Planktonic Foraminifers DNA Analysis

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Planktonic foraminifers are ubiquitous protists found in marine zooplankton. About 70 % of oceanic carbonate sediments are composed of foraminifers shells. These sediments are widely used for paleoenvironmental, stratigraphic and evolutionary analyses. Fossil forms of all extant planktonic foraminfers can be found in the geologic record.

Objectives

1. Make a molecular study (with rRNA coding genes) to infer a general molecular phylogeny of planktonic foraminifers. This study should enable us to calibrate the molecular clock with the fossil record in order to calculate DNA evolutionary rates among different lineages.
2. Make a broad-scale study of the genetic variability in a planktonic group of organism. We will characterise the latitudinal variability of DNA sequences at the species level in order to define genetic boundaries between populations. We will also look for correlation between oceanographic factors and geographical distribution. Genetic variability between or among species may help us to understand gene flows across different water masses.

Methods

Two to four net tows (63 and 200 μm mesh, 20 and 175 m deep) were made at each daily CTD-station. Samples were immediately distributed in Petri dishes and examined with a dissecting microscope. Foraminifers were isolated and transferred to other dishes containing filtered seawater. They were then sorted by species or by morphotypes if taxonomic identification was not possible with the optic available on board. In the latter case, some specimens were dried and stored on micropaleontology slides for further examination by scanning electronic microscopy (SEM).

DNA extractions were performed on day of collection to avoid damage of fragile specimens and artefacts due to degradation of cell material. Foraminifers were individually cleaned by brushing

to eliminate the spines, detritus and micro-organisms on their surface. DNA extractions were performed by dissolving specimens in 40 μl of a guanidine-based buffer containing Guanidium isothiocyanate, Tris-HCl, EDTA, Sodium loryl sarkosinate and β-mercaptoethanol. All DNA extracts were preserved at -20 °C.

Accomplishments

About 1160 DNA extractions on more than 1400 specimens were achieved during AMT-8 (appendix 1). Twenty species belonging to 8 different genera (on 12 living) were determined and extracted. We found representatives of 3 families (Globigerinidae, Hastigerinidae and Globorotaliidae) and species having interesting evolutionary features or unknown fossil origin. Many species were found at different stations of the transect, sometimes in different biogeographical oceanic provinces. *Orbulina universa* and *Globigerinella siphonifera* - two widely distributed species - were intensively studied at each station and will be used as reference species for studying the plankton community genetic structure over basin scales.

Further work

Post cruise work in Geneva will consist in amplifying DNA by polymerase chain reaction (PCR), cloning of the PCR products in supercompetent bacteria, and sequencing clones on a ABI 377 Prism automated sequencer. To start with, genes coding for the ribosomal RNA will be analysed.

AMT-8 SAMPLING

Date	Sday	Time	Tow	Station	Depth (m)	Nb nets	Mesh (μm)	Nb of species	Nb of extr.
18.05.99	138	1330	1	A825	20	0.5	200	4	13
19.05.99	139	1030	2	A826	20	1	63	4	11
.			2.1		175	1	63	5	23
20.05.99	140	1030	3	A828	20	1	63	1	5
			3.1		175	1.5	63	7	24
21.05.99	141	1030	4	A830	20	1	63	5	7
			4.1		175	1	63	9	57
		1500	5	A831	20	1	63	6	10
22.05.99	142	1030	6	A832	20	1	63	4	8
			6.1		175	1	63	7	23
23.05.99	143	1030	7	A834	20	1	63	4	6
			7.1		175	1.5	63	7	39
24.05.99	144	1030	8	A836	20	1	63	4	54
			8.1		175	2.5	63	12	70
			8.1		175	1	200		
25.05.99	145	1030	9	A837	20	1	63	5	44
			9.1		175	1	63	7	65
26.05.99	146	1030	10	A839	20	1	63	7	63
			10.1		175	1	63	6	89
27.05.99	147	1030	11	A841	20	1	63	5	13
			11.1		175	1	63	4	16
		1330	12	A842	20	1	63	7	34
			12		20	1	200		
			12.1		175	1	63	7	30
			12.1		175	1	200		
28.05.99	148	1030	13	A843	20	1	63	4	12
			13.1		175	1.5	63	3	7
29.05.99	149	1030	14	A845	20	1	63	4	5
			14.1		175	1.5	63	10	69
		1300	15	A846	20	1	63	1	4
			15		20	1	200		
			15.1		175	1	63	8	51
			15.1		175	1	200		
30.05.99	150	1030	16	A847	20	1	63	5	28
			16.1		175	1.5	63	11	67
31.05.99	151	1030	17	A849	20	1	63	5	33
			17.1		175	1	63	9	26
01.06.99	152	1000	18	A851	20	1.5	63	7	34
			18		20	0.5	200		
			18.1		175	1.5	63	11	50
		1800	19	A852	20	1	63	5	31
			19		20	0.5	200		
			19.1		175	1.5	63	7	38
02.06.99	153	1030	20	A853	20	1	63	7	17
			20.1		175	1.5	63	10	81
03.06.99	154	1030	21	A855	20	1	63	4	40
			21.1		175	1	63	9	85
		1500	22	A857	20	1	63	6	22
			22.1		175	1	63	6	24
04.06.99	155	1030	23	A859	20	1	63	3	9
			23.1		166	1	63	11	40
05.06.99	156	1030	24	A862	50	1	63	2	2