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Influence of near-bottom environmental conditions on the structure of bathyal macrobenthic crustacean assemblages from the Capbreton canyon (Bay of Biscay, NE Atlantic)

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Abstract — Sled and box-corer samplings were performed at two sites in the Capbreton canyon in order to appreciate the influence of near-bottom environmental conditions on the structure of their macrobenthic communities (crustaceans). Although located at similar depths (ca. 1 000 m), these two sites were characterised by different physicochemical conditions at the sediment-water interface, probably related with the morphology of the submarine valley (reduced environment, oxygen depletion and stagnation of bottom water at site A; normal oceanic conditions on the near-bottom environment of site B). The analysis of the collected fauna revealed a low similarity between the two sites, mainly due to the unusual dominance of three epibenthic species in sled samples from site A: the amphipod *Bonnierella abyssorum*, the tanaid *Apseudes spinosus* and the isopod *Arcturopsis giardi*. Due to their apparent rarity or absence in adjacent non-canyon communities, such epibenthic crustaceans may be considered as 'canyon indicator species' able to exhibit abundant populations within the peculiar confinement area of this canyon. © 1999 Éditions scientifiques et médicales Elsevier SAS

Benthos ecology / submarine canyon / bathyal zone / Bay of Biscay / NE Atlantic

1. INTRODUCTION

Located in the south-eastern part of the Bay of Biscay (NE Atlantic ocean), the Capbreton canyon is a 'gouf'-type submarine valley according to the morphological description of Shepard and Dill [29], Vanney and Mougenot, [38] and to the recent classification proposed by Teixeira Gomes [35]. Such a major topographic accident separates the northern Aquitanian shelf from the narrower southern Cantabrian platform. It begins at less than 250 m from the shoreline in front of Capbreton (early mouth of the Adour river) and extends through 135 nautical miles before ending on the abyssal plain at about 3 000 m water depth [38]. Deeply cutting the continental shelf between the coast and the meridian 2° W, its upper part is narrow and sinuous whereas its lower part widens out to the open ocean.

During the course of a French-Spanish co-operative research programme on the pelagic and benthic ecosystems from the Capbreton area, different sampling operations from CAPBRETON cruises on board of the RV *Côte d'Aquitaine* [32] were performed all along the upper part of the submarine valley down to 1 000 m depth in order to study the megafauna as well as the supra- and endobenthic fauna of these deep muddy bottoms. This paper deals with a comparison of the structure of benthic communities (crustacean components) from two sites sampled at the same depth but under quite different environmental conditions.

2. STUDY AREA

Figure 1 shows the study area located in the south-eastern part of the Bay of Biscay and the geographical position of the sampling sites A and B within the Capbreton canyon.

According to earlier hydrographical observations from Le Floch [17] and Ogawa and Tauzin [18], as well as unpublished data recorded during the CAPBRETON cruises, these two sampling sites are under the influence of Mediterranean waters which flow

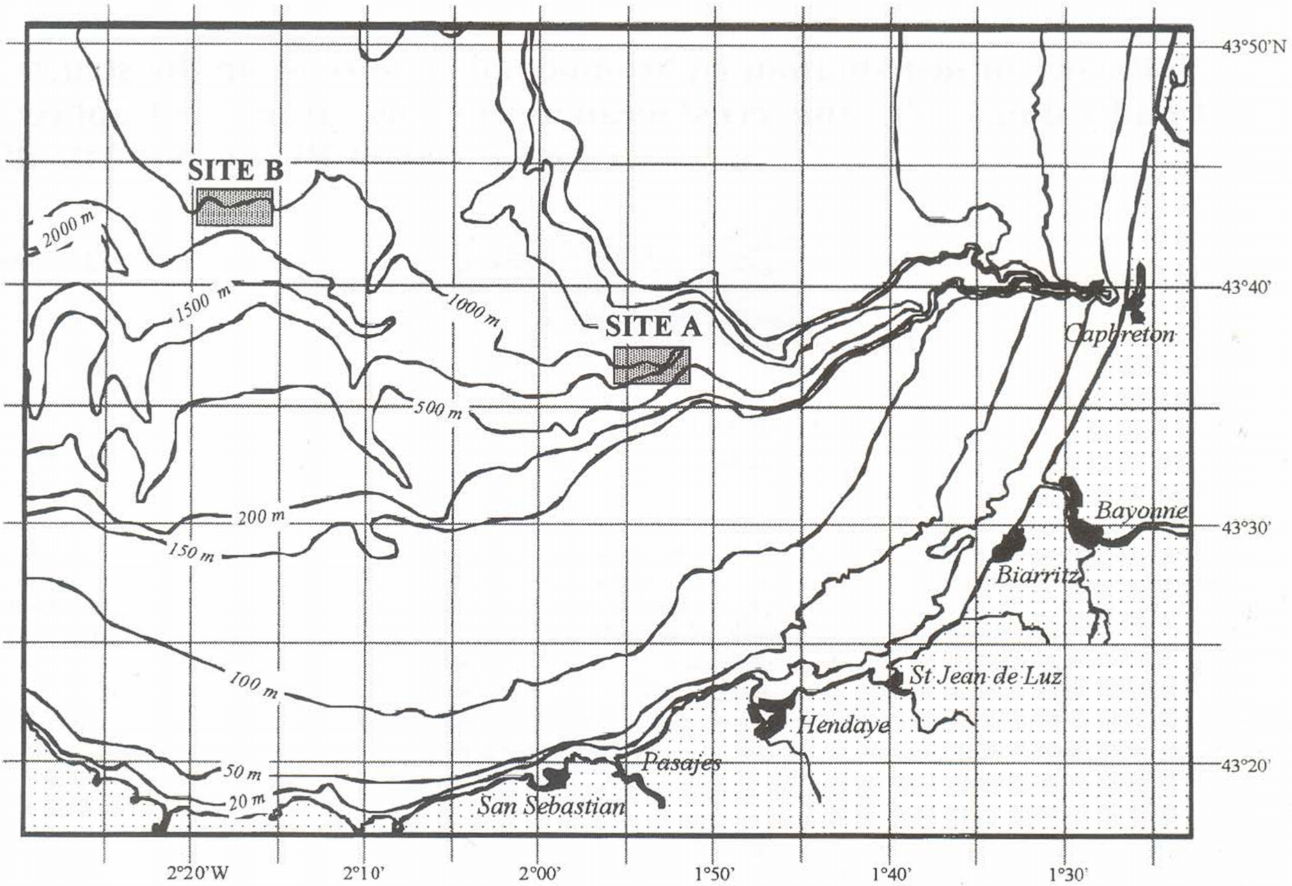

Figure 1. Geographical location of sites A and B within the upper part of the Capbreton canyon (Bay of Biscay, NE Atlantic).

northwards between 800 and 1 200 m depth, well characterised by their temperature (9–10.5 °C), high salinity (35.80 ‰) and low oxygen content (minimum value slightly inferior to 4.38 $mL \cdot L^{-1}$ at about 850 m water depth). According to the disposition of isotherms and isohalines on a longitudinal profile of the canyon depicted by Ogawa and Tauzin [18] and Sorbe ([32], CAPBRETON 87 data), the near-bottom waters at the two sampling sites probably show similar temperature and salinity values while their oxygen content is quite different (see below).

Tauzin [34] mapped the sediment covering of the canyon as well as of its adjacent shelves. Except in its uppermost part (< 200 m depth) where sandy bottoms are known to occur, the whole submarine valley is covered by muddy sediments with a variable proportion of silt and clay.

Ogawa and Tauzin [18] described the physico-chemical environment at the water-sediment interface at different stations all along the canyon (some of them not very far from the present sampling sites). Except for the uppermost part of the canyon where some water renewal actually occurred, the near-bottom waters generally showed a low oxygen content due to their stagnation westward from the meridian 1°38' W as demonstrated by the presence of monosulphide as well as pyrite microspheres in surficial sediments (more or less reduced environment). Their mean level of oxygen saturation was about 50 % but locally some values were less than 25 % (hypoxia). Furthermore, between 1°50' and 1°58' W, very low oxygen contents were measured in the near-bottom waters (minimum value at 20 cm above the sea-floor: 1.96 $mL \cdot L^{-1}$) showing some tendency to confinement in this sinuous part of the canyon. Westwards from the meridian 2° W, the near-bottom waters showed a higher oxygen content (5.74 $mL \cdot L^{-1}$ at about 1 600 m depth) probably due to a better circulation of water masses in this enlarged part of the canyon (oxygen saturation level: 75 %).

Tauzin [34] measured the organic carbon content (% of dry sediment) of surficial sediments all along the bottom and the flanks of the canyon. The observed values fluctuated between 0.44 and 5.39 % and an organic-rich area was detected at a bathymetric level located just above the aforementioned confinement area.

According to such environmental features, the Capbreton canyon may be classified as 'inactive', i.e without any role in the transport of organic nutrients down to the depauperate abyssal communities. Furthermore, at least in its uppermost portion, it probably acts as a depocenter by trapping large aggregates of shallow water detritus which contribute to increase the organic content of the underlying sediments.

Before the present research programme on the Capbreton ecosystem, the deep benthic macrofauna of the canyon was poorly known. Le Danois [16] established a first list of invertebrate species from this area, allowing to distinguish a faunal boundary at 500 m depth for the epibenthic megafauna. Lagardère [15] described the vertical zonation of the benthic decapods between 130 and 1 000 m depth within the Capbreton canyon, showing a lower diversity and abundance of these crustaceans above 400 m depth. Peypouquet [19] discovered the presence of Mediterranean benthic ostracods in the epibathyal Capbreton area, probably related with the deep northward outflow of Mediterranean water. Although the analysis of the benthic material collected during the Capbreton sampling programme is still not achieved, some partial observations have already been published on the macrofauna of this canyon [1, 20, 21, 22, 26, 32, 36, 37]. The DI19 sample from site A was partially analysed at a higher taxonomic level (major zoological groups) by Urzelai et al. [36].

3. MATERIALS AND METHODS

The bathyal benthic material examined in this study was collected in the two sampling sites A and B at approximately 1 000 m depth during the two oceanographic cruises CAPBRETON 88 and CAPBRETON 89 (*figure 1, table I*). Within each site, the benthic fauna was sampled with two different gears: one qualitative sample performed in the uppermost surficial subtratum (ca. 5 cm thick) with a Sanders-Hessler type epibenthic sled (DI; gear designed by INSUB,

Table I. Main characteristics of the sled and box-corer stations within sampling sites A and B of the Capbreton canyon during CAPBRETON 88 and CAPBRETON 89 cruises. DI, Epibenthic sled; KF, Flusha box-corer.

Cruise/Station	Site	Date	Hour	Position		Depth
		d/m/y	h:m	N	W	(m)
CAPBRETON 88						
DI19*	A	07/07/88	09:15	43°38.00'	1°51.79'	923
CAPBRETON 89						
DI66*	B	16/09/89	07:36	43°43.73'	2°17.36'	1 009
KF38	B	12/09/89	08:12	43°41.90'	2°18.54'	993
KF39	B	12/09/89	08:55	43°41.88'	2°19.05'	1 007
KF40	B	12/09/89	09:39	43°42.01'	2°18.52'	971
KF41	B	12/09/89	10:34	43°42.02'	2°18.30'	1 026
KF42	B	12/09/89	11:21	43°41.95'	2°18.41'	1 018
KF43	B	12/09/89	12:50	43°41.95'	2°18.40'	1 015
KF44	B	12/09/89	13:40	43°41.95'	2°18.39'	1 027
KF45	B	12/09/89	14:27	43°42.00'	2°18.35'	1 010
KF50	A	14/09/89	10:19	43°35.35'	1°55.15'	1 000
KF51	A	14/09/89	11:14	43°35.37'	1°54.89'	996
KF52	A	14/09/89	12:57	43°35.27'	1°55.04'	999
KF53	A	14/09/89	13:30	43°35.27'	1°54.96'	997
KF57	A	14/09/89	17:46	43°35.37'	1°54.90'	995
KF58	A	14/09/89	18:30	43°35.26'	1°55.28'	1 002
KF60	A	14/09/89	20:30	43°35.41'	1°54.01'	996

* Hour, depth and position of the boat at the beginning of the haul.