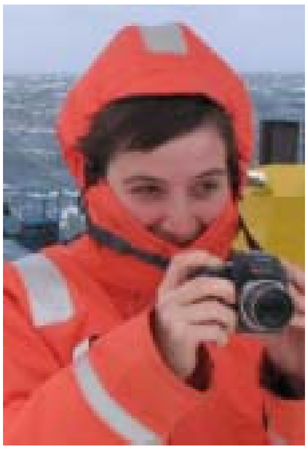
2.3 Aerosols and rainfall

D285 **Hélène Planquette**



The atmosphere can represent an important role in material transport from land to sea and may represent an external source of trace elements, such as Fe. The aim of the study is to quantify any Fe input from the atmosphere around the Crozet Plateau.

<u>Aerosol Collection</u>

Aerosol collection requires a 72h period of sampling. As many rain events occurred during this cruise, it was therefore almost impossible to collect aerosol samples around the Crozet region. Aerosol samples for Fe analysis are collected with a high volume (1 m^3. min^{-1}) air sampler (Graseby-Anderson) as the ship's course coincided with the prevailing wind direction, so that exhaust from the ship's stack was not blown over the collector during this period.

The filters used for aerosol collection have been acid-washed.

A filter blank will be determined on an unexposed acid-washed filter that had been loaded into a sampling cassette and left for ~ 24h, with no air drawn through it.

After aerosol collection, the filters were stored in double plastic bags, in a –20°C freezer. They will be analysed probably at UEA, with the collaboration of Dr Alex Baker. The soluble Fe will be extracted with ammonium acetate buffer as a model for Fe release from aerosol in rainwater. Then, Fe will be determined by Graphite Furnace Atomic Absorption Spectrometry (GFAAS).

<u>Rain collection</u>

Atmospheric iron concentrations will be investigated in rain samples collected at different periods (see Table 1) with a 30 cm diameter funnel attached to a sample bottle, which was located on the monkey island. The polypropylene funnel (30 cm diameter) and acid-washed (with nitric acid) low-density polyethylene bottles were both acid-washed prior to use.

The samples were stored in a freezer at –20 C.

The iron and other metals of interest will be determined by GFAAS.

Table 2.4 Rain Samples.

Event	Sample	Start Date	Time (GMT)	End Date	Time (GMT)	Comments
1	R1 D285	8-nov-04	09H13	08-nov-04	09H13	Blank, 125 mL
2	R2 D285	8-nov-04	09H13	08-nov-04	15H05	50 mL,
3	R3 D285	8-nov-04	15H05	08-nov-04	20H15	60 mL,
4	R4 #1 D 285	9-nov-04	20H15	09-nov-04	13H30	500 mL, split in two bottles
	R4 #2 D 285	9-nov-04	20H15	09-nov-04	13H30	because overfilled
5	R5 #1 D285	18-nov-04	09H32	18-nov-04	15H26	500 mL split in two bottles
5	R5 #2 D285	18-nov-04	09H32	18-nov-04	15H26	
6	R6 D285	22-nov-04	18H30	22-nov-04	22H25	250 mL
8	R7 D285	30-nov-04	06H20	30-nov-04	10H00	50 mL
9	R8 D285	30-nov-04	10H00	30-nov-04	16H00	40 mL
10	R9 D285	02-déc-04	08h03	03-déc-04	15h20	40 mL

D286 **Megan French**

Objective

The amount of mineral aerosol particles has doubled as a result of human activity (Tegan et al., 1996 in Harrison, 2000). It is thought that the resultant increases in dust delivered to oceans via atmospheric deposition could increase CO_2 uptake by the oceans (Harrison, 2000). Takeda (1998) supports this hypothesis by concluding that changes in iron inputs from atmospheric dust to the ocean were responsible for changes in primary production and thus the drawdown of atmospheric CO_2 during the last glaciation.

These findings highlight the importance of quantifying the atmospheric deposition fluxes of minerals such as silica and iron, which are believed to play important roles in the oceanic cycling of carbon. In the context of this research, objectives included investigating atmospheric inputs of iron and silica to the ocean in the vicinity of the Crozet Plateau in order to quantify this pathway as an external source of minerals to the water column.

Method

A high volume (1 m^3 min^{-1}) air sampler (Graseby-Anderson) was used for obtaining trace metal (1st leg only) and major ion aerosol samples over the duration of the cruise. A rainfall collector was used to collect rainfall over the 1st leg of the cruise only (see above).

The aerosol collector acts as a vacuum with a pre-calibrated air-flow rate and monitored sampling time. Filters were placed in the upper compartment of the collector approximately every 3 days (Fig. 2.8) during the 1st leg and every 2 days during the 2nd leg of the cruise. Upon removal, filters were stored in sealed double plastic bags and frozen (-20 ^{o}C) for transport back to the UK for analysis (UEA).

It is thought that the potential for data from the filters will be hindered by the difficulties encountered in retrieving good quality filters. This was due both to the fact that it proved difficult to obtain filters over the course of the 2/3 day sample period that had not been marred by the occurrence of rainfall, high winds closing the collector lid, or by an alteration in the ship's course that meant fumes became part of the head wind during sampling.

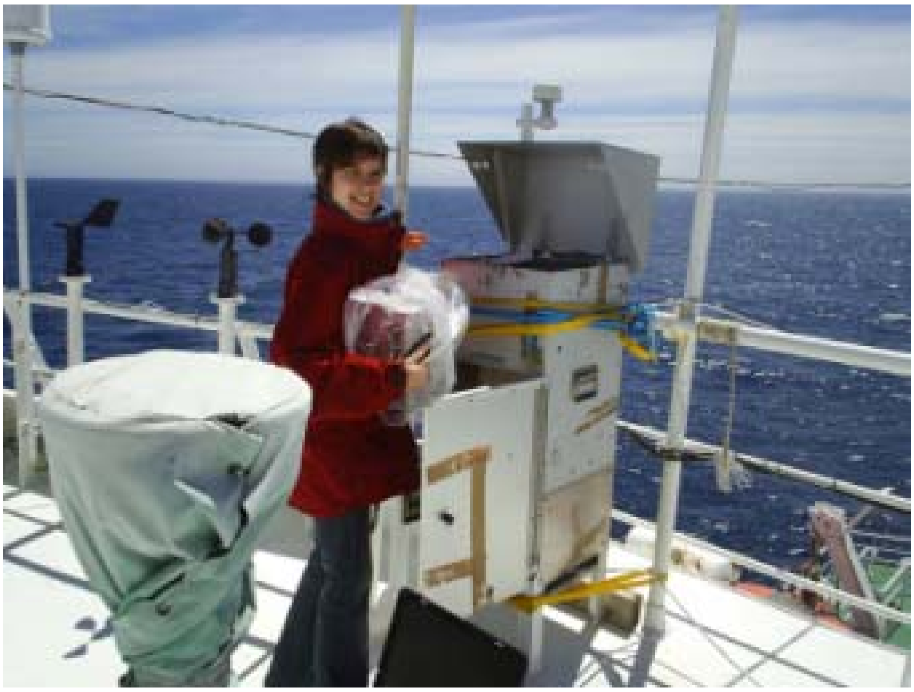


Fig. 2.8 Aerosol filter changing

References

Dugdale, R.C., Wilkerson, F.P., and Minas, H.J. 1995. The role of a silica pump in driving new production. Deep-Sea Research I 42, pp. 697 - 719.

Harrison, K. G. 2000. Role of increased marine silica input on paleo-pCO2 levels. Paleoceanography 15 (3), p.292-298.

Nelson, D. M., Treguer, P., Brzezinski, M. A., et al. 1995. Production and dissolution of Biogenic Silica in the oceans, revised global estimates. Global Biogeochemical Cycles 9, p. 359 - 372.

Skalar Seawater Analysis Handbook. Publication No. 0102009A. US. 1994.

Takeda, S. 1998. Influence of iron availability on nutrient consumption ratio of diatoms in oceanic waters. Nature 393; 774-777.

Yool, A., and Tyrrell, T. 2003. Role of diatoms in regulating the ocean's silicon cycle. Global Biogeochemical Cycles 17 (4): 14.1-14.21.

2.4 Underway Fast Repetition Rate fluorometry (FRRf)

Underway FRRf on D285 **Mark Moore**

A Chelsea Scientific instruments FAST*tracka*™ Fast Repetition Rate fluorometer (FRRf) (Kolber et al. 1998) was connected to the ships non-toxic supply within the bottle annex in order to monitor the physiological state of photosystem II (PSII) within the surface phytoplankton population throughout the study area. Saturation of variable chlorophyll fluorescence was performed using 100 flashlets of 1.1μs duration with a 2.3μs repetition rate. Subsequent relaxation of fluorescence was monitored using flashlets provided at 98.8μs spacing, giving a total relaxation protocol length of around 2ms. Such a protocol should allow adequate resolution of Q_a relaxation kinetics (Kolber et al. 1998).

The data were stored internally on the instrument and downloaded at between 2 and 7 day intervals throughout the D285. Instrument optics were cleaned whilst the download operation was being carried out. Some fouling of the optical surfaces was apparent after the longest sample collection periods and it is recommended that downloading of files and cleaning of optical surfaces be performed more regularly during Leg 2. A total of 9 files were collected (Table 2.5). Data were then analysed using custom software in a Matlab™ environment. Only limited initial checks on data quality were performed during the cruise. However data appeared to be a similar quality to previous deployments of the instrument in this mode. An exception was found for file 'uw4' where data quality appeared particularly poor. The cause of this problem is unknown at the current time and will require further investigation.

Much of the signal was dominated by marked diel variability in the parameters that can be measured by an FRRf deployed in this mode (F_v'/F_m' and σ_{PSII}'), limiting the interpretation of special variability within physiological parameters to night-time data.

Table 2.5 Underway FRRf files collected during D285

	UW1	UW2	UW3	UW4	UW5	UW6	UW7	UW8	UW9
Start time	14:45 3 Nov 2004	13:01 4 Nov 2004	13:19 7 Nov 2004	12:12 9 Nov 2004	12:05 11 Nov 2004	12:37 13 Nov 2004	12:30 18 Nov 2004	14:39 24 Nov 2004	16:18 2 Dec 2004
End time	12:21 5 Nov 2004	12:45 7 Nov 2004	11:40 9 Nov 2004	12:15 11 Nov 2004	11:49 13 Nov 2004	11:46 18 Nov 2004	14:00 24 Nov 2004	15:35 2 Dec 2004	07:08 8 Dec 2004

Underway FRRf on D286 **Anna Hickman**

Underway FRRf measurements were collected following methods of CROZEX Leg 1, and are as follows:

A Chelsea Scientific instruments FAST*tracka*™ Fast Repetition Rate fluorometer (FRRf) (Kolber et al. 1998) was connected to the ships non-toxic supply within the bottle annex in order to monitor the physiological state of photosystem II (PSII) within the surface phytoplankton population throughout the study area. Saturation of variable chlorophyll fluorescence was performed using 100 flashlets of 1.1μs duration with a 2.3μs repetition rate. Subsequent relaxation of fluorescence was monitored using flashlets provided at 98.8μs spacing, giving a total relaxation protocol length of around 2ms. Such a protocol should allow adequate resolution of Q_a relaxation kinetics (Kolber et al. 1998).

The data were stored internally on the instrument and downloaded at between 1 and 5 day intervals throughout the D286. Instrument optics were flushed and cleaned whilst the download operation was being carried out. A total of 10 files were collected (Table ?). Only limited initial checks on data quality were performed during the cruise.

The underway instrument was swapped after completion of UW14 with the instrument used on SeaSoar. Some data were lost at the end of files UW17 and UW18 possibly due to a damaged flashcard limiting storage capacity of the second instrument. However, this problem will require further investigation.

Table 2.6 Underway FRRf files collected during D286

	UW10	UW11	UW12	UW13	UW14	UW15	UW16	UW17	UW18	UW19
Start time	19:20 JD 348	14:55 JD 349	13:56 JD 350	10:03 JD 353	13:54 JD 356	15:30 JD 358	13:17 JD 361	12:11 JD 365	12:42 JD 040	13:06 JD 090
End time	14:40 JD 349	13:22 JD 350	09:46 JD 353	13:35 JD 356	08:30 JD 358	12:50 JD 361	11:46 JD 365	12:10 JD 040	12.30 JD 090	13:20 JD 010

2.5 Satellite images **Hugh Venables, Katya Popova**

Concurrent Modis Chlorophyll and SST images were processed at Plymouth and placed on their website as png images, generally within 6 hours of the satellite pass. These were then downloaded by Katya Popova and the relevant images e-mailed to the PSO's account (due to size restrictions on personal accounts). Each image was 50-400K depending on coverage. The files were copied to /data61/sat and then to /data61/hjv/psat/chl (or /sst) with the filenames changed to ddmmi.png where dd is day of month, mm is month and i is image number (there could be up to 3 images per day). The matlab script psat2boat, in /data61/hjv/matlab, could then be run to create composite images. Time periods for the composites can be selected by entering day of month and month for start and end or jday for September-December. Images were then saved in data61/hjv/matlab as jpg or eps format to be imported into illustrator or printed. eps gives greater resolution so is preferable if software is available to view it. Plotting images to the screen was time consuming (1011x1424 pixels) and so psat2boatquick can be used to quickly plot successive days images subsampled to every 10 data point in latitude and longitude to allow coverage to be assessed so that a sensible series of composites could be created.

The composites were created by averaging all available data for each position, using a counting array to record how many previous images had provided data for each position, so each image was given equal weight in the composite.