

Cruise Summary

1. Cruise Information

Cruise ID	YK14-10
Name of Vessel	S/V Yokosuka
Cruise Title	AUV-based near bottom magnetic survey for uncovering the correlation between magnetic anomalies and submarine hydrothermal activities (I), and Preliminary survey for submarine drilling by IODP in northern Izu-Bonin Arc
Chief Scientist	Tamaki Ura [Kyushu Institute of Technology]
Proposals	Subject 1: AUV-based near bottom magnetic survey for uncovering the correlation between magnetic anomalies and submarine hydrothermal activities Subject 2: Preliminary survey for submarine drilling by IODP in northern Izu-Bonin arc
Representatives of the Science Parties	Tamaki Ura [Kyushu Institute of Technology] and Moe Kyaw [JAMSTEC]
Cruise Period	13th June 2014 - 18th June 2014
Ports of Call	JAMSTEC, Yokosuka ~ JAMSTEC, Yokosuka
Research Area	Bayonnaise Knoll Caldera, Myojin Caldera, and east off Aogashima (see Fig. 1.1)

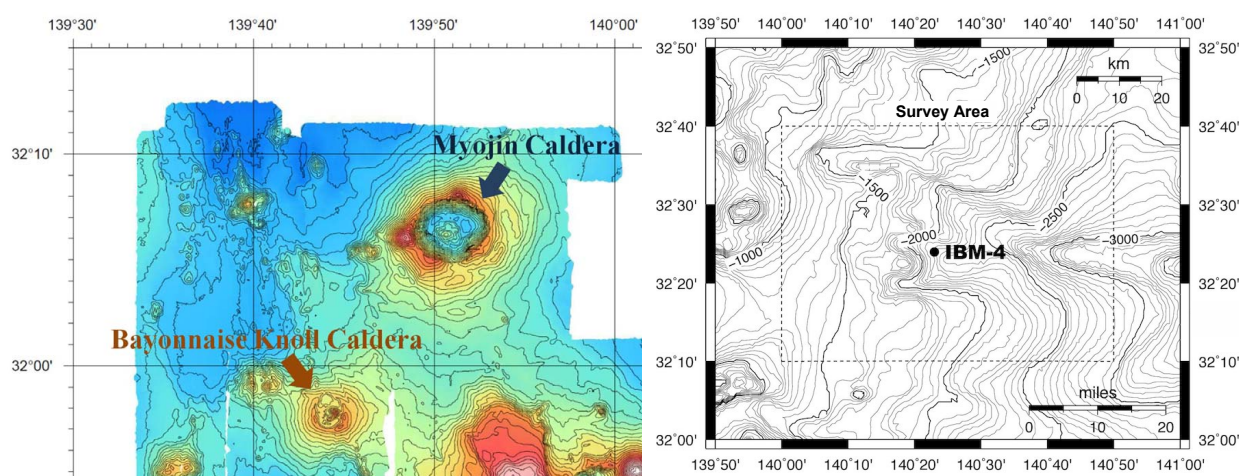


Fig. 1.1 Location of the YK14-10 cruise : (a) survey area for subject 1 (b) survey area for subject 2.

2. Overview of the Observation

2.1 Backgrounds

2.1.1 Subject 1 of YK14-10 Cruise

In the vicinity of the latitude 32° in Izu-Bonin Arc region, there are two well-known submarine hydrothermal deposits called Hakurei deposit in Bayonnaise knoll caldera, and Sunrise deposit in Myojin caldera. Curiously, both deposits are located on the southeast slopes of each caldera. Though look similar at first glance, two hydrothermal deposits were born on the basis of totally different tectonic backgrounds. Located close to each other but having different tectonic backgrounds, Hakurei and Sunrise deposits are expected to have difference in their formative factors, as well as underground structures. In this cruise, we made AUV-based magnetic field survey in Bayonnaise knoll caldera and Myojin caldera, in order to elucidate the origin and structure of these calderas. Total three dives were planned initially, two of which are devoted to the survey of Myojin caldera. Affected by bad weather and limited ship time, however, only two dives devoted to the survey of Bayonnaise knoll caldera were conducted.

2.1.2 Subject 2 of YK14-10 Cruise

The main purpose of subject 2 of YK14-10 cruise is to clarify the long-term sea currents and bottom conditions of IBM-4 site which is one of the potential locations for IODP drilling.

2.2 Methods

In order to conduct deep-sea near-bottom geomagnetic survey, we use deep-sea cruising AUV "Urashima" (Fig.2.1). Developed by Japan Agency for Marine-Earth Science and Technology (JAMSTEC) since 1998, "Urashima" is one of the largest AUVs currently working in the world. In this cruise, as a sensor for measuring bottom geomagnetic field, three-component magnetometer was installed in Urashima.



Fig.2.1 Overall feature of a cruising AUV Urashima.

In order to acquire high-quality magnetic field data, attitude change of a platform in which the magnetometer is installed should be suppressed as small as possible. However, since a cruising AUV realizes ascending or descending motion by changing its longitudinal attitude, continual change in vehicle's pitch is inevitable when following a rugged bottom. To overcome this and achieve a bottom-following dive with stabilized attitude of a vehicle, we applied an adaptive depth control to the Urashima dives of YK14-10 cruise. The adaptive depth control is a constant depth control adapting to the slope of the bottom over which the vehicle dives. By applying adaptive depth control, the vehicle could cover the Bayonnaise knoll caldera safely, keeping its attitude changes minimum. Figure 2.2 shows the dive trajectories generated by Urashima dive #169 and #170.

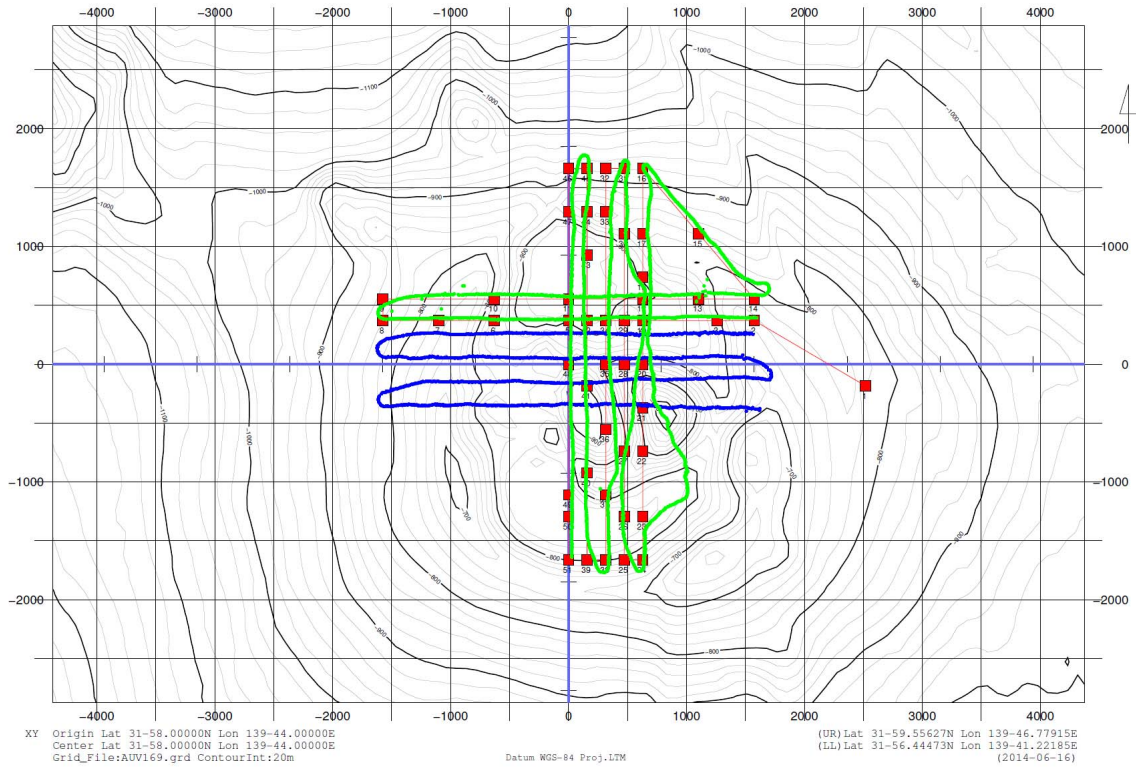


Fig.2.2 Trajectories of Urashima during dive #169 (blue) and #170 (green).

2.3 Instruments

2.3.1 Three-component magnetometer

Vector geomagnetic field were measured by deep sea three-component magnetometers (TIERRA TECNICA Tech Inc., Japan; National Institute of Polar Research). This system consists of a three-axis fluxgate-type sensor (Bartington MAG-03H), an A/D conversion unit (3ch-32bit-A/D), and a data controller/logger (Linux OS). The circuit case of the A/D conversion unit and data controller/logger was fixed in the bow payload space of Urashima.

2.3.2 Acoustic Doppler Current Profiler (ADCP) and Doppler Velocity Log (DVL)

In this cruise, we investigated the Bayonnaise knoll caldera by using "Urashima" to measure the

currents and echo amplitude, which reflects to turbidity, by using an up-looking 600-kHz acoustic Doppler current profiler (ADCP) and also a 300-kHz down-looking Doppler velocity logger (DVL) usually mounted on the AUV.

2.4 Survey Results

Figure 2.3 shows measured magnetic field with respect to the earth-fixed frame of reference. In the figure, red, green, and blue lines represent measured magnetic field in north, east, and depth directions, respectively.

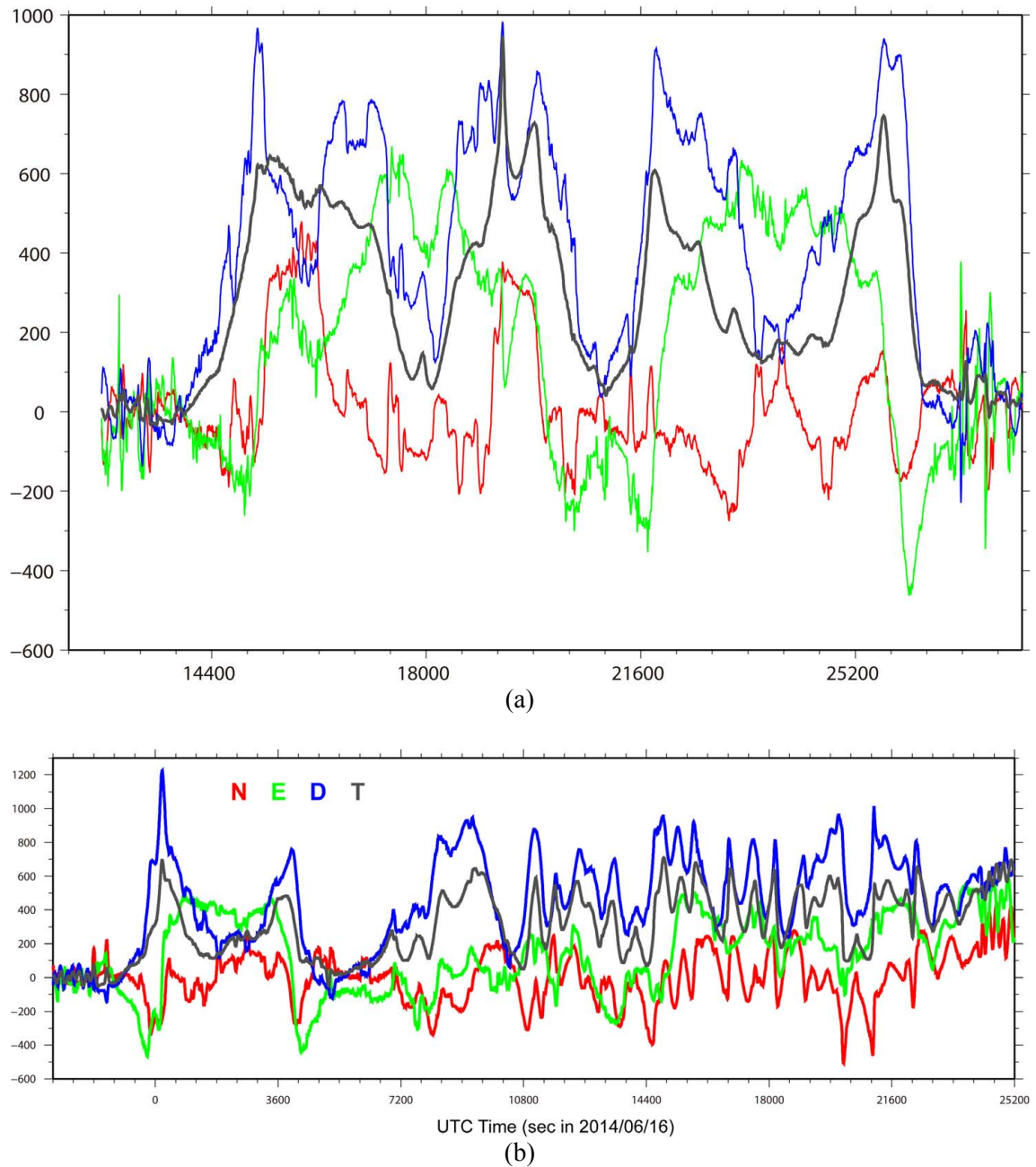


Fig.2.3 Measured geomagnetic field during (a) dive #169 (b) dive #170.