

Shipboard magnetic and gravity surveys around the Iheya North Knoll and the Iheya Minor Ridge in the Mid-Okinawa Trough: Preliminary results of KR18-14 Leg1/Leg2 cruises

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The Okinawa Trough, an active back-arc basin behind the Ryukyu trench, exhibits active rifting associated with extension of the continental margin. In the Mid-Okinawa Trough, more than 10 hydrothermal vent sites belonging to relatively large hydrothermal vent fields at the Iheya North Knoll, the Iheya Minor Ridge, the Izena Hole and etc., were discovered by previous studies (e.g., Halbach et al., 1989; Sakai et al., 1990; Momma et al., 1996; Kasaya et al., 2015; Nakamura et al., 2015). Although shipboard magnetic and gravity surveys are too low in resolution to investigate the hydrothermal sites, they are important for understanding the geological background of the hydrothermal systems across an entire region. As for the area off Kumejima Island in the Okinawa Trough, Kitada et al. (2018) revealed the characteristics of the submarine volcanic activity around a hydrothermal area by using dense magnetic and gravity data. In order to characterize sub-seafloor structures and the spatial distribution of the submarine volcanic activity around the Iheya North Knoll and the Iheya Minor Ridge, we conducted detailed magnetic and gravity surveys with a line spacing of 0.5 nmi aboard research vessel Kairei during the KR18-14 Leg1 and Leg2 cruises from October to November 2018. Additionally, we also compiled magnetic, gravity and bathymetric data which were collected during previous cruises by the Japan Agency for Marine-Earth Science and Technology (JAMSTEC) over the recent years. Magnetization intensities were estimated from observed magnetic anomalies, without applying annihilator. Bouguer gravity anomalies were calculated from free-air anomalies obtained. The distribution of magnetization intensity and variation in Bouguer gravity anomalies revealed the characteristics of submarine volcanic activity. Most of the knolls in the area show a relatively high magnetization (~ 1.0 to ~ 3.0 A/M) corresponding to the individual submarine knolls. Higher Bouguer gravity anomalies (~ 45 to ~ 55 mgal) implying the lower crustal thickness were observed in the Iheya graben. The knolls including the Iheya Minor Ridge, elongated in the ENE-WSW direction parallel to the graben, exhibit the ENE-WSW trending magnetization distribution with relatively high positive intensities, so volcanism appears to be constrained by normal faults forming the rift structure. On the other hand, the Iheya North Knoll have a relatively low magnetization of ~ -1.0 to ~ 0.0 A/M with less variation of the magnetization. Although the data are sparse (the line spacing of ~ 1.5 to ~ 2 nmi), low magnetization (~ 1.5 A/M) with no prominent magnetic signature was also observed in the Izena Hole. Moreover, these knolls are located on the area where the Bouguer gravity anomaly is changed from ~ 30 to ~ 10 mgal and ~ 45 to ~ 30 mgal, respectively. The magmatism associated with submarine volcanic activity and back-arc rifting will be discussed based on the results obtained from these dense surveys.

Keywords: Okinawa Trough, backarc rifting, hydrothermal systems, magnetic anomaly, gravity anomaly