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Microstructural studies of rocks from the 25 S oceanic core complex, along the Central Indian Ocean Ridge

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This study shows the microstructural development of rocks from the 25˚S oceanic core complex (OCC) along the Central Indian Ocean Ridge, located near the Rodriguez Triple Junction. The samples described here are recovered by three submersible SHINKAI 6500 dives (Kumagai et al., 2008, Morishita et al., 2009).

Characteristic foliated rocks with slickenline are recognized at a top surface of OCC, making up platy landform. Attitudes of those rocks are striking NE-SW and dipping to the NW and SE at moderate angle (20–30˚). Direction of lineation structures is perpendicular to the divergence ridge axis. We collect 55 samples during the three dives, and evaluate 10 samples as deformed rocks based on hand specimen scale structures on the shipboard. Deformed rocks distributed around the OCC surface consist of peridotite, gabbro, basalt, breccia and those altered rocks.

Although almost olivine grains in peridotite are altered and replaced by talc, which forms anastmosing texture, olivine remnants show mylonitic texture characterized by undulose extinction and grain size reduction. Orthopyroxene grains are also elongated. Serpentine with platy shape makes up foliation, showing serpentinite mylonite texture. Olivine and serpentine are replaced by talc following mylonitization. Talc occurs as two different textures. One is static replacing primary minerals, and the other is syn-tectonic deformation textures such as foliated with shape preferred orientations, comprising talc schist. Gabbro also shows mylonitic structures featured by grain size reduction of plagioclase. Tremolite/actinolite is dominant facies in well foliated and altered gabbro in which has porphyroclasts of hornblende and plagioclase. Deformation of basalt is inhomogeneous and accompanying chloritization. Some part of basalt keeps plagioclase with basaltic textures, glassy texture and pseudomorph texture of them. Chlorite-rich basalt develops penetrative foliation and alters to chlorite schist.

Breccia is composed of many kinds of clasts such as altered peridotite, gabbro, basalt and minerals of them. Some breccia contains clasts of basaltic grass with round shape. The clasts are suspended in matrix of tremolite/actinolite, chlorite or talc. Hand-specimen colors of breccia depend on the matrix minerals. White part is abundant in talc, and black part is in chlorite or tremolite/actinolite. Breccia also undergoes subsequent brittle deformation, such as development of micro-faults with preferred orientations. Especially, foliated breccia with slickenline from OCC surface develops such brittle deformation structures.

The development of deformation structures is considered to be formed as follows. Peridotite and gabbro are deformed in ductile regime. This means that primitive (or initial) deformation of the OCC should occur in around the boundary between mantle and crust (Moho), but this speculation requires further investigation of deformation condition. The peridotite and gabbro suffered alteration during proceeding deformation and uplift of the OCC. They alter to serpentinite, talc schist and chlorite schist. Near the seafloor, those rocks are mixed with basalt and form breccia. Mixing process is brecciation, and depositions may contribute to the mixing. The final deformation concentrates in the breccia on the OCC surface, which makes platy landform with lineations. And, there are partly covered with weak deformed debris basalts. Metasomatic products such as serpentine, talc, chlorite and tremolite/actinolite may act as lubricant for the OCC development.