

Research Vessel

METEOR

Reise Nr. 71/3

**Short Cruise Report, Leg 71/3
Heraklion/Greece to Istanbul,/Turkey
17. Jan. - 04. Feb. 2007**

Biology and Biogeochemistry of the Eastern Mediterranean Sea

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ZMK: Center for Marine and Atmospheric Research, University of Hamburg, Germany

IfBM: Institute of Biogeochemistry and Marine Chemistry

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UniMi: University of Milano, Italy

UniA: University of Athens, Greece

UniAe: University of the Aegean, Mytilene, Greece

HCMR: Hellenic Center for Marine Research, Athens, Greece

UniTü: University of Tübingen, Germany

DWD: Deutscher Wetterdienst, Hamburg, Germany

Goals and Research Program

Work on M71-3 aimed to answer the question whether phosphate loss and incomplete utilisation of nitrate on the one hand, or dinitrogen fixation on the other hand are responsible for unusual nutrient ratios in the water column of the eastern Mediterranean Sea. We investigated the reason for unusually depleted $^{15}\text{N}/^{14}\text{N}$ ratios in dissolved nitrate, suspended matter and surface sediments of that oligotrophic ocean basin. During a total of 18 days of ship time on r/v METEOR, Leg 3 of M71 performed water column and surface sediment work in the eastern Mediterranean Sea (Heraklion-Istanbul). Stations will be aligned on one E-W and two N-S transects and sampled all major basins and water masses. On stations, CTD casts were obtained and water samples for nutrient concentrations were taken. These samples and those of suspended matter and surface sediment will be analysed for the stable nitrogen isotope composition of dissolved nitrate, suspended matter, and surface sediments. In addition, phytoplankton samples were taken and experiments were carried out to determine N_2 fixation rates, genetic expressions of nitrogen fixation, and the composition of microbial and algal assemblages. One mooring of sediment traps (Ierapetra Deep) was deployed and will be recovered in September 2007 to monitor changes in particle flux and its isotope signature over a seasonal cycle.

Narrative of the Cruise

METEOR departed Heraklion/Crete on January 17, 2007 after several days of uncertainty whether a missing container and the permission for research in the EEZ of Greece would permit attaining many of the scientific and operational goals of Leg M71-3. On the 17th, both the permission arrived, and ok was given to travel to Gioia Tauro/Calabria to pick up the stray container. However, an air freight containing sediment trap equipment was still lacking and was scheduled to be picked up in Heraklion on the way East.

The transit of 680 additional miles, the short stopover in Gioia Tauro and the subsequent transit back through the Strait of Messina (passing Vesuvius at dusk, volcanic plume against a red evening sky) to the working area lasted until January 21. At 05:00 UTC we arrived at our first station H04 in the western Ionian Basin (Figure 1), and operations started with a program that – with some modifications due to different water depths – included one to four CTD casts and rosette sampling to meet all requests for water samples. In preparation for the first station, a sampling scheme had been developed that permitted sampling of diverse small (for oxygen, nutrients, N_2O , and several aliquots for different filtration steps) and large (<50 l) volume requests (for obtaining suspended matter and bacterial concentrates). An in-situ pump was usually positioned over the second rosette to sample the chlorophyll maximum. Following CTD casts, a multinet was deployed in steps of 50 to 200 m from 0-600 m, followed by a multicorer. During transits, we sampled surface waters by means of an outboard tow-fish connected to a pump in the clean container, and by a flow-through centrifuge taking in water from the shipboard membrane pump. On these transits, the shipboard thermosalinograph recorded T and S of surface waters, and a variety of navigational, sea state, weather and radiation properties were collected by shipboard sensors.

Station work at station H04 ended at 16:00 UTC and the vessel transited to station H03, where we arrived on January 22 at 05:10 UTC. Operations there went smoothly and ended at 16:40 UTC. The ship turned north and transited 122 nm for station H05 that was reached on January 23 at 04:00 UTC. Weather was relatively calm during these first

days, with occasional sunshine and slight swells, while a tremendous storm hit central Europe and killed 47 persons. Our transit north continued with 7 stations in rapid succession (H06 to H12); these were targeted to study the deep-water hydrography in the northern Ionian Sea and the Strait of Otranto, the entrance to the Adriatic Sea. This was a rather demanding program that ended on 26 January at 03:30 at station H12, and all scientific personnel appreciated the resting period during a transit of 200 nm to station H02. During night hours of this transit, the to-fish was again deployed for a second round of nutrient-addition experiments.

Time became short for the last two stations (H02 and H01) that completed the W-E transect through the Ionian Basin along 35°45'N. Meteor was scheduled to pick up equipment (a sediment trap) that had missed departure in Heraklion, and had to go back there on January 28 before turning east for the remainder of the cruise. Also, weather was turning bad: a force 7 wind from the north had been announced, and we had to test the release of the sediment trap mooring before the actual deployment on one of the stations. In addition, these were stations interesting to all groups, and demand for water and station time was high.

We arrived at midnight of January 27 at station H02 and spent 7 rushed hours with 4 CTD casts, a multinet deployment (which failed, as it turned out later due to a short in the instrument), and a multicorer cast which recovered our first sapropel (S1) at 30 cm in the core. Then we turned east and steamed to the final station, H01, where again a full program of 4 CTD casts, multinet (on winch W3 this time, also a failure) and multicorer was scheduled. In addition, the sediment trap release was tested successfully. A POSIDONIA transducer test failed for as yet unknown reasons – so far, none of two transducers tested had registered on the ship's receivers when lowered repeatedly with a MUC and with the sediment trap release. Operations started at 17:00 UTC and ended just in time (23:30 UTC) before work became uncomfortable with cold winds of 7 Bft from the north and significantly higher waves than in previous days and nights. It was also time to steam to Heraklion and to pick up our freight. In the morning of January 28, we made our way parallel to the northern coast of Crete to Heraklion, where we arrived shortly after noon on January 28 and were greeted by two tug boats that towed us to our berth, and by our colleagues from HCMR who came in full force to cheer us up and to deliver sweets and Cretan wine. It took only 30 minutes and we were out again, on our way to the next station.

This was located in Ierapetra Deep, a morphological depression northward of the Hellenic Arc, in an area that is characterized by thick thermocline due to an anticyclonic gyre in surface waters. Here we arrived at 04:00 UTC on January 29 after a somewhat choppy journey – the wind had been blowing from the north at 7 Bft since the morning of January 28 and swell was over 2 m – and the usual program of multiple CTD and rosette sampler casts was started. The highlight of this station clearly was the deployment of a sediment trap mooring, which commenced in daylight hours (at 13:40 UTC) and lasted until 17:30 UTC, when the position of the trap had been triangulated. The program finished with two further multinet casts and we left the station after with the tow-fish outboard to pump water during the transit.

The two next stations were situated in the western Levantine Basin and on the western slope of Herodotus Abyssal Plain. They were the remainder of a more comprehensive set of stations planned for this part of the eastern Mediterranean Sea, of which several fell victim to problems with research permissions and diplomatic considerations. The first station (Her01) was reached on January 30, 2007 at 04:30 UTC and lasted to 14:10, the second (Her03) started at 20:40 UTC on the same day and was finished at 07:50 UTC on January 30, 2007. Both saw a program of 4 CTD and rosette sampler casts to various depth intervals, multinet deployments, in-situ pumping to obtain suspended matter from the chlorophyll maximum, and finished with multicoring. Most notable was the recovery of a small fish in the organic-rich sediment of sapropel S1 at Her03.

The ship then turned north for our second but last station in the northwestern slope of the Rhodes Basin, which was targeted to characterise the water flowing out of the Aegean and Cretan Seas. The station (Rho02) was reached on January 31 at 21:30 UTC and operations here ended at 04:40 UTC. Meteor then headed north into the Aegean on her way to the North Skyros Basin and in the general direction of Istanbul. The transit was over 300 nm and we reached our last station (Sk01) on February 2, at 15:50. The routine program was run and at 23:35 the last multicorer was on deck and the scientific program was completed.

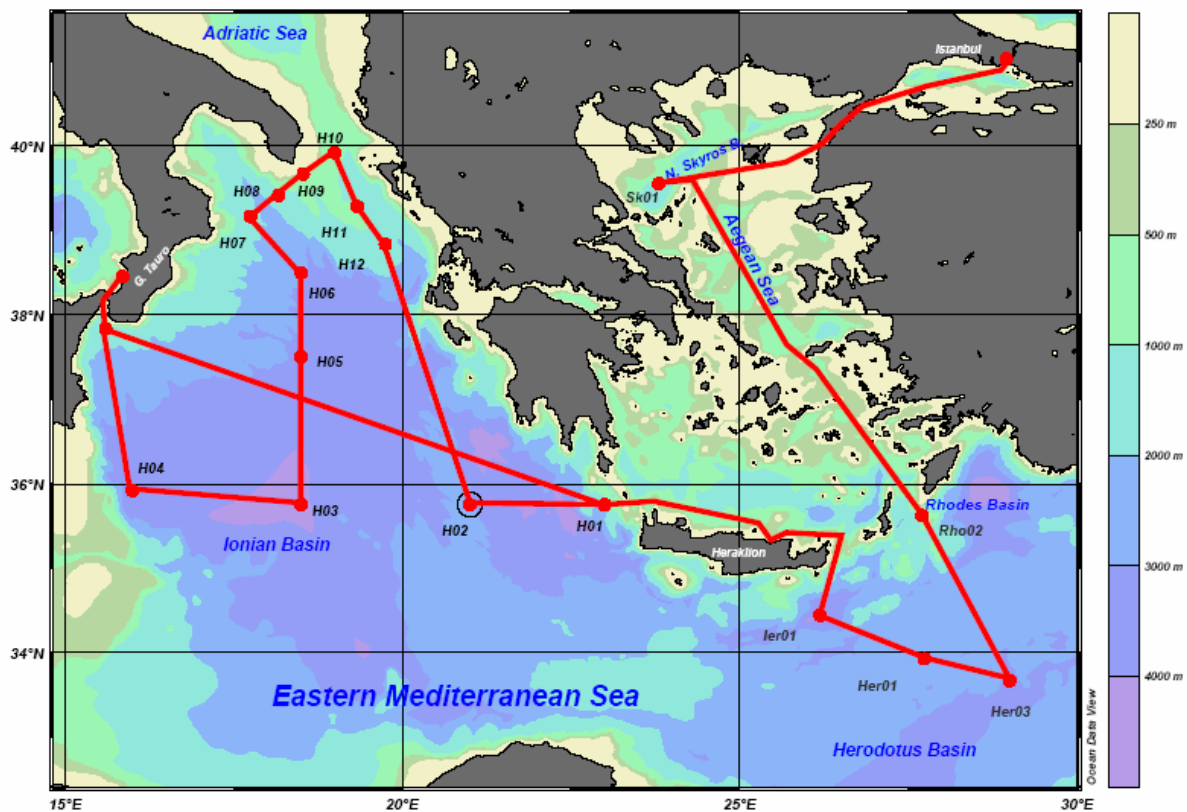


Figure 1: Track and station map of M71-3

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Table 1: Station list and sampling on stations during M71-3

Station	M71-3 number	Lat °N	Min °N	Lon °E	Min °E	decLat	decLon	Water depth (m)	Date	Start UTC	End UTC	CTD/rosette	MN	MUC	ISP	Fish	Extras
H04	101-105	35	55.00	16	0.00	35.9167	16.0000	3750	21.01.2007	05:00	16:00	3	1	1		x	
H03	106-111	35	45.00	18	30.00	35.7500	18.5000	4087	22.01.2007	05:30	18:00	4	1	1	1	x	
H05	112-116	37	30.00	18	30.00	37.5000	18.5000	3154	23.01.2007	04:00	15:05	3	1	1	1		
H06	117-122	38	30.00	18	30.00	38.5000	18.5000	3040	23.01.2007	22:00	09:30	3	1	2	1		
H07	123-126	39	10.00	17	45.00	39.1667	17.7500	1866	24.01.2007	14:40	21:00	2	1	1	1		
H08	127-129	39	25.03	18	10.01	39.4172	18.1668	1350	24.01.2007	23:15	02:30	2	1	1	1		
H09	130-131	39	40.00	18	32.00	39.6667	18.5333	543	25.01.2007	05:00	07:00	1	1	1	1	x	
H10	132-136	39	55.00	19	0.00	39.9167	19.0000	1008	25.01.2007	09:30	14:10	3	2	1	1		
H11	137-139	39	17.00	19	20.00	39.2833	19.3333	1035	25.01.2007	17:50	20:50	1		1	1		
H12	140-142	38	50.00	19	45.00	38.8333	19.7500	1450	25.01.2007	23:50	03:30	2		1	1	x	
H02	143-148	35	45.00	21	0.00	35.7500	21.0000	3008	27.01.2007	00:00	07:00	4	1	1	1		
H01	149-154	35	45.00	23	0.00	35.7500	23.0000	2117	27.01.2007	17:00	23:30	4		1	1		Release test
Ier01	155-162	34	26.54	26	11.51	34.4423	26.1918	3626	29.01.2007	04:00	19:00	4	2	1	1	x	Mooring
Her01	163-170	33	55.44	27	44.45	33.9240	27.7408	2680	30.01.2007	04:30	14:10	4	2	1	1		
He03	171-179	33	40.00	29	0.00	33.6667	29.0000	3090	30.01.2007	20:40	07:50	4	2	1	1		
Rho02	180-187	35	37.12	27	42.03	35.6187	27.7005	1305	31.01.2007	21:30	04:40	4	2	1	1		
Sk01	188-194	39	33.39	23	48.08	39.5565	23.8013	1264	02.02.2007	15:50	23:40	4	2	1			

MN= multiple closing planktonnet
MUC= Multicorer
ISP= In-situ pump
Fish= tow-fish