SUPPLEMENTARY MATERIAL

APPENDIX A

Material and methods

Table A1

List of the ostracod species recovered at Fonte dei Pulcini A section.

Table A2

List of palynomorphs identified in the Fonte dei Pulcini A section.

Figure A1

Results of the quantitative analyses on the FPA ostracod assemblages: a. Community analysis; b. cluster analysis R-mode dendrogram; c. DCA ordination biplot (modified from Grossi and Gliozzi, 2008). Simbols of Fig. A1c: open triangles: Leptocytheridae species; open squares: “pointed candonids” species. For abbreviations of Figs. A1b,c see Tab. A1.

Figure A2

Quantitative analysis of nannofossils. Percentages of relative abundances (a) and number of placoliths per unit area (b) in the FPA section.

Material and methods

Micropaleontological analyses

-Ostracods

Micropalaeontological analyses on ostracods were performed on 107 samples, which were disaggregated in 5% H_2O_2 solution, washed using a 0.125 mm mesh sieve, and dried. When possible, up to 300 ostracod valves/sample were handpicked under the stereomicroscope. Ostracod valves were medium- to well-preserved along all the succession, with only some barren samples in the middle and lower portions. Each species frequency was normalised to 10 g of dried sieved sample and the normalised abundance was calculated for each taxon. The frequency matrix was processed statistically by means of multivariate analyses [R-mode hierarchical Cluster Analysis (Morisita-Horn distance measure and the un-weighted pair group method using arithmetic average - UPGMA) and Q-mode Detrended Correspondence Analysis (DCA) using the software package PAST- PAlaeontological STatistics (ver. 1.83; Hammer et al., 2001).

- Palynomorphs

Palynological analyses were performed on 34 samples. Tablets of exotic *Lycopodium* spores (average = 10679 grains per tablets) were added to sediment samples to permit calculation of palynomorph concentrations according to the following formula: taxon concentration (with respect to mass)= [(taxon counted) x (total *Lycopodium* spores)]/*Lycopodium* counted. Total concentrations of palynomorphs were calculated on the basis of dry weight. Chemical-physical processing followed conventional procedures including treatment with HCl, HF, KOH and sieving. Zinc chloride with a density of 2.0 g/cm^3 was used for heavy liquid separation. The residual samples were mounted in glycerine. Routine counting was completed at 960x to 1600x magnification. All pollen, spores, dinocysts and reworked taxa were used in analyses. The number of palynomorphs counted in each sample is shown in both percentage and concentration diagrams. Taxa percentages were calculated on a sum of total pollen grains, spores, dinocysts and reworked taxa.

-Nannofossils

Micropalaeontological analyses on nannofossil assemblages were performed on 107 samples. Sediment sales in vials with distilled water were disaggregated via ultrasound. After the coarser portion of the sediment settled, some drops of the remaining suspension were poured on a coverglass with distilled water using a pipette. Once the suspension dried at 90°C, the coverglass was fixed to the glass slide by use Norland Optical Adhesive 61 ("NOA 61") and long-wave UV light. In each sample, 300 calcareous nannofossils vs. fields of view were counted. Finally, to define the FPA nannofossil density, the number of placoliths counted in each sample was normalized per unit area (1 mm^2).

XRD analyses

Mineralogical analyses were performed by X-ray diffraction (XRD) on bulk samples and on clay minerals. For bulk mineralogy, samples were air-dried, ground in an agate mortar, and packed in steel sample holders for XRD. For clay mineral analyses, a sample suspension in demineralized water was obtained after 24 h of mechanical shaking.

The <2µm fraction was separated using centrifugation and deposited onto glass slides for XRD analysis. Separation of the clay fraction and preparation of the samples for XRD analysis were performed following the standard procedure adopted from the XRD laboratory at the Department of Geological Sciences of Roma Tre University (Italy) and compiled by Giampaolo and Lo Mastro (2000). Analyses were obtained using a Scintag model X1 diffractometer, with

Cu-Kα radiation. Scans were run from 2° to 70° 2θ, with step scan of 0.05° 2θ, 3 s of counting time for bulk-sample diffractograms and from 1.1° to 30° 2θ and from 1.1° to 48° 2θ for glycolated and air-dried samples, respectively, with step scan of 0.05° 2θ and 4 s of counting time. Semi-quantitative analyses were performed considering the integrated peak area using specific software for the diffractometer used.

Stable isotope analyses

Stable isotopes ($\delta^{18}O$ and $\delta^{13}C$) were measured using an automated continuous-flow carbonate preparation GasBenchII device and a ThermoElectron Delta Plus XP mass spectrometer (Spötl and Vennemann, 2003) at the geochemistry laboratory of the IAMC-CNR Institute of Naples (Italy).

A total of 107 bulk samples (collected at constant intervals of 0.5 m) were analyzed after heating powders (ϕ<90μm) under vacuum at 380°C. From each of 57 samples, an average of 7 valves of the *Loxocorniculina djafarovi* ostracod species were hand-picked, cleaned in an ultrasonic bath, and then heated under vacuum at 380°C before analysis.

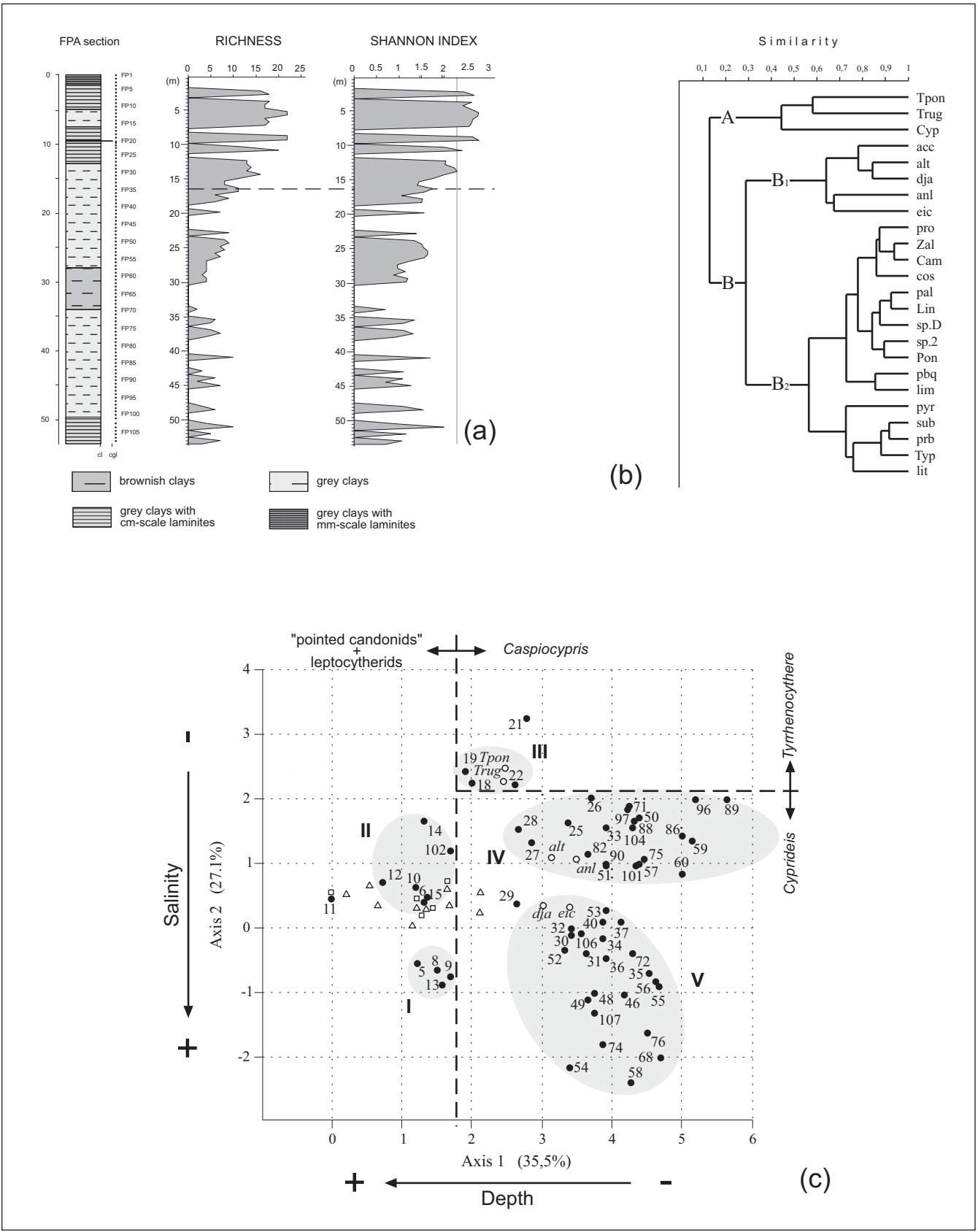
Acidification of all samples was performed at 50 °C. An internal standard (Carrara Marble with $\delta^{18}O$ = 2.43 vs. Vienna Peedee belemnite [VPDB] and $\delta^{13}C$ = 2.43 vs. VPDB) was run for every 6 samples, and, for every 30 samples, the NBS19 international standard was measured. Standard deviations of carbon and oxygen isotope measures were estimated to be 0.1 and 0.08‰, respectively, on the basis of ~70 repeated samples. All the isotope data are reported in per mil (‰) relative to the VPDB standard.

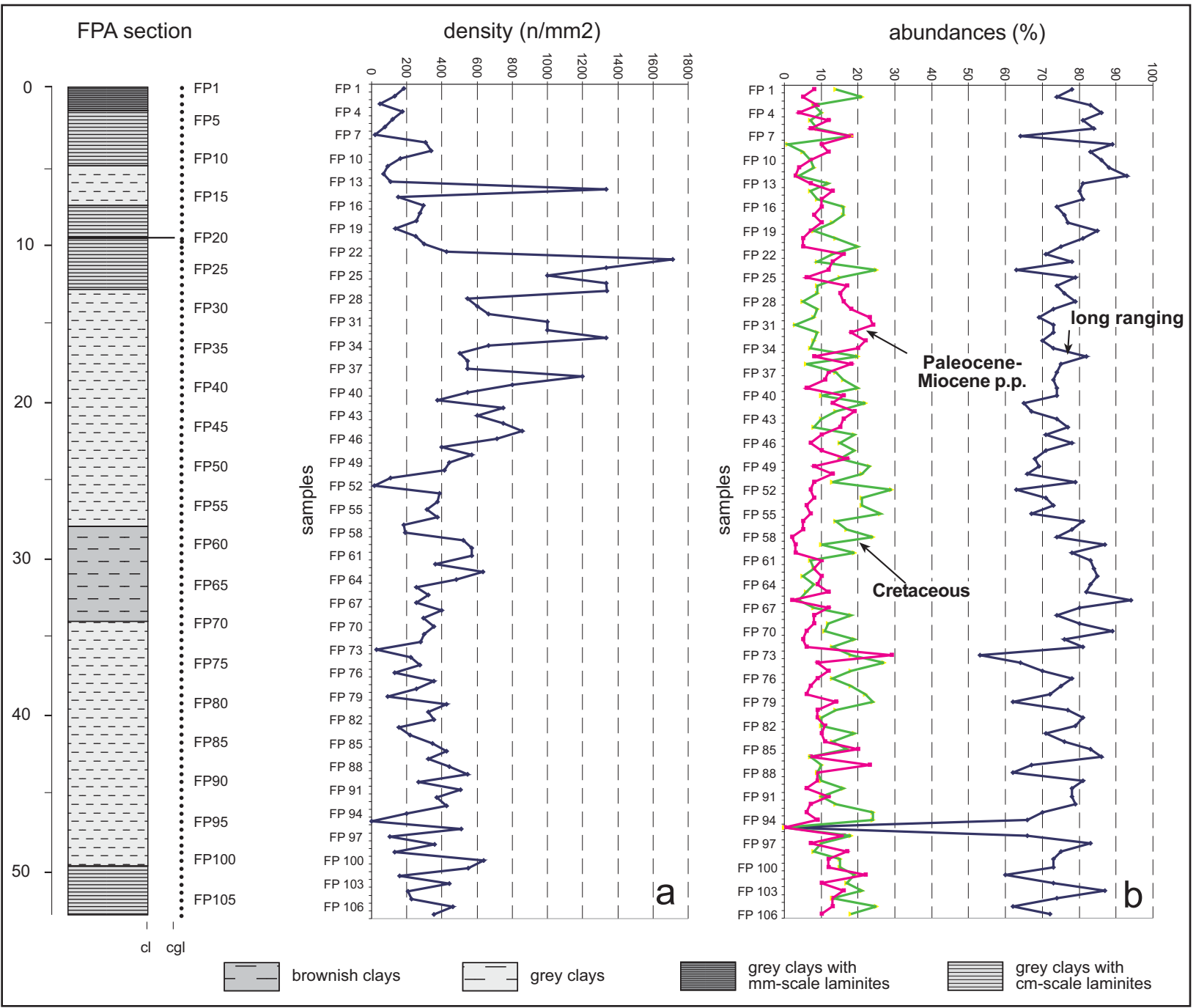
Mineral magnetic analyses

For all the bulk samples (107) collected at 50 cm intervals, we measured the low-field (and low frequency) mass-specific magnetic susceptibility (χ) using a Kappabridge KLY-2 (AGICO) magnetic susceptibility meter with operating frequency of 920 Hz, and a magnetic induction of 0.4 mT (noise level $2x10^{-10}$ m^3 kg^{-1}) at the palaeomagnetism laboratory of the Istituto Nazionale di Geofisica e Vulcanologia (INGV), Rome. For selected bulk samples throughout the investigated section, the temperature dependence of magnetic susceptibility, up to a maximum temperature of 700°C, was measured with a furnace-equipped Kappabridge KLY-3, following the procedures described by Hrouda (1994).

OSTRACOD SPECIES FROM FONTE DEI PULCINI A SECTION
Amnicythere costata (Olteanu, 1989) (**cos**)
Amnicythere litica (Livental in Agalarova et al., 1961) (**lit**)
Amnicythere palimpsesta (Livental, 1929) (**pal**)
Amnicythere propinqua (Livental, 1929) (**pro**)
Amnicythere subcaspia (Livental in Agalarova et al., 1940) (**sub**)
Amnicythere accicularia (Olteanu, 1989) (**acc**)
Amnicythere sp.D Miculan in Bassetti et al., 2004 (**spD**)
Amnicythere sp. 2 (**sp2**)
Euxinocythere (Maeotocythere) praebaquana (Livental in Agalarova et al., 1940) (**pbq**)
Euxinocythere (Maeotocythere) praebosqueti (Suzin, 1956) (**prb**)
Cyprideis anlavauxensis Carbonnel, 1978 (**anl**)
Cyprideis sp. 5 Gliozzi and Grossi, 2004 (juv.)
Tyrrhenocythere ruggierii Devoto in Colacicchi et al., 1967 (**Trug**)
Tyrrhenocythere pontica (Livental, in Agalarova et al., 1961) (**Tpon**)
Loxoconcha (Loxoconcha) eichwaldi Livental, 1929 (**eic**)
Loxocorniculina djafarovi (Schneider in Suzin, 1956) (**dja**)
Loxocauda limata (Schneider in Agalarova et al., 1940) (**lim**)
Cytherura pyrama Schneider in Agalarova et al., 1940 (**pyr**)
Camptocypria sp. 1 Gliozzi and Grossi, 2004 (**Cam**)
Caspiocypris alta (Zalanyi, 1929) (**alt**)
Lineocypris sp. 1 Gliozzi and Grossi, 2004 (**Lin**)
Pontoniella cf. *P. pontica* (Agalarova, 1961) (**Pon**)
Pontoniella verrucosa Stancheva, 1966
Typhlocypris sp. (**Typ**)
Zalanyiella venusta (Zalanyi, 1029) (**Zal**)
Cypria sp. (juv.) (**Cyp**)

PALYNOTAXA FROM FONTE DEI PULCINI A SECTION	
Pollen	*Thalictrum*
Abies	*Tsuga*
Acer	*Ulmus*
Alnus	Urticaceae
Asteraceae Asteroideae	*Viburnium*
Asteraceae Cichorioideae	*Zelkova*
Betula	Undetermined
Brassicaceae	Indeterminable
Cannabaceae	*Classopollis*
Carpinus	Other reworked
Carya	
Caryophyllaceae	**Spores and Algues**
Celastraceae	Monolete spores
Celtis	Trilete spores
Chenopodiaceae	Other spores
Cupressaceae	Reworked spores
Dipsacaceae	
Engelhardia	*Botryococcus*
Ephedra	*Ovoidites*
Eucommia	*Pediastrum*
Ericaceae	Tasmanaceae
Fabaceae	
Galium	Dinocysts
Hamamelidaceae	*Achomosphaera* spp.
Helianthemum	*Galeacysta etrusca*
Inapertured	*Homotryblium* sp
Juglandaceae	*Impagidinium*(?) sp. 1 (Corradini and Biffi)
Juglans	*Impagidinium*(?) sp. 2 (Corradini and Biffi)
Lilaceae	*Impagidinium*(?) sp. 3 (Corradini and Biffi)
Lygeum	*Impagidinium* spp.
Myrica	
Oleaceae	*Impagidinium strialatum*
Pinaceae saccatae indeterminable	*Lingulodinium machaerophorum*
Pinaceae saccatae reworked	*Nematosphaeropsis labyrinthus*
Pinus	*Operculodinium* spp.
Plantago	*Pyxidiniopsis psilata*
Platanus	*Reticulatosphaera*
Platycarya	*Spiniferites* spp.
Poaceae	*Spiniferites* cf. *bentori oblongus*
Pterocarya	*Spiniferites mirabilis*
Quercus	*Spiniferites ramosus*
Quercus cf. *ilex*	*Spiniferites hyperacanthus*
Ranunculaceae	
Rumex	Other dinocysts
Salix	
Sapotaceae	Other Lago-Mare dinocysts including
Sciadopitys	different morphotypes
Symplocos	
Taxodium type	Reworked dinocysts


FPA section
RICHNESS
SHANNON INDEX
(m)
(a)
brownish clays
grey clays
grey clays with cm-scale laminites
grey clays with mm-scale laminites
Similarity
Tpon
Trug
Cyp
acc
alt
dja
anl
eic
pro
Zal
Cam
cos
pal
Lin
sp.D
sp.2
Pon
pbq
lim
pyr
sub
prb
Typ
lit
A
B
B1
B2
(b)
"pointed candonids" + leptocytherids
Caspiocypris
Tyrrhenocythere
Cyprideis
Salinity
Axis 2 (27.1%)
Axis 1 (35,5%)
Depth
I
II
III
IV
V
(c)


FPA section
density (n/mm2)
abundances (%)
samples
a
b
Paleocene-
Miocene p.p.
long ranging
Cretaceous
cl
cgl
brownish clays
grey clays
grey clays with
mm-scale laminites
grey clays with
cm-scale laminites