

High resolution sidescan sonar survey at Yokoniwa Rise, CIR, the possible peridotite-related hydrothermal site

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The Kairei Hydrothermal Field (KHF) is located at the southern end of the Central Indian Ridge (CIR), near the Rodriguez ridge triple junction. The KHF was discovered by ROV Kaiko (JAMSTEC) in 2000, based on the preceding report about hydrothermal plume anomaly detected in Hakuho-maru KH-93-3 cruise in 1993. The recent submersible survey in 2009 discovered a group of dead chimneys on the hill north of the KHF, where peridotite is widely exposed. To survey an extent of the dead chimneys, and to know acoustic expression of peridotite outcrops, we conducted high-resolution acoustic survey using AUV-r2D4 (Institute of Industrial Science, The Univ. of Tokyo) in Hakuho-maru KH-10-6 cruise in 2010.

The area of chimneys, tentatively called Yokoniwa Rise, is settled at ~10 km eastern off-axis from the CIR segment-1. The acoustic survey of AUV-r2D4 is conducted at 100 kHz frequency, 30~150 m altitude, with 3 knots of vehicle speed. The survey imaged ~6 km (NS) x ~2.3 km (WE) area along 4 survey lines. We obtained following results.

(1) Anomalous acoustic signals in water column

We found anomalous backscattering signals from water column, at 2 different sites; one is west of survey area located above piles of lava, and another is near the southwestern corner of survey area and no outstanding signals on sidescan sonar imagery. The both anomalous backscattering signals may image turbid water distribution caused by volcanic or hydrothermal activities, both in and out of our survey area. We did not observe anomalous backscattering signals above the reported area of dead chimneys.

(2) Distribution of flat and high-backscattering features

There are a large number of high-backscattering features which seems like a floating cloud: they have obscure boundaries. Because most of the high-backscattering features are not accompanied with acoustic shadow, they are bathymetrically flat features on seafloor. The floating clouds distribute discontinuously and concentrate in ~N15W trending area. It almost coincides with trend of surrounding abyssal hills. The chimney-like features are found over the high-backscattering features, including the area of dead chimneys and peridotite outcrops observed in 2009.

(3) Tectonic deformation may be not effective in this area.

Linear features on the sidescan sonar imagery are widely varied in trend and relatively short in length: total number of linear features are 216, average trend is N10W, standard deviation is 20, and average length is 136 m. Most of linear features seems to be controlled by local bathymetry (based on 20 kHz Seabeam2120 data), so that we may observe flow channel or gravitational collapse of seafloor as the linear features.

(4) We will check detail ground reference data of peridotite outcrops, using the sidescan sonar imagery obtained in our survey and submersible's video image obtained in 2009.

Keywords: r2D4, interferometry sonar, floating cloud-like features, chimney-like structure, backscattering signals in water column, Hydrothermal field