (Fig. 1). The sedimentary transport into the East-Corsica basin is mainly driven by the Golo River (main river of the East-Corsican margin) (Calvès et al., 2012).

The oceanographic structure of the East-Corsica basin includes a surface layer of Modified Atlantic Water (MAW, down to 200 m water depth) principally constituted by North Atlantic central water drawn into the Mediterranean Sea through the Gibraltar Strait and an intermediate layer of Levantine Intermediate Water below (LIW, down to 600–1000 m water depth) mainly formed in the Levantine basin (Eastern Mediterranean) (Gasparini et al., 2005; Astraldi and Gasparini, 2013). The LIW enters into the Western Mediterranean Sea through the strait of Sicily. In the northern part of the Tyrrhenian Sea (and in the Corsica Trough especially), a strong seasonal variability of this water mass is noted with a maximal flow observed during winter and early spring (Astraldi and Gasparini, 1992; Vidal et al., 2000).

3. Materials and method

The present work is based on the study of 291 samples collected in the borehole GDEC-4-2 drilled at a water depth of 492 m in the East-Corsica margin. Samples were washed and sieved (63 μm) before performing micropaleontological analyses on the sedimentary fraction > 150 μm . Taxonomy of benthic foraminifera was based on Ausseil-Badie (1978); Jorissen, (1987), Sgarrella and Moncharmont Zei (1993), Abu-Zied, (2001), Fontanier (2003), Aiello et al. (2006), Milker et al. (2009), Frezza and Carboni (2009), Mojtahid et al. (2009, 2010). Data on ostracoda systematics are taken from Müller (1894), Bonaduce et al. (1975), Peypouquet and Nachite (1984), Didié and Bauch, (2001) Aiello et al. (2006), Triantaphyllou et al.

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