
MR02-K05 Leg1 Cruise Summary



1. Ship

R/V Mirai
L x B x D 128.58m x 19.0m x 13.2m
Gross Tonnage 8,672 tons
Call Sign JNSR

2. Cruise Code

MR02-K05 (Leg1)

3. Project Name

Arctic Ocean Observation Study

4. Undertaking Institute

Japan Marine Science and Technology Center (JAMSTEC)
2-15 Natsushima-cho, Yokosuka 237-0061, Japan

5. Chief Scientist

Akihiko Murata (JAMSTEC) : Sekinehama [Aug. 25] – Barrow [Sep. 6]
Koji Shimada (JAMSTEC) : Barrow [Sep. 7] – Dutch Harbor [Oct. 10]

6. Periods and Ports of Call

Leg-1a: August 25 (Sekinehama, Japan) to September 1 (Dutch Harbor, USA)
(call at Dutch Harbor for September 1-2)
Leg-1b September 2 (Dutch Harbor, USA) to September 6 (Barrow, USA)
Leg-1c September 7 (Dutch Harbor, USA) to September 20 (Tuktoyaktuk, Canada)
Leg-1d September 20 (Tuktoyaktuk, Canada) to October 10 (Dutch Harbor, USA)

7. Observation Summary

CTD (+ water sampling)	113 stations (Leg 1)
CTD (only)	33 stations (Leg 1)
XCTD	24 stations (Leg 1)
ADCP Observation	Continuously
Oceanic Environment Monitoring	Continuously
Surface Meteorology	Continuously
Towing Plankton Net Sampling	38 stations

Sediment Core Sampling	2 locations
Piston Core Sampling	3 locations
Sea Floor Topography (Seabeam)	Continuously
Sea Floor Topography (Sub-bottom profiler)	Mackenzie Canyon and Kopanor Mud Volcano area only
Tethered balloon Launching	5 times
Radiosonde Launching	120 times
Doppler Radar Observation	Continuously
Aerosol measurement	Continuously
Dual polarization lidar	Continuously
Cloud radar and microwave radiometer	Continuously
Eddy flux measurement	Continuously
Geophysical Parameters	Continuously

8. Data Policy

All data obtained during this cruise will be under the control of the Data Management Office (DMO) of JAMSTEC.

9. Overview

(1) Leg-1a: August 25 (Sekinehama) – September 1 (Dutch Harbor, USA)

We set sail for Dutch Harbor on 25 August, 2002 at Sekinehama, Japan. On the passage, we conducted sonde observations at the time when a satellite (ADEOS II) is just above the ship, in addition to continuous weather and underway observations.

(2) Leg-1b: September 2 (Dutch Harbor, USA) – September 7 (Off Barrow, USA)

We had a CTD test cast off Dutch harbor (54–58.30oN, 169–29.73oW) on 2 September. On 4 September, we arrived at the Bering Strait and carried out 2 hydrographic observations. After passing through the Bering Strait, 10 hydrographic observations were conducted in the Chukchi Sea, especially focused on the Barrow Canyon, during 5 to 6 September. After that, we left for Pt. Barrow to rendezvous with CCGS Louis S. St-Laurent.

(3) Leg-1c: September 7 (Off Barrow, USA) – September 20 (Off Tuktoyaktuk, Canada)

On September 7 three vessels, R/V Mirai, CCGS Louis S. St-Laurent and CCGS Sir Wilfrid Laurier, rendezvoused off Point Barrow for the transfer of personnel and scientific instruments. The ocean color was green suggesting the strong buoyancy driven current of Eastern Chukchi Summer Water. After the rendezvous, we sail toward the mouth of the Barrow Canyon where three mooring are deployed to measure the volume, heat and salt flux through the Barrow Canyon. We have conducted CTD/ADCP section across the Barrow Canyon. Detail structure of the coastal current of ECSW with the advective speed greater than 2 knots was observed.

During September 8–12, we conducted the hydrographic survey focusing on the shelf basin interaction on the northern end of the Chukchi Sea and southern Chukchi Borderland. We have occupied two complete full water sampling sections across the shelf slope. On the Chukchi Borderland, the sea ice retreated about 75N. We have conducted spatially high resolution hydrographic survey using CTD/ADCP in this area. We will

describe later in detail, significant differences has observed across the Northwind Ridge. Due to the ice condition, we could not enter the area north of 75N in first half of September.

We streamed to east after September 13. Taking the hydrographic station done by CCGS Louis S. St-Laurent into consideration, we occupied hydrographic sections in the southern Canada Basin. We reached the SHEBA97 hydrographic section at 72–50N 142W on September 16, and occupied the sections at the same stations of SHEBA97 until September 17.

We have transited to Canadian Beaufort Sea on September 18 and reached the shelf slope off the Kugmallit Canyon on September 19. We have conducted hydrographic section onto the Mackenzie shelf along the Kugmallit Canyon. In the afternoon on September 19, we have rendezvoused with a sailing boat Sedna IV. Canadian broadcast team interviewed the scientific activity of R/V Mirai. On September 20 three Canadians (Eddy Carmack, Conie Lovjoy and Loius Harwood) disembarked off Tuktoyaktuk.

(4) Leg-1d: September 20 (Off Tuktoyaktuk, Canada) – October 10 (Dutch Harbor, USA)

After the personnel transfer off Tuktoyaktuk, our scientific targets moved to shelf basin interactions and paleo oceanography on the Mackenzie Shelf in the first half of Leg-1d. The submarine canyons (Mackenzie and Kugmallit) and steep shelf slope close to coast are the area where strong water mass exchanges between shelf and basin and vertical mixing. The area is also corresponds to the area of Cape Bathurst Polynia and Lake Mackenzie. At first we streamed to the Cape Bathurst area for the surveys of the physics-biological connection. After that, we backed to the Mackenzie Canyon and sampled piston core sampling at three locations along the center of the canyon. Fortunately strong easterly begun to blow after the geological survey, we occupied along and across sections in the vicinity Mackenzie Canyon. Halocline water greater than 32 psu was upwelled onto the shelf region near the Herschel Island where the historically famous whaling area. Final mission in the Mackenzie shelf is to detect the oceanographic-geological interaction around the Kopanor Mud Volcano at 70–23N, 135–25W. Due to the rough condition, planned three piston core samplings were cancelled. However, the excellent survey of sea floor topography was done by the excellent operation of the ship, detail 3-D features of the mud volcano and an evidence of gas emissions were clarified. These new results will be important preliminary understandings for future developments of Arctic environmental sciences.

The scheduled personnel transfer on September 29 was canceled due to rough condition. We streamed back to Western Canada Basin. We have complete a section along 152–30W from the shelf region into the central Canada Basin at 74N. We turned direction heading west across the Northwind Ridge. In late September, the sea ice was completely retreated southern half of the Chukchi Borderland at 76–77N. This ice condition was historical record of ice retreat in the western Canada Basin. We tried to occupy the zonal section across the Northwind Ridge and Chukchi Plateau into the Chukchi Abyssal Plain. The sea began to freeze in early October under the cold weather. We have reached 76–23N on October 3 in the Northwind Abyssal Plain. This location was a farthest north record of ice strengthen vessel in the western Arctic Ocean. Under the maximum ice retreat area, subsurface warm water originated from the Chukchi Sea was observed. We tackle to enter the Chukchi Abyssal Plain where the influences of the Pacific Water via the Herald Canyon. On October 4, we entered the deep Chukchi Abyssal Plain and had the last full depth water sampling there. After the final full water sampling stations, we continued to have XCTD section from the southern end of the Chukchi Plateau to the

50m isobath in the Northern Chukchi Sea.

We occupied hydrographic section across the eastern half of the Bering Strait on October 7 and then ended the cruise of MR02K01–Leg1 at Dutch Harbor in the early morning on October 10.

10. Acknowledgement

MR02K01 Leg1 as a part of JWACS 2002 program has been a great success and this is because of the excellent science team, support and help of the crews of R/V Mirai and technical staffs of GODI and MWJ. We have established to address these important climate related questions together in the Arctic. I would like to express my heartfelt appreciation to all of them.

(MR02–K05 Leg1 Chief Scientist Koji Shimada)