

Reconstruction of vertical temperature structure in the East China Sea to better understand the past Kuroshio variability

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The East China Sea (ECS) is a marginal sea, located in western edge of the Pacific and the Kuroshio is one of the major current systems in the ECS and has a crucial impact on water properties in the ECS (Chen et al., 2010; Guo et al., 2012). Because the position of the Kuroshio in the ECS is relatively stable (standard deviation is ~10 km) compared with the outside ECS (Andres et al., 2008), it is suitable to investigate long-term variations in the Kuroshio without the consideration of meandering of the main axis. However, there has been ongoing debate about the variability of the Kuroshio in the past in the East China Sea. One argument is, like the Ryukyu Current today, the Kuroshio main axis migrated to be outside of the Okinawa Trough during the last glacial maximum (LGM)(e.g., Ujiie et al., 1991; Ujiie and Ujiie, 1999; Diekmann et al., 2008). Another argument is that the Kuroshio main axis remained located in the Okinawa Trough even at the lowest sea level stand (e.g., Kawahata and Ohshima, 2004; Lee et al., 2013). Based on a comparison of planktic foraminifera assemblages inside and outside the Okinawa Trough, Ujiie et al. (2003) advocated “outside Okinawa Trough”. Their comparison revealed the appearance of cold water species inside the Okinawa Trough during LGM, despite only minimal variation in assemblage-derived sea surface temperature (SST) outside the Okinawa Trough. However, a recent study based on comparison of Mg/Ca-derived SST records demonstrated that there was no significant difference in SST between inside and outside the Okinawa Trough, suggesting the entrance of the Kuroshio inside the Okinawa Trough during the LGM (Lee et al., 2013). Although there are many studies focusing on reconstruction of surface hydrology in the Okinawa Trough since the MIS 3 or LGM using planktic foraminifera assemblages (Li et al., 2001; Ujiie et al., 2003; Xu and Oda, 1999) and alkenon-derived SST (Ijiri et al., 2005; Yu et al., 2009), and Mg/Ca-based SST (Chen et al., 2010; Kubota et al., 2010; Sun et al., 2005), information concerning water properties at subsurface and intermediate depth is sparse, which is important as variations in the Kuroshio velocity and transport have a greater impact on temperature and salinities at subsurface and intermediate depths rather than those at surface (Oka and Kawabe, 1998). In this study, we reveal temperature structure in the Okinawa Trough since the late MIS 3 and discuss how we understand the Kuroshio variability in the past.

Keywords: Kuroshio , East China Sea , Last Glacial period