Dataset name: **Suspended particle chemistry and biochemistry**

|  |  |
| --- | --- |
| Parameters: | * **POC, PN, δ13C, δ15N**
* **BSi, LSi**
* **Particulate POP, Ca, Na, Al**
* **Particulate 234Th**
* **Total Fatty Acids (FA) concentrations**
* **Neutral and Polar FA concentrations**
* **FA classes (SAFA, BACT, PUFA, MUFA) concentrations**
* **EPA (20:5n-3) and DHA (22:6n-3) concentrations**
 |

PROJECT TITLE: **MOBYDICK**

Oceanographic cruise: **MOBYDICK**

Start date: **18/02/2018**

End date: **27/03/2018**

Project manager: **Bernard Quéguiner** bernard.queguiner@mio.osupytheas.fr

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 Geographic information: **Indian sector of the Southern Ocean**

 Latitude: **49.5°S – 52.5°S**

 Longitude: **67,0°E – 74.5°E**

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# OPERATIONS

## Sampling device(s)

Particulate samples fractionated according to size were collected using *in situ* pumps (ISP\_ISMI casts) at all sampled stations (see Table 1). Five ISP were deployed per cast at variable depths between 20 and 300 m with different filter configurations according to ISP number and targeted parameters. Three different filter configurations were used: 1/50/300 µm, 1/20/200 µm, 1/20/50 µm. Vertical profiles of total 234Th were also acquired from rosette casts (see Table 2)

## List of ISP stations sampled

**Table 1: details of ISP casts**

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| Station | Cast | Start date | depth | ISP # | Filtered volume | Filterconfiguration |
| M2-1 | ISP001 | 27/02/2018 | 310 m | PIS008 | 1,033 L | 1/50/300 µm |
| M2-1 | ISP001 | 27/02/2018 | 210 m | PIS009 | 873 | 1/50/300 µm |
| M2-1 | ISP001 | 27/02/2018 | 130 m | PIS010 | 688 L | 1/50/300 µm |
| M2-1 | ISP001 | 27/02/2018 | 80 m | PIS012 | 237 L | 1/50/300 µm |
| M2-1 | ISP001 | 27/02/2018 | 50 m | PIS011 (A) | 0 L | 1/20/200 µm |
| M2-1 | ISP001 | 27/02/2018 | 50 m | PIS011 (C) | 0 L | 1/50/300 µm |
| M4-1 | ISP002 | 03/03/2018 | 595 m | PIS012 | 1,414 L | 1/50/300 µm |
| M4-1 | ISP002 | 03/03/2018 | 420 m | PIS009 | 1,351 L | 1/50/300 µm |
| M4-1 | ISP002 | 03/03/2018 | 129 m | PIS010 | 613 L | 1/50/300 µm |
| M4-1 | ISP002 | 03/03/2018 | 55 m | PIS008 | 316 L | 1/50/300 µm |
| M4-1 | ISP002 | 03/03/2018 | 22 m | PIS011 (A) | 365 L | 1/20/200 µm |
| M4-1 | ISP002 | 03/03/2018 | 22 m | PIS011 (C) | 374 L | 1/50/300 µm |
| M3-1 | ISP003 | 05/03/2018 | 300 m | PIS012 | 1,150 L | 1/50/300 µm |
| M3-1 | ISP003 | 05/03/2018 | 200 m | PIS009 | 967 L | 1/50/300 µm |
| M3-1 | ISP003 | 05/03/2018 | 100 m | PIS010 | 1,054 L | 1/50/300 µm |
| M3-1 | ISP003 | 05/03/2018 | 60 m | PIS008 | 417 L | 1/50/300 µm |
| M3-1 | ISP003 | 05/03/2018 | 30 m | PIS011 (A) | 457 L | 1/20/200 µm |
| M3-1 | ISP003 | 05/03/2018 | 30 m | PIS011 (C) | 472 L | 1/50/300 µm |
| M2-2 | ISP004 | 07/03/2018 | 200 m | PIS012 | 923 L | 1/50/300 µm |
| M2-2 | ISP004 | 07/03/2018 | 150 m | PIS009 | 688 L | 1/50/300 µm |
| M2-2 | ISP004 | 07/03/2018 | 100 m | PIS010 | 1,079 L | 1/50/300 µm |
| M2-2 | ISP004 | 07/03/2018 | 60 m | PIS008 | 658 L | 1/50/300 µm |
| M2-2 | ISP004 | 07/03/2018 | 30 m | PIS011 (A) | 325 L | 1/20/200 µm |
| M2-2 | ISP004 | 07/03/2018 | 30 m | PIS011 (C) | 343 L | 1/50/300 µm |

**Table 1: details of ISP casts (cont'd)**

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| M1 | ISP005 | 09/03/2018 | 200 m | PIS012 | 800 L | 1/50/300 µm |
| M1 | ISP005 | 09/03/2018 | 150 m | PIS009 | 786 L | 1/50/300 µm |
| M1 | ISP005 | 09/03/2018 | 80 m | PIS010 | 914 L | 1/50/300 µm |
| M1 | ISP005 | 09/03/2018 | 50 m | PIS008 | 2 L | 1/50/300 µm |
| M1 | ISP005 | 09/03/2018 | 20 m | PIS011 (A) | 286 L | 1/20/200 µm |
| M1 | ISP005 | 09/03/2018 | 20 m | PIS011 (C) | 293 L | 1/50/300 µm |
| M4-2 | ISP006 | 13/03/2018 | 300 m | PIS008 | 1 L | 1/50/300 µm |
| M4-2 | ISP006 | 13/03/2018 | 200 m | PIS009 | 924 L | 1/50/300 µm |
| M4-2 | ISP006 | 13/03/2018 | 100 m | PIS010 | 956 L | 1/50/300 µm |
| M4-2 | ISP006 | 13/03/2018 | 60 m | PIS012 | 285 L | 1/50/300 µm |
| M4-2 | ISP006 | 13/03/2018 | 30 m | PIS011 (A) | 943 L | 1/20/200 µm |
| M4-2 | ISP006 | 13/03/2018 | 30 m | PIS011 (C) | 515 L | 1/50/300 µm |
| M2-3 | ISP007 | 16/03/2018 | 200 m | PIS007 | 1,253 L | 1/50/300 µm |
| M2-3 | ISP007 | 16/03/2018 | 150 m | PIS009 | 932 L | 1/50/300 µm |
| M2-3 | ISP007 | 16/03/2018 | 100 m | PIS010 | 656 L | 1/50/300 µm |
| M2-3 | ISP007 | 16/03/2018 | 60 m | PIS012 | 258 L | 1/50/300 µm |
| M2-3 | ISP007 | 16/03/2018 | 30 m | PIS011 (A) | 351 L | 1/20/200 µm |
| M2-3 | ISP007 | 16/03/2018 | 30 m | PIS011 (C) | 611 L | 1/50/300 µm |
| M3-3 | ISP008 | 18/03/2018 | 300 m | PIS007 | 1,168 L | 1/20/50 µm |
| M3-3 | ISP008 | 18/03/2018 | 200 m | PIS009 | 940 L | 1/20/50 µm |
| M3-3 | ISP008 | 18/03/2018 | 100 m | PIS010 | 954 L | 1/20/50 µm |
| M3-3 | ISP008 | 18/03/2018 | 60 m | PIS012 | 567 L | 1/20/50 µm |
| M3-3 | ISP008 | 18/03/2018 | 30 m | PIS011 (A) | 584 L | 1/20/200 µm |
| M3-3 | ISP008 | 18/03/2018 | 30 m | PIS011 (C) | 846 L | 1/20/50 µm |

## List of rosette stations sampled

**Table 2 : details of rosette casts for total (dissolved+particulate) 234Th**

|  |  |  |  |
| --- | --- | --- | --- |
| **Station ID** | **Type of operation** | **Cast ID** | **# of depths** |
| M2\_1 | CTD\_OMICS\_P | CTD\_003 | 16 depths (10 to 500 m) |
| M4\_1 | CTD\_OMICS\_P | CTD\_016 | 16 depths (10 to 800 m) |
| M3 | CTD\_OMICS\_P | CTD\_020 | 16 depths (10 to 800 m) |
| M2\_2 | CTD\_OMICS\_P | CTD\_034 | 16 depths (10 to 500 m) |
| M1 | CTD-eDNA | CTD\_039 | 11 depths (100 to 800 m) |
| M1 | CTD-NCP | CTD\_040 | 4 depths (30 to 80 m) |
| M4\_2 | CTD\_OMICS\_P | CTD\_048 | 16 depths (10 to 800 m) |
| M2\_3 | CTD\_OMICS\_P | CTD\_055 | 16 depths (10 to 500 m) |
| M3\_3 | CTD\_OMICS\_P | CTD\_062 | 15 depths (10 to 800 m) |

# INSTRUMENTS

Instrument Type: **In Situ Pump**

Manufacturer: **McLane Research Laboratories**

Model: **WTS-6-1-142**

Instrument Features / Calibration: N/A

# DESCRIPTION of PARAMETERS

## Measurement details

Particulate samples fractionated according to size were processed on board as follow:

For the 1/50/300 µm configuration, the following subsampling scheme was used:

* The 300 µm filter was expected to collect only zooplanctonic organisms. The whole filtered material was resuspended with filtered (0.4 µm) seawater and subsampled using a MOTODA splitting box. Subsamples were recollected on GF/F filters to allow particulate organic carbon (POC), particulate organic nitrogen (PON), δ13C, δ15N (1/4), lipid content (1/2) and microzooplankton taxonomy determination (1/4)
* The 50 µm filter was cut into quarters. 3 quarters were resuspended using filtered seawater and recollected separately on different filter types to allow the analysis of targeted parameters. ¼ was recollected on a 25 mm QMA filters for 234Th, POC, PN, δ13C, δ15N determination. ¼ was recollected on a 25 mm PC filter for 234Th, BSi, LSi determination. The third quarter was recollected on a 47 mm GFF filter and immediately extracted using a 2:1 chloroform:acetone solvent for lipid content determination. The last quarter was stored at –80°C and will be processed at home laboratory under clean conditions for Al, Ca, Na and P content.
* The 1 µm QMA filter was subsampled using a 25 mm plexiglass punch. 4 punches were collected for lipid content determination and immediately extracted using a 2:1 chloroform:acetone solvent. 4 additional punches were sampled for 234Th, POC, PN, δ13C, δ15N (1 punch), for BSi and LSi (1 punch), for particulate ogranic phosphorus (POP), Al, Ca, Na determination (1 punch) and for backup analysis (1 punch). The remaining part of the QMA filter was frozen (–80°C) and kept as a backup for lipid content analysis.

For the 1/20/200 µm configuration, the following subsampling scheme was used:

* The 200 µm filter was processed in the same way as the 300 µm. The whole filtered material was resuspended with filtered (0.4 µm) seawater and subsampled using a MOTODA splitting box. Subsamples were recollected on GF/F filters to allow POC, PN, δ13C, δ15N (1/4), lipid content (1/2) and microzooplankton taxonomy determination (1/4)
* The 20 µm filter was cut in two parts. One half was resuspended using filtered seawater and recollected on GF/F filter followed by lipid extraction using a 2:1 chloroform:acetone solvent. The remaining half was frozen and kept as a backup.
* The 1 µm QMA filter was subsampled using a 25 mm plexiglass punch. 4 punches were collected for lipid content determination and immediately extracted using a 2:1 chloroform:acetone solvent. The remaining part of the QMA filter was frozen (–80°C) and kept as a backup for lipid content analysis.

For the 1/20/50 µm configuration used only at the last station (M3-3), the following subsampling scheme was used:

* The 50 and 20 µm filters were processed in the same way. 3 quarters were resuspended using filtered seawater and recollected separately on different filter types to allow the analysis of targeted parameters. ¼ was recollected on a 25 mm QMA filters for 234Th, POC, PN, δ13C, δ15N determination. ¼ was recollected on a 25 mm PC filter for 234Th, BSi, LSi determination. The third quarter was recollected on a 47 mm GFF filter and immediately extracted using a 2:1 chloroform:acetone solvent for lipid content determination. The last quarter was stored at –80°C and will be processed at home laboratory under clean conditions for Al, Ca, Na and P content.
* The 1 µm QMA filter was subsampled using a 25 mm plexiglass punch. 4 punches were collected for lipid content determination and immediately extracted using a 2:1 chloroform:acetone solvent. 4 additional punches were sampled for 234Th, POC, PN, δ13C, δ15N (1 punch), for BSi and LSi (1 punch), for POP, Al, Ca, Na determination (1 punch) and for backup analysis (1 punch). The remaining part of the QMA filter was frozen (–80°C) and kept as a backup for lipid content analysis.

## Analytical procedure

### Particulate 234Th

Subsamples of the 1-50 µm, 50-300 µm, 1-20 µm, 20-50 µm, > 50µm fraction were dried, mounted on polyacrylamide support filter and beta counted onboard until a 2% relative standard deviation was achieved

Sensor Precision: <2% for samples, < 0.5% for 99Tc std

### POC, PN, δ13C, δ15N

POC, PN, δ13C, δ15N determination will be performed on all sampled size fractions. Sample will de-carbonated with HCl fuming, dried and encapsulated in tin capsule for EA-IRMS analysis (Planchon *et al.*, 2013).

Sensor Precision: <0.1 µmol for for POC and PN, 0.1 ‰ for δ13C and δ15N

### BSi and LSi

Subsamples of the 1-50 µm, 50-300 µm, 1-20 µm, 20-50 µm, > 50µm fraction will be processed for BSi and LSi determination. It includes a two steps alkaline digestion followed by an acid digestion (Ragueneau *et al.*, 2005). The analysis of silicic acid will be performed by Technicon AutoAnalyzer.

### POP, particulate Ca, Na, and Al

Subsamples of the 1-50 µm, 50-300 µm, 1-20 µm, 20-50 µm, > 50µm size fraction will be processed for POP, Ca, Al, Na analysis. Samples will be digested with a tri-acid mixture (HNO3, HCl, HF). Digested samples will be evaporated to dryness and redissolved with a 1% HNO3 analytical matrix (Cardinal *et al.*, 2001). Ca, Al, Na and P content will be determined by ICP-QMS and using different certified reference materials BHVO-1, JB-3, JGb-1 and SLRS-5.

Sensor Precision: ~5% RSD.

### Total FA concentrations, neutral and polar FA concentrations, FA classes (SAFA, BACT, PUFA, MUFA) concentrations, EPA (20:5n-3) and DHA (22:6n-3)

Subsamples of all size fractions will be processed for lipid analysis. The procedure will include lipid class division, transmethylation and analysis by gaz chromatography (GC-FID and GC-MS) (Soudant *et al.*, 1999).

## Units

* POC µmol C L–1
* PON µmol N L–1
* δ13C ‰ versus PDB
* δ15N ‰ versus atmospheric N2
* BSi, LSi µmol Si L–1
* POP nmol Si L–1
* particulate Ca nmol Si L–1
* particulate Na nmol Si L–1
* particulate Al nmol Si L–1
* Particulate 234Th dpm L–1
* Total FA concentration ng/L
* Neutral and polar FA concentrations ng/L
* 20:5n-3 (EPA) & 22:6n-3 (DHA) ng/L

## Post-cruise data analysis/treatment required

All samples will be re-counted after a delay of six 234Th half-lifes after sampling in order to correct for any residual beta activity due to beta emitters longer than 234Th. This will be performed at the home laboratory from September 2018.

## Estimated Date of Delivery

Analysis of particulate samples is expected to be done during 2019. The final database will be available by the end of 2019.

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