

Emplacement and solidification of a large off-ridge lava flow from ODP-Hole 1256C, Guatemala Basin

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Site 1256 is located at 91deg56.1' W in the 3650-m deep Guatemala Basin on Cocos plate formed at ~15 Ma on the eastern flank of the East Pacific Rise. A large off-ridge lava flow 75-100 m in thickness and ca. 10 cubic kilometers in volume drilled at site 1256 provides an unprecedented opportunity to understand the internal structures and solidification and emplacement processes of large lava flows. Hole C penetrated a 35-m thick lava from 280 mbsf to 315 mbsf. We present mineral compositions and grain size analyses of the core samples from Hole 1256C, and discuss the crystallization and emplacement processes of the large off-ridge lava flow. Phenocrysts are olivine, clinopyroxene and plagioclase, and the groundmass minerals are clinopyroxene, plagioclase and magnetite with mesostatic quartz and biotite. The core samples show variolitic, subophitic and poikilitic textures and mesostatic intergrowth of plagioclase and quartz. The lava flow consists mostly of NMORB with high-K²O EMORB intervened at a depth interval of 290-300 mbsf (Wilson et al.,2003). High-K²O EMORB has high-Mg# (60~70) clinopyroxenes and is interpreted to have intruded into the solidifying lava body at the final stage of the lava emplacement. Given the interval of EMORB was intruded after the upper and lower lavas solidified, olivine phenocryst size and number density distributions prior to the intrusion of EMORB are similar to those formed by crystal precipitation by Rowland and Walker (1988). Mapping analyses of augite and pigeonite demonstrated domains different in Al²O₃, CaO and MgO concentrations within a single grain. Three types of augite (Augite-N1, Augite-N2 and Augite-N3) and two types of pigeonite (Pigeonite-N1 and Pigeonite-N2) are identified for the domains in pyroxene crystals from NMORB lava intervals. The EMORB lava interval has three type augite (Augite-E1, Augite-E2 and Augite-E3) and two types of pigeonite domains. Two pairs of Pigeonite-N1 & Augite-N3 and Pigeonite-E1 & Augite-E1 are in equilibrium with each other in terms of Fe-Mg partitioning. The crystallization order is Augite-N3 & Pigeonite-N1, Pigeonite-N2, Augite-N1, Augite-N2(rim), followed by the intrusion of EMORB, and then Augite-E1 and Pigeonite-E1, Pigeonite-E2, Augite-E2 and Augite-E3 (rim).

Keywords: Ocean Drilling, Hole 1256C, Off-ridge volcano, Mid-ocean ridge, Large lava flow, Oceanic crust