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中央インド洋海嶺南部のテクトニクス：メルト供給量の時空間変動
Tectonics of southern Central Indian Ridge: implication for spatial and temporal variation of melt supply

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The Central Indian Ridge (CIR) is categorized into intermediate spreading systems and its southern end forms a R-R-R triple junction with SWIR and SEIR. The southern CIR shows slow-spreading morphology, where the axial valley develops along the ridge crest and an oceanic core complex has been reported near the triple junction. We conducted detailed geophysical mapping all over the OCC and three submersible dives in 2006. On the top of the corrugations, several deformed rocks (mylonite, cataclasite, and schists) were recovered and striations parallel to the corrugation was widely observed on the seafloor. The observations suggest that the OCC had formed during Matsuyama chron at the southwestern inside-corner of the CIR-2 segment. Another small OCCs were also discovered in the same cruise, about 18km eastern off-axis of the southernmost (CIR-1) segment. Olivine-rich gabbroic rock, troctolite, dominates the recovered samples and a weathered Pl-dunite was also sampled from the 3170m WD. In recent cruises in 2009 and 2010, we further discovered ultramafic exposure at non-transform offset massif between segments CIR-1 and CIR-2, and at past NTO massifs or segment ends. They are associated with relatively smooth surface without corrugation and their extent is several kilometers. These structures suggesting melt-limited environment are distributed along 2nd order segment boundary from the axial valley to 30km off-axis, i.e. ˜1.7 Ma. This unique environment is likely related to the formation of Kairei Hydrothermal Field (KHF) at CIR-1 ridge flank, where the fluids shows the high concentration of hydrogen and low methane content, and a hydrogen-based hyperthermophilic subsurface lithoautotrophic microbial ecosystem was confirmed. The widespread OCC-like structures around the triple junction are key to solve how and when an oceanic detachment nucleates and develops to localize the strain for a few million years and to understand adjacent unique, hydrogen-rich, hydrothermal activities.

To understand the tectonic evolution of the area we here compile the bathymetry, magnetics, and gravity data collected during previous six cruises, then make the detailed bathymetry, equivalent magnetization and residual mantle bougurer anomaly maps, ranging from the triple junction to CIR-4 segment. The mapped area covers the axial valley and off-axis up to chron 2Aold (˜3.6 Ma). The OCC-like structures are concentrated in CIR-1 and southern CIR-2 on and off-axis areas. The northern CIR-3 and 4 segments seems relatively magmatically active, with low RMBA and higher magnetization. Central magnetic anomaly high is recognized along the SEIR and CIR, not along SWIR. The off-axis areas of CIR-1 segment shows high RMBA in general, suggesting the existence of high density material in the shallow part. The 24S OCC is also accompanies by clear RMBA high. The deep-tow magnetic profile across the CIR-segment shows highly asymmetric spreading since 2Ma, supporting the idea that the detachment faulting may play an important roll in the formation of OCC-like structures.
Keywords: mid-ocean ridge, oceanic core complex, hydrothermal activity, detachment, oceanic crust, seafloor spreading