



**HAL**  
open science

# KARYOTYPES OF TWO MEDITERRANEAN BIVALVE SPECIES

C Thiriot-Quiévreux

► **To cite this version:**

C Thiriot-Quiévreux. KARYOTYPES OF TWO MEDITERRANEAN BIVALVE SPECIES. *Vie et Milieu / Life & Environment*, 2004, pp.7-11. hal-03217962

**HAL Id: hal-03217962**

**<https://hal.sorbonne-universite.fr/hal-03217962v1>**

Submitted on 5 May 2021

**HAL** is a multi-disciplinary open access archive for the deposit and dissemination of scientific research documents, whether they are published or not. The documents may come from teaching and research institutions in France or abroad, or from public or private research centers.

L'archive ouverte pluridisciplinaire **HAL**, est destinée au dépôt et à la diffusion de documents scientifiques de niveau recherche, publiés ou non, émanant des établissements d'enseignement et de recherche français ou étrangers, des laboratoires publics ou privés.

## KARYOTYPES OF TWO MEDITERRANEAN BIVALVE SPECIES

C. THIRIOT-QUIÉVREUX

Observatoire Océanologique de Villefranche, UPMC – CNRS – INSU, BP 28, 06230 Villefranche-sur-Mer, France  
thiriot@obs-vlfr.fr

BIVALVE  
MYTILASTER MINIMUS  
ANOMIA EPHIPIUM  
CHROMOSOME NUMBER  
KARYOTYPE

**ABSTRACT.** – Chromosome preparations of two Mediterranean species were studied using an air-drying technique and conventional Giemsa staining. In *Mytilaster minimus* (Mytilidae), a diploid chromosome number of 28 was found in gill tissue and the karyotype included five metacentric and nine subtelocentric chromosome pairs. In *Anomia ephippium* (Anomiidae), chromosome numbers were  $n=6$  in gonadal tissue and  $2n=12$  in gill tissue. Its karyotype included one metacentric, two submetacentric and three subtelocentric chromosome pairs. Results are discussed within known bivalve chromosome data.

BIVALVE  
MYTILASTER MINIMUS  
ANOMIA EPHIPIUM  
NOMBRE DE CHROMOSOMES  
CARYOTYPE

**RÉSUMÉ.** – Les préparations chromosomiques de deux espèces de Bivalves méditerranéens ont été étudiées par une technique de suspension cellulaire et séchage à l'air et une coloration standard au Giemsa. Chez *Mytilaster minimus* (Mytilidae), le nombre diploïde de chromosomes est égal à 28 dans le tissu branchial et le caryotype est composé de 5 métacentriques et de 9 paires subtelocentriques de chromosomes. Chez *Anomia ephippium* (Anomiidae), le nombre haploïde est de 6 dans le tissu gonadique et le nombre diploïde est de 12 dans le tissu branchial. Son caryotype est composé de 1 métacentrique, 2 paires submetacentriques et de 3 subtelocentriques de chromosomes. Les résultats sont discutés à la lumière des données connues sur les chromosomes de Bivalves.

### INTRODUCTION

The area of Banyuls-sur-Mer (West Mediterranean, Gulf of Lion) includes many bivalve species (Mars 1965). In particular, the mytilid *Mytilaster minimus* (Poli, 1795) is abundant on calcareous substrates, such as sidewalk-like banks (Delamare Deboutteville & Bougis 1951). The anomiid *Anomia ephippium* (Linné, 1758) is a common eurybathial species from the infralittoral to the bathylittoral level (Mars 1965). Chromosome data of bivalve species have been reviewed (Patterson 1969, Nakamura 1985, Thiriot-Quévieux 2002). This paper reports the not yet published karyotypes of these latter species.

### MATERIALS AND METHODS

Specimens of *Mytilaster minimus* also called *Brachidontes (Mytilaster) minimus* were sampled from the sidewalk-like banks near Banyuls. Specimens of *Anomia ephippium* were dredged at ca. 30 m in the Bay of Banyuls.

Live animals were incubated for 12 h in a 0.005% solution of colchicine in sea water. Gills in *Mytilaster minimus*, and gonads and gills in *A. ephippium*, were then removed by dissection and treated for 45 min in 0.9%

sodium citrate in distilled water. The material was fixed in a freshly prepared mixture of absolute alcohol and acetic acid (3:1) with three changes of 20 min each. Slides were made using an air-drying technique (Thiriot-Quévieux & Ayraud 1982). Staining was performed with 4% Giemsa in phosphate buffer pH 6.8 and photomicrographs of suitable metaphases were taken with a Zeiss Photomicroscope II.

Karyotype formula were obtained by statistical analysis of chromosome measurements. Terminology relating to centromere position follows that of Levan *et al.* (1964). Both the arm ratio and the centromeric index are given because each expresses centromeric position and allows comparison with previous studies. When a centromere position was found on the borderline between two categories, two chromosome categories were listed according to the confidence limit of the means ( $P=0.05$ ).

### RESULTS

#### *Mytilaster minimus*

The chromosomes of 16 metaphases taken from 6 animals were counted. The diploid chromosome number was 28. Seven well spread metaphases were analysed (Table I). The karyotype (Fig. 1) consists of 5 metacentric (m), 2 subtelocentric (st) and 7 subtelocentric-telocentric (st-t) chromosome

Table I. – Top, chromosome measurements and classification in 7 cells of *Mytilaster minimus*. Below, chromosome measurements and classification in 10 cells of *Anomia ephippium*.

| Chromosome pair No. | Relative length |      | Arm ratio |      | Centromeric index |      | Classification |
|---------------------|-----------------|------|-----------|------|-------------------|------|----------------|
|                     | Mean            | SD   | Mean      | SD   | Mean              | SD   |                |
| 1                   | 10.83           | 0.67 | 0.77      | 0.09 | 43.29             | 3.06 | m              |
| 2                   | 9.62            | 0.48 | 0.82      | 0.10 | 44.78             | 2.81 | m              |
| 3                   | 8.59            | 0.44 | 0.74      | 0.09 | 41.93             | 3.33 | m              |
| 4                   | 7.24            | 0.69 | 0.65      | 0.16 | 38.79             | 6.08 | m              |
| 5                   | 5.62            | 0.76 | 0.68      | 0.18 | 39.53             | 7.13 | m              |
| 6                   | 9.17            | 0.85 | 0.23      | 0.05 | 18.43             | 3.27 | st             |
| 7                   | 7.50            | 0.49 | 0.21      | 0.09 | 16.40             | 5.58 | st-t           |
| 8                   | 7.12            | 0.25 | 0.16      | 0.04 | 13.74             | 2.72 | st-t           |
| 9                   | 6.88            | 0.29 | 0.17      | 0.03 | 14.45             | 2.38 | st-t           |
| 10                  | 6.58            | 0.27 | 0.17      | 0.03 | 14.23             | 2.44 | st-t           |
| 11                  | 6.41            | 0.34 | 0.16      | 0.04 | 13.42             | 2.91 | st-t           |
| 12                  | 5.99            | 0.33 | 0.17      | 0.04 | 14.70             | 2.46 | st-t           |
| 13                  | 5.18            | 0.48 | 0.21      | 0.06 | 17.07             | 3.65 | st-t           |
| 14                  | 4.27            | 0.63 | 0.22      | 0.04 | 17.78             | 2.82 | st             |

| Chromosome pair No. | Relative length |      | Arm ratio |      | Centromeric index |      | Classification |
|---------------------|-----------------|------|-----------|------|-------------------|------|----------------|
|                     | Mean            | SD   | Mean      | SD   | Mean              | SD   |                |
| 1                   | 19.94           | 1.39 | 0.85      | 0.06 | 45.82             | 1.78 | m              |
| 2                   | 19.39           | 1.26 | 0.85      | 0.11 | 36.35             | 4.17 | sm             |
| 3                   | 17.79           | 1.09 | 0.37      | 0.06 | 26.82             | 3.09 | sm-st          |
| 4                   | 20.88           | 1.80 | 0.28      | 0.05 | 21.59             | 3.06 | st             |
| 5                   | 12.39           | 1.40 | 0.33      | 0.06 | 24.85             | 3.36 | st-sm          |
| 6                   | 9.61            | 0.68 | 0.31      | 0.07 | 18.43             | 4.04 | st             |

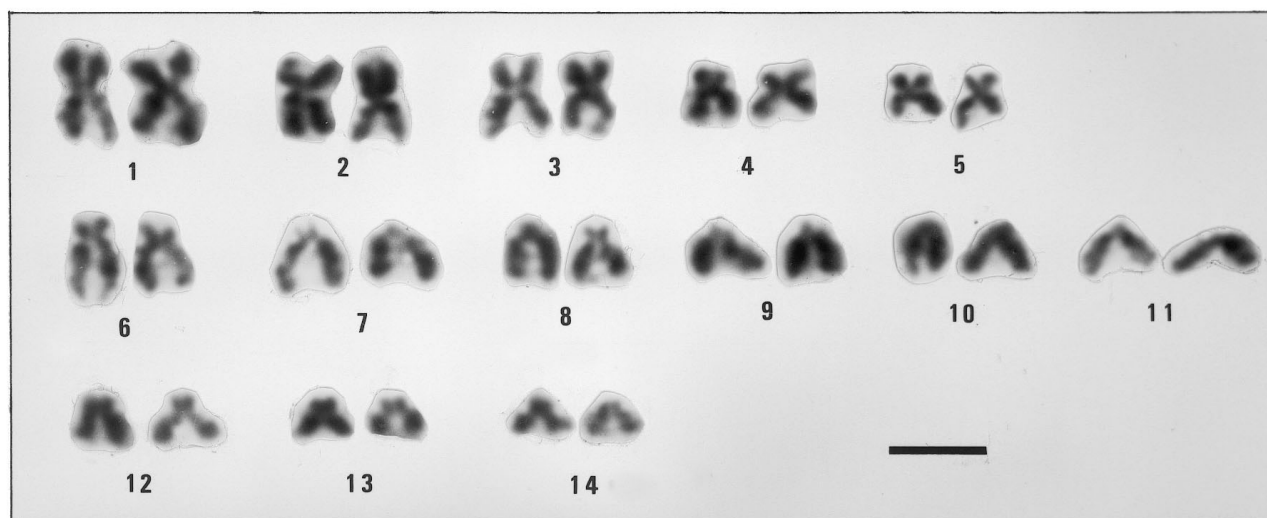


Fig. 1. – Karyotype of *Mytilaster minimus*. Scale bar = 5  $\mu$ m

pairs. The Figure 2 shows the ideogram constructed from relative length and centromeric index values.

### *Anomia ephippium*

The chromosomes of 25 metaphases taken from 8 animals were counted. The diploid chromosome number was 12. Sixteenth meioses with  $n=6$  were also observed in the gonad (Fig. 3). Ten well spread metaphases were analysed (Table I). The karyotype (Fig. 3) consists of 1 m, 1 sm, 1 sm-st, 1 st-sm, 2 st.

## DISCUSSION

Chromosome data of the Mytilidae family have been reported by Libertini *et al.* (1996) and more recently by Torreiro *et al.* 1999 and Vitturi *et al.* 2000. The diploid chromosome numbers range from  $2n=22$  to 32. One species of *Brachidontes*, *B. recurvus* showed  $2n=30$  with 15 submetacentric chromosome pairs (Diopotex-Chong *et al.* 1978) while *Brachidontes pharaonis* had  $2n=28$  with 6 metacentric-submetacentrics and 8 subtelocentrics (Vitturi *et al.* 2000) and *Brachidontes rodriguezii*  $2n=32$  with 2 metacentrics, 12 subtelocentrics and 2 telocentric-subtelocentrics (Torreiro *et al.* 1999).

Three species of *Mytilaster* were studied, i.e. *Mytilaster (Brachidontes) minimus* with  $n=15$  (Rasotto *et al.* 1981), *Mytilaster lineatus* with  $2n=26$  and a karyotype including 6 metacentric, 4 submetacentric, 1 subtelocentric and 1 telocentric chromosome pairs, and *Mytilaster solidus* with  $2n=28$  and 5 metacentric, 3 submetacentric, 2 subtelocentric and 4 telocentric chromosome pairs (Libertini *et al.* 1996). The chromosome number of *Mytilaster minimus*, here studied ( $n=14$ ), is different from the one reported ( $n=15$ ) by Rasotto *et al.* (1981) but similar to *Mytilaster solidus* (Libertini *et al.* 1996) and to *Brachidontes pharaonis* (Vitturi *et al.* 2000). Its karyotype formula (5 m, 9 st) includes more subtelocentrics than the other *Mytilaster* species even if several pairs are on the borderline of subtelocentric-telocentrics. Chromosomal rearrangements have been suggested as a source of variation at the genus level among mytilid species (Libertini *et al.* 1996). Further banding techniques would be necessary to analyse the role of chromosomal rearrangements which may have occurred during the evolutionary speciation process.

Among Anomiidae, Rasotto *et al.* (1981) reported haploid number of  $n=12$  in *Anomia ephippium* while Ieyama & Inaba (1974) and Ieyama (1984) gave  $2n=14$  in gill tissue cell of *Anomia chinensis* with a karyotype including 3 metacentric and 4 subtelocentric chromosomes and  $2n=26$  in *Monia umbonata*. Our study showed  $n=6$

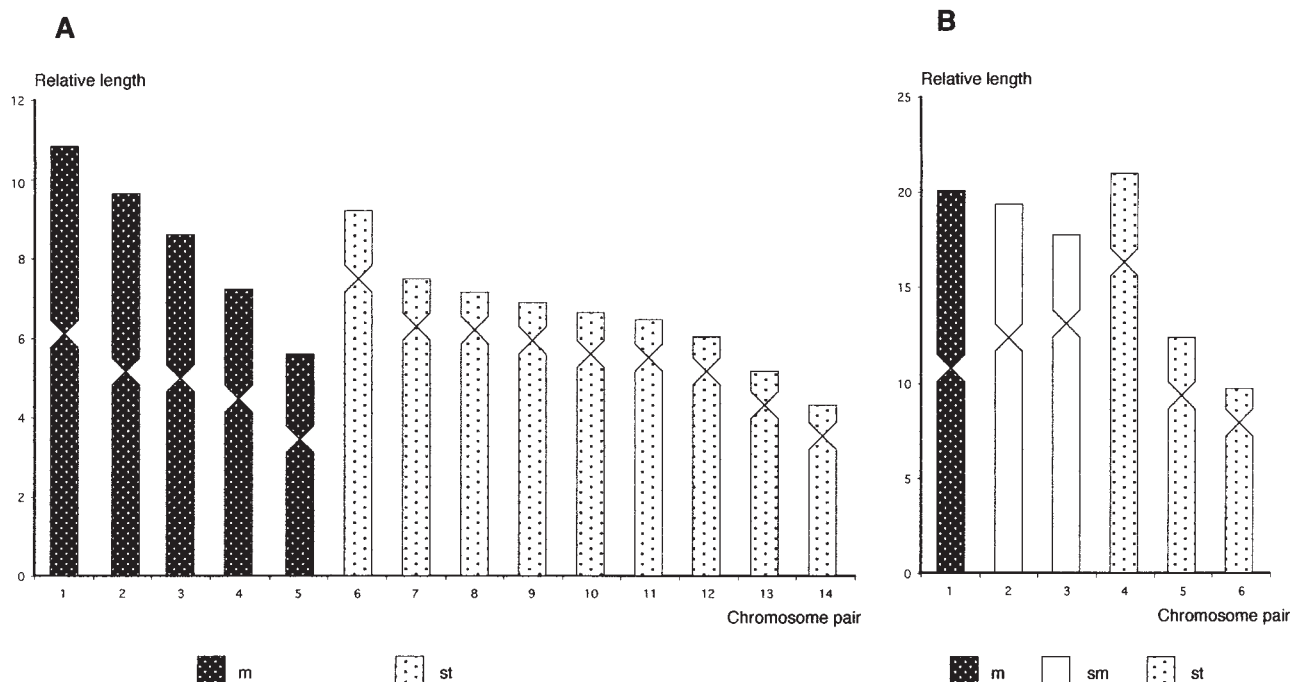


Fig. 2. – Ideograms constructed from relative length and centromeric index values. A, *Mytilaster minimus*; B, *Anomia ephippium*.

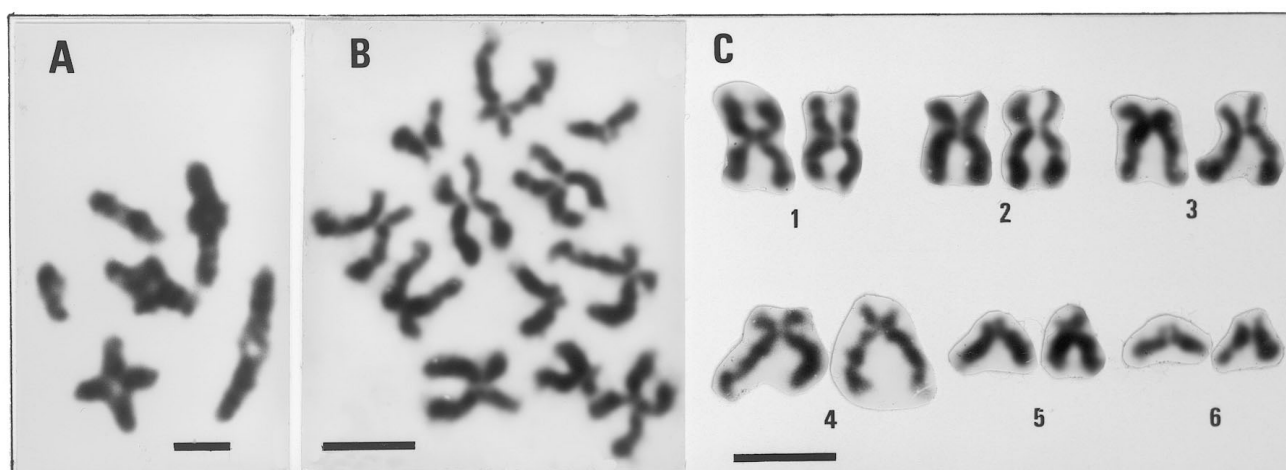


Fig. 3. – *Anomia ephippium*. A, meiosis; B, mitotic metaphase; C, karyotype. Scale bar = 5  $\mu$ m.

in meioses and  $2n=12$  in mitoses of *Anomia ephippium*. This is the smallest chromosome number reported among bivalve species studied up to now where the most frequent haploid chromosome number is  $n=19$  (Thiriote-Quévieux 2002).

Looking among close taxonomically bivalve families, the Ostreidae also showed low haploid chromosome numbers ( $n=10$  for most of the species and  $n=9$  in *Dendostrea folium*, Ieyama 1990) as the Gryphaeidae with  $n=9$  in *Pycnodonta cochlear* (Vitturi *et al.* 1985). The interpretation of chromosome number as an indicator of evolutionary status must be viewed with caution and is not necessarily congruent with bivalve phylogeny based on combined morphology and DNA sequence data (Giribet & Wheeler 2002). The Subclass Pteriomorpha is considered monophyletic. However chromosome numbers range from  $n=6$  to 19 within this Subclass. Even within families of this Subclass, chromosome numbers varied which do not imply an evolutionary trend. Looking at the families studied by Giribet & Wheeler (2002) and following the same phylogenetic rank, one finds  $n=11$  to 16 in the Mytilidae,  $n=14$  to 19 in the Arcidae,  $n=13-14$  in the Pteriidae,  $n=16$  to 19 in the Limidae,  $n=9-10$  in the Ostreidae,  $n=13$  to 19 in the Pectinidae, and  $n=6-14$  in the Anomiidae (references quoted in Nakamura 1985, Libertini *et al.* 1996, Thiriote-Quévieux *et al.* 1991, Thiriote-Quévieux 2002). This chromosomal variability does not infer any evolutionary trend. Gene sequences and chromosome profiles may not have evolved in parallel fashions.

ACKNOWLEDGMENTS. – This work was carried out during the summer 1985 at the Laboratoire Arago, Banyuls-sur-Mer. Thanks are due to the collaboration of J Soyer, who was the Director of the Laboratoire Arago at that time, and to P Chang for English editing.

## REFERENCES

- Delamare Deboutteville C, Bougis P 1951. Recherches sur le trottoir d'Algues calcaires effectuées à Banyuls pendant le stage d'été. *Vie Milieu* 2: 161-181.
- Diopotex-Chong MA, Rodriguez-Romer F, Uribe-Alcocer M, Laguarda-Figueras A 1978. Karyotypic characters of *Brachidontes recurvus* Rafinesque, 1820, (Pelecypoda: Mytilidae). *An Centro Cienc del Mar y Limnol*, Univ Nal Auton Mexico 5: 55-58.
- Giribet G, Wheeler W 2002. On bivalve phylogeny: a high level analysis of the Bivalvia (Mollusca) based on combined morphology and DNA sequence data. *Invertebr Biol* 121: 271-324.
- Ieyama H 1984. Chromosomes of six species in three families of Pteriomorpha. *Venus* 43: 106-110.
- Ieyama H 1990. Chromosomes of the oysters *Hyatissa imbricata* and *Dendostrea folium* (Bivalvia: Pteriomorpha). *Venus* 49: 63-68.
- Ieyama H, Inaba A 1974. Chromosome numbers of ten species in four families of Pteriomorpha (Bivalvia). *Venus* 33: 129-137.
- Levan A, Fredga K, Sandberg AA 1964. Nomenclature for centromere position on chromosomes. *Hereditas* 52: 201-220.
- Libertini A, Boato A, Panozzo M, Fogato V 1996. Karyotype and genome size in some species of Mytilidae (Bivalvia, Mollusca). *Kromosomo II* 82: 2819-2827.
- Mars P 1965. Faune marine des Pyrénées-Orientales. *Vie Milieu* 15 (suppl 4), 156 p.
- Nakamura HK 1985. Review of molluscan cytogenetic information based on the CISMOCH-Computerized index system for Molluscan chromosomes. Bivalvia, Polyplacophora and Cephalopoda. *Venus* 44: 193-225.
- Patterson CM 1969. Chromosomes of molluscs. Proc 2nd Sympos Mollusca. *Mar Biol Ass India* 2: 635-689.

- Rasotto M, Altieri D, Colombera D 1981. I cromosomi spermatocitari di 16 specie appartenenti alla classe Pelecypoda. Atti 5th Congr Soc Malac Ital: 113-127.
- Thiriou-Quiévreux C 2002. Review of the literature on bivalve cytogenetics in the last ten years. *Cah Biol Mar* 43: 17-26.
- Thiriou-Quiévreux C, Albert P, Soyer J 1991. Karyotypes of five subantarctic bivalve species. *J Moll Stud* 57: 59-70.
- Thiriou-Quiévreux C, Ayraud N 1982. Les caryotypes de quelque espèces de Bivalves et de Gastéropodes marins. *Mar Biol* 70: 165-172.
- Torreiro A, Martínez-Expósito, Trucco MI, Pasantes JJ 1999. Cytogenetics in *Brachidontes rodriguezii* d'Orb (Bivalvia, Mytilidae). *Chromosome Res* 7 : 49-55.
- Vitturi R, Carbone P, Catalano E 1985. The chromosomes of *Pycnodonta cochlear* (Poli) (Mollusca, Pelecypoda). *Biol Zbl* 104: 177-182.
- Vitturi R, Gianguzza P, Colomba MS, Riggio S 2000. Cytogenetic characterization of *Brachidontes pharaonis* (Fisher P., 1870): karyotype, banding and fluorescent in situ hybridization (FISH) (Mollusca: Bivalvia: Mytilidae). *Ophelia* 52: 213-220.

Reçu le 29 avril 2003; received April 29, 2003  
Accepté le 16 juin 2003; accepted June 16, 2003

**APPEL A COMMUNICATION****Environnement Identité Méditerranée – EIM 2004****Juillet 19-25, 2004****CORTE****Université de Corse**

**Objectifs :** Ce congrès annuel est alternativement organisé à l'Université de Corse (UdC) et dans une autre université de la Méditerranée. C'est un espace privilégié de rencontres et d'échanges entre les chercheurs travaillant sur les thèmes de l'Environnement et de l'Identité. Placé sous l'égide de l'Institut de l'Environnement (IE), ce congrès est structuré autour de 5 workshops pluridisciplinaires et transversaux

**Quelles gestion et valorisation pour les patrimoines naturels en Méditerranée ?**

**Feux de Forêt :** Modélisation, Simulation, Météorologie, Aspects humains, Biomasse  
Resp. : J.H. Balbi

**Gestion de l'eau :** Caractérisation physico-chimique, Caractérisation biologique, Eaux de surface, Eaux souterraines Socio-économie, Patrimoine et valorisation  
Resp. : B. Marchand

**Ressources Naturelles :** Agroressources, Ressources agri-environnementales, Produits naturels, Biodiversité, Gestion des espaces naturels  
Resp. : A. Bighelli

**Quelles politiques de valorisation pour les patrimoines culturels en Méditerranée ?**

**Développement durable :** Territoires, Environnement, Recyclage, Tourisme  
Resp. : D. Prunetti

**Patrimoines culturels :** Identités, Education, Langues, Territoires, Environnement  
Resp. : P. Pesteil

Envoyer un résumé (1 page max.) à l'adresse email suivante : Email : [ie@univ-corse.fr](mailto:ie@univ-corse.fr)

Veillez respecter s.v.p. le format ci-dessous : Titre, auteurs, affiliations, mots-clés (max. 5), résumé (texte seulement, police de caractère : Times New Roman, 12, marge 2.5, moins de 500 mots). Langues : Français, anglais ou italien

**Programme préliminaire :** Lundi 19 : Accueil ; Mardi 20 matin : Session plénière d'ouverture ; Mardi 20 a.m. : Travaux ; Mercredi 21 : Travaux ; Mercredi 21 soir : Soirée culturelle (buffet) ; Jeudi 22 : Travaux ; Vendredi 23 matin : Session plénière de clôture ; Samedi 24 : Excursions

**Frais d'inscription** comprenant : déplacements AR Bastia-Corte, recueil d'abstracts, pauses-café, soirée culturelle, actes, excursion. Universitaires : 220 € ; Étudiants : 120 € ; Universitaires liés par une convention avec l'UdC : 180 € ; Accompagnant : 60 €.

**Restauration et Hébergement :** Lunch : 8 € ; Chb. simple/Petit dej. : 25 € ; Chb. Double/Petit dej. : 40 €

**Comité d'organisation :** A. Aiello, Président de l'UdC, J.F. Santucci, Directeur de l'IE, A. Mondoloni, [ie@univ-corse.fr](mailto:ie@univ-corse.fr), J.H. Balbi : [balbi@univ-corse.fr](mailto:balbi@univ-corse.fr), A. Bighelli : [ange.bighelli@univ-corse.fr](mailto:ange.bighelli@univ-corse.fr), B. Marchand : [marchand@univ-corse.fr](mailto:marchand@univ-corse.fr), P. Pesteil : [decanat.lettres@univ-corse.fr](mailto:decanat.lettres@univ-corse.fr), D. Prunetti : [prunetti@univ-corse.fr](mailto:prunetti@univ-corse.fr)

**DATES IMPORTANTES :** Date limite de réception des résumés : 30 Avril 2004 ; Notification d'acceptation : 17 Mai 2004

**Call for paper****Environnement Identité Méditerranée - EIM 2004****July 19-25, 2004****CORTE****University of Corsica**

**Objectives:** This symposium is organized every two years at the University of Corsica (UdC) and in another Mediterranean Island the following year. The goal of the symposium is to be a forum for exchanges and meetings between researchers working on the topics of Environment and Identity. The symposium is supervised this year by the Institute of Environment (IE). It is split into 5 workshops around the following topics.

**Gestion and valorisation for natural heritage in Mediterranean basin?**

**Forest Fire:** Modeling, Simulation, Meteorology, Human aspects, Biomass  
Resp.: J.H. Balbi

**Water Management:** Physic-chemical Characterization, Biological Characterization, Surface Waters Underground waters, Socio-economy, Heritage and Valorization  
Resp.: B. Marchand

**Natural Resources: Agro-resources, Agri-environmental Resources, Natural Products, Biodiversity, Landscape Management**  
Resp.: A. Bighelli

**What politics of valorisation for cultural heritage in Mediterranean basin?**

**Sustainable Development:** Territories, Environment, Recycling, Tourism  
Resp.: D. Prunetti

**Cultural Heritage:** Identities, Education, Languages, Territories, Environment  
Resp.: P. Pesteil

Send an abstract of your paper (1 page max.) to the following email address: Email : [ie@univ-corse.fr](mailto:ie@univ-corse.fr)

Using the following format: Title, authors, affiliations, keywords (max. 5), Abstract (no pictures, character police: times New Roman 12, Marge 2.5, less than 500 words) Language: English, French or Italian

**Program First Draft:** Monday 19: Opening; Tuesday 20 morning: Keynotes Speakers; Tuesday 20 afternoon: Working sessions; Wednesday 2: Working sessions; Wednesday 21 evening: Social Event; Thursday 22: Working sessions; Friday 23 morning: Closing session; Saturday 24: Excursions

**Registration fees:** (includes: transfer Bastia Corte, abstracts, coffee-break, Social Event, proceedings, excursion) University member: 220 €; Special prices for: Students: 120 € Special links with UdC: 180 € Accompanying people: 60 €

**Acomodation:** Lunch: 8 € Single room/breakfast: 25 € Double room/breakfast: 40 €

**Organizing Committee:** A. Aiello, President of UdC, J.F. Santucci, Dean of IE, A. Mondoloni: [ie@univ-corse.fr](mailto:ie@univ-corse.fr), J.H. Balbi: [balbi@univ-corse.fr](mailto:balbi@univ-corse.fr), A. Bighelli: [ange.bighelli@univ-corse.fr](mailto:ange.bighelli@univ-corse.fr), B. Marchand: [marchand@univ-corse.fr](mailto:marchand@univ-corse.fr), P. Pesteil: [decanat.lettres@univ-corse.fr](mailto:decanat.lettres@univ-corse.fr), D. Prunetti: [prunetti@univ-corse.fr](mailto:prunetti@univ-corse.fr)

**IMPORTANT DATES:** Abstracts Due to: 30 April 2004; Acceptation notification: 17 May 2004