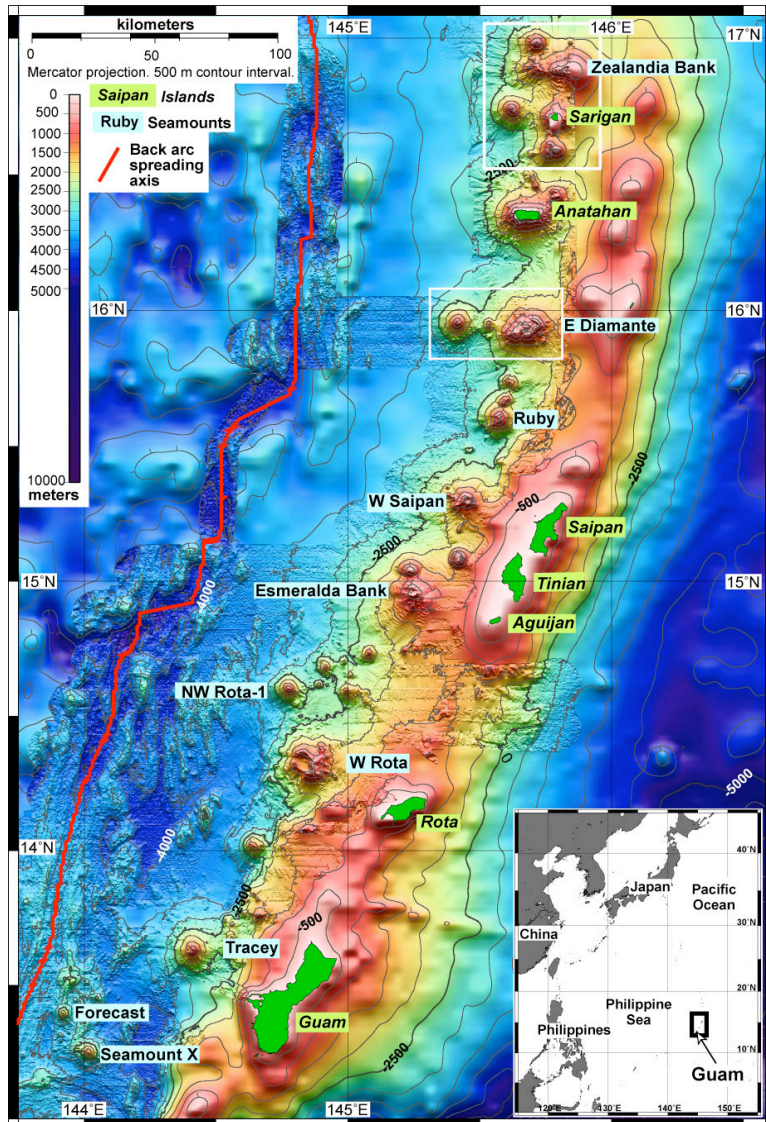


Cruise Summary

1. Cruise Information

Cruise number	NT09-08
Ship name	Natsushima/Hyper-Dolphin
Title of the cruise	Mariana Waters
Chief Scientist	Yoshihiko Tamura (IFREE, JAMSTEC)
Representative of Science Party	Yoshihiko Tamura (IFREE, JAMSTEC)
Title of proposal	The Frontier of the Project IBM: Southern Mariana Stage 2
Cruise period	June 10, 2009 ~ June 23, 2009
Port call	Guam to Saipan
Research area	The original study areas were from Tracey, west of Guam to Zealandia Bank



Bank. However, the areas south of $14^{\circ}40'$, which include Tracey, W Rota and NW Rota-1 could not be studied because of the US Navy operations.

Figure 1. Research map of the southern Mariana arc. Dive points of Diamante seamounts and Zealandia are shown in Figs. 2 and 3.

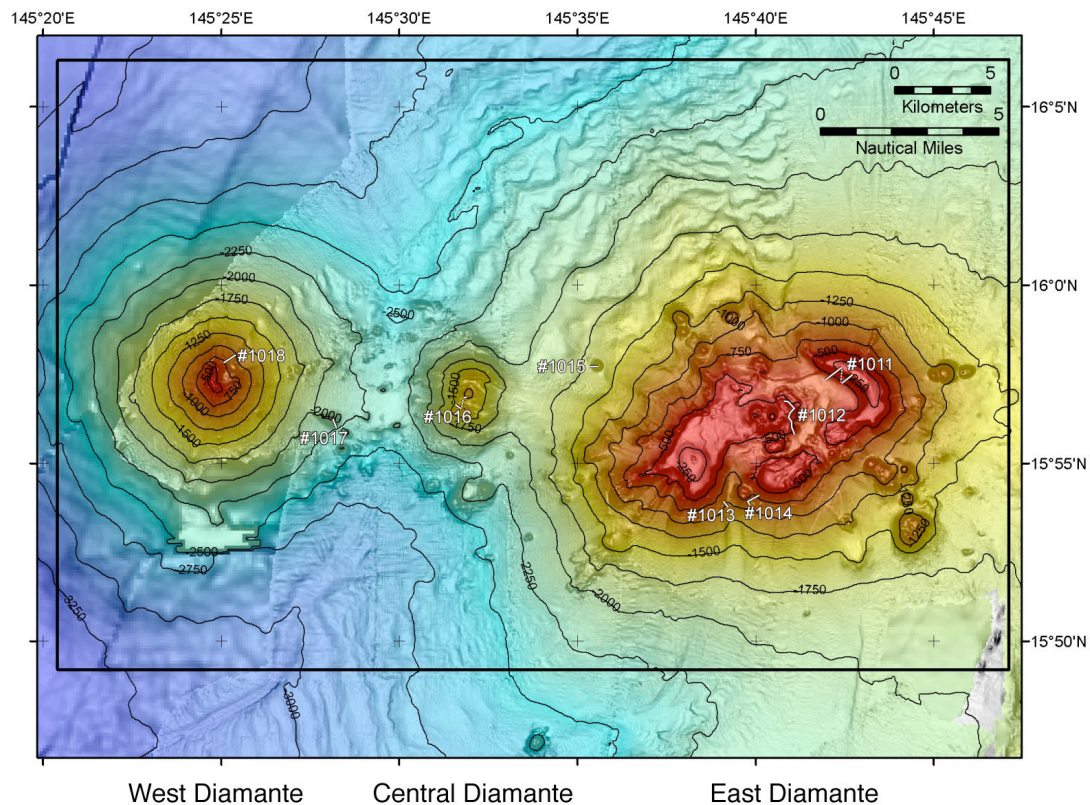


Figure 2. Dive points in East Diamante, Central Diamante and West Diamante.

The observations and samples carried out during HPD#1011-#1014 represent a major improvement in our understanding of the Diamante cross-chain (Fig. 2) and especially how East Diamante volcano evolved. The Diamante cross-chain also provides another useful perspective about how magmatic evolution varies with depth to the subduction zone, complementing studies in the Izu cross chains at $\sim 32^\circ\text{N}$ (Hochstaedter *et al.*, 2000, 2001; Machida & Ishii, 2003; Ishizuka *et al.*, 2003, 2006; Honda *et al.*, 2007; Tamura *et al.*, 2007), the Kasuga cross-chain in the northern Marianas at $\sim 22^\circ\text{N}$ (Stern *et al.*, 1993), and the Guguan cross-chain at $\sim 17^\circ\text{N}$ (Stern *et al.*, 2006). West and Central Diamante are relatively simple basaltic volcanoes. Our dive results on these volcanoes (HPD#1016 and HPD#1018, respectively) and parasitic cones on their eastern slopes (HPD#1015 and HPD#1017, respectively) are consistent with previous dive results indicating that these edifices are basaltic. Central Diamante is volcanologically interesting because it encapsulates the fact that the cross-chain is built on a site of N-S crustal extension, one of several E-W volcanic systems between $14^\circ 40'$ and 17°N that are so controlled.

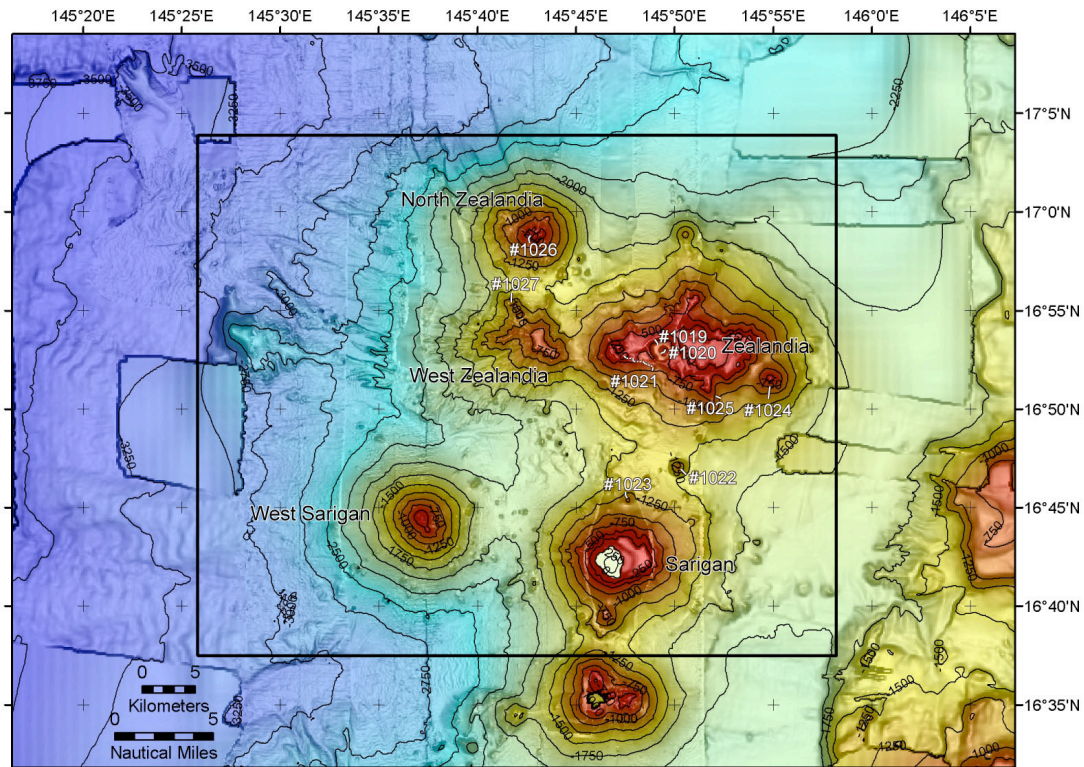


Figure 3. Dive points around Zealandia Bank and Sarigan island, between $\sim 16^{\circ}45'$ and 17° N.

The second area studied by NT09-08 is a group of 6 volcanoes around Sarigan island and Zealandia Bank, which lies about 100 km north of the Diamante cross-chain (Fig. 3). Takahashi *et al.* (2007) investigated crustal and mantle structure along a WNW-oriented line sited between Zealandia Bank and Sarigan, using active-source seismic profiling. They interpreted velocity variations to indicate a middle crust with velocity of ~ 6 km/s (which may be tonalitic in composition), laterally heterogeneous lower crust with velocities of ~ 7 km/s, and unusually low mantle velocities. Of special significance to the results of NT09-08 is the inferred presence of middle crust with V_p corresponding to felsic or intermediate igneous rocks. The abundant felsic igneous rocks that we recovered, especially from the western part of Zealandia Bank may reflect melts derived from this layer; this may also be the source of abundant felsic material found on E. Diamante. The inferred presence of mafic and ultramafic cumulates at the base of the arc crust is also important, in light of the ultramafic xenoliths recovered in HPD#1027 samples, which may be the first recovery of such material from an intra-oceanic magmatic arc.