Age constraints and magnetic structures of the IODP Hole 1256D oceanic crust

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Hole 1256D is located in the equatorial East Pacific crust formed at the East Pacific Rise ˜15 Ma ago with spreading rate of ˜220 mm/y. The Superfast Spreading Rate Crust mission (ODP Leg 209, IODP Exp. 309/312) successfully penetrated into gabbros and provided a complete and intact section of the upper oceanic crust: 810 m of extrusive normal mid-ocean-ridge basalt (the uppermost 100 m is a massive lava pond) beneath ˜250 m-thick sediments, 345 m of sheeted dikes, and 101 m of plutonic rocks. In this paper, we report magnetic structures of the Hole 1256D and newly obtained U-Pb ages of gabbros. We also report structures observed in the Hole 1256D, with in-situ directions restored using paleomagnetic techniques.

Magnetic logging data suggested the lava pond and plutonic rocks (the uppermost and lowermost part of the present Hole 1256D) have normal polarity, whereas pillow lavas, sheet flows and sheeted dikes in the middle part of the Hole 1256D have reversed polarity. Our own magnetic measurement on cubes separated from the 1256D cores agreed with the general trend obtained from the logging. Age of the uppermost oceanic crust deduced form magnetic stripe patterns and U-Pb ages of gabbros coincide within an error range: 15.2 Ma and 15.1 Ma (+- 0.14 Ma). Restored directions of flow foliation in gabbro and its contact plane with granoblastic wallrocks indicate that the gabbro forms a laccolith. The inverse magnetic structure along the 1256D hole could be attributed either to 1) slow cooling rate of the plutonic rocks due to high rate of the magma supply, that controlled the shape of the isotherm at the Curie temperature, which was rather flat in the shallow part of plutonic section, or 2) different age of extrusion/intrusion from the intermediate part of the 1256D crust.